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Development of a photometric primary transfer standard for reflectance goniospectrophotometry

Denis J. O. Daoust

DEVELOPMENT OF A PHOTOMETRIC PRIMARY TRANSFER STANDARD FOR REFLECTANCE GONIOSPECTROPHOTOMETRY

by

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(1979)

A thesis submitted in partial fulfillment
of the requirements for the degree of Master
of Science in the Center for Imaging Science
in the College of Graphic Arts and Photography
of the Rochester Institute of Technology

July, 1987

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ABSTRACT

Currently, photometric standards are calibrated only at CIE-recommended geometries. A need exists for calibrating at many combinations of illumination and viewing angles. The common practice is to assume $BaSO_4$ is lambertian although its non-lambertian behavior is well-known. Accordingly, a study was undertaken to develop a standard for this type of metrology. Two diffuse materials, $BaSO_4$ and PTFE, were characterized goniospectrophotometrically. PTFE, when pressed to a density of 1.55g/cc against a lapping film, exhibited properties lending itself as a transfer standard. Bidirectional absolute spectral reflectance factors at 60 combinations of illumination and viewing angles in a single plane were measured. Neither material was found to be lambertian and both polarized the reflected radiation. The PTFE standard had greater spectral non-selectivity and could be prepared repeatably.

ACKNOWLEDGEMENTS

Many people were instrumental in the successful completion of this thesis and deserve the following recognition.

Dr. Roy Berns acted as thesis advisor and provided excellent guidance during thesis completion. Dr. Roger Easton, a committee member, was a key person in ensuring the final report was correct from a grammatical point-of-view. Mr. Mark Fairchild, a committee member, offered invaluable advice and assistance throughout the project. Dr. Hsia, from the National Bureau of Standards, assisted by making some important recommendations regarding the design of the goniospectrophotometer and the methods of measurement used.

Mitch Miller detailed the operation of the instrument at the beginning of the project. Tim Gallagher was always available to fix mechanical and electrical problems with the equipment. Dick Norman skilfully machined some of the required parts. Carl Salvaggio provided the FORTRAN routine for the 3D plot. Wayne Farrell helped with the operation of the Tracor Northern instrument, Dave Telep with some data manipulation, and Lisa Fairchild with preparing the sintered samples. Last but not least, Ricardo Motta provided much insight during the many late-night discussions this author had with him.

DEDICATION

This thesis is dedicated to the most important person in my life, Brigitte, my wife.

Cette thèse est dédiée à la personne la plus importante dans ma vie, Brigitte, ma femme.

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I. INTRODUCTION

1. LITERATURE REVIEW

A. Goniospectrophotometry

1) Definition

The term "goniospectrophotometry" comes from the combination of four terms, namely: 1) "gonio" which is a greek derivative relating to the variation of some angle, 2) "spectro" which involves a change in wavelength, 3) "photo" which restricts the topic to visible radiation, and 4) "metry" which translates to "measurement". Goniospectrophotometry therefore means the measurement of visible radiation at different wavelengths and different angles of illumination and viewing. Related but more restricted topics would be goniophotometry (measurements at a specific wavelength), and spectrophotometry (measurements at specific angles of illumination and viewing). It should be noted at this point that when "photo" is employed in colorimetric terms, it is understood to encompass slightly more than the visible range, i.e. some near ultraviolet and near infrared radiation is included in the measurement.

2) Goniospectrophotometry vs Spectrogoniophotometry

In an article published in 1969, Billmeyer and Davidson[1] adopted the terms "goniospectrophotometer" and "spectrogonio-photometer" as defined by Johnston[2] at the 1st AIC Congress, also in 1969:

1) Goniospectrophotometer: instrument primarily intended to measure reflectance as a function of wavelength, and secondarily as a function of angle.

2) Spectrogoniophotometer: instrument primarily intended to measure reflectance as a function of angles of illumination and viewing, and secondarily as a function of wavelength.

In its Glossary of Color Terms[3], the Federation of Societies for Coatings Technology defines the goniospectrophotometer as an "instrument used to measure a spectrophotometric curve at various angles of incidence and reflectance" and the spectrogoniophotometer as "a goniophotometer used to measure the geometric distribution of reflected or transmitted flux at individual wavelengths." In the following report, however, these two terms will be used interchangeably with no specific meaning attached to either. This approach seems to be the one taken by most authors when writing on the subject. However, the Munsell Color Science Laboratory instrument will be consistently called a goniospectrophotometer.

B. Historical Background

1) General

The task of quantitatively evaluating the appearance of objects in order to determine their spectral and geometric distributions is one which continually challenges color scientists. In an attempt to simplify this process, certain authors have suggested schemes for classifying the different materials.

Hunter[4] groups objects into four categories (opaque nonmetals, opaque metals, translucent and transparent)

whereas CIE[5] uses three groups subdivided into six subgroups depending on scattering properties and surface structure.

These classifications enable the selection of the measurement method relevant to each type of material. Such measurement methods are suggested by Hunter Associates Laboratory.[6] Instrument design depends primarily on the type of measurement required, e.g. will it be for "a specific chromatic attribute such as color, or a certain geometric attribute such as gloss"?[6] A most logical classification approach for photometric instruments in use today was derived by Rhael.[7] He examined the degree of spectral dispersion of the instruments and came up with 3 classes:

1) entire spectral range as a unit,
2) a few broad wavebands, and
3) many narrow wavebands.

He also gave examples for each category. For example, comparators and the Munsell Color Atlas would fall into the first category, colorimeters into the second and spectrophotometers into the third. In an excellent historical review, Gibson[8] treated early spectrophotometers dating from Fraunhofer's attempt to measure the relative radiance of the solar spectrum in 1817.

Nimeroff[9] offers an overview of relevant goniophotometers, starting with Bouguer's instrument of 1762 which was used to corroborate Lambert's law experimentally.

Other studies on the development of relevant instruments are found in publications by Hunter[4] and Christie[10]. However, the field of interest of this thesis is goniospectrophotometers and the following section will deal exclusively with this subject.

2) Goniospectrophotometers

Goniospectrophotometers date from the 1930's with McNicholas (1934)[11] at the National Bureau of Standards. Clark, et al.[12] (1953) described what they called a goniometric spectrometer which shared some physical similarities with McNicholas' design. The illumination was monochromatic and provision was made for horizontal rotation of the sample (360°) and detector horizontal (258°) and vertical (-6.5° to 90°) rotation. The spectral range extended from 400 nm to 2600 nm. This instrument was primarily used for the infrared (IR) measurement of diffuse transmittance and reflectance of skin.

Kapany and Simms[13] (1965) explained the use of an abridged goniospectrophotometer to measure the performance of fiber optics in the IR region. Bandpass filters were placed in front of the detector which could be rotated ±90° to the optical axis. Brandenberg and Neu[14] (1966) used what could be termed a pseudo-3D goniospectrophotometer since the source could rotate vertically (10° to 87°), the sample horizontally (360°) and the detector both horizontally (-70° to 250°) and vertically (12° to 80°). However, illumination and viewing at normal (0°) angles could not be made because of physical design limitations. Monochromatic light was generated by narrow bandpass

interference filters placed one at a time in front of the lamp. Measurements were made on a magnesium oxide coating, two white paints, a dull aluminum surface, and a polished aluminum surface.

Brookshier[15] (1966) developed a broad-spectral-range goniophotometer for use over the 200 to 3000 nm region. It was used during a NASA program to obtain goniophotometric reflectance profiles for a number of coatings important in the radiation and thermal balance of spacecraft.

At the 1967 Annual Meeting of the Optical Society of America, Comstock[16] (1967) described a simple three-dimensional spectrogoniometer in which a narrow incident beam was directed onto a sample and a monochromatic detector was stepped and read through 64 contiguous positions necessary for a hemispherical summation. The system used a combination of interference filters and PMT as detector. Most reflectance data was on specialized materials but illustrative data on the spectral reflectance of MgO samples was presented at the Meeting.

Brookshier[17] (1968) described an automatic scanning spectrogoniophotometer developed for use in the elucidation of the diffuse and specular characteristics of materials. His instrument featured a digital readout which continuously displayed the position of the detector through the use of an optical shaft encoder system. The detector could be rotated around the sample with a precision of ±0.05 degree of arc.

Four goniospectrophotometric types of instrument were described at the first "Association Internationale de la Couleur" (AIC) Congress in 1969, Stockholm. Loof[18] (1969) indicated that a goniophotometric attachment was in preparation for the Zeiss DMC 25 spectrophotometer. During this same congress, Hemmendinger and Johnston[2] (1969) described the Trilac spectrophotometer manufactured by Leres in France. At the time this was the only known commercially available instrument to combine spectrophotometric and goniophotometric capability. A monochromatic light beam was split to illuminate the sample and standard alternately over the 400-700 nm range. The Trilac was used to study the phenomenon of "goniochromatism" which was then defined as "the change in color as the illumination and viewing angles are changed".[2] Three pairs of samples were measured: two blue metallic paint samples, two blue metallic vinyl fabrics, and two woven samples of the same fabric construction. Different goniochromatic effects were pictured in comparative graphs.

Baba[19] (1969) described the use of two goniospectrophotometers: an ordinary Hitachi Model 139 spectrophotometer with a special attachment for partial goniophotometry and a three-dimensional spectrogoniophotometer (whose commercial availability in Japan was not then known). The 3-D goniospectrophotometer lamp house could be moved in the vertical plane (-10° to 210°), the receptor housing in the horizontal plane (360°) and the sample holder in three

planes (360° in the horizontal plane, 90° of declination in the vertical plane and 360° of rotation in its own plane). It operated over the 300-700 nm range and had two modes of measurement available: monochromatic 3-D goniophotometry and spectrophotometry under optional illuminating and viewing conditions. Magnesium oxide, ordinary and metallized paint surfaces, paper, and cloth were measured and analyzed.

Billmeyer and Davidson[1] (1969) compared their own research spectrogoniophotometer with the Trilac instrument previously described. Their instrument was a modified Brice-Phoenix[20] (1950) light-scattering photometer (which was a goniospectrophotometer used to evaluate the light-scattering properties of dilute solutions of high-molecular-weight materials). The monochromatic illumination was provided by a tungsten iodide incandescent lamp through a filter turret containing 16 interference filters (≈10 nm bandwidth) which sampled the 400-700 nm range every 20 nm. Colorimetric filters were also available. Rotation of the sample table provided for an illumination angle from 0° to 88° and the detector arm could be rotated from 23° to 88° (angle measured between the illuminating and viewing beams). This instrument achieved a much better angular resolution (.5° to 2°) than the Trilac (8.5° to 17°). Measurements were made on $BaSO_4$, MgO, papers, and metallized paint films.

Grum, et al.[21] (1971) described how two Cary spectrophotometers (models 11 and 14) were converted to

abridged spectrogoniophotometers using prisms with different apex angles. This instrument was used by Eastman Kodak to measure the light-scattering properties of transmission samples and predict particle-size distributions. Measurements were made from 380 to 700 nm at 10nm increments for angles of 0°, 10°, 20° and 30°. Nanjo, et al.[22] (1977) published a paper describing what they termed "a versatile and fully automatic goniospectrophotometer". The following settings could be controlled by a small personal computer: wavelength, angle of incidence (360° in the horizontal plane), angle of sample holder (360° in the horizontal plane) and viewing angle (horizontal and vertical planes). The state of the polarization of the incident light could also be specified. Measurements at 550 nm were made to obtain goniophotometric and polarization characteristics of smoked MgO, and also of $BaSO_4$ prepared by a new recipe (mentioned in the article). Weidner and Hsia [23] (1980) described the construction and testing of a specular reflectometer-spectrophotometer for calibrating the reflectance of mirror standards over the 250-2500 nm spectral range at the National Bureau of Standards. It used an integrating sphere arrangement which rotates 360° around a sample table which could also rotate 360°. Measurements with both vertically and horizontally polarized radiation were normally made.

This instrument could also be used to measure the bidirectional reflectance of a diffuse sample in the plane of the

incident sample beam, as described by Weidner and Hsia[24] (1981) when they determined the reflection properties of pressed Halon®[25]. Johnson and Stephenson[26](1983) investigated the influence of geometric tolerances on 45°/0° and 0°/45° colorimetric measurements using a Zeiss DMC-26 spectrophotometer with goniometer head. Illumination angles were varied from -15° to +15° and viewing angles from 30° to 60°. Many different materials were measured (ceramic tiles, Munsell papers, fluorescent and retroreflective class 1 & 2 materials). Clarke, et al.[27] (1983) determined the goniophotometric and polarization properties of white reflection standard materials using the National Physical Laboratory (NPL) reflection goniophotometer. Though this particular instrument was not described as having spectral capabilities, it is obvious from its physical design that it could easily be modified to do so since it uses optical benches which can accept all sorts of accessories. Grum and Miller[28] (1985) published a paper on "Goniospectrophotometric Characteristics of Standard Reference Materials for Colorimetry" and Fairchild and Grum[29] (1985) a paper on "Thermochromism of Ceramic Reference Tiles" both of which used the Munsell Color Science Laboratory goniospectrophotometer which will be modified for use in this thesis. Finally, Grum, et al.[30] (1986) also used this particular goniospectrophotometer for a study on "Goniospectrophotometric Characteristics of White Reflectance Standards within the CIE Recommended View Angle Limits for Normal/45°

Reflectance Factor Measurement."

Other articles which were referred to by other authors and could not be obtained are as follows: **1)** "Three-Dimensional Goniophotometer" by Kubo and Hori[31] (1966), **2)** "A Goniophotometer: Measurement of Reflection Characteristics of Paper under Pressure" by Inamoto, et al.[32] (1969), **3)** "An Abridged Goniophotometer for Evaluating Projection Screens and Other Diffusing Materials" by Saunders and De Palma[33] (1969), **4)** "The Use of a Time-shared Computer in Connection with an Automatic Goniophotometer" by Burrus[34], (1971), **5)** "Electronic Goniometer with Digital Display" by Emre and Marx[35] (1972), **6)** "The Newly Developed Recording Goniospectrophotometer and Its Application to the Measurement of Geometrical Metamerism" by Okazaki, et al.[36] (1973), **7)** "Goniospectrophotometry with Polarization from 0.25 to 1 μm" by Lafait[37] (1973), **8)** "Goniospectrophotometer for Measuring Three-Dimensional Light Scattering Distributions" by Toporetz, et al.[38] (1973), **9)** "The Spatial Distribution of Light Scattered by Very Cloudy Glasses and by a Rough Surface" by Toporetz, et al.[39] (1974), **10)** "A New Goniophotometer"[40] (1975), **11)** "Absolute Reflectance Measurements Using Integrating Spheres - Goniophotometric Corrections in the Evaluation of Results of Different Methods" by Reule[41] (1978), **12)** "Autocollimation of the Goniometer-Spectrometer" by Gorban', et al.[42] (1980), **13)** "Updating the GS-1M Goniometer-Spectrometer" by Zabudskii and Kobel'skii[43] (1980), **14)** "High Speed Gonio-Photometer by Means of Multi-

Photoreceptors" by Yamada, et al.[44] (1981), **15)** "Goniophotometer for Measuring the Bidirectional Reflection Characteristics of Materials" by Nepogodin[45] (1984).

A last goniospectrophotometer is described by Erb[46] (1977) who uses interference filters to get "monochromatic light". Unfortunately, a translated version of this German article could not be obtained to get more information about the instrument.

C. Situations Involving Goniospectrophotometry

In the world of color science, many situations are such that the only adequate instrument for the job is the goniospectrophotometer. A representative selection of these situations is presented below to stress the importance of goniospectrophotometry in the world of color science.

1) Helmholtz Reciprocity Law

Helmholtz Reciprocity Law is:[47]

> "The loss in flux density which an infinitely narrow bundle of rays of definite wavelength and state of polarization undergoes on its path through any medium by reflection, refraction, absorption, and scattering is exactly equal to the loss in flux density suffered by a bundle of the same wavelength and polarization pursuing an exactly opposite path."

Several authors[46,48,49,50] have questioned the validity of Helmholtz reciprocity law. While one author[46] admits that these discrepancies cannot be understood theoretically, others provide tentative explanations like: "... is probably due to the fact that the geometries are not exactly reversed, and to the uncertainties of measurement..."[51]. However, so many other

authors[4,14,26,27,47,52,53,54,55] state their support for the law that the inconsistency is probably best explained by the following comment taken from ASTM Standard E179-81[53]:

> "Several experimenters have presented evidence tending to refute the Helmholtz Reciprocal Relation, but it is strongly suspected that insufficient attention was given to the foregoing requirements for uniformity of weighting of all light fluxes leaving or entering the instrument apertures involved".

The latest study on the subject was reported in 1985 by Clarke and Parry [56] in an article titled "Helmholtz Reciprocity: Its Validity and Application to Reflectometry".

2) <u>Incomplete exclusion of Specular Component in Integrating Spheres</u>

As stated by Billmeyer and Marcus,[48] "... there is strong evidence of the serious problem of incomplete exclusion of the specular component with all of the integrating sphere geometries when operated in the specular-excluded mode, even with samples normally considered to be highly glossy or highly matte".

Hunter[55] stated: "The $D_{SEX}/0°$ geometry is not recommended for color measurement, because the light trap procedure for eliminating specular reflection fails with all but the glossiest surfaces to trap all of the specular reflection".

A concern was expressed by Hemmendinger[57] regarding the lack of existing information about "subtle differences in the effect produced by small differences in sphere design". He even questioned the validity of applying correction data based on a

reference laboratory instrument whose design is different from that of the operating laboratory.

Clark and Compton[58] recognized the inadequacy of integrating sphere gloss traps in an article titled "Correction Methods for Integrating Sphere Measurement of Hemispherical Reflectance". This inadequacy was found to be worse for samples with the "orange-peel" finish found on many gloss paint or polymer samples.

Budde[59] suggests the need for a "standard sphere" with an optional standard gloss trap whose specification might involve the solid angle of illumination or viewing and its relation to the sample area which is to be irradiated or viewed. His description of the incomplete specular exclusion problem is probably the best found in the literature:

> " A gloss trap is supposed to trap the specular spike which is superimposed on the diffuse reflectance. However since the shape of this spike and its "shoulders" vary from one material to the next... it is impossible to design a universal gloss trap which just traps the specular component without affecting much the measurement of the diffuse reflectance. Although many reflectometers make provision for trapping the specular component, it is unfortunate that their gloss traps vary in design. Therefore specular-component-excluded color measurements made in one instrument usually cannot be strictly compared with those made in an instrument with a gloss trap of different design."

Presently, there is no recommendation from the Commission Internationale de l'Eclairage about the adequate size for specular-excluded ports except to say that: "The integrating

sphere may be of any diameter provided the total area of the ports does not exceed 10 percent of the internal reflecting sphere area".[60]

3) Tolerances about Illuminating and Viewing Angles

Tolerances about illuminating and viewing angles when measuring bidirectional reflectance factor functions (BRDF's) of surfaces are of much interest to the color scientist since they are likely to introduce unacceptable errors in the measurements if not strict enough. CIE actually allows tolerances on the preferred geometries sufficiently generous to include most of the commercially available color instruments.[60] Studies have been made in relation to the sixty-degree specular gloss[61] and to the CIE-recommended angle limits for 0°/45° reflectance factor measurement.[26,30] The results of these three studies indicate a need for tighter tolerances to stay within the normally accepted spectral reflectance factor accuracy of ±0.005.

4) Goniochromatism

As mentioned earlier, "goniochromatism" is defined as "the change in color as the illumination and viewing angles are changed".[2] This phenomenon can result in effects where a sample can appear lighter than another one at a certain angle but darker at another angle. Another possibility is that two samples match most closely at 35°, but that at 75°, their X-, Y- and Z-values are closer to the match point than at 45°.[2]

Four independent sets of experiments related to goniochromatism were found in the literature. The instruments used were: **1)** the Trilac goniospectrophotometer[2], **2)** the research spectrogoniophotometer of the Renssalaer Color Measurement Laboratory[1], **3)** an instrument used at the Hunter Associates Laboratory by Leete[62], and finally **4)** a recording goniospectrophotometer used by Okazaki, et al.[36] These four studies demonstrated that the goniochromatic types of materials have to be spectrogoniophotometrically analyzed in order to be adequately characterized.

5) <u>Off-Specular Maxima</u>

Off-specular maxima have been observed by a few authors. The term "off-specular peak" is often used to describe this phenomenon even though the data involved does not show any peak.

Off-specular maxima were encountered by Knowles-Middleton and Mungal[64] (1952) when measuring the luminous directional reflectance of snow. They found that the specular component did not attain a maximum at an angle of reflection equal to that of incidence. Instead, the maximum was displaced to much larger angles. However, the authors explained their results by stating it was due to the rapid increase of slope of the Fresnel reflectance curve for ice at angles of incidence greater than 45°.

Torrance and Spencer[65] (1967) have studied this subject in much detail and developed an analytical model which assumes

that any roughened surface consists of small, randomly-disposed, mirror-like facets. This analysis was successful in predicting off-specular maxima in reflection distributions observed experimentally.

Erb, et al.[63] (1985) found some off-specular maxima in the directional distribution of diffusely reflecting materials (opal glasses). These maxima occurred at reflection angles larger than the angle of regular (specular) reflection. The flux in this direction was a few times higher than the flux at the specular angle. The reasons for the off-specular maxima are unknown.

6) Characterization of Metallic Samples

Metallized samples, such as automotive paints containing aluminum flakes as a colorant, require special equipment for measurement since their appearance is strongly dependent on the geometry of illumination and viewing.[66,67] In general, metals owe their appearance chiefly to the manner in which light is reflected in and near the direction of specular reflection.[4] Specific ASTM methods have been published relating to the measurement and calculation of reflecting characteristics of metallic surfaces [68] and in relation to their gloss measurement.[69] Because these methods use many different non-standard angles (other than 0° or 45°), goniospectrophotometric readings become a necessity and it is therefore important that the special equipment required for these measurements be properly calibrated. The major problem

so far is that neither the instruments nor the method of calculation have yet been standardized.[66]

7) Characterization of White Standard Reference Materials.

The characterization of white reference standards has been of much interest over the past years. This is particularly true for pressed and smoked MgO and pressed $BaSO_4$, probably because of their widespread adoption as white reflectance working standards. There is, therefore, a need for a critical evaluation of the properties of these materials, particularly in relation to those of the perfect diffuser. Many such studies have been carried out by different authors, some of whom studied both goniophotometric and polarization properties[22,27,70,71] while others limited their evaluation to either goniophotometric properties[1,14,16,28,30] or strictly reflectance measurements.[72,73,74] These types of characterization make the goniospectrophotometer the most suitable instrument for the purpose.

D. Problems Related to Goniospectrophotometry

Although a full-fledged goniospectrophotometer is the most flexible type of photometer available, its added flexibility also creates increased complexity. Two problems arising therefrom are described below.

1) Amount of Data Generated

Ideally, the properties of a material should be understood in terms of spectral reflectance properties under all geometric conditions of illumination and viewing.[75] However, many

authors[2,10,22,23,47,75] have recognized that it is almost impossible to handle the large amount of data generated by a three-axis spectrogoniophotometric study. Even with the help of automation or computers, this still remains a tedious and lengthy task. To improve the situation, suggestions have been made such as: 1) simplifying the geometric attributes (considering only relatively flat, uniform surface areas, and over-simplified specular and diffuse distributions of light)[6], 2) attempting to develop models whose reflectance could be mathematically defined[10], or 3) using what is called "application-oriented goniophotometry".[75] These three types of simplification appreciably reduce the number of measurements to be made but it should be realized that some information is also lost in the process.

2) Unavailability of Transfer Standard

Concern has been expressed at the Munsell Color Science Laboratory that there is no actual goniospectrophotometric transfer or calibration standard presently existing.[76] Most likely this is because only four geometries are recommended by CIE (0°/d, d/0°, 0°/45° and 45°/0°)[60] which means calibration standards are provided to match only these four geometries.

As far as calibration is concerned, the following is stated in ASTM Standard Recommended Practice E167[77]: "The method chosen for calibration by means of ASTM standards is determined by the character of the materials to be measured." Recommendations are given for both diffuse specimens and

specular measurement. It should be pointed out that the American Society for Testing Materials recommends many different geometries each of which related to a specific appearance attribute or type of material.[53] These geometries involve specular angles of 20°, 30°, 45°, 75° and 85°, and diffuse. They also include 30° incidence with off-specular measurements at 0.3°, 2° and 5°. Publications like NBS Technical Note 594-10[78] describe a few calibration methods (20°, 60° and 85° in this case) and emphasize the importance of using the proper procedure. This particular reference, however, is restricted to gloss measurements using polished black glass as the primary standard.

To circumvent this situation, two actions have been taken: **1)** "At each angle combination, the instrument was standardized to a $BaSO_4$ standard. This material was considered to be a uniform diffuser. The 45°/0° reflectance values of the $BaSO_4$, traceable to PTB (Physikalisch-Technische Bundesanstalt, West Germany), were used"[26], and **2)** "The special angle of 45°, preferred for radiance factor measurements, was also included to allow a direct link with standard reference data".[27]

The major drawback of the first approach is that it assumes the calibrated standard is a perfect diffuser (it is now well known that this is not the case with any of the standard reference materials used currently, although some of them provide very close approximations). There is, however, presently no other option available to anybody who wants to

make measurements at angles other than the CIE-recommended 0°/45° or 45°/0°. An expensive calibration has to be performed on a reference standard (in the U.S.A., this is normally by the National Bureau of Standards) and, in some way, its 0°/45° or 45°/0° calibration data has to used to "tie the data down".

E. Selection of Material for Transfer Standard

Since this study only deals with reflectance goniospectrophotometry, the text will restricts itself strictly to white reflectance standards.

1) Definition of Different Types of Standards

When dealing with white reflectance standards, the terminology employed in different references can be quite confusing. Some terms used in association with the three highest levels of white reflectance standards are:

a) for the perfect reflecting diffuser: primary standard,[27,66,73,74,79,80,81] ideal reference standard,[4] perfect reflecting diffuser,[82] reference standard[60] and perfect diffuser.[70]

b) for standard reference materials measured in a reference laboratory by an absolute method (like $BaSO_4$, Halon® and matte opal glasses): secondary transfer standard,[79] primary standard,[4,82] transfer standard,[66,80,81] laboratory standard,[81] secondary standard[27,74] and working standard.[70,73]

c) for standard reference materials calibrated in terms of the previous standard category: secondary working

standard,[4,79] working standard,[27,66,80,81] instrument standard[80,81] and transfer standard.[82]

In this report, the following definitions will be used:[83]

a) reference standard: represents the perfect reflecting diffuser as recommended by CIE:[60] "The perfect reflecting diffuser is recommended as the reference standard. It is defined as the ideal uniform diffuser with a reflectance equal to unity."

b) primary transfer standard: includes any standard calibrated by an absolute method by a standardization laboratory like the National Bureau of Standards. It includes, but is not restricted to, materials like $BaSO_4$, Halon® or opal glasses.

c) secondary transfer standard: standard prepared and/or calibrated by any laboratory in relation to a primary transfer standard.

The standard being developed in this thesis will therefore be referred to as a primary transfer standard. Although this standard will not be measured by an absolute method, the data reported will be absolute (calibrated against NBS data). Also, this standard will be prepared by an intermediate standardizing laboratory (Munsell Color Science Laboratory) and then be used by other laboratories to calibrate secondary transfer standards and instruments.

2) Possible Reference Standards Available

Typical white materials used as reflectance standards include: **1)** Ever-White,[84] **2)** barium sulfate pressings, barium sulfate coatings, carboxymethyl-cellulose (CMC) coatings of barium sulfate, potassium sulfate coatings, polyvinyl alcohol (PVA) coatings of barium sulfate, opal glasses (such as the Russian MS-14 and MS-20 or the Japanese ones), white structural glass (Vitrolite tile) and polytetrafluoroethylene (PTFE, commonly known as Halon®),[85] **3)** smoked or pressed MgO, fibrefax (a ceramic-fiber insulating felt), fluoroplastic-4,[74] and **4)** glossy ceramic tiles and white enamel plates.[79]

3) Selection of Most Suitable Material

Among the different materials abovementioned, only a few are considered adequate for the purpose of this study. An important criterion for the selection is that the standard must either be readily available or be easy to prepare by the user. This basically restricts the range of possible materials to pressed powders like MgO, barium sulfate and PTFE. Russian opals, for example, are hard to obtain and smoked MgO is difficult to prepare. Tablets pressed from $BaSO_4$ have been found to exhibit better stability and reproducibility than those pressed from MgO powder, and therefore MgO has been replaced by $BaSO_4$ for most applications.[27,80] Some drawbacks of $BaSO_4$, however, are that it is very difficult to press flawlessly,[27] its reflectance cannot be recovered once it has

been soiled and its IR reflectance is sensitive to changes in humidity.[86]

Halon®, on the other hand, has many advantages which make it the best candidate for the purpose of this study. These advantages were well summarized by a couple of authors:[80,87]

- it is highly reproducible,
- pressings can be readily cleaned,
- raw material is obtainable in pure form because it does not have an affinity for impurities,
- pressings of Halon® repel water and other chemicals,
- standard-size plaques are easily obtained,
- Halon® pressings are stable (with time or when heavily exposed to UV) ,
- the goniophotometric curves approximate that of a perfect diffuser,
- pressings are highly reflective,
- its reflectance is superior to $BaSO_4$ in the near-infrared spectral region,
- pressings can be molded or machined without losing their optical properties,
- Halon® is a rugged material,
- because of its optical and physical properties, Halon® can be used as a primary transfer standard of reflectance as well as a secondary transfer standard, and
- Halon® can also be used to coat integrating spheres.

A few disadvantages are:[87]

- the reflectance depends on the density of the pressed tablets,
- it has a soapy feeling if the density is too low,
- it shows a slight decrease of reflectance in the UV region below 250 nm, and`
- some luminescence has been measured by three authors.[88,89,90]

4) <u>Previous Research on Halon®</u>

The history of Halon® starts in 1973 when it was invented by Seiner, who now holds two patents on the subject[90,91] (1973 and 1976). In reference to Halon®, Eckerle, et al.[88] (1976) reported: "The present writer's attention was first called to this material several years ago by M. Saltzman of Allied Chemical who was one of the first to recognize its potential and by R. Johnston who had done some preliminary investigations of its suitability as a reflectance standard." However, the actual introduction of Halon® to the world of color science was done during a presentation to the 18th session of the CIE in September 1975 by Grum and Saltzman.[87]

As early as March 1976, articles began to appear periodically concerning either the measurement of some characteristics of Halon® or its use in different applications.

Grum and Saltzman's paper[87] (1975) compared Halon® to $BaSO_4$ and MgO in absolute reflectance from 250 nm to 2500 nm. A few photographs and electromicrographs of Halon® pressings were shown. The effect of pressure was studied and it was shown that although the reflectance of Halon® is pressure-sensitive, this sensitivity is not critical if the pressure is standardized. Stability tests (exposure to a UV-germicidal lamp and to a xenon lamp) were carried out and no change of reflectance in the visible region was observed. The same was found when Halon® pressings were subjected to incubation (dry oven, <18% RH, and 77°C). Goniophotometric measurements

showed Halon® pressings to be nearly perfect diffusers. Long-term keeping properties in the ambient environment of the laboratory and also use of Halon® samples in a G.E. spectrophotometer for months produced no change of reflectance. Advantages and disadvantages of the Halon® material were listed and three cleaning procedures were suggested.

Eckerle, et al.[88] (1976) described "a highly effective design" of an averaging sphere for ultraviolet, visible and near-infrared wavelengths (200 nm to 2000 nm). Three different preparations of $BaSO_4$ and Halon® were used as sphere coatings. The comparison resulted in the following two conclusions: 1) Halon® showed a significant advantage in the UV region over all but one of the $BaSO_4$ samples, and 2) Halon® had very high reflectance through the visible and near IR to at least 2000 nm with minimal spectral fluctuation. Halon® was found to fluoresce very slightly with excitation in the wavelength range 250 nm to 280 nm and emission in the range 310 nm to 350 nm. It was not determined if this fluorescence was a property of the material or if it resulted from a contaminant such as the plasticizer from the bag in which the material was shipped and stored. Stability tests (heavy exposure to a high pressure xenon arc lamp) were performed and the change in sphere efficiency was found to be only a little greater than the 5% uncertainty of the efficiency determinations. These authors (Eckerle, et al) also reported the work of Norris[92] on the reflectance

characteristics of Halon® and of Johnston[93] on the deterioration of the reflectance properties in the visible range of Halon® with age. It seems no articles have been published on these two studies.

Saunders and Ott [89] (1976) studied the effect of UV-produced fluorescence on spectral irradiance measurements in integrating spheres. The two coating materials compared were $BaSO_4$ and Halon®, and two lamps (tungsten and deuterium) were used to provide the illumination. The results showed that the integrating sphere coated with Halon® was fluorescing due to incident short length radiation, which supported the findings of Eckerle, et al above.

Venable, et al [94] (1977) carried out a thorough study and error analysis of the Van den Akker or "auxiliary sphere" method of determining a scale of directional-hemispherical reflectance factor. As part of this study, data was provided for both Halon® (one preparation) and $BaSO_4$ (two different preparations) as follows: **1)** reflectance (6° incidence) of integrating sphere wall coatings at 400 nm, 550 nm and 700 nm as a function of thickness, **2)** Van den Akker reflectance (6° incidence) of the coatings as a function of wavelength, **3)** normalized self-radiance at 550 nm as a function of angle of viewing, **4)** relative directional-hemispherical reflectance as a function of angle of incidence, **5)** adjustment function C (defined in the article) as a function of angle of incidence at 450 nm, 550 nm and 750 nm, **6)** correction coefficient (6°, lambda) as a function

of wavelength and **7)** retroreflective bidirectional reflectance factor for 6° incidence as a function of observation angle.

CIE published "A Review of Publications on Properties and Reflection Values of Material Reflection Standards"[74] (1979) which included Halon® as part of section "D. Glasses, Tiles and Plastics". The three references described in this review[87,88,89] were already covered above.

Erb and Budde[80] (1979) included Halon® in their article on "Properties of Standard Materials for Reflection". However, this paper was merely a summary of the CIE publication 46 above[74] and therefore did not provide any additional information on the subject.

Schutt, et al.[86] (1981) compared the reflectivity of Halon® with that of $BaSO_4$ coated on panels measured under the sun's illumination. Three different Halon® surface preparations (surfaces were sprayed) and three sample treatments provided nine combinations for which reflectance values were measured at Thematic Mapper wavelengths i.e. corresponding to the six spectral bands chosen for the earth-resource mission of the Landsat-D satellite. Polarization was considered and its effect was found to be the same for both $BaSO_4$ and Halon®. The study concluded that the reflective properties of Halon® were comparable with those of $BaSO_4$ but Halon® is both washable and insensitive to humidity changes. Even though this article clearly addresses a remote-sensing application, it constitutes

another example of the increasing interest in Halon® as a white reference coating.

Weidner and Hsia [24] (1981) published a detailed study of the reflection properties of pressed polytetrafluoroethylene powder, or Halon®. In this article they basically described the data obtained during five years of investigation of this material at the National Bureau of Standards, including:

1) techniques for preparing reflection standards and coating integrating spheres with the pressed powder,
2) effects of powder density and thickness on the Halon® reflectance ,
3) problems with fluorescence, possibly due to the presence of contaminants in the powder,
4) absolute reflectance (6°/hemispherical reflectance factor relative to a perfect diffuser) for the spectral range of 200 nm to 2500 nm,
5) directional/ hemispherical reflectance factor relative to 6°/hemispherical reflectance for several wavelengths in the ultraviolet and visible spectrum and for angles of incidence between 5° and 75°,
6) bidirectional reflectance factor for 300 nm, 600 nm and 1500 nm at angles of incidence of -10°, -30°, -50°, and -70° and at 10° viewing intervals from -80° to +80°, and
7) indication that although PTFE powder is very fine and easily mixes in the air about the working area, it is nontoxic; however, PTFE may form toxic gases at

thermal decomposition temperatures above 400°C (which could happen with inadvertent contact with any high temperature source). On this topic, the authors refer to a publication by Du Pont on the safe handling of fluorocarbon resins.[95]

At the end of the article, it was also stated that: "Further studies of the reflection properties of pressed PTFE powder are being made at NBS. Among these properties are the 45°/0° or 0°/45° reflectance factors for the visible spectral region. The results of these studies will be published at a future date."

Budde, Erb and Hsia[96] (1982) were involved in an international intercomparison of absolute reflectance scales for d/0° and 0°/d geometries. The authors represented NRC (Canada), PTB (FRG) and NBS (USA) respectively. Although the intercomparison was not originally supposed to involve Halon®, an exchange of a Halon® sample between NBS and NRC was arranged. The results of this intercomparison are presented as a table of reflectance data as a function of wavelength at 25nm intervals. The ratio of the NBS values to the NRC values are also included in the table and average 1.00127 ± 0.00097.

Schutt, et al. [97] (1984) followed up their 1981 article with a description of the compositions of two optical reference coatings formulated with silicone binders and using Halon® as the reflecting material. The two paints proposed provide a more durable coating but to the cost of ≈ 5% reflectance. The two

new compositions resulted because the binder suggested in the 1981 article is no longer manufactured.

Butner, Schutt and Shai [98] (1984) compared the reflectance characteristics of polytetrafluoroethylene and barium sulfate paints. This comparison was intended to present some preliminary results of the directional reflectance measurements taken on two TFE-containing silicone paints, because their conformance to the ideal Lambertian diffuser was found to exceed that of barium sulfate pressed powder and paint. Reflectances were measured at forward viewing angles of 0°, 25° and 50° (to the paint surface normal) for wavelengths of 253.7 nm, 435.8 nm and 546.1 nm. Samples were illuminated at an incidence angle of 25° by a mercury lamp. The total hemispherical reflectance relative to pressed barium sulfate powder was shown for the TFE paints and the $BaSO_4$ paints from 220 nm to 2500 nm. Tests were also carried out to quantify the effects of water on the reflectance characteristics of these materials and it was found that both TFE paints were not significantly affected. It was stated that future work would extend the optical characterization over a wider range of wavelengths and viewing and incidence angles.

Weidner, Hsia and Adams [99] (1985) reported on a laboratory intercomparison study of pressed polytetrafluoroethylene powder reflectance standards. Two round-robin experiments involving nine laboratories provided data on the variability of the reflectance of pressed PTFE reflectance standards prepared

in different laboratories. The specimens were all measured relative to a freshly prepared PTFE specimen. The data were adjusted to an absolute reflectance scale based on the 6°/hemispherical reflectance of PTFE previously published.[24] The first round-robin resulted in samples with densities ranging from 0.87 g/cm^3 to 2.10 g/cm^3. Variation in reflectance values led to the conclusion that improvement in reproducibility of spectral reflectance measurements for pressed PTFE powder in the UV and near IR required that the density of the specimen be controlled and care be taken to maintain the material purity. For the second round robin, the participants were asked to try to submit pressed PTFE samples of 0.9 ± 0.05 g/cm^3 in density. The sample returned ranged in densities from ≈0.80 to 1.08 g/cm^3. A smaller spread in reflectance values were obtained and indicated that controlling the density was important.

In both cases, repeatability improved within the visible range (400 nm - 700 nm). Additional experiments carried out by NBS included: **1)** specimen positioning at the reflectometer sample port which demonstrated that larger spacings between the plane of the specimen and the plane of the integrating sphere port resulted in decreased reflectance values, **2)** comparison of PTFE from two manufacturers (the differences reported were not significant), and **3)** the reproducibility of the reflectance values for pressed PTFE powder as determined by the double-sphere technique was tested and no differences were found between these trials. Finally, NBS recommended procedures for

preparing and using pressed PTFE powder as a reflectance standard.

Grum and Miller[28] (1985) studied the goniospectrophotometric characteristics of two standard reference material, namely Eastman white reflectance standard ($BaSO_4$) and Halon®. The measurements were performed for geometries ranging from 0°/35° to 0°/55° in five- degree increments to determine if the CIE recommendation of geometric tolerances for spectral reflectance factor measurements is adequate for accurate measurements. From the data, it was obvious that the spectral reflectance factors decreased with increasing collection angles for both $BaSO_4$ and Halon®.

Grum, Fairchild, and Berns[30] (1986) took a closer look at the 0°/45° angles tolerances using 1-degree increments from 40° to 50° to collect spectral data from 380nm to 700nm in 10nm increments. Tables and graphs showing luminous reflectance factors (D_{65}, 2°) and spectral reflectance factors at various view angles (0° illumination) were presented and resulted in the conclusion that the current CIE tolerances need to be tightened.

Weidner, et al.[100] (1986) investigated the use of sintered mixtures of phosphors in polytetrafluoroethylene resin for fluorescence standards. The spectral properties of PTFE are ideal for this application because of its low absorption in both the UV and visible spectrum. Initially, the stability of the specimen was examined under exposure to UV radiation. The observed differences were too small to be seen when plotting

reflectance (0 to 1.0) as a function of wavelength (380nm to 750nm). This was the only data presented in the article (plotted, but no corresponding table). The powder was pressed to a density of 1 g/cm^3 in a crucible which shared close similarities with the powder press described by Weidner, et al [99] in their 1985 article.

2. OBJECTIVE

The objective of this thesis is the development of a photometric primary transfer standard for reflectance goniospectrophotometry for calibration of secondary transfer standards or spectrophotometric instruments at nonstandard angles. This research implies the design and characterization of an instrument for the necessary measurements, the soltware development for data manipulation, the comparison of different materials and surface preparations, and the characterization of the selected transfer standard. This work is more or less an extension to the work already started by Grum and Saltzman,[87] Weidner and Hsia[24] and Wiedner, Hsia and Adams.[99] The scope of this evaluation also falls very well in line with one of the proposed areas of study (to measure the gonioreflectometric characteristics of PTFE) of the newly formed CIE TC2-11 "Committee on Gonioreflectometry of Standard Materials" chaired by Dr. J.J. Hsia.

3. Definitions

A. Reflectance Terms

One of the best references to date on measurement geometries is NBS Monograph 160: "Geometrical Considerations and

Nomenclature for Reflectance" (1977).[101] It covered nine kinds of reflectance and nine kinds of reflectance factors and described in detail the terminology applying to each set of conditions. in our case, we are interested in the "Bidirectional Reflectance Factor" (BRF) which is normally represented by the symbol R and is a function of the angles θ_i, ϕ_i, θ_r, and ϕ_r, where i and r stand for incident and reflected respectively. These angles are defined graphically in figure 1 (taken from Nicodemus, et al.[101]). To avoid confusing ϕ_i and ϕ_r with the flux Φ, symbols η_i and η_r are used, respectively, in ANSI and ISO documents. However, this convention has not yet been widely accepted by the color science world.

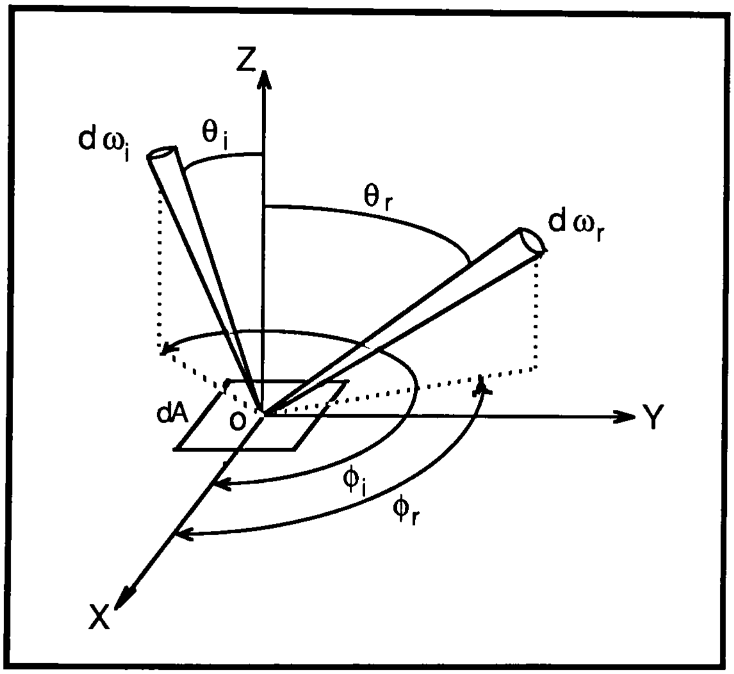


Figure 1 - Geometry of incident and reflected elementary beams.

It should be noted that for this thesis the difference between Φ_i and Φ_r will always be 180° because of the design of the

goniospectrophotometer. In other words, the change of the two θ angles will always be in a common plane (see figure 2).

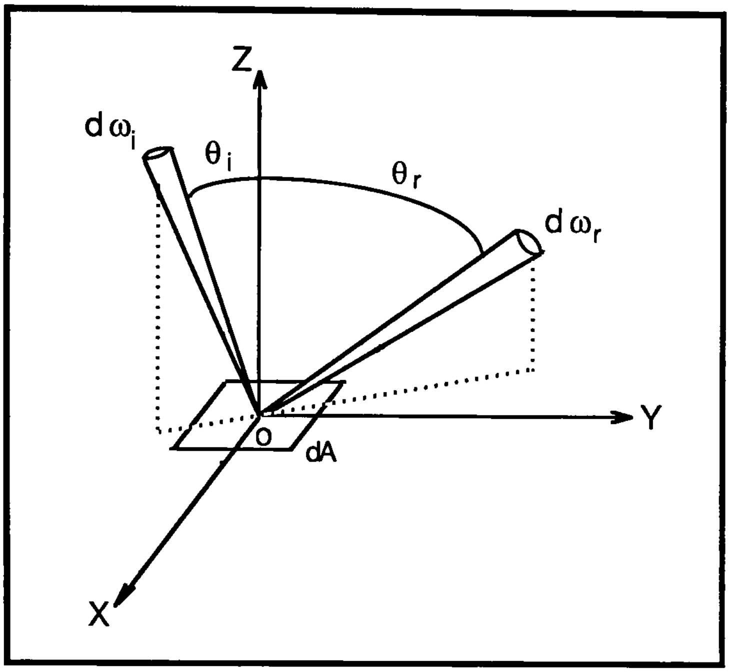


Figure 2 - Geometry when $\Phi_i + \Phi_r = 180°$.

However, in this report, "ß" will be used instead of "R" to represent the reflectance factors. This will ensure consistency with the derivation of the polarization formulas in the subsequent theory section based on Clarke, et al. (1983).[27] In their article, "R" is used to represent detector readings and "ß" for luminance factors. The use of ß to represent bidirectional reflectance factors is recommended by Wyszecki and Stiles in their book Color Science.[79]

B. Polarization Terms

Light can be treated as a travelling electromagnetic wave.[102,103,104] Figure 3 (from Oriel[105]) shows the relationship between the electric field, the magnetic field, and the direction of the light ray.

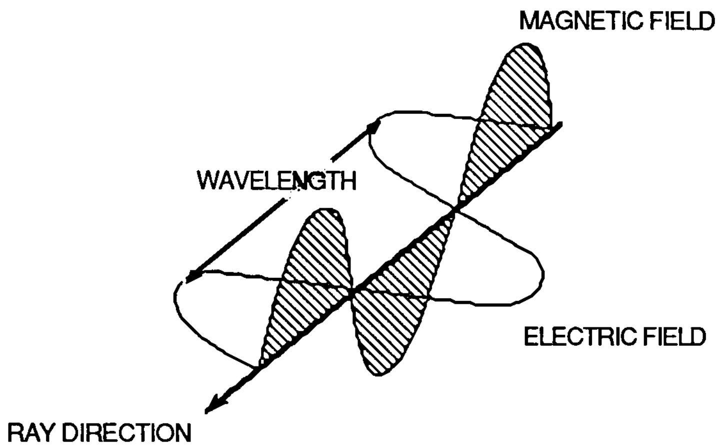


Figure 3 - Electromagnetic Wave

Note that the electric and magnetic fields are perpendicular. This is always true and implies that defining the electric vector also defines the magnetic vector. The electric field is used to define polarization.

If we use a light source as an emitter of electromagnetic waves, we can consider the source to be made up of a large number of atomic or molecular emitters. If they are randomly oriented, their electric fields will have no preferred orientation and the light will be unpolarized. However, if these electric fields were all oriented in the same direction, the beam would be linearly

polarized. A linearly polarized beam can be oriented either horizontally or vertically relative to a plane of reference. For reflectance measurements, this reference plane is either the plane of incidence or the plane of reflection. The terms often used to describe the two states of polarization are "parallel" (for horizontal) and "perpendicular" (for vertical). Unfortunately, no unique pair of symbols or subscripts is used to represent these two states. Table 1 lists examples of the symbols used by different authors.

TABLE 1 - Equivalent Subscripts to Represent the Electric Vector

parallel	p	TM	∥	1	π	0°	H	L	P
perpendicular	s	TE	⊥	r	σ	90°	V	P	S

NOTE: 1. "p" and "s" are derived from the German words "parallel" and "senkrecht" respectively.
2. The first 8 pairs were listed in CIE Publication 59.
3. "P" and "S" are often used in the specification of dielectric coatings.
4. "L" and "P" were used in an article by Carmer and Bair.

In this report, subscripts "s" and "p" will be exclusively used to represent the perpendicular and the parallel polarization components respectively. It should be noted that any ray with linear polarization can be resolved into two components polarized

along any arbitrary orthogonal axes by normal vector-sum rules as seen in figure 4 (from Oriel):

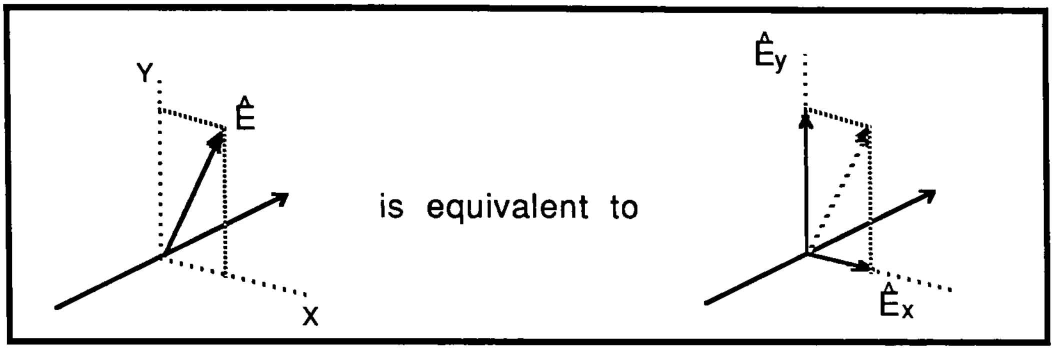


Figure 4 - Resolution of Linearly Polarized Light

C. Accuracy vs Precision

The terms "accuracy" and "precision" can be easily confused if not carefully used. "Accuracy" is the ability of an instrument to measure the true value of some function. "Precision" is the ability of an instrument to output the same value when repeatedly measuring an identical function. Precision is often related to words like repeatability, reproducibility, and stability and involves such things as sample positioning, drift of the source, and even angle errors. More confusion arises when the two terms are used in conjunction to qualify a measurement. To better understand this situation, consider a few examples. Assume a series of readings were taken under identical conditions thus obtaining a normal distribution. A few possible different cases are seen in figures 5 to 10:

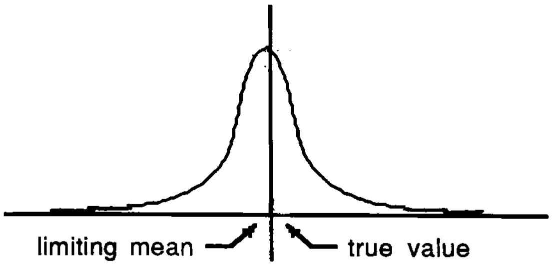


Figure 5 - Accurate and precise measurement process.

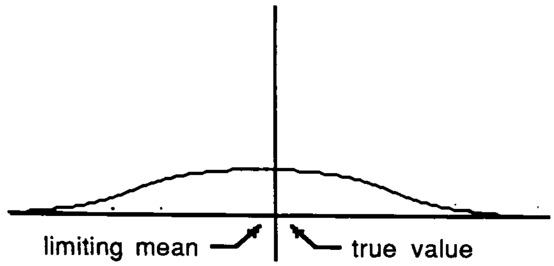


Figure 6 - Accurate but imprecise measurement process.

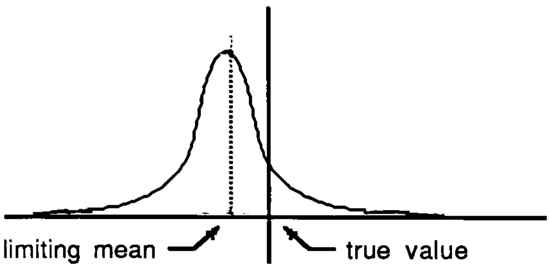


Figure 7 - Precise but inaccurate measurement process.

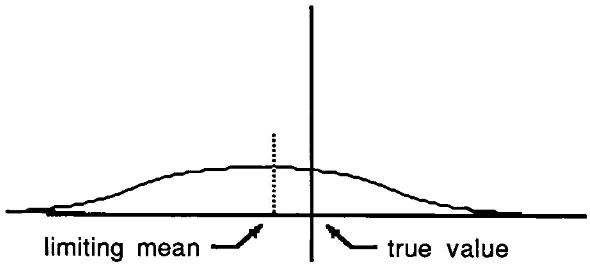


Figure 8 - Imprecise and inaccurate measurement process.

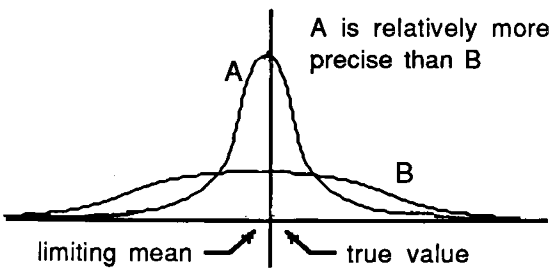


Figure 9 - Difference in precision when having same limiting mean.

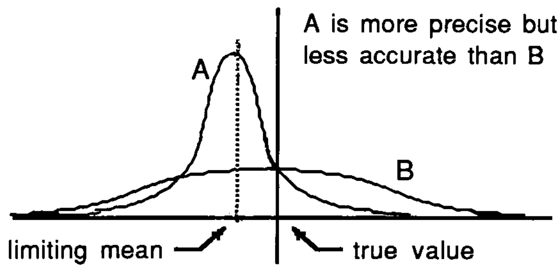


Figure 10 - Difference in precision when having different accuracies.

In practice, the instrument is limited in both accuracy and precision. One way to obtain high accuracy is to optimize each element when designing and calibrating an instrument. Analysis of appropriate standard reference materials (from NBS, for example) or use of calibrated and line sources are the easiest and best ways

to investigate bias, i.e. mean not equal to the true value. The mean can be better-determined by making multiple measurements but since this is time-consuming, it is often not applied as much as desired.

4. Theory

A. Radiometry of Measurements

There are two major approaches taken when measuring reflected radiation using a goniospectrophotomer.

1) keep the measured area always larger than, or at most equal to, the surface of the irradiated specimen (the surrounding area must be perfectly "black"),

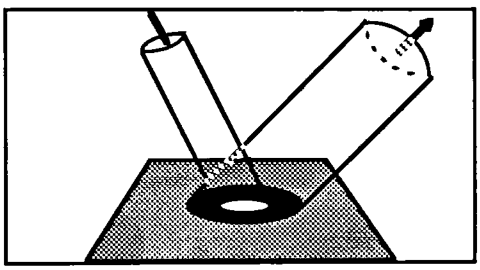


Figure 11 - Measured area larger than illuminated area.

Note that the whole surface shown in gray in figure 11 should really be black (gray was chosen for clarity).

2) keep the irradiated area always larger than, or at most equal to, the area of the measured specimen.

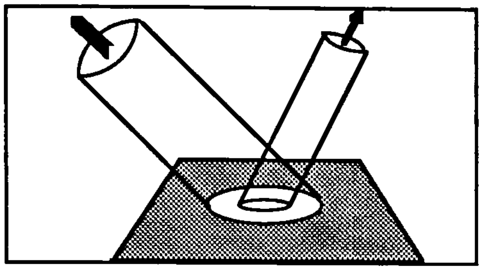


Figure 12 - Measured area smaller than illuminated area.

The second alternative applies to the MCSL goniospectrophotometer. During the following derivation of radiometric relationships, refer to figure 13. The entire system will be studied step-by-step to cover all the radiometric quantities and geometric factors involved.

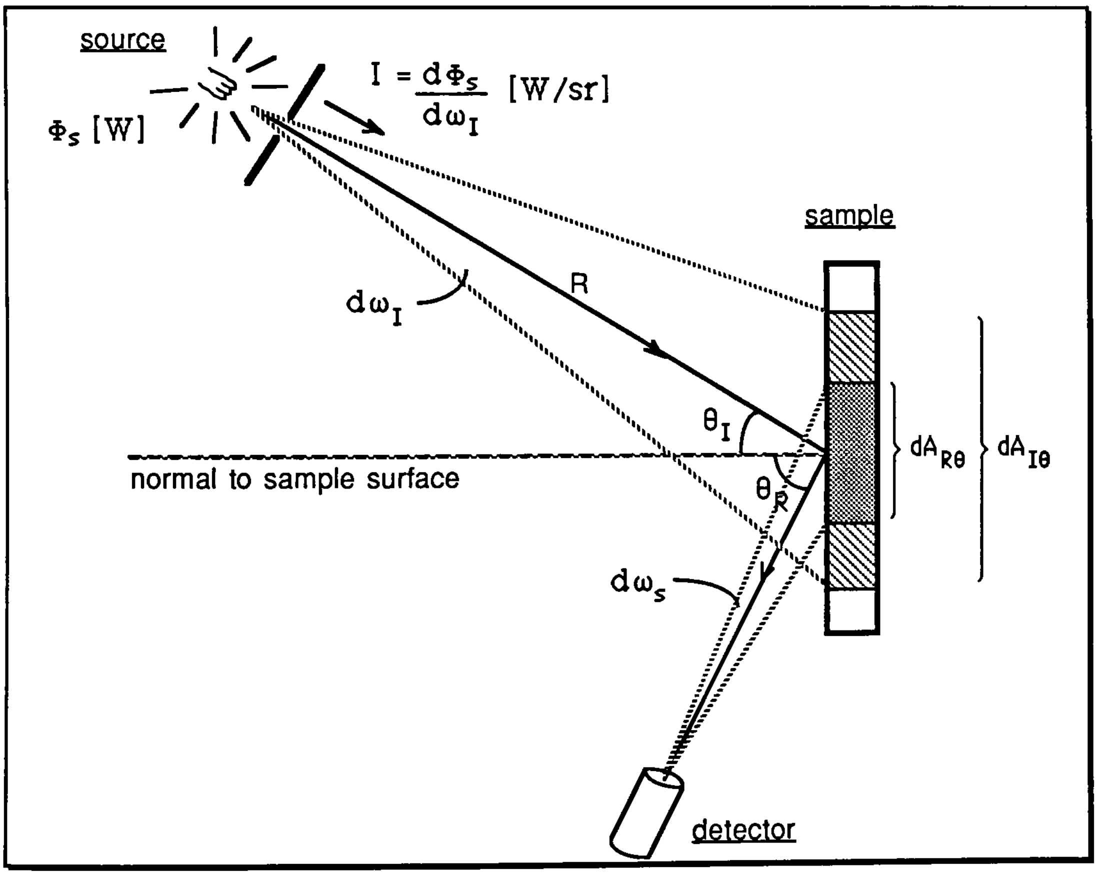


Figure 13 - Geometric factors and radiometric quantities involved in the system.

1) Radiant flux from the source

The radiant flux is expressed in watts and is a characteristic of the actual lamp used:

$$\Phi_s \quad [W] .$$

2) Total intensity from source

Since there are 4π steradians in a sphere, the total intensity from the point source is:

$$I_T = \frac{\Phi_s}{4\pi} \quad [W/sr] .$$

3) Intensity towards sample

Assume the radiant flux from the source is uniformly distributed around its hemisphere:

$$I_s = \frac{\Phi_s}{d\omega_l} \quad [W/sr] .$$

where $d\omega_l = \frac{dA_{l\theta}}{R^2}$, and $dA_{l\theta}$ represents the area determined by the incident beam at an incident angle θ, and R is the distance betwween the source and the sample surface.

4) Irradiance onto the sample at normal angle of illumination

$$E_0 = \frac{\Phi_s}{dA_{l0}} \quad [W/m^2] .$$

where the "o" subscript represents the normal angle of incidence.

5) <u>Irradiance onto the sample at any angle of illumination</u>

One complication arises from variation of the angle of illuminaiton. Because the cross-section of the ilumination beam is constant, a change in incident angle changes the size of the irradiated area of the sample as shown in figure 14:

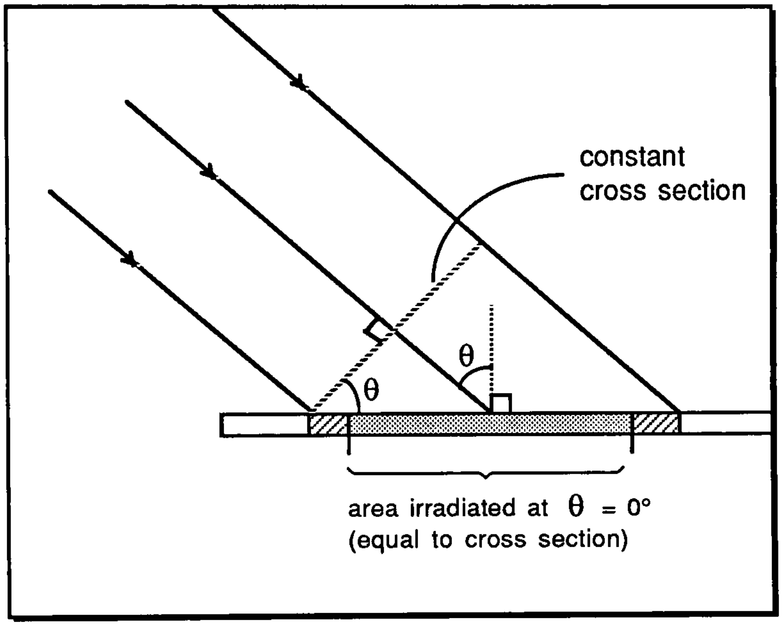


Figure14- Sample Area Cosine Factor.

In the diagram above, the two angles are equal since their two sides are mutually perpendicular. Therefore, the following relationships are true:

$$\text{Cos}\theta = \frac{\text{illumination beam cross section}}{\text{surface width}},$$

$$\text{surface width} = \frac{\text{beam cross section}}{\cos\theta}, \text{ and}$$

$$dA_{I\theta} = \frac{dA_{I0}}{\text{Cos}\theta_I} \quad [m^2],$$

which gives:

$$E_{\theta_I} = \frac{\Phi_s}{dA_{I\theta}} = \frac{\Phi_s \mathrm{Cos}\theta_I}{dA_{I0}} \quad [\mathrm{W/m^2}] .$$

Therefore,

$$E_{\theta_I} = E_0 \mathrm{Cos}\theta_I \quad [\mathrm{W/m^2}] .$$

This relationship means that increasing the illumination angle decreqases the irradiance at that angle relaive to normal incidence. This makes sense because increasing trhe angle results in a larger irradiated surface and spreads the flux over a larger area, thus decreasing the irradiance [W/m^2].

The irradiance can also be represented by the inverse square law of illumination (assuming a point source):

$$E_{\theta_I} = \frac{I_s \mathrm{Cos}\theta_I}{R^2} \quad [\mathrm{W/m^2}] .$$

6) <u>Radiance from sample for $\theta_I = 0°$ and any angle of viewing θ_R</u>

Assume the irradiance onto the sample surface is constant ($\theta_I = 0°$ in this case) and uniform, and the surface is a perfect reflecting diffuser obeying Lambert's cosine law (the luminance is proportional to $\mathrm{Cos}\theta_R$):

$$L(0, \theta_R) = \frac{E_0 \mathrm{Cos}\theta_R}{\pi} \quad [\mathrm{W/m^2 sr}] \quad \{\text{Lambert's cosine law}\}.$$

7) <u>Radiance from imperfect sample for $\theta_I = 0°$ and any θ_R</u>

In this case, the sample surface still obeys Lambert's cosine law but is no longer perfectly reflecting. This introduces an

additional quantity known as the radiance factor ß into the radiance equation. "ß" is defined as "the ratio of the radiant flux reflected in the directions delimited by a given cone, with apex at the given surface element, to the radiant flux reflected in the same directions by the perfect reflecting diffuser identically illuminated".[79] This ß is dependent on three angles, namely θ_I, θ_R, and Ψ. Angle Ψ is the angle between the half-planes through the normal to the surface that contains the direction defined by θ_I and θ_R (this angle is seen in figure 1, broken down in two angles, ϕ_i and ϕ_r). Since Ψ is constant (180°), it will not be shown as an argument of ß in the following derivations. If ß is now included in the radiance equation:

$$L(0,\theta_R) = \beta(0,\theta_R)\frac{E_0 \mathrm{Cos}\theta_R}{\pi} \quad [\mathrm{W/m^2sr}] \; .$$

Two assumptions are made with reference to the reflectance fac-tor:

1. the reflection of the diffuser is isotropic, meaning that $\beta(\theta_I,\theta_R)$ is unchanged by any rotation of the surface in its own plane,
2. Helmholtz's law of reciprocity is valid, which means that the reflectance of the diffusing surface is the same if the directions of incidence and view are interchanged, that is,

$$\beta(\theta_I,\theta_R) = \beta(\theta_R,\theta_I).$$

8) <u>Radiance from imperfect sample for any θ_I and θ_R</u>

The illumination angle will now be varied again which means that E is replaced by its E equivalent.

$$E_{\theta_I} = E_0 Cos\theta_I \qquad \text{[from 5)]} .$$

$$L(\theta_I,\theta_R) = \beta(\theta_I,\theta_R) \frac{E_{\theta_I} Cos\theta_R}{\pi} \qquad [W/m^2sr] \text{ , and}$$

$$L(\theta_I,\theta_R) = \beta(\theta_I,\theta_R) \frac{E_0 Cos\theta_I Cos\theta_R}{\pi} \qquad [W/m^2sr] \text{ .}$$

9) <u>Intensity from imperfect sample with surface dA_{R0}.</u>

Surface dA_{R0} is that seen by the detector at a viewing angle of 0° ("R" stands for reflection). The surface dA_{R0} behaves like a source whose radiant intensity dI is given by the following expression:

$$dI_0(\theta_I,\theta_R) = L(\theta_I,\theta_R) dA_{R0} \text{ , and}$$

$$dI_0(\theta_I,\theta_R) = \beta(\theta_I,\theta_R) \frac{E_0 Cos\theta_I Cos\theta_R dA_{R0}}{\pi} \qquad [W/sr] \text{ .}$$

This equation represents the situation of constant surface area dA_{R0} while the viewing angle changes. While looking at this viewed area as θ_R increases, the area wil decrease due to the cosine factor. The notation dI_0 seen in the equation indicates the intensity when the viewed area is dA_{R0}.

10) <u>Intensity from imperfect sample with surface $dA_{R\theta}$.</u>

This time the area dA_{R0} becomes $dA_{R\theta}$:

$$dI_\theta(\theta_I,\theta_R) = \beta(\theta_I,\theta_R)\frac{E_0 Cos\theta_I Cos\theta_R dA_{R\theta}}{\pi}.$$

Because the cross-section of the viewing beam is constant, a change in viewing angle produces a change in the projected area of the sampel as follows:

$$dA_{R\theta} = \frac{dA_{R0}}{Cos\theta_R}.$$

Note that if you could see the spot viewed on the sample by the detector it would appear to remain constant with angle changes (from the viewer's point-of-view). The intensity equation becomes:

$$dI_\theta(\theta_I,\theta_R) = \beta(\theta_I,\theta_R)\frac{E_0 Cos\theta_I Cos\theta_R dA_{R0}}{\pi Cos\theta_R},$$ and finally

$$\boxed{dI_\theta(\theta_I,\theta_R) = \beta(\theta_I,\theta_R)\frac{E_0 Cos\theta_I dA_{R0}}{\pi}.}$$

Therefore, to compensate for the extra cosine effect due to the instrument geometry, all readings are divided by $Cos\theta_I$ to cancel the $Cos\theta_I$ in the numerator (see the section on data manipulation for further details).

B. Polarization

1) Source of Polarization

Unacceptable errors may be introduced into the spectrophotometric measurement if polarization effects are ignored. Clarke[27] stresses the problems associated with the assumption that the exceptionally matte finish of properly made powder pressings can be practically treated as an ideal diffuser and as a complete depolarizer. As described in the next section on scattering, it is widely accepted that part of the light incident on a matt surface is reflected or scattered without penetrating the sample and suffering multiple interreflections and scattering. This implies that the reflectance factors of matte samples are dependent on the polarization of the incident beam and that the sample can influence the polarization during reflection. CIE Publication 59 - "Polarization: Definitions and Nomenclature, Instrument Polarization"[109] - provides a good overview of optical components capable of influencing the state of polarization in instruments. More specifically, for the goniospectrophotometer used for this research:

a) mirror: polarization from surface reflections,

b) prism: polarization caused by surface reflections at non-normal angles of incidence. This effect should be extremely small since the prism is oriented normal to the beam. However, any deviation from normal would introduce polarization according to the following formula:

$$\frac{I_p}{I_s} = \sec^4(\Theta - \varnothing).$$

where I_p and I_s are the intensities of the p-state and s-state respectively, Θ is the reflection angle and $\varnothing$ is the refraction angle,

c) <u>slit:</u> no effect unless slit width is very small,

d) <u>diffracting grating:</u> the major source of polarization. The effect is very dependent on the properties of the grating. In the region of an anomaly in the grating, $\frac{E_p}{E_s}$ can change very rapidly with wavelength (by as much as a factor of 2 or 3 over a wavelength interval of 10 nm),

e) <u>source:</u> arc lamps do not appear to possess much intrinsic polarization. However, the long tube containing the lamp introduces polarization of a few percent with a plane of vibration perpendicular to the axis of the tube, and

f) <u>detector:</u> the polarization sensitivity of a detector is primarily determined by the polarization introduced by the reflection off the envelope or window, if any, and off the photo-sensitive surface. When light falls onto the detector at normal incidence, no polarization sensitivity is observed. However, as the angle of incidence increases, the light component polarized with its plane of vibration in the plane of incidence will suffer less

reflection loss and the detector will thus appear to be more sensitive to light of this state of polarization.

Since the detector used with the MCSL goniospectrophotometer is an array, its polarization sensitivity depends mainly on: 1) the diffraction grating used, and 2) the difference in angle of incidence between each of the 256 detectors in its array (see figure 15):

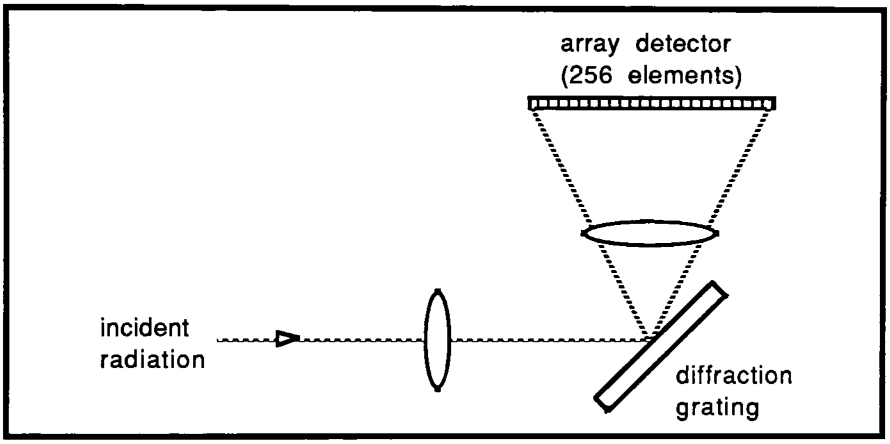


Figure 15 - Polarization introduced by detector.

As seen above, the detectors in the middle of the array will be illuminated normally while those at either end will not. The overall effect is that of a polarization-sensitive detector.

2) Correcting for the Presence of Polarization

The following derivations are based on an article by Clarke, Garforth, and Parry[27] (1983). Additional comments and intermediate steps were added for the sake of clarity.

Consider first an ideal system, i.e. one using the perfectly reflecting diffuser as reference and having non-polarized

ilumination, a non-polarizing sample, and a polarization-insensitive detection system. Note that the term "illumination" includes all optical components before the sample and the term "detection system" includes all optical components afer the sample. In this ideal case, the reflectance factor ß can be defined as:

$$\beta_{sample} = \frac{\text{reflectance of sample}}{\text{reflectance of perfect reflecting diffuser}}.$$

As a convention, all primed terms relate to the reference and all unprimed terms to the sample. Representing the reflectance by the detector reading R:

$$\beta = \frac{R}{R'} .$$

Consider the two orthogonal plane-polarization components of the illumination and the detection system:

$$\beta_{ss} = \beta_{sp} = \beta_{ps} = \beta_{pp} = \beta_{sr} = \beta_{pr} = \beta_{rs} = \beta_{rp} = \beta_{rr},$$

where <u>s</u> = polarization perpendicular to the plane of incidence (or reflection),

<u>p</u> = polarization parallel to the plane of incidence (or reflection),

<u>r</u> = random/unbiased polarization,

<u>plane of incidence/reflection</u> = plane containing both the incident (or reflected) beam of radiation and the normal to the sample plane,

1st subscript = refers to the polarization of the illumination, and

2nd subscript = refers to the polarization of the detection system.

Note that if the sample was the perfect reflecting diffuser, all ß's would be unity. The general setup required to measure the separate s- and p-polarization components mentioned above is seen in Figure 16:

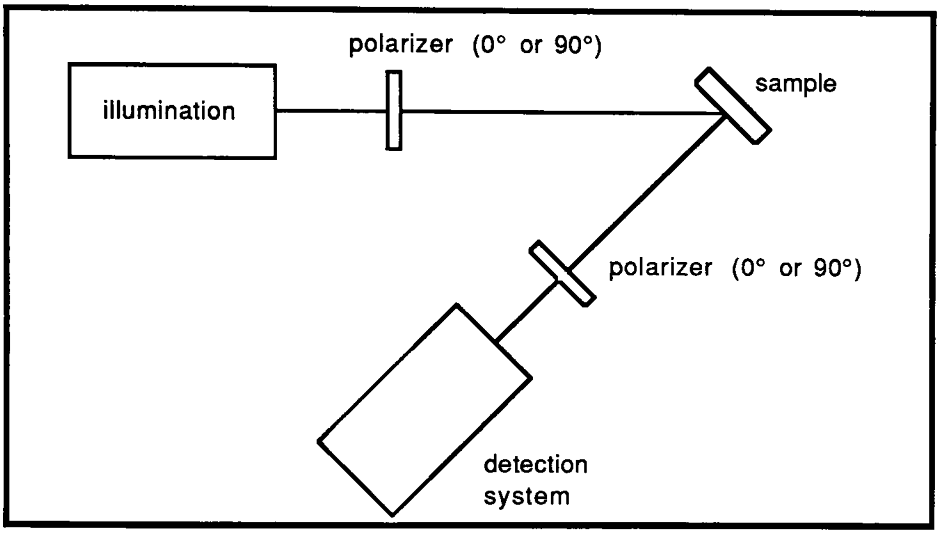


Figure 16 - Polarization Components Setup

Now consider the case of a polarizing sample. Since some polarization is now introduced in the system, the ß's are no longer equal. Instead,

$\beta_{ss} = \frac{R_{ss}}{R'_{ss}}$,	$\beta_{sp} = \frac{R_{sp}}{R'_{sp}}$,	$\beta_{ps} = \frac{R_{ps}}{R'_{ps}}$,	$\beta_{pp} = \frac{R_{pp}}{R'_{pp}}$,

$\beta_{sr} = \frac{R_{sr}}{R'_{sr}}$,	$\beta_{pr} = \frac{R_{pr}}{R'_{pr}}$,	$\beta_{rs} = \frac{R_{rs}}{R'_{rs}}$,	$\beta_{rp} = \frac{R_{rp}}{R'_{rp}}$,	$\beta_{rr} = \frac{R_{rr}}{R'_{rr}}$.

Remember that any plane-polarized flux can be represented by the sum of its orthogonal plane-polarized components which leads to the expression for β_{sr}:

$$R_{sr} = R_{ss} + R_{sp}\,, \quad \text{and} \quad R'_{sr} = R'_{ss} + R'_{sp}\,, \quad \text{which gives:}$$

$$\boxed{\beta_{sr} = \frac{R_{ss} + R_{sp}}{R'_{ss} + R'_{sp}}.}$$

Since the illumination is still ideal, the s- and p-components incident on the sample are equal in intensity. In the case of a perfectly reflecting diffuser [PRD], these s- and p-components are equally reflected towards the detector (since the PRD is non-polarizing). Also, since our ideal detector has no bias in polarization, it will read the same value for both the s- and p- components. Therefore,

$$\boxed{R'_{ss} = R'_{sp}\,,}$$

and

$$\boxed{\beta_{sr} = \frac{R_{ss}+R_{sp}}{R'_{ss}+R'_{sp}} = \frac{R_{ss}+R_{sp}}{R'_{ss}+R'_{ss}} = \frac{R_{ss}+R_{sp}}{2R'_{ss}} = \frac{1}{2}\left(\frac{R_{ss}}{R'_{ss}}+\frac{R_{sp}}{R'_{ss}}\right) = \frac{1}{2}\left(\frac{R_{ss}}{R'_{ss}}+\frac{R_{sp}}{R'_{sp}}\right) = \frac{\beta_{ss}+\beta_{sp}}{2}.}$$

It can similarly be shown that:

$$\boxed{\beta_{pr} = \frac{\beta_{ps}+\beta_{pp}}{2},} \quad \boxed{\beta_{rs} = \frac{\beta_{ss}+\beta_{ps}}{2},} \quad \boxed{\beta_{rp} = \frac{\beta_{sp}+\beta_{pp}}{2},} \quad \boxed{\beta_{rr} = \frac{\beta_{ss}+\beta_{sp}+\beta_{ps}+\beta_{pp}}{4}.}$$

These results mean the five other reflection factors can be computed once the four main factors β_{ss}, β_{sp}, β_{ps} and β_{pp} are known. Assume the reference is not a perfectly reflecting

diffuser, then $R'_{ss} \neq R'_{sp}$ and four additional measurements are needed (R'_{ss}, R'_{sp}, R'_{ps} and R'_{pp}). It should be noted that these four calibration readings can serve for a complete angular scan.

At this point, assume the illumination is polarized and the detection system is polarization-sensitive. Four additional readings (under special conditions) are needed to establish two instrument-polarization constants A and B. A is the bias associated with the polarization of the illumination system for random detection and is found by dividing the s-component by the p-component of the illumination. The instrumental setup required for this measurement is shown in figure 17:

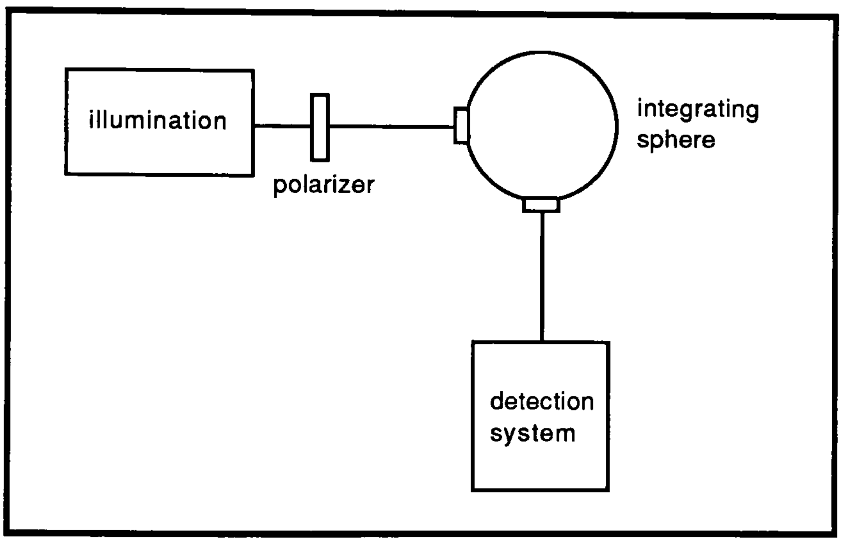


Figure 17 - "A" Constant Measurement Setup.

B is the bias associated with the polarization of the detection system for random illumination and is found by dividing the s- component by the p-component read by the

detector. The instrumental setup required for this measurement is shown in figure 18.

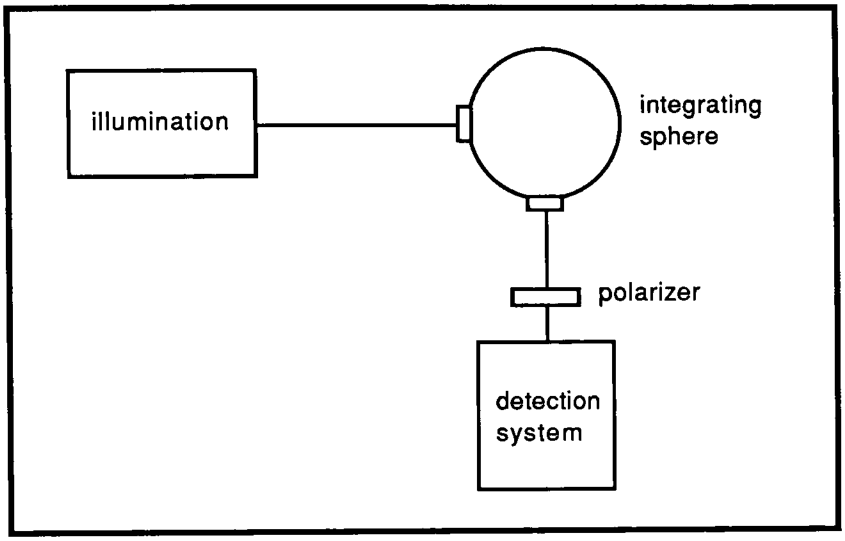


Figure 18 - "B" Constant Measurement Setup

A and B do not vary if no changes occur in the optical system, and so need be redetermined only occasionally. When using an array detector, these two constants are determined for each element of the array due to their different characteristics. Therefore, spectral files for A and B must be kept and applied to the appropriate wavelengths during the data manipulation

To continue the present analysis, both the illumination and the detection system must be assumed stable, but not necessarily equal, in sensitivity to s- or p-polarized radiation. The flux Φ_s from the illumination system and the polarization sensitivity S_s for the detection system can be found from:

$$\Phi_s = A\,\Phi_p\,, \quad \text{and} \quad S_s = B\,S_p\,.$$

In figure 19 below, the reflectance factor β_{ss} is related to the reading R_{ss} by:

$$R_{ss} = \Phi_s \beta_{ss} g S_s .$$

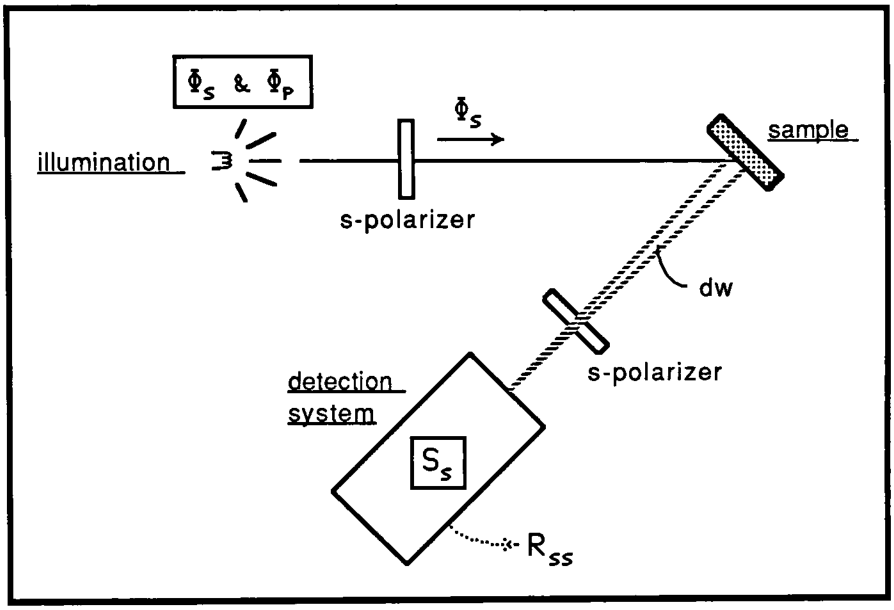


Figure 19 - ß and R Relationship Diagram

In general,

$$R_{ID} = \Phi_I \beta_{ID} g S_D .$$

where g = geometrical factor which tends to $\frac{dw}{\pi}$,

D = related to the detection system, and

I = related to the illumination.

The derivation of the final reflectance factor equations is continued by applying the relationships previously described. The detector-reading equations can be transformed as follows:

$R_{ss} = \Phi_s \beta_{ss} g S_s$	$S_s = B S_p$ →	$\frac{R_{ss}}{B} = \Phi_s \beta_{ss} g S_p$	$\Phi_s = A \Phi_p$ →	$R_{ss} = B A \Phi_p \beta_{ss} g S_p$
$R_{sp} = \Phi_s \beta_{sp} g S_p$	$\Phi_s = A \Phi_p$ →	$R_{sp} = A \Phi_p \beta_{sp} g S_p$	(as is) →	$R_{sp} = A \Phi_p \beta_{sp} g S_p$
$R_{ps} = \Phi_p \beta_{ps} g S_s$	$S_s = B S_p$ →	$\frac{R_{ps}}{B} = \Phi_p \beta_{ps} g S_p$	(as is) →	$\frac{R_{ps}}{B} = \Phi_p \beta_{ps} g S_p$
$R_{pp} = \Phi_p \beta_{pp} g S_p$	(as is) →	$R_{pp} = \Phi_p \beta_{pp} g S_p$	(as is) →	$R_{pp} = \Phi_p \beta_{pp} g S_p$

These last four equations all have expression ($\Phi_p g S_p$) in common. Factor this expression out:

$R_{ss} = \beta_{ss} AB (\Phi_p g S_p)$	At this point, the only undetermined quantities we have are Φ_p g and $\mathbb{S}_p$ which serve to calibrate the gonio-photometer for its reflectance factor scales on any sample at any angle.
$R_{sp} = \beta_{sp} A (\Phi_p g S_p)$	
$R_{ps} = \beta_{ps} B (\Phi_p g S_p)$	
$R_{pp} = \beta_{pp} (\Phi_p g S_p)$	

The only reflectance factor whose absolute magnitude is already known is β'_{rr} (from NBS, in our case). If we measure the calibrated standard, the reflectance factors are related to the detector readings in the same manner as for a sample, as derived above. We can also isolate the β's:

$$R'_{ss} = \beta'_{ss} AB(\Phi_p g S_p) \longrightarrow \beta'_{ss} = R'_{ss}/AB(\Phi_p g S_p)$$

$$R'_{sp} = \beta'_{sp} A (\Phi_p g S_p) \longrightarrow \beta'_{sp} = R'_{sp}/A(\Phi_p g S_p)$$

$$R'_{ps} = \beta'_{ps} B (\Phi_p g S_p) \longrightarrow \beta'_{ps} = R'_{ps}/B(\Phi_p g S_p)$$

$$R'_{pp} = \beta'_{pp} (\Phi_p g S_p) \longrightarrow \beta'_{pp} = R'_{pp}/(\Phi_p g S_p)$$

By adding the four reflectance factors representing the four polarization conditions:

$$\beta'_{ss}+\beta'_{sp}+\beta'_{ps}+\beta'_{pp} = \frac{R'_{ss}}{AB(\Phi_p g S_p)} + \frac{R'_{sp}}{A(\Phi_p g S_p)} + \frac{R'_{ps}}{B(\Phi_p g S_p)} + \frac{R'_{pp}}{(\Phi_p g S_p)},$$

$$\beta'_{ss}+\beta'_{sp}+\beta'_{ps}+\beta'_{pp} = \frac{R'_{ss}/AB + R'_{sp}/A + R'_{ps}/B + R'_{pp}}{(\Phi_p g S_p)}, \text{ and}$$

$$(\Phi_p g S_p) = \frac{R'_{ss}/AB + R'_{sp}/A + R'_{ps}/B + R'_{pp}}{\beta'_{ss}+\beta'_{sp}+\beta'_{ps}+\beta'_{pp}}.$$

Using the previously-derived equation:

$$\beta'_{rr} = \frac{\beta'_{ss}+\beta'_{sp}+\beta'_{ps}+\beta'_{pp}}{4},$$

yields:

$$(\Phi_p g S_p) = \frac{R'_{ss}/AB + R'_{sp}/A + R'_{ps}/B + R'_{pp}}{4\ \beta'_{rr}}.$$

This expression is substituted into the four following equations for reflectance factors:

$$\beta_{ss} = R_{ss} / AB\,(\Phi_p\, g\, S_p)$$

$$\beta_{sp} = R_{sp} / A\,(\Phi_p\, g\, S_p)$$

$$\beta_{ps} = R_{ps} / B\,(\Phi_p\, g\, S_p)$$

$$\beta_{pp} = R_{pp} / (\Phi_p\, g\, S_p)$$

This substitution yields four main reflectance-factor equations used for calculating the ß's:

$$\beta_{ss} = \frac{4\ \beta'_{rr}\, R_{ss}}{R'_{ss} + R'_{sp}B + R'_{ps}A + R'_{pp}AB},$$

$$\beta_{sp} = \frac{4\ \beta'_{rr}\, R_{sp}}{R'_{ss}/B + R'_{sp} + R'_{ps}A/B + R'_{pp}A},$$

$$\beta_{ps} = \frac{4\ \beta'_{rr}\, R_{ps}}{R'_{ss}/A + R'_{sp}B/A + R'_{ps} + R'_{pp}B}, \text{ and}$$

$$\beta_{pp} = \frac{4\ \beta'_{rr}\, R_{pp}}{R'_{ss}/AB + R'_{sp}/A + R'_{ps}/B + R'_{pp}}.$$

These ß's are determined for any angle of incidence in terms of:

1. the instrument readings of the sample at that angle,
2. the four calibrating readings,
3. the two polarization constants A, B, and
4. the absolute reflectance factor β'_{ss} of the standard.

From these four fundamental reflectance factors of the sample, the other five principal reflectance factors can be calculated using the equations just derived:

$$\beta_{sr} = \frac{\beta_{ss}+\beta_{sp}}{2}, \quad \beta_{pr} = \frac{\beta_{ps}+\beta_{pp}}{2}, \quad \beta_{rs} = \frac{\beta_{ss}+\beta_{ps}}{2}, \quad \beta_{rp} = \frac{\beta_{sp}+\beta_{pp}}{2}, \text{ and}$$

$$\beta_{rr} = \frac{\beta_{ss}+\beta_{sp}+\beta_{ps}+\beta_{pp}}{4}.$$

C. Interaction of Radiation with Rough Surfaces

Many authors have tried to describe the effect of incident radiation upon rough surfaces.[65, 109, 110, 111] These models also attempt to explain phenomena like polarization and off-specular reflections. Some authors specifically state their support of Helmholtz's reciprocity law on the basis of their hypothesis.

An elaborate discussion on the subject is found in Kortüm's Reflectance Spectroscopy.[109] The explanation which follows is based on this reference.

When radiation encounters a non-absorbing medium, two extreme cases can happen:

1) specular (or regular) reflection ony - this is the case of a perfect mirror (or ideal polished surface),
2) diffuse reflection only - this is the case of a perfect reflecting diffuser (or ideal matte surface).

However, the radiation reflected by a realistic diffusing medium is a superposition of these two components.

1) <u>Specular Reflections</u>

Assume that:

- a parallel monochromatic beam of light falls at an angle θ_I onto the interface between two media of refractive indices n_I and n_T (see figure 20 based on Kortüm's book[109]), and
- neither medium has any appreciable absorbance.

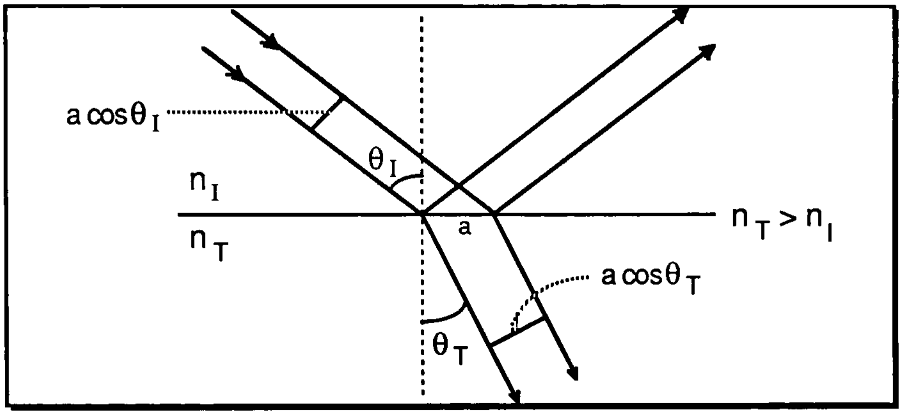


Figure 20 - Mirror reflection of a parallel beam of rays on a plane phase boundary.

The law of conservation of energy implies that:

$$E_I = E_R + E_T\frac{\cos\theta_T}{\cos\theta_I},$$

where E_I = incident irradiance (rasdiation flux per unit area of the cross-section of the beam),

E_R = reflected irradiance,

E_T = refracted irradiance,

θ_I = angle of incidence,

θ_T = angle of refraction (transmision), and

$\frac{\cos\theta_T}{\cos\theta_I}$ = factor which accounts for the increase in beam cross-section of the beam due to refraction.

The derivation of Kortüm[109] yields the following well-known Fresnel equations which describe the reflection, refraction and polarization of non-absorbing media for specular reflection.

$$E_{RS} = -E_{IS}\frac{\sin(\theta_I-\theta_T)}{\sin(\theta_I+\theta_T)}, \qquad E_{RP} = E_{IP}\frac{\tan(\theta_I-\theta_T)}{\tan(\theta_I+\theta_T)},$$

$$E_{TS} = E_{IS}\frac{2\cos\theta_I\sin\theta_T}{\sin(\theta_I+\theta_T)}, \text{ and } \quad E_{TP} = E_{IP}\frac{2\cos\theta_I\sin\theta_T}{\sin(\theta_I+\theta_T)\cos(\theta_I-\theta_T)}.$$

Note that

$$E_{IS} + E_{RS} = E_{TS}, \text{ and } \qquad E_{IP} - E_{RP} = E_{TP}\frac{\cos\theta_T}{\cos\theta_I}.$$

<u>NOTE</u>: remember that the subscripts "S" and "P" are used to represent the perpendicular and parallel polarization components respectively.

The specular reflectances of a non-absorbing medium for the reflection components are (the transmission components are not considered here):

$$R_S = \left(\frac{E_{RS}}{E_{IS}}\right)^2 = \frac{\sin^2(\theta_I-\theta_T)}{\sin^2(\theta_I+\theta_T)}, \quad R_P = \left(\frac{E_{RP}}{E_{IP}}\right)^2 = \frac{\tan^2(\theta_I-\theta_T)}{\tan^2(\theta_I+\theta_T)},$$

$$R_{spec} = \frac{1}{2}(R_S+R_p) = \frac{1}{2}\left\{\left(\frac{E_{RS}}{E_{IS}}\right)^2+\left(\frac{E_{RP}}{E_{IS}}\right)^2\right\}, \text{ and}$$

$$R_{spec} = \frac{1}{2}\left\{ \frac{\sin^2(\theta_I-\theta_T)}{\sin^2(\theta_I+\theta_T)} + \frac{\tan^2(\theta_I-\theta_T)}{\tan^2(\theta_I+\theta_T)} \right\}.$$

Figure 21 (based on Hecht and Zajac[104]) shows the reflectance of the parallel ("p") and the vertical ("s") components of the beam as a function of the angle of incidence for specular reflection with $n_I=1$ and $n_T=1.5$.

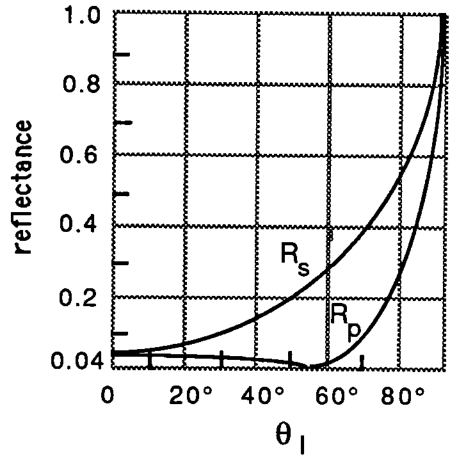


Figure 21 - Reflectance of "s" and "p" components vs angle of incidence.

Three major observations can be made about figure 21:

a) for perpendicular incidence ($\theta_I=\theta_T=0°$) the difference between the two polarizations disappears since the incident plane is no longer defined. The previous equation becomes (see Kortüm[109] for details):

$$R_{spec} = \left(\frac{n_T-n_I}{n_T+n_I}\right)^2 = \left(\frac{1.5-1.0}{1.5+1.0}\right)^2 = 0.04 = 4\% .$$

b) although $R_S = \frac{\sin^2(\theta_I-\theta_T)}{\sin^2(\theta_I+\theta_T)}$ can never be zero, $R_P = \frac{\tan^2(\theta_I-\theta_T)}{\tan^2(\theta_I+\theta_T)}$ becomes zero when the denominator is infinite and therefore $\theta_I+\theta_T = 90°$. This means that the reflectance for linearly-polarized light with E parallel to the plane of incidence vanishes (or is totally transmitted). From Snell's law:

$n_I \sin(\theta_I) = n_T \sin(\theta_T)$,

$n_I \sin(\theta_P) = n_T \sin(90-\theta_P)$, where θ_P is the polarization or Brewster's angle,

$n_I \sin(\theta_P) = n_T \cos(\theta_P)$,

$\tan(\theta_P) = \frac{\sin(\theta_P)}{\cos(\theta_P)} = \frac{n_T}{n_I}$, and

$\theta_P = \tan^{-1}\left(\frac{n_T}{n_I}\right) = \tan^{-1}\left(\frac{1.5}{1.0}\right) = 56.3°$ in this example.

c) when $\theta_I = 90°$, $R_P = R_S = 1$ (found by substituting in the Fresnel equations for reflection).

Unfortunately, these derived equations only apply to specular reflectance from ideal polished surfaces. When dealing with real surfaces, both specular and diffuse reflections are present and cannot be isolated from each other for analysis.

2) Diffuse Reflection

A basic assumption of isotropic distribution of reflected radiation is required, which means that the density of reflected

radiation (surface brightness) is independent of direction and follows Lambert's cosine law.

Consider a diffuse surface composed of particles with diameters much greater than the wavelength of the radiation (as is true for powders like $BaSO_4$ and Halon). The specular component is reflected by means of elementary mirrors (crystal surfaces) inclined at all possible angles to the macroscopic surface. Also, there is radiation which partly penetrates the sample where it undergoes numerous reflections, refractions, and diffractions from the irregularly located particles. The emerging radiation is diffuse.

The first law of diffuse reflection was proposed by Lambert on the basis of the observation that a white wall illuminated by sunlight appears to have an equal luminance at all observation angles. Lambert's law is:

$$L(0,\theta_R) = \frac{E_0 \cos\theta_R}{\pi} \quad [W/m^2sr] .$$

Over the years, many authors have attempted to explain or model the diffuse reflection from rough surfaces (see Kortüm for an extensive bibliography). These authors are: Lambert (Lambert's cosine law which is a spherical angular distribution), v. Seeliger (flattened sphere angular distribution), Bouguer (Bouguer's law), Zöellner, Pokrowski, Schulz, Barkas, Grabowski, Berry, and Rense. Kortüm selected Lambert's cosine law as the best model but only after stating: "Thus, a solution of the problem of *diffuse reflection* cannot be asserted." It is

currently a known fact, however, that Lambert's law only partially holds for diffuse surfaces like $BaSO_4$ or Halon.

As far as polarization is concerned, a diffuse reflector should totally depolarize any incident light in theory but this has also been proven not to be the case in practice. Hopefully, the results obtained in this thesis will enable more in-depth analyses.

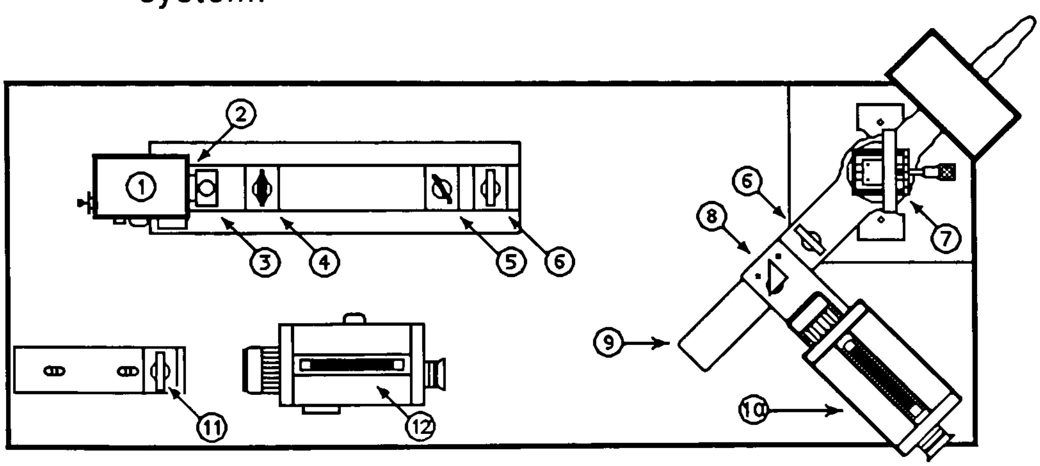
II. METHODS

1. PREPARATION OF GONIOSPECTROPHOTOMETER

A. Design and Description

1) Components Diagram

Figure 22 is a scaled drawing of the Munsell Color Science Laboratory Goniospectrophotometer. Missing from the drawing (because they are not mounted on the instrument platform) are the lamp power supply, the lamp cooling fan, the sample vacuum pump and the computer system.



(1) Lamp Housing
(2) Heat-Absorbing Filter
(3) Slit
(4) Focusing Lens
(5) Beam Splitter
(6) Polarizer
(7) Sample Holder
(8) Folding Prism
(9) Detector Arm
(10) Silicon Array Detector
(11) Polytetrafluoroethylene Tablet
(12) PhotoMultiplier Tube Detector

Figure 22 - Goniospectrophotometer Components Diagram

2) <u>Optical Diagram</u>

The illumination, monitoring, and viewing beams are shown in figure 23.

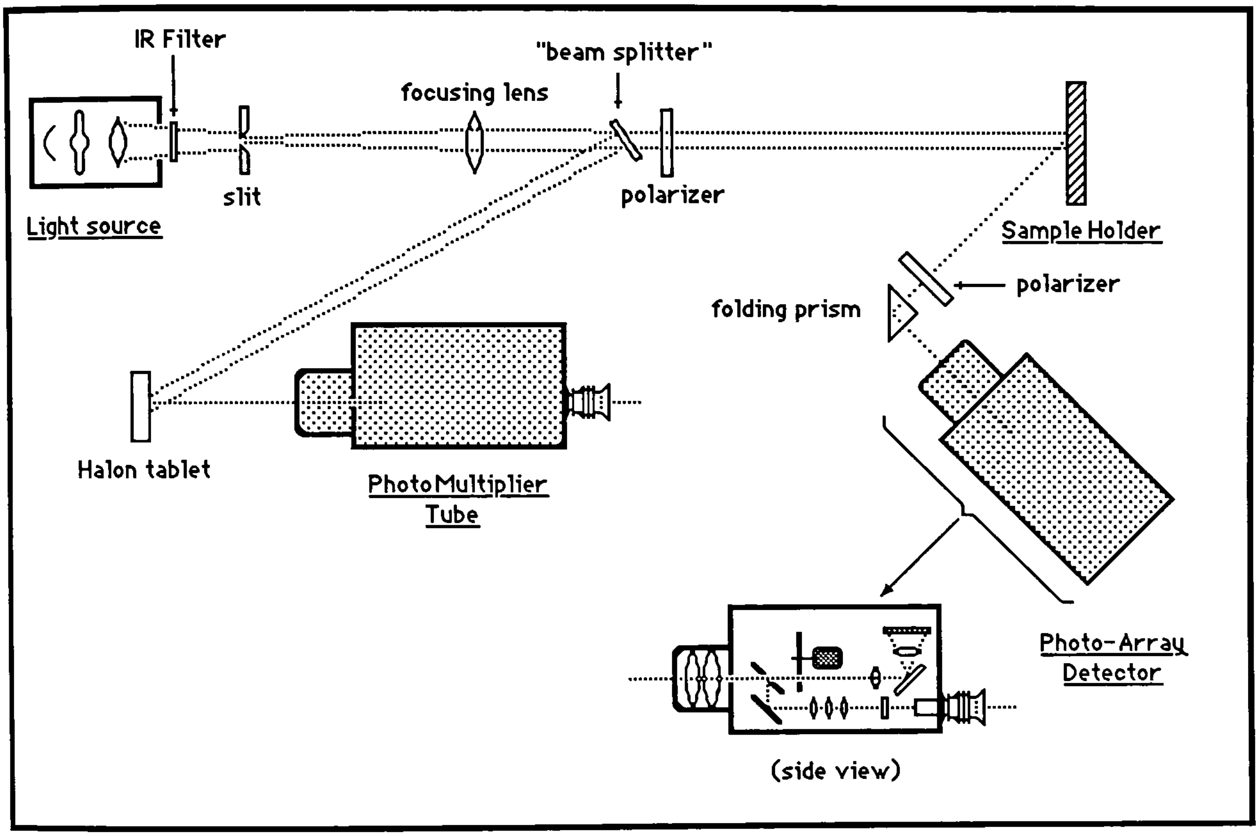


Figure 23 - Goniospectrophotometer Optical Diagram

3) <u>Instrument Platform</u>

The instrument platform consists of:

a) <u>Table</u>

The main instrument support is a sturdy metal table/desk of dimensions ≈ 30" X 60". On it are the optical bench, goniometric arm, Halon tablet support, and PMT detector.

b) Optical Bench

An optical bench (by Oriel Corp.) is used to mount the lamp housing, lens, beam splitter and polarizer.

c) Goniometric Arm

A custom-built goniometric arm is mounted on the table. It allows rotation of the sample holder and detector around the vertical axis.

4) Illumination System

a) Optical System

i) Source

The source is a 150W-xenon lamp (see characteristics in table 2).[112] A typical lamp is shown in figure 24.[113]

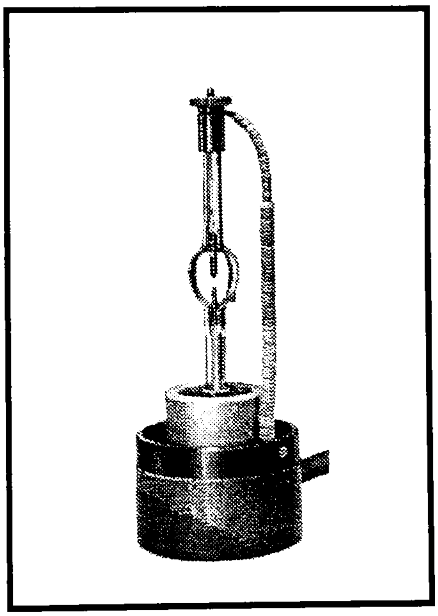


Figure 24 - 150W high-pressure xenon lamp with mount.

TABLE 2 - 150W Xenon Lamp Characteristics

Lamp Type	XBO 150W
Lamp Supply Voltage	20V
Current	7.5A dc
Power Consumption	150W
Voltage of Ignition Impulse (minimum)	20KVs
Arc Dimensions (W X H)	0.5 X 2.2 mm
Air Gap Between Ignition Lead and Metal Parts	≈ 30 mm
Luminous Flux	3200 lumens
Color Temperature	≈ 6,000 K
Average Life	1200 hours

A xenon source was chosen over tungsten because of its more intense output across the spectral range. This is particularly important since array detectors do not have very high sensitivity. The lamp is powered by a dedicated regulated power supply and is mounted in a special lamp housing (manufactured by Leitz) which contains a concave mirror (which images the arc back just above itself), a condensing lens, and a heat-absorbing filter (see figure 25).[113] A ventilation and cooling fan (mounted in the ceiling) is connected to the lamp housing via a 2.5"-diameter flexible hose.

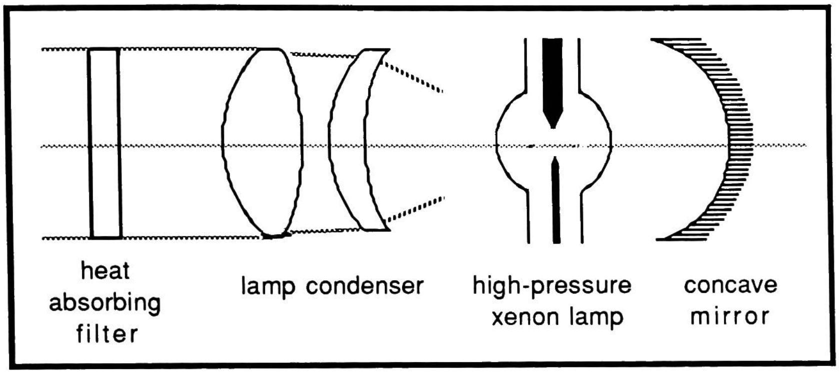


Figure 25 - Xenon Lamp Optical System

Figure 26 shows the interior of the lamp housing (**36.** lamp mount, **37.** lamp condenser, **38.** grub screw used to remove lamp).[113]

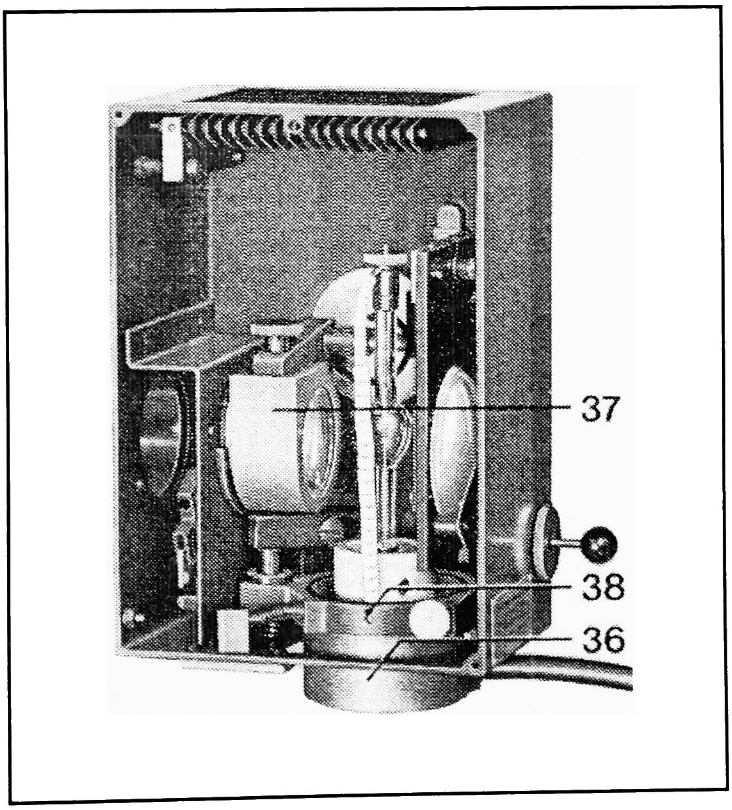


Figure 26 - Xenon Lamp Housing Interior

ii) Heat-Absorbing Filter

A Calflex B1/K2 heat-absorbing filter is mounted on the lamp housing to reduce both the UV and IR radiation.

iii) Slit

A slit (Schoeffel Instrument Corporation) is mounted immediately after the heat-absorbing filter and constitutes the field stop in the illumination beam. Its width can be varied from 0 to ≈7.5 mm (using a micrometer) and its height adjusted to 2.2, 6.3, or 16 mm (using a double-blade slider).

iv) Focusing Lens

This lens focuses the image of the slit onto the sample plane. The illumination cone angle is ≈1.5°.

b) Feedback System

i) Beam Splitter

The "beam splitter" is a microscope slide which provides enough reflection to be read by the PMT.

ii) Halon® tablet

A pressed Halon® tablet is used to receive the reflection off the beam splitter.

iii) Photomultiplier Tube Detector

A PMT detector is used to monitor the reflection of the xenon source off a Halon® tablet. The PMT

reading is incorporated in the data manipulation equations to correct for any lamp variation or drift. The PMT is a Spectra® Spotmeter™ detector (model UBD) from Photo Research. Its optical system is shown in figure 27.[114]

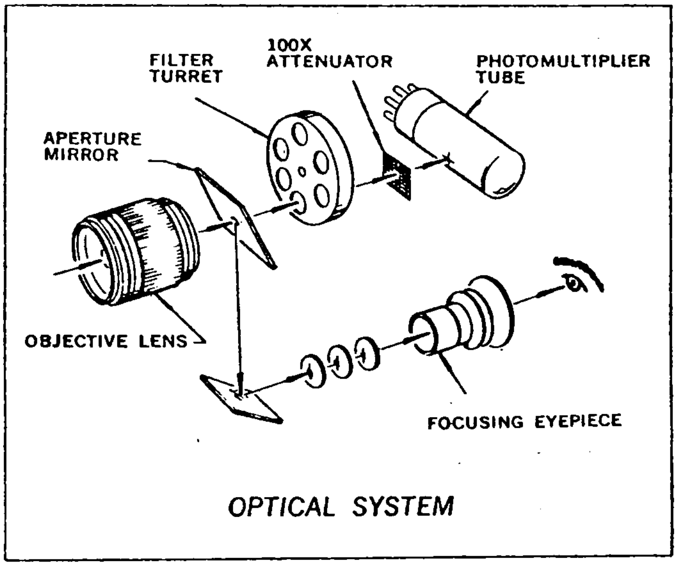


Figure 27- PMT Detector Optical System

The viewing system in figure 27 is the same one used in the array detector and will be detailed in the array-detector section. The measuring field is 0.25° half-angle and the lens is a Macro-Spectar MS-60

(60mm, f/2.8) which focuses from 2.5" to infinity. The detector is shown in figure 28.[115]

Figure 28 - PMT Detector

5) Polarizers

The two identical polarizers ("near UV visible linear polarizer model 27340" from Oriel) transmit from 300 to 750 nm, which covers the required range of 390 to 730 nm. They are a modification of the polyvinyl alcohol-iodine type polarizer and are mounted in a 2" (50.2 mm) diameter black-anodized aluminum ring.[105] These rings are mounted within a rotary stage.

6) Sample Holder

Three different types of sample holders can be used with this goniospectrophotometer.

a) <u>Reflection-sample holder</u>

This holder was used for all sample measurements. It consists of a round plate mounted inside an outer ring which enables the plate to rotate around the optical axis (see figure 29). The sample is held in place by suction through a circular groove in the plate front surface.

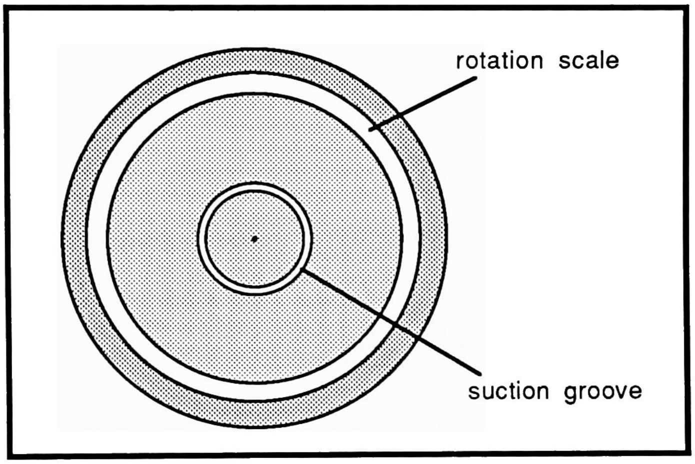


Figure 29 - Reflection Sample Holder

The holder is mounted on a translation stage (motion from front to back) which can be adjusted with a micrometer and can rotate about the vertical axis (to change illumination angles).

b) <u>Transmission sample holder</u>

This holder is identical to that for reflection samples except for a 1" diameter hole in the middle. It was used to check translucency.

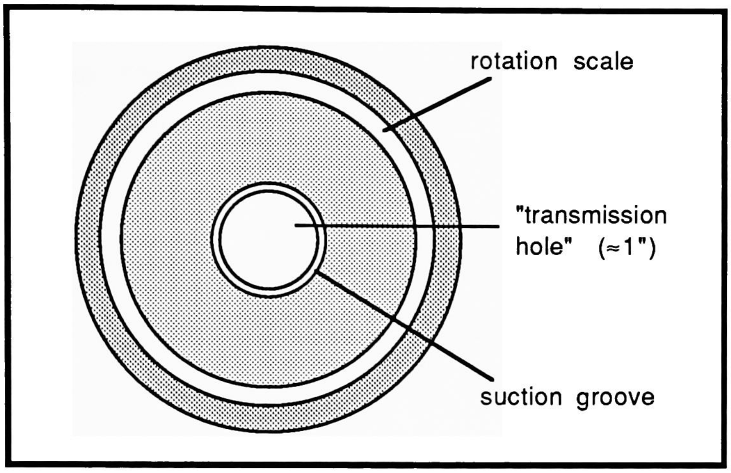


Figure 30 - Transmission Sample Holder

c) Temperature-Controlled Sample Holder

The temperature can be varied using a heating plate on which samples are mounted during the measurements. Temperatures are specified by and controlled with a Borg-Warner temperature controller (model TC-108). A thermistor is attached to the front surface of the sample to verify the temperature at the time of the measurements. This holder was used by Fairchild and Grum to study the thermochromism of ceramic reference tiles.[29]

7) Detection System

a) Folding Prism

This prism uses total internal reflection to redirect the radiation coming from the sample to prevent the

detector from obscuring the illumination beam when the angle between the illumination and viewing beams is small.

b) Detector

The detector is a Photo Research PR-703A/PC SpectraScan™ Fast Spectral Scanning SpectraRadiometer. It can be interfaced to any IBM or IBM-compatible system (see figure 31[116]).

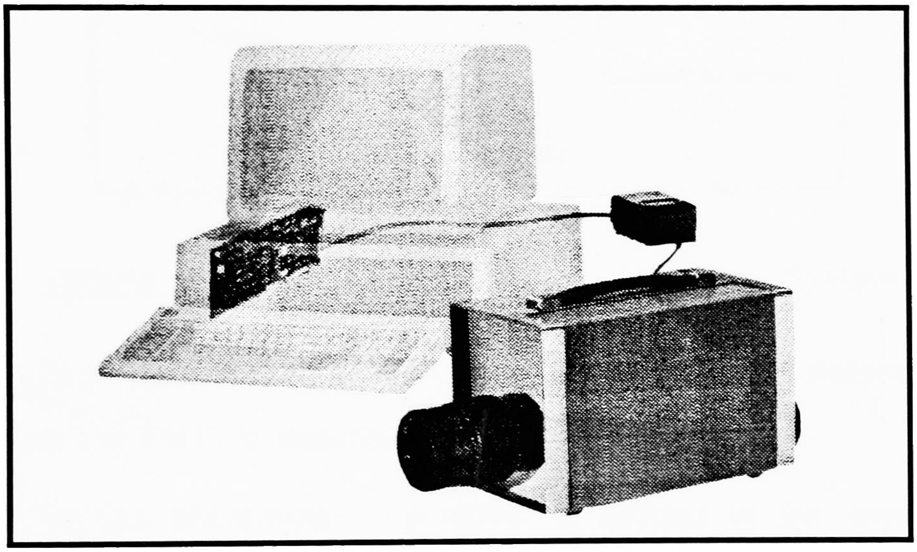


Figure 31 - SpectraScan Detector and Interface Board.

The small size of the detector housing (allowing it to be mounted onto a goniometric arm) and the fact that it is an array detector (enabling a full spectral reading to be obtained in a matter of seconds) made the SpectraScan® the prime choice for the goniospectro-

photometer. The optical diagram of the detector is seen in figure 32.[117]

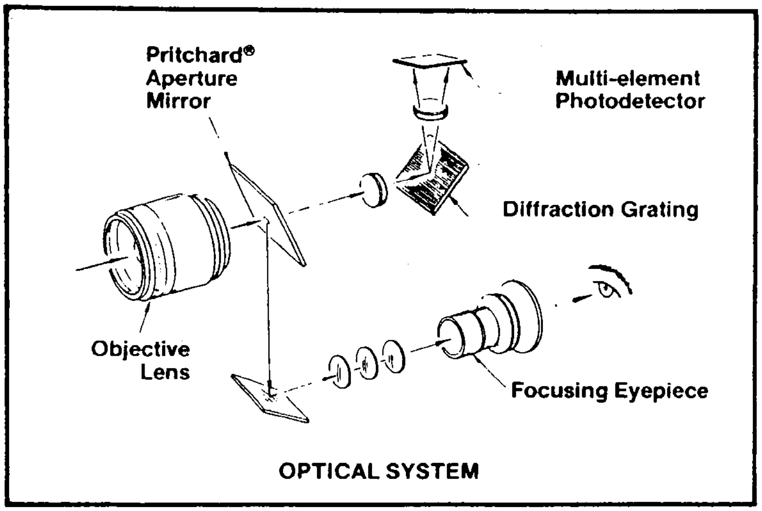
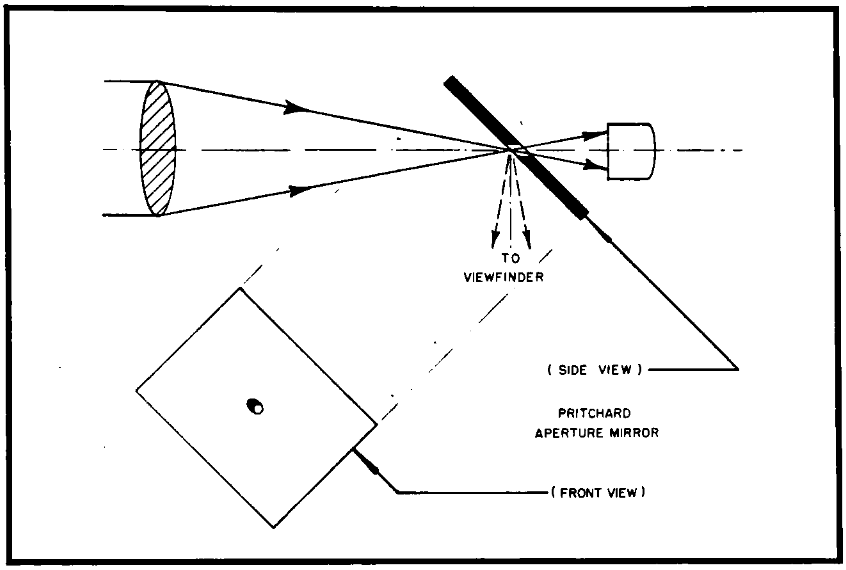


Figure 32 - SpectraScan Detector Optical System

The Pritchard® Aperture Mirror used in this detector (and the PMT) is described by R.A. Walker:[118]

> "In the photometer, the mirror is located in the image plane of the objective lens, centered on and oriented at approximately 45° to the optical axis. The photons that form the central portion of the image pass through the aperture to the photodetector, while the balance of the image-forming light is reflected from the mirror surface to the viewing optical system. The object plane of the viewing optics is adjusted to coincide with the center of the aperture, so that the edges of the aperture and the image formed by the objective lens are simultaneously in sharp focus. Thus, the operator sees a small, circular black spot superimposed on the center of an image of the object

being measured. This black spot clearly and accurately defines the measuring field, because every photon in that part of the image that is obscured by the black spot passes onto the photodetector. The image in the viewfinder is erect and quite bright since the mirror surface is nearly 100% reflecting and therefore does not attenuate the viewing light path."



<u>Figure 33</u> - The Pritchard Aperture Mirror System

The advantages of such a system are:

a) different aperture sizes and shapes can be obtained by changing the mirror assembly,

b) because the black spot uniquely and completely defines the measuring field, the system is completely self-aligning and insensitive to slight differences in aperture location, and

c) the Pritchard® aperture mirror system is completely free from polarization effects (since the radiation in the measuring path passes straight through the hole in the aperture mirror and encounters no mirror surfaces, fiber optics, or other optical impediments on its way to the photodetector. On this point, however, we should remember that the array detector introduces polarization after this mirror aperture, namely at the grating and detectors.

The only significant disadvantages of this system are:

a) blackout of scene information inside measuring field, and

b) need to maintain an external inventory of aperture mirrors for field changing (if differents field sizes are required).

8) Computer System

The SpectraScan is connected to and controlled by a Xerox IBM-compatible computer (using MS-DOS). The detector can be controlled by either Photo Research software (which also calculates many colorimetric quantities) or any programming language which can write to and read from files. To operate the detector, a message string of the type

"WAV;S390.0,E730.0,M4, G1.0;X*" is written to a file named "Photo". This string contains the following information:

1) WAV: spectral measurement (as opposed to linear).
2) S390.0: start measurement at 390 nm.
3) E790.0: end measurement at 730 nm.
4) M4: make 4 measurements and report average.
5) G1.0: use an integration time of 1.0 second.
6) X*: command which means "execute".

When taking the reading, the Photo Research writes the data to different files. The intensity read from the sample is put in file "RAWLIGHT.ASC" and the dark current reading (done by automatically closing a shutter and measuring for the same amount of time as the integration time) is put in "RAWDARK.ASC". The process is repeated as many times as specified (4 times here) and the average value is put into the file "RAWDIFF.ASC". Each of the 256 detectors in the array monitors a spectral band of width 1.33nm over the range 390nm to 730nm. The measurements are interpolated by the Photo Research software to 2 nm intervals and put into "CORRECTD.ASC" (see figure 34). This last file was used in the data manipulation.

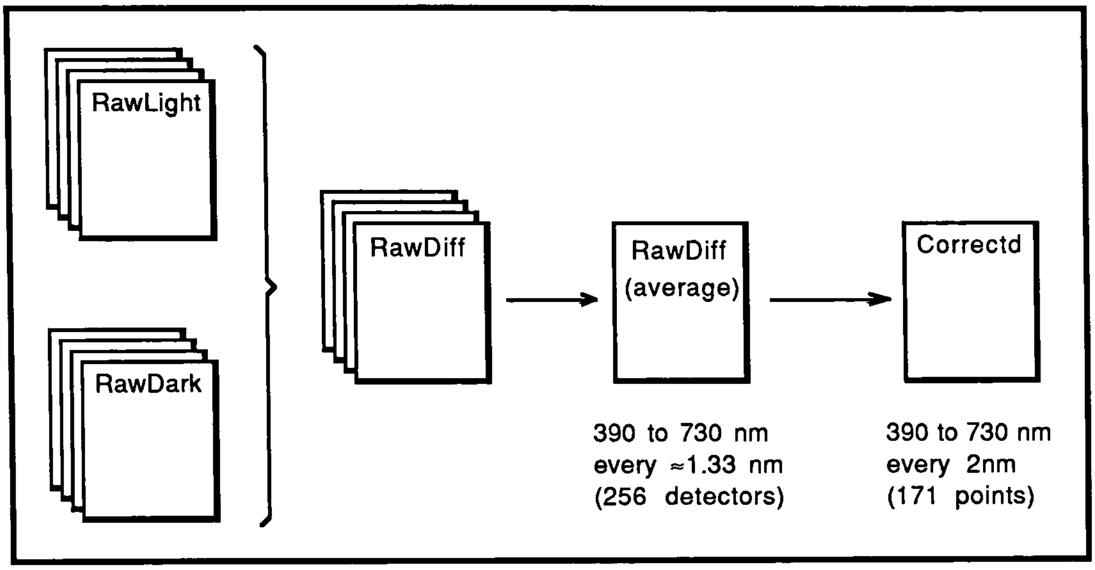


Figure 34 - Photo Research Software Data Manipulation

The numbers found in "CORRECTS.ASC" are compatible with the 8087[119] format, i.e. they have three digits in the exponent. Also, the first six lines of the file contain data which is not relevant for our use. Therefore, when reading the data from this file, the data manipulation program (written in Turbo Pascal) eliminates the first six lines in the file and the first digit in the exponent (which is always zero).

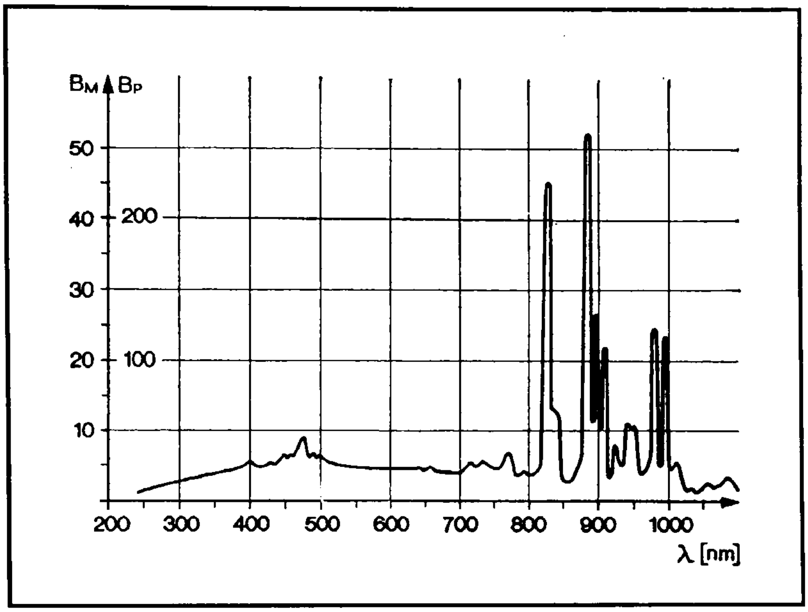
B. Characterization

1) Source

a) Spectral Power Distribution

Figure 35 shows a typical spectral energy distribution for a 150W high-pressure xenon lamp.[113] To

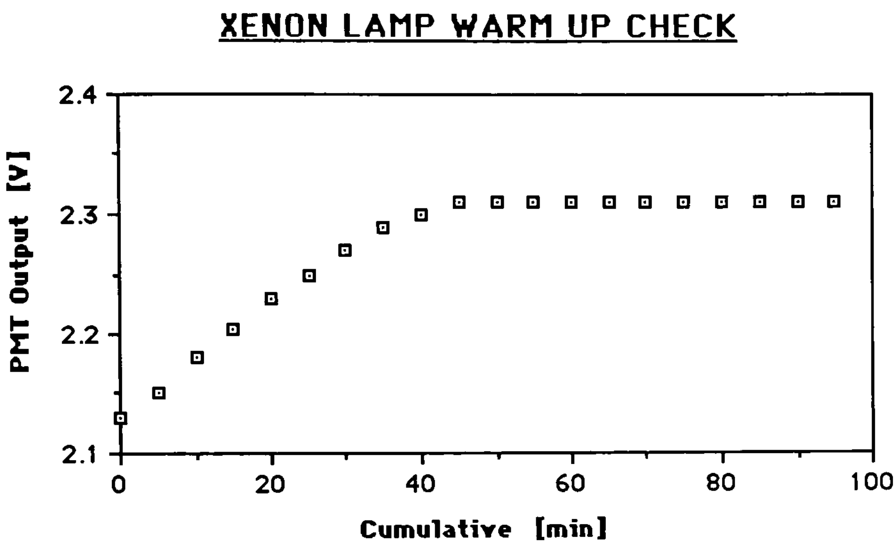
compare the xenon output to other lamps, refer to appendix 2.



<u>Figure 35</u> - Xenon lamp spectral energy distribution.

b) <u>Warm-up Time</u>

To find the lamp warm-up time, a PMT detector was warmed up (≈1 hour) and used to monitor the output of the lamp from start up. Data was taken every 5 minutes for 95 minutes. Figure 36 was obtained from the data found in appendix 3.

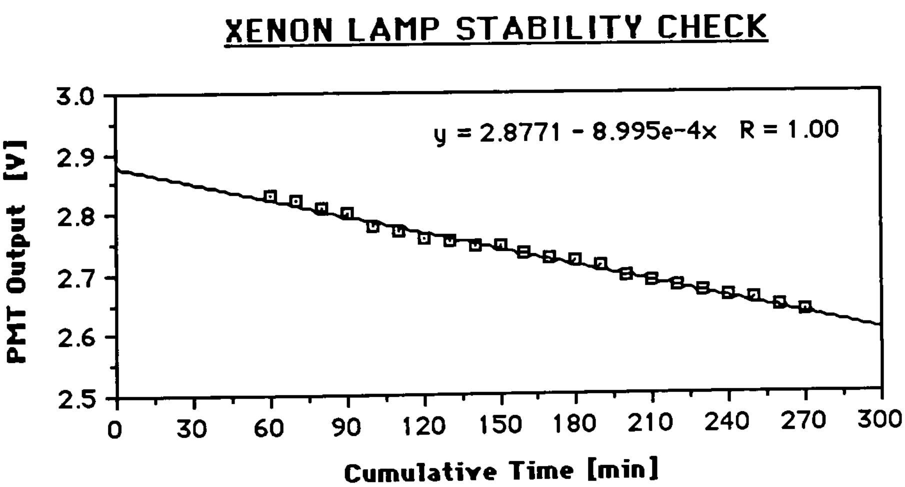


<u>Figure 36</u> - Xenon lamp warm up.

The lamp warm-up time was chosen to be 1 hour.

c) <u>Stability Check</u>

The same procedure was used to check for lamp stability after warm up. The data from appendix 4 is plotted in figure 37.

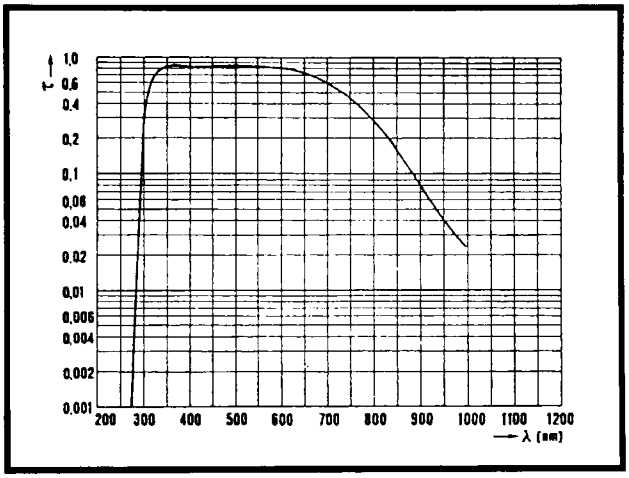


<u>Figure 37</u> - Xenon lamp stability check graph

Because of the drift of ≈2%/hour seen above, the lamp output was monitored by a PMT via a beam splitter. The PMT readings were used to compensate for lamp variability.

2) <u>Heat-Absorbing Filter</u>

The transmittance of the heat-absorbing filter is seen in figure 38.[113]



<u>Figure 38</u> - Heat-absorbing filter transmittance

3) <u>PMT</u>

a) <u>Warm up time</u>

Using a tunsgten lamp as stable illumination, the PMT was monitored and its output became stable after half an hour. A half hour was therefore allowed for PMT warm up.

b) Stability

The PMT was monitored over a 2-hour period (a tungsten lamp was used as illumination once again) and its output remained at 2.69 ± 0.01 volts.

c) Polarization Sensitivity

The setup used to check the polarization sensitivity of the PMT is illustrated in figure 39:

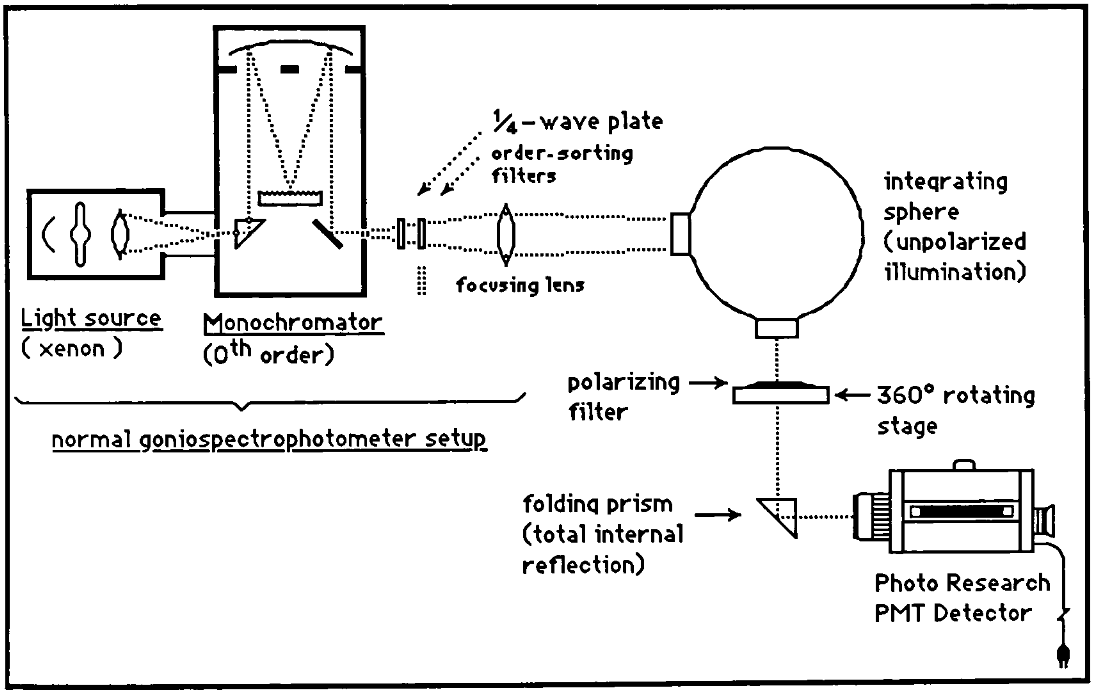


Figure 39 - Apparatus to check PMT polarization sensitivity.

Readings were taken every 10° from 0° to 360°. Figure 40 shows the results (the data is in appendix 5).

PMT POLARIZATION CHECK

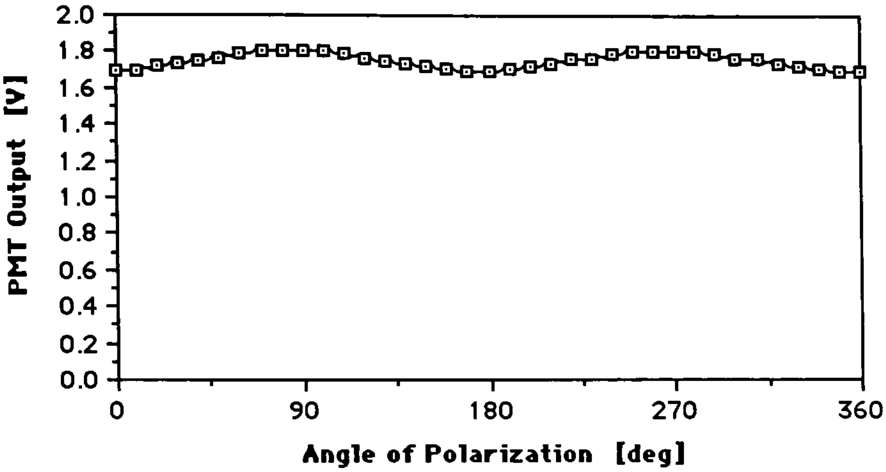


Figure 40 - PMT polarization sensitivity check graph

The difference between 0° and 90° is:

$$\frac{(1.81-1.70)}{1.70} = \frac{0.11}{1.70} = 6.47\% .$$

d) Sensitivity to magnetic fields

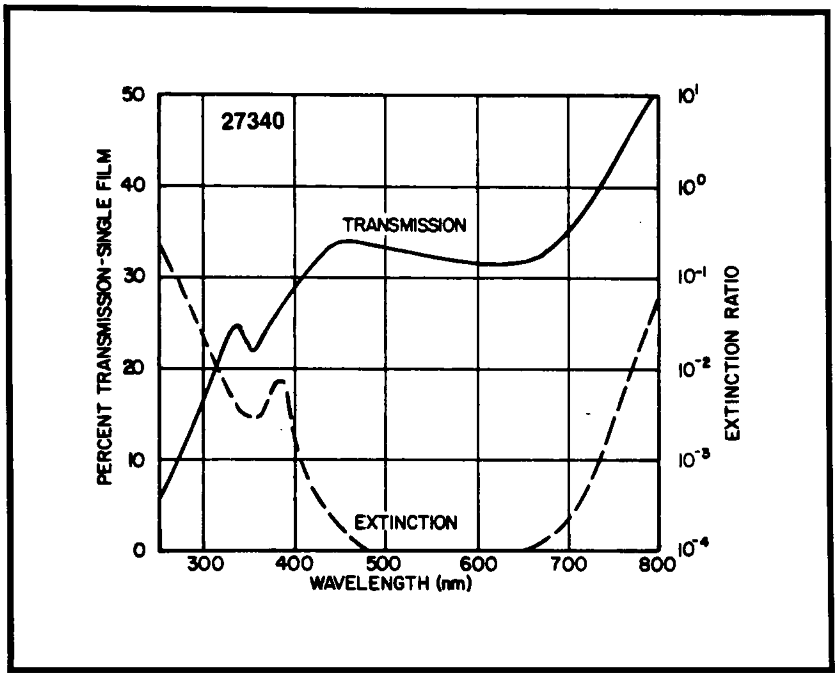
PMT's are well-known to be sensitive to magnetic fields. The PMT output was monitored as the array detector was moved about the sample to check for effects from the shutter motor. No effect on the PMT output could be measured.

4) Polarizers

a) Transmission and Extinction Ratio

Figure 41 shows the percent transmission and the extinction ratio of the polarizers.[105] The extinction

ratio is defined as T_{min}/T_{max} where T is the transmittance.



<u>Figure 41</u> - Polarizers percent transmission and extinction ratio.

Note that the transmittance of a polarizer rotated in a plane-polarized beam varies according to :

$$T = (T_{min} + T_{max}) \, Cos^2\theta + T_{min} \, .$$

where θ is the angle of the polarizer from the direction of T_{max}.[105]

b) Angular Positioning Accuracy

Through the use of a vernier, a 0.2° accuracy could be achieved on both polarizers.

5) Illumination Beam Uniformity

To check the uniformity of the illuminated sample patch across its width, a few methods were used:

a) The different optical components were adjusted until the patch looked uniform (visually).

b) An array radiometer was used with the polychromator removed at the sample plane and the beam was adjusted until the curve made by the detectors output matched the one taken measuring stray light only (a Tracor Northern was used which has 512 detectors across a ≈1" width and which can be monitored in real time on a dedicated cathode ray tube).

c) A PMT, mounted on a translation stage parallel to the sample plane, was used to scan across the illuminated patch. The viewing spot from the PMT was 1mm in diameter and readings were taken every 1mm. A chart recorder was also connected to the PMT to plot the shape of the intensity curve (see appendix 6 for an example).

After many adjustments and trials, the curve in figure 42 was obtained. The data is in appendix 7.

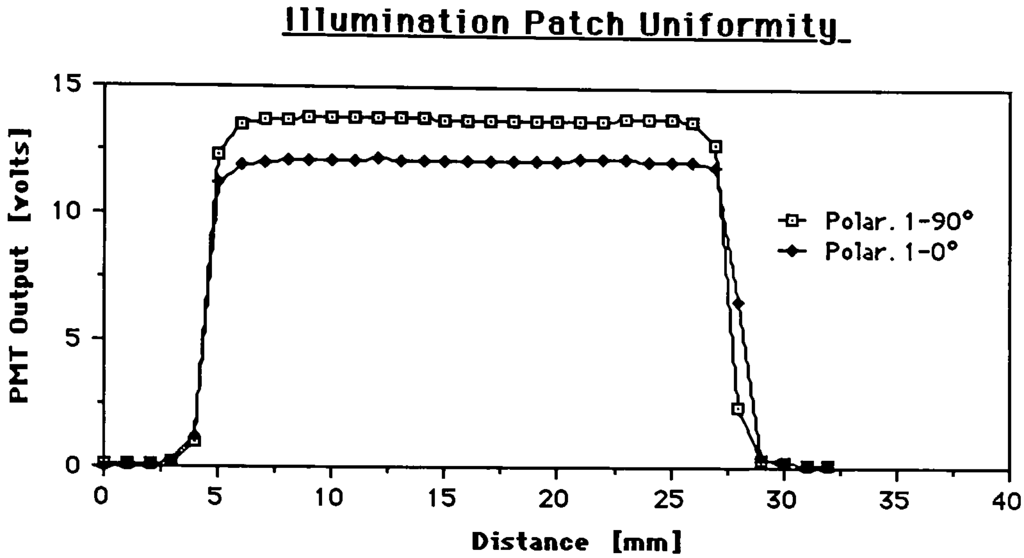


Figure 42 - Illuminated patch uniformity graph

Note that the readings were taken for 0° and 90° polarization in the illumination beam with nothing in the viewing beam between the sample and the PMT. To determine the variation across the patch, the following statistics were computed (polarizer at 90°).

TABLE 3 - Statistics for Patch Uniformity

Data File: Good Patch Data	
Variable: Flat - 1/90°	Observations: 18
Minimum: 13.710	Maximum: 13.770
Range: 0.060	Median: 13.745
Mean: 13.743	Standard Error: 0.004
Variance:	0.000
Standard Deviation:	0.018
Coefficient of Variation:	0.129
Skewness: -0.338	Kurtosis: -0.811

The most relevant piece of data in this table is probably the coefficient of variation of 0.129 which is the standard deviation divided by the mean and multiplied by 100. For the polarizer at 0°, the coefficient of variation was 0.124.

6) Sample Holder

a) Vertical-Axis Rotation Positioning Error

The angles can be set to an accuracy of 5 minutes of arc (12 divisions per degree on the vernier).

b) Optical/Horizontal-Axis Rotation

The angles can be set to an accuracy of 30 minutes of arc (half of the one-degree markings on the scale, no vernier).

c) Sample Size Limitations

i) surface size

The surface size of the measured sample is limited by holder constraints. If suction is used, the sample has to be at least 1.25" in diameter (or a square with minimum side of 1.25"). If the sample has to be rotated around the optical axis, the maximum is 3.5" in diameter or ≈2.5" for a square. The largest sample size is 8" half-width (not to hit the detector during rotation of the arm). The distance between the center and base of the sample holder is 2.5".

ii) sample thickness

The maximum acceptable sample thickness is ≈0.75". The thickness is limited by the maximum travel achievable by the translation stage during the alignment of the sample surface.

7) Detector

a) warm up time

The array detector required the longest warm-up time to become stable. As seen in figure 43 (data normalized for both detectors), the PMT was stable after approximately fifty minutes while the array detector was still varying after 109 minutes (see appendix 8 for data). Further tests indicated that 3 hours were required for it to stabilize

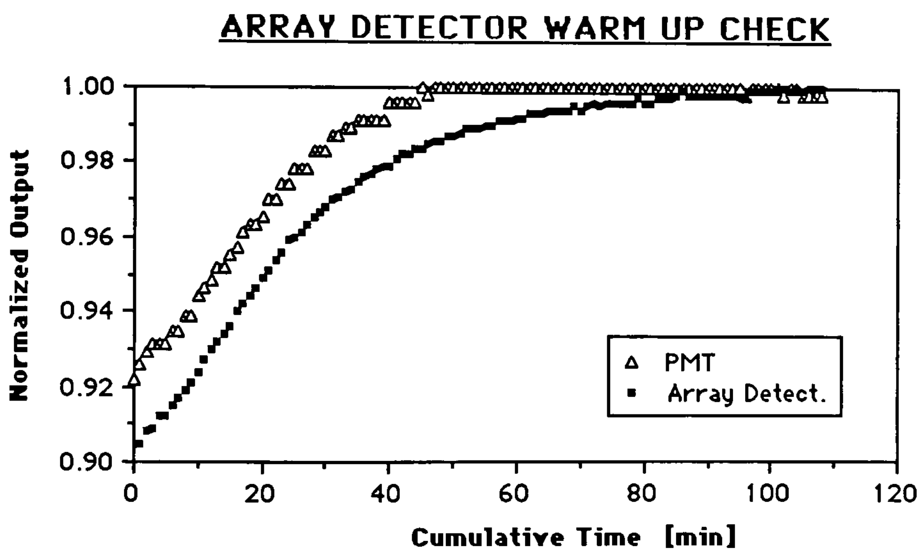


Figure 43 - Array detector warm-up.

b) Stability

The stability of the array detector was checked as part of the whole system and is found under "8) Overall System, b) Repeatability Check".

c) Wavelength Calibration

Since there is no mechanical adjustment available on the array detector, Photo Research software must be used for wavelength and calibration checks. A wavelength check is required if the instrument calibration is off by more than 0.3 nm at the 546.07 nm peak.[120] The values obtained during the check were as follows:

TABLE 4 - Wavelength Check Data Before Calibration

Peak #	Measured	Reference	Deviation
1	402.80	404.66	-1.86 nm
2	434.14	435.83	-1.69 nm
3	466.14	467.82	-1.68 nm
4	478.24	479.99	-1.75 nm
5	506.82	508.58	-1.76 nm
6	544.46	546.07	-1.61 nm
7	576.24	578.01	-1.77 nm
8	642.12	643.85	-1.73 nm

It should be noted that a mercury-cadmium lamp is suggested as the source for this calibration, as it

provides 8 intensity peaks in the 390-730nm range. However, only a mercury-zinc-cadmium source was available. It was satisfactory since the zinc lines are outside the range of interest and did not interfere with the measurements. The system used by Photo Research to find the 8 peaks is clever. For each wavelength, it evaluates the highest peak, blocks it off, and rescales the remaining peaks. A graph showing the line source output is found at appendix 1. After calibration, the following values were obtained.

TABLE 5- Wavelength Check Data After Calibration

Peak #	Measured	Reference	Deviation
1	404.34	404.66	-0.32 nm
2	435.64	435.83	-0.19 nm
3	467.94	467.82	0.12 nm
4	480.12	479.99	0.13 nm
5	508.50	508.58	-0.08 nm
6	546.12	546.07	0.05 nm
7	578.44	578.01	0.43 nm
8	643.84	643.85	-0.01 nm

d) Bandwidth Calculation

The bandwidth of this detector is reported to be 5 nm.[117] This number was checked using the data obtained during the wavelength calibration (see data in appendix 9). A typical plot of the 2nm data is seen in figure 44 (for the 404.34 nm peak).

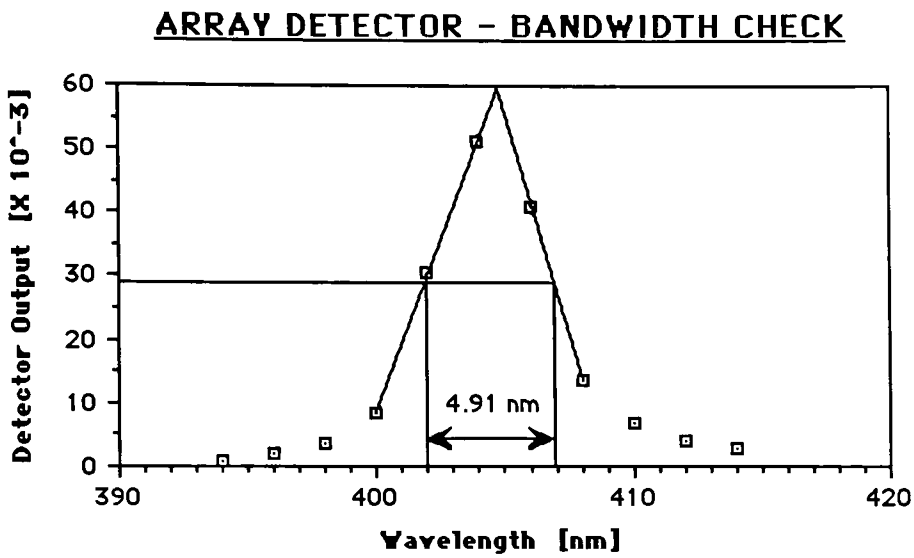


FIGURE 44 - Bandwidth Calculation Graph

To calculate the FWHM (full width at half maximum), the following procedure was used:

i) the data points around each peak were plotted,

ii) a line was computed through only those points lying on the sides of the triangle representing the bandpass,

iii) a linear-regression line was fitted to both the rising and the falling slopes,

iv) the intersection of these two regression lines was found and used as the maximum intensity,

v) the half-maximum was calculated (maximum/2),

vi) the wavelengths corresponding to the half-maxima points were found, and

vii) the difference between these two wavelengths was taken as the bandwidth.

Table 6 shows a typical calculation where L1 and L2 are the two FWHM wavelengths.

TABLE 6 - Bandwidth calculation (404.34 nm)

WAVELENGTH		EXPERIMENTAL BANDWIDTH CHECK		
	Slope up	a= -428.5589	b= 1.073575	
404.34	Slope down	a= 555.428	b=-1.358	
	max. reading:	5.885	L1= 406.837	L2= 401.930
	BANDWIDTH		4.91nm	

Bandwidth calculations were performed for all 8 peaks, as shown in table 7.

TABLE 7- Bandwidths calculated for the 8 peaks

Peak #	Measured [nm]	Bandwidth [nm]
1	404.34	4.91
2	435.64	4.77
3	467.94	5.30
4	480.12	4.82
5	508.50	4.88
6	546.12	4.68
7	578.44	6.34
8	643.84	4.54
	Average:	5.03
	Std Dev:	0.57

e) Linearity Check

Using a filter of known transmittance, the linearity of the detector can be tested by comparing the measured transmittance with the known true transmittance.[121] By using several filters with transmittance $\tau_1, \tau_2, ..., \tau_N$, more points on the input-output characteristic may be tested using combinations with transmittances $\tau_{1,2} = \tau_1 \times \tau_2$, etc. For the array detector, gelatin neutral-density filters in the range d=0.1ND to 0.8ND, Δd=0.1ND were used. (going higher than 0.8 attenuated too much radiation). A tungsten lamp was placed ≈1 foot away from a Halon sample whose reflection was measured by the detector. An integration time (IT) of 1 second was used to match that of the final measurements. The plot of detector linearity is shown in figure 45 (the data is in appendix 10).

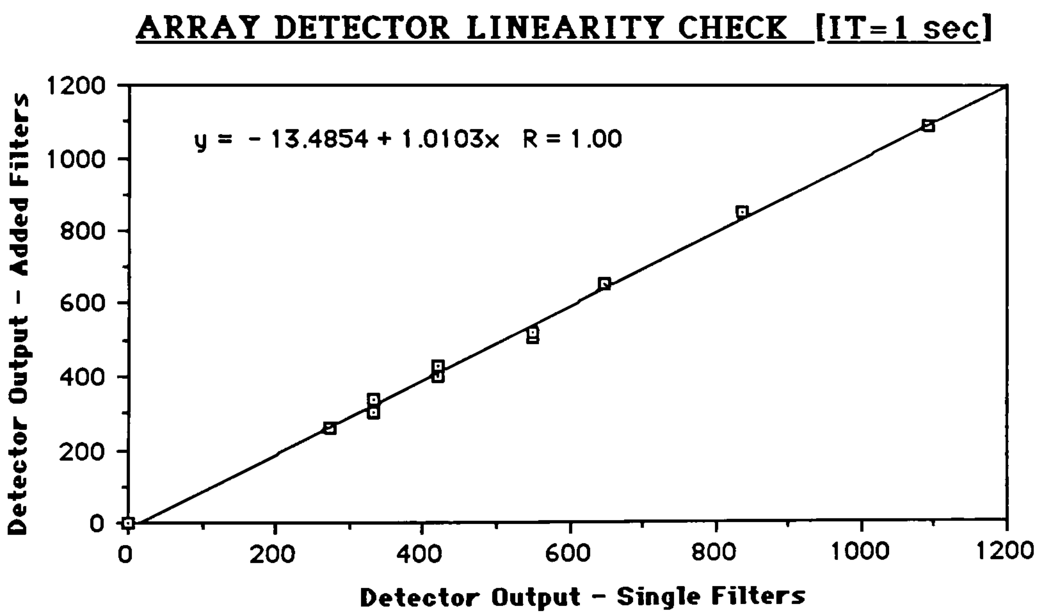


Figure 45 - Array Detector Linearity Check [IT=1 sec]

f) Dark Current

The dark current is measured by taking a reading for the same time as for the measurement. A shutter is included in the viewing eyepiece system and is closed during every measurement. The dark current is subtracted from each measurement in the software.

g) Angular Positioning Error

The detector-arm angle can be adjusted to a 6-minute accuracy (10 divisions per degree).

h) Viewing Spot Positioning Error

The viewing spot itself is 3.5 mm in diameter and must be centered on a 0.5 mm diameter hole punched in the center of the sample holder. Because of the Pritchard aperture system, a positioning error of the order of ± 1 mm is present.

8) Overall System

a) Polarization Bias Constants

As already covered in the section on polarization theory, two constants A and B must be determined for the illumination and the viewing system respectively. The data obtained for these constants is found in appendix 11. Measured values for "A" range from 0.966 to 1.006, while for "B" they range from 1.025 to 1.304.

b) <u>Repeatability Check</u>

A Halon® tablet was used for 50 measurements made at 45°/0°. The spectral averages and coefficients of variation for this check are found in appendix 12. Except for 8 out of 69 wavelengths, all have coefficient of variations of .2% and below. The mean and standard deviation of all coefficients of variation are 0.16 and 0.08 respectively. Therefore, the precision of the instrument is ≈0.16%.

c) <u>Accuracy Check</u>

A pale grey porcelain tile previously calibrated by NBS (see appendix 13) was measured at 45°/0°. The NBS values were subtracted from the measured values and the differences were calculated for the 69 wavelengths (see appendix 14). Figure 46 shows a histogram of the differences. The mean of the differences is 0.00188 and the standard deviation is 0.00170. Therefore, the instrument is accurate to within 0.002 reflectance unit from the NBS values, which is in line with the laboratory intercomparison study referenced to previously.[99]

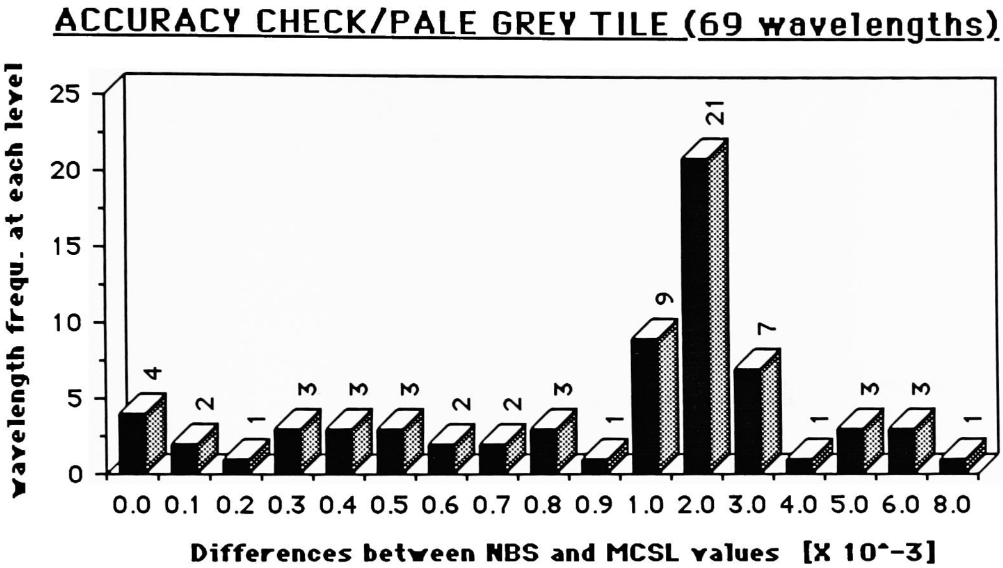


Figure 46 - Histogram of NBS and MCSL Differences

C) Instrument Alignment

As seen in figure 47, many adjustments are available to ensure the lamp image is properly aligned and focused.[113] The legend below belongs to figure 47:

2. Knob for lamp condenser adjustment.
4. Centering lever of the concave mirror (by rotation of the pulled-out lever the concave mirror is focused on the arc).
5. Clamping screw for the concave mirror adjustment
6. Knurled knob for the horizontal lamp adjustment
7. Knurled knob for the vertical lamp adjustment.

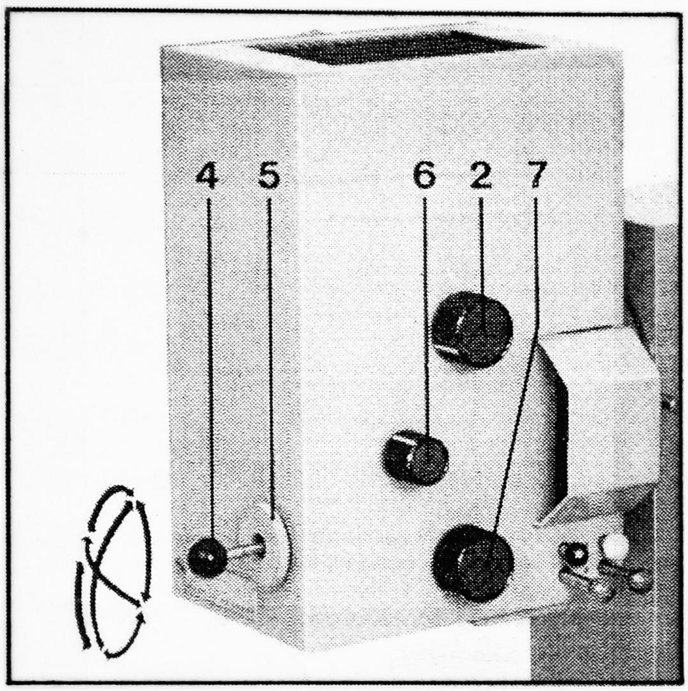


Figure 47 - Centering the Xenon Lamp in the Housing

The procedure for proper centering of the source is relatively complex and is included in appendix M.

The rest of the system was aligned as follows:

1) put detector arm at 45°,
2) align sample holder so that it is viewed at 0°,
3) center viewing spot of detector on punched hole of sample holder,
4) align front surface of sample holder with vertical rotation axis of goniometric arm by rotating the sample holder back and forth and adjusting the translation stage micrometer until the image of the holder is seen to stand still during rotation,

5) rotate sample holder to get 0° illumination,

6) move goniometric arm mount on table until the illuminated patch is centered on the holder,

7) put a mirror on the sample holder, align its surface with the arm rotation axis (see 4 above), and set the illumination angle to 22.5°, and

8) put detector at 22.5° from surface normal (opposite to illumination) and see if the specular reflection is right in the middle of the detector lens (**DO NOT** look through the viewfinder during this operation!). If not, the goniometric arm mount must be rotated around its own axis to get the proper relative angle with respect to the illumination.

NOTE: 1. The last part (#8) is delicate because any adjustment around the arm axis also affects the alignment achieved in #6. Therefore, steps 6 and 8 will have to be done alternately until both correct conditions are met.

2. The prism might also have to be adjusted when aligning the system. It can have quite an effect on the detector-sample alignment and once set properly should not be moved at all.

3. The 22.5° angle used above can be different if both the illumination and viewing angles are identical.

D) <u>Instrument Calibration</u>

1) <u>Method</u>

To calibrate the system, a white porcelain tile calibrated by NBS at 45°/0° was used. The calibration data is found in appendix 16 (both the 10nm data provide by NBS and the 5nm data interpolated for the data manipulation program are included).

2) <u>Halon vs NBS Tile</u>

Since the porcelain tile used to calibrate the instrument has an orange peel texture, it was thought that an error would result when replacing the tile between measurements. A possible solution could be to measure the NBS tile many times with replacement and determine the mean of the measurements and then calibrate a Halon using that mean. The Halon would then be used as the calibration standard with the hope that its more uniform surface would not introduce as much error. A method was developed to check this possibility. The data manipulation involved is in appendix 17. A few remarks about this method are:

a) 50 measurements were made with replacement for each of the two samples,

b) for each measurement, 4 scans were made by the detector (which means 200 readings were actually averaged),

c) the formulas developed under the polarization theory were used,

d) the PMT readings were recorded and provided correction for variability of the source, and

e) all data were spectral and the mean and standard deviation were calculated at each wavelength for the five reflectance factors.

To find if the standard deviation of the Halon data was significantly different from the standard deviation of the porcelain tile data, an F-test was used.[122] The following hypotheses were made (σ_1 = Halon, σ_2 = porcelain):

1. Null hypothesis: $\sigma_1 = \sigma_2$.

   Alternate hypothesis: $\sigma_1 \neq \sigma_2$.

2. Level of significance: $\alpha = 0.02$.

3. Criterion: reject the null hypothesis if $F>1.991$, the value of $F_{0.01}$ for 50-1=49 and 50-1=49 degrees of freedom, where

$$F = \frac{s_1^2}{s_2^2} \text{ or } \frac{s_2^2}{s_1^2}$$

   whichever is larger; otherwise accept it.

4. Calculation: the data in appendix 18, shows that none of the spectral F values exceed 1.991 which means the null hypothesis $\sigma_1 = \sigma_2$ cannot be rejected.

Therefore, the NBS porcelain tile will be retained as the calibration tile for all measurements.

2. PREPARATION OF SAMPLES

A. Materials Description

1) Russian Opal

This sample is a 2" x 2" x 0.4375" block having a polished surface. The detailed chemical composition of this type of opal is still unknown.

2) Barium Sulfate

Barium sulfate (in this case, $BaSO_4$ powder from Eastman Kodak, lot no. 103-7) is a very white salt which comes either in a dry-powder or liquid-suspended form. Its chemical composition is:

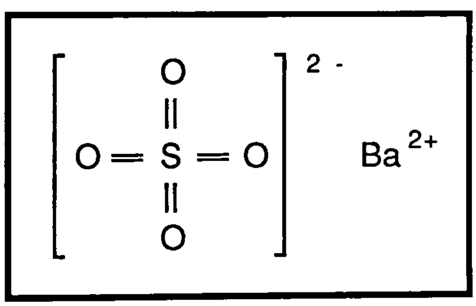


Figure 48 - Chemical Composition of $BaSO_4$

This material is used to coat integrating spheres (often through the use of a binder) or to make tablets of pressed powder.

3) Polytetrafluoroethylene (PTFE)

PTFE comes in a dry-powder form which looks like flour and feel soapy to the touch. Its chemical composition is:

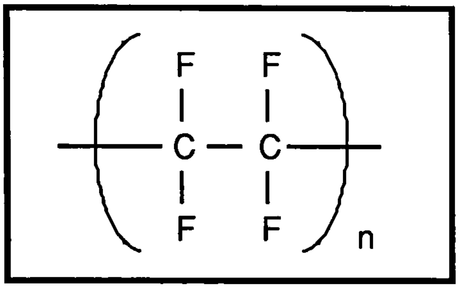


Figure 49 - Chemical Composition of PTFE.

Note that PTFE is known under two other names: Halon® and Teflon®. When pressed, PTFE polymerizes and makes very uniform tablets. Two powder batches were tested: an old batch (lot no. 074286, drum no. 80 from Allied Chemical) and a newer one (lot no. 695401, drum no. 78 from Ausimont U.S.A., Inc., Fluoropolymer Division). Both companies are from Elizabeth, New Jersey 07201.

B. Preparation

1) Russian Opal

This sample was cleaned using liquid lens cleaner and lens tissue. Care was taken to not scratch the polished surface.

2) Barium Sulfate

The $BaSO_4$ dry powder was pressed using a Zeiss hand press. Figure 50 shows the main parts of this device.

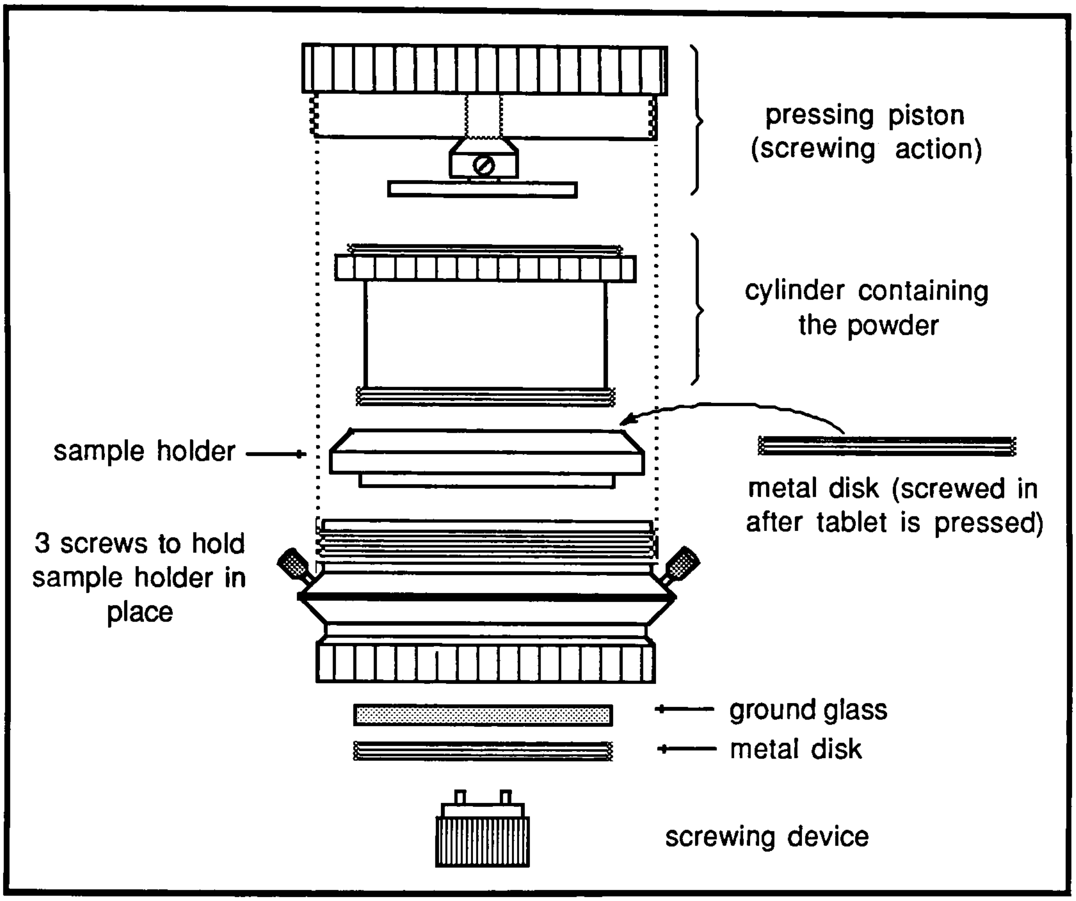


Figure 50 - Zeiss Press

3) Polytetrafluoroethylene

Halon® was pressed using both the Zeiss press and a hydraulic press. For the latter, a metal cylinder and piston were used to press the powder against a flat surface.

Figure 51 illustrates this device. Before using the Halon® powder, it was mixed in a kitchen-type blender for a few seconds.

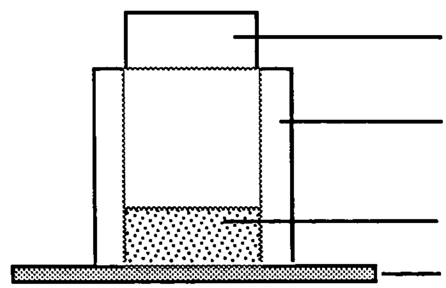


Figure 51 - Hydraulic Press Device.

C. Density

1) $BaSO_4$

Sixteen grams of powder was used and the pressing operation was repeated until a uniform surface was obtained. This was no easy task since $BaSO_4$ is a salt and does not self-adhere very well. The tablet was kept in the holder at all times and had a density of ≈ 1.66 g/cc.

2) Halon®

Tablets were pressed at 1g/cc in the Zeiss press (using 9.61 grams of powder) and at the following densities in the hydraulic press (using 30 grams of powder). At 2.30 g/cc, the sample became noticeably translucent.

Table 8 - Halon tablets densities

Density [g/cc]	Hydraulic Pressure [lbs]
1.5539	1,000
1.7759	2,000
2.0719	5,000
2.2199	10,000
2.3021	24,000

To calculate the tablet density, the weight of the sample was divided by its volume as follows:

$$\text{dens} = \frac{W}{\pi \frac{D^2}{4} H},$$

where dens = density [g/cc],
W = weight of tablet [g],
D = diameter of tablet [cm^2], and
H = thickness of tablet [cm].

To convert hydraulic pressures to surface pressures (in MPa):

1,000 lbs [hydraulic pressure] ÷ 3.14159 in.^{2} [area of sample] = 318.31015 psi,

but,

1Pa = 1 psi X 6.894757 x 10^3 ,
1MPa = 1 psi X 6.894757 x 10^{-3}, and

318.31015 psi = 2.195 MPa.

The converted data are tabulated in table 9 and plotted in Fig. 52.

Table 9 - Halon Pressures vs Densities

Hydraulic Pressure [lbs]	Pressure [MPa]	Density [g/cc]
1,000	2.196	1.5539
2,000	4.388	1.7759
5,000	10.972	2.0719
10,000	21.948	2.2199
24,000	52.672	2.3021

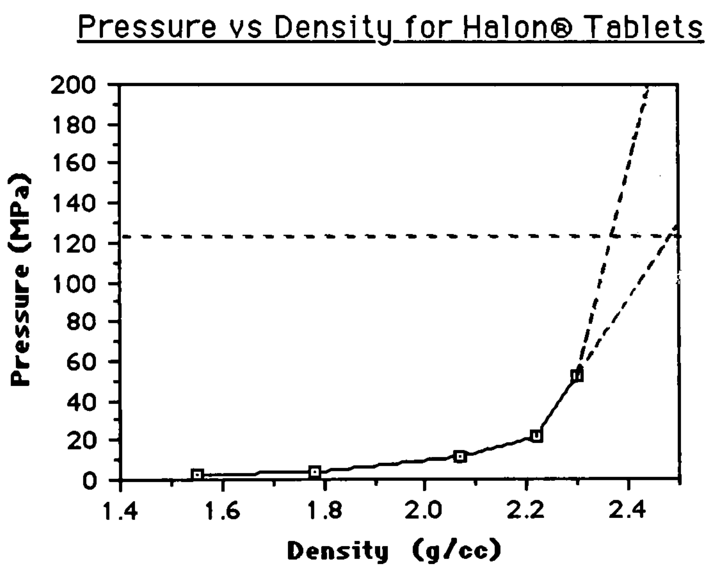


Figure 52 - Halon Density vs Pressure Graph

Referring to Grum and Saltzman's article,[87] three points become evident:

a) Figure 3 in the article (which is a picture of PTFE samples pressed at difference pressures) shows that

a tablet pressed at 5 MPa is not very sturdy and seems to have a very low density. This was not the case in this research where the final samples pressed at 2.2 MPa had a density of 1.55g/cc and were sturdy enough to be sanded.

b) It is stated that "An ideal packing density is about 2.5 g/cm^3". The 2.3g/cc sample pressed during the present research showed signs of translucency which cannot be accepted. Also, figure 52 above indicates that a pressure between 130 and 300 MPa would be required to achieve a 2.5g/cc density (corresponding to 59,000 to 136,000 lbs of hydraulic pressure). This discrepancy can only be explained by a calculation error.

c) A pressure of 14 MPa ± 2 MPa is recommended. According to table 9 above, this pressure range would correspond to a density range of ≈ 2.11 ± 0.03 g/cc. Since the article does not relate MPa's to densities, it is not possible to carry the analysis any further.

The final densities selected for measurements were 1g/cc (Zeiss press), 1.55g/cc (hydraulic press), and 2g/cc (hydraulic press).

D. <u>Surface Finish</u>

Many methods were used to obtain the different surface finishes:

1) press against glass (to obtain a polished surface),
2) press against ground glass (to obtain a rough surface),
3) sand polished sample using sandpaper, and
4) sinter (cook) the sample and then sand it.

An additional method was to press the tablets directly against sandpaper surfaces backed by a flat piece of glass. It was subsequently found that Carmer and Bair[107] used a similar approach when they pressed MgO powder against a porous drying paper backed by a stainless steel surface.

E. <u>Powder Batch</u>

Two drums of Halon® powder were available and the two batches were compared to check for any difference in reflectance.

F. <u>Parallelness Check</u>

A Nikon measurescope was used to check the parallelism of the surfaces of the tablets. This is important because of how the samples are held onto the sample holder (by suction). To perform the check, the tablets were mounted perpendicular to the microscope platform. By using the translation

micrometers and the cross hair in the eyepiece, it was possible to verify that the surfaces were in fact parallel.

G. **Translucency Check**

Two articles report values for the translucency of Halon® tablets:

1) Grum and Saltzman[87] report that a 3mm thickness gives an opacity value of 1.0, and

2) Weidner and Hsia[24] show the values reported in table 10.

Table 10 - Reflectance of Pressed PTFE Powder Relative to That of a 10mm-Thick Layer

Thickness [mm]	Relative Reflectance 400 nm	Relative Reflectance 550 nm	Relative Reflectance 600 nm
1	0.991	0.989	0.986
2	0.995	0.994	0.993
4	0.998	0.998	0.997
6	1.000	1.000	0.999
8	1.000	1.000	1.000
10	1.000	1.000	1.000

A thickness of 8mm would therefore mean an opacity of 1.0 at these 3 wavelengths.

A translucency check was performed by using the transmission sample holder and backing the 9-mm-thick sample by a Halon tablet and a black trap. The results in appendix 19 show no significant difference between the two sets of readings (the average of all differences is < .2%).

3. CONDITIONS OF MEASUREMENT

A. Angles and Polarization Combinations

Five different illumination angles (-75° to 0° in 15° increments) and 11 different viewing angles (-75° to +75° in 15° increments) were used to produce 60 combinations. It should be noted that the illumination and viewing angles are never equal in practice. At each angle combination, four different polarization states were measured (ss, sp, ps, and pp). Because of the design of the goniospectrophotometer, a full scan of viewing angles could not be performed directly. Each scan was started at -75° viewing and when the illumination beam was reached, the sample holder was rotated around the vertical axis by $2\theta_I$ and the sample rotated around the optical axis by 180° (see figure 53). This ensured the same sample patch was illuminated during the whole scan.

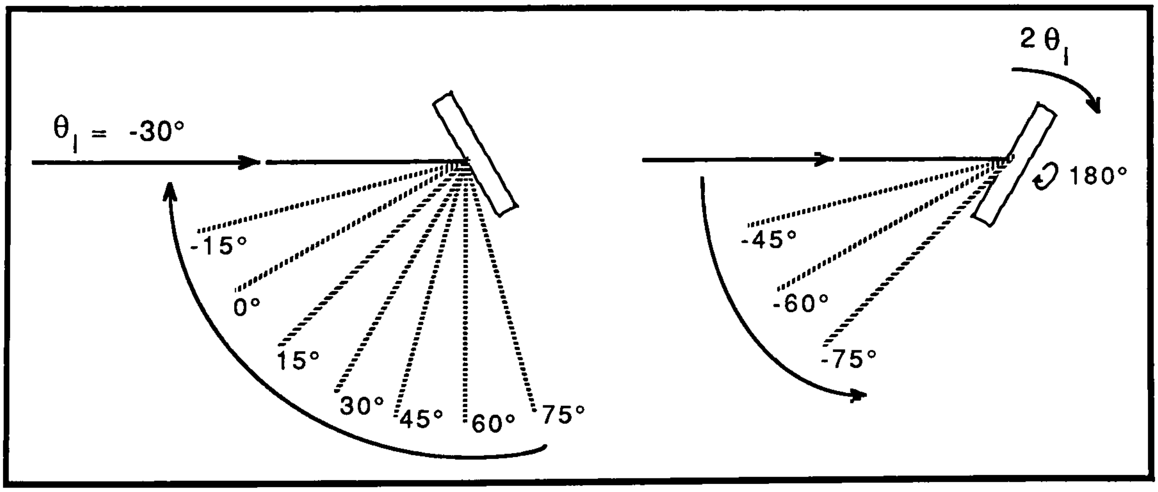


Figure 53 - Viewing Angles Scan

B. Positioning of Surface

1) Centering

Because of the 180° flip seen in figure 53, it was critical that the sample be centered. A circle of the size of the sample was drawn using a compass and used for centering the round tablet.

2) Alignment of Surface

The sample surface had to be aligned with the pivot point of the detector arm so that the same spot on the sample was viewed when the angles were changed. By looking directly at the sample surface and rotating around it, the three cases seen in figure 54 can occur.

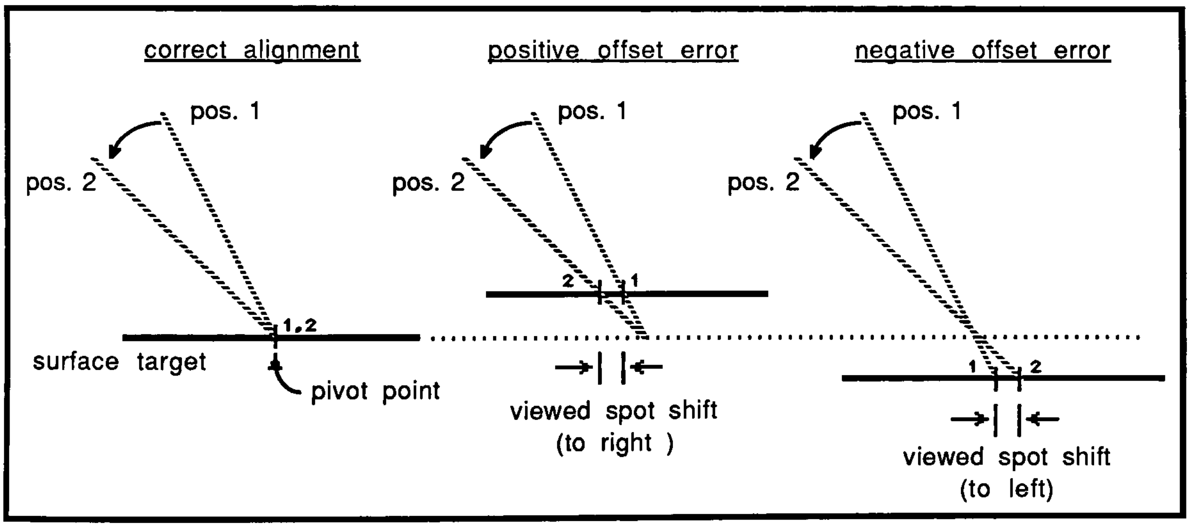


Figure 54 - Sample Surface Offset Errors

However, the folding prism changes these shifts to the opposite direction as seen in figure 55.

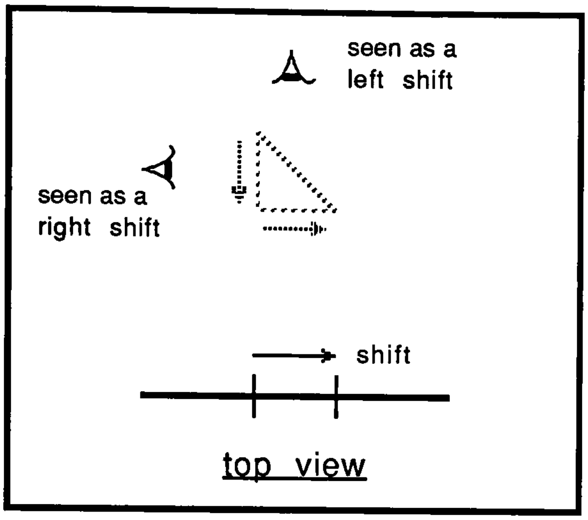


Figure 55 - Effect of Folding Prism on Offset Errors

To adjust for the offset errors, a micrometer moves the sample.

C. Zeroing of PMT

The PMT has to zero the dark current (dark current zero knob) and the amp current (amp zero knob). When zeroing the dark current, the sensitivity knob has to be set to "zero dark current" and the filter selector knob to "zero". When zeroing the amp current, the sensitivity knob has to be set to "zero amp" and the filter selector knob does not matter.

D. Instrument Warm Up Time

The SpectraScan® was warmed up for three hours and the PMT and lamp for one hour.

E. Stray Light Considerations

Figure 56 shows the goniospectrophotometer before any stray light considerations were taken.

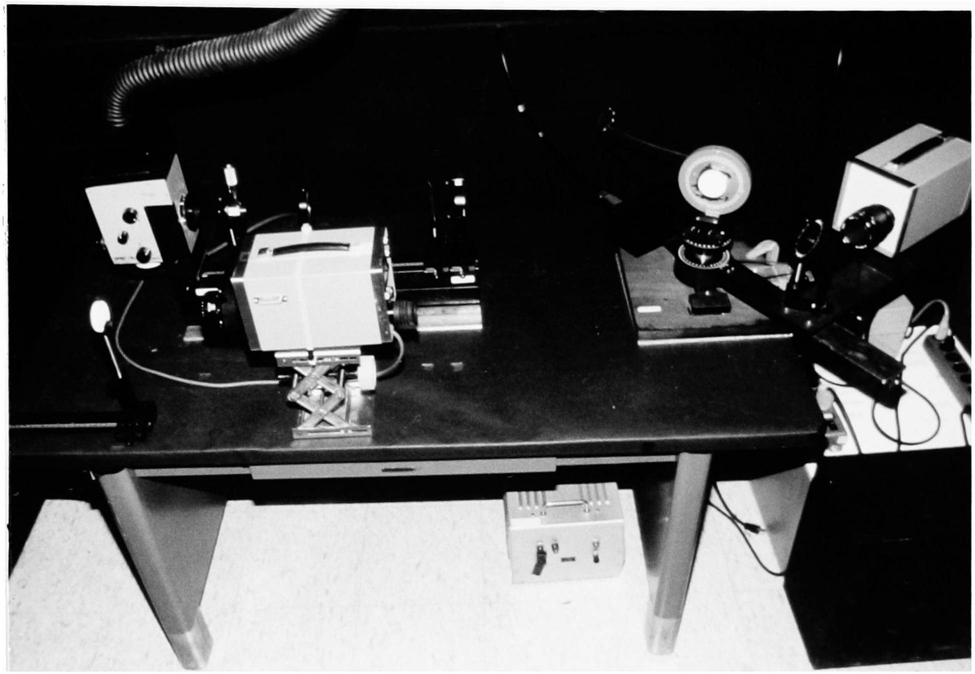


Figure 56 - Goniospectrophotometer Before Stray Light Considerations.

To prevent stray light from reaching the detector:

1) the lamp housing and slit were enclosed in a light-tight box (the aperture was a non-limiting stop),
2) the light-tight box was covered with black velvet on the surface facing the sample,
3) velvet covered the PMT, table and optical bench, adjacent wall, detector arm, and SpectraScan®,
4) the computer screen was turned away from the instrument and its intensity was set to a minimum, and
5) a flashlight was used when changing any angle.

Figure 57 shows the instrument as it was finally used.

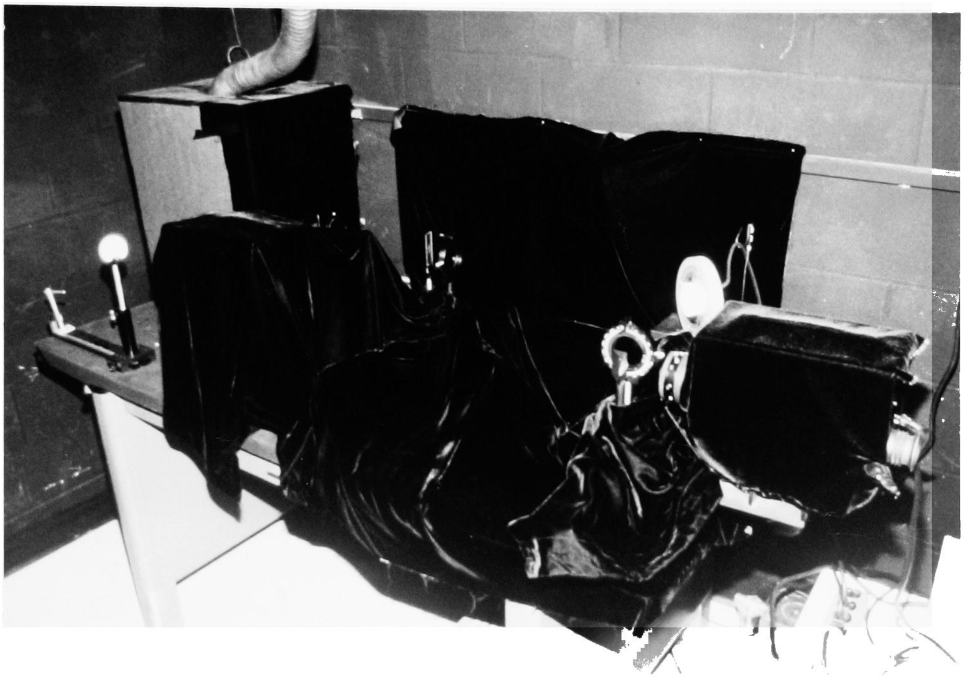


Figure 57 - Goniospectrophotometer After Stray Light Considerations.

The low sensitivity inherent to the SpectraScan (being an array detector) prevented the measurement of stray light from other sources.

F. Number of Scans per Measurement

The average of four scans was taken for each measurement.

G. Integration Time

A 1-second integration time was selected for all measurements. This number ensured there were no "low light level" or "overload" warnings from the detector.

H. Number of Samples to Average

1) Preliminary

Four scans averaged by the detector were considered sufficient for preliminary measurements purposes.

2) Repeatability Checks

Fifty measurements were taken for all repeatability checks to ensure a large-enough population.

3) Final Measurements

Four separate Halon® samples were measured (four scans each) and averaged. Also, a single $BaSO_4$ sample was measured. The $BaSO_4$ was included because of its general acceptance as a standard material in the color science community.

4. DATA STORAGE

A. Naming of Files

The format shown in figure 58 was used to name the data files.

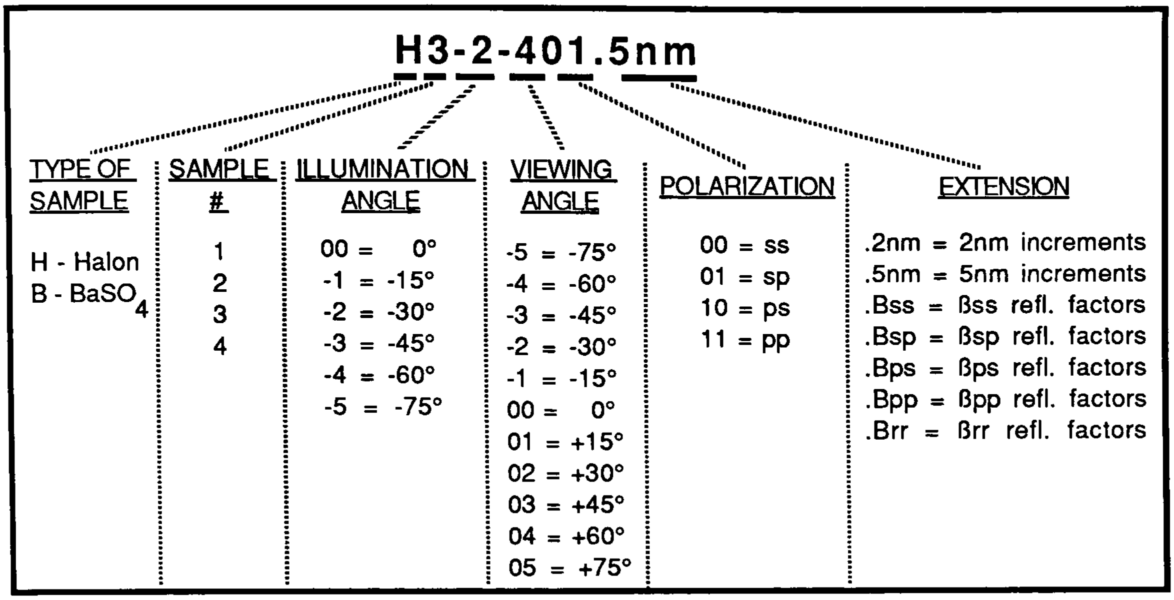


Figure 58 - Naming of Data Files

When the reflectance factor extensions were used, the polarizations were set to "**11**".

B. Memory Requirements

For each of the 5 samples (4 Halon tablets and 1 $BaSO_4$) there were:

1) 4 polarizations X 60 angles X 170 points (2nm data or 3450 bytes) = 40,800 data points or 828 Kbytes,

2) 4 polarizations X 60 angles X 69 points (5nm data or 1380 bytes) = 16,560 data points or 331.2 Kbytes, and

3) 5 reflectance factors X 60 angles X 69 points (5nm data or 1380 bytes) = 20,700 data points or 414 Kbytes.

Therefore, each sample involved 78,060 points or 1.5732 Mbytes of memory. Thus, for 5 samples, there are 390,300

data points or 7.9 Mbytes. Considering the data taken for other measurements (translucency check, A and B constants, Halon vs NBS tile check, preliminary data, repeatability tests, accuracy check, warm up checks, etc), over 300,000 points and 6.5 Mbytes have to be added to our initial numbers to total well over half-a-million data points and around 15 Mbytes of memory.

5. MANIPULATION OF DATA

A. Preliminary Measurements

Luminance values were recorded during the preliminary measurements. An example of the Photo Research software output can be seen in appendix 1. The "nits" [cd/m^2] value in the luminance box was used in the following equation:

$$L_{sample_{adjusted}} = \frac{L_{NBS_{table}}}{L_{NBS_{measured}}} \times \frac{PMT_{reference}}{PMT_{sample}} \times L_{sample_{measured}}$$

where

$L_{NBS_{table}}$ = "Y" (.86841) of calibrated NBS tile for D_{65},

$L_{NBS_{measured}}$ = measured luminance ("Y") for NBS tile,

$PMT_{reference}$ = PMT reading when measuring NBS tile,

PMT_{sample} = PMT reading when measuring sample, and

$L_{sample_{measured}}$ = luminance from sample.

The preliminary data reported in the results section and the corresponding plots use $L_{sample_{adjusted}}$.

B. <u>Final Measurements</u>

The reader is referred to the self-explanatory data manipulation table in appendix 20. This manipulation was applied to all reflectance factor data. The Turbo Pascal program which performed all the calculations for this part is found in appendix 21 as well as some of the programs used for the thesis (listing is provided as first page of appendix). A complete list of the equipment used for this research is included in appendix 22.

III. RESULTS AND DISCUSSION

1. PRELIMINARY RESULTS

All data were entered on a form as seen in appendix 23. The micrometer reading was the translation stage position once the sample surface was aligned.

A. Different Materials

The luminous reflectance factors of russian opal, $BaSO_4$, and Halon (1.55g/cc) were measured and are compared in figure 59 (the data is appendix 24).

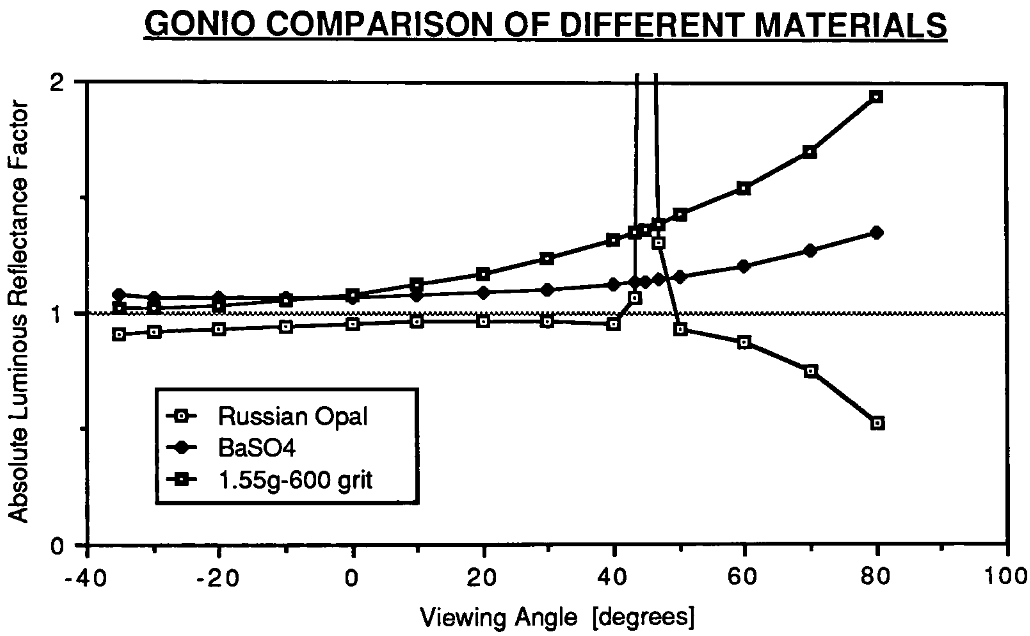


Figure 59 - Gonio Comparison of Different Materials

The polar plot of Fig. 60 gives a better representation of how lambertian each material is. The russian opal is much

more lambertian than Halon or $BaSO_4$ until the specular angle is reached (45° incidence).

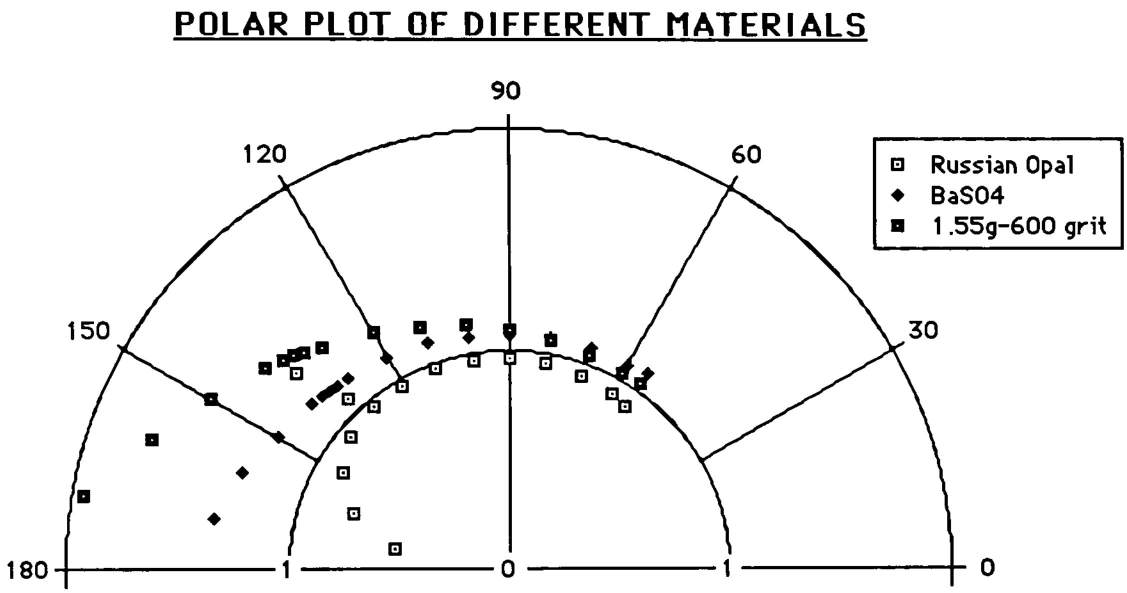


Figure 60 - Polar Plot of Different Materials

B. Different Halon Powder Batches

The measurements of batches from two different manufacturers showed no significant differences. This supports the findings of Weidner, et al.[90] who did a similar comparison.

C. Effect of Sintering

Two Halon samples were pressed at 1g/cc and one of them was sintered (cooked) and sanded. The luminous reflectance factors showed no significant differences at all angles of viewing (45° illumination).

D. Different Halon Densities

Halon tablets were pressed at 1g/cc, 1.55g/cc, and 2g/cc. Their absolute luminous reflectance factor values are shown in figure 61 (the data is in appendix 25).

GONIO COMPARISON OF DIFFERENT HALON DENSITIES

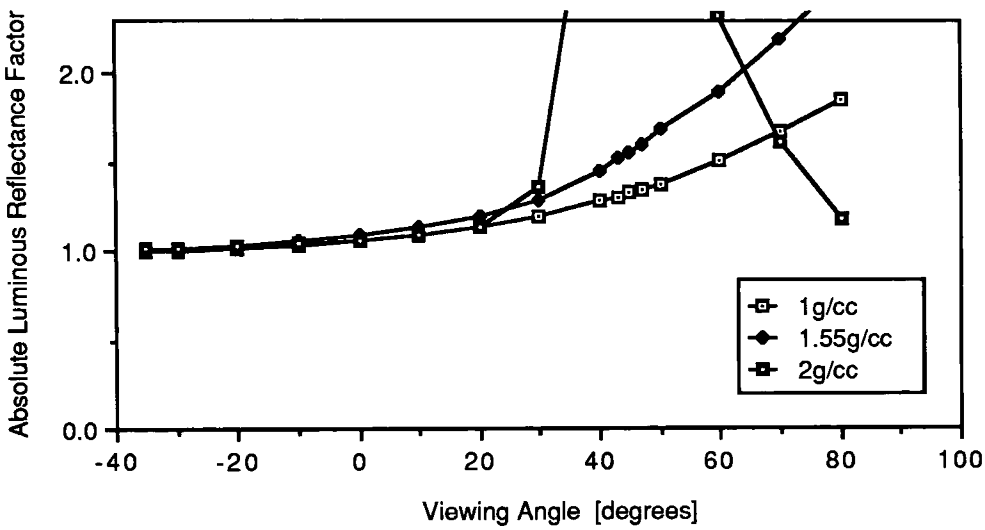


Figure 61 - Comparison of Different Halon Densities

In figure 61, the 1g/cc sample yielded the most lambertian curve. However, the low density led to a fragile sample (which had to be kept in its holder). The 2g/cc sample had the disadvantage of having a wide band of specular reflection.

E. Different Surface Preparations

The normal surface preparations are:

1) pressed against polished glass,

2) pressed against a ground glass, and

3) pressed against polished glass and sanded using a 600-grit (or sometimes 320-grit) wet/dry sandpaper.

The sanding was done by placing the sample face down on a sandpaper sheet backed by a flat surface. Much variability resulted from the kind of motion used during the sanding. To help reduce this problem, the samples were pressed directly against 320-, 600-, and 1500-grit sandpaper. During the process of locating some 1500-grit sandpaper, this author found a product called "Ultralap". It consists of an ultra-fine uniform abrasive coated on a polyester wet-or-dry paper. This particular lapping film is manufactured by Moyce Industries, Inc., Philadelphia, which provided the sheets used for this research. A technical data sheet, which also contains their address and phone number (for additional information), is in appendix 26. The tablets pressed against this lapping film yielded the most lambertian reflectance curves, as seen in figures 62 and 63. Figure 62 shows that samples which were not pressed directly against sandpaper or lapping film are substantially less lambertian (data is in appendix 27).

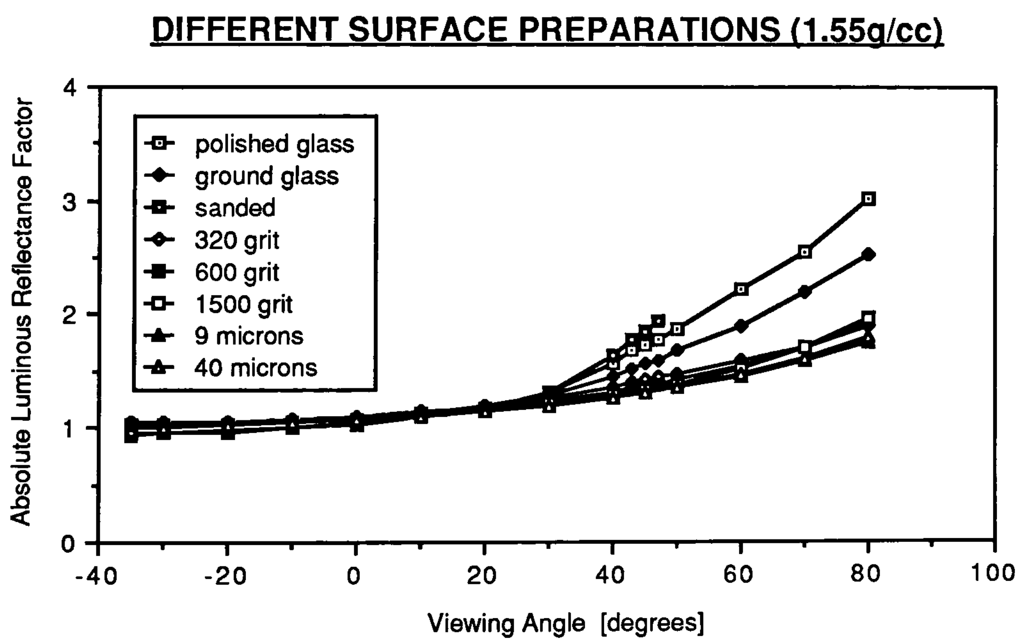


Figure 62 - Different Surface Preparations (1.55g/cc)

Figure 63 compares the results from sandpaper and lapping film pressings and indicates that the latter is a better preparation.

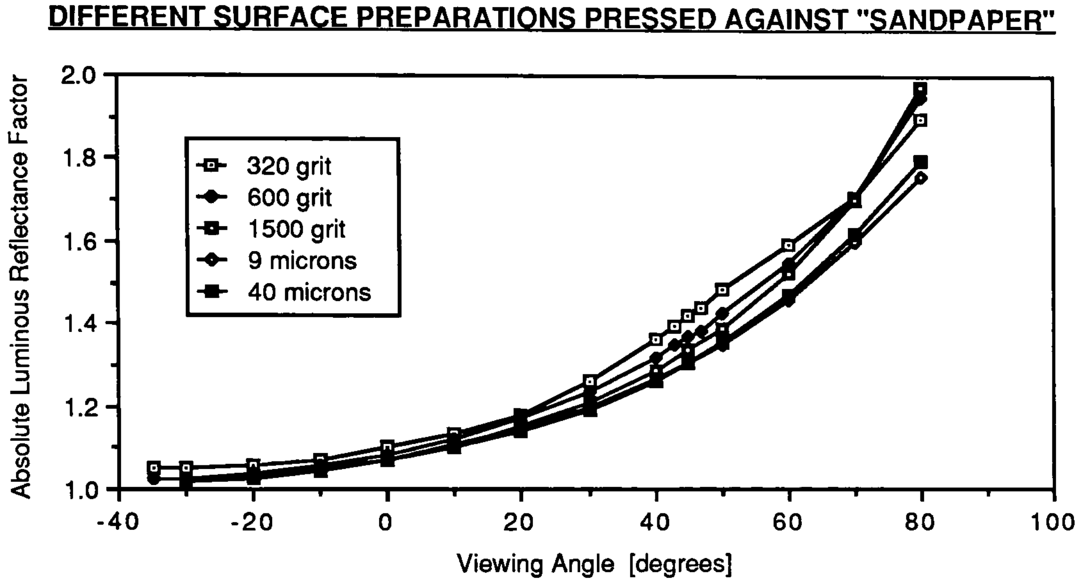


Figure 63 - Different Surface Preparations Pressed Against "Sandpaper".

There is a marked difference between the curves for the 320 and 600 grit sandpapers. However, the difference between 600 and 1500 grit is much less, which is surprising considering the larger difference in grit size. A possible reason is the type of backing used. After a point, finer grits do not result in a more uniform surface. This is readily seen when comparing the sandpaper (1500 grit) with the lapping film (40 microns, aluminum oxide) in figure 64.

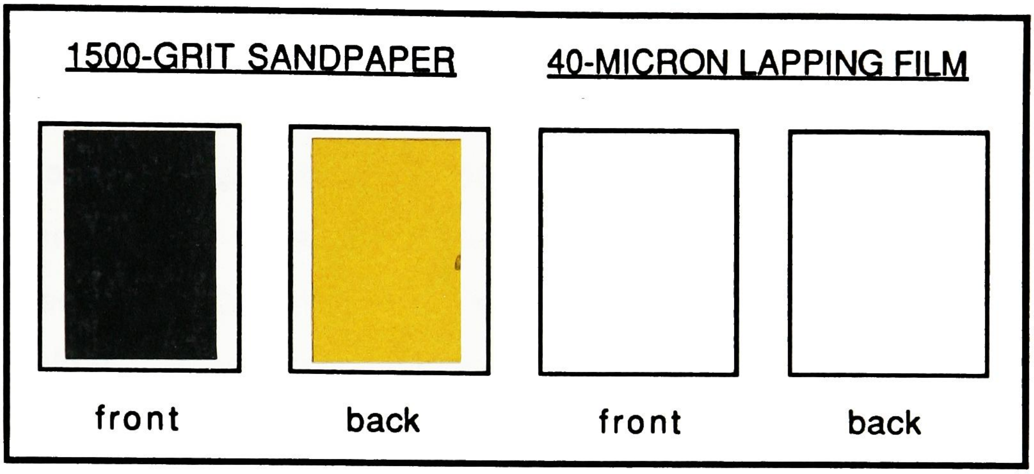


Figure 64 - 1500-Grit Sandpaper vs 40µm Lapping Film

The 9-micron and 40-micron pressings yielded similar reflectance curves. The final choice was the 40-micron lapping film. The 1.55g/cc samples obtained with the 40µm film are as lambertian as the 1g/cc tablets pressed against ground glass (see figure 65 below). Data is in appendix 28.

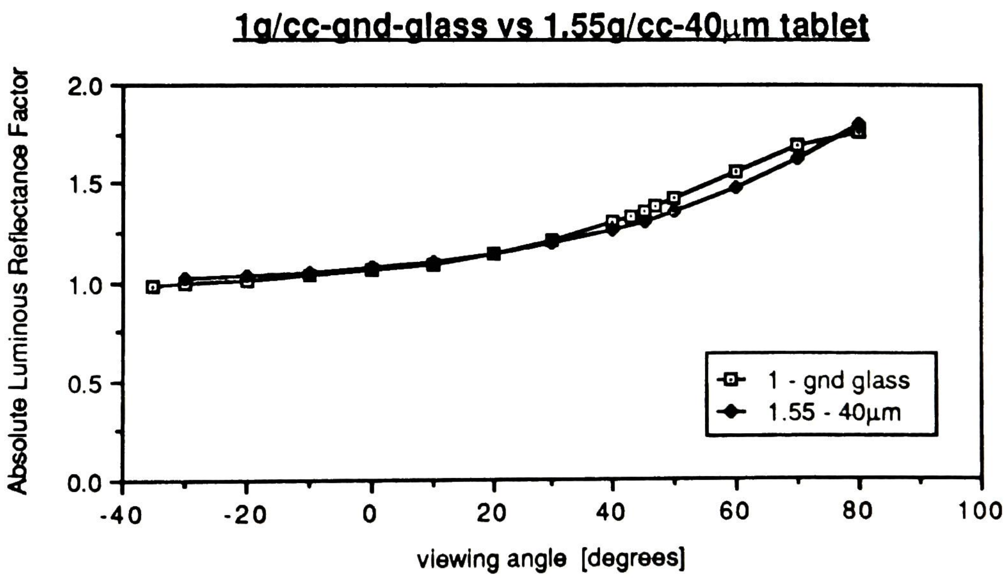
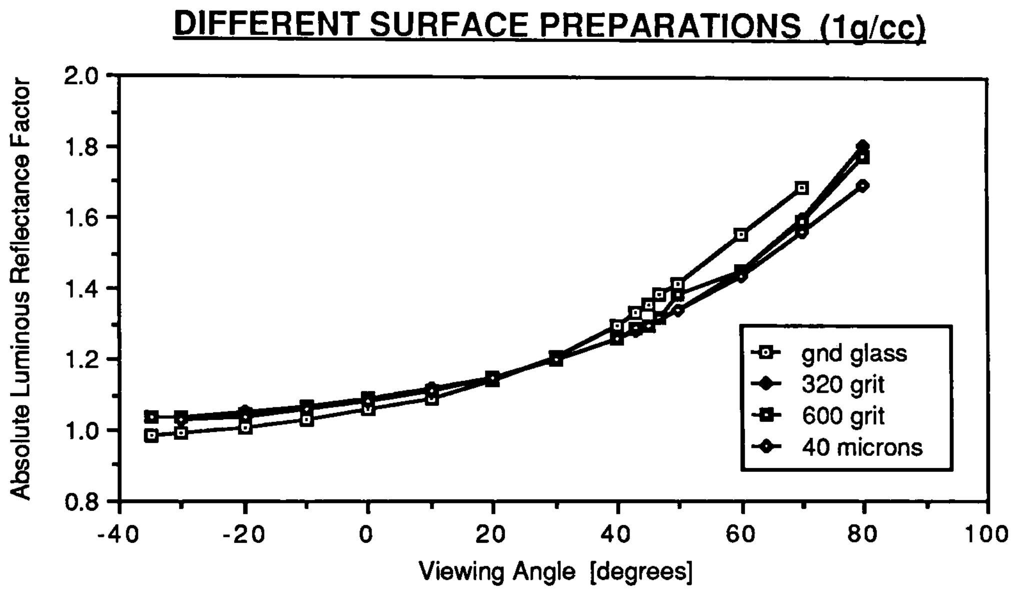


Figure 65 - 1g/cc-Gnd-Glass vs 1.55g/cc-40µm tablet

Figure 66 compares different surface preparations for the 1g/cc sample and indicates that the differences between ground glass, 320-grit, 600-grit, and 40µm finishes are not very great (the ground-glass finish being the worst). Remember that the 1g/cc is too fragile to be used without a holder. One disadvantage of the 40µm sample is that its surface texture is easily destroyed when rubbed. Data is in appendix 28.



<u>Figure 66</u> - Different Surface Preparations (1g/cc)

2. FINAL RESULTS

The repeatability study is a critical part of this research since developing a standard implies obtaining the highest repeatability achievable.

A. Repeatability Study of Halon Sample Measurements

Figure 67 illustrates the different tests carried out during the repeatability study. Ten measurements were taken except for the medium term check for which four different tablets were measured. Note that the first check (same sample, no replacement) characterizes the variability associated with the instrument itself.

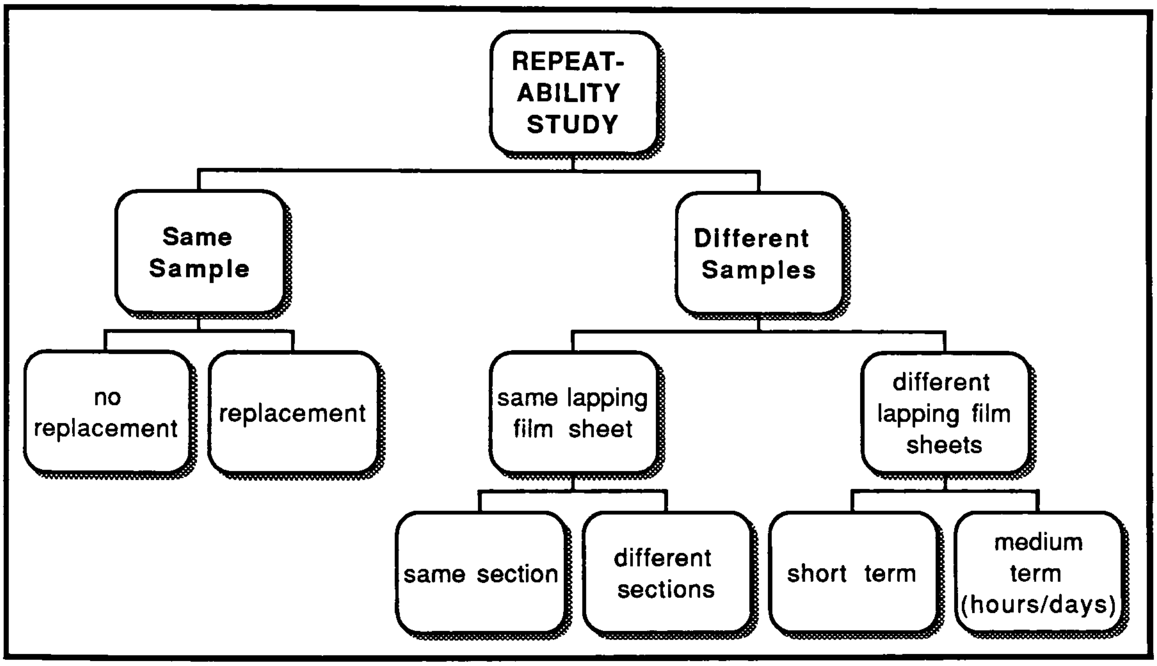


Figure 67 - Repeatability Study Steps

All tests were done using 1.55g/cc Halon tablets pressed against 40μm lapping film. The film sheets were rinsed with distilled water and the first two Halon pressings were discarded to ensure that no dirt was left on the surface. All

measurements were done at 45°/0° and were the average of 4 detector scans. A calibration was performed before each check (4 repeat measurements of the NBS tile were made at 45°/0° using 4 scans).

The six tables containing the results for the tests are in appendix 29. The mean and the standard deviation of the spectral coefficients of variation are found in table 11.

Table 11 - Repeatability Study Results

Mean and S.D. of Spectral Coefficients of Variation

	ßss		ßsp		ßps		ßpp		ßrr	
	mean	S.D.	mean	S.D.	mean	S.D.	mean	S.D.	mean	S.D.
1	0.22	0.14	0.28	0.25	0.24	0.15	0.24	0.16	0.16	0.08
2	0.28	0.14	0.30	0.18	0.32	0.20	0.32	0.20	0.22	0.09
3	0.34	0.17	0.39	0.20	0.36	0.18	0.34	0.20	0.26	0.07
4	0.37	0.15	0.42	0.25	0.38	0.16	0.43	0.23	0.32	0.13
5	0.44	0.17	0.44	0.23	0.41	0.16	0.39	0.22	0.35	0.10
6	0.63	0.28	0.65	0.17	0.85	0.26	0.72	0.23	0.64	0.21

The first column of table 11 is the test number:

1- same sample, no replacement,

2- same sample, with replacement,

3- different samples, same sheet, same section,

4- different samples, same sheet, different sections,

5- different samples, different sheets, short term, and

6- different samples, different sheets, medium term.

As expected, the numbers increase with the number of variables. The values for test 5 compare well with NBS who reports total uncertainty of ≈0.33% for similar conditions. The worst case is when the system is shut down each time and the samples are pressed against different sheets. This gives an average variability of 0.64% for β_{rr}. Subtracting the variability (test 2) yields a sample variability of 0.42% for test 6. This value is somewhat higher than what was expected. The higher variability could be a result of preparing the four samples all at once and keeping them covered with a clean piece of paper. It was later discovered that any slight rubbing of the surface resulted in a loss of the surface roughness obtained by pressing against the lapping film. However, as explained further, this kind of variability is much more acceptable than assuming a lambertian behavior.

B. $BaSO_4$

The tables of the final data for $BaSO_4$ are in appendix 30. Each table includes five reflectance factors (β_{ss}, β_{sp}, β_{ps}, β_{pp}, and β_{rr}) at 69 wavelengths (390nm to 730nm every 5nm) and is done for 60 angle combinations.

1) Comparison With Previous Studies

When trying to make direct comparisons with different authors, a few obstacles were encountered:

a) The sample preparations were different, as with Kortüm[109] who pressed samples at high pressure between two pieces of smooth paper, or Young, et al.[123] who machined a sprayed coating of $BaSO_4$, or Budde[124] who mixed $BaSO_4$ with a binder, or Butner, et al.[98] who measured $BaSO_4$ paints.

b) The azimuth angle between the illumination and viewing angles was not 180°, as with Brandenberg and Neu[14] who measured at 30° off the plane of incidence.

c) The quantity measured was not the bidirectional absolute spectral reflectance factor but relative reflectance (Billmeyer, et al[70]), or directional reflecting function (Nanjo, et al.[22]), or luminance factor (Kartachevskaya, et al.[73] and Clarke, et al.[125]).

d) The geometry of measurement was not bidirectional but 0°/d (Grum and Wightman[125]).

Some general comparisons can still be made as seen in the following paragraphs. Figure 68 shows different reflectance factors vs specular angles. This plot is similar to that found in Nanjo, et al.[22] except that β_{ss} and β_{pp} are not as close together as the curves obtained by them.

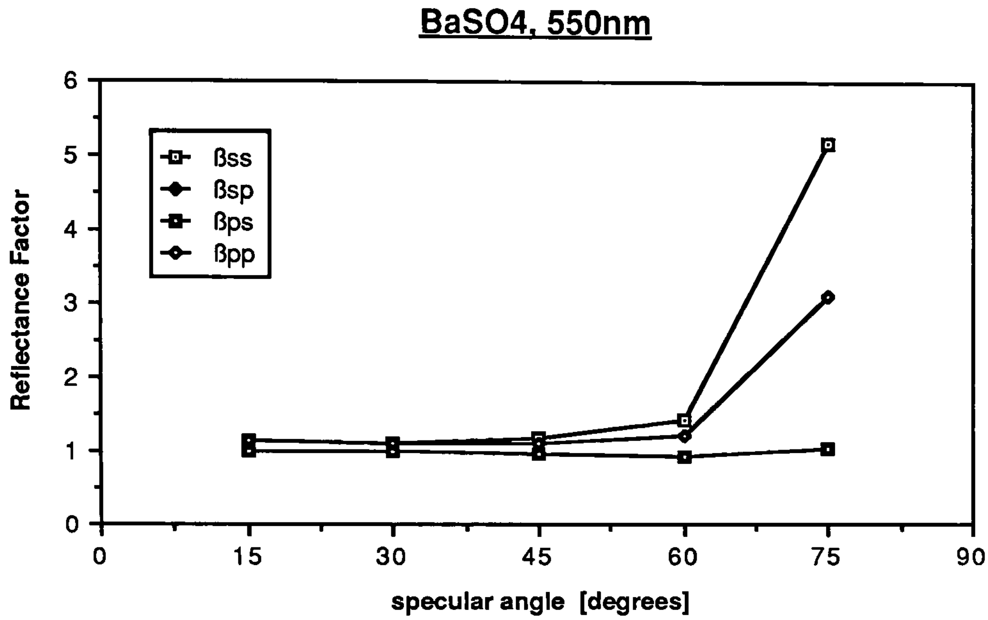


Figure 68 - $BaSO_4$ / Different Reflectance Factors vs Specular Angles

Figure 69 below is a plot of the different ß's at -75° incidence and 550nm. Again comparing to Nanjo, et al.[22], the same tendency is obtained at large specular angles where the reflectance factors increase significantly. However, the tendency at angles toward the angle of incidence is much reduced compared to the plots shown by Nanjo, et al. A possible explanation is the difference in sample surface preparation.

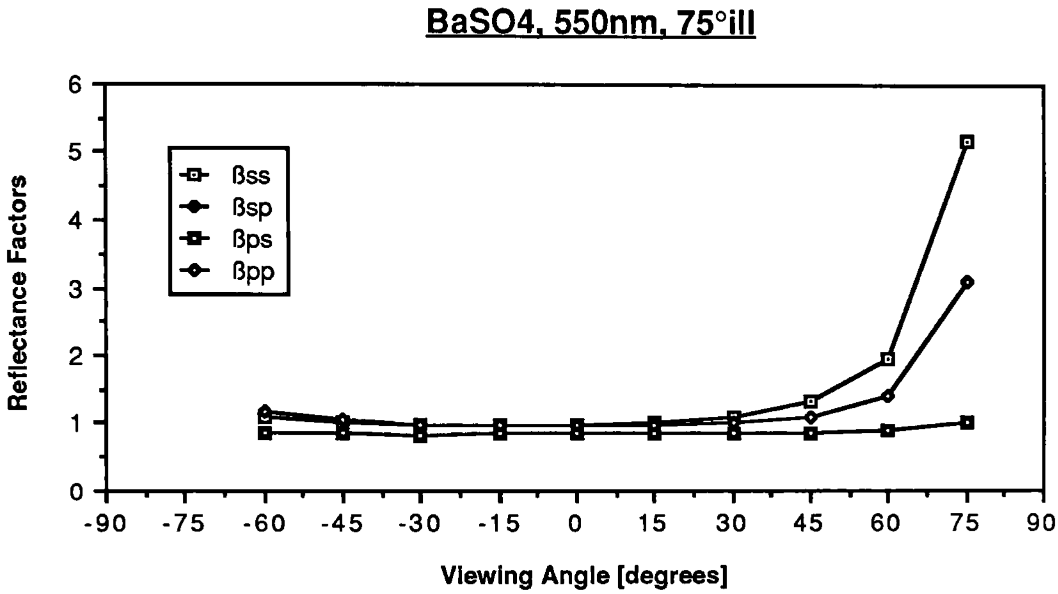


Figure 69 - $BaSO_4$ / Different Reflectance Factors vs Viewing Angles.

The effect of angle-of-incidence on the four reflectance factors if shown in figure 70 which was measured at 555nm and 0° viewing. Note that β_{sp} and β_{ps} are right on top of each other. This will happen in all the plots where they are both included (their values are always very close). The trends seen in figure 70 are much less pronounced than the ones observed by Clarke, et al.[27] Here again, a different surface preparation is probably the cause.

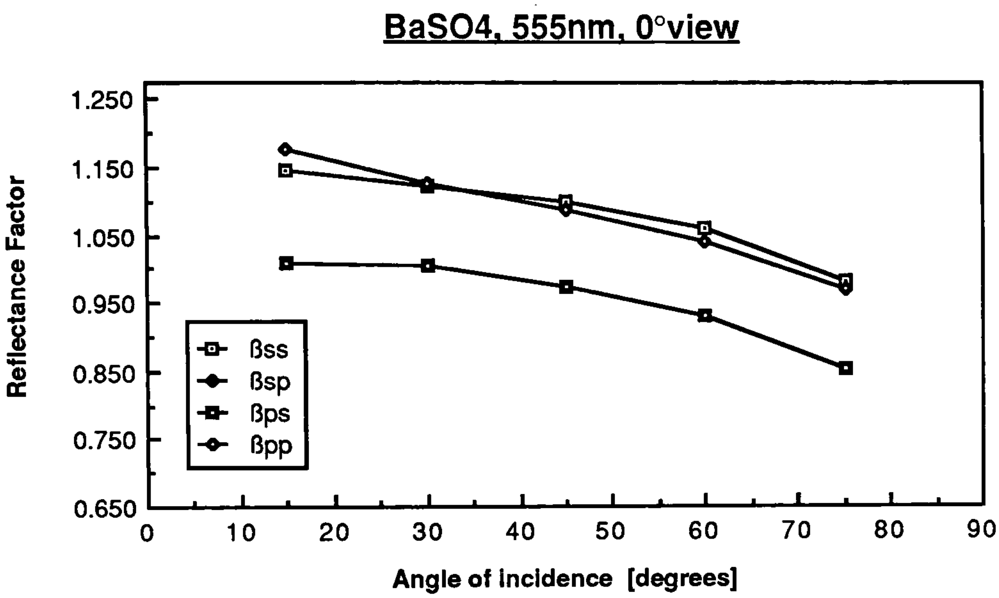


Figure 70 - $BaSO_4$ / Different Reflectance Factors vs Illumination Angles.

Figure 71 was compared to similar curves by Brandenberg and Neu[14] who measured $BaSO_4$ paints. The plot was thought to be similar to that in the article until they were realized to be mirror images. The reflectance plot shown by Brandenberg and Neu has peaks on the incidence side. The backscattered reflectance is shown to be much higher than the forwardly scattered reflectance at high angles. This was not the case in this research. Brandenberg and Neu attributed the backscattering mainly to the roughness of the surface.

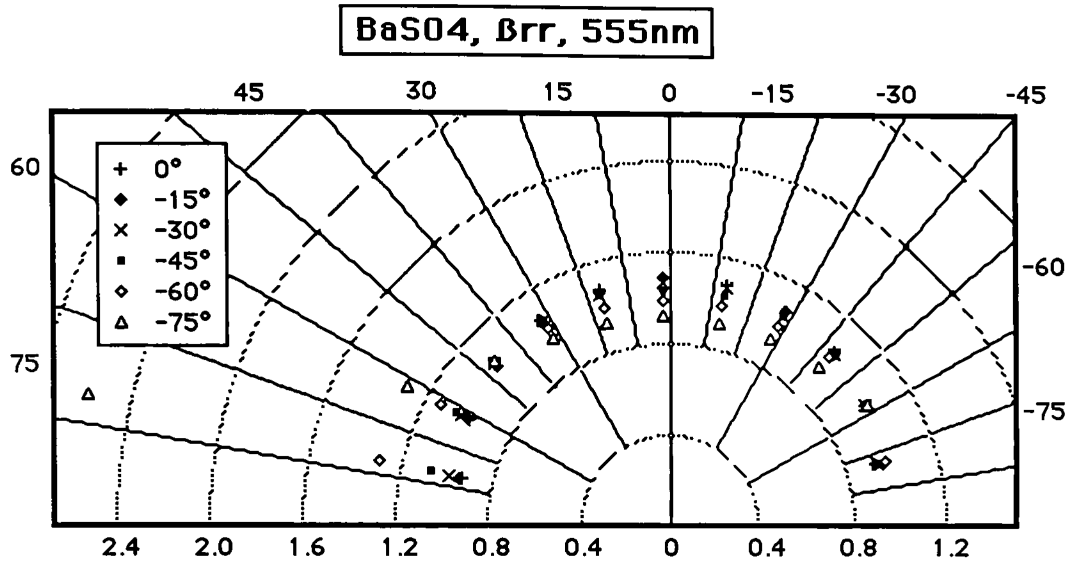


Figure 71 - $BaSO_4$ / Gonio Plot of β_{rr} at 555nm for Different Illumination and Viewing Angles.

Since figure 71 was plotted at 555nm and Brandenberg and Neu's was done at 507nm, another gonio plot was drawn at 505nm and -75° illumination to verify the backscattering from the $BaSO_4$ sample. Here, backscattering radiation means radiation reflected toward the same side of the normal to the sample as the incident angle is. Figure 72 does show some backscattered reflectance but the largest peak is definitely in the forward-scattered direction.

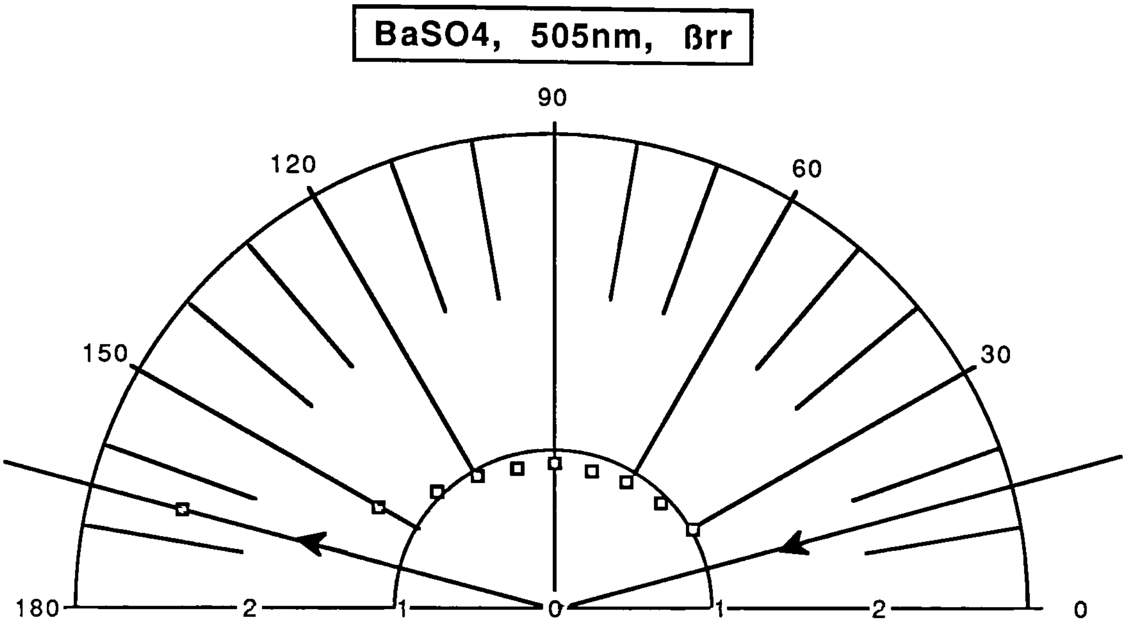


Figure 72 - $BaSO_4$ / Gonio Plot of β_{rr} at 505nm for -75° illumination and different viewing angles.

The last comparison is shown in figure 73 below which shows the β_{rr} of $BaSO_4$ at 600nm for different angles of incidence and viewing. The data is normalized to the value at 0° incidence to match the data plotted in Weidner and Hsia.[24] The same trends as in the article are obtained, i.e. the reflectance factors are slightly lower at larger viewing angles for small angles of incidence but are higher for large angles of incidence. At -75° incidence, a large peak occur at the specular angle. The backscattered reflectance is higher in Weidner and Hsia's plot than the one obtained here. However, direct comparison of data is

limited because the angles used in the article are different from the ones used in this thesis.

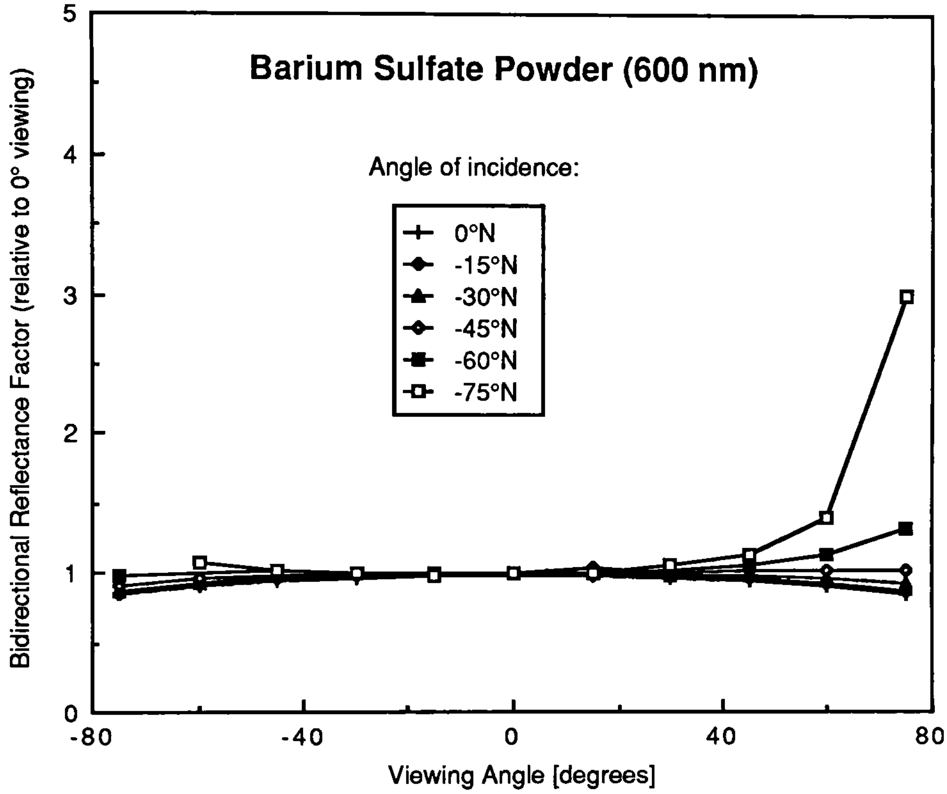
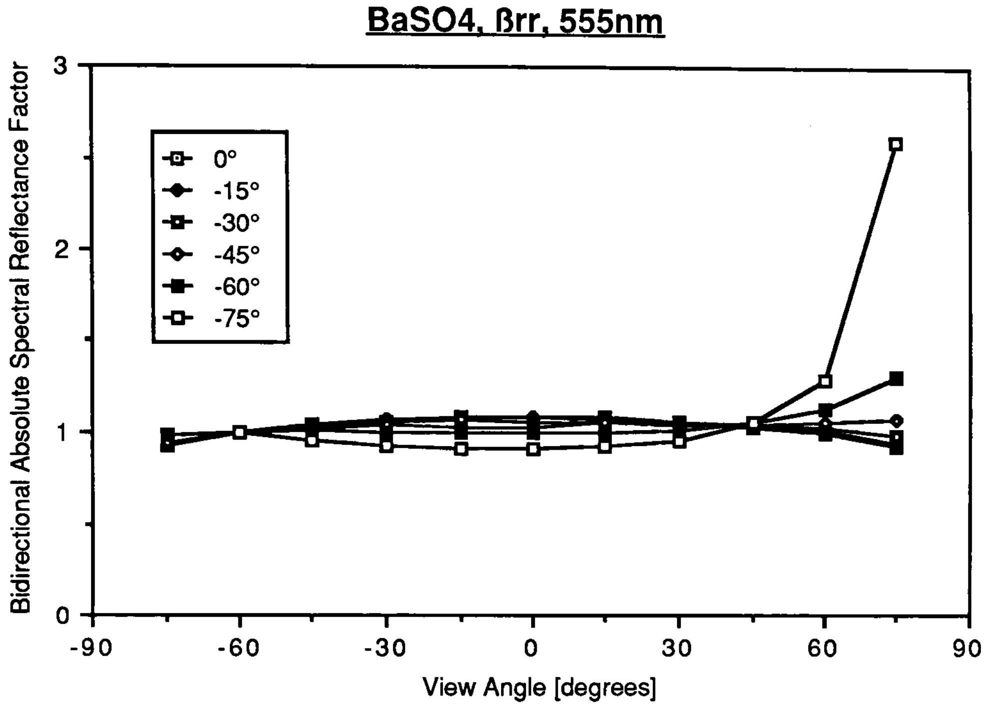


Figure 73 - $BaSO_4$ / Normalized β_{rr} at 600nm for Different Angles of Illumination and Viewing.

2) How Lambertian is $BaSO_4$?

Figure 74 below is a linear plot of figure 71 and has the same format as figure 73 except that the data are not normalized. The 555nm wavelength was selected because it corresponds to the maximum visual response.



<u>Figure 74</u> - $BaSO_4$, β_{rr}, 555nm, six angles of incidence

It is interesting to note that the six curves intersect at approximately 42° viewing angle. No explanation can be suggested for this behavior. Appendix 31 compares the gonio plots for these six incident angles (note that since the software package could not take negative values, 90° was added to the angles).

Since figure 74 seems to indicate that $BaSO_4$ is most lambertian at -45° illumination, this particular curve is plotted again in figure 75 using a different scale.

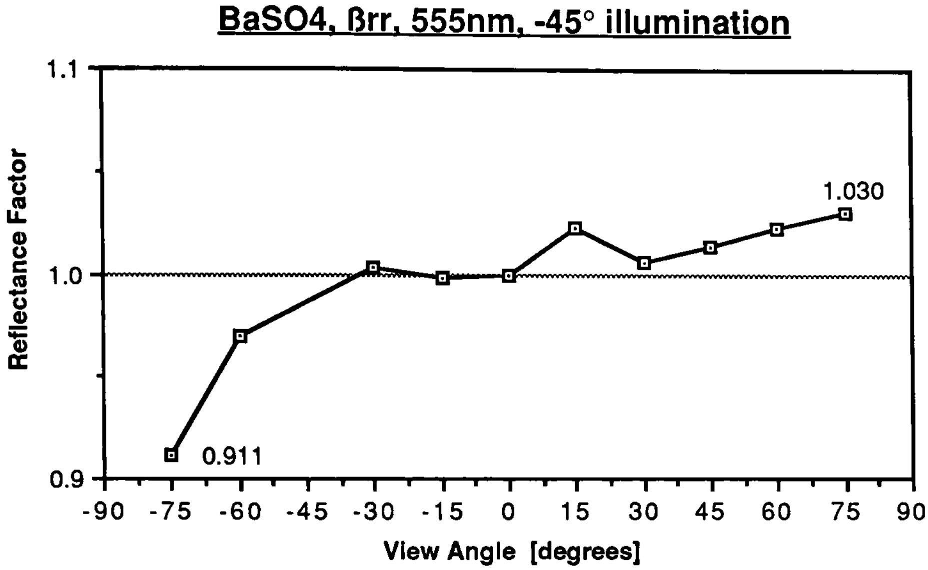


Figure 75 - $BaSO_4$, β_{rr}, 555nm, -45° illumination.

The data are normalized to 0° viewing and gives values of 0.911 and 1.030 at -75° and 75° viewing respectively. This means the $BaSO_4$ varied from ≈-8.9% to +3% relative to the lambertian line (1.0) over the -75° to 75° range. If these numbers are calculated at 30°, the variation is 0.6% which indicates that $BaSO_4$ is close to being lambertian if small angles of viewing are considered. Table 12 includes the variation found at 30° for the 6 angles of incidence (all data being first normalized to 0° viewing).

Table 12 - BaSO$_4$ / Departure from Lambertian Behaviour at 30° viewing.

angle of incidence	variation from 1.0
-15°	2.2%
-30°	0.7%
-45°	0.6%
-60°	2.2%
-75°	4.8%

NOTE: 0° incidence could not be normalized for 0° viewing (since it could not be measured at that angle combination).

The general conclusion of this short study is that BaSO$_4$ is close to being lambertian only in a restricted range of angles of illumination and viewing. However, only a single measurement was made of a single sample. It is suspected that because it is so hard to get a uniform pressing out of BaSO$_4$ powder, there is a large variability in the surface preparation between different samples.

3) How spectrally non-selective is BaSO$_4$?

A desirable characteristic for white standard materials is that they be spectrally non-selective and stay so under all conditions of ilumination and viewing. This is particularly important if the wavelength calibration of an instrument is not accurate. A spectrally non-selective

sample attenuates any reflectance factor error associated with a wavelength shift. A rather surprising result is that $BaSO_4$ becomes spectrally selective at large specular angles. Also, spectral non-selectivity means that when calibrating the instrument for the 100% point, detector linearity problems are prevented at that end of the scale. Figure 76 is a plot of the $BaSO_4$ β_{rr} at different specular angles vs wavelength.

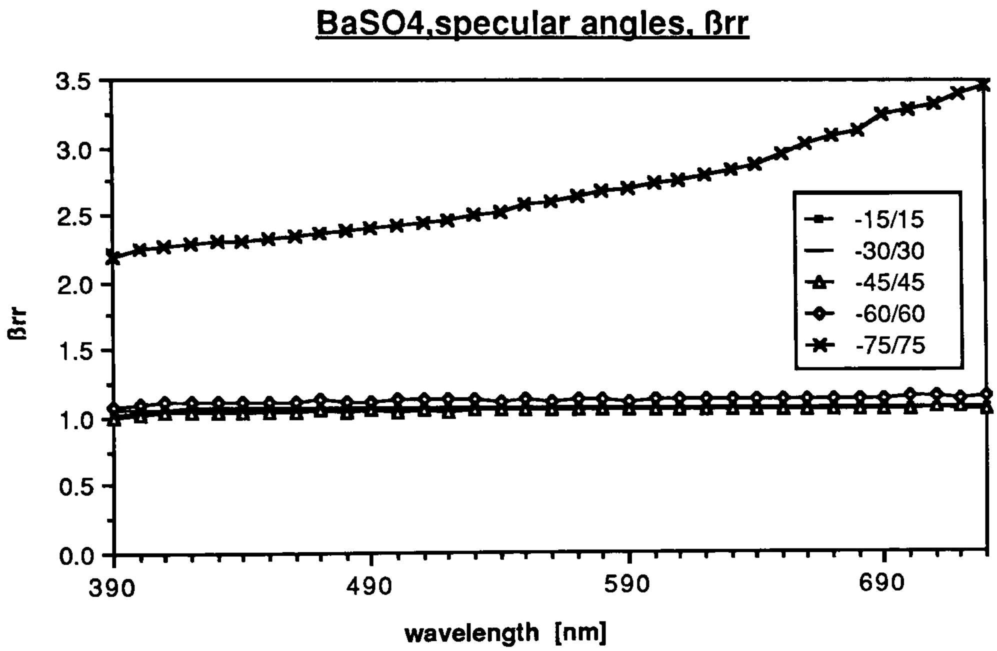


Figure 76 - $BaSO_4$, β_{rr}, different specular angles vs wavelengths.

The first interesting point in figure 76 is the behaviour of β_{rr} at -75°/75°. Contrary to the results obtained at the four other specular angles, there is an upward tendency in the β_{rr} values as the wavelength gets higher. A possible

reason is that at grazing angles a larger specular component is present and the effect of scattering (which is wavelength dependent) is different.

Figure 77 shows the same plot as in figure 76 but ignoring the 75° specular-angle curve.

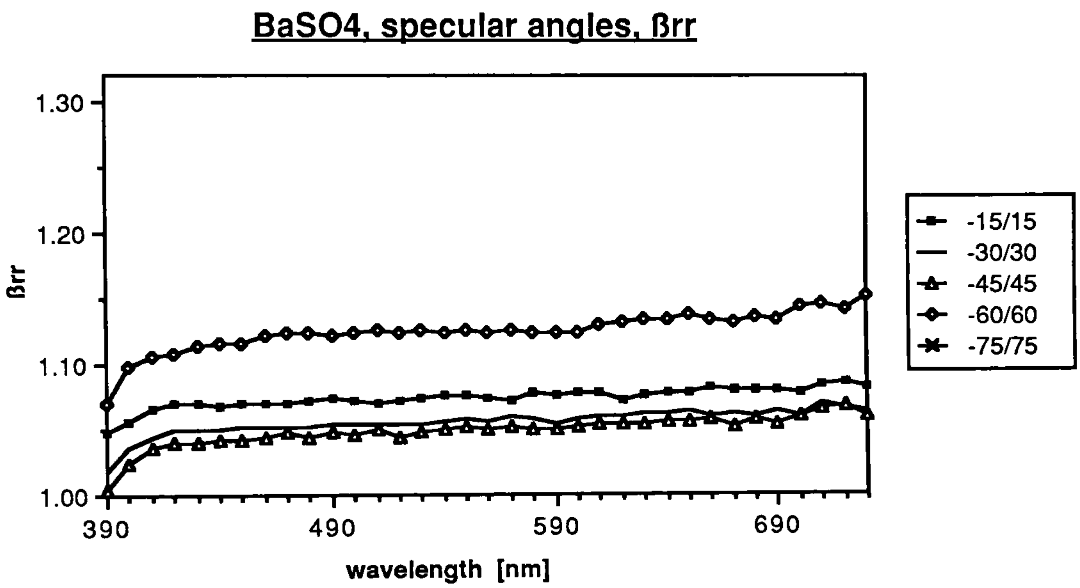


Figure 77 - $BaSO_4$, β_{rr}, 15°, 30°, 45°, and 60° specular angles vs wavelength.

The curves obtained are relatively flat from ≈420nm to 730nm. To know how flat they actually are at each angle, the mean, standard deviation, and coefficient of variation of the spectral β_{rr}'s are calculated for each case and the results presented in table 13.

Table 13 - BaSO4 / "Flatness" of specular angles spectral curves.

Angles	Mean	S.D.	C.V.
-15°15°	1.074	0.007	0.69%
-30°/30°	1.055	0.009	0.86%
-45°/45°	1.049	0.011	1.09%
-60°/60°	1.125	0.015	1.29%
-75°/75°	2.684	0.370	13.79%

4) How does $BaSO_4$ affect different polarization components?

The different reflectance factors for the four basic polarization conditions are plotted in figure 78.

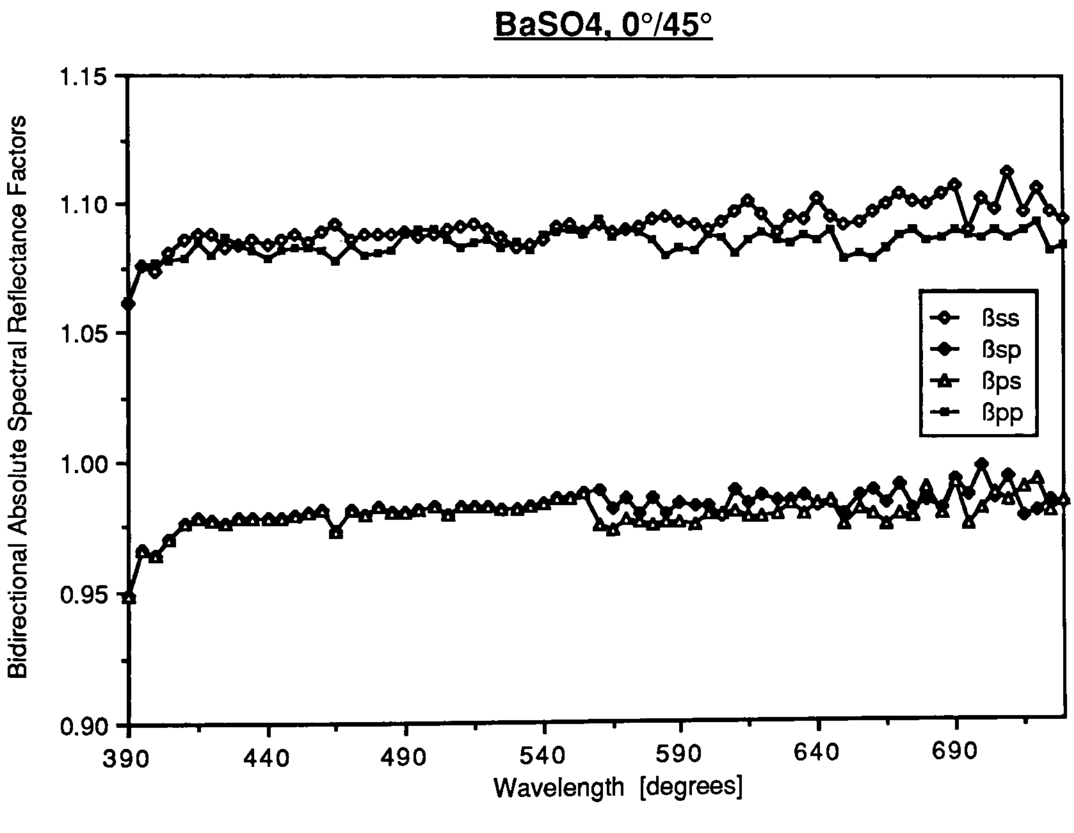


Figure 78 - BaSO4, ß's, 0°/45° vs wavelength

The reflectance factors in figure 78 are paired as follows:

a) β_{ss} and β_{pp} which are approximately equal to 1.08, and

b) β_{sp} and β_{ps} which are approximately equal to 0.98.

The lower reflectance value for β_{sp} and β_{ps} is attributed to the sample partially polarizing the reflected radiation. Since the two polarizers are crossed in this case, any imbalance has a direct effect on the readings.

The next figure is similar to figure 78 but the angle combination is now -75°/75° which was chosen because it represents an extreme case.

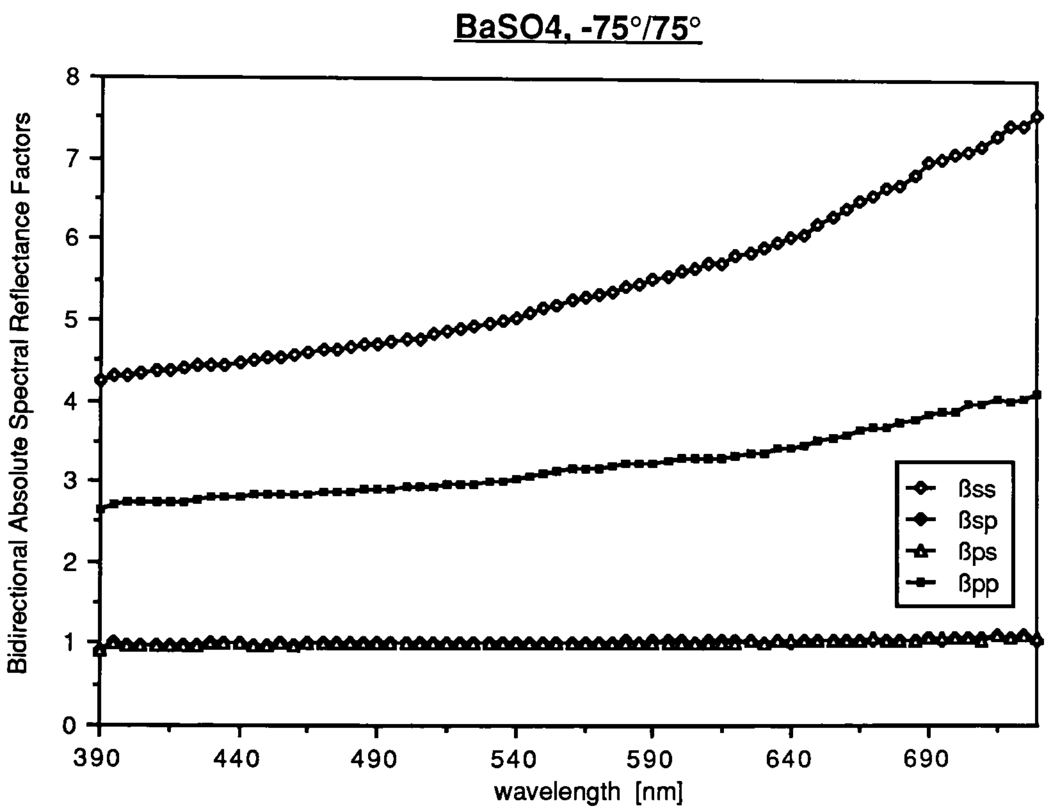


Figure 79 - $BaSO_4$, ß's, -75°/75° vs wavelength.

In this case, β_{sp} and β_{ps} agree but β_{ss} and β_{pp} are much different. To thoroughly understand what is going on, more study must be done regarding the effect of density, molecular structure, and surface preparation of the pressed samples on polarization through the system. This is outside the scope of this thesis.

Figure 80 shows the effect of viewing angle on the four reflectance factors at 0° illumination.

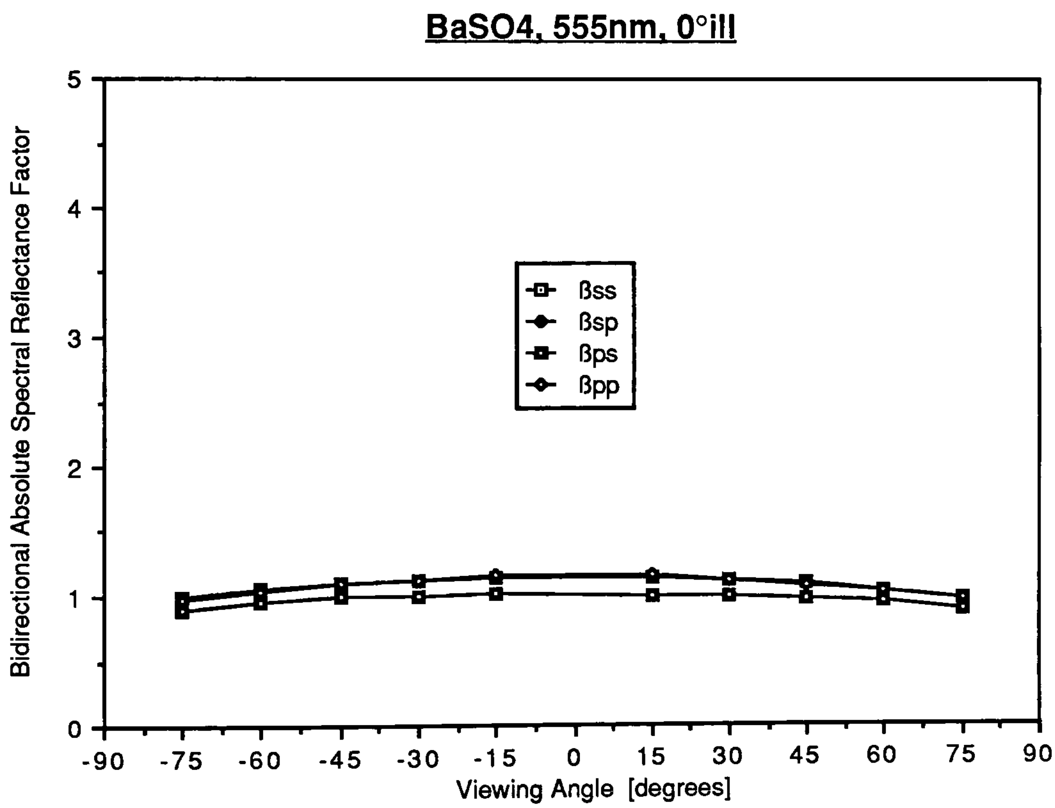


Figure 80 - BaSO4, 555nm, 0°ill vs viewing angle.

There is not much difference between the four ß's at different viewing angles. However, this does not hold true

when plotting the same graph at -75° illumination as seen in figure 81. The difference at -75° was already illustrated in figure 79 where β_{ss} had the largest values.

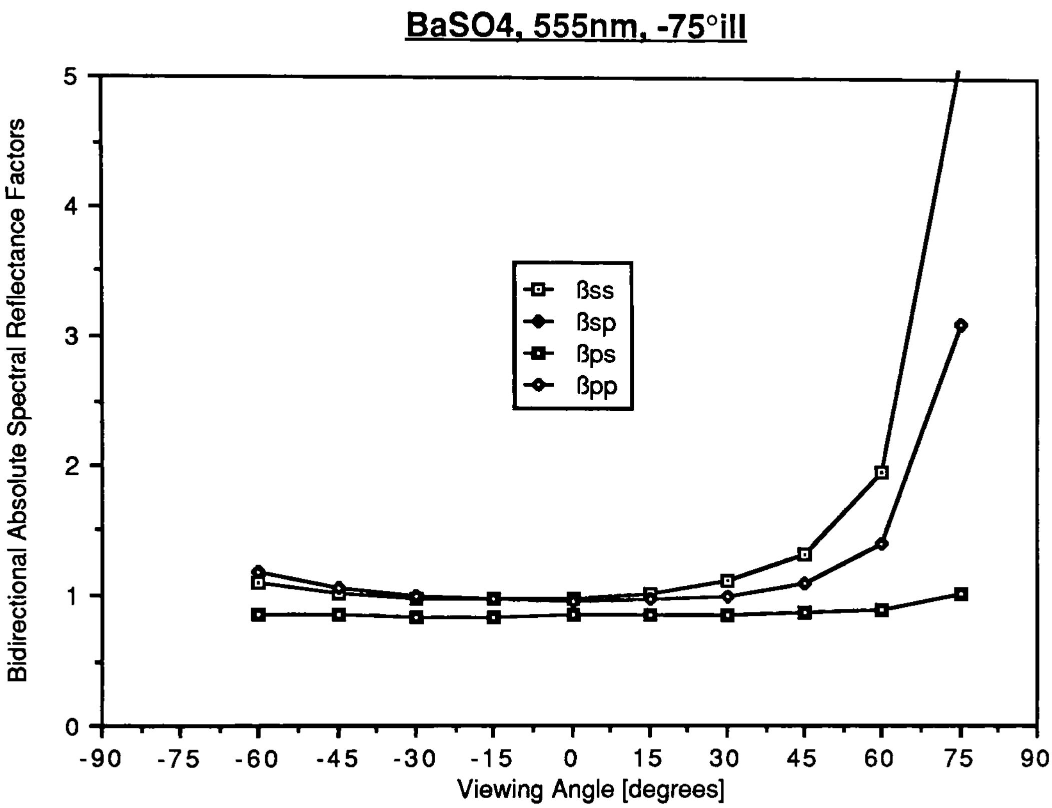


Figure 81 - BaSO4, 555nm, -75° ill vs viewing angle.

Figure 81 also shows that the difference between the four ß's is only large in the forward-scattered direction. Note that these higher values for β_{ss} and β_{pp} are what makes the β_{rr} values go up (remember that β_{rr} is the average of the four basic ß's).

C. Halon

The 60 tables for the Halon data are in appendix 32.

1) Comparison with Previous Studies

Here again, direct comparisons are difficult to make because:

a) the Halon samples density was different (Grum and Saltzman,[87] Weidner and Hsia,[24] and Weidner, et al.[99]),

b) Halon was used as an integrating sphere coating (Eckerle, et al.[88] and Saunders and Ott[89]),

c) the study was related to fluorescence measurements (Saunders and Ott[89]),

d) the measurement geometry was different (Venable, et al.[94] and Budde, et al.[96]),

e) Halon was sprayed instead of pressed (Schutt, et al.,[86] Schutt, et al.,[97] and Butner, et al.[98]),

f) Halon was used to make "sintered mixtures of phosphors in polytetrafluoroethylene resin for fluorescence standards" (Weidner, et al.[100]), or

g) the measurement angle combinations were different (Grum, et al.[30]).

However, the following general comparisons can be made. Figure 82 is the β_{rr} for Halon at 600nm (0° incidence) for different viewing angles.

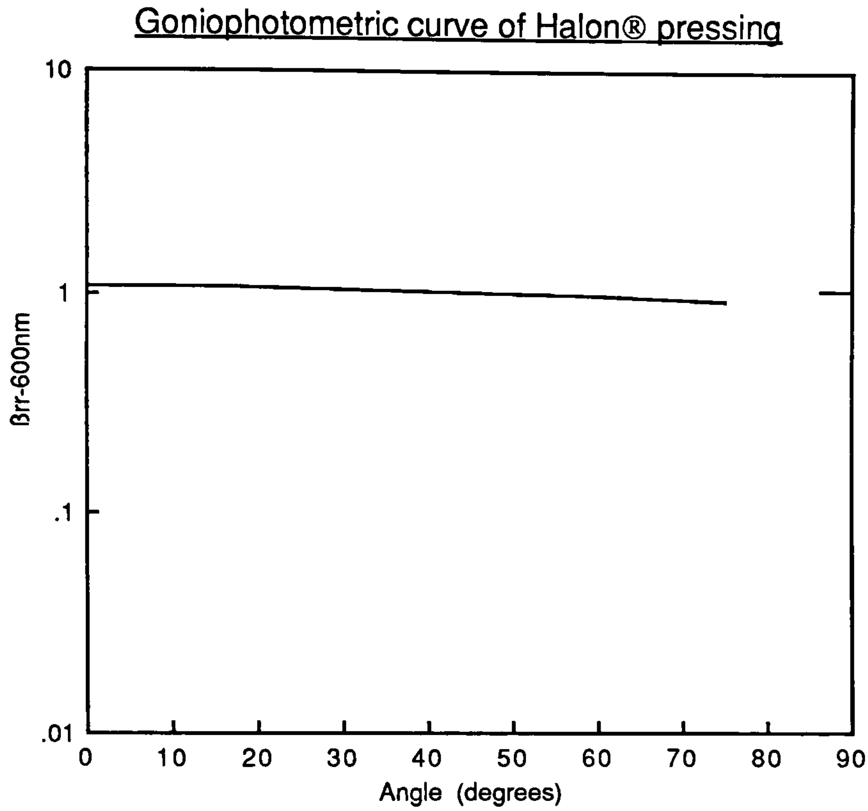


Figure 82 - Halon®, β_{rr}, 600nm, 0° incidence vs viewing angle (log scale).

A logarithmic scale was selected for the y-axis to compare this graph to the one in Grum and Saltzman[87] which led to the conclusion that "Halon pressing is a nearly perfect diffuser". However, if these data are plotted against a linear scale (as in figure 83), the curve departs from a lambertian behaviour. Therefore, Halon® is not as perfect a diffuser as first indicated by the article.

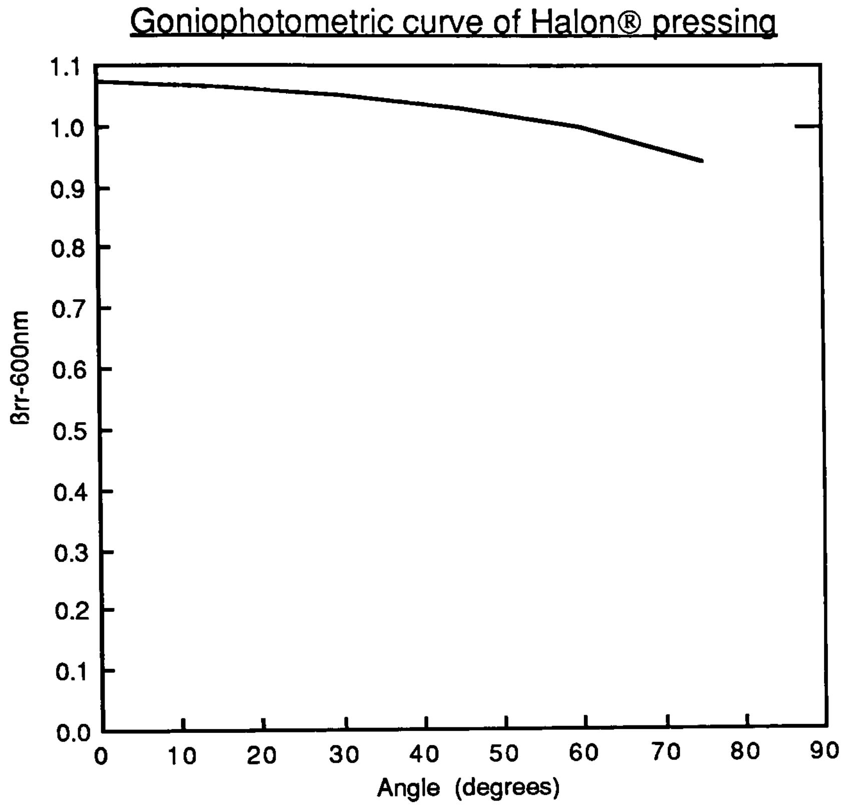


Figure 83 - Halon, β_{rr}, 600nm, 0° incidence vs viewing angle (linear scale).

Figure 84 compares Weidner and Hsia's results[24] with the data obtained in this research. Note that the data points were normalized to the value at 0° viewing. The angles of illumination used in the article were -10°, -30°, -50°, and -70° and the viewing angles were -80° to 80° every 10°. The only significant differences are at viewing angles larger than 60° and are probably due to the different sample densities (1g/cc in the article vs 1.55 g/cc) and the surface preparation (pressed against ground glass vs

lapping film). The remaining portion of the two curves indicates that the results obtained are almost identical.

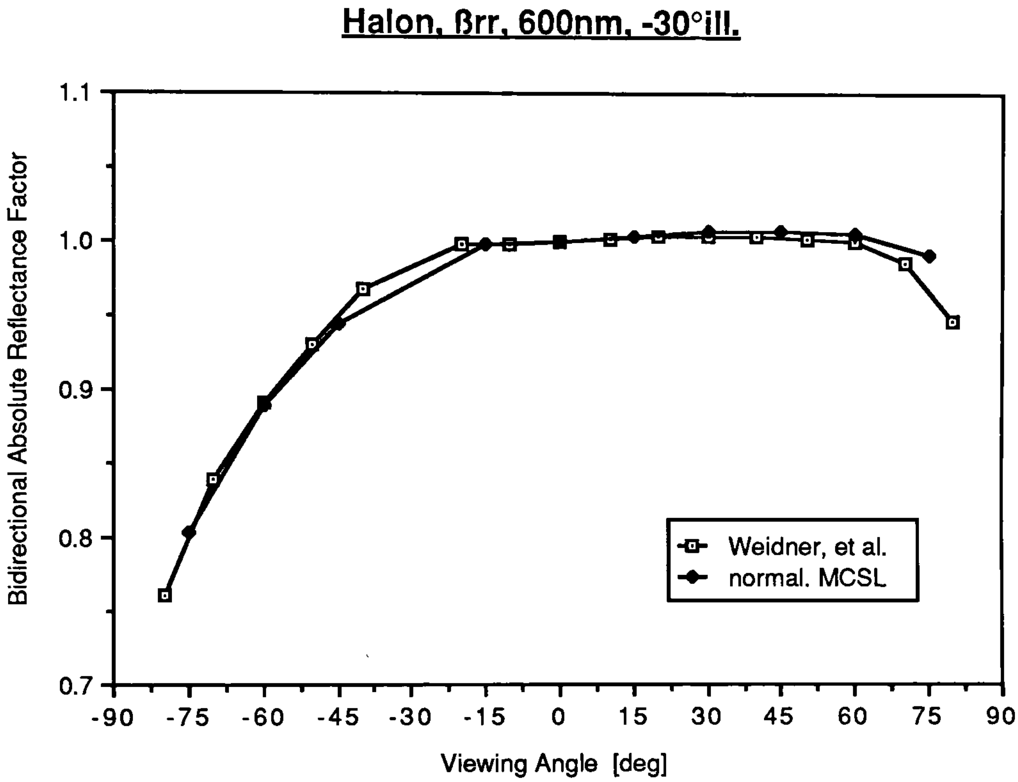


Figure 84 - Halon, β_{rr}, 600nm, -30° incidence vs viewing angle .

The next figure compares five angles of incidence for Halon, β_{rr}, 600nm vs viewing angles. A similar graph is found in Weidner and Hsia[24] and shows the same trends, i.e. there is not much change in the reflectance factors values in the backscattered direction but there is a significant increase in the forward-scattered direction. This increase gets larger as the angle of incidence gets larger.

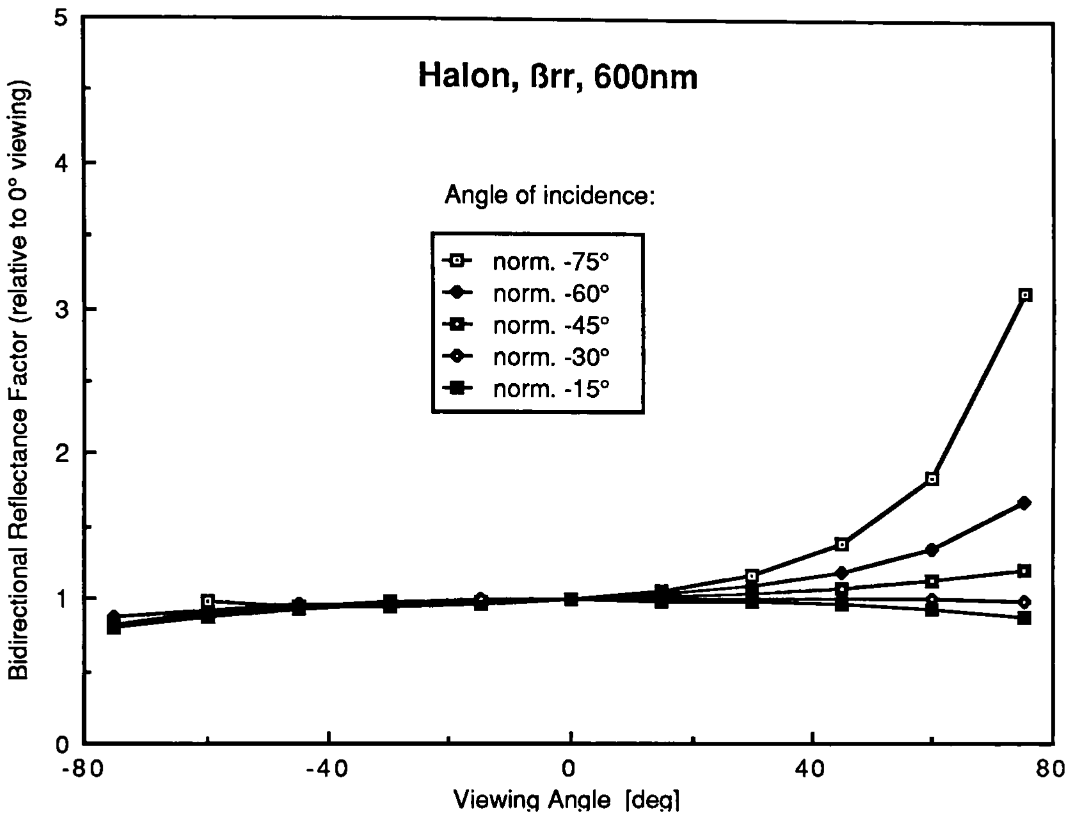


Figure 85 - Halon, normalized β_{rr} at 600nm, for different angles of illumination and viewing .

2) How Lambertian is Halon?

Figure 86 shows β_{rr} at 555nm for six angles of incidence vs. viewing angles. The data are not normalized.

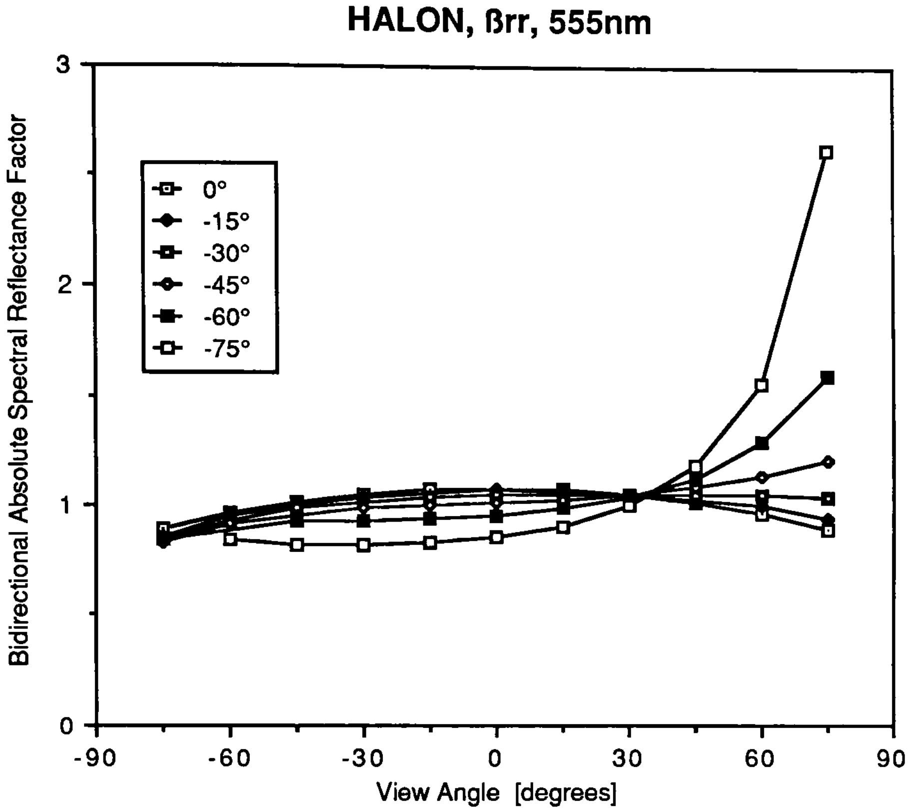


Figure 86 - Halon, β_{rr}, 555nm, six angles of incidence vs viewing angles.

The six curves from figure 86 intersect at ≈33° viewing. The flattest curve is the one for -30° illumination and is plotted using a different scale in figure 87.

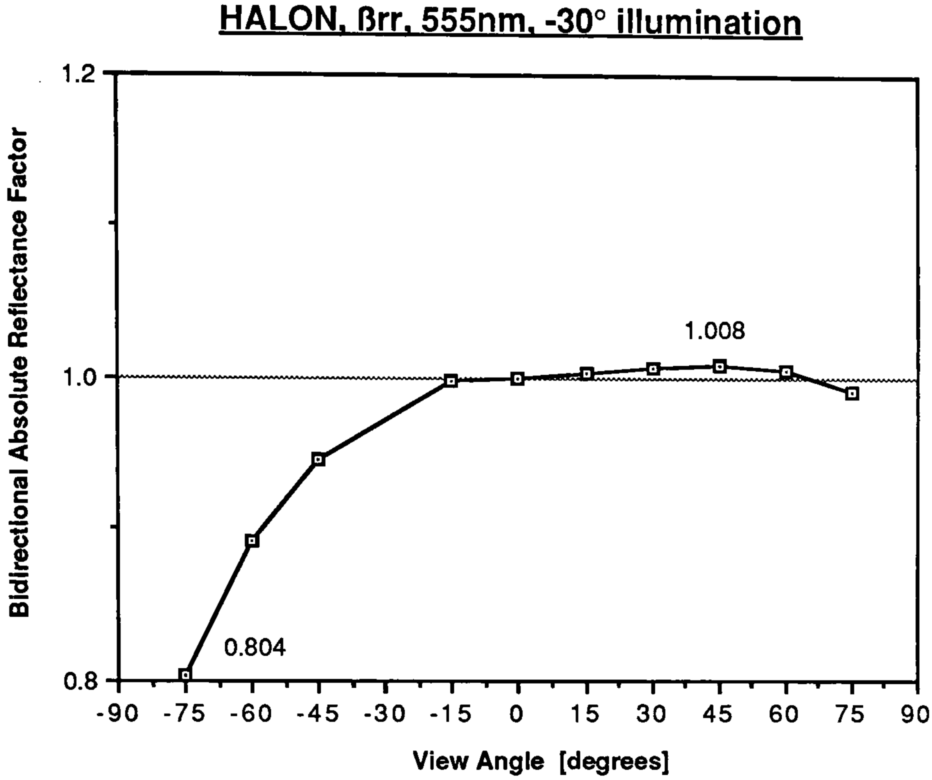


Figure 87 - Halon®, β_{rr}, 555nm, -30° illumination (linear plot).

The data is normalized to 0° viewing and gives values of 0.804 at -75° and 1.008 at 45° viewing. This means Halon® varied from -19.6% to +0.8% from the lambertian line (1.0) over the -75° to 75° range. Interestingly, Halon® is extremely lambertian past the -30° viewing angle (towards positive angles). In fact, it varies only between -0.86% and +0.77% for viewing angles of -15° and +75°. These percentages correspond to reflectance factor values of -0.009 and +0.008 respectively. Figure 88 is a gonio

plot of the same data as figure 87 and makes this lambertian behaviour more obvious. Remember that because of software limitations, 90° was added to all angles of incidence to make them positive.

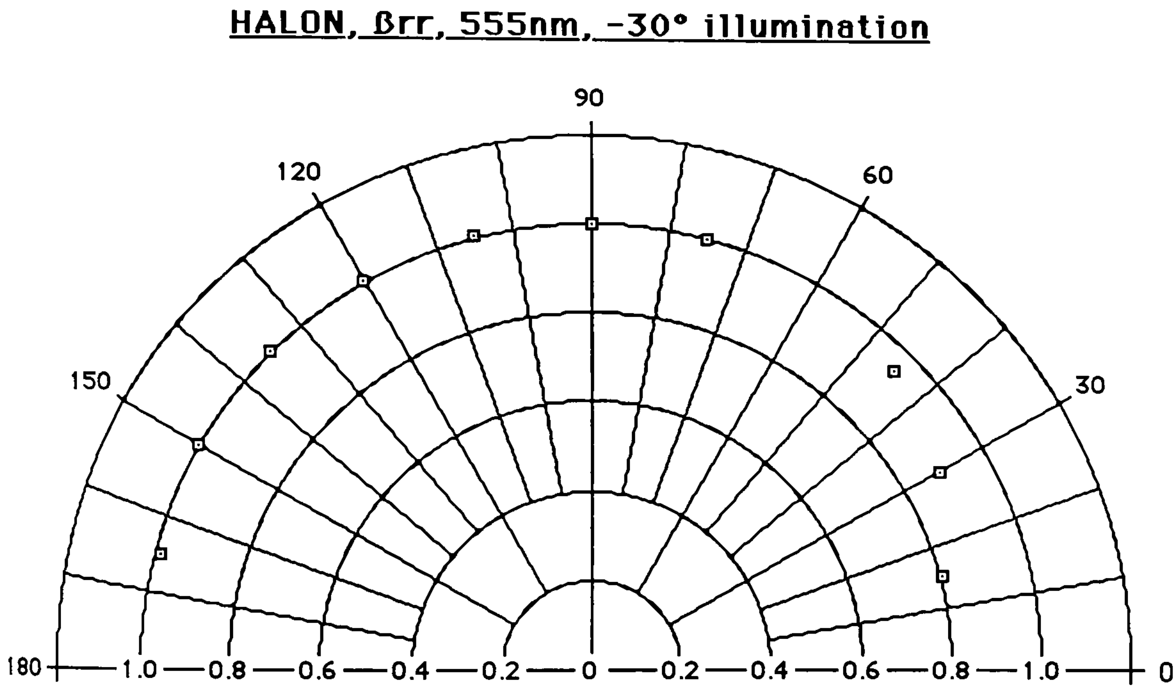


Figure 88 - Halon, β_{rr}, 555nm, -30° illumination (polar plot).

3) <u>How spectrally non-selective is Halon?</u>

Figure 89 is a plot of Halon β_{rr} at different specular angles vs. wavelength.

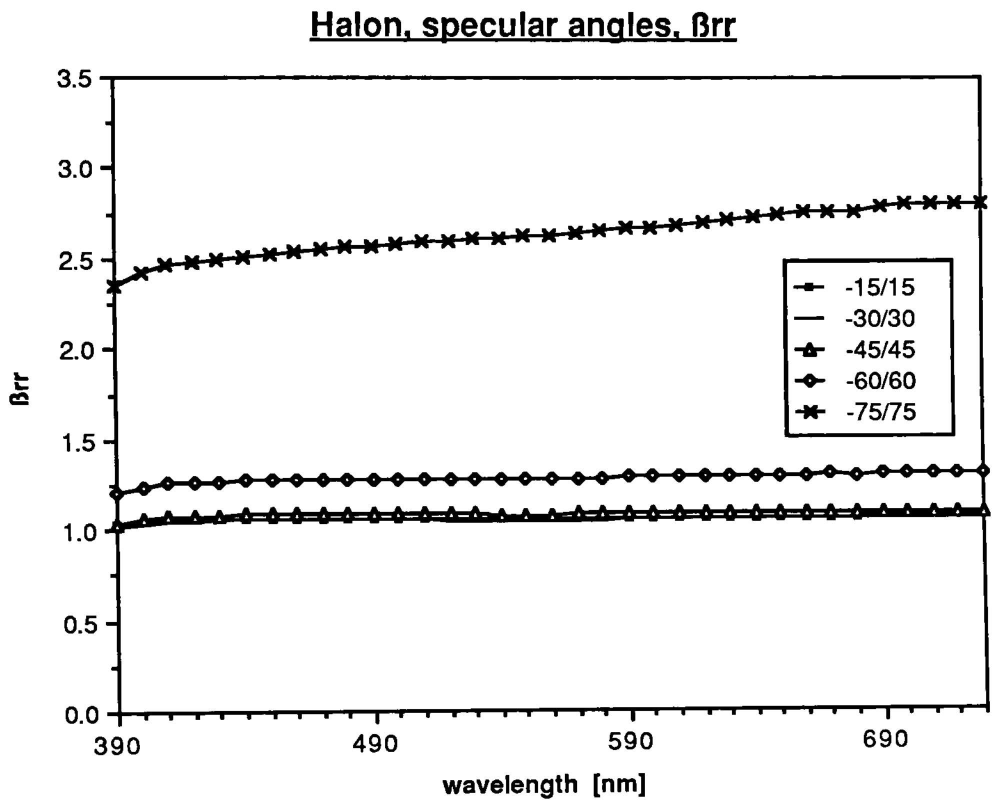


Figure 89 - Halon, β_{rr}, different specular angles vs wavelengths.

At -75°/75°, β_{rr} is much higher (≈2.5 times) than at -15°, -30°, -45°, or -60° specular. At this larger angle, the surface roughness has more influence on the reading because of effects like shadowing between mirror facets, if this theory is accepted to explain the reflection behaviour of radiation when incident on rough surfaces.

Figure 90 uses a different scale to minimize the effect at 75° specular angle.

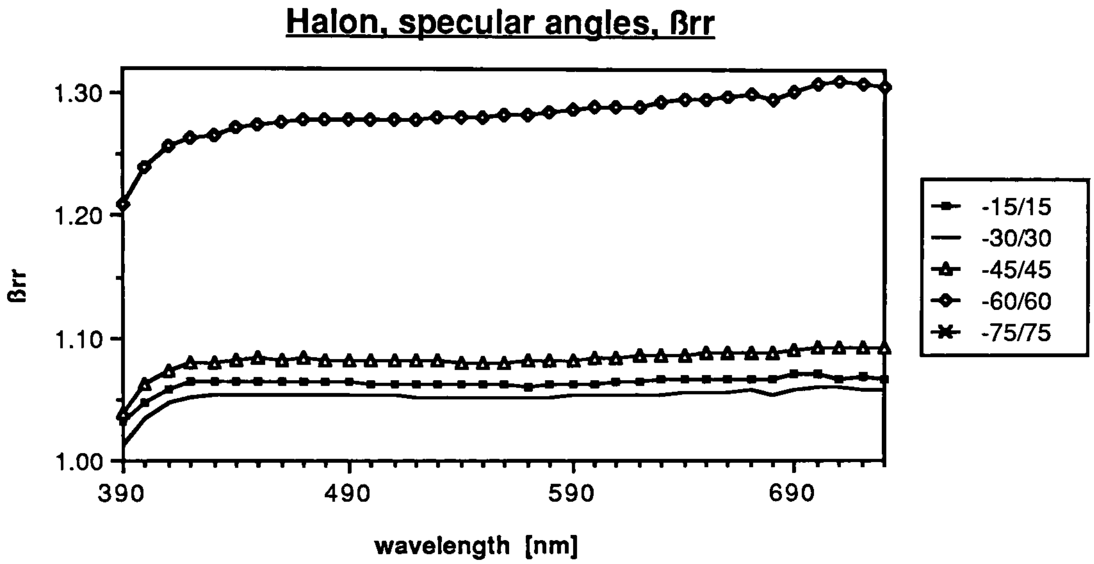


Figure 90 - Halon, β_{rr}, -15°, -30°, -45°, and -60° specular angles vs wavelength.

The curves are relatively flat from ≈420nm to 730nm. Table 14 shows how flat they actually are over this spectral range.

Table 14 - Halon / "Flatness" of specular angles spectral curves.

Angles	Mean	S.D.	C.V.
-15°15°	1.065	0.003	0.25%
-30°/30°	1.054	0.003	0.26%
-45°/45°	1.085	0.004	0.38%
-60°/60°	1.287	0.013	0.98%
-75°/75°	2.660	0.099	3.73%

4) <u>Variability in the Measurements</u>

As seen in appendix 32, coefficients of variation were calculated for each reflectance factor at 69 wavelengths. An extensive study can be done on how these coefficients vary with wavelength, different angles, and various reflectance factors. An area which must be considered is the error introduced in the data by the general practice of assuming lambertian behavior in comparison to the error introduced because of the variability in the measurements? To answer this question, plots can be made using y-error bars representing the standard deviation (coefficient of variation times the mean and then divided by 100). The criterion is that if the lambertian curve (horizontal line) is included within the error bars, a lambertian assumption introduces a smaller error than using the numbers measured in this research. Figure 91 illustrates this point for the wavelength λ = 555nm. The coefficients for the five reflectance factors vary from 0.38% to 2.25% for β_{ss}, 0.26% to 2.36% for β_{sp}, 0.42% to 2.69% for β_{ps}, 0.28% to 5.90% for β_{pp}, and 0.37% to 2.25% for β_{rr}. Large illumination and viewing angles yield higher coefficients of variation.

Halon, 555nm, 0° illumination

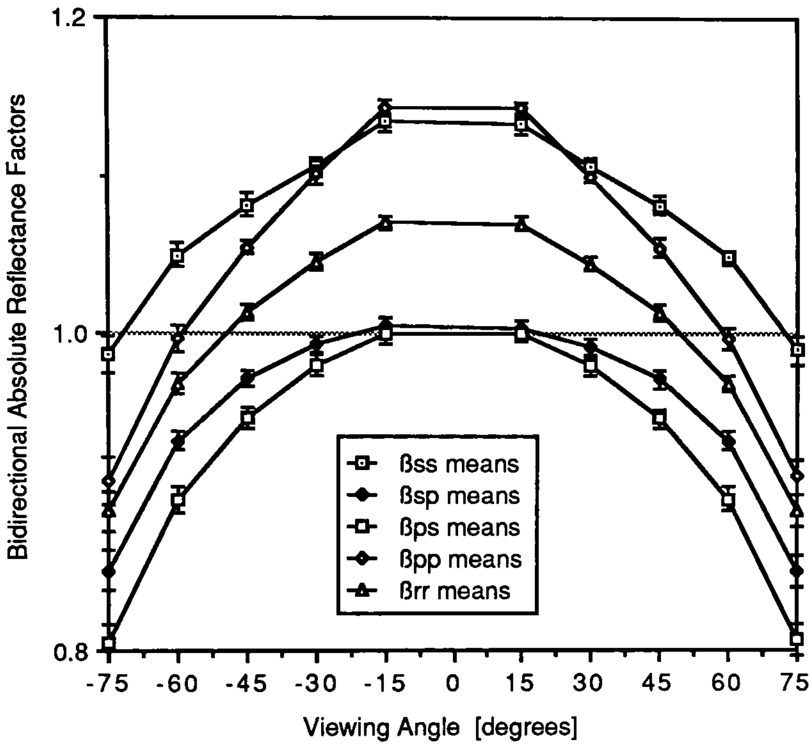


Figure 91 - Halon, 555nm, 0° illumination, y-error bars.

It is obvious from the curves of Fig. 91 that past ±15° viewing, a lambertian assumption introduces unacceptable errors. Figure 92 shows the worst case encountered at 555nm (β_{pp} at -75° illumination).

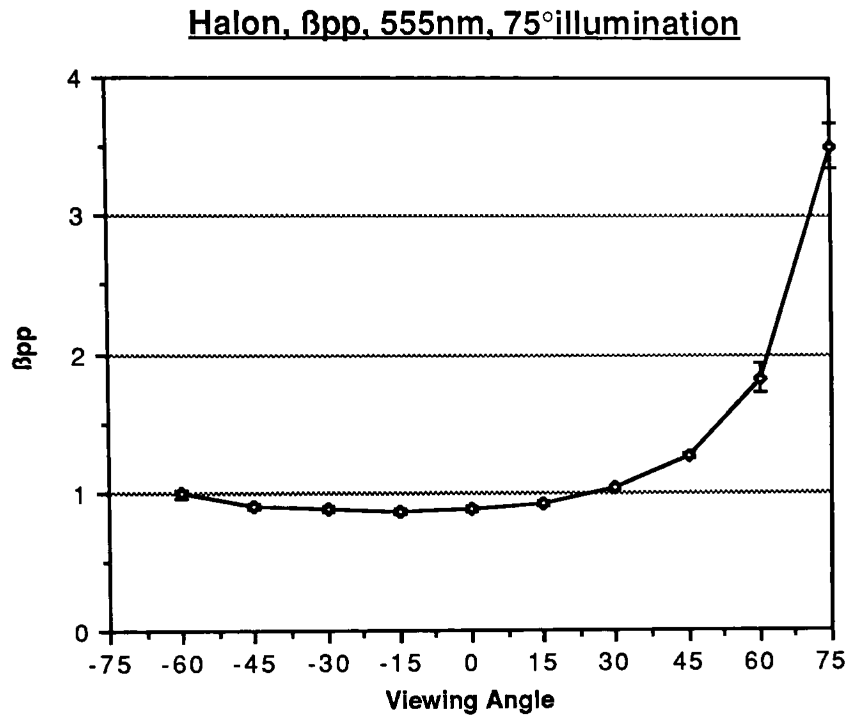


Figure 92 - Halon, 555nm, -75° illumination, β_{pp}, y-error bars.

5) How does Halon® affect different polarization components?

The same procedure was followed for $BaSO_4$. Figure 93 compares the four reflectance factors vs. wavelength at 0°/45°.

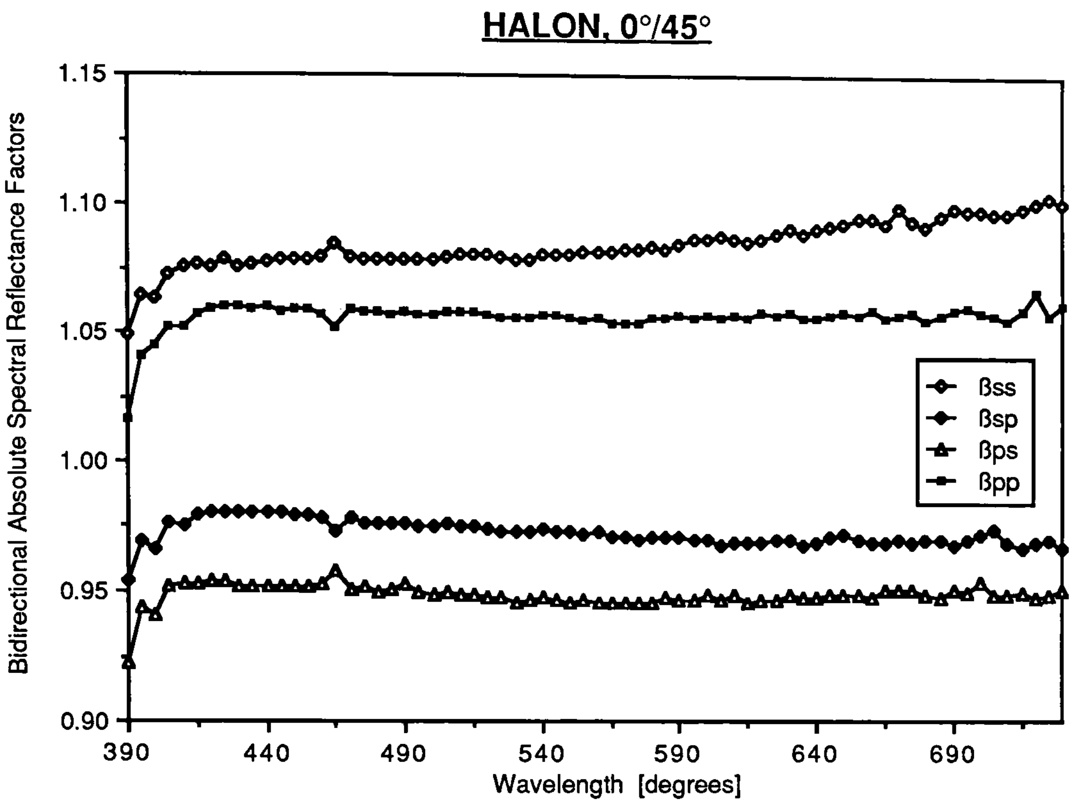


Figure 93 - Halon, ß's, 0°/45° vs wavelength.

The pairing between reflectance factors is still present but the curves are farther apart in each pair. A likely reason is the polymer structure of Halon® which has long chains possibly creating a pattern in the pressing and therefore affecting polarization in a particular manner.

Figure 94 shows the four curves at -75°/75°. The β_{sp}/β_{ps} curves are similar but the β_{ss}/β_{pp} curves are spread apart approximately one reflectance unit. Here again, this increase in the β_{ss}/β_{pp} values result in higher β_{rr}'s.

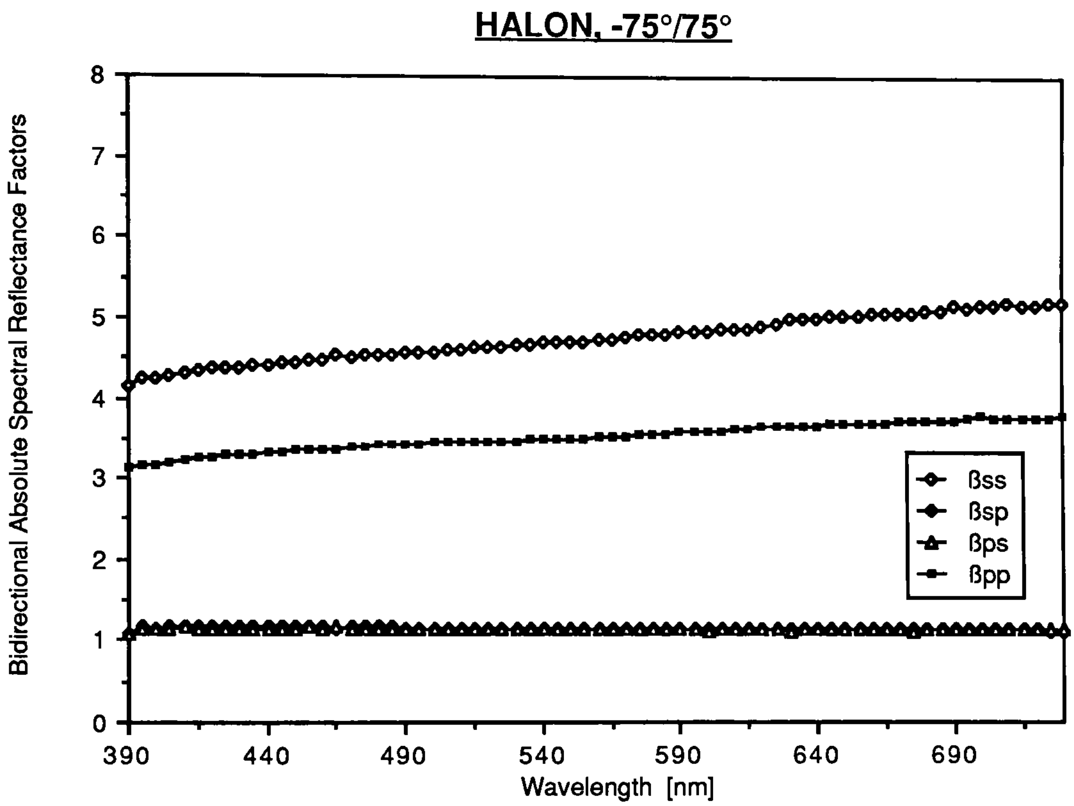


Figure 94 - Halon, ß's, -75°/75° vs wavelength.

Figure 95 below is the plot of the four basic ß's against viewing angle.

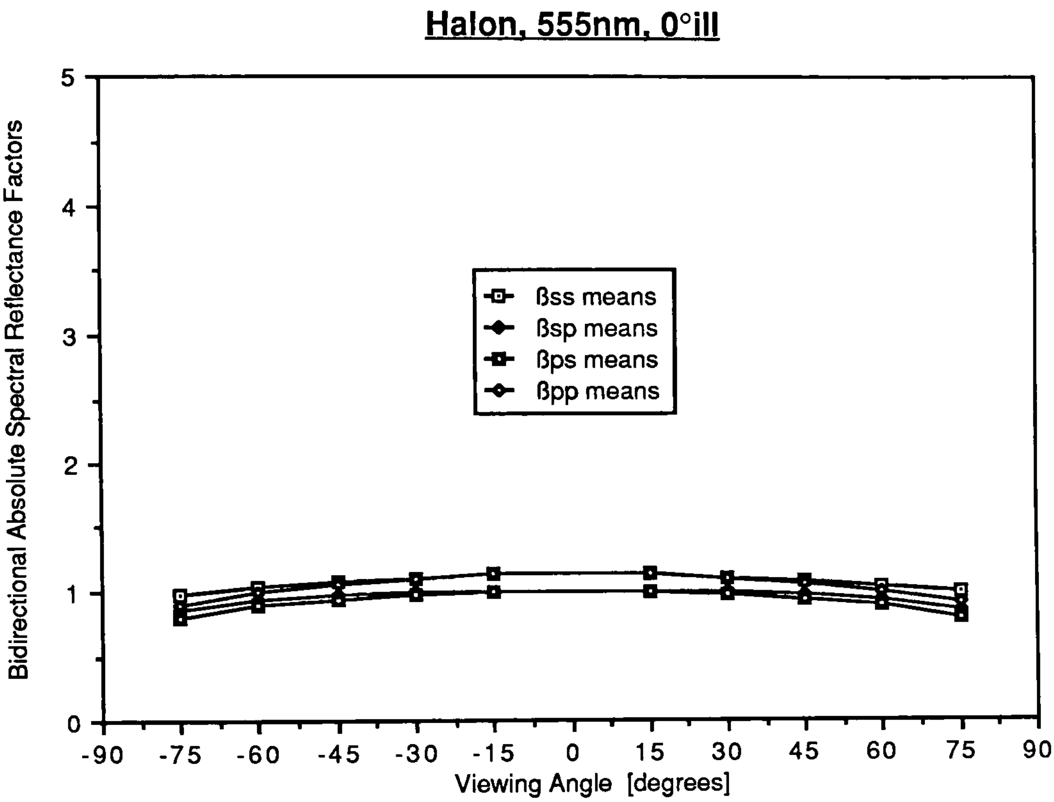


Figure 95 - Halon, 555nm, 0° ill vs viewing angle.

However, the viewing angle has quite an effect on the ß values when illuminating at -75° as seen in figure 96. The high values at +75° viewing for $ß_{ss}$ and $ß_{pp}$ were also evident in figure 94 where their curves were much higher than the $ß_{sp}$ and $ß_{ps}$ ones.

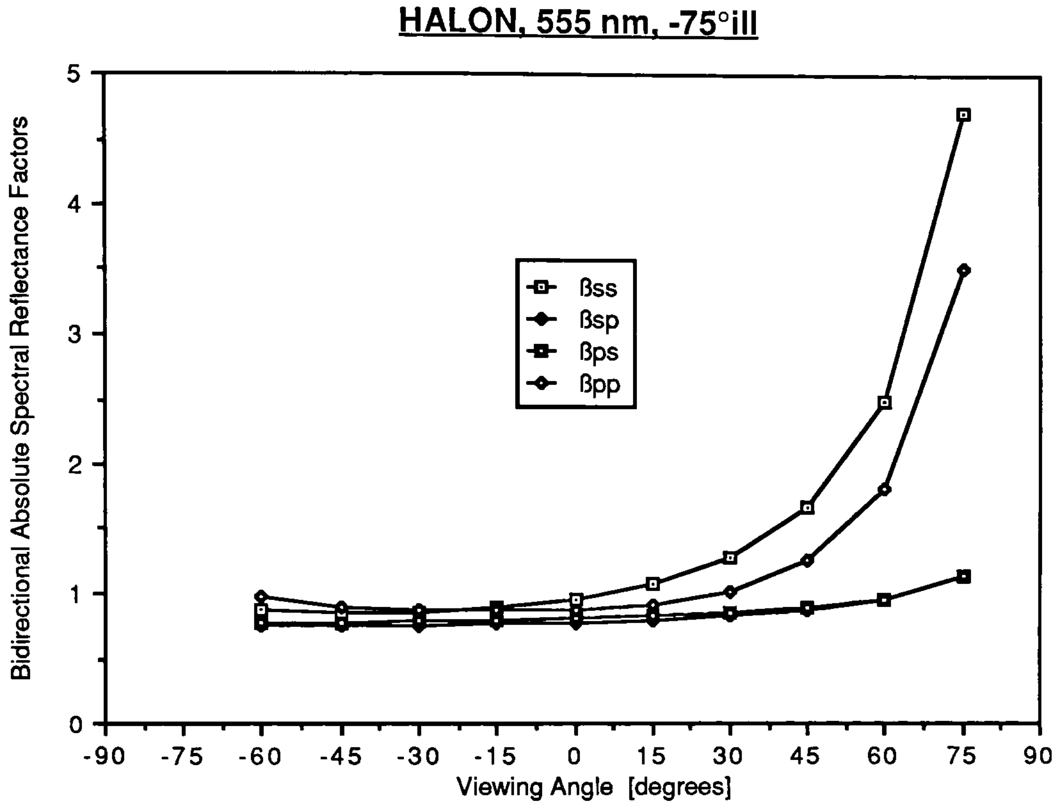


Figure 96 - Halon®, 555nm, -75°ill vs viewing angle.

D. Halon® vs $BaSO_4$

1) Which material is most lambertian?

To compare the two powders, the same conditions (angles, wavelength, and polarization) must be used. As discussed previously, $BaSO_4$ is most lambertian at -45° illumination and Halon® at -30° illumination. Figure 97 compares the two materials at -30° illumination (data normalized for 0° viewing). A polar version of this plot is in appendix 33.

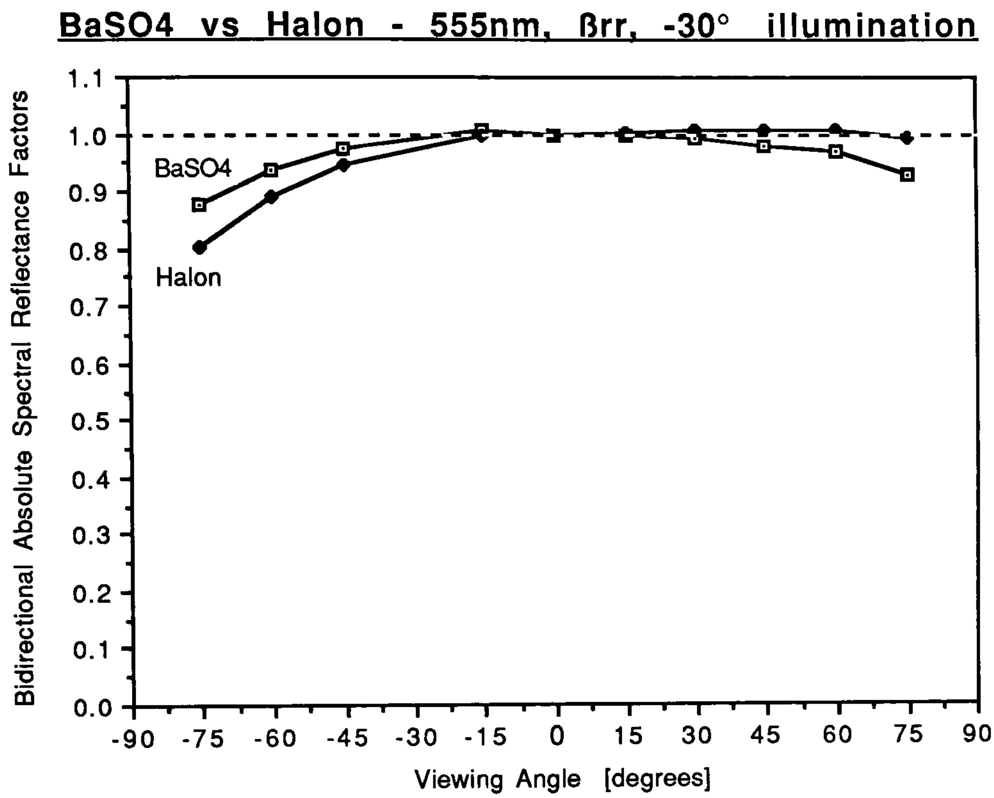


Figure 97 - $BaSO_4$ vs Halon®, β_{rr}, 555nm, -30°ill vs viewing angle.

In figure 97, $BaSO_4$ is more lambertian for angles between -75° and -15° but Halon is definitely better from -15° to +75°. For the -15° to 75° region, the coefficients of variation for $BaSO_4$ and Halon® are 2.74% and 0.60%, respectively.

Figure 98 below is the same plot as figure 97 but at -45° illumination. A polar version of this plot is in appendix 34. $BaSO_4$ is overall more lambertian in this case.

Calculating the coefficients of variation over the -15° to 75° range give 1.21% for $BaSO_4$ and 7.12% for Halon.

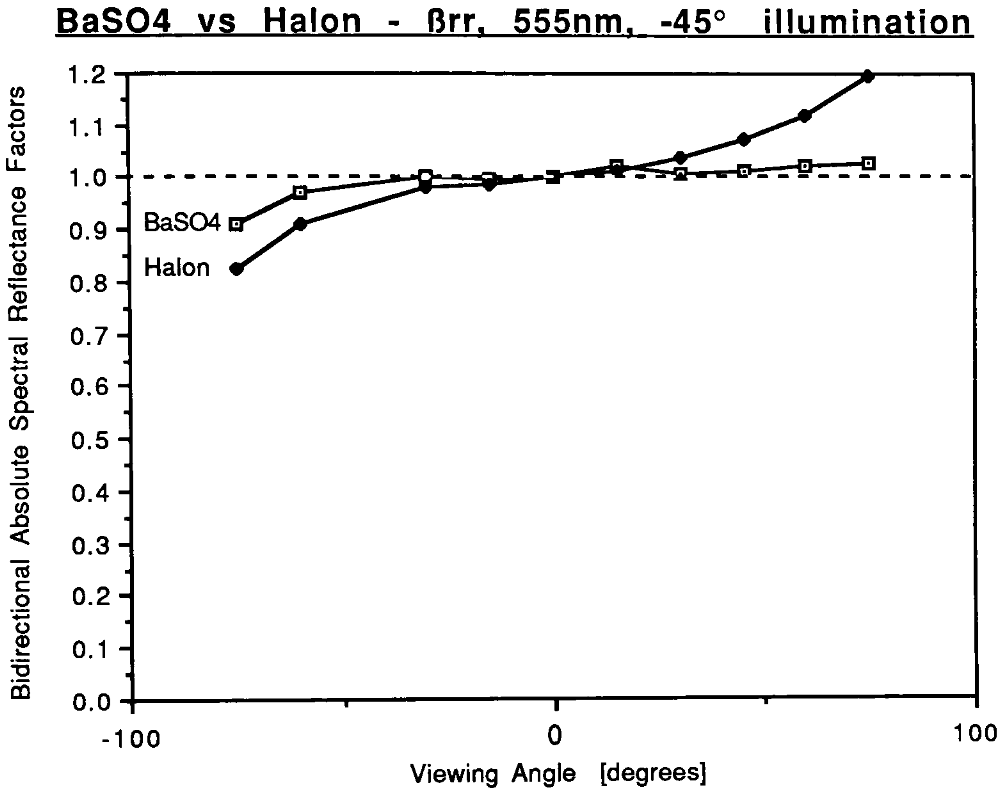


Figure 98 - $BaSO_4$ vs Halon®, β_{rr}, 555nm, -45°ill vs viewing angle.

At this point, it is easy to conclude that, from -15° to 75°, Halon is more lambertian at -30° incidence than $BaSO_4$ at -45° incidence. However, comparisons under different measurement conditions should be avoided since they are less meaningful. To properly evaluate how lambertian each material is, plots should be made at many different angle combinations and wavelengths. Here again, surface

preparation and density have a major effect on the results since part of the reflection is bounced directly off the surface, and part of it penetrates the sample first and emerges back out.

2) Which material is most spectrally neutral?

Figure 99 is a plot of the curves already seen in figures 76 and 89 for the 75° specular angle for $BaSO_4$ and Halon respectively (using a larger scale for emphasis).

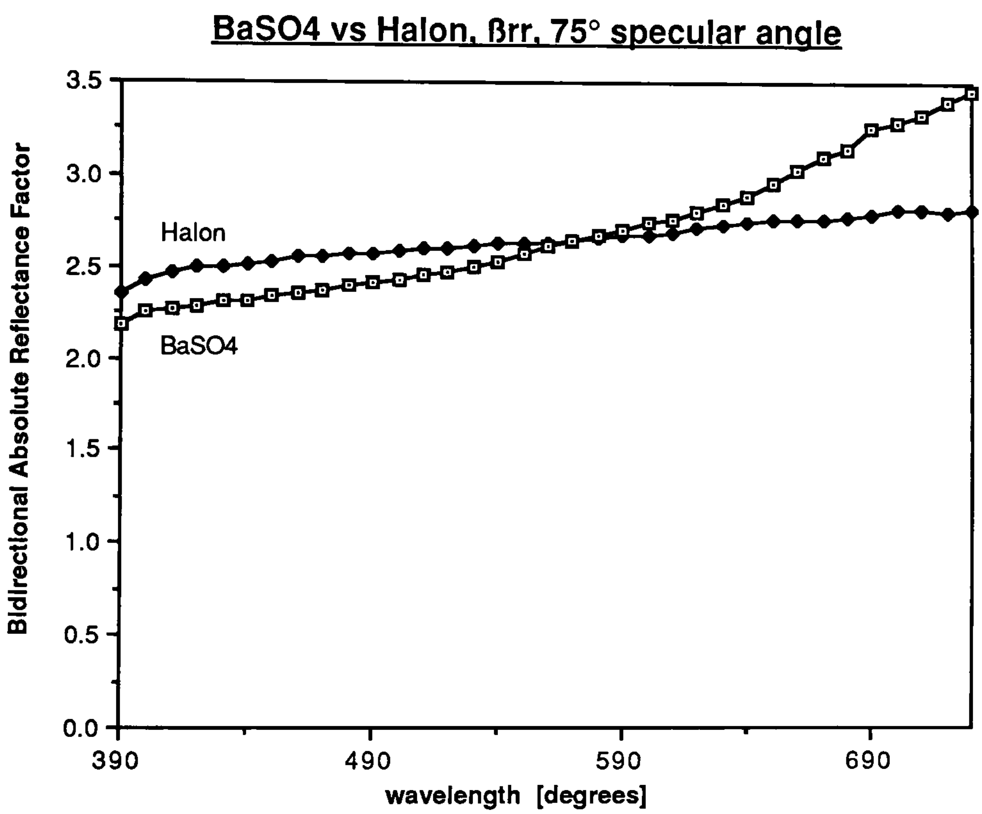


Figure 99 - $BaSO_4$ vs Halon, β_{rr}, 75° specular angle vs wavelength.

The main point illustrated by figure 99 is that Halon is substantially more neutral than $BaSO_4$ over the 390nm to 730nm range at that large angle. The shape of the $BaSO_4$ curve indicates that the reflection should be yellow-orange. This colored reflection was observed visually. Tables 15 and 16 show the descriptive statistics of the data points for $BaSO_4$ and Halon®, respectively.

Table 15 - $BaSO_4$, β_{rr}, 75° specular angle

Descriptive Statistics

Data File:	BaS04,spec,ßrr		
Variable:	-75/75	Observations:	35
Minimum:	2.18700	Maximum:	3.45400
Range:	1.26700	Median:	2.61000
Mean:	2.68449	Standard Error:	0.06259
Variance:		0.13709	
Standard Deviation:		0.37026	
Coefficient of Variation:		13.79256	

Table 16 - Halon, β_{rr}, 75° specular angle

Descriptive Statistics

Data File:	Halon,spec,ßrr		
Variable:	-75/75	Observations:	35
Minimum:	2.35800	Maximum:	2.80700
Range:	0.44900	Median:	2.62700
Mean:	2.63786	Standard Error:	0.01986
Variance:		0.01380	
Standard Deviation:		0.11749	
Coefficient of Variation:		4.45410	

The range covered by the $BaSO_4$ $ß_{rr}$ values is almost three times that of Halon® and its coefficient of variation is 13.79% vs. 4.45% for Halon®.

Referring to Fig. 77 for $BaSO_4$ and 90 for Halon®, the curves appear relatively flat for both materials. The $BaSO_4$ curves do show more variation than Halon® but still stay flat. Table 13 and 14 (seen previously) indicate that Halon is overall spectrally more neutral (at least for specular angles). Figure 100 below shows a similar comparison at 0°/45°.

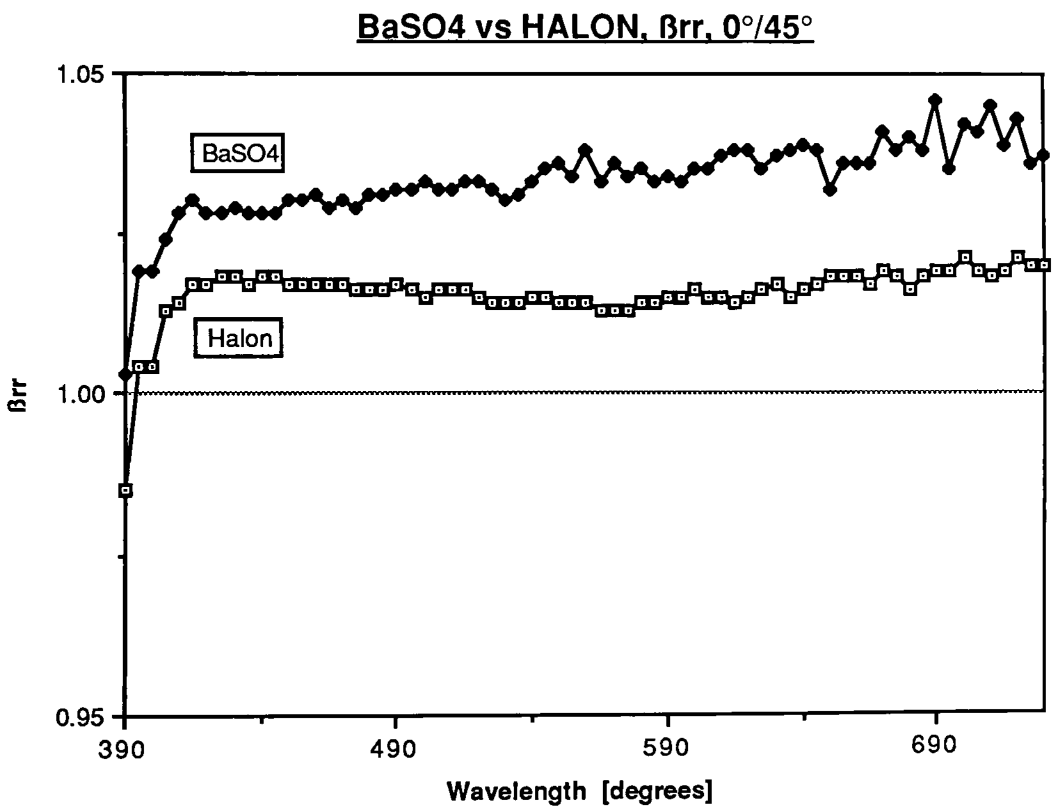


Figure 100 - $BaSO_4$ vs Halon®, $ß_{rr}$, 0°/45° vs wavelength.

Even here, Halon® is spectrally more neutral than $BaSO_4$. The coefficients of variation for 415nm $\leq \lambda \geq$ 730nm are 0.41% for $BaSO_4$ and 0.20% for Halon®.

3) <u>Which material most affects the different polarization components?</u>

Comparing $BaSO_4$ to Halon reveals some interesting differences. Figures 78 and 93 were intentionally plotted using the same scale to facilitate the discussion. Halon definitely affects the different ß's more than $BaSO_4$ at 0°/45°, possibly because of its polymer structure as opposed to the crystalline structure of $BaSO_4$.

Figures 79 and 94 compare the two materials at -75°/75°. At this angle combination, $BaSO_4$ loses its spectral neutrality for β_{ss} which implies β_{rr} will be slightly larger in the red end of the spectrum.

Figures 81 and 96 show the marked effect of large viewing angles on β_{ss} and β_{pp} for $BaSO_4$ and Halon, respectively Figure 101 includes these two reflectance factors for the two materials.

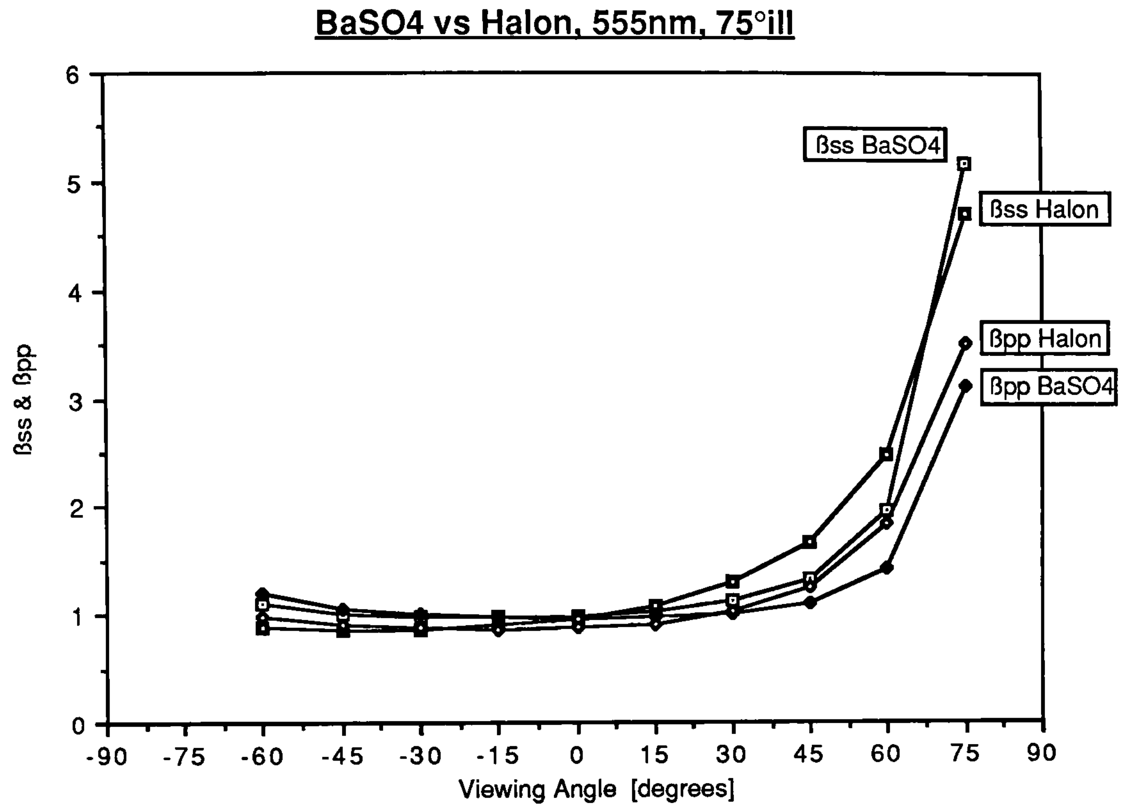


Figure 101 - $BaSO_4$ vs Halon®, $ß_{ss}$ & $ß_{pp}$, 555nm, -75° illumination vs viewing angle.

A rather surprising behavior is shown by the $ß_{ss}$ curve for $BaSO_4$ in figure 101. In all the other reflectance factor graphs seen previously, a smooth transition to the last point of $ß_{ss}$ $BaSO_4$ is expected. Also, the way the Halon®-$ß_{ss}$ and -$ß_{pp}$ behave (somewhat "parallel") indicates that $BaSO_4$ should probably be similar. Instead, the $ß_{pp}$-$BaSO_4$ curve is below the $ß_{pp}$-Halon® curve but the $ß_{ss}$-$BaSO_4$ one is higher thant the $ß_{ss}$-Halon® one. The only possibility is a bad reading at that polarization and angle combination

(assuming the curve is incorrect), which is not impossible considering only one reading was taken for $BaSO_4$. Remember that Halon® was the final choice for this study and $BaSO_4$ was mainly included to provide comparison data.

IV. CONCLUSION

The object of this research was to develop a photometric primary transfer standard for reflectance goniospectrophotometry. Implicit in this objective was identifying a repeatable procedure that could be followed in any primary or secondary laboratory. In other words, rather than calibrating an individual material, a standardized method of sample preparation would yield a reference material with known spectral character with respect to angle. Based on this objective, the research was successful. The following summarizes the findings of this research and additionally describes improvements in method, instrument design, and topics for future research.

1. CONCLUSIONS

A. Sample Preparation

Many factors are important when preparing pressed tablets of Halon:

1) The density must be controlled. In general, a lower density results in a more lambertian behavior for identical surface preparations. The importance of this factor was stressed in 1985 during an extensive laboratory intercomparison which had to be repeated because the large range of Halon sample densities resulted in unacceptable variability in the reflectance measurements.[99]
2) Sintering of the pressings can be used to obtain more sturdy samples. The effect on the reflectance is negligible. However, the operation is delicate since the

tablets surface tends to curl during the cooking operation (depending on oven design). Also, care must be taken to never exceed 425°C (797°F), at which point decomposition products may be given off which are harmful if inhaled.

3) Different preparations result in significantly different goniospectrophotometric reflectance curves. The best method found experimentally is to press Halon tablets against lapping film (Ultralap, for example) backed by a flat surface (like a piece of glass).

4) The samples must be thick enough to be opaque (8mm is required for Halon).

B) Measurement Technique

1) Polarization

As shown by the experimental results, polarization cannot be neglected. Instruments almost always introduce some polarization effects at either the illumination or the detection level and should not be assumed to be polarization-free unless integrating spheres or opal glasses are used correctly. Differences of the order of 10% were measured between the β_{ss}/β_{pp} and the β_{sp}/β_{ps} components for $BaSO_4$ and Halon® at 0°/45°. In the case of $BaSO_4$, the β_{ss} and β_{pp} curves were similar, and the β_{sp} and β_{ps} were also similar. For Halon®, β_{ss} was larger than β_{pp} and β_{sp} larger than β_{ps} by ≈3%. At 75° specular angle, β_{rr} was ≈150% higher that at lower specular angles (15°, 30°, 45°, and 60°) for both materials. The polarization components

causing this increase were β_{ss} and β_{pp} which were respectively 400% and 250% higher than β_{sp} and β_{ps}.

2) Angle Resolution

All plotted curves were smooth and well-behaved, thus means there is no need to use tiny angle increments when making goniospectrophotometric studies of white diffusing surfaces. Also, the expected peaks at specular angles were literally non-existent for $BaSO_4$ and Halon.

3) Wavelength Resolution

Here again, all curves were smooth. However, small-increment data allow accurate interpolations for different bandwidths (10nm or 20nm, for example).

4) Proper Calibration

It is always important to ensure proper wavelength calibration for the instrument and reflectance calibration for the samples. However, with white samples like $BaSO_4$ and Halon®, the error introduced by being slightly off is smaller because of their spectral neutrality over the measurement range.

C) Results

1) Variability in Halon® Measurements

The coefficients of variation of Halon® for l = 555nm varied from 0.26% to 5.90%, depending on angle combinations and reflectance factor components. At first, this ≈6% variability seems unacceptable but it is much more accurate than assuming lambertian behavior for Halon®. Therefore,

Halon® is repeatable enough to be used as primary transfer standard (especially at larger angles).

2) Lambertian Behavior

The illumination/detection conditions have a marked effect on how lambertian each material is. $BaSO_4$ is more lambertian than Halon® at -45° illumination whereas the opposite is true at -30°. However, the main conclusion is that neither material is lambertian for any large range of angles.

3) Spectral Non-selectivity

Halon® retains its neutrality much better than $BaSO_4$ over the whole range of angles (4.45% variation for Halon vs 13.79% for $BaSO_4$ at 75° specular). Even at 0°/45°, Halon® displays a flatter curve than $BaSO_4$ (0.20 % vs 0.41%).

2. RECOMMENDATIONS

A. Method

1) Improve the precision of the instrument so that 4 measurements are considered enough to well determine the mean (see next section about instrument).
2) If 1 cannot be achieved, make more measurements to reduce random error (either by taking more scans for each measurements or by measuring more samples).
3) Use control charts (using both x bar and the range R) in conjunction with standard reference materials to monitor the performance of the instrument. An example of an x bar graph is seen in figure 102 (based on reference 108).

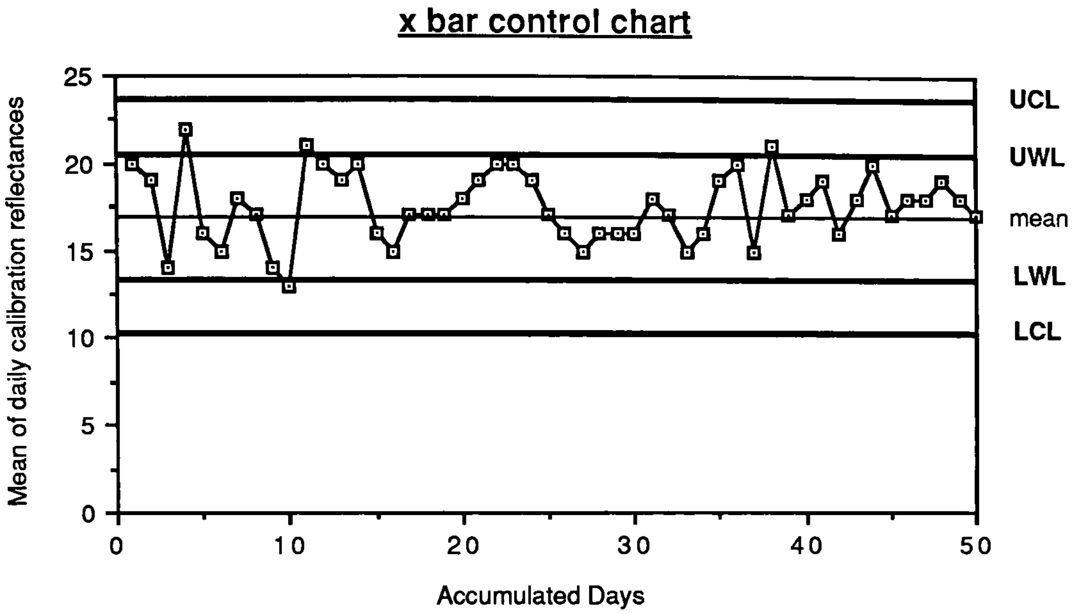


Figure 102 - Example of x-bar Control Chart.

UCL stands for "upper control limit", UWL is "upper warning limit", LCL is "lower control limit", and LWL is "lower warning limit". An example of an R control chart is in figure 103.

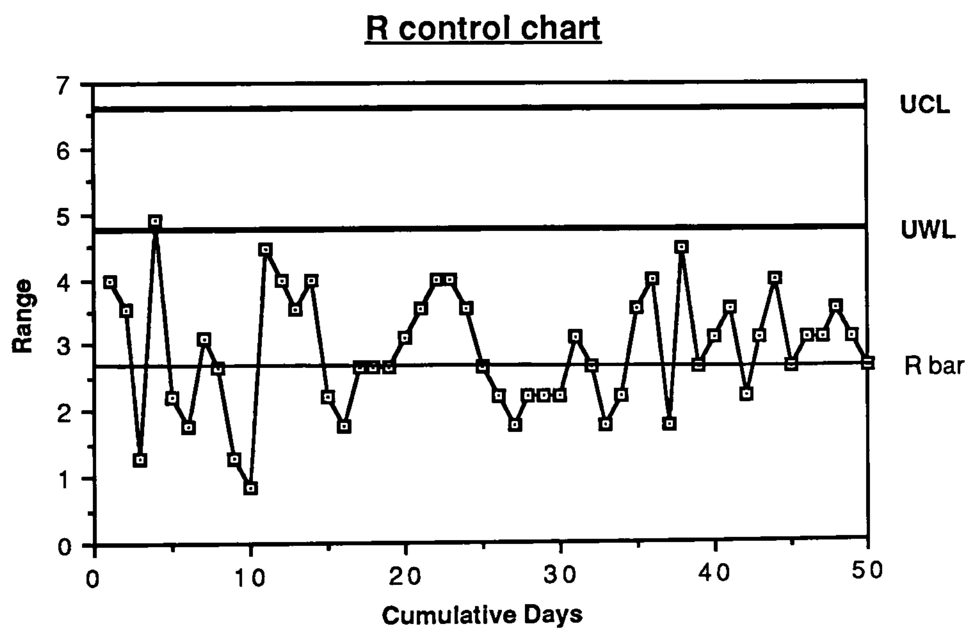


Figure 103 - Example of R Control Chart.

4) Use a temperature controlled room to ensure proper functioning of all components (especially the detector).

B. Instrumentation

Improvements for the goniospectrophotometer could include:

1) A more stable lamp (to prevent drifts) and variations) and use a log book for recording usage of this lamp (or even better, connect a recording timer to the lamp).
2) An optical table as the instrument platform.
3) Computer control of the polarizer angle.
4) A double monochromator (for less stray light) and PMT (for sensitivity), if not using the SpectraScan.
5) Incorporation of all required calibration components as part of the instrument:
   a) LASER and mirrors for alignment,
   b) mercury cadmium lamp for wavelength calibration,
   c) calibrated standard lamp for photometric calibration, and
   d) NBS-calibrated tile for absolute-measurement calibration.
6) A smaller viewing spot to allow measurements at larger viewing angles (assuming an illumination patch of the same width as previous is kept).
7) Modification of the detector arm to allow full scanning around the sample without having to flip the sample holder and rotating the sample when the detector reaches

the illumination beam. The present arrangement is in figure 104.

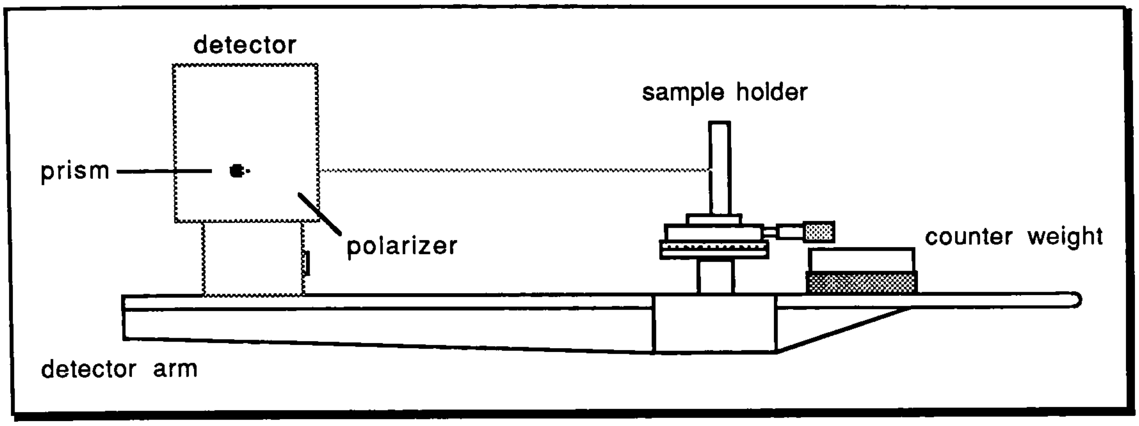


Figure 104 - Present Detector Arm Arrangement.

A suggestion for the new setup is in figure 105. Alignment is a concern with this new arrangement since there are now two prisms in the detecting beam path. The best approach is probably to align and permanently "lock" the two prisms to the post and then adjust other components to align the system (rotation of the prism post and positioning of the detector). It is important that the design of the detector supporting bracket enable the operator to look through the detector eyepiece for aligning the sample surface. Another advantage is that the detector is sitting on top of the arm and not at 90°, thus resulting in a twisting moment on the arm rotation bearings. Also, the counterweight is not needed since the center-of-gravity of the detector can be positioned such that its moment will balance the other side of the arm).

Because of the longer detecting path, a 1/4° aperture is suggested instead of the present 1/2° (remember that the Pritchard-aperture mirrors are interchangeable). Watch for sensitivity problems if using the SpectraScan.

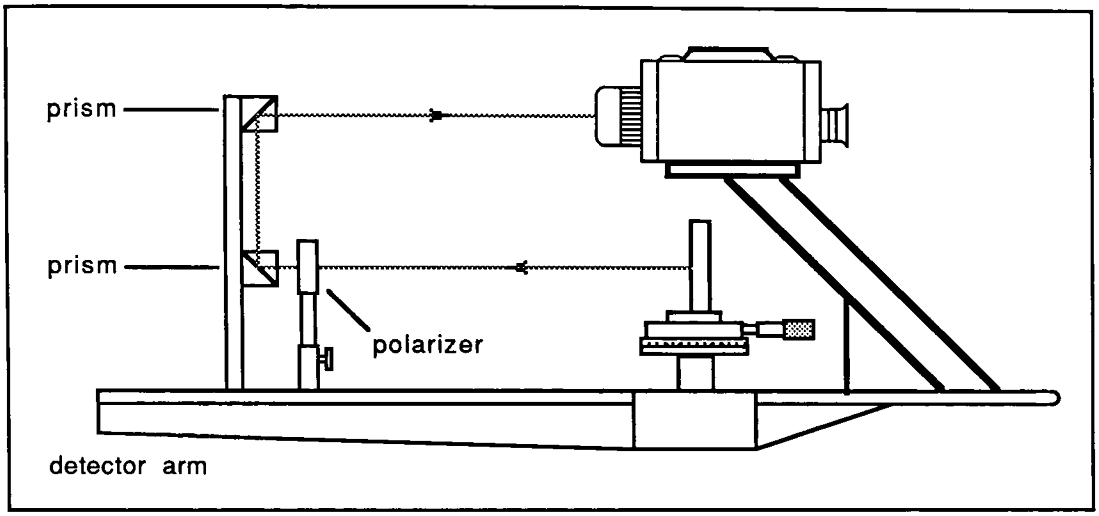


Figure 105 - Suggested Detector Arm Arrangement.

8) Use a smaller size polarizer to allow getting closer to the illumination beam without blocking it. The only requirement is that the polarizer be large enough not to be the limiting aperture in the detecting system beam (the Pritchard aperture has to be the field stop).

C. **Further Studies**

In the discussion section of this thesis, many parameters had to be fixed to limit the number of possibilities when plotting the results. An in-depth analysis should be done possibly under the following headings:

1) Lambertian behavior: plot the different reflectance factors at selected wavelengths vs. both the illumination

and viewing angles. The perfect tool for this kind of study is a 3D plot (slice, wire-frame, or surface). An example of a typical plot is given in appendix 35. Compare these more detailed results with authors who studied topics like "Reflection behavior of the perfect diffuser under real conditions",[111] "Unidirectional reflectance of imperfectly diffuse surfaces",[14] "Reflectance variables of compacted powders",[126] and "Light reflection from rough surfaces".[127]

2) Spectral neutrality: plot the different reflectance factors at many different illumination or viewing angles vs. wavelength (3D plots),

3) Polarization: compare the different reflectance factors at different angles and wavelengths. The depolarization of both $BaSO_4$ and Halon could also be calculated and plotted. A good review on depolarization effects is Clarke, et al.[27] The areas covered by different authors include: "Some polarization characteristics of magnesium oxide and other diffusers",[117] "Reflection and polarization properties of powder materials",[128] "The effect of optical polarization on reflection spectra",[129] and "Effect of Polarization on reflectance Factor Measurements".[130]

4) Off-specular maxima: this well-known phenomenon has been observed in the data and should be compared to studies on "Off-specular peaks in the directional

distribution of diffusely reflecting materials",[63] "Theory for off-specular reflections from roughened surfaces",[65] and "Polarization, Directional Distribution, and off-specular peak phenomena in light reflected rom roughened surfaces",[131]

5) Helmholtz reciprocity law: remember that the geometry of the illumination and detection system must be identical under exchange. Comparisons should be made at many angle combinations to see if the lack of reciprocity due to the imperfect instrument increases with larger angles, and

6) Reflectance models for the two materials: model the reflectance factor data using multi-parameter equations and maximize the fit. Such studies have been done on $BaSO_4$ paint by Harrison,[132] who built an eighteen-parameter model, and Young, et al.[123] who did one with three parameters which proved to be superior to Harrison's.

Other goniospectrophotometric studies (new measurements) could include extensive studies on the effect of density, environment temperature, humidity, thickness, sintering at different temperatures, fluorescence (if any), instrument geometry, surface roughness, contamination, etc., on the reflectance of $BaSO_4$ and Halon.

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VITA

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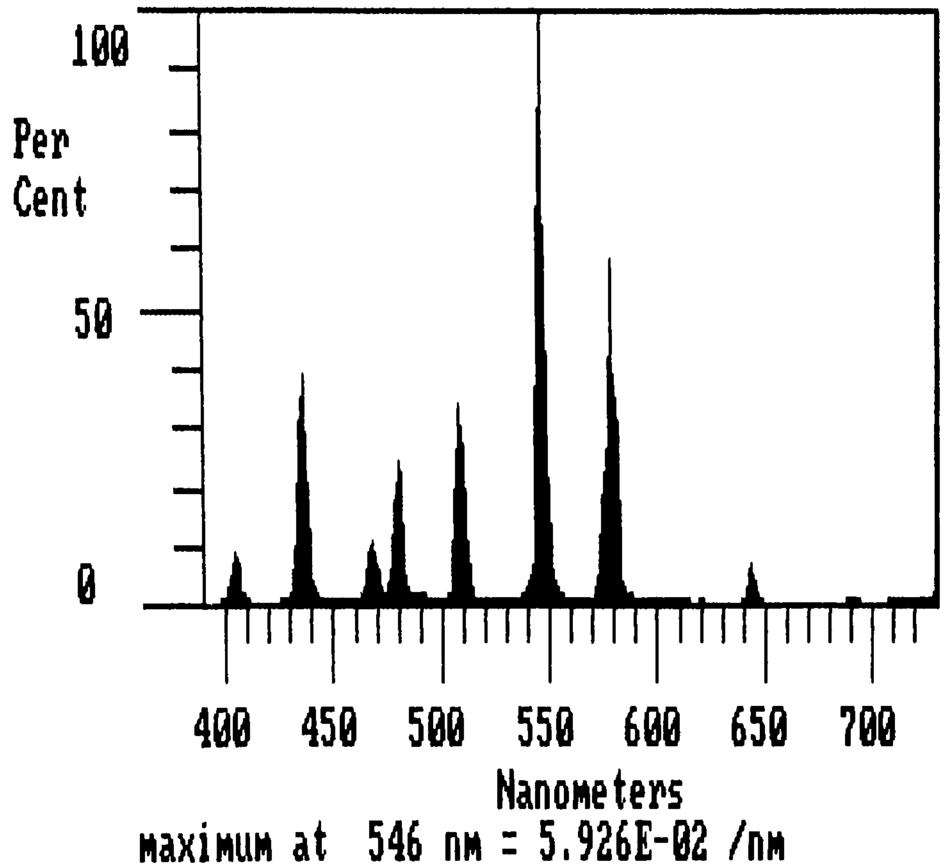
Appendix 1

Photo Research Array Detector Screen Output

Photo Research SpectraScan



LUMINANCE 1.259E+02 fL 4.315E+02 nits	s/n 1128 date 24 JUN 86 time 8:13
COLOR TEMP. not applic.	identif. _ _
COLOR COORDS. x = 0.2915 y = 0.4296	319 msec. Illuminant A
u' = 0.1540 v' = 0.5106 v = 0.3404	Dominant Wav. 497.22 nm Purity:36.15 %
RADIANCE 1.101E+00 w/ster * m2	scan number : 1

f1	f2	f3	f4	f5	f6	f7	f8	f9	f10
measure	FUNCT.	freerun	live	rawdata	setup	ratio	dual	swap	HELP

Appendix 3

XENON LAMP WARM UP CHECK DATA

Cumulative Time [min.]	PMT Output [V]
0	2.130
5	2.150
10	2.180
15	2.205
20	2.230
25	2.250
30	2.270
35	2.290
40	2.300
45	2.310
50	2.310
55	2.310
60	2.310
65	2.310
70	2.310
75	2.310
80	2.310
85	2.310
90	2.310
95	2.310

Appendix 4

XENON STABILITY CHECK DATA

Cumulative Time [min.]	Array Detector
60	2.830
70	2.820
80	2.810
90	2.800
100	2.780
110	2.770
120	2.760
130	2.755
140	2.745
150	2.745
160	2.735
170	2.725
180	2.720
190	2.710
200	2.695
210	2.685
220	2.680
230	2.670
240	2.660
250	2.655
260	2.645
270	2.635

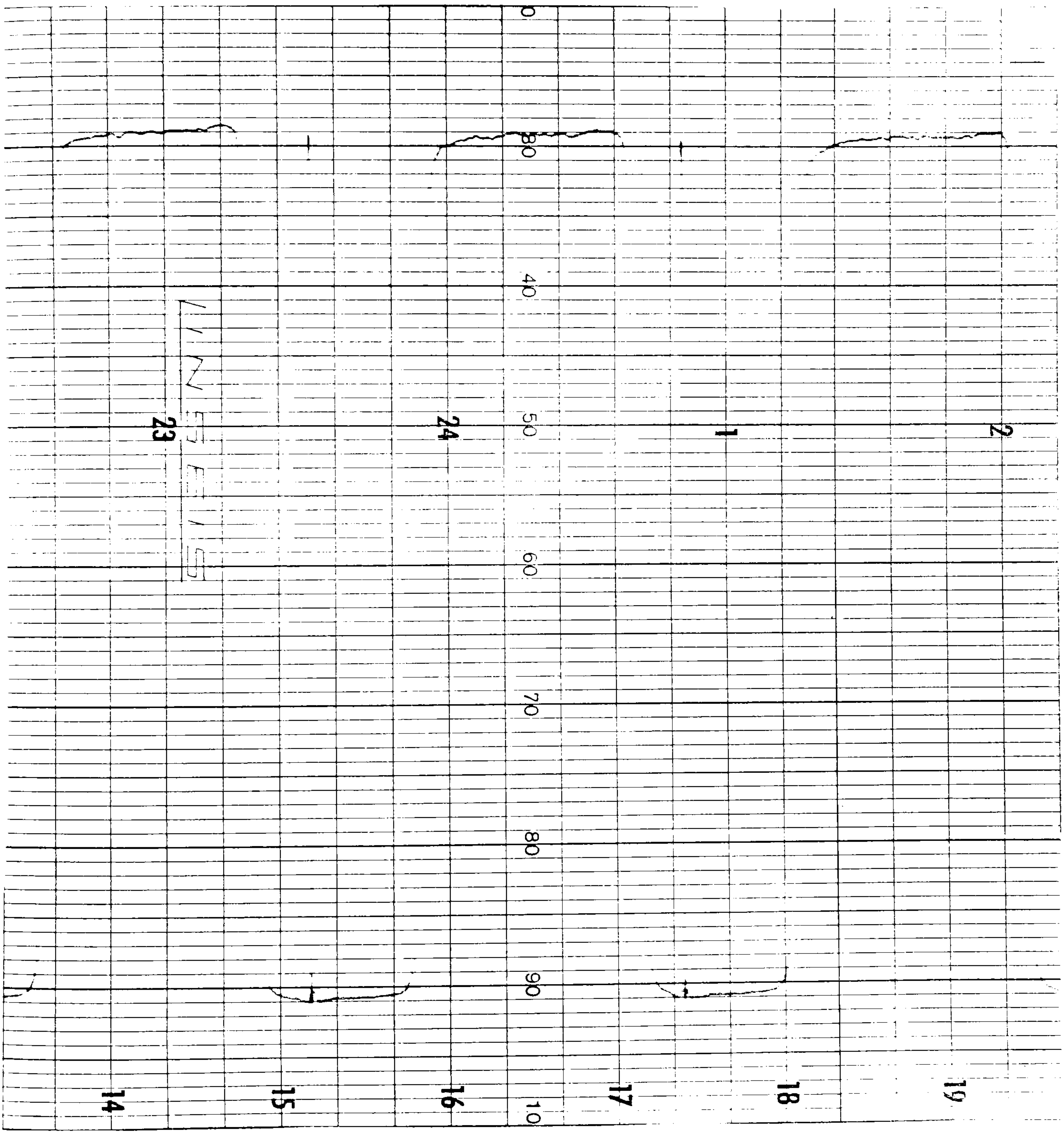
Appendix 5

PMT Polarization Check Data

Polarization Angle [deg.]	PMT Output [V]
0	1.70
10	1.70
20	1.72
30	1.73
40	1.75
50	1.77
60	1.79
70	1.80
80	1.81
90	1.81
100	1.80
110	1.79
120	1.77
130	1.75
140	1.73
150	1.72
160	1.71
170	1.70
180	1.70
190	1.71
200	1.72
210	1.74
220	1.76
230	1.77
240	1.79
250	1.80
260	1.80
270	1.81
280	1.80
290	1.79
300	1.77
310	1.76
320	1.74
330	1.72
340	1.71
350	1.70
360	1.70

Appendix 6

Patch Uniformity Chart Recorder Output Example



Appendix 7

Illumination Patch Uniformity Data

Distance [mm]	Polar.-1/90°	Polar.-1/0°	Flat- 1/90°	Flat- 1/0°
0	.05	.05	13.71	12.13
1	.07	.07	13.76	12.13
2	.11	.11	13.75	12.13
3	.21	.21	13.77	12.16
4	1.04	1.04	13.77	12.14
5	12.31	12.31	13.75	12.13
6	13.51	13.51	13.75	12.13
7	13.66	13.66	13.74	12.13
8	13.71	13.71	13.73	12.13
9	13.76	13.76	13.73	12.14
10	13.75	13.75	13.71	12.15
11	13.77	13.77	13.72	12.15
12	13.77	13.77	13.74	12.17
13	13.75	13.75	13.74	12.17
14	13.75	13.75	13.74	12.16
15	13.74	13.74	13.75	12.14
16	13.73	13.73	13.75	12.14
17	13.73	13.73	13.76	12.12
18	13.71	13.71		
19	13.72	13.72		
20	13.74	13.74		
21	13.74	13.74		
22	13.74	13.74		
23	13.75	13.75		
24	13.75	13.75		
25	13.76	13.76		
26	13.67	13.67		
27	12.77	12.77		
28	2.43	2.43		
29	.28	.28		
30	.15	.15		
31	.07	.07		
32	.05	.05		

Appendix 8

Array Detector Warm up check Data

Time [min]	PMT	Array	PMT Norm.	Array Norm
0	2.13	81.70	0.922	0.892
1	2.14	82.94	0.926	0.905
2	2.145	83.22	0.929	0.908
3	2.15	83.32	0.931	0.909
4	2.15	83.52	0.931	0.912
5	2.15	83.60	0.931	0.912
6	2.16	83.81	0.935	0.915
7	2.16	84.01	0.935	0.917
8	2.17	84.22	0.939	0.919
9	2.17	84.39	0.939	0.921
10	2.18	84.65	0.944	0.924
11	2.185	84.90	0.946	0.927
12	2.19	85.17	0.948	0.930
13	2.20	85.43	0.952	0.932
14	2.20	85.57	0.952	0.934
15	2.205	85.80	0.955	0.936
16	2.21	86.11	0.957	0.940
17	2.22	86.29	0.961	0.942
18	2.225	86.47	0.963	0.944
19	2.225	86.71	0.963	0.946
20	2.23	86.91	0.965	0.949
21	2.24	87.15	0.970	0.951
22	2.24	87.39	0.970	0.954
23	2.25	87.59	0.974	0.956
24	2.25	87.83	0.974	0.959
25	2.26	87.92	0.978	0.960
26	2.26	88.07	0.978	0.961
27	2.26	88.23	0.978	0.963
28	2.27	88.37	0.983	0.965
29	2.27	88.56	0.983	0.967
30	2.27	88.66	0.983	0.968
31	2.28	88.90	0.987	0.970
32	2.28	89.00	0.987	0.971
33	2.285	89.09	0.989	0.972
34	2.285	89.19	0.989	0.973
35	2.29	89.33	0.991	0.975
36	2.29	89.44	0.991	0.976
37	2.29	89.50	0.991	0.977
38	2.29	89.59	0.991	0.978
39	2.29	89.69	0.991	0.979
40	2.30	89.74	0.996	0.979
41	2.30	89.84	0.996	0.981
42	2.30	89.93	0.996	0.982
43	2.30	90.00	0.996	0.982
44	2.30	90.12	0.996	0.984
45	2.31	90.18	1.000	0.984
46	2.305	90.20	0.998	0.985
47	2.31	90.30	1.000	0.986
48	2.31	90.37	1.000	0.986
49	2.31	90.42	1.000	0.987
50	2.31	90.47	1.000	0.987
51	2.31	90.56	1.000	0.988
52	2.31	90.61	1.000	0.989
53	2.31	90.60	1.000	0.989
54	2.31	90.64	1.000	0.989
55	2.31	90.68	1.000	0.990
56	2.31	90.70	1.000	0.990
57	2.31	90.77	1.000	0.991

Appendix 8 (cont'd)

58	2.31	90.82	1.000	0.991
59	2.31	90.81	1.000	0.991
60	2.31	90.87	1.000	0.992
61	2.31	90.87	1.000	0.992
62	2.31	90.94	1.000	0.993
63	2.31	90.94	1.000	0.993
64	2.31	90.96	1.000	0.993
65	2.31	91.05	1.000	0.994
66	2.31	91.03	1.000	0.994
67	2.31	91.08	1.000	0.994
68	2.31	91.08	1.000	0.994
69	2.31	91.13	1.000	0.995
70	2.31	91.11	1.000	0.994
71	2.31	91.14	1.000	0.995
72	2.31	91.21	1.000	0.996
73	2.31	91.20	1.000	0.995
74	2.31	91.22	1.000	0.996
75	2.31	91.22	1.000	0.996
76	2.31	91.23	1.000	0.996
77	2.31	91.25	1.000	0.996
78	2.31	91.24	1.000	0.996
79	2.31	91.34	1.000	0.997
80	2.31	91.28	1.000	0.996
81	2.31	91.28	1.000	0.996
82	2.31	91.30	1.000	0.997
83	2.31	91.38	1.000	0.997
84	2.31	91.36	1.000	0.997
85	2.31	91.44	1.000	0.998
86	2.31	91.51	1.000	0.999
87	2.31	91.42	1.000	0.998
88	2.31	91.45	1.000	0.998
89	2.31	91.42	1.000	0.998
90	2.31	91.47	1.000	0.998
91	2.31	91.46	1.000	0.998
92	2.31	91.48	1.000	0.998
93	2.31	91.44	1.000	0.998
94	2.31	91.48	1.000	0.998
95	2.31	91.47	1.000	0.998
96	2.305	91.47	0.998	0.998
97	2.31	91.52	1.000	0.999
98	2.31	91.51	1.000	0.999
99	2.31	91.50	1.000	0.999
100	2.31	91.57	1.000	0.999
101	2.31	91.58	1.000	1.000
102	2.305	91.58	0.998	1.000
103	2.31	91.57	1.000	0.999
104	2.31	91.58	1.000	1.000
105	2.305	91.53	0.998	0.999
106	2.305	91.61	0.998	1.000
107	2.305	91.62	0.998	1.000
108	2.305	91.60	0.998	1.000

Appendix 9

Spectral Intensities of Line Source Every 2nm

wave length		SPECTRAL INTENSITIES				
390	--	2.557E-04	2.266E-04	6.094E-05	2.074E-04	3.538E-04
400	--	8.407E-04	3.079E-03	5.135E-03	4.080E-03	1.364E-03
410	--	6.848E-04	4.053E-04	2.694E-04	2.777E-04	2.617E-04
420	--	2.903E-04	3.373E-04	4.088E-04	4.712E-04	5.530E-04
430	--	9.281E-04	5.777E-03	1.824E-02	2.278E-02	1.218E-02
440	--	3.308E-03	1.875E-03	7.784E-04	6.348E-04	6.321E-04
450	--	5.522E-04	5.547E-04	5.720E-04	5.903E-04	6.000E-04
460	--	5.912E-04	5.994E-04	2.025E-03	5.426E-03	6.513E-03
470	--	4.109E-03	2.906E-03	1.261E-03	3.746E-03	1.059E-02
480	--	1.425E-02	1.307E-02	2.861E-03	1.165E-03	9.839E-04
490	--	1.089E-03	1.106E-03	9.330E-04	8.116E-04	7.782E-04
500	--	8.179E-04	1.101E-03	1.335E-03	1.134E-02	2.028E-02
510	--	1.603E-02	6.711E-03	1.720E-03	9.353E-04	7.309E-04
520	--	6.935E-04	5.322E-04	5.754E-04	5.456E-04	5.532E-04
530	--	5.716E-04	6.098E-04	7.367E-04	9.477E-04	1.425E-03
540	--	2.584E-03	3.934E-03	3.976E-02	5.910E-02	3.780E-02
550	--	1.255E-02	3.497E-03	1.590E-03	1.086E-03	8.616E-04
560	--	7.652E-04	6.662E-04	6.385E-04	6.091E-04	7.645E-04
570	--	8.563E-04	2.811E-03	1.103E-02	1.549E-02	3.435E-02
580	--	2.306E-02	1.855E-02	2.662E-03	1.208E-03	1.040E-03
590	--	6.822E-04	6.362E-04	6.304E-04	5.204E-04	4.974E-04
600	--	4.836E-04	5.334E-04	4.717E-04	4.821E-04	4.829E-04
610	--	4.384E-04	4.516E-04	4.387E-04	4.110E-04	4.120E-04
620	--	4.145E-04	4.098E-04	3.956E-04	3.652E-04	3.654E-04
630	--	3.620E-04	3.141E-04	3.103E-04	3.427E-04	4.213E-04
640	--	4.754E-04	3.165E-03	4.137E-03	2.277E-03	6.735E-04
650	--	3.948E-04	3.447E-04	2.942E-04	2.644E-04	2.766E-04
660	--	3.526E-04	2.758E-04	3.056E-04	2.564E-04	2.855E-04
670	--	3.092E-04	3.415E-04	3.366E-04	2.890E-04	1.640E-04
680	--	1.923E-04	2.867E-04	3.078E-04	3.192E-04	3.689E-04
690	--	6.002E-04	5.902E-04	4.524E-04	1.909E-04	1.918E-04
700	--	1.493E-04	3.678E-04	3.529E-04	4.474E-04	5.825E-04
710	--	5.072E-04	5.402E-04	4.591E-04	6.046E-04	4.928E-04
720	--	5.185E-04	5.745E-04	7.540E-04	8.199E-04	9.955E-04

Appendix 10

Array Detector Linearity Check

N.D. Filter	Detector Output [X 10^3]
0.1	11.00
0.2	8.41
0.3	6.50
0.2 + 0.1	6.48
0.4	5.21
0.3 + 0.1	5.08
0.5	4.31
0.4 + 0.1	4.02
0.3 + 0.2	4.03
0.6	3.41
0.5 + 0.1	3.26
0.4 + 0.2	3.04
0.8	2.48
0.6 + 0.2	2.51
0.5 + 0.3	2.50

Appendix 11

Goniospectrophotometer A and B polarization constants

Wavelength	A constant	B constant	Wavelength	A constant	B constant
390	1.004	1.304	565	0.976	1.053
395	1.006	1.271	570	0.976	1.051
400	1.000	1.248	575	0.974	1.048
405	0.997	1.223	580	0.975	1.046
410	0.996	1.204	585	0.975	1.044
415	0.993	1.193	590	0.974	1.042
420	0.991	1.182	595	0.974	1.039
425	0.987	1.172	600	0.974	1.038
430	0.987	1.164	605	0.973	1.037
435	0.986	1.155	610	0.973	1.036
440	0.983	1.152	615	0.973	1.034
445	0.983	1.145	620	0.973	1.031
450	0.982	1.140	625	0.972	1.030
455	0.982	1.132	630	0.972	1.028
460	0.981	1.123	635	0.973	1.029
465	0.982	1.106	640	0.973	1.026
470	0.980	1.116	645	0.973	1.025
475	0.980	1.109	650	0.973	1.028
480	0.980	1.105	655	0.974	1.029
485	0.980	1.102	660	0.973	1.029
490	0.980	1.100	665	0.973	1.029
495	0.979	1.096	670	0.975	1.030
500	0.980	1.091	675	0.973	1.030
505	0.979	1.087	680	0.976	1.029
510	0.979	1.085	685	0.977	1.031
515	0.979	1.082	690	0.974	1.033
520	0.979	1.077	695	0.973	1.033
525	0.978	1.073	700	0.978	1.030
530	0.979	1.072	705	0.976	1.031
535	0.978	1.069	710	0.979	1.035
540	0.978	1.067	715	0.979	1.043
545	0.978	1.063	720	0.966	1.044
550	0.978	1.060	725	0.980	1.036
555	0.977	1.057	730	0.976	1.038
560	0.975	1.055			

Appendix 12

REPEATABILITY CHECK - HALON sample / no replacement.

BIDIRECTIONAL ABSOLUTE SPECTRAL REFLECTANCE FACTORS [-45 deg/0 deg]

WAV.	Bss		Bsp		Bps		Bpp		Brr	
[nm]	mean	coeff. var.	mean	coeff. var.	mean	coeff. var.	mean	coeff. var.	mean	coeff. var.
390	1.049	0.93	0.922	1.42	0.950	0.53	1.021	0.98	0.986	0.57
395	1.061	0.36	0.933	0.51	0.964	0.34	1.033	0.29	0.998	0.33
400	1.066	0.26	0.932	0.50	0.965	0.56	1.038	0.54	1.000	0.26
405	1.072	0.16	0.940	0.11	0.971	0.22	1.043	0.20	1.007	0.15
410	1.074	0.20	0.941	0.25	0.971	0.23	1.044	0.42	1.008	0.18
415	1.074	0.10	0.942	0.14	0.972	0.24	1.046	0.19	1.009	0.14
420	1.075	0.19	0.942	0.26	0.970	0.21	1.047	0.26	1.008	0.20
425	1.072	0.13	0.942	0.13	0.972	0.23	1.048	0.14	1.008	0.10
430	1.077	0.17	0.945	0.30	0.972	0.20	1.047	0.33	1.010	0.20
435	1.077	0.16	0.943	0.21	0.972	0.16	1.049	0.18	1.010	0.14
440	1.073	0.23	0.939	0.30	0.968	0.13	1.045	0.11	1.007	0.13
445	1.076	0.16	0.942	0.19	0.972	0.19	1.046	0.19	1.009	0.16
450	1.074	0.18	0.941	0.20	0.970	0.21	1.046	0.25	1.008	0.18
455	1.073	0.13	0.941	0.18	0.968	0.15	1.046	0.22	1.007	0.13
460	1.077	0.12	0.939	0.18	0.969	0.18	1.047	0.13	1.008	0.13
465	1.083	0.11	0.936	0.15	0.976	0.17	1.040	0.19	1.009	0.14
470	1.076	0.17	0.941	0.13	0.970	0.19	1.048	0.16	1.009	0.15
475	1.075	0.17	0.939	0.18	0.971	0.13	1.046	0.16	1.008	0.13
480	1.077	0.18	0.939	0.23	0.969	0.17	1.045	0.10	1.008	0.15
485	1.077	0.18	0.939	0.17	0.969	0.16	1.046	0.17	1.008	0.15
490	1.083	0.18	0.941	0.14	0.972	0.16	1.051	0.17	1.012	0.14
495	1.079	0.16	0.941	0.17	0.970	0.15	1.049	0.16	1.010	0.15
500	1.079	0.13	0.940	0.12	0.968	0.20	1.047	0.12	1.009	0.11
505	1.078	0.15	0.940	0.08	0.971	0.23	1.049	0.17	1.010	0.14
510	1.078	0.20	0.941	0.16	0.971	0.18	1.053	0.12	1.011	0.13
515	1.079	0.15	0.940	0.16	0.970	0.17	1.049	0.17	1.009	0.14
520	1.078	0.17	0.938	0.14	0.970	0.23	1.049	0.10	1.009	0.14
525	1.082	0.14	0.941	0.10	0.968	0.14	1.051	0.11	1.011	0.10
530	1.079	0.22	0.937	0.22	0.968	0.08	1.050	0.15	1.009	0.15
535	1.082	0.11	0.940	0.13	0.969	0.19	1.051	0.15	1.010	0.13
540	1.081	0.19	0.940	0.14	0.971	0.18	1.053	0.12	1.011	0.12
545	1.083	0.17	0.939	0.18	0.971	0.16	1.052	0.12	1.011	0.14
550	1.080	0.15	0.940	0.20	0.969	0.13	1.050	0.11	1.010	0.13
555	1.079	0.13	0.942	0.13	0.969	0.23	1.049	0.20	1.010	0.14
560	1.081	0.19	0.942	0.32	0.969	0.14	1.052	0.16	1.011	0.16
565	1.082	0.25	0.936	0.14	0.966	0.19	1.049	0.10	1.008	0.14
570	1.080	0.20	0.941	0.08	0.969	0.10	1.051	0.13	1.010	0.09
575	1.082	0.15	0.939	0.14	0.969	0.17	1.055	0.16	1.011	0.12
580	1.088	0.22	0.939	0.23	0.970	0.14	1.056	0.16	1.013	0.14
585	1.086	0.15	0.942	0.29	0.971	0.24	1.055	0.21	1.014	0.16
590	1.086	0.21	0.939	0.22	0.969	0.24	1.057	0.14	1.013	0.16
595	1.089	0.23	0.940	0.07	0.971	0.19	1.056	0.12	1.014	0.11
600	1.093	0.11	0.940	0.14	0.971	0.17	1.057	0.28	1.015	0.12
605	1.086	0.20	0.943	0.21	0.972	0.27	1.057	0.24	1.014	0.17
610	1.086	0.27	0.938	0.12	0.969	0.17	1.054	0.24	1.012	0.15
615	1.084	0.13	0.940	0.25	0.969	0.18	1.052	0.13	1.011	0.16
620	1.085	0.09	0.940	0.21	0.973	0.19	1.055	0.19	1.013	0.11
625	1.086	0.22	0.941	0.11	0.971	0.13	1.056	0.15	1.013	0.12
630	1.091	0.26	0.939	0.20	0.970	0.29	1.058	0.11	1.015	0.12
635	1.084	0.14	0.940	0.22	0.968	0.10	1.052	0.18	1.011	0.10
640	1.084	0.21	0.935	0.22	0.969	0.28	1.058	0.21	1.012	0.15
645	1.094	0.21	0.941	0.32	0.970	0.20	1.055	0.13	1.015	0.17
650	1.090	0.21	0.940	0.25	0.969	0.25	1.059	0.28	1.015	0.22
655	1.088	0.27	0.934	0.33	0.970	0.43	1.058	0.29	1.013	0.19
660	1.089	0.23	0.936	0.20	0.965	0.24	1.053	0.43	1.011	0.12
665	1.085	0.30	0.936	0.16	0.967	0.24	1.055	0.13	1.011	0.14
670	1.088	0.23	0.936	0.38	0.973	0.09	1.060	0.40	1.014	0.07
675	1.084	0.27	0.935	0.43	0.965	0.29	1.059	0.25	1.011	0.19
680	1.090	0.29	0.936	0.39	0.962	0.33	1.055	0.26	1.011	0.18
685	1.086	0.20	0.939	0.25	0.971	0.21	1.056	0.19	1.013	0.08
690	1.097	0.20	0.939	0.21	0.971	0.61	1.054	0.38	1.015	0.18
695	1.084	0.29	0.933	0.15	0.962	0.20	1.053	0.13	1.008	0.07
700	1.086	0.23	0.934	0.72	0.971	0.50	1.058	0.63	1.012	0.36
705	1.094	0.30	0.937	0.54	0.972	0.19	1.062	0.41	1.016	0.18
710	1.094	0.25	0.936	0.56	0.974	0.17	1.058	0.53	1.015	0.23
715	1.097	0.20	0.940	0.46	0.966	0.56	1.058	0.51	1.015	0.09
720	1.094	0.86	0.936	1.42	0.973	0.53	1.057	0.73	1.015	0.51
725	1.089	0.31	0.936	0.49	0.965	0.72	1.052	0.48	1.011	0.19
730	1.099	0.50	0.936	0.98	0.970	0.79	1.064	0.39	1.017	0.25

Appendix 13

Pale Grey Tile Calibration Data

Wavelength	R
380	0.54687
390	0.56863
400	0.58522
410	0.59450
420	0.60124
430	0.60718
440	0.61154
450	0.61518
460	0.61762
470	0.61891
480	0.61938
490	0.62006
500	0.62064
510	0.62102
520	0.62130
530	0.62145
540	0.62098
550	0.62002
560	0.61830
570	0.61612
580	0.61497
590	0.61506
600	0.61609
610	0.61714
620	0.61784
630	0.61820
640	0.61779
650	0.61725
660	0.61717
670	0.61763
680	0.61904
690	0.62018
700	0.62099
710	0.62095
720	0.62057
730	0.61996
740	0.61898
750	0.61816
760	0.61753
770	0.61617

Appendix 14

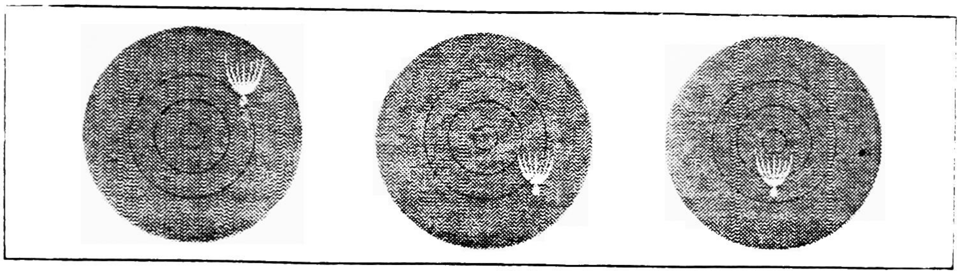
Accuracy Check Results

WAVELENGTH	NBS TILE DATA	MCSL TILE DATA	Difference	% Difference
390	0.569	0.560	-0.00826	-1.45
395	0.578	0.572	-0.00518	-0.90
400	0.585	0.580	-0.00499	-0.85
405	0.590	0.586	-0.00467	-0.79
410	0.594	0.594	-0.00052	-0.09
415	0.598	0.596	-0.00162	-0.27
420	0.601	0.600	-0.00122	-0.20
425	0.604	0.603	-0.00096	-0.16
430	0.607	0.606	-0.00079	-0.13
435	0.610	0.608	-0.00154	-0.25
440	0.612	0.611	-0.00030	-0.05
445	0.613	0.614	0.00074	0.12
450	0.615	0.615	-0.00022	-0.04
455	0.617	0.618	0.00189	0.31
460	0.618	0.617	-0.00094	-0.15
465	0.618	0.618	-0.00037	-0.06
470	0.619	0.619	0.00003	0.01
475	0.619	0.619	0.00002	0.00
480	0.619	0.619	-0.00057	-0.09
485	0.620	0.620	0.00032	0.05
490	0.620	0.620	-0.00014	-0.02
495	0.620	0.621	0.00055	0.09
500	0.621	0.621	0.00008	0.01
505	0.621	0.622	0.00133	0.21
510	0.621	0.623	0.00168	0.27
515	0.621	0.621	-0.00002	-0.00
520	0.621	0.619	-0.00191	-0.31
525	0.621	0.620	-0.00150	-0.24
530	0.621	0.620	-0.00154	-0.25
535	0.621	0.620	-0.00130	-0.21
540	0.621	0.620	-0.00107	-0.17
545	0.621	0.619	-0.00202	-0.33
550	0.620	0.618	-0.00238	-0.38
555	0.619	0.619	-0.00039	-0.06
560	0.618	0.616	-0.00247	-0.40
565	0.617	0.615	-0.00235	-0.38
570	0.616	0.613	-0.00344	-0.56
575	0.615	0.613	-0.00208	-0.34
580	0.615	0.613	-0.00237	-0.38
585	0.615	0.613	-0.00186	-0.30
590	0.615	0.614	-0.00101	-0.16
595	0.616	0.615	-0.00079	-0.13
600	0.616	0.615	-0.00143	-0.23
605	0.617	0.614	-0.00243	-0.39
610	0.617	0.615	-0.00219	-0.35
615	0.618	0.616	-0.00199	-0.32
620	0.618	0.615	-0.00332	-0.54
625	0.618	0.616	-0.00243	-0.39
630	0.618	0.617	-0.00113	-0.18
635	0.618	0.615	-0.00257	-0.42
640	0.618	0.613	-0.00441	-0.71
645	0.617	0.618	0.00011	0.02
650	0.617	0.614	-0.00290	-0.47
655	0.617	0.616	-0.00073	-0.12
660	0.617	0.618	0.00045	0.07
665	0.617	0.616	-0.00166	-0.27
670	0.618	0.617	-0.00050	-0.08
675	0.618	0.615	-0.00311	-0.50
680	0.619	0.618	-0.00134	-0.22
685	0.620	0.617	-0.00237	-0.38
690	0.620	0.622	0.00192	0.31
695	0.621	0.618	-0.00257	-0.41
700	0.621	0.621	0.00029	0.05
705	0.621	0.615	-0.00632	-1.02
710	0.621	0.620	-0.00080	-0.13
715	0.621	0.620	-0.00042	-0.07
720	0.621	0.615	-0.00568	-0.92
725	0.620	0.624	0.00346	0.56
730	0.620	0.626	0.00607	0.98

Appendix 15

Centering of Xenon Lamp in Housing

Image of the discharge arc

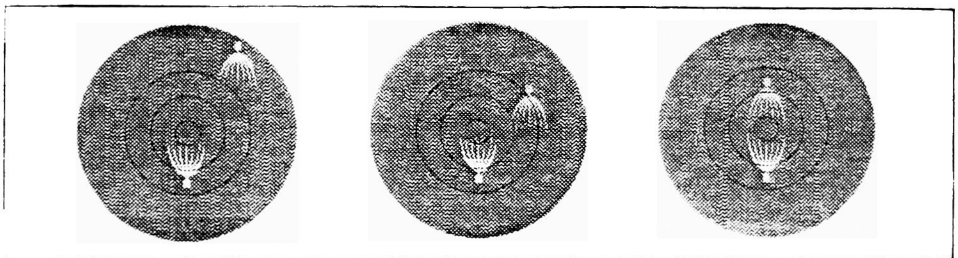


Adjust the lamp condenser with knurled knob (27.2) until the cathode focal spot is sharply focused on the centring disc

Rotate the knob (27.7) for the vertical adjustment until the focal spot is situated below the middle circle of the centring disc

Rotate knob (27.6) for the horizontal adjustment until the focal spot occupies the centre as illustrated

Image and mirror image of the discharge arc



Unclamp (27.5) the concave mirror adjustment. Pull out the centring lever (27.4) and move it in all directions until the mirror image of the discharge arc appears on the inner circle of the centring disc. Rotate the centring lever (27.4) in the circular arrow direction until the mirror image of the discharge arc is sharply focused on the centring disc. Remove the centring disc from the dust glass of the microscope.

Appendix 16

NBS 45°/0° Calibration Data for White Porcelain Tile

10 nm POINTS
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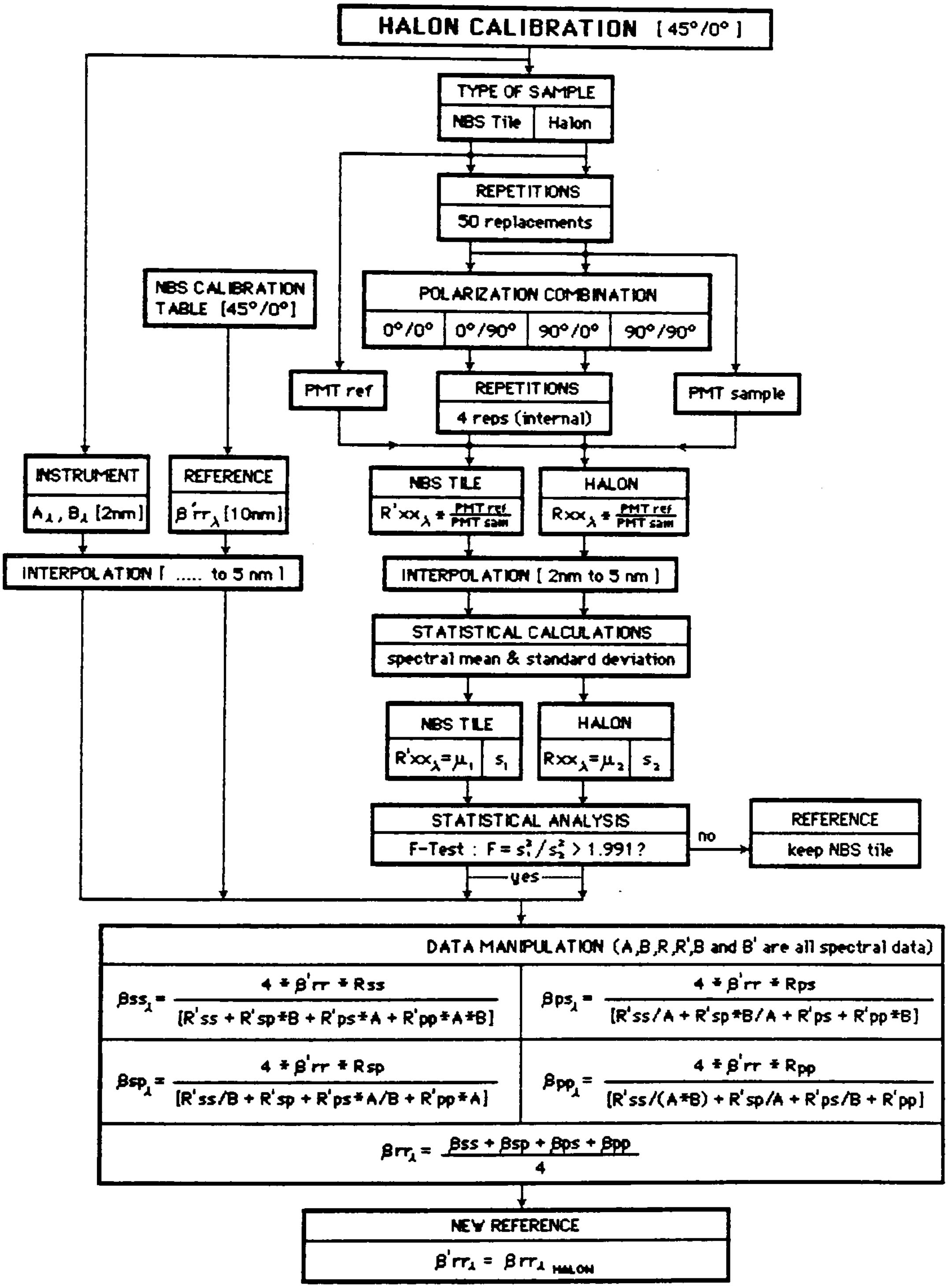
WAVELENGTH	REFLECTANCE FACTOR
380	.60506
390	.75392
400	.83738
410	.86802
420	.87428
430	.87539
440	.87591
450	.87653
460	.87672
470	.87704
480	.87702
490	.87698
500	.87608
510	.87514
520	.87361
530	.87161
540	.8698
550	.8676
560	.86525
570	.86262
580	.86035
590	.85763
600	.85506
610	.85239
620	.84978
630	.847
640	.84427
650	.84179
660	.83896
670	.83643
680	.83362
690	.83181
700	.82921
710	.82631
720	.82385
730	.82125
740	.81963
750	.81763

Appendix 16 (cont'd)

5 nm POINTS
****

WAVELENGTH	REFLECTANCE FACTOR
390	.75392
395	.8030388
400	.83738
405	.857525
410	.86802
415	.8729956
420	.87428
425	.8751937
430	.87539
435	.8756806
440	.87591
445	.8762406
450	.87653
455	.8766438
460	.87672
465	.8768932
470	.87704
475	.8770525
480	.87702
485	.877055
490	.87698
495	.8765862
500	.87608
505	.8756494
510	.87514
515	.8744412
520	.87361
525	.8726276
530	.87161
535	.8707175
540	.8698
545	.8687338
550	.8676
555	.8664519
560	.86525
565	.86393
570	.86262
575	.8614906
580	.86035
585	.8590088
590	.85763
595	.8563418
600	.85506
605	.8537274
610	.85239
615	.8510919
620	.84978
625	.8483975
630	.847
635	.8456162
640	.84427
645	.8430362
650	.84179
655	.8403782
660	.83896
665	.8376938
670	.83643
675	.83498
680	.83362
685	.8327019
690	.83181
695	.8305781
700	.82921
705	.8277513
710	.82631
715	.8250612
720	.82385
725	.8224975
730	.82125

Appendix 17



HALON CALIBRATION [45°/0°]
TYPE OF SAMPLE
NBS Tile
Halon
REPETITIONS
50 replacements
NBS CALIBRATION TABLE [45°/0°]
POLARIZATION COMBINATION
0°/0°
0°/90°
90°/0°
90°/90°
PMT ref
REPETITIONS
4 reps (internal)
PMT sample
INSTRUMENT
Aλ, Bλ [2nm]
REFERENCE
β'rrλ [10nm]
NBS TILE
R'xxλ = PMT ref / PMT sam
HALON
Rxxλ = PMT ref / PMT sam
INTERPOLATION [..... to 5 nm]
INTERPOLATION [2nm to 5 nm]
STATISTICAL CALCULATIONS
spectral mean & standard deviation
NBS TILE
R'xxλ = μ1
s1
HALON
Rxxλ = μ2
s2
STATISTICAL ANALYSIS
F-Test : F = s1²/s2² > 1.991 ?
no
REFERENCE
keep NBS tile
yes
DATA MANIPULATION (A,B,R,R',B and B' are all spectral data)
βssλ = 4 * β'rr * Rss / [R'ss + R'sp*B + R'ps*A + R'pp*A*B]
βpsλ = 4 * β'rr * Rps / [R'ss/A + R'sp*B/A + R'ps + R'pp*B]
βspλ = 4 * β'rr * Rsp / [R'ss/B + R'sp + R'ps*A/B + R'pp*A]
βppλ = 4 * β'rr * Rpp / [R'ss/(A*B) + R'sp/A + R'ps/B + R'pp]
βrrλ = βss + βsp + βps + βpp / 4
NEW REFERENCE
β'rrλ = βrrλ HALON

Appendix 18

Porcelain vs Halon Calibration Check Results

Halon Averages

λ[nm]	ss	sp	ps	pp
390	1.7970804272E-03	1.1918995650E-03	1.6057330333E-03	1.2998172241E-03
395	2.5136376845E-03	1.7182001111E-03	2.2566028853E-03	1.8740127181E-03
400	2.7627593791E-03	1.9201004808E-03	2.4895457207E-03	2.1065601341E-03
405	3.0996649574E-03	2.1964784930E-03	2.8023412581E-03	2.4185231589E-03
410	3.3011609536E-03	2.3732192636E-03	2.9922976713E-03	2.6226933073E-03
415	3.3860407740E-03	2.4619340089E-03	3.0755700246E-03	2.7287538507E-03
420	3.5619997209E-03	2.6149020424E-03	3.2435609356E-03	2.9055330150E-03
425	3.6972327626E-03	2.7359438430E-03	3.3699898355E-03	3.0466437324E-03
430	3.7323120781E-03	2.7838060806E-03	3.4069400550E-03	3.1087270412E-03
435	3.9611703781E-03	2.9745100320E-03	3.6180814880E-03	3.3257282084E-03
440	4.0855303481E-03	3.0796990132E-03	3.7365521790E-03	3.4491780348E-03
445	4.2396633572E-03	3.2075685818E-03	3.8793084209E-03	3.5968312992E-03
450	4.9623393636E-03	3.7758230272E-03	4.5416340353E-03	4.2387810348E-03
455	5.1567381678E-03	3.9578976936E-03	4.7248545803E-03	4.4442419808E-03
460	5.9692644903E-03	4.6010586584E-03	5.4688860940E-03	5.1740591410E-03
465	7.0097351934E-03	5.4294715236E-03	6.4224977351E-03	6.1088017157E-03
470	6.6755126670E-03	5.1848551574E-03	6.1175034692E-03	5.8412217302E-03
475	5.6699154392E-03	4.4250014901E-03	5.1982817063E-03	4.9872027765E-03
480	6.0996975822E-03	4.7779325274E-03	5.5917990150E-03	5.3865279166E-03
485	5.5601711881E-03	4.3646037544E-03	5.0962513880E-03	4.9271845917E-03
490	5.8337205282E-03	4.5954734267E-03	5.3458086939E-03	5.1877391817E-03
495	5.3124765981E-03	4.1912479356E-03	4.8647953970E-03	4.7358948786E-03
500	5.1283864156E-03	4.0602011338E-03	4.6930367020E-03	4.5889148792E-03
505	5.0283482950E-03	3.9921329140E-03	4.5999719770E-03	4.5155795544E-03
510	4.9073259957E-03	3.9035255756E-03	4.4872612901E-03	4.4146520947E-03
515	4.7487160859E-03	3.7889686872E-03	4.3397115248E-03	4.2833666896E-03
520	4.6982771457E-03	3.7598501422E-03	4.2936664043E-03	4.2553350826E-03
525	4.6173974852E-03	3.7080370307E-03	4.2202894083E-03	4.1962347981E-03
530	4.4473809590E-03	3.5780847669E-03	4.0627313142E-03	4.0497095148E-03
535	4.3154178189E-03	3.4711719449E-03	3.9401036400E-03	3.9317441063E-03
540	4.1543478102E-03	3.3472481012E-03	3.7933549759E-03	3.7932277839E-03
545	4.0425527206E-03	3.2660121772E-03	3.6922893155E-03	3.7005483058E-03
550	3.9787407929E-03	3.2212100787E-03	3.6355763721E-03	3.6540891073E-03
555	3.8760714074E-03	3.1409642344E-03	3.5401060570E-03	3.5650341353E-03
560	3.7265989611E-03	3.0185165984E-03	3.4016730280E-03	3.4320682884E-03
565	3.6132241487E-03	2.9317484605E-03	3.2996292023E-03	3.3349272134E-03
570	3.5412608676E-03	2.8785906142E-03	3.2338551936E-03	3.2771428916E-03
575	3.4660350060E-03	2.8217195310E-03	3.1650342981E-03	3.2128898841E-03
580	3.4514536471E-03	2.8164654951E-03	3.1497443088E-03	3.2064500859E-03
585	3.4444259239E-03	2.8141498869E-03	3.1434123716E-03	3.2068765181E-03
590	3.3860617345E-03	2.7705746672E-03	3.0889585872E-03	3.1570610435E-03
595	3.2233863367E-03	2.6415871102E-03	2.9418483889E-03	3.0132927944E-03
600	3.0697471763E-03	2.5187902325E-03	2.8017367429E-03	2.8738974235E-03
605	3.0092472992E-03	2.4675119220E-03	2.7440655760E-03	2.8178099946E-03
610	3.0313368264E-03	2.4908091425E-03	2.7653246013E-03	2.8436502128E-03
615	3.1280284442E-03	2.5743735285E-03	2.8523787961E-03	2.9417635222E-03
620	3.1653523564E-03	2.6146849348E-03	2.8853673009E-03	2.9840541594E-03
625	3.0255382247E-03	2.5002465834E-03	2.7615071835E-03	2.8582279457E-03
630	2.9719963944E-03	2.4567382821E-03	2.7119217405E-03	2.8107019656E-03
635	2.8259452373E-03	2.3412109057E-03	2.5766266170E-03	2.6760409893E-03
640	2.7215246556E-03	2.2556324893E-03	2.4770623149E-03	2.5802867566E-03
645	2.8323038023E-03	2.3506740502E-03	2.5781773323E-03	2.6871107305E-03
650	2.7698527661E-03	2.2929948775E-03	2.5249129561E-03	2.6269422111E-03
655	2.6830770035E-03	2.2178640792E-03	2.4411741802E-03	2.5406997733E-03
660	2.6941786136E-03	2.2278787594E-03	2.4520483066E-03	2.5527114637E-03
665	2.7624997490E-03	2.2833251416E-03	2.5123810638E-03	2.6142342932E-03
670	2.7680392026E-03	2.2876185340E-03	2.5175571066E-03	2.6218426008E-03
675	2.7618953590E-03	2.2744702399E-03	2.5063068046E-03	2.6121046830E-03
680	2.9230861772E-03	2.4168925568E-03	2.6516485637E-03	2.7647106679E-03
685	3.1624142607E-03	2.6105142150E-03	2.8661097761E-03	2.9909489427E-03
690	3.0257536024E-03	2.4923093577E-03	2.7486226849E-03	2.8540201003E-03
695	2.5824684772E-03	2.1334565884E-03	2.3409826178E-03	2.4429762304E-03
700	2.4259772411E-03	2.0083326548E-03	2.1970106286E-03	2.3015466072E-03
705	2.4133697147E-03	2.0046065643E-03	2.1892742807E-03	2.2939810374E-03
710	2.9362936957E-03	2.4173075623E-03	2.6509809977E-03	2.7668753074E-03
715	2.7917641344E-03	2.2877518592E-03	2.5289540784E-03	2.6188099839E-03
720	2.4186566134E-03	1.9811289772E-03	2.1898091533E-03	2.2746775683E-03
725	2.4905890040E-03	2.0491519490E-03	2.2470562734E-03	2.3470221669E-03
730	2.8032137548E-03	2.3009375336E-03	2.5291420309E-03	2.6425202147E-03

Appendix 18 (cont'd)

Halon Standard Deviations

λ[nm]	SS	SD	DS	DD
390	1.8232357718E-05	1.2278094752E-05	1.6242169447E-05	1.9631425503E-05
395	1.7754751141E-05	1.2686675934E-05	1.7574263504E-05	2.7127442323E-05
400	1.9525610899E-05	1.5957262675E-05	1.7184975818E-05	2.7974805676E-05
405	1.9857744582E-05	1.4947144867E-05	1.6977960605E-05	3.4297919509E-05
410	2.0417474971E-05	1.3740233420E-05	1.9475264257E-05	3.7850558044E-05
415	2.2771217966E-05	1.5755208959E-05	2.0387735321E-05	4.0301352416E-05
420	2.3975533556E-05	1.6107203100E-05	2.1381716201E-05	4.4993162973E-05
425	2.5212783791E-05	1.8154643360E-05	2.3352656995E-05	4.8801391913E-05
430	2.5186070938E-05	1.8525923255E-05	2.1629229872E-05	4.8840887916E-05
435	2.5835181838E-05	1.9569085570E-05	2.2873976515E-05	5.3033987649E-05
440	2.8704008548E-05	2.0354942334E-05	2.5555066849E-05	5.6163567685E-05
445	2.9478453020E-05	2.1661248509E-05	2.5202657143E-05	5.8658427519E-05
450	3.5767911686E-05	2.4547676450E-05	2.9694216362E-05	6.9188298624E-05
455	3.4841392630E-05	2.5723552827E-05	3.2124111173E-05	7.2974353089E-05
460	4.3026507463E-05	2.9289547257E-05	3.7501405481E-05	8.6240342192E-05
465	4.8730664017E-05	3.6706937895E-05	4.3779819223E-05	1.0321341516E-04
470	4.5864612058E-05	3.3002544989E-05	4.1541551580E-05	9.9328925442E-05
475	3.6942614433E-05	2.7368261592E-05	3.4643258614E-05	8.4771968751E-05
480	4.1121479824E-05	3.1471774254E-05	3.7482417811E-05	9.1871639821E-05
485	3.6843454351E-05	2.8261816629E-05	3.3881404652E-05	8.4683405418E-05
490	3.9169686078E-05	3.0532548954E-05	3.7124128521E-05	8.7570575980E-05
495	3.7040522530E-05	2.6418053117E-05	3.1851198031E-05	8.0747933166E-05
500	3.5192435147E-05	2.7230934851E-05	3.1210246454E-05	7.8449902164E-05
505	3.6036816993E-05	2.6074409353E-05	3.0383579756E-05	7.9198417751E-05
510	3.2849701983E-05	2.5269878682E-05	3.0522875750E-05	7.6065219830E-05
515	3.1863028283E-05	2.5769220792E-05	2.7743705923E-05	7.4258567934E-05
520	3.1873967015E-05	2.3966704967E-05	2.7408959674E-05	7.4731208604E-05
525	3.1907154967E-05	2.4204354345E-05	2.7049788231E-05	7.3296162241E-05
530	2.9353682388E-05	2.3970477109E-05	2.6785983411E-05	7.1135831562E-05
535	3.0898815032E-05	2.2204760856E-05	2.7014898700E-05	6.8488636902E-05
540	3.0052301985E-05	2.2410736195E-05	2.5604886361E-05	6.7337707021E-05
545	2.8088366110E-05	2.2866606099E-05	2.6582766057E-05	6.5328567998E-05
550	2.9455279360E-05	2.2255176002E-05	2.7541948879E-05	6.4953315913E-05
555	2.7378127802E-05	2.2431398711E-05	2.5171719527E-05	6.4006952266E-05
560	2.6149821593E-05	2.1277262850E-05	2.4703484281E-05	6.1913956722E-05
565	2.5280455572E-05	2.1512763780E-05	2.3578430698E-05	6.0755877973E-05
570	2.3077328902E-05	2.0116563332E-05	2.2887205922E-05	6.0078194459E-05
575	2.5249999494E-05	2.0078164125E-05	2.2045537438E-05	5.8689339308E-05
580	2.6971489534E-05	2.0373265711E-05	2.2945817788E-05	5.9000788294E-05
585	2.5964836874E-05	1.9329079691E-05	2.2616729489E-05	5.8968271547E-05
590	2.6485422180E-05	1.9468370329E-05	2.3772433171E-05	5.7607983412E-05
595	2.3572223703E-05	1.9801434393E-05	2.0876498940E-05	5.6335799219E-05
600	2.1456739298E-05	1.9708765397E-05	1.9681803285E-05	5.4035312127E-05
605	2.1734817659E-05	1.3417828592E-05	1.9334820759E-05	5.2952103236E-05
610	2.2208606186E-05	1.8839605205E-05	1.9061104985E-05	5.2565518890E-05
615	2.3923817872E-05	1.9628057462E-05	2.1236515814E-05	5.5137050556E-05
620	2.5257171024E-05	1.9447248635E-05	2.0683793264E-05	5.7288714630E-05
625	2.3179985700E-05	1.8186007319E-05	2.0133085463E-05	5.5020150265E-05
630	2.1459101789E-05	1.6782235133E-05	1.9908243849E-05	5.4973527034E-05
635	2.1980015069E-05	1.7684625620E-05	1.8957930493E-05	5.0873052004E-05
640	2.2766199174E-05	1.6861772737E-05	1.8604830679E-05	4.8468522100E-05
645	2.1838464296E-05	1.8310446575E-05	2.1057372235E-05	5.2553114893E-05
650	2.0158444830E-05	1.8981140960E-05	2.2183002735E-05	5.0811955222E-05
655	1.9944266104E-05	1.7444955397E-05	1.8173339517E-05	4.8330481327E-05
660	1.8821160382E-05	1.7846184934E-05	1.8493616843E-05	4.9606907747E-05
665	2.1893259052E-05	1.7043995026E-05	2.0304503772E-05	5.0197582120E-05
670	2.2636137997E-05	1.7317968726E-05	1.9776321373E-05	5.1716355333E-05
675	2.1222029174E-05	1.7123045047E-05	1.9015909024E-05	5.0919960489E-05
680	2.4203032540E-05	1.9477545559E-05	2.2075057260E-05	5.4023983499E-05
685	2.5761668326E-05	2.1861959131E-05	2.2896322706E-05	6.2157677692E-05
690	2.4655271558E-05	1.9418889935E-05	2.4711697939E-05	5.3609605642E-05
695	2.1473817206E-05	1.8512225358E-05	1.9150077331E-05	4.7316037429E-05
700	1.9949935761E-05	1.6328524348E-05	1.7848400638E-05	4.7128621193E-05
705	2.0219907712E-05	1.8540688420E-05	1.8421289066E-05	4.8662337984E-05
710	2.6895207564E-05	2.2803602645E-05	2.2749530726E-05	5.8061034989E-05
715	2.5674897796E-05	2.1669922276E-05	1.9477686547E-05	4.8191672414E-05
720	2.1323643804E-05	1.9140657176E-05	2.4879057338E-05	4.9417293678E-05
725	2.1688355938E-05	2.3516991520E-05	1.9289265121E-05	4.7464569345E-05
730	3.2505662501E-05	2.3590668636E-05	2.9149730845E-05	5.8296545014E-05

Appendix 18 (cont'd)

NBS Averages

λ[nm]	ss	sp	ps	pp
390	1.3025653673E-03	9.0755275359E-04	1.3174344892E-03	1.0705031802E-03
395	1.9225304134E-03	1.3986346866E-03	1.9667331897E-03	1.6335343921E-03
400	2.1845012794E-03	1.6179957935E-03	2.2419574091E-03	1.8953395007E-03
405	2.4970709318E-03	1.8806793955E-03	2.5701189097E-03	2.2144679557E-03
410	2.6812768167E-03	2.0539457917E-03	2.7673275170E-03	2.4195210130E-03
415	2.7540821659E-03	2.1334088725E-03	2.8509901547E-03	2.5256296568E-03
420	2.9063572042E-03	2.2705245393E-03	3.0074625253E-03	2.6891538360E-03
425	3.0167113757E-03	2.3752956748E-03	3.1272768671E-03	2.8215583801E-03
430	3.0448763787E-03	2.4141878156E-03	3.1640249058E-03	2.8795422226E-03
435	3.2358725307E-03	2.5797397572E-03	3.3605029203E-03	3.0808594962E-03
440	3.3420424476E-03	2.6737256105E-03	3.4697402297E-03	3.1999536145E-03
445	3.4691738916E-03	2.7807356934E-03	3.6038668735E-03	3.3367700736E-03
450	4.0638856754E-03	3.2744629985E-03	4.2191807155E-03	3.9293252589E-03
455	4.2278027455E-03	3.4353521844E-03	4.3933041896E-03	4.1252730301E-03
460	4.8953051712E-03	3.9955422946E-03	5.0795405568E-03	4.7921979695E-03
465	5.7442741056E-03	4.7058402254E-03	5.9590541807E-03	5.6538279290E-03
470	5.4753925695E-03	4.4996766058E-03	5.6806493803E-03	5.4196581134E-03
475	4.6499868867E-03	3.8349106811E-03	4.8259248360E-03	4.6285839929E-03
480	5.0076949567E-03	4.1372429606E-03	5.1872865324E-03	5.0021171888E-03
485	4.5681393289E-03	3.7808297495E-03	4.7264952753E-03	4.5718874884E-03
490	4.7813119497E-03	3.9711554272E-03	4.9589718555E-03	4.8246944046E-03
495	4.3529593572E-03	3.6249395113E-03	4.5089085910E-03	4.3933763301E-03
500	4.2001893912E-03	3.5054470597E-03	4.3482309889E-03	4.2614893931E-03
505	4.1185466358E-03	3.4469873307E-03	4.2536936675E-03	4.1866928919E-03
510	4.0194659840E-03	3.3666591006E-03	4.1422765811E-03	4.0905509939E-03
515	3.8903610539E-03	3.2649294907E-03	4.0084126413E-03	3.9700675689E-03
520	3.8493559566E-03	3.2324152488E-03	3.9642336858E-03	3.9354875717E-03
525	3.7873516580E-03	3.1830798415E-03	3.8904751808E-03	3.8884589962E-03
530	3.6413287886E-03	3.0658738226E-03	3.7425204277E-03	3.7448194428E-03
535	3.5242134983E-03	2.9732435219E-03	3.6203602691E-03	3.6292572589E-03
540	3.3943502184E-03	2.8562443806E-03	3.4774110652E-03	3.4981633554E-03
545	3.3045356788E-03	2.7836553806E-03	3.3738391627E-03	3.4058355961E-03
550	3.2438239765E-03	2.7405351198E-03	3.3089647662E-03	3.3628659182E-03
555	3.1606152159E-03	2.6684856088E-03	3.2271381298E-03	3.2754484966E-03
560	3.0286427835E-03	2.5570307014E-03	3.0902259286E-03	3.1463821388E-03
565	2.9355078132E-03	2.4768672348E-03	2.9939273039E-03	3.0508875453E-03
570	2.8724192296E-03	2.4290564760E-03	2.9240274460E-03	2.9934454071E-03
575	2.8085393367E-03	2.3709669246E-03	2.8590774429E-03	2.9392015458E-03
580	2.7968188134E-03	2.3629810398E-03	2.8379890183E-03	2.9365776836E-03
585	2.7827960922E-03	2.3592740651E-03	2.8283647552E-03	2.9218916705E-03
590	2.7301343844E-03	2.3154872501E-03	2.7735064969E-03	2.8724651663E-03
595	2.5984139729E-03	2.2015031521E-03	2.6366057351E-03	2.7401858233E-03
600	2.4739600435E-03	2.0968061647E-03	2.5074794652E-03	2.6112640366E-03
605	2.4207817037E-03	2.0506790445E-03	2.4516719615E-03	2.5530835887E-03
610	2.4298465255E-03	2.0618201787E-03	2.4639022772E-03	2.5757102381E-03
615	2.5070314711E-03	2.1288640175E-03	2.5360238405E-03	2.6555433493E-03
620	2.5361269518E-03	2.1553427577E-03	2.5532417554E-03	2.6974561170E-03
625	2.4244999745E-03	2.0553287803E-03	2.4436768632E-03	2.5829526178E-03
630	2.3770664552E-03	2.0127972561E-03	2.3885480455E-03	2.5338944122E-03
635	2.2618607728E-03	1.9205073888E-03	2.2704643995E-03	2.4102667160E-03
640	2.1742922358E-03	1.8417195380E-03	2.1786775667E-03	2.3221164012E-03
645	2.2558164073E-03	1.9135758775E-03	2.2599490176E-03	2.4159477102E-03
650	2.2088345799E-03	1.8609845965E-03	2.2072854537E-03	2.3570176083E-03
655	2.1325340875E-03	1.7980776318E-03	2.1280736679E-03	2.2731482079E-03
660	2.1374132605E-03	1.8004481410E-03	2.1346948733E-03	2.2785403054E-03
665	2.1908909294E-03	1.8380489339E-03	2.1769545675E-03	2.3313815915E-03
670	2.1898398623E-03	1.8411837874E-03	2.1794050086E-03	2.3343340897E-03
675	2.1839803044E-03	1.8244790132E-03	2.1660008089E-03	2.3287425975E-03
680	2.3104227460E-03	1.9312195363E-03	2.2889077231E-03	2.4548713313E-03
685	2.4952214318E-03	2.0843462224E-03	2.4674847420E-03	2.6557243152E-03
690	2.3913899145E-03	1.9854105169E-03	2.3560832105E-03	2.5381731720E-03
695	2.0392131208E-03	1.6964885885E-03	2.0052388533E-03	2.1709796378E-03
700	1.9087342132E-03	1.5971707633E-03	1.8802734158E-03	2.0342920825E-03
705	1.9049182232E-03	1.5889757408E-03	1.8685673689E-03	2.0325609849E-03
710	2.2996858016E-03	1.9097492896E-03	2.2610903089E-03	2.4446258117E-03
715	2.1978608562E-03	1.8072291673E-03	2.1496362033E-03	2.3110881557E-03
720	1.8960125590E-03	1.5579692847E-03	1.8582963816E-03	2.0043823578E-03
725	1.9518885172E-03	1.6076262768E-03	1.9032768288E-03	2.0696541209E-03
730	2.1970351433E-03	1.7965561719E-03	2.1439321182E-03	2.3201768349E-03

NBS Standard Deviations

λ[nm]	ss	sp	ps	pp
390	1.2954130741E-05	1.1096403747E-05	2.8233241437E-05	1.0300503165E-05
395	1.3398136179E-05	1.0806911263E-05	1.8258949935E-05	1.1042480671E-05
400	1.3217125812E-05	1.1648768212E-05	1.6067737162E-05	1.1968928479E-05
405	1.3062507346E-05	9.9975483329E-06	1.5091628497E-05	1.2616950094E-05
410	1.2950007889E-05	1.1822786076E-05	1.3874351438E-05	1.2552060894E-05
415	1.1391603540E-05	9.5319202119E-06	1.3472592287E-05	1.0245369206E-05
420	1.2794060843E-05	1.1138361636E-05	1.4433439917E-05	1.0323612669E-05
425	1.3282299071E-05	1.1454327017E-05	1.4213810341E-05	1.2311140696E-05
430	1.6115633071E-05	1.2591094143E-05	1.4270917139E-05	1.3236941879E-05
435	1.5960293433E-05	1.1776269094E-05	1.5298202361E-05	1.2310213092E-05
440	1.5062678684E-05	1.2654034687E-05	1.5973433741E-05	1.4959991016E-05
445	1.5104095551E-05	1.4706086189E-05	1.8901894714E-05	1.7748751997E-05
450	1.8656941682E-05	1.7290473545E-05	1.7545958441E-05	1.4684911946E-05
455	1.9367154742E-05	1.4957666915E-05	1.9636883932E-05	1.5558490018E-05
460	2.3181930186E-05	1.6339572502E-05	2.7052464147E-05	1.8848017607E-05
465	2.2829438050E-05	1.7741444910E-05	2.2371690308E-05	2.3776250429E-05
470	2.0464043282E-05	1.7951928395E-05	2.6664167612E-05	2.0706883397E-05
475	1.8386760753E-05	1.5244729593E-05	1.9390081018E-05	1.7805096878E-05
480	2.0333171084E-05	1.7321698634E-05	1.9782481268E-05	2.0408673464E-05
485	2.2729815330E-05	1.6773018204E-05	1.8418071432E-05	1.8977511555E-05
490	1.9074482247E-05	1.6367214872E-05	1.9231817334E-05	2.1626597438E-05
495	1.9911326729E-05	1.7055869522E-05	1.8189856935E-05	1.8082971814E-05
500	1.5968104564E-05	1.3998276164E-05	1.7699067092E-05	1.9137132494E-05
505	1.4937824037E-05	1.5965230689E-05	1.7390346568E-05	1.8607566466E-05
510	1.7833292258E-05	1.6325426216E-05	1.5374894514E-05	1.6570120783E-05
515	1.6296624102E-05	1.3299325848E-05	1.6032971128E-05	1.9615383706E-05
520	2.1040643777E-05	1.6018248553E-05	1.7450011695E-05	1.6470377221E-05
525	1.6448982843E-05	1.4316523650E-05	1.7098630844E-05	1.5180506240E-05
530	1.3949276955E-05	1.1497798359E-05	1.7360294325E-05	1.5824904902E-05
535	1.4032289542E-05	1.0928323275E-05	1.4300229220E-05	1.4256595453E-05
540	1.4188598066E-05	1.2205938441E-05	1.3623817690E-05	1.3684071851E-05
545	1.4167195112E-05	1.3283952619E-05	1.3263685096E-05	1.3539978891E-05
550	1.2695201101E-05	1.3098301456E-05	1.3056939631E-05	1.4363873297E-05
555	1.2803831681E-05	1.2349551346E-05	1.2661728109E-05	1.1831679785E-05
560	1.2365330251E-05	1.1956406310E-05	1.3623029031E-05	1.2090317946E-05
565	1.1859823937E-05	1.1033454753E-05	1.2388618379E-05	1.1520535570E-05
570	1.1143816421E-05	1.1275384429E-05	9.9080193379E-06	1.0858418402E-05
575	1.1511383563E-05	9.9649310980E-06	1.1069797956E-05	1.1650141153E-05
580	1.0050531539E-05	1.0867439791E-05	1.0304084305E-05	1.2361151054E-05
585	1.2150728534E-05	9.7602083500E-06	1.1462121968E-05	9.8576766172E-06
590	1.1713335624E-05	9.4033428279E-06	1.0272243026E-05	1.0153710586E-05
595	1.1481773271E-05	1.0230579976E-05	1.2911009591E-05	1.0423029179E-05
600	1.1593748735E-05	9.7772105308E-06	9.6772262470E-06	1.0243183129E-05
605	9.5886112539E-06	1.0046076142E-05	9.7212480782E-06	8.3716047717E-06
610	1.2457482796E-05	1.0320880518E-05	9.3936346493E-06	1.1114124262E-05
615	8.2329602926E-06	1.0411413729E-05	1.2006981617E-05	9.9025066275E-06
620	9.6579434812E-06	9.1588744174E-06	1.0452473056E-05	9.1682840388E-06
625	1.0675470970E-05	8.3134341177E-06	9.5890356341E-06	1.0314326511E-05
630	9.9804318266E-06	9.9402537094E-06	9.1765962072E-06	1.2766690969E-05
635	1.0000257801E-05	8.4244931807E-06	1.0426594476E-05	9.5836590777E-06
640	8.5906480720E-06	1.0186456249E-05	1.0985780946E-05	8.6396119727E-06
645	8.9013608298E-06	8.3593123703E-06	1.0350558719E-05	1.1738980156E-05
650	1.4098876643E-05	1.0097862847E-05	9.9455349968E-06	1.2140431332E-05
655	1.0201176405E-05	7.9694148103E-06	8.9377410842E-06	8.3880883516E-06
660	1.2602151505E-05	9.8313312408E-06	1.3311963092E-05	9.2579047630E-06
665	7.9799820386E-06	9.5871182124E-06	9.6919366681E-06	8.8762102474E-06
670	9.6549375426E-06	1.1057323077E-05	1.1809673448E-05	1.1284309400E-05
675	1.1190037685E-05	1.1129782771E-05	9.9744900701E-06	1.1886655291E-05
680	1.0925852460E-05	1.0511090959E-05	1.2555902623E-05	1.0739415821E-05
685	1.1595459790E-05	9.2827353782E-06	1.1862478021E-05	1.0891842095E-05
690	1.2882067879E-05	1.5371020616E-05	1.7219586527E-05	1.3531704815E-05
695	1.3220021911E-05	8.4455814556E-06	1.1352799779E-05	1.0765821420E-05
700	1.4543731335E-05	1.5224252733E-05	1.6145761197E-05	1.1507807038E-05
705	9.8972110788E-06	1.0185487747E-05	1.3246500643E-05	1.2214703237E-05
710	1.6932998375E-05	1.3858062907E-05	1.6899665979E-05	1.7372966263E-05
715	1.7388207230E-05	1.5394549925E-05	1.4313673226E-05	1.0323858037E-05
720	2.0269452954E-05	1.7927907427E-05	1.8937528664E-05	1.5221953350E-05
725	1.4821733566E-05	1.4719765831E-05	1.5052433403E-05	1.6569916769E-05
730	1.8457587692E-05	2.3645238977E-05	1.7665319894E-05	1.8011855382E-05

F Test Values

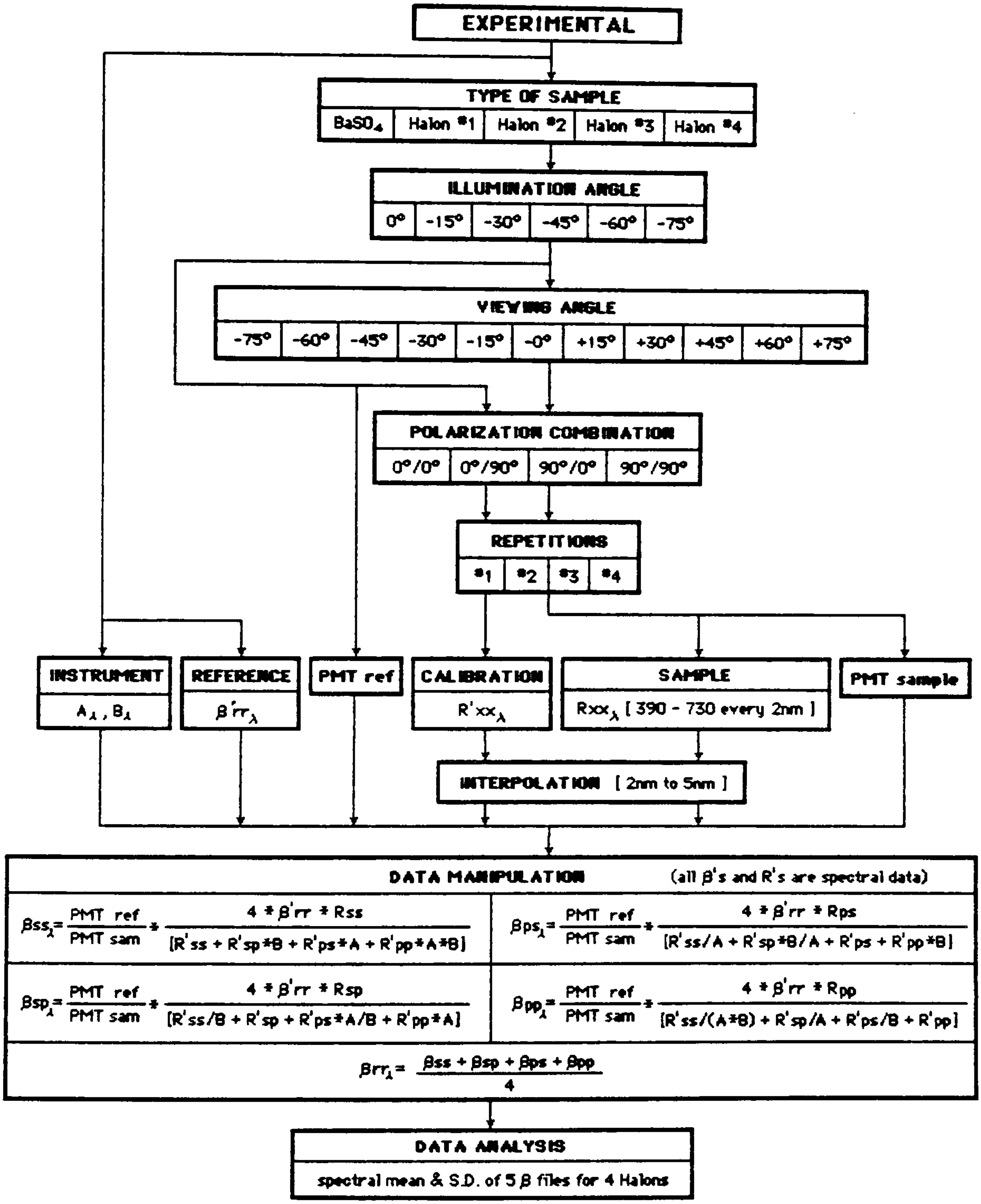
λ[nm]	SS	SP	PS	PP
390	5.0481341293E-01	8.1677519406E-01	3.0215752196E+00	2.7530443467E-01
395	5.6945524383E-01	7.2561704837E-01	1.0794370687E+00	1.6569736339E-01
400	4.5821023620E-01	5.3289693121E-01	8.7420157993E-01	1.9305280443E-01
405	4.3270633622E-01	4.4737379063E-01	7.9013476134E-01	1.3532349845E-01
410	4.0228700347E-01	7.4037448177E-01	5.0752642993E-01	1.0997285535E-01
415	2.5026332079E-01	3.6602644320E-01	4.3668106491E-01	6.4627296128E-02
420	2.8476083764E-01	4.7819205796E-01	4.5567434255E-01	5.2646603082E-02
425	2.7752678870E-01	3.9807390780E-01	3.7046606431E-01	6.3640293072E-02
430	4.0942456540E-01	4.6192048341E-01	4.3533306695E-01	7.3452777480E-02
435	3.8164422766E-01	3.6213823230E-01	4.4729851978E-01	5.3879378210E-02
440	2.7537171054E-01	3.8647222591E-01	3.9069920409E-01	7.0950145425E-02
445	2.6253068473E-01	4.6092179468E-01	5.6249415877E-01	9.1553469968E-02
450	2.7207819572E-01	4.9612715070E-01	3.4914872101E-01	4.5048194668E-02
455	3.0898730308E-01	3.3811607062E-01	3.7366541735E-01	4.5456331517E-02
460	2.9028660557E-01	3.1121180484E-01	5.2037757286E-01	4.7765069661E-02
465	2.1947536721E-01	2.3360474502E-01	2.6112573152E-01	5.3065765813E-02
470	1.9907991311E-01	2.9588799916E-01	4.1199375632E-01	4.3458827136E-02
475	2.4771664857E-01	3.1027374395E-01	3.1327214134E-01	4.4114782598E-02
480	2.4496563362E-01	3.0292736137E-01	2.7855203242E-01	4.9347666132E-02
485	3.8060205683E-01	3.5222671158E-01	2.9550544800E-01	5.0220600416E-02
490	2.3714028360E-01	2.8722638401E-01	2.6836638477E-01	6.0990189132E-02
495	2.8896562881E-01	4.1681759759E-01	3.2614221928E-01	5.0150674791E-02
500	2.0587712638E-01	2.6425548602E-01	3.2159282806E-01	5.9507117637E-02
505	1.7182321069E-01	3.7490517708E-01	3.2759600196E-01	5.5200898593E-02
510	2.9471360586E-01	4.1737145470E-01	2.5373091873E-01	4.7454685415E-02
515	2.6159003642E-01	2.6635244055E-01	3.3396355560E-01	6.9775101458E-02
520	4.3575844220E-01	4.4669737169E-01	4.0532775279E-01	4.8573911792E-02
525	2.6576753723E-01	3.4985504872E-01	3.9957189500E-01	4.2895332428E-02
530	2.2582822058E-01	2.3007849047E-01	4.2004805369E-01	4.9488625555E-02
535	2.0624024956E-01	2.4222271445E-01	2.8020721330E-01	4.3330590435E-02
540	2.2290688551E-01	2.9664026734E-01	2.8310786939E-01	4.1296575955E-02
545	2.5439864618E-01	3.3748246648E-01	2.4895913493E-01	4.2956579985E-02
550	1.8576028878E-01	3.4639203444E-01	2.2474676881E-01	4.8903560203E-02
555	2.1871190313E-01	3.0310259218E-01	2.5302311548E-01	3.4169491649E-02
560	2.2360112246E-01	3.1576923340E-01	3.0411016700E-01	3.8132767480E-02
565	2.2008309847E-01	2.6304534442E-01	2.7606792888E-01	3.5955781782E-02
570	2.3318296417E-01	3.1416307424E-01	1.8740800473E-01	3.2666258890E-02
575	2.0794151647E-01	2.4632052432E-01	2.5213782783E-01	3.9404328740E-02
580	1.3885713437E-01	2.8453335632E-01	2.0165626798E-01	4.3893700781E-02
585	2.1899461682E-01	2.5497395704E-01	2.5684460255E-01	2.7945529167E-02
590	1.9559032787E-01	2.3329495229E-01	1.8671675921E-01	3.1065919686E-02
595	2.3725579310E-01	2.6693603613E-01	3.8247677778E-01	3.4230952774E-02
600	2.9195795890E-01	2.4609970545E-01	2.4175307994E-01	3.5934743184E-02
605	1.9462535648E-01	2.9751993967E-01	2.5279224773E-01	2.4994877012E-02
610	3.1464293611E-01	3.0011652241E-01	2.4286849589E-01	4.4704226475E-02
615	1.1842709236E-01	2.8136156321E-01	3.1966946976E-01	3.2255458684E-02
620	1.4621768685E-01	2.2180323443E-01	2.5537462199E-01	2.5611673845E-02
625	2.1210346354E-01	2.0897108413E-01	2.2684498939E-01	3.5142949334E-02
630	2.1630949595E-01	3.5082887855E-01	2.1246986451E-01	5.3932367925E-02
635	2.0699812917E-01	2.2693204433E-01	3.0248449088E-01	3.5488457758E-02
640	1.4238714883E-01	3.6495539268E-01	3.4866666383E-01	3.1773792649E-02
645	1.6613786388E-01	2.0842184473E-01	2.4161241057E-01	4.9895779553E-02
650	4.3916454625E-01	2.8301816219E-01	2.0100906081E-01	5.7086894778E-02
655	2.6161605670E-01	2.0869552579E-01	2.4187225779E-01	3.0121996367E-02
660	4.4832876255E-01	3.0348265812E-01	5.1813209945E-01	3.4829008037E-02
665	1.3285655776E-01	3.1639773601E-01	2.2784335917E-01	3.1267241178E-02
670	1.8192579090E-01	4.0766750579E-01	3.5660280598E-01	4.7609557970E-02
675	2.7802847897E-01	4.2248508092E-01	2.7513587556E-01	5.4493314096E-02
680	2.0378447451E-01	2.9122397872E-01	3.2351334509E-01	3.9517376827E-02
685	2.0259465318E-01	1.8029089071E-01	2.6842277789E-01	3.0705283579E-02
690	2.7299304698E-01	6.2655126292E-01	4.8555705042E-01	6.3711789830E-02
695	3.7900579128E-01	2.0813343551E-01	3.5145108877E-01	5.1769933828E-02
700	5.3145767512E-01	8.6931684172E-01	8.1831109174E-01	5.9623253930E-02
705	2.3958924950E-01	3.0179493738E-01	5.1708542283E-01	6.3005708335E-02
710	3.9638565828E-01	3.6931600354E-01	5.5183768704E-01	8.9532024748E-02
715	4.5866137414E-01	5.0468370834E-01	5.4004189380E-01	4.5892324079E-02
720	9.0356878027E-01	8.7729471368E-01	5.7940036490E-01	9.4881787495E-02
725	4.6702995867E-01	3.9177640527E-01	6.0895060217E-01	1.2187133383E-01
730	3.2242732274E-01	1.0046317854E+00	3.6726024070E-01	9.5462162713E-02

Appendix 19

Translucency Check Data

Wav	White Backing	Black Backing	Difference	% Diff
390	1.678	1.673	5.000e-3	0.298
395	2.370	2.369	1.000e-3	0.042
400	2.616	2.617	-1.000e-3	-0.038
405	2.949	2.945	4.000e-3	0.136
410	3.170	3.160	1.000e-2	0.316
415	3.257	3.255	2.000e-3	0.061
420	3.440	3.442	-2.000e-3	-0.058
425	3.595	3.592	3.000e-3	0.083
430	3.639	3.641	-2.000e-3	-0.055
435	3.870	3.869	1.000e-3	0.026
440	4.003	4.010	-7.000e-3	-0.175
445	4.167	4.167	0.000	0.000
450	4.896	4.893	3.000e-3	0.061
455	5.080	5.074	6.000e-3	0.118
460	5.889	5.888	1.000e-3	0.017
465	6.933	6.939	-6.000e-3	-0.087
470	6.633	6.618	0.015	0.226
475	5.613	5.607	6.000e-3	0.107
480	6.029	6.032	-3.000e-3	-0.050
485	5.519	5.509	0.010	0.181
490	5.754	5.768	-0.014	-0.243
495	5.251	5.259	-8.000e-3	-0.152
500	5.064	5.063	1.000e-3	0.020
505	4.950	4.956	-6.000e-3	-0.121
510	4.829	4.833	-4.000e-3	-0.083
515	4.664	4.691	-0.027	-0.579
520	4.613	4.619	-6.000e-3	-0.130
525	4.533	4.532	1.000e-3	0.022
530	4.348	4.351	-3.000e-3	-0.069
535	4.213	4.205	8.000e-3	0.190
540	4.059	4.053	6.000e-3	0.148
545	3.930	3.930	0.000	0.000
550	3.871	3.868	3.000e-3	0.078
555	3.762	3.765	-3.000e-3	-0.080
560	3.615	3.615	0.000	0.000
565	3.497	3.512	-0.015	-0.429
570	3.430	3.437	-7.000e-3	-0.204
575	3.359	3.357	2.000e-3	0.060
580	3.352	3.348	4.000e-3	0.119
585	3.341	3.354	-0.013	-0.389
590	3.297	3.300	-3.000e-3	-0.091
595	3.136	3.125	0.011	0.351
600	2.982	2.976	6.000e-3	0.201
605	2.920	2.926	-6.000e-3	-0.206
610	2.939	2.946	-7.000e-3	-0.238
615	3.040	3.031	9.000e-3	0.296
620	3.086	3.070	0.016	0.519
625	2.948	2.950	-2.000e-3	-0.068
630	2.899	2.889	1.000e-2	0.345
635	2.761	2.758	3.000e-3	0.109
640	2.660	2.648	0.012	0.451
645	2.753	2.755	-2.000e-3	-0.073
650	2.705	2.708	-3.000e-3	-0.111
655	2.628	2.622	6.000e-3	0.228
660	2.638	2.634	4.000e-3	0.152
665	2.716	2.722	-6.000e-3	-0.221
670	2.720	2.724	-4.000e-3	-0.147
675	2.720	2.726	-6.000e-3	-0.221
680	2.874	2.879	-5.000e-3	-0.174
685	3.108	3.123	-0.015	-0.483
690	2.983	2.981	2.000e-3	0.067
695	2.552	2.549	3.000e-3	0.118
700	2.400	2.380	0.020	0.833
705	2.378	2.366	0.012	0.505
710	2.892	2.894	-2.000e-3	-0.069
715	2.766	2.774	-8.000e-3	-0.289
720	2.389	2.377	0.012	0.502
725	2.459	2.460	-1.000e-3	-0.041
730	2.771	2.759	0.012	0.433

Appendix 20



EXPERIMENTAL
TYPE OF SAMPLE
BaSO4
Halon #1
Halon #2
Halon #3
Halon #4
ILLUMINATION ANGLE
0°
-15°
-30°
-45°
-60°
-75°
VIEWING ANGLE
-75°
-60°
-45°
-30°
-15°
-0°
+15°
+30°
+45°
+60°
+75°
POLARIZATION COMBINATION
0°/0°
0°/90°
90°/0°
90°/90°
REPETITIONS
#1
#2
#3
#4
INSTRUMENT
Aλ , Bλ
REFERENCE
β'rrλ
PMT ref
CALIBRATION
R'xxλ
SAMPLE
Rxxλ [390 - 730 every 2nm]
PMT sample
INTERPOLATION [2nm to 5nm]
DATA MANIPULATION
(all β's and R's are spectral data)
βssλ = PMT ref / PMT sam * 4 * β'rr * Rss / [R'ss + R'sp*B + R'ps*A + R'pp*A*B]
βpsλ = PMT ref / PMT sam * 4 * β'rr * Rps / [R'ss/A + R'sp*B/A + R'ps + R'pp*B]
βspλ = PMT ref / PMT sam * 4 * β'rr * Rsp / [R'ss/B + R'sp + R'ps*A/B + R'pp*A]
βppλ = PMT ref / PMT sam * 4 * β'rr * Rpp / [R'ss/(A*B) + R'sp/A + R'ps/B + R'pp]
βrrλ = (βss + βsp + βps + βpp) / 4
DATA ANALYSIS
spectral mean & S.D. of 5 β files for 4 Halons

Appendix 21

Turbo Pascal Programs

(MS-DOS version)

# of pages	Name	Program Purpose
5 (1 - 5)	FTEST.PAS	Do the F test for the Halon vs NBS tile comparison.
21 (6 - 26)	THESIS.PAS	Data manipulation program for final measurements.
3 (27 - 29)	THEPRINT.PAS	Print formatted output for $BaSO_4$ data files.
7 (30 - 36)	FINAL.PAS	Print formatted output of Halon data files (also calculates spectral means and coefficients of variations).

NOTE: There is another dozen programs which are not included here because of space limitations. However, they use procedures similar to the ones found in the programs above.

```
PROGRAM FTEST;

{  This program was used when comparing the standard deviations of
   the Halon tablet with the NBS porcelain tile.  It calculates the
   spectral means, standard deviations, and F values  }

{  Denis Daoust ----   April 1987  }

CONST
    PATH='C:\PASCAL\GONIODAT\';

VAR
    Q:INTEGER;
    NUMB:STRING[2];
    SUMXSS,SUMXSP,SUMXPS,SUMXPP: ARRAY [1..69] OF REAL;
    SUMX2SS, SUMX2SP,SUMX2PS,SUMX2PP: ARRAY [1..69] OF REAL;
    X:INTEGER;
    SSFILE,SPFILE,PSFILE,PPFILE:TEXT;
    SSDATA,SPDATA,PSDATA,PPDATA:REAL;
    KIND:STRING[3];
    MEANSS,MEANSP,MEANPS,MEANPP:REAL;
    STANDEVSS,STANDEVSP,STANDEVPS,STANDEVPP:REAL;
    SSFILEM,SPFILEM,PSFILEM,PPFILEM:TEXT;
    SSFILES,SPFILES,PSFILES,PPFILES:TEXT;
    SSFILEF,SPFILEF,PSFILEF,PPFILEF:TEXT;
    SSFILE1,SPFILE1,PSFILE1,PPFILE1:TEXT;
    SSFILE2,SPFILE2,PSFILE2,PPFILE2:TEXT;
    FTESTSS,FTESTSP,FTESTPS,FTESTPP:REAL;
    Z:INTEGER;
    SS1,SP1,PS1,PP1,SS2,SP2,PS2,PP2:REAL;
    N:INTEGER;

BEGIN
    TEXTBACKGROUND(1);
    CLRSCR;
    N:=10;
    FOR Z:=1 TO 2 DO
    BEGIN
        IF Z=1 THEN KIND:='NBS'
        ELSE KIND:='HAL';
        GOTOXY(10,9);
        WRITELN('NOW USING THE ',KIND,' FILES ...... ');
        FOR X:= 1 TO 69 DO
```

```
BEGIN
    SUMXSS[X]:=0;
    SUMXSP[X]:=0;
    SUMXPS[X]:=0;
    SUMXPP[X]:=0;
    SUMX2SS[X]:=0;
    SUMX2SP[X]:=0;
    SUMX2PS[X]:=0;
    SUMX2PP[X]:=0;
END;
    FOR Q:=1 TO 10 DO
    BEGIN
        GOTOXY(10,13);
        WRITELN('WORKING ON FILE # ',Q);
        STR(Q,NUMB);
        IF LENGTH(NUMB)=1 THEN NUMB:='0'+NUMB;
        ASSIGN(SSFILE,PATH+KIND+NUMB+'C00.5NM');
        ASSIGN(SPFILE,PATH+KIND+NUMB+'C01.5NM');
        ASSIGN(PSFILE,PATH+KIND+NUMB+'C10.5NM');
        ASSIGN(PPFILE,PATH+KIND+NUMB+'C11.5NM');
        RESET(SSFILE);
        RESET(SPFILE);
        RESET(PSFILE);
        RESET(PPFILE);
        FOR X:=1 TO 69 DO
        BEGIN
        READLN(SSFILE,SSDATA);
        READLN(SPFILE,SPDATA);
        READLN(PSFILE,PSDATA);
        READLN(PPFILE,PPDATA);
        GOTOXY(45,13);
        WRITE('AVERAGING WAVELENGTH # ',X);
        SUMXSS[X]:=SUMXSS[X]+SSDATA;
        SUMXSP[X]:=SUMXSP[X]+SPDATA;
        SUMXPS[X]:=SUMXPS[X]+PSDATA;
        SUMXPP[X]:=SUMXPP[X]+PPDATA;
        SUMX2SS[X]:=SUMX2SS[X]+SQR(SSDATA);
        SUMX2SP[X]:=SUMX2SP[X]+SQR(SPDATA);
        SUMX2PS[X]:=SUMX2PS[X]+SQR(PSDATA);
        SUMX2PP[X]:=SUMX2PP[X]+SQR(PPDATA);
        END;
        CLOSE(SSFILE);
        CLOSE(SPFILE);
        CLOSE(PSFILE);
```

```
            CLOSE(PPFILE);
        END;
    ASSIGN(SSFILEM,PATH+KIND+'AVGSS.5NM');
    ASSIGN(SPFILEM,PATH+KIND+'AVGSP.5NM');
    ASSIGN(PSFILEM,PATH+KIND+'AVGPS.5NM');
    ASSIGN(PPFILEM,PATH+KIND+'AVGPP.5NM');
    ASSIGN(SSFILES,PATH+KIND+'STDSS.5NM');
    ASSIGN(SPFILES,PATH+KIND+'STDSP.5NM');
    ASSIGN(PSFILES,PATH+KIND+'STDPS.5NM');
    ASSIGN(PPFILES,PATH+KIND+'STDPP.5NM');
    REWRITE(SSFILEM);
    REWRITE(SPFILEM);
    REWRITE(PSFILEM);
    REWRITE(PPFILEM);
    REWRITE(SSFILES);
    REWRITE(SPFILES);
    REWRITE(PSFILES);
    REWRITE(PPFILES);
    GOTOXY(10,13);
    WRITELN('                                                                  ');
    GOTOXY(10,16);
    WRITELN('NOW CALCULATING THE SPECTRAL MEANS AND STANDARD DEVIATIONS');
    FOR X:=1 TO 69 DO
    BEGIN
        MEANSS:=SUMXSS[X]/N;
        MEANSP:=SUMXSP[X]/N;
        MEANPS:=SUMXPS[X]/N;
        MEANPP:=SUMXPP[X]/N;
        STANDEVSS:=SQRT((SUMX2SS[X]-N*SQR(MEANSS))/(N-1));
        STANDEVSP:=SQRT((SUMX2SP[X]-N*SQR(MEANSP))/(N-1));
        STANDEVPS:=SQRT((SUMX2PS[X]-N*SQR(MEANPS))/(N-1));
        STANDEVPP:=SQRT((SUMX2PP[X]-N*SQR(MEANPP))/(N-1));
        WRITELN(SSFILEM,MEANSS);
        WRITELN(SPFILEM,MEANSP);
        WRITELN(PSFILEM,MEANPS);
        WRITELN(PPFILEM,MEANPP);
        WRITELN(SSFILES,STANDEVSS);
        WRITELN(SPFILES,STANDEVSP);
        WRITELN(PSFILES,STANDEVPS);
        WRITELN(PPFILES,STANDEVPP);
    END;
    CLOSE(SSFILEM);
    CLOSE(SPFILEM);
    CLOSE(PSFILEM);
```

```
        CLOSE(PPFILEM);
        CLOSE(SSFILES);
        CLOSE(SPFILES);
        CLOSE(PSFILES);
        CLOSE(PPFILES);
    END;
    ASSIGN(SSFILE1,PATH+'NBSSTDSS.5NM');
    ASSIGN(SPFILE1,PATH+'NBSSTDSP.5NM');
    ASSIGN(PSFILE1,PATH+'NBSSTDPS.5NM');
    ASSIGN(PPFILE1,PATH+'NBSSTDPP.5NM');
    ASSIGN(SSFILE2,PATH+'HALSTDSS.5NM');
    ASSIGN(SPFILE2,PATH+'HALSTDSP.5NM');
    ASSIGN(PSFILE2,PATH+'HALSTDPS.5NM');
    ASSIGN(PPFILE2,PATH+'HALSTDPP.5NM');
    ASSIGN(SSFILEF,PATH+'FTEST_SS.5NM');
    ASSIGN(SPFILEF,PATH+'FTEST_SP.5NM');
    ASSIGN(PSFILEF,PATH+'FTEST_PS.5NM');
    ASSIGN(PPFILEF,PATH+'FTEST_PP.5NM');
    RESET(SSFILE1);
    RESET(SPFILE1);
    RESET(PSFILE1);
    RESET(PPFILE1);
    RESET(SSFILE2);
    RESET(SPFILE2);
    RESET(PSFILE2);
    RESET(PPFILE2);
    REWRITE(SSFILEF);
    REWRITE(SPFILEF);
    REWRITE(PSFILEF);
    REWRITE(PPFILEF);
    CLRSCR;
    GOTOXY(10,19);
    WRITELN('NOW CALCULATING THE F VALUES');
    FOR X:=1 TO 69 DO
    BEGIN
        READLN(SSFILE1,SS1);
        READLN(SPFILE1,SP1);
        READLN(PSFILE1,PS1);
        READLN(PPFILE1,PP1);
        READLN(SSFILE2,SS2);
        READLN(SPFILE2,SP2);
        READLN(PSFILE2,PS2);
        READLN(PPFILE2,PP2);
        FTESTSS:=SQR(SS1)/SQR(SS2);
```

```
        FTESTSP:=SQR(SP1)/SQR(SP2);
        FTESTPS:=SQR(PS1)/SQR(PS2);
        FTESTPP:=SQR(PP1)/SQR(PP2);
        WRITELN(SSFILEF,FTESTSS);
        WRITELN(SPFILEF,FTESTSP);
        WRITELN(PSFILEF,FTESTPS);
        WRITELN(PPFILEF,FTESTPP);
    END;
    CLOSE(SSFILE1);
    CLOSE(SPFILE1);
    CLOSE(PSFILE1);
    CLOSE(PPFILE1);
    CLOSE(SSFILE2);
    CLOSE(SPFILE2);
    CLOSE(PSFILE2);
    CLOSE(PPFILE2);
    CLOSE(SSFILEF);
    CLOSE(SPFILEF);
    CLOSE(PSFILEF);
    CLOSE(PPFILEF);
END.
```

```
PROGRAM THESIS;

{ This program was the main program used for the final measurements.
  It prompts for all polarization, illumination, and viewing angles
  as well as when to rotate the sample holder }

{ Denis Daoust - May 1987          ---> VERSION 8.03 <--            }


type
    string31=string[31];

var
   IllumAngle,ViewAngle,IllPol,ViewPol,STAGE,ARM,PMT:integer;
   FName:string31;
   REDO:CHAR;
   PMTSAMPLE:REAL;
   NAMETOPRINT:STRING31;
   datavalue:real;
   code:integer;

{----------------------------------------------------------------------------}

PROCEDURE WARNING;

BEGIN
    TEXTBACKGROUND(1);
    CLRSCR;
    GOTOXY(10,7);
    TEXTCOLOR(28);
    WRITELN('********************  IMPORTANT NOTICE  ********************');
    WRITELN;
    TEXTCOLOR(15);
    GOTOXY(1,9);
    WRITELN('If you did not run "tools.bat" from the C:\ ':62);
    WRITELN('directory yet, please do so now.  Otherwise ':62);
    WRITELN('the program won't be able to communicate    ':62);
    WRITELN('with the Photo Research...                  ':62);
END;

{----------------------------------------------------------------------------}

PROCEDURE MainMenu;
```

```
const
     TAB10 = '          ';

var
     option:string[1];

BEGIN
     GOTOXY(1,16);
     TEXTCOLOR(12);
     WRITELN('          ----------------------------------------------------------------');
     TEXTCOLOR(15);
     GOTOXY(10,18);
     WRITELN(' SELECT ONE OF THE FOLLOWING OPTIONS:');
     WRITELN;
     WRITELN(TAB10,'       M - make measurement.');
     WRITELN(TAB10,'       Q - quit.');
     WRITELN;
     REPEAT
        BEGIN
           GOTOXY(10,23);
           WRITE(' OPTION---> ');
           TEXTCOLOR(12);
           READ(KBD,OPTION);
           TEXTCOLOR(15);
        END;
     UNTIL Upcase(OPTION) IN ['M','Q'];
     IF (UPCASE(OPTION)='Q') THEN
     BEGIN
         TEXTBACKGROUND(0);
         CLRSCR;
         TEXTCOLOR(14);
         HALT;
     END;
END;

{-------------------------------------------------------------------------------}

PROCEDURE BEEP;
begin
     sound(2500);
     delay(600);
     nosound;
end;
```

```
{--------------------------------------------------------------------------------}

PROCEDURE DisplayAngles(NUMBER,ILLUMANGLE,VIEWANGLE,ILLPOL,VIEWPOL,COUNTER,EQUALITY,STAGE,ARM:INTEGER);

BEGIN
     BEEP;
     TEXTCOLOR(12);
     GOTOXY(18,4);
     WRITELN(ILLUMANGLE:3);
     GOTOXY(58,4);
     WRITELN(VIEWANGLE:3);
     GOTOXY(26,5);
     IF ILLUMANGLE=0 THEN STAGE:=0 ELSE STAGE:=360+ILLUMANGLE;
     IF EQUALITY=1 THEN
     BEGIN
        STAGE:=ILLUMANGLE;
     END;
     WRITELN(STAGE:3);
     GOTOXY(63,5);
     ARM:=90-VIEWANGLE+ILLUMANGLE;
     IF ARM<0 THEN ARM:=360+ARM;
     IF EQUALITY=1 THEN
         BEGIN
             ARM:=ARM-15-COUNTER*15;
         END;
     WRITELN(ARM:3);
     GOTOXY(24,6);
     WRITELN(ILLPOL:3);
     GOTOXY(62,6);
     WRITELN(VIEWPOL:3);
{     WRITELN(lst,NUMBER:11,ILLUMANGLE:11,STAGE:11,VIEWANGLE:11,ARM:11,ILLPOL:11,VIEWPOL:11);}
{     WRITELN(LST,ILLUMANGLE:10,STAGE:10,VIEWANGLE:10,ARM:10);}
END;

{--------------------------------------------------------------------------------}

PROCEDURE MEASURE(NUMBER,ILLUMANGLE,VIEWANGLE,ILLPOL,VIEWPOL,COUNTER,EQUALITY,STAGE,ARM,PMT:INTEGER);

type
    DIM10 = array [0..10] of real;

const
     T='          ';
```

```
     SPACE='                                                                      ';

   var
      C:DIM10;
      PHOTOFILE:text;
      IT:REAL;
      MESSAGE:STRING[30];
      READY:CHAR;

   BEGIN
        TEXTCOLOR(12);
        ASSIGN(PHOTOFILE,'PHOTO');
        REWRITE(PHOTOFILE) ;
        MESSAGE:='WAV;S390.0,E730.0,M4,G1.0;X*';
        IF PMT=0 THEN
           BEGIN
               GOTOXY(10,2);
               WRITELN('ILLUMINATION                        DETECTION SYSTEM');
               TEXTCOLOR(15);
               GOTOXY(10,3);
               WRITELN('************                        ****************');
               WRITELN;
               GOTOXY(10,4);
               WRITELN('angle:       deg                    angle:         deg');
               GOTOXY(10,5);
               WRITELN('set stage at:                       set arm at:');
               GOTOXY(10,6);
               WRITELN('polarization:       deg             polarization:     deg');
               DisplayAngles(NUMBER,ILLUMANGLE,VIEWANGLE,ILLPOL,VIEWPOL,COUNTER,EQUALITY,STAGE,ARM);
               GOTOXY(10,15);
               WRITELN('                                                                      ');
               GOTOXY(10,9);
               TEXTCOLOR(15);
               WRITELN('ONCE THE CONDITIONS ABOVE HAVE BEEN SET, PRESS ANY KEY.          ');
               WRITELN(SPACE);
               WRITELN(SPACE);
               WRITELN(SPACE);
               WRITELN(SPACE);
               READ(KBD,READY);
               GOTOXY(10,12);
               IF ((ILLPOL=90) AND (VIEWPOL=90)) THEN
               BEGIN
                   WRITE('PLEASE ENTER THE CURRENT PMT READING: ');
                   TEXTCOLOR(12);
```

```
                READLN(PMTSAMPLE);
                TEXTCOLOR(15);
            END;
END;
     TEXTCOLOR(15);
     GOTOXY(1,9);
     WRITELN(T,'************************************************************  ');
     WRITELN(T,'|                                                            |');
     WRITELN(T,'|   The Photo Research is presently making a measurement.   |');
     WRITELN(T,'|                                                            |');
     WRITE(T,'|');
     TEXTCOLOR(28);
     WRITE('  ................. please be patient  ..............    ');
     TEXTCOLOR(15);
     WRITELN('|');
     WRITELN(T,'|                                                            |');
     WRITELN(T,'************************************************************');
     WRITELN(PHOTOFILE,MESSAGE);
     CLOSE(PHOTOFILE);
     GOTOXY(1,11);
     WRITELN(T,'|   The Photo Research has now completed the measurement.   |');
     GOTOXY(1,13);
     WRITELN(T,'************************************************************');
     WRITELN(T,'                                                             ');
     WRITELN(T,'                                                             ');
END;

{--------------------------------------------------------------------------}

PROCEDURE ErrorCheck(VAR REDO:CHAR);

var
   ErrorFile:text;
   Code,Status:integer;
   ErrorCode:string[5];

BEGIN
     REDO:='A';
     ASSIGN(ErrorFile,'D:\ERRCODE.ASC');
     RESET(ErrorFile);
     READLN(ErrorFile,ErrorCode);
     VAL(ErrorCode,Code,Status);
     IF CODE<>0 THEN
     BEGIN
```

```
            TEXTCOLOR(28);
            GOTOXY(6,17);
            WRITELN('            There has been a problem with the measurement.');
            WRITELN('                 Check error code ',ErrorCode,' in the manual...');
            WRITELN;
            WRITELN;
            WRITELN;
            TEXTCOLOR(15);
            REPEAT
                BEGIN
                    WRITE('          REDO MEASUREMENT (Y/N) OR STOP (S)?  ');
                    READ(KBD,REDO);
                    IF REDO='S' THEN
                    BEGIN
                        TEXTBACKGROUND(1);
                        CLRSCR;
                        HALT;
                    END;
                    CLRSCR;
                END;
                GOTOXY(6,22);
            WRITELN('

            WRITELN('

            UNTIL UPCASE(REDO) IN ['Y','N','S'];
        END;
        CLOSE(ErrorFile);
END;

{---------------------------------------------------------------------------------}

PROCEDURE SaveFileAs(IllumAngle,ViewAngle,IllPol,ViewPol:integer;VAR FName:string31);

var
   ROW,Illfile, Viewfile, IllPolFile, ViewPolFile,TAKEOUT,SCRAP: integer;
   Illum, View: string[2];
   IPol,VPol:string[1];
   DataToSave,DataSaved:text;
   Data:string[13];

BEGIN
     IllPolFile:=0;
     ViewPolFile:=0;
     IllFile:=TRUNC(Illumangle/15);
     ViewFile:=TRUNC(Viewangle/15);
```

```
      If IllPol=90 then IllPolFile:=1;
      If ViewPol=90 then ViewPolFile:=1;
      Str(IllFile,Illum);
      Str(ViewFile,View);
      Str(IllPolFile,IPol);
      Str(ViewPolFile,VPol);
      If Length(Illum)=1 then Illum:='0'+Illum;
      If Length(View)=1 then View:='0'+View;
      FName:='C:\PASCAL\GONIODAT\B1'+Illum+View+IPol+VPol+'.2nm';
      GOTOXY(1,15);
      WRITE('         Filename =  ');
      TEXTCOLOR(12);
      WRITE(FName);
      WRITELN('                                  ');
      GOTOXY(10,23);
      WRITELN;
      TEXTCOLOR(15);
      ASSIGN(DataToSave,'D:\CORRECTD.ASC');
      RESET(DataToSave);
      ASSIGN(DataSaved,FName);
      REWRITE(DataSaved);
      FOR TAKEOUT:=1 TO 6 DO
         BEGIN
             READLN(DataToSave,scrap);
         END;
      FOR ROW:=1 TO 171 DO
          BEGIN
              READLN(DataToSave,Data);
              DELETE(Data,11,1);
              val(data,datavalue,code);
              WRITELN(DataSaved,Datavalue/Cos(2*pi*ILLUMANGLE/360));
          END;
      CLOSE(DataToSave);
      CLOSE(DataSaved);
END;

{----------------------------------------------------------------------------}

PROCEDURE INTERPOLATE(FName:string31);

{ This program interpolates data from 2 nm to 5 nm }
{ using a third-order polynomial calculated by the }
{ Newton-Gregory method.}
```

```
type

    DIM600 = array [0..600] of real;
    DIM200 = array [0..200] of real;
    DIM10 = array [0..10] of real;

var

    INX : DIM600;
    AUT : DIM200;
    D : DIM10;
    Filename, G : string[20];
    NewName:string31;
    FFile,GFile : text;
    X,N,line,start,znd,inc : integer;
    WL, YOUT : real;
    dum:char;

{---------------------------------------------------------}

PROCEDURE INTERP (wl:real; INX:DIM600;
                  var YOUT:real);

var
     JI,fm,m,u,v,k,den,z,fi,FJ:integer;
     S,FZ,j,xo,YO:Real;
     d:dim200;

BEGIN
     m:=3;        {  M is the order of the polynomial  }
     FM:=M+1;
     J:=(WL-start)/inc-fm/2+2;
     IF WL<=(start+fm/2*inc) then j:=1;
     IF wl>=(znd-fm/2*inc) then j:=n-m;
     JI:=TRUNC(j);
     FJ:=JI;
     xo:=start+(fj-1)*inc;
     yo:=INX[ji];

     FOR z:=1 TO M DO
         BEGIN
             d[z]:=INX[JI+1]-INX[JI];
             JI:=JI+1;
         END;
```

```
      IF M<>1 THEN
      BEGIN
           FOR u:=2 TO M DO
           BEGIN
                FOR v:= u TO M DO
                     BEGIN
                          k:=M-v+u;
                          D[K]:=D[K]-D[K-1];
                     END;
           END;
      END;

      S:=(WL-XO)/INC;
      YOUT:=YO;
      FZ:=S;
      DEN:=1;
      FOR Z:=1 TO M DO
          BEGIN
               FI:=Z;
               YOUT:= YOUT +FZ/DEN*D[Z];
               FZ:=FZ*(S-FI);
               DEN:=DEN*(FI+1);
          END;
END;

{------------- MAIN BODY OF INTERPOLATION PROCEDURE -------------}

BEGIN
     start:=390;
     znd:=730;
     inc:=2;
     GOTOXY(10,19);
     WRITELN(' Presently interpolating the 2 nm data to 5 nm data...');
     WRITELN;
     WRITELN('          [the extension in the filenane will be changed to ".5nm"]');
     Assign(FFile,FName);
     Reset(FFile);
     NewName:=Copy(FName,1,28)+'5nm';
     Assign(Gfile,NewName);
     Rewrite(GFile);
     N:=171;
     for x:=1 to N do
        readln(FFile,INX[X]);
```

```
     close(FFile);
{     writeln(LST,'Here are the first 19 points (2 nm) of file ',FName);
     writeln(LST);
     for x:=1 to 19 do
         BEGIN
              writeln(LST,INX[X]);
         END;
     writeln(LST); }
     for x:=1 to 69 do
         begin
              wl:=390+(5*(x-1));
              INTERP(wl,inx,yout);
              aut[x]:=yout;
         end;
     for x:=1 to 69 do
         writeln(GFile,Aut[x]);
     close(GFile);
 {   writeln(LST,'Here are the first 19 points (5 nm) of file ', NewName);
     writeln(LST);
     for x:=1 to 19 do
         BEGIN
              writeln(LST,aut[x]);
        END;}
     GOTOXY(10,19);
     WRITELN('                                                              ');
     GOTOXY(10,21);
     WRITELN('                                                              ');
END;

{----------------------------------------------------------------------------}

PROCEDURE ReflectanceFactors(FName:STRING31;PMTREF,PMTSAMPLE:REAL;VAR NAMETOPRINT:STRING31);

var
    FNameSS,FNameSP,FNamePS,FNamePP,OLDFNAME:STRING31;
    AFile,BFile:text;
    NBSFile:text;
    RPssFile,RPspFile,RPpsFile,RPppFile:text;
    RssFile,RspFile,RpsFile,RppFile:text;
    BssFile,BspFile,BpsFile,BppFile,BrrFile:text;
    junk:real;
    x,i,P:integer;
    A,B:real;
    VALUE,BPrr:real;
```

```
    RPss,RPsp,RPps,RPpp:real;
    Rss,Rsp,Rps,Rpp:real;
    Bss,Bsp,Bps,Bpp,Brr:real;
    BssS:string[12];
    BP:ARRAY [1..69] OF REAL;

BEGIN
    GOTOXY(10,19);
    WRITELN('PRESENTLY OPENING ALL REQUIRED FILES........');
    OLDFNAME:=FNAME;
    NAMETOPRINT:=FNAME;
    Delete(FName,26,6);
    Delete(OldFName,28,4);
    FNameSS:=FName+'00.5nm';
    FNameSP:=FName+'01.5nm';
    FNamePS:=FName+'10.5nm';
    FNamePP:=FName+'11.5nm';
    DELETE(NAMETOPRINT,28,4);

    ASSIGN(AFile,'C:\PASCAL\GONIODAT\ACONSTAN.5nm');
    ASSIGN(BFile,'C:\PASCAL\GONIODAT\BCONSTAN.5nm');
    ASSIGN(NBSFile,'C:\PASCAL\GONIODAT\NBSCalib.5nm');
    ASSIGN(RPssFile,'C:\PASCAL\GONIODAT\CALIBR00.5nm');
    ASSIGN(RPspFile,'C:\PASCAL\GONIODAT\CALIBR01.5nm');
    ASSIGN(RPpsFile,'C:\PASCAL\GONIODAT\CALIBR10.5nm');
    ASSIGN(RPppFile,'C:\PASCAL\GONIODAT\CALIBR11.5nm');
    ASSIGN(RssFile,FNameSS);
    ASSIGN(RspFile,FNameSP);
    ASSIGN(RpsFile,FNamePS);
    ASSIGN(RppFile,FNamePP);
    ASSIGN(BssFile,OldFName+'.Bss');
    ASSIGN(BspFile,OldFName+'.Bsp');
    ASSIGN(BpsFile,OldFName+'.Bps');
    ASSIGN(BppFile,OldFName+'.Bpp');
    ASSIGN(BrrFile,OldFName+'.Brr');

    Reset(AFile);
    Reset(BFile);

    Reset(NBSFile);
    FOR P:=1 TO 69 DO
    BEGIN
        READLN(NBSFILE,VALUE);
        BP[P]:=VALUE;
```

```
END;
CLOSE(NBSFILE);

Reset(RPssFile);
Reset(RPspFile);
Reset(RPpsFile);
Reset(RPppFile);
Reset(RssFile);;
Reset(RspFile);
Reset(RpsFile);
Reset(RppFile);

Rewrite(BssFile);
Rewrite(BspFile);
Rewrite(BpsFile);
Rewrite(BppFile);
Rewrite(BrrFile);

GOTOXY(10,19);
WRITELN('PRESENTLY CALCULATING THE REFLECTANCE FACTORS......');
WRITELN;

FOR I:=1 TO 69 DO
    BEGIN
        READLN(AFile,A);
        READLN(BFile,B);
        BPRR:=BP[I];
        READLN(RPssFile,RPss);
        READLN(RPspFile,RPsp);
        READLN(RPpsFile,RPps);
        READLN(RPppFile,RPpp);
        READLN(RssFile,Rss);
        READLN(RspFile,Rsp);
        READLN(RpsFile,Rps);
        READLN(RppFile,Rpp);

        IF A=0 THEN
        WRITELN('A= ',A);
        IF B=0 THEN
        WRITELN('B= ',B);
        IF RPss=0 THEN
        WRITELN('RPss= ',RPss);
        IF RPSP=0 THEN
        WRITELN('RPsp= ',RPSP);
```

```
            IF RPPS=0 THEN
            WRITELN('RPps= ',RPPS);
            IF RPPP=0 THEN
            WRITELN('RPpp= ',RPPP);

            Bss:=(PMTREF/PMTSAMPLE)*((4*BPrr*Rss)/(RPss + RPsp*B + RPps*A + RPpp*A*B));
            Bsp:=(PMTREF/PMTSAMPLE)*((4*BPrr*Rsp)/(RPss/B + RPsp + RPps*A/B + RPpp*A));
            Bps:=(PMTREF/PMTSAMPLE)*((4*BPrr*Rps)/(RPss/A + RPsp*B/A + RPps + RPpp*B));
            Bpp:=(PMTREF/PMTSAMPLE)*((4*BPrr*Rpp)/(RPss/(A*B) + RPsp/A + RPps/B + RPpp));
            Brr:=(Bss + Bsp + Bps + Bpp)/4;

            WRITELN(BssFile,Bss);
            WRITELN(BspFile,Bsp);
            WRITELN(BpsFile,Bps);
            WRITELN(BppFile,Bpp);
            WRITELN(BrrFile,Brr);

        END;

    CLOSE(AFILE);
    CLOSE(BFILE);
    CLOSE(RPssFile);
    CLOSE(RPspFile);
    CLOSE(RPpsFile);
    CLOSE(RPppFile);
    CLOSE(RssFile);
    CLOSE(RspFile);
    CLOSE(RpsFile);
    CLOSE(RppFile);
    CLOSE(BssFile);
    CLOSE(BspFile);
    CLOSE(BpsFile);
    CLOSE(BppFile);
    CLOSE(BrrFile);
    CLRSCR;
{     GOTOXY(10,17);
    WRITELN('                                                                        ');
    GOTOXY(10,19);
    WRITELN('                                                                        ');
}
END;

{----------------------------------------------------------------------------}
```

```
PROCEDURE PRINTRESULTS(NAMETOPRINT:STRING31;ILLUMANGLE,VIEWANGLE:INTEGER);

VAR
    AFILE:TEXT;
    N,X:INTEGER;
    WAVELENGTH1,WAVELENGTH2:INTEGER;
    DATA:ARRAY [1..69] OF REAL;
    SAMPLENAME:STRING[6];
    NAME:STRING[8];
    DATASS,DATASP,DATAPS,DATAPP,DATARR:ARRAY [1..69] OF REAL;
    SSFILE,SPFILE,PSFILE,PPFILE,RRFILE:TEXT;

BEGIN
CLRSCR;
GOTOXY(10,11);
WRITELN('PRINTING THE FINAL RESULTS FOR ',ILLUMANGLE:3,CHAR(248),'/',VIEWANGLE:3,CHAR(248),' ANGLE COMBINATI

    WRITELN(LST);
    WRITELN(LST);
    WRITELN(LST);
    WRITELN(LST);
    WRITELN(LST);
    WRITE(LST,CHAR(27),CHAR(15));
    WRITELN(LST);
    WRITE(LST,'                              ',ILLUMANGLE:3,CHAR(248),'/',VIEWANGLE:3,CHAR(248),' BIDIRE

    WRITELN(LST,'ABSOLUTE SPECTRAL REFLECTANCE FACTORS FOR BaSO4');
    WRITELN(LST,'                              *******************************************************

    WRITELN(LST);
    WRITE(LST,CHAR(27),CHAR(15));
    WRITELN(LST);
    WRITE(LST,'                ===============================================        ==================

    WRITELN(LST,'==========================');
    WRITE(LST,'                | Wav |  Bss  |  Bsp  |  Bps  |  Bpp  |  Brr  |        | Wav |  Bss  |  B

    WRITELN(LST,'  |  Bps  |  Bpp  |  Brr  |');
    WRITE(LST,'                -----------------------------------------------        ------------------

    WRITELN(LST,'--------------------------');
{    WRITE(LST,'         ||       |       |       |       |       |           |       |       |       | ')

    WRITELN(LST,'    |       |       |');}
    DELETE(NAMETOPRINT,28,4);
    ASSIGN(SSFILE,NAMETOPRINT+'.BSS');
    ASSIGN(SPFILE,NAMETOPRINT+'.BSP');
    ASSIGN(PSFILE,NAMETOPRINT+'.BPS');
    ASSIGN(PPFILE,NAMETOPRINT+'.BPP');
    ASSIGN(RRFILE,NAMETOPRINT+'.BRR');
    RESET(SSFILE);
```

```
     RESET(SPFILE);
     RESET(PSFILE);
     RESET(PPFILE);
     RESET(RRFILE);
 FOR X:=1 TO 69 DO
 BEGIN
     READLN(SSFILE,DATASS[X]);
     READLN(SPFILE,DATASP[X]);
     READLN(PSFILE,DATAPS[X]);
     READLN(PPFILE,DATAPP[X]);
     READLN(RRFILE,DATARR[X]);
 END;
 FOR N:=1 TO 35 DO
 BEGIN
     WAVELENGTH1:=385+(5*N);
     WAVELENGTH2:=560+(5*N);
     IF WAVELENGTH2=735 THEN
     BEGIN
        WRITE(LST,'                    ',' |',WAVELENGTH1:4,' |',DATASS[N]:6:3,' |',DATASP[N]:6:3,' |',DATAPS

        WRITE(LST,DATAPP[N]:6:3,' |',DATARR[N]:6:3,' |','       |     |       |       |       |      |');
        WRITELN(LST,'      |');
     END
     ELSE
     BEGIN
     WRITE(LST,'                    ',' |',WAVELENGTH1:4,' |',DATASS[N]:6:3,' |',DATASP[N]:6:3,' |',DATASP[N]:

     WRITE(LST,DATAPP[N]:6:3,' |',DATARR[N]:6:3,' |','       |',WAVELENGTH2:4,' |',DATASS[N+35]:6:3,' |');
     WRITELN(LST,DATASP[N+35]:6:3,' |',DATAPS[N+35]:6:3,' |',DATAPP[N+35]:6:3,' |',DATARR[N+35]:6:3,' |');
     END;
 END;
 CLOSE(SSFILE);
 CLOSE(SPFILE);
 CLOSE(PSFILE);
 CLOSE(PPFILE);
 CLOSE(RRFILE);
 {WRITE(LST,'                  |    |       |       |       |       |       |   |       |       |      |

 WRITELN(LST,' |       |       |');}
 WRITE(LST,'                   ==============================================        ======================

 WRITELN(LST,'==================');
 WRITE(LST,CHAR(18));
 WRITE(LST,CHAR(12));
 END;    { PROCEDURE PRINTRESULTS }

 {---------------------------------------------------------------------------}
```

```
PROCEDURE CalculateAngles(IllumAngle,ViewAngle,IllPol,ViewPol,STAGE,ARM,PMT:integer);

var
    ILLUMINATION,VIEWING,POLILL,POLVIEW,NUMBER,COUNTER,EQUALITY,SCRAP,TAKEOUT,ROW:INTEGER;
    DUMMY:CHAR;
    PMTREF:REAL;
    DataToSave,DataSaved:text;
    Data:string[13];
    POL:STRING[2];
    POL1,POL2,PO1,PO2:INTEGER;
    POL1S,POL2S:STRING[1];
    Z:INTEGER;
    ZS:STRING[1];
    X:INTEGER;
    MEANSS,MEANSP,MEANPS,MEANPP:ARRAY [1..69] OF REAL;
    FILEC1,FILEC2,FILEC3,FILEC4:TEXT;
    FILEMSS,FILEMSP,FILEMPS,FILEMPP:TEXT;
    SS,SP,PS,PP:REAL;
    C:INTEGER;

BEGIN
REDO:='A';
PMT:=0;
ILLUMANGLE:=15;
{gotoxy(10,12);
write('Please enter the illumination angle: ');
readln(illumangle);
gotoxy(10,14);
write('Please enter the viewing angle: ');
readln(viewangle);}
NUMBER:=1;
{    WRITELN(lst,'   MEAS. #   ILLUMANGLE  STAGE    VIEWANGLE    ARM     ILLPOL    VIEWPOL');
     WRITELN(lst,'   *******   **********  *****    *********    ***     ******    *******');
     WRITELN(LST);
 }
(* C:=4;
FOR Z:=1 TO C DO
BEGIN  { 4 REPS }
    CLRSCR;
    GOTOXY(10,2);
    WRITELN('THIS IS NBS TILE MEASUREMENT # ',Z);
    BEEP;
IF Z=(C/2+1) THEN
BEGIN  { IF Z=3 }
```

```
    GOTOXY(10,14);
    TEXTCOLOR(15);
    WRITE('        PLEASE ENTER THE CURRENT PMT READING: ');
    TEXTCOLOR(12);
    READ(PMTREF);
    TEXTCOLOR(15);
  END;  { Z=3 }
  GOTOXY(7,9);
  WRITELN('PLEASE POSITION THE CALIBRATION STANDARD ON THE SAMPLE HOLDER');
  WRITELN('      AND ENSURE YOU HAVE 0 DEG / 45 DEG.');
  WRITELN;
       POL1:=-90;
       FOR PO1:=0 TO 1 DO
       BEGIN  { POL1 }
          POL1:=POL1+90;
          POL2:=-90;
          FOR PO2:=0 TO 1 DO
          BEGIN   { POL2 }
             POL2:=POL2+90;
             STR(PO1,POL1S);
             STR(PO2,POL2S);
             POL:=POL1S+POL2S;
             WRITELN('         Adjust the polarizers to ',POL1,' deg / ',POL2,' deg.');
             WRITELN;
             TEXTCOLOR(12);
             WRITE('                  WHEN READY, PRESS ANY KEY

             READ(KBD,DUMMY);
             TEXTCOLOR(15);
             GOTOXY(10,16);
             WRITELN('                                                                  ');
             WRITELN('                                                                  ');
             WRITELN('                                                                  ');
             WRITELN('                                                                  ');
             TEXTCOLOR(15);
             STR(Z,ZS);
             FName:='C:\PASCAL\GONIODAT\CALIB'+ZS+POL+'.2nm';
             WRITELN;
             WRITELN;
             WRITELN;
             PMT:=1;
             REPEAT
                BEGIN  { REPEAT }
                   MEASURE(NUMBER,ILLUMANGLE,VIEWANGLE,ILLPOL,VIEWPOL,COUNTER,EQUALITY,STAGE,ARM,PMT);
                   ERRORCHECK(REDO);
```

```
                    GOTOXY(10,15);
                    WRITE(' Filename = ');
                    TEXTCOLOR(12);
                    WRITELN(FName);
                    TEXTCOLOR(15);
                END;   { REPEAT }
            UNTIL REDO<>'Y';
            IF REDO='A' THEN
            BEGIN   { IF REDO }
                ASSIGN(DataToSave,'D:\CORRECTD.ASC');
                RESET(DataToSave);
                ASSIGN(DataSaved,FName);
                REWRITE(DataSaved);
                FOR TAKEOUT:=1 TO 6 DO
                    READLN(DataToSave,scrap);
                FOR ROW:=1 TO 171 DO
                BEGIN { FOR ROW }
                    READLN(DataToSave,Data);
                    DELETE(Data,11,1);
                    WRITELN(DataSaved,Data);
                END; { FOR ROW }
                CLOSE(DataToSave);
                CLOSE(DataSaved);
                INTERPOLATE(FName);
                GOTOXY(10,15);
                WRITELN('                                                  ');
            END;  { IF REDO }
        END;   { POL2 }
    END;   { POL1 }
CLRSCR;
END;  { 4 REPS }
     GOTOXY(10,24);
     WRITELN('PRESENTLY AVERAGING THE 4 CALIBRATION FILES......');
     FOR X:=1 TO 69 DO
     BEGIN  { FOR X }
         MEANSS[X]:=0;
         MEANSP[X]:=0;
         MEANPS[X]:=0;
         MEANPP[X]:=0;
     END;   { FOR X }
     FOR Z:=1 TO C DO
     BEGIN  { 4 MEAN REPS }
               STR(Z,ZS);
               ASSIGN(FILEC1,'C:\PASCAL\GONIODAT\CALIB'+ZS+'00.5NM');
```

```
            ASSIGN(FILEC2,'C:\PASCAL\GONIODAT\CALIB'+ZS+'01.5NM');
            ASSIGN(FILEC3,'C:\PASCAL\GONIODAT\CALIB'+ZS+'10.5NM');
            ASSIGN(FILEC4,'C:\PASCAL\GONIODAT\CALIB'+ZS+'11.5NM');
            RESET(FILEC1);
            RESET(FILEC2);
            RESET(FILEC3);
            RESET(FILEC4);
            FOR X:=1 TO 69 DO
            BEGIN  { 69 WAVELENGTHS }
                READLN(FILEC1,SS);
                READLN(FILEC2,SP);
                READLN(FILEC3,PS);
                READLN(FILEC4,PP);
                MEANSS[X]:=MEANSS[X]+(SS/C);
                MEANSP[X]:=MEANSP[X]+(SP/C);
                MEANPS[X]:=MEANPS[X]+(PS/C);
                MEANPP[X]:=MEANPP[X]+(PP/C);
            END;   { 69 WAVELENGTHS }
            CLOSE(FILEC1);
            CLOSE(FILEC2);
            CLOSE(FILEC3);
            CLOSE(FILEC4);
END;    { 4 MEAN REPS }
ASSIGN(FILEMSS,'C:\PASCAL\GONIODAT\CALIBR00.5NM');
ASSIGN(FILEMSP,'C:\PASCAL\GONIODAT\CALIBR01.5NM');
ASSIGN(FILEMPS,'C:\PASCAL\GONIODAT\CALIBR10.5NM');
ASSIGN(FILEMPP,'C:\PASCAL\GONIODAT\CALIBR11.5NM');
REWRITE(FILEMSS);
REWRITE(FILEMSP);
REWRITE(FILEMPS);
REWRITE(FILEMPP);
FOR X:=1 TO 69 DO
BEGIN    { 69 WAVELENGTHS }
    WRITELN(FILEMSS,MEANSS[X]);
    WRITELN(FILEMSP,MEANSP[X]);
    WRITELN(FILEMPS,MEANPS[X]);
    WRITELN(FILEMPP,MEANPP[X]);
END;    { 69 WAVELENGTHS }
CLOSE(FILEMSS);
CLOSE(FILEMSP);
CLOSE(FILEMPS);
CLOSE(FILEMPP);
GOTOXY(10,24);
WRITELN('                                                              ');
```

```
*)
PMTREF:=1.62;
FOR ILLUMINATION:=0 TO 5 DO
BEGIN  { FOR ILLUMINATION }
         PMT:=0;
         EQUALITY:=0;
         COUNTER:=-1;
         ILLUMANGLE:=ILLUMANGLE-15;
         VIEWANGLE:=75;
         FOR VIEWING:= 0 TO 10 DO
         BEGIN
             IF VIEWANGLE<>ILLUMANGLE THEN
             BEGIN
                ILLPOL:=-90;
                FOR POLILL:=0 TO 1 DO
                BEGIN
                     ILLPOL:=ILLPOL+90;
                     VIEWPOL:=-90;
                     FOR POLVIEW:=0 TO 1 DO
                     BEGIN
                         VIEWPOL:=VIEWPOL+90;
                         GOTOXY(10,10);
                         REPEAT
                             BEGIN
                                 MEASURE(NUMBER,ILLUMANGLE,VIEWANGLE,ILLPOL,VIEWPOL,COUNTER,EQUALITY,STAGE,A

                                 ERRORCHECK(REDO);
                             END;
                         UNTIL REDO<>'Y';
                         IF REDO='A' THEN
                            BEGIN
                                SaveFileAs(IllumAngle,ViewAngle,IllPol,ViewPol,FName);
                                INTERPOLATE(FName);
                            END;
{                         REPEAT
                             BEGIN
                                 GOTOXY(10,24);
                                 WRITE('Press "M" for another measurement or "Q" to quit...');
                                 TEXTCOLOR(12);
                                 READ(KBD,DUMMY);
                                 TEXTCOLOR(15);
                             END;
                         UNTIL Upcase(DUMMY) IN ['M','Q'];
                         CLRSCR;
                         GOTOXY(10,24);
```

```
                    WRITELN('                                                                          ');

                    IF (UPCASE(DUMMY)='Q') THEN
                    BEGIN
                        TEXTBACKGROUND(0);
                        CLRSCR;
                        TEXTCOLOR(14);
                        HALT;
                    END;
 }                   NUMBER:=NUMBER+1;
                END;
            END;

            ReflectanceFactors(FName,PMTREF,PMTSAMPLE,NAMETOPRINT);
            PRINTRESULTS(NAMETOPRINT,ILLUMANGLE,VIEWANGLE);
            VIEWANGLE:=VIEWANGLE-15;
          END
          ELSE
          BEGIN
              VIEWANGLE:=VIEWANGLE-15;
              EQUALITY:=1;
{              WRITELN(lst,'               ----------------------------------------');}
          END;
          IF EQUALITY=1 THEN COUNTER:=COUNTER+2;
      END;
{       WRITELN(lst,'         ==================================================================');}
    END;
END;

{=========================== MAIN PROGRAM ===============================}

BEGIN
{    WARNING;
     MainMenu;}
     TEXTBACKGROUND(1);
     CLRSCR;
     CalculateAngles(IllumAngle,ViewAngle,IllPol,ViewPol,STAGE,ARM,PMT);
END.
```

```
PROGRAM THEPRINT;

{  This program was used to print the formatted output for the
   BaSO4 data files  }

{  Denis Daoust  ----   May 1987  }

CONST
    PATH='C:\PASCAL\GONIODAT\';

VAR
    AFILE:TEXT;
    N,X:INTEGER;
    WAVELENGTH1,WAVELENGTH2:INTEGER;
    DATA:ARRAY [1..69] OF REAL;
    SAMPLENAME:STRING[6];
    NAME:STRING[8];
    DATASS,DATASP,DATAPS,DATAPP,DATARR:ARRAY [1..69] OF REAL;
    FILESS,FILESP,FILEPS,FILEPP,FILERR:TEXT;

BEGIN
CLRSCR;
GOTOXY(10,11);
    WRITELN(LST);
    WRITELN(LST);
    WRITELN(LST);
    WRITELN(LST);
    WRITELN(LST);
    WRITE(LST,CHAR(27),CHAR(15));
    WRITELN(LST);
    WRITE(LST,'                                  45',CHAR(248),'/00',CHAR(248),' BIDIRECTIONAL ABSOLUTE SP

    WRITELN(LST,'REFLECTANCE FACTORS FOR BaSO4');
    WRITELN(LST,'                                  ******************************************************

    WRITELN(LST);
    WRITE(LST,CHAR(27),CHAR(15));
    WRITELN(LST);
    WRITE(LST,'                 ==============================================        =================

    WRITELN(LST,'===========================');
    WRITE(LST,'                 | Wav |  Bss  |  Bsp  |  Bps  |  Bpp  |  Brr  |        | Wav |  Bss  |  B

    WRITELN(LST,'  |  Bps  |  Bpp  |  Brr  |');
    WRITE(LST,'                 ----------------------------------------------        -----------------

    WRITELN(LST,'---------------------------');
{   WRITE(LST,'          ||       |       |       |       |       |           |       |       |       |  ')
```

```
      WRITELN(LST,'     |       |       |');}
      ASSIGN(FILESS,PATH+'NO_01_11.BSS');
      ASSIGN(FILESP,PATH+'NO_01_11.BSP');
      ASSIGN(FILEPS,PATH+'NO_01_11.BPS');
      ASSIGN(FILEPP,PATH+'NO_01_11.BPP');
      ASSIGN(FILERR,PATH+'NO_01_11.BRR');
      RESET(FILESS);
      RESET(FILESP);
      RESET(FILEPS);
      RESET(FILEPP);
      RESET(FILERR);
  FOR X:=1 TO 69 DO
  BEGIN
      READLN(FILESS,DATASS[X]);
      READLN(FILESP,DATASP[X]);
      READLN(FILEPS,DATAPS[X]);
      READLN(FILEPP,DATAPP[X]);
      READLN(FILERR,DATARR[X]);
  END;
  FOR N:=34 TO 35 DO
  BEGIN
      WAVELENGTH1:=385+(5*N);
      WAVELENGTH2:=560+(5*N);
      IF WAVELENGTH2=735 THEN
      BEGIN
         WRITE(LST,'                    ',' |',WAVELENGTH1:4,' |',DATASS[N]:6:3,' |',DATASP[N]:6:3,' |',DATAPS

         WRITE(LST,DATAPP[N]:6:3,' |',DATARR[N]:6:3,' |','       |     |       |       |       |      |');
         WRITELN(LST,'       |');
      END
      ELSE
      BEGIN
      WRITE(LST,'                    ',' |',WAVELENGTH1:4,' |',DATASS[N]:6:3,' |',DATASP[N]:6:3,' |',DATASP[N]:

      WRITE(LST,DATAPP[N]:6:3,' |',DATARR[N]:6:3,' |','       |',WAVELENGTH2:4,' |',DATASS[N+35]:6:3,' |');
      WRITELN(LST,DATASP[N+35]:6:3,' |',DATAPS[N+35]:6:3,' |',DATAPP[N+35]:6:3,' |',DATARR[N+35]:6:3,' |');
      END;
  END;
  CLOSE(FILESS);
  CLOSE(FILESP);
  CLOSE(FILEPS);
  CLOSE(FILEPP);
  CLOSE(FILERR);
  {WRITE(LST,'                  |    |      |      |      |      |      |   |      |      |

  WRITELN(LST,' |       |       |');}
  WRITE(LST,'                 =============================================      =====================
```

```
WRITELN(LST,'==================');
WRITE(LST,CHAR(18));
WRITE(LST,CHAR(12));
END.
```

```
PROGRAM FINAL;

{  This program was used to print the formatted output of the
   Halon data files  }

{  Denis Daoust  ----  May 1987  }

type
    string31=string[31];

var
   IllumAngle,ViewAngle,IllPol,ViewPol,STAGE,ARM,PMT:integer;
   FName:string31;
   REDO:CHAR;
   PMTSAMPLE:REAL;
   NAMETOPRINT:STRING31;
   datavalue:real;
   code:integer;

{--------------------------------------------------------------------------}

PROCEDURE CalculateAngles(IllumAngle,ViewAngle,IllPol,ViewPol,STAGE,ARM,PMT:integer);


CONST
    PATH='C:\PASCAL\GONIODAT\';
    TAB='        ';
    N=4;    { NUMBER OF FILES TO BE AVERAGED }

var
     ILLUMINATION,VIEWING,POLILL,POLVIEW,NUMBER,COUNTER,EQUALITY,SCRAP,TAKEOUT,ROW:INTEGER;
     DUMMY:CHAR;
     PMTREF:REAL;
     DataToSave,DataSaved:text;
     Data:string[13];
     POL:STRING[2];
     POL1,POL2,PO1,PO2:INTEGER;
     POL1S,POL2S:STRING[1];
     Z:INTEGER;
     ZS:STRING[1];
     X:INTEGER;
     FILEC1,FILEC2,FILEC3,FILEC4:TEXT;
     FILEMSS,FILEMSP,FILEMPS,FILEMPP:TEXT;
```

```
     SS,SP,PS,PP:REAL;
     C:INTEGER;
    Q:INTEGER;
    NUMB:STRING[1];
    SUMXSS,SUMXSP,SUMXPS,SUMXPP,SUMXRR: ARRAY [1..69] OF REAL;
    SUMX2SS, SUMX2SP,SUMX2PS,SUMX2PP,SUMX2RR: ARRAY [1..69] OF REAL;
    SSFILE,SPFILE,PSFILE,PPFILE,RRFILE:TEXT;
    SSDATA,SPDATA,PSDATA,PPDATA,RRDATA:REAL;
    KIND:STRING[3];
    MEANSS,MEANSP,MEANPS,MEANPP,MEANRR:REAL;
    STANDEVSS,STANDEVSP,STANDEVPS,STANDEVPP,STANDEVRR:REAL;
    SSFILEM,SPFILEM,PSFILEM,PPFILEM,RRFILEM:TEXT;
    SSFILES,SPFILES,PSFILES,PPFILES,RRFILES:TEXT;
    SSFILE1,SPFILE1,PSFILE1,PPFILE1,RRFILE1:TEXT;
    SSFILE2,SPFILE2,PSFILE2,PPFILE2,RRFILE2:TEXT;
    HARDCOPY:STRING[1];
    PRINT:INTEGER;
    CHECK:STRING[50];
    NAME:STRING[8];
    M:INTEGER;
    WAVE:INTEGER;
    illpolfile,viewpolfile:integer;
    illfile,viewfile:integer;
    illum,view:string[2];
    ipol,vpol:string[1];

BEGIN  { procedure calculateangle }
REDO:='A';
PMT:=0;
ILLUMANGLE:=0;
NUMBER:=1;

FOR ILLUMINATION:=1 TO 1 DO
BEGIN  { FOR ILLUMINATION }
        PMT:=0;
        EQUALITY:=0;
        COUNTER:=-1;
        ILLUMANGLE:=ILLUMANGLE-15;
        VIEWANGLE:=75;
        FOR VIEWING:= 0 TO 0 DO
        BEGIN   { for viewing }
            IF VIEWANGLE<>ILLUMANGLE THEN
            BEGIN  { viewangle<>illumangle }
     IllPolFile:=0;
```

```
       ViewPolFile:=0;
       IllFile:=TRUNC(Illumangle/15);
       ViewFile:=TRUNC(Viewangle/15);
       If IllPol=90 then IllPolFile:=1;
       If ViewPol=90 then ViewPolFile:=1;
       Str(IllFile,Illum);
       Str(ViewFile,View);
       Str(IllPolFile,IPol);
       Str(ViewPolFile,VPol);
       If Length(Illum)=1 then Illum:='0'+Illum;
       If Length(View)=1 then View:='0'+View;

  { STATISTICS }

      TEXTBACKGROUND(1);
      CLRSCR;
      GOTOXY(10,14);
  {    REPEAT
      BEGIN
         WRITE('DO YOU WANT A HARDCOPY OF THE RESULTS (Y/N) ?');
         READ(KBD,HARDCOPY);
      END;
      UNTIL UPCASE (HARDCOPY) IN ['Y','N'];
      CLRSCR;
      IF (HARDCOPY='Y') OR (HARDCOPY='y') THEN PRINT:=1 ELSE PRINT :=0;
   }
       PRINT:=1;
       IF PRINT=1 THEN
         BEGIN
            WRITELN(LST,CHAR(18));
            WRITELN(LST);
            WRITELN(LST);
  illumangle:=-45;
  viewangle:=0;
  WRITELN(LST);
            WRITE(LST,              illumangle:10,char(248),'/',viewangle:3,char(248),' BIDIRECTIONAL ABSOL

            writeln(lst,'REFLECTANCE FACTORS');
            WRITELN(LST,'      *************************************************************');
            WRITELN(LST);
            WRITELN(LST,'---------------------------------------------------------------------------');
            WRITELN(LST,'¦     ¦     Bss     ¦     Bsp     ¦     Bps     ¦     Bpp     ¦     Brr     ¦');
            WRITELN(LST,'¦ WAV.¦-----------------------------------------------------------------¦');
            WRITELN(LST,'¦     ¦ mean  coeff.¦ mean  coeff.¦ mean  coeff.¦ mean  coeff.¦ mean  coeff.¦');
            WRITELN(LST,'¦ [nm]¦        var. ¦        var. ¦        var. ¦        var. ¦        var. ¦');
```

```
            WRITELN(LST,'|---------------------------------------------------------------------------|');
            WRITELN(LST,'|      |           |           |           |           |           |');
         END;
        FOR X:= 1 TO 69 DO
        BEGIN
            SUMXSS[X]:=0;
            SUMXSP[X]:=0;
            SUMXPS[X]:=0;
            SUMXPP[X]:=0;
            SUMXRR[X]:=0;
            SUMX2SS[X]:=0;
            SUMX2SP[X]:=0;
            SUMX2PS[X]:=0;
            SUMX2PP[X]:=0;
            SUMX2RR[X]:=0;
        END;
            FOR Q:=1 TO N DO
            BEGIN
                GOTOXY(10,13);
                WRITELN('WORKING ON FILE # ',Q);
                STR(Q,NUMB);
                ASSIGN(SSFILE,PATH+'H'+NUMB+'-30011.BSS');
                ASSIGN(SPFILE,PATH+'H'+NUMB+'-30011.BSP');
                ASSIGN(PSFILE,PATH+'H'+NUMB+'-30011.BPS');
                ASSIGN(PPFILE,PATH+'H'+NUMB+'-30011.BPP');
                ASSIGN(RRFILE,PATH+'H'+NUMB+'-30011.BRR');
                RESET(SSFILE);
                RESET(SPFILE);
                RESET(PSFILE);
                RESET(PPFILE);
                RESET(RRFILE);
                FOR X:=1 TO 69 DO
                BEGIN
                READLN(SSFILE,SSDATA);
                READLN(SPFILE,SPDATA);
                READLN(PSFILE,PSDATA);
                READLN(PPFILE,PPDATA);
{                READLN(RRFILE,RRDATA);}

                rrdata:=(ssdata+spdata+psdata+ppdata)/4;
                GOTOXY(45,13);
                WRITE('AVERAGING WAVELENGTH # ',X);
                SUMXSS[X]:=SUMXSS[X]+SSDATA;
                SUMXSP[X]:=SUMXSP[X]+SPDATA;
```

```
                SUMXPS[X]:=SUMXPS[X]+PSDATA;
                SUMXPP[X]:=SUMXPP[X]+PPDATA;
                SUMXRR[X]:=SUMXRR[X]+RRDATA;
                SUMX2SS[X]:=SUMX2SS[X]+SQR(SSDATA);
                SUMX2SP[X]:=SUMX2SP[X]+SQR(SPDATA);
                SUMX2PS[X]:=SUMX2PS[X]+SQR(PSDATA);
                SUMX2PP[X]:=SUMX2PP[X]+SQR(PPDATA);
                SUMX2RR[X]:=SUMX2RR[X]+SQR(RRDATA);
                END;
                GOTOXY(45,13);
                WRITELN('                                        ');
                CLOSE(SSFILE);
                CLOSE(SPFILE);
                CLOSE(PSFILE);
                CLOSE(PPFILE);
                CLOSE(RRFILE);
             END;
{        ASSIGN(SSFILEM,PATH+'HALAVGSS.5NM');
        ASSIGN(SPFILEM,PATH+'HALAVGSP.5NM');
        ASSIGN(PSFILEM,PATH+'HALAVGPS.5NM');
        ASSIGN(PPFILEM,PATH+'HALAVGPP.5NM');
        ASSIGN(RRFILEM,PATH+'HALAVGRR.5NM');
        ASSIGN(SSFILES,PATH+'HALSTDSS.5NM');
        ASSIGN(SPFILES,PATH+'HALSTDSP.5NM');
        ASSIGN(PSFILES,PATH+'HALSTDPS.5NM');
        ASSIGN(PPFILES,PATH+'HALSTDPP.5NM');
        ASSIGN(RRFILES,PATH+'HALSTDRR.5NM');
        REWRITE(SSFILEM);
        REWRITE(SPFILEM);
        REWRITE(PSFILEM);
        REWRITE(PPFILEM);
        REWRITE(RRFILEM);
        REWRITE(SSFILES);
        REWRITE(SPFILES);
        REWRITE(PSFILES);
        REWRITE(PPFILES);
        REWRITE(RRFILES);
}        GOTOXY(10,13);
        WRITELN('                                                                                ');
        GOTOXY(10,16);
        WRITELN('NOW CALCULATING THE SPECTRAL MEANS AND COEFFICIENTS OF VARIATION');
        FOR X:=1 TO 69 DO
        BEGIN
           MEANSS:=SUMXSS[X]/N;
```

```
            MEANSP:=SUMXSP[X]/N;
            MEANPS:=SUMXPS[X]/N;
            MEANPP:=SUMXPP[X]/N;
            MEANRR:=SUMXRR[X]/N;
{  Even if the name STANDEV.. is used, it is actually the coeff. of variation which is calculated  }
            STANDEVSS:=SQRT((SUMX2SS[X]-N*SQR(MEANSS))/(N-1))/MEANSS*100;
            STANDEVSP:=SQRT((SUMX2SP[X]-N*SQR(MEANSP))/(N-1))/MEANSP*100;
            STANDEVPS:=SQRT((SUMX2PS[X]-N*SQR(MEANPS))/(N-1))/MEANPS*100;
            STANDEVPP:=SQRT((SUMX2PP[X]-N*SQR(MEANPP))/(N-1))/MEANPS*100;
            STANDEVRR:=SQRT((SUMX2RR[X]-N*SQR(MEANRR))/(N-1))/MEANRR*100;
  {          WRITELN(SSFILEM,MEANSS);
            WRITELN(SPFILEM,MEANSP);
            WRITELN(PSFILEM,MEANPS);
            WRITELN(PPFILEM,MEANPP);
            WRITELN(RRFILEM,MEANRR);
            WRITELN(SSFILES,STANDEVSS);
            WRITELN(SPFILES,STANDEVSP);
            WRITELN(PSFILES,STANDEVPS);
            WRITELN(PPFILES,STANDEVPP);
            WRITELN(RRFILES,STANDEVRR);
   }
           IF PRINT=1 THEN
           BEGIN
               WAVE:=385+5*X;
               WRITE(LST,'|',WAVE:4,' |',MEANSS:6:3,STANDEVSS:6:2,' |',MEANSP:6:3,STANDEVSP:6:2,' |');
               WRITELN(LST,MEANPS:6:3,STANDEVPS:6:2,' |',MEANPP:6:3,STANDEVPP:6:2,' |',MEANRR:6:3,STANDEVRR:

           END;
end;
        IF PRINT=1 THEN
        BEGIN
            WRITELN(LST,'|     |               |               |               |               |               |');
            WRITELN(LST,'-------------------------------------------------------------------------------');
            WRITELN(LST,CHAR(12));
        END;
    {   CLOSE(SSFILEM);
        CLOSE(SPFILEM);
        CLOSE(PSFILEM);
        CLOSE(PPFILEM);
        CLOSE(RRFILEM);
        CLOSE(SSFILES);
        CLOSE(SPFILES);
        CLOSE(PSFILES);
        CLOSE(PPFILES);
        CLOSE(RRFILES);}
```

```
                    NUMBER:=NUMBER+1;
               VIEWANGLE:=VIEWANGLE-15;
            END  { if viewangle<>illumangle }

            ELSE
            BEGIN  { else }
                VIEWANGLE:=VIEWANGLE-15;
                EQUALITY:=1;
            END;   { else }
            IF EQUALITY=1 THEN COUNTER:=COUNTER+2;
        END; { for viewing }
    END;  { for illumination }
END; { procedure calculateangles }

{============================  MAIN PROGRAM  ==============================}

BEGIN
    TEXTBACKGROUND(1);
    CLRSCR;
    CalculateAngles(IllumAngle,ViewAngle,IllPol,ViewPol,STAGE,ARM,PMT);
END.
```

Appendix 22

Research Equipment List

1) Instrument platform (metal desk).
2) Optical bench.
3) Goniometric arm.
4) 150W high-pressure xenon lamp with mount.
5) Xenon lamp housing.
6) Dedicated regulated lamp power supply.
7) Cooling fan (for lamp).
8) Heat-absorbing filter.
9) Micro-adjustable slit.
10) Stray light box.
11) Focusing lens.
12) Beam splitter (microscope slide).
13) Photo-multiplier tube (Photo Research Spectra Spotmeter, 1/2°)
14) Multimeter (remote readout for PMT).
15) Polarizers (X2 Oriel linear polarizers).
16) Polarizer rotary stages (X2).
17) Transmission sample holder.
18) Reflection sample holder.
19) Vacuum pump for sample holders.
20) Prism (to "fold" the detection beam).
21) Array detector (Photo Research SpectraScan, 1/2°).
22) Velvet (many yards for stray light prevention).
23) IBM-compatible Xerox system (to control SpectraScan).

24) Turbo Pascal software.
25) Integrating sphere (for polarization checks).
26) Schoeffel monochromator (PMT polarization check).
27) Northern Tracor array radiometer (beam uniformity check).
28) Translation stage (beam uniformity check).
29) Chart recorder (stability and beam uniformity checks).
30) Mercury cadmium zinc lamp (wavelength calibration).
31) Neutral density filters [0.1 to 0.8ND every 0.1] (linearity check).
32) Stable tungsten lamp (stability and linearity checks).
33) National Bureau of Standards calibrated white porcelain tile.
34) National Bureau of Standards calibrated pale grey porcelain tile.
35) Mirror (instrument alignment).
36) LASER (instrument alignment).
37) Russian opal sample.
38) Barium sulfate powder (Eastman Kodak).
39) Polytetrafluoroethylene powder (Allied Chemical Halon).
40) Stainless steel spoon (recommended for handling Halon).
41) Blender with stainless steel blade and glass container (for Halon).
42) Hand press (Zeiss).
43) Hydraulic press (Carver).
44) Metal cylinder, piston and bottom plate.
45) Weighing scale (grams).
46) Micrometer (to measure thickness of samples).
47) Glass plate (to press samples against).
48) Ground glass plate (to press samples against).
49) Sandpaper (320, 600, 1000, and 1500 grit).

50) Oven (to sinter/cook samples).

51) Nikon measurescope (to measure parallelness of sample surfaces).

52) Black trap (translucency check).

53) Flashlight (used during measurements).

54) Lapping film (Ultralap, 9 & 40 µm).

55) H.P. Plotter (3D surface plot).

56) Access to VAX system (3D surface plot).

57) Apple Macintosh computer and appropriate software (for whole thesis).

58) Apple Laserwriter (to print thesis).

Appendix 23

Premilimary Data Acquisition Sheet Example

PRELIMINARY DATA ACQUISITION

DATE		START TIME		END TIME	

SAMPLE

type of material
- Russian Opal
- $BaSO_4$
- Halon (new batch)
- Halon (old batch)

density
- N/A
- 1g/cc
- 1.55g/cc
- 2g/cc

preparation
- tile
- pressed (Zeiss)
- pressed (Zeiss) & sintered
- pressed (hydr.)
- pressed (hydr.) & sintered

surface
- polished
- sanded (600 grit)
- pressed against 320/600/1500/9µm/40µm

illumin. angle: _____ °	µmeter reading: _______	# scans: ____	time: ______ sec.

ANGLE	TABLE Y_{NBS} (45°/0°)	PMT_{NBS} (45°/0°)	MEASURED Y_{NBS} (45°/0°)	PMT_{sample}	MEASURED Y_{sample}	ADJUSTED Y_{sample}
-35°						
-30°						
-20°						
-10°						
0°						
+10°						
+20°						
+30°						
+40°						
+43°						
+45°						
+47°						
+50°						
+60°						
+70°						
+80°						

Appendix 24

Different Materials Data

Viewing Angle	Russian Opal	BaSO4	1.55g-600 grit
-35	0.905	1.081	1.025
-30	0.917	1.069	1.027
-20	0.934	1.065	1.038
-10	0.946	1.065	1.057
0	0.956	1.068	1.085
10	0.964	1.074	1.122
20	0.967	1.089	1.170
30	0.967	1.103	1.235
40	0.959	1.127	1.319
43	1.064	1.136	1.348
45	5.000	1.140	1.367
47	1.306	1.149	1.385
50	0.932	1.161	1.427
60	0.872	1.206	1.547
70	0.755	1.278	1.707
80	0.523	1.353	1.946

Appendix 25

Different Halon Densities Data

Viewing Angle	1g/cc	1.55g/cc	2g/cc
-35	1.000	1.013	1.016
-30	1.001	1.016	1.018
-20	1.014	1.033	1.024
-10	1.033	1.054	1.040
0	1.058	1.086	1.057
10	1.094	1.128	1.086
20	1.135	1.188	1.142
30	1.196	1.291	1.366
40	1.278	1.453	3.423
43	1.305	1.518	
45	1.326	1.558	
47	1.349	1.595	
50	1.380	1.687	
60	1.512	1.902	2.327
70	1.666	2.190	1.618
80	1.852	2.521	1.174

Appendix 26

Ultralap Technical Data Sheet

technical data

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Appendix 27

Different Surface Preparations Data (1.55g/cc)

Viewing Angle	polished glass	ground glass	sanded	320 grit	600 grit	1500 grit	9 microns	40 microns
-35	0.939	1.013	0.950	1.053	1.025			
-30	0.948	1.016	0.958	1.049	1.027	1.018	1.018	1.017
-20	0.969	1.033	0.980	1.058	1.038	1.029	1.029	1.027
-10	0.998	1.054	1.007	1.073	1.057	1.046	1.050	1.045
0	1.039	1.086	1.041	1.099	1.085	1.070	1.072	1.070
10	1.091	1.128	1.091	1.135	1.122	1.104	1.106	1.100
20	1.172	1.188	1.168	1.179	1.170	1.153	1.145	1.141
30	1.314	1.291	1.316	1.261	1.235	1.210	1.198	1.192
40	1.574	1.453	1.633	1.360	1.319	1.286	1.266	1.264
43	1.674	1.518	1.768	1.395	1.348			
45	1.727	1.558	1.856	1.418	1.367	1.336	1.308	1.308
47	1.776	1.595	1.933	1.440	1.385			
50	1.874	1.687		1.481	1.427	1.389	1.348	1.355
60	2.228	1.902		1.590	1.547	1.520	1.461	1.472
70	2.541	2.190		1.707	1.707	1.703	1.600	1.620
80	3.014	2.521		1.899	1.946	1.972	1.758	1.798

Appendix 28

1g/cc & 1.55g/cc-40μm Tablets Data

Viewing Angle	1 - gnd glass	1 - 320 grit	1 - 600 grit	1 - 40 microns	1.55 - 40μm
-35	0.985	1.037	1.035		
-30	0.991	1.037	1.036	1.028	1.017
-20	1.007	1.050	1.044	1.040	1.027
-10	1.030	1.066	1.065	1.056	1.045
0	1.057	1.090	1.086	1.080	1.070
10	1.092	1.115	1.114	1.108	1.100
20	1.141	1.151	1.150	1.149	1.141
30	1.209	1.202	1.200	1.200	1.192
40	1.300	1.262	1.261	1.261	1.264
43	1.332	1.283	1.286		
45	1.356	1.300	1.296	1.296	1.308
47	1.383	1.318	1.315		
50	1.418	1.343	1.384	1.342	1.355
60	1.555	1.455	1.449	1.439	1.472
70	1.688	1.598	1.590	1.561	1.620
80		1.811	1.776	1.698	1.798

Appendix 29

REPEATABILITY CHECK - HALON sample / with replacement.
****

BIDIRECTIONAL ABSOLUTE SPECTRAL REFLECTANCE FACTORS [-45 deg/0 deg]
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WAV. [nm]	Bss mean	Bss coeff. var.	Bsp mean	Bsp coeff. var.	Bps mean	Bps coeff. var.	Bpp mean	Bpp coeff. var.	Brr mean	Brr coeff. var.
390	1.058	0.59	0.919	0.95	0.955	1.03	1.026	0.68	0.990	0.39
395	1.068	0.38	0.937	0.45	0.971	0.46	1.035	0.31	1.003	0.16
400	1.070	0.23	0.939	0.64	0.969	0.41	1.041	0.41	1.005	0.13
405	1.075	0.25	0.944	0.32	0.976	0.25	1.048	0.32	1.011	0.19
410	1.078	0.17	0.944	0.33	0.979	0.33	1.047	0.18	1.012	0.16
415	1.079	0.34	0.947	0.16	0.979	0.34	1.051	0.21	1.014	0.24
420	1.080	0.13	0.948	0.22	0.977	0.31	1.052	0.15	1.014	0.15
425	1.079	0.24	0.949	0.24	0.976	0.26	1.053	0.24	1.014	0.21
430	1.080	0.17	0.948	0.21	0.977	0.32	1.054	0.27	1.015	0.21
435	1.081	0.17	0.948	0.20	0.976	0.30	1.055	0.23	1.015	0.19
440	1.081	0.34	0.946	0.26	0.975	0.29	1.051	0.15	1.014	0.24
445	1.081	0.20	0.946	0.15	0.976	0.16	1.052	0.18	1.014	0.15
450	1.079	0.13	0.948	0.24	0.975	0.26	1.051	0.11	1.013	0.16
455	1.079	0.21	0.949	0.29	0.973	0.25	1.052	0.21	1.013	0.22
460	1.080	0.07	0.947	0.26	0.975	0.20	1.051	0.19	1.013	0.15
465	1.089	0.11	0.942	0.34	0.981	0.25	1.047	0.21	1.015	0.21
470	1.081	0.14	0.946	0.19	0.975	0.23	1.053	0.21	1.014	0.14
475	1.082	0.19	0.945	0.28	0.977	0.32	1.051	0.15	1.014	0.21
480	1.081	0.14	0.944	0.18	0.974	0.20	1.051	0.30	1.013	0.18
485	1.082	0.08	0.945	0.21	0.974	0.21	1.053	0.19	1.014	0.15
490	1.085	0.08	0.946	0.09	0.977	0.19	1.057	0.12	1.016	0.11
495	1.086	0.17	0.945	0.17	0.976	0.21	1.055	0.18	1.015	0.17
500	1.084	0.19	0.944	0.12	0.976	0.27	1.055	0.24	1.015	0.19
505	1.084	0.25	0.944	0.14	0.975	0.18	1.055	0.14	1.015	0.16
510	1.083	0.25	0.946	0.13	0.976	0.19	1.057	0.25	1.016	0.19
515	1.083	0.09	0.945	0.19	0.974	0.16	1.057	0.28	1.015	0.16
520	1.086	0.44	0.942	0.21	0.974	0.25	1.055	0.27	1.014	0.26
525	1.087	0.11	0.945	0.09	0.975	0.26	1.057	0.36	1.016	0.18
530	1.086	0.22	0.944	0.38	0.974	0.33	1.058	0.44	1.015	0.30
535	1.087	0.19	0.946	0.19	0.974	0.23	1.059	0.36	1.017	0.17
540	1.084	0.11	0.944	0.27	0.975	0.10	1.057	0.18	1.015	0.12
545	1.088	0.19	0.947	0.33	0.977	0.13	1.058	0.20	1.017	0.17
550	1.090	0.34	0.945	0.27	0.976	0.24	1.058	0.29	1.017	0.26
555	1.089	0.32	0.944	0.11	0.975	0.22	1.057	0.30	1.016	0.19
560	1.087	0.23	0.945	0.23	0.975	0.23	1.059	0.36	1.017	0.22
565	1.085	0.12	0.943	0.33	0.973	0.30	1.059	0.44	1.015	0.27
570	1.090	0.44	0.947	0.29	0.973	0.25	1.059	0.52	1.017	0.32
575	1.090	0.27	0.946	0.28	0.976	0.36	1.062	0.43	1.018	0.30
580	1.091	0.08	0.944	0.28	0.974	0.18	1.061	0.28	1.018	0.15
585	1.092	0.28	0.946	0.05	0.978	0.23	1.062	0.17	1.019	0.16
590	1.091	0.37	0.946	0.08	0.978	0.29	1.061	0.17	1.019	0.18
595	1.094	0.39	0.946	0.25	0.976	0.20	1.060	0.22	1.019	0.23
600	1.094	0.26	0.947	0.28	0.977	0.30	1.061	0.12	1.020	0.20
605	1.094	0.35	0.947	0.28	0.975	0.25	1.064	0.22	1.020	0.15
610	1.091	0.28	0.944	0.14	0.975	0.17	1.063	0.32	1.018	0.20
615	1.089	0.24	0.945	0.20	0.975	0.24	1.061	0.23	1.017	0.21
620	1.090	0.19	0.944	0.11	0.976	0.24	1.061	0.12	1.018	0.08
625	1.096	0.46	0.944	0.20	0.977	0.45	1.063	0.24	1.020	0.28
630	1.098	0.32	0.946	0.37	0.977	0.21	1.067	0.31	1.022	0.23
635	1.091	0.31	0.945	0.31	0.974	0.31	1.063	0.38	1.018	0.22
640	1.093	0.37	0.942	0.42	0.974	0.19	1.061	0.42	1.018	0.26
645	1.094	0.31	0.946	0.29	0.976	0.34	1.065	0.26	1.020	0.21
650	1.092	0.21	0.948	0.26	0.974	0.49	1.066	0.35	1.020	0.19
655	1.091	0.10	0.942	0.32	0.976	0.28	1.062	0.04	1.018	0.10
660	1.090	0.30	0.941	0.33	0.970	0.19	1.062	0.50	1.016	0.30
665	1.091	0.55	0.943	0.50	0.973	0.10	1.062	0.39	1.017	0.35
670	1.098	0.43	0.942	0.29	0.973	0.06	1.062	0.41	1.019	0.24
675	1.093	0.34	0.943	0.57	0.972	0.26	1.065	0.60	1.018	0.36
680	1.094	0.24	0.941	0.14	0.973	0.35	1.060	0.28	1.017	0.17
685	1.095	0.30	0.944	0.35	0.974	0.24	1.063	0.38	1.019	0.11
690	1.097	0.24	0.945	0.66	0.979	0.48	1.060	0.31	1.020	0.21
695	1.096	0.55	0.936	0.14	0.974	0.72	1.063	0.32	1.017	0.31
700	1.095	0.61	0.942	0.36	0.975	1.17	1.066	0.38	1.019	0.34
705	1.095	0.36	0.939	0.50	0.981	0.58	1.065	0.50	1.020	0.19
710	1.097	0.48	0.944	0.83	0.976	0.41	1.065	0.73	1.021	0.28
715	1.105	0.62	0.949	0.40	0.975	0.24	1.060	0.67	1.022	0.20
720	1.095	0.34	0.939	0.78	0.974	0.53	1.067	0.39	1.019	0.33
725	1.098	0.41	0.943	0.22	0.973	0.87	1.064	0.88	1.020	0.35
730	1.102	0.52	0.943	0.74	0.985	0.73	1.070	1.36	1.025	0.76

REPEATABILITY CHECK - HALON / same section of lapping film sheet.
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BIDIRECTIONAL ABSOLUTE SPECTRAL REFLECTANCE FACTORS [-45 deg/0 deg]
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WAV. [nm]	Bss mean	Bss coeff. var.	Bsp mean	Bsp coeff. var.	Bps mean	Bps coeff. var.	Bpp mean	Bpp coeff. var.	Brr mean	Brr coeff. var.
390	1.062	0.82	0.934	1.20	0.957	1.20	1.034	1.01	0.997	0.43
395	1.074	0.19	0.947	0.45	0.976	0.39	1.045	0.53	1.011	0.22
400	1.075	0.26	0.946	0.86	0.981	0.28	1.050	0.48	1.013	0.30
405	1.082	0.28	0.952	0.22	0.984	0.34	1.054	0.36	1.018	0.23
410	1.085	0.37	0.952	0.15	0.986	0.12	1.054	0.28	1.019	0.17
415	1.087	0.25	0.953	0.45	0.985	0.20	1.059	0.30	1.021	0.23
420	1.086	0.12	0.953	0.31	0.984	0.21	1.057	0.19	1.020	0.15
425	1.088	0.34	0.956	0.19	0.984	0.25	1.059	0.22	1.022	0.17
430	1.088	0.32	0.957	0.62	0.984	0.24	1.061	0.29	1.022	0.28
435	1.088	0.32	0.954	0.25	0.984	0.33	1.060	0.20	1.022	0.26
440	1.086	0.21	0.952	0.31	0.982	0.18	1.059	0.32	1.020	0.21
445	1.088	0.30	0.954	0.22	0.984	0.28	1.058	0.14	1.021	0.20
450	1.087	0.27	0.954	0.31	0.983	0.34	1.059	0.42	1.021	0.30
455	1.087	0.25	0.955	0.23	0.982	0.27	1.059	0.25	1.021	0.22
460	1.089	0.35	0.952	0.23	0.984	0.41	1.059	0.20	1.021	0.28
465	1.096	0.24	0.949	0.25	0.989	0.23	1.054	0.23	1.022	0.22
470	1.088	0.36	0.953	0.31	0.982	0.27	1.059	0.31	1.021	0.28
475	1.090	0.26	0.952	0.24	0.983	0.13	1.058	0.26	1.021	0.20
480	1.089	0.43	0.951	0.27	0.981	0.29	1.058	0.29	1.020	0.26
485	1.090	0.28	0.951	0.29	0.982	0.26	1.060	0.22	1.021	0.25
490	1.092	0.26	0.953	0.27	0.985	0.27	1.061	0.18	1.023	0.22
495	1.092	0.18	0.953	0.34	0.983	0.23	1.063	0.32	1.023	0.25
500	1.090	0.30	0.951	0.31	0.983	0.26	1.061	0.24	1.021	0.23
505	1.092	0.28	0.951	0.28	0.983	0.36	1.062	0.28	1.022	0.26
510	1.091	0.24	0.952	0.26	0.983	0.20	1.063	0.18	1.022	0.21
515	1.091	0.31	0.952	0.21	0.982	0.39	1.063	0.21	1.022	0.24
520	1.091	0.10	0.950	0.36	0.981	0.21	1.061	0.24	1.021	0.19
525	1.092	0.18	0.951	0.21	0.983	0.20	1.063	0.16	1.022	0.17
530	1.092	0.12	0.952	0.29	0.980	0.17	1.064	0.07	1.022	0.12
535	1.094	0.32	0.953	0.28	0.982	0.27	1.066	0.18	1.024	0.23
540	1.095	0.50	0.952	0.38	0.984	0.40	1.065	0.39	1.024	0.40
545	1.096	0.26	0.953	0.36	0.982	0.22	1.066	0.25	1.024	0.24
550	1.096	0.37	0.952	0.26	0.982	0.21	1.067	0.39	1.024	0.25
555	1.095	0.14	0.951	0.25	0.983	0.27	1.065	0.25	1.023	0.21
560	1.095	0.36	0.954	0.26	0.982	0.31	1.067	0.26	1.024	0.26
565	1.094	0.27	0.950	0.18	0.981	0.22	1.066	0.22	1.023	0.16
570	1.099	0.22	0.951	0.26	0.983	0.34	1.066	0.17	1.025	0.20
575	1.097	0.23	0.953	0.37	0.985	0.21	1.068	0.08	1.026	0.19
580	1.097	0.27	0.951	0.36	0.983	0.36	1.068	0.17	1.025	0.24
585	1.098	0.34	0.953	0.41	0.985	0.21	1.069	0.22	1.026	0.26
590	1.098	0.27	0.953	0.47	0.985	0.28	1.069	0.46	1.026	0.30
595	1.100	0.28	0.953	0.31	0.983	0.22	1.069	0.34	1.026	0.22
600	1.101	0.32	0.953	0.28	0.985	0.41	1.069	0.34	1.027	0.26
605	1.103	0.56	0.953	0.35	0.984	0.35	1.072	0.24	1.028	0.28
610	1.100	0.28	0.951	0.44	0.983	0.10	1.069	0.25	1.026	0.14
615	1.099	0.46	0.950	0.42	0.983	0.28	1.067	0.30	1.025	0.28
620	1.100	0.34	0.950	0.62	0.984	0.35	1.071	0.56	1.026	0.33
625	1.104	0.25	0.953	0.45	0.986	0.23	1.071	0.38	1.028	0.26
630	1.105	0.53	0.952	0.32	0.985	0.31	1.070	0.32	1.028	0.29
635	1.098	0.53	0.951	0.21	0.984	0.32	1.069	0.24	1.025	0.27
640	1.101	0.39	0.948	0.44	0.984	0.46	1.069	0.24	1.026	0.26
645	1.103	0.49	0.951	0.35	0.983	0.35	1.071	0.36	1.027	0.33
650	1.104	0.40	0.953	0.40	0.985	0.64	1.071	0.44	1.028	0.30
655	1.103	0.36	0.950	0.36	0.982	0.27	1.070	0.49	1.026	0.31
660	1.100	0.43	0.947	0.32	0.978	0.39	1.066	0.45	1.023	0.30
665	1.100	0.23	0.950	0.36	0.981	0.59	1.068	0.45	1.025	0.35
670	1.104	0.27	0.952	0.55	0.980	0.35	1.069	0.20	1.026	0.24
675	1.104	0.18	0.949	0.26	0.984	0.60	1.070	0.25	1.027	0.17
680	1.103	0.29	0.947	0.47	0.982	0.22	1.067	0.36	1.025	0.14
685	1.105	0.19	0.950	0.44	0.986	0.24	1.066	0.30	1.027	0.25
690	1.105	0.14	0.950	0.61	0.985	0.71	1.069	0.58	1.027	0.26
695	1.101	0.36	0.949	0.54	0.980	0.54	1.069	0.47	1.025	0.21
700	1.107	0.74	0.952	0.84	0.984	0.57	1.069	0.30	1.028	0.41
705	1.104	0.74	0.952	0.81	0.987	0.68	1.072	0.19	1.029	0.42
710	1.106	0.38	0.948	0.43	0.985	0.58	1.070	0.62	1.027	0.37
715	1.107	0.73	0.951	0.71	0.983	0.50	1.071	1.00	1.028	0.31
720	1.108	0.60	0.958	0.90	0.980	0.77	1.071	1.11	1.029	0.30
725	1.106	0.41	0.952	0.46	0.982	0.41	1.070	0.64	1.027	0.32
730	1.102	1.00	0.950	0.83	0.985	0.59	1.071	0.61	1.027	0.37

REPEATABILITY CHECK - DIFFERENT SECTIONS OF SAME LAPPING FILM SHEET.
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BIDIRECTIONAL ABSOLUTE SPECTRAL REFLECTANCE FACTORS [-45 deg/0 deg]
****

WAV. [nm]	Bss mean	Bss coeff. var.	Bsp mean	Bsp coeff. var.	Bps mean	Bps coeff. var.	Bpp mean	Bpp coeff. var.	Brr mean	Brr coeff. var.
390	1.061	0.94	0.931	1.79	0.967	0.85	1.045	1.54	1.001	1.14
395	1.075	0.52	0.949	0.42	0.981	0.32	1.050	0.32	1.014	0.16
400	1.079	0.30	0.954	0.36	0.981	0.45	1.049	0.45	1.016	0.25
405	1.085	0.27	0.954	0.22	0.988	0.43	1.058	0.22	1.022	0.19
410	1.091	0.47	0.957	0.66	0.990	0.29	1.062	0.21	1.025	0.36
415	1.090	0.31	0.959	0.26	0.989	0.28	1.064	0.46	1.026	0.28
420	1.090	0.30	0.958	0.40	0.988	0.22	1.062	0.29	1.025	0.26
425	1.091	0.39	0.960	0.40	0.988	0.32	1.066	0.38	1.026	0.33
430	1.091	0.14	0.958	0.28	0.988	0.28	1.066	0.23	1.026	0.20
435	1.091	0.37	0.959	0.37	0.989	0.34	1.064	0.39	1.026	0.34
440	1.089	0.30	0.958	0.20	0.986	0.27	1.063	0.43	1.024	0.26
445	1.093	0.28	0.959	0.20	0.988	0.27	1.065	0.42	1.026	0.27
450	1.091	0.23	0.957	0.24	0.987	0.37	1.064	0.29	1.025	0.25
455	1.091	0.31	0.959	0.19	0.986	0.26	1.064	0.30	1.025	0.24
460	1.093	0.33	0.958	0.28	0.989	0.20	1.064	0.41	1.026	0.26
465	1.101	0.32	0.954	0.26	0.994	0.26	1.060	0.27	1.027	0.27
470	1.094	0.31	0.958	0.20	0.987	0.30	1.066	0.25	1.026	0.26
475	1.094	0.31	0.956	0.30	0.987	0.31	1.065	0.27	1.025	0.27
480	1.093	0.31	0.956	0.37	0.986	0.30	1.064	0.43	1.025	0.32
485	1.094	0.28	0.957	0.24	0.987	0.28	1.065	0.29	1.026	0.23
490	1.097	0.27	0.958	0.23	0.989	0.33	1.069	0.34	1.028	0.26
495	1.097	0.40	0.958	0.29	0.989	0.30	1.068	0.32	1.028	0.30
500	1.096	0.36	0.958	0.31	0.987	0.20	1.067	0.37	1.027	0.28
505	1.095	0.27	0.956	0.24	0.988	0.28	1.068	0.28	1.027	0.25
510	1.096	0.27	0.959	0.27	0.988	0.26	1.069	0.26	1.028	0.23
515	1.096	0.15	0.957	0.21	0.988	0.45	1.069	0.33	1.027	0.27
520	1.099	0.32	0.955	0.31	0.986	0.33	1.067	0.17	1.027	0.27
525	1.098	0.30	0.957	0.43	0.988	0.38	1.069	0.34	1.028	0.33
530	1.097	0.25	0.959	0.27	0.987	0.35	1.069	0.27	1.028	0.24
535	1.099	0.27	0.960	0.29	0.988	0.44	1.071	0.43	1.030	0.32
540	1.099	0.17	0.958	0.38	0.988	0.34	1.070	0.45	1.029	0.31
545	1.100	0.27	0.958	0.39	0.989	0.21	1.071	0.34	1.030	0.27
550	1.100	0.21	0.957	0.26	0.989	0.26	1.071	0.44	1.029	0.23
555	1.100	0.20	0.958	0.38	0.988	0.36	1.072	0.28	1.029	0.25
560	1.102	0.27	0.959	0.34	0.988	0.29	1.072	0.31	1.030	0.20
565	1.101	0.20	0.957	0.34	0.988	0.30	1.070	0.34	1.029	0.26
570	1.103	0.27	0.958	0.38	0.988	0.40	1.072	0.40	1.030	0.33
575	1.102	0.38	0.959	0.29	0.990	0.40	1.074	0.44	1.031	0.32
580	1.104	0.35	0.958	0.41	0.990	0.42	1.074	0.28	1.031	0.32
585	1.105	0.35	0.958	0.33	0.988	0.35	1.074	0.56	1.031	0.36
590	1.105	0.20	0.958	0.33	0.990	0.35	1.074	0.58	1.032	0.32
595	1.106	0.37	0.960	0.36	0.991	0.26	1.074	0.54	1.033	0.33
600	1.106	0.50	0.959	0.28	0.991	0.15	1.076	0.38	1.033	0.22
605	1.107	0.47	0.958	0.51	0.991	0.46	1.078	0.27	1.033	0.34
610	1.105	0.50	0.957	0.48	0.991	0.24	1.076	0.44	1.032	0.32
615	1.107	0.43	0.958	0.15	0.989	0.36	1.074	0.34	1.032	0.25
620	1.105	0.43	0.958	0.29	0.990	0.19	1.075	0.35	1.032	0.24
625	1.106	0.23	0.960	0.43	0.992	0.54	1.078	0.40	1.034	0.35
630	1.109	0.38	0.958	0.45	0.991	0.34	1.079	0.54	1.034	0.37
635	1.103	0.30	0.955	0.29	0.989	0.48	1.073	0.42	1.030	0.31
640	1.105	0.38	0.955	0.44	0.990	0.36	1.075	0.44	1.031	0.28
645	1.107	0.34	0.958	0.43	0.990	0.35	1.078	0.55	1.033	0.37
650	1.109	0.52	0.957	0.46	0.990	0.34	1.079	0.23	1.034	0.25
655	1.106	0.25	0.956	0.45	0.987	0.34	1.077	0.35	1.032	0.27
660	1.106	0.32	0.953	0.50	0.986	0.35	1.075	0.50	1.030	0.31
665	1.109	0.27	0.956	0.34	0.986	0.57	1.075	0.42	1.032	0.35
670	1.105	0.42	0.954	0.47	0.986	0.49	1.075	0.73	1.030	0.31
675	1.107	0.41	0.954	0.37	0.989	0.27	1.078	0.19	1.032	0.23
680	1.107	0.49	0.952	0.32	0.982	0.53	1.074	0.53	1.029	0.39
685	1.109	0.37	0.954	0.64	0.987	0.11	1.077	0.54	1.032	0.35
690	1.114	0.68	0.957	0.73	0.987	0.55	1.083	0.25	1.035	0.41
695	1.103	0.62	0.950	0.56	0.985	0.36	1.077	0.11	1.028	0.33
700	1.108	0.64	0.954	0.58	0.984	0.76	1.079	0.64	1.031	0.54
705	1.108	0.45	0.959	0.76	0.985	0.65	1.082	0.91	1.034	0.53
710	1.117	0.75	0.958	0.96	0.993	0.92	1.081	0.96	1.037	0.64
715	1.118	0.55	0.960	0.49	0.991	0.67	1.079	0.98	1.037	0.41
720	1.114	0.48	0.955	0.47	0.984	0.64	1.077	0.61	1.032	0.32
725	1.114	0.72	0.959	1.06	0.986	0.37	1.074	0.42	1.033	0.37
730	1.114	0.22	0.955	1.11	0.992	0.75	1.080	1.14	1.035	0.52

REPEATABILITY CHECK - DIFFERENT LAPPING FILM SHEETS.
****

BIDIRECTIONAL ABSOLUTE SPECTRAL REFLECTANCE FACTORS [-45 deg/0 deg]
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WAV. [nm]	Bss mean	Bss coeff. var.	Bsp mean	Bsp coeff. var.	Bps mean	Bps coeff. var.	Bpp mean	Bpp coeff. var.	Brr mean	Brr coeff. var.
390	1.056	1.03	0.935	0.95	0.961	0.94	1.029	1.37	0.995	0.58
395	1.072	0.37	0.945	0.74	0.975	0.75	1.048	0.28	1.010	0.39
400	1.077	0.38	0.945	0.50	0.976	0.43	1.046	0.47	1.011	0.30
405	1.081	0.23	0.950	0.45	0.982	0.46	1.056	0.22	1.018	0.29
410	1.083	0.44	0.951	0.42	0.983	0.28	1.055	0.41	1.018	0.33
415	1.085	0.37	0.952	0.19	0.985	0.37	1.056	0.18	1.020	0.24
420	1.083	0.36	0.952	0.38	0.983	0.39	1.058	0.33	1.019	0.34
425	1.085	0.39	0.954	0.35	0.983	0.37	1.058	0.28	1.020	0.31
430	1.084	0.37	0.954	0.35	0.984	0.38	1.060	0.20	1.021	0.30
435	1.086	0.35	0.953	0.40	0.983	0.32	1.059	0.50	1.020	0.34
440	1.084	0.39	0.952	0.39	0.982	0.30	1.057	0.25	1.019	0.29
445	1.087	0.32	0.952	0.34	0.982	0.31	1.058	0.25	1.020	0.28
450	1.085	0.32	0.952	0.43	0.981	0.45	1.058	0.20	1.019	0.33
455	1.085	0.29	0.952	0.37	0.981	0.38	1.058	0.26	1.019	0.31
460	1.087	0.32	0.950	0.35	0.983	0.45	1.058	0.38	1.020	0.36
465	1.095	0.32	0.947	0.35	0.989	0.35	1.053	0.33	1.021	0.32
470	1.087	0.41	0.951	0.32	0.982	0.25	1.058	0.33	1.020	0.31
475	1.088	0.28	0.950	0.28	0.983	0.38	1.058	0.27	1.020	0.29
480	1.087	0.35	0.951	0.26	0.981	0.35	1.058	0.30	1.019	0.30
485	1.087	0.39	0.951	0.30	0.981	0.39	1.059	0.36	1.020	0.34
490	1.090	0.50	0.953	0.32	0.984	0.37	1.062	0.24	1.022	0.31
495	1.090	0.30	0.953	0.34	0.982	0.34	1.063	0.29	1.022	0.30
500	1.090	0.46	0.952	0.36	0.982	0.29	1.061	0.21	1.021	0.31
505	1.091	0.33	0.952	0.32	0.983	0.38	1.062	0.25	1.022	0.30
510	1.090	0.26	0.951	0.36	0.983	0.30	1.063	0.25	1.022	0.28
515	1.090	0.47	0.951	0.43	0.982	0.31	1.062	0.40	1.021	0.37
520	1.088	0.59	0.950	0.30	0.983	0.34	1.061	0.26	1.021	0.34
525	1.090	0.41	0.951	0.29	0.983	0.27	1.063	0.31	1.022	0.31
530	1.090	0.43	0.952	0.38	0.981	0.32	1.064	0.48	1.021	0.38
535	1.092	0.39	0.953	0.24	0.982	0.28	1.065	0.40	1.023	0.31
540	1.094	0.41	0.952	0.49	0.981	0.36	1.064	0.32	1.023	0.35
545	1.096	0.32	0.951	0.32	0.983	0.30	1.065	0.26	1.024	0.25
550	1.094	0.44	0.954	0.31	0.984	0.26	1.064	0.32	1.024	0.27
555	1.093	0.55	0.951	0.41	0.982	0.36	1.065	0.27	1.023	0.37
560	1.094	0.54	0.953	0.38	0.983	0.31	1.065	0.38	1.024	0.38
565	1.092	0.41	0.951	0.32	0.980	0.35	1.064	0.38	1.022	0.34
570	1.096	0.39	0.952	0.28	0.984	0.37	1.068	0.41	1.025	0.31
575	1.097	0.43	0.953	0.39	0.985	0.28	1.067	0.24	1.025	0.31
580	1.098	0.42	0.952	0.41	0.983	0.31	1.069	0.45	1.026	0.38
585	1.098	0.32	0.952	0.29	0.984	0.38	1.066	0.45	1.025	0.33
590	1.098	0.24	0.952	0.58	0.983	0.24	1.069	0.40	1.026	0.32
595	1.099	0.50	0.954	0.39	0.984	0.19	1.068	0.46	1.026	0.35
600	1.100	0.48	0.954	0.42	0.985	0.30	1.068	0.18	1.027	0.32
605	1.100	0.35	0.953	0.33	0.985	0.35	1.069	0.42	1.027	0.27
610	1.098	0.48	0.950	0.23	0.982	0.42	1.069	0.45	1.025	0.35
615	1.100	0.26	0.952	0.38	0.983	0.29	1.068	0.39	1.026	0.28
620	1.099	0.41	0.952	0.30	0.985	0.33	1.070	0.34	1.026	0.30
625	1.100	0.43	0.953	0.23	0.984	0.49	1.071	0.19	1.027	0.30
630	1.100	0.36	0.953	0.30	0.986	0.33	1.070	0.55	1.027	0.34
635	1.097	0.65	0.950	0.41	0.982	0.39	1.070	0.38	1.025	0.42
640	1.097	0.49	0.949	0.36	0.983	0.33	1.069	0.54	1.025	0.39
645	1.100	0.35	0.951	0.37	0.984	0.54	1.070	0.16	1.027	0.23
650	1.106	0.52	0.954	0.59	0.985	0.69	1.070	0.29	1.029	0.40
655	1.098	0.50	0.950	0.54	0.983	0.41	1.069	0.23	1.025	0.38
660	1.097	0.50	0.951	0.43	0.978	0.38	1.065	0.28	1.023	0.34
665	1.101	0.34	0.949	0.09	0.984	0.26	1.068	0.41	1.025	0.23
670	1.100	0.46	0.947	0.20	0.981	0.74	1.065	0.41	1.023	0.33
675	1.097	0.24	0.950	0.70	0.983	0.54	1.072	0.70	1.026	0.49
680	1.100	0.58	0.947	0.48	0.979	0.37	1.064	0.43	1.023	0.42
685	1.103	0.37	0.948	0.44	0.981	0.28	1.067	0.41	1.025	0.28
690	1.109	0.26	0.953	0.42	0.984	0.66	1.073	0.57	1.030	0.29
695	1.103	0.28	0.949	0.49	0.982	0.49	1.070	0.53	1.026	0.30
700	1.100	0.70	0.951	0.61	0.984	1.06	1.072	0.83	1.027	0.62
705	1.102	0.59	0.952	0.87	0.984	0.48	1.071	0.43	1.027	0.24
710	1.110	0.68	0.950	0.63	0.983	0.44	1.070	0.47	1.028	0.39
715	1.106	0.87	0.953	0.96	0.986	0.64	1.068	0.51	1.028	0.57
720	1.106	1.03	0.949	1.44	0.982	0.50	1.071	0.84	1.027	0.79
725	1.107	0.55	0.949	1.17	0.984	0.54	1.072	0.32	1.028	0.37
730	1.108	0.95	0.948	1.00	0.986	0.82	1.075	1.39	1.029	0.69

REPEATABILITY CHECK - Halon / medium term.
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BIDIRECTIONAL ABSOLUTE SPECTRAL REFLECTANCE FACTORS [-45 deg/0 deg]
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WAV.	Bss		Bsp		Bps		Bpp		Brr	
[nm]	mean	coeff. var.	mean	coeff. var.	mean	coeff. var.	mean	coeff. var.	mean	coeff. var.
390	1.049	0.50	0.954	0.52	0.922	0.46	1.016	0.94	0.985	0.54
395	1.064	0.57	0.969	0.55	0.944	0.96	1.041	0.60	1.004	0.54
400	1.063	0.58	0.966	0.74	0.941	0.76	1.045	0.91	1.004	0.69
405	1.072	0.80	0.977	0.78	0.952	1.05	1.052	0.78	1.013	0.81
410	1.076	0.91	0.976	0.78	0.953	1.10	1.052	0.68	1.014	0.82
415	1.077	0.91	0.980	0.69	0.953	1.05	1.057	0.74	1.017	0.80
420	1.076	1.08	0.981	0.75	0.954	1.10	1.059	0.81	1.017	0.90
425	1.079	1.23	0.981	0.87	0.954	1.24	1.060	0.94	1.018	1.03
430	1.076	1.00	0.981	0.78	0.952	1.14	1.060	0.92	1.018	0.91
435	1.077	1.15	0.981	0.96	0.952	1.31	1.059	1.01	1.017	1.05
440	1.078	1.12	0.981	0.84	0.952	1.35	1.060	1.09	1.018	1.04
445	1.079	1.15	0.981	0.98	0.952	1.34	1.058	1.08	1.018	1.09
450	1.079	1.22	0.980	0.95	0.952	1.30	1.059	1.04	1.017	1.09
455	1.079	1.03	0.980	0.91	0.952	1.22	1.059	1.02	1.017	1.00
460	1.080	1.03	0.979	0.89	0.953	1.27	1.057	0.89	1.017	0.98
465	1.085	1.08	0.973	0.93	0.958	1.20	1.052	0.89	1.017	0.98
470	1.080	1.02	0.979	0.84	0.951	1.12	1.059	0.87	1.017	0.92
475	1.079	0.91	0.977	0.82	0.952	1.30	1.058	1.02	1.016	0.97
480	1.079	0.79	0.977	0.81	0.950	1.26	1.058	0.93	1.016	0.89
485	1.079	0.81	0.977	0.69	0.951	1.14	1.057	0.80	1.016	0.81
490	1.079	0.92	0.977	0.77	0.953	1.24	1.058	0.72	1.017	0.87
495	1.079	0.88	0.976	0.68	0.950	1.11	1.057	0.82	1.016	0.83
500	1.079	0.73	0.976	0.72	0.949	1.11	1.057	0.70	1.015	0.78
505	1.080	0.74	0.977	0.69	0.950	0.95	1.058	0.68	1.016	0.73
510	1.081	0.80	0.976	0.71	0.949	1.00	1.058	0.75	1.016	0.77
515	1.081	0.73	0.975	0.59	0.949	1.02	1.058	0.62	1.016	0.69
520	1.081	0.62	0.974	0.53	0.948	0.89	1.057	0.64	1.015	0.61
525	1.080	0.66	0.973	0.51	0.948	0.80	1.056	0.75	1.014	0.63
530	1.079	0.56	0.973	0.61	0.946	0.81	1.056	0.71	1.014	0.61
535	1.079	0.46	0.973	0.54	0.947	0.76	1.056	0.64	1.014	0.53
540	1.081	0.45	0.974	0.53	0.948	0.71	1.057	0.58	1.015	0.49
545	1.081	0.45	0.973	0.50	0.947	0.73	1.057	0.51	1.015	0.50
550	1.081	0.42	0.973	0.50	0.946	0.63	1.056	0.40	1.014	0.43
555	1.082	0.51	0.972	0.62	0.947	0.64	1.055	0.52	1.014	0.52
560	1.082	0.60	0.973	0.45	0.946	0.65	1.056	0.44	1.014	0.50
565	1.082	0.59	0.971	0.38	0.946	0.67	1.054	0.38	1.013	0.46
570	1.083	0.38	0.971	0.56	0.946	0.73	1.054	0.45	1.013	0.47
575	1.083	0.46	0.970	0.44	0.946	0.57	1.054	0.50	1.013	0.44
580	1.084	0.35	0.971	0.53	0.946	0.55	1.056	0.54	1.014	0.44
585	1.083	0.40	0.971	0.40	0.948	0.61	1.056	0.46	1.014	0.42
590	1.085	0.38	0.971	0.31	0.947	0.59	1.057	0.38	1.015	0.33
595	1.087	0.34	0.970	0.44	0.947	0.83	1.056	0.54	1.015	0.46
600	1.087	0.28	0.970	0.37	0.949	0.45	1.057	0.52	1.016	0.34
605	1.088	0.26	0.968	0.44	0.947	0.70	1.056	0.57	1.015	0.36
610	1.087	0.39	0.969	0.46	0.949	0.65	1.057	0.38	1.015	0.44
615	1.086	0.43	0.969	0.60	0.946	0.68	1.056	0.46	1.014	0.47
620	1.087	0.39	0.969	0.50	0.947	0.59	1.058	0.64	1.015	0.48
625	1.089	0.52	0.970	0.43	0.947	0.77	1.057	0.65	1.016	0.52
630	1.091	0.40	0.970	0.49	0.949	0.79	1.058	0.64	1.017	0.51
635	1.089	0.44	0.968	0.68	0.948	0.78	1.056	0.51	1.015	0.53
640	1.091	0.33	0.969	0.55	0.948	0.74	1.056	0.48	1.016	0.45
645	1.092	0.33	0.971	0.50	0.949	0.78	1.057	0.63	1.017	0.50
650	1.093	0.20	0.972	0.74	0.949	0.63	1.058	0.46	1.018	0.45
655	1.095	0.32	0.970	0.75	0.949	0.71	1.057	0.54	1.018	0.51
660	1.095	0.49	0.969	0.59	0.948	0.68	1.059	0.37	1.018	0.36
665	1.093	0.40	0.969	0.65	0.951	0.77	1.056	0.43	1.017	0.48
670	1.099	0.58	0.970	0.58	0.951	0.87	1.057	1.06	1.019	0.63
675	1.094	0.63	0.969	0.93	0.951	0.72	1.058	0.75	1.018	0.63
680	1.092	0.45	0.970	0.64	0.949	0.79	1.055	0.94	1.016	0.55
685	1.096	0.36	0.970	0.71	0.948	0.72	1.057	0.84	1.018	0.50
690	1.099	0.31	0.968	0.52	0.951	0.56	1.059	0.99	1.019	0.43
695	1.098	0.54	0.970	0.70	0.950	0.60	1.060	0.50	1.019	0.50
700	1.098	0.42	0.972	0.58	0.954	0.69	1.058	1.02	1.021	0.60
705	1.097	0.89	0.974	0.85	0.949	0.76	1.057	0.77	1.019	0.64
710	1.097	0.60	0.969	0.78	0.949	0.90	1.055	0.89	1.018	0.66
715	1.099	0.59	0.967	0.59	0.950	0.80	1.059	1.20	1.019	0.65
720	1.101	0.22	0.969	1.12	0.948	0.73	1.066	0.89	1.021	0.58
725	1.103	0.55	0.970	0.55	0.949	0.30	1.057	1.36	1.020	0.60
730	1.101	0.75	0.967	0.78	0.951	0.52	1.061	0.79	1.020	0.61

Appendix 30

$BaSO_4$ Reflectance Factors

(60 angle combinations)

0°/-75° BIDIRECTIONAL ABSOLUTE SPECTRAL REFLECTANCE FACTORS FOR $BaSO_4$

Wav	Bss	Bsp	Bps	Bpp	Brr
390	0.970	0.860	0.860	0.947	0.904
395	0.979	0.871	0.871	0.955	0.913
400	0.975	0.876	0.876	0.960	0.913
405	0.983	0.877	0.877	0.970	0.920
410	0.986	0.880	0.880	0.965	0.921
415	0.984	0.885	0.885	0.968	0.923
420	0.985	0.882	0.882	0.970	0.922
425	0.987	0.883	0.883	0.971	0.923
430	0.982	0.883	0.883	0.968	0.921
435	0.983	0.883	0.883	0.968	0.922
440	0.981	0.883	0.883	0.971	0.922
445	0.987	0.882	0.882	0.968	0.923
450	0.985	0.885	0.885	0.972	0.924
455	0.984	0.884	0.884	0.971	0.923
460	0.983	0.884	0.884	0.972	0.924
465	0.991	0.879	0.879	0.967	0.925
470	0.985	0.885	0.885	0.969	0.924
475	0.988	0.886	0.886	0.973	0.926
480	0.984	0.886	0.886	0.971	0.925
485	0.985	0.888	0.888	0.973	0.926
490	0.988	0.889	0.889	0.975	0.928
495	0.987	0.888	0.888	0.976	0.929
500	0.987	0.888	0.888	0.973	0.927
505	0.988	0.890	0.890	0.975	0.928
510	0.991	0.891	0.891	0.979	0.931
515	0.990	0.890	0.890	0.976	0.930
520	0.992	0.890	0.890	0.979	0.931
525	0.990	0.892	0.892	0.978	0.932
530	0.989	0.893	0.893	0.979	0.931
535	0.989	0.892	0.892	0.979	0.932
540	0.993	0.894	0.894	0.980	0.933
545	0.994	0.896	0.896	0.979	0.933
550	0.991	0.895	0.895	0.981	0.933
555	0.993	0.896	0.896	0.981	0.934
560	0.991	0.895	0.869	0.983	0.935

Wav	Bss	Bsp	Bps	Bpp	Brr
565	0.985	0.897	0.868	0.982	0.933
570	0.991	0.899	0.872	0.983	0.936
575	0.993	0.898	0.870	0.983	0.936
580	0.997	0.897	0.871	0.984	0.937
585	0.995	0.896	0.870	0.984	0.936
590	0.998	0.899	0.869	0.982	0.937
595	0.990	0.896	0.869	0.979	0.933
600	0.992	0.899	0.870	0.982	0.936
605	0.999	0.895	0.870	0.985	0.937
610	0.996	0.895	0.869	0.987	0.937
615	0.994	0.897	0.871	0.986	0.937
620	0.992	0.898	0.873	0.985	0.937
625	0.996	0.897	0.873	0.982	0.937
630	0.995	0.898	0.872	0.988	0.938
635	0.996	0.903	0.874	0.987	0.940
640	0.991	0.898	0.871	0.980	0.935
645	0.998	0.898	0.875	0.986	0.939
650	0.996	0.900	0.875	0.989	0.940
655	0.999	0.903	0.876	0.989	0.942
660	1.000	0.895	0.874	0.980	0.937
665	0.997	0.897	0.874	0.982	0.938
670	1.004	0.902	0.876	0.983	0.941
675	0.994	0.897	0.874	0.987	0.938
680	0.998	0.898	0.879	0.987	0.941
685	0.996	0.897	0.872	0.984	0.937
690	1.002	0.903	0.876	0.980	0.940
695	0.996	0.893	0.874	0.985	0.937
700	0.997	0.900	0.885	0.984	0.941
705	0.996	0.899	0.876	0.981	0.938
710	0.995	0.905	0.879	0.987	0.941
715	0.998	0.905	0.876	0.993	0.943
720	0.992	0.905	0.875	0.992	0.941
725	0.994	0.900	0.871	0.983	0.937
730	1.000	0.885	0.885	0.974	0.936

0°/-60° BIDIRECTIONAL ABSOLUTE SPECTRAL REFLECTANCE FACTORS FOR $BaSO_4$

Wav	Bss	Bsp	Bps	Bpp	Brr
390	1.028	0.936	0.936	1.015	0.971
395	1.040	0.930	0.930	1.037	0.982
400	1.045	0.936	0.936	1.032	0.983
405	1.052	0.943	0.943	1.040	0.991
410	1.054	0.944	0.944	1.040	0.992
415	1.051	0.945	0.945	1.042	0.992
420	1.053	0.947	0.947	1.042	0.993
425	1.051	0.949	0.949	1.046	0.995
430	1.052	0.948	0.948	1.047	0.994
435	1.052	0.949	0.949	1.043	0.993
440	1.049	0.948	0.948	1.041	0.992
445	1.052	0.949	0.949	1.040	0.993
450	1.048	0.951	0.951	1.041	0.993
455	1.050	0.950	0.950	1.044	0.994
460	1.054	0.949	0.949	1.044	0.995
465	1.057	0.944	0.944	1.041	0.995
470	1.053	0.951	0.951	1.047	0.996
475	1.056	0.949	0.949	1.044	0.996
480	1.054	0.949	0.949	1.043	0.995
485	1.052	0.953	0.953	1.046	0.997
490	1.056	0.952	0.952	1.048	0.998
495	1.054	0.952	0.952	1.047	0.997
500	1.053	0.949	0.949	1.044	0.995
505	1.058	0.953	0.953	1.045	0.998
510	1.055	0.951	0.951	1.046	0.998
515	1.057	0.951	0.951	1.049	0.999
520	1.058	0.953	0.953	1.046	0.999
525	1.056	0.954	0.954	1.047	0.999
530	1.058	0.955	0.955	1.048	0.999
535	1.054	0.956	0.956	1.048	0.999
540	1.055	0.952	0.952	1.046	0.999
545	1.061	0.955	0.955	1.049	1.001
550	1.057	0.955	0.955	1.051	1.001
555	1.060	0.958	0.958	1.046	1.001
560	1.055	0.960	0.940	1.047	1.001
565	1.056	0.958	0.942	1.046	1.000
570	1.061	0.960	0.941	1.048	1.002
575	1.063	0.957	0.943	1.048	1.003
580	1.059	0.955	0.938	1.052	1.001
585	1.059	0.955	0.941	1.048	1.001
590	1.063	0.955	0.941	1.048	1.002
595	1.059	0.958	0.945	1.047	1.002
600	1.055	0.958	0.942	1.051	1.001
605	1.060	0.960	0.945	1.046	1.003
610	1.059	0.956	0.948	1.045	1.002
615	1.056	0.955	0.941	1.045	0.999
620	1.058	0.957	0.946	1.045	1.001
625	1.059	0.955	0.944	1.048	1.002
630	1.060	0.957	0.944	1.053	1.003
635	1.058	0.959	0.942	1.045	1.001
640	1.061	0.957	0.942	1.046	1.002
645	1.066	0.954	0.945	1.044	1.002
650	1.063	0.956	0.942	1.046	1.002
655	1.058	0.961	0.947	1.052	1.004
660	1.062	0.961	0.941	1.048	1.003
665	1.056	0.953	0.946	1.045	1.000
670	1.062	0.958	0.949	1.048	1.004
675	1.062	0.957	0.949	1.045	1.003
680	1.064	0.962	0.954	1.037	1.004
685	1.060	0.957	0.948	1.040	1.001
690	1.064	0.957	0.951	1.042	1.004
695	1.068	0.960	0.951	1.047	1.007
700	1.067	0.958	0.951	1.048	1.006
705	1.068	0.966	0.943	1.043	1.005
710	1.067	0.961	0.947	1.055	1.008
715	1.059	0.956	0.961	1.045	1.005
720	1.062	0.965	0.958	1.050	1.009
725	1.077	0.955	0.944	1.044	1.005
730	1.067	0.952	0.940	1.047	1.002

0°/-45° BIDIRECTIONAL ABSOLUTE SPECTRAL REFLECTANCE FACTORS FOR $BaSO_4$

Wav	Bss	Bsp	Bps	Bpp	Brr
390	1.077	0.950	0.950	1.061	1.012
395	1.081	0.970	0.970	1.075	1.023
400	1.078	0.969	0.969	1.070	1.020
405	1.087	0.979	0.979	1.082	1.030
410	1.089	0.978	0.978	1.082	1.030
415	1.092	0.980	0.980	1.087	1.032
420	1.090	0.983	0.983	1.086	1.032
425	1.088	0.981	0.981	1.089	1.032
430	1.086	0.984	0.984	1.086	1.032
435	1.089	0.981	0.981	1.083	1.031
440	1.087	0.981	0.981	1.084	1.031
445	1.090	0.981	0.981	1.085	1.032
450	1.090	0.983	0.983	1.086	1.033
455	1.089	0.984	0.984	1.088	1.033
460	1.092	0.985	0.985	1.084	1.034
465	1.096	0.975	0.975	1.081	1.033
470	1.091	0.984	0.984	1.087	1.035
475	1.091	0.984	0.984	1.083	1.033
480	1.091	0.986	0.986	1.084	1.034
485	1.092	0.986	0.986	1.085	1.035
490	1.091	0.985	0.985	1.090	1.036
495	1.092	0.985	0.985	1.092	1.036
500	1.092	0.987	0.987	1.091	1.037
505	1.094	0.983	0.983	1.088	1.036
510	1.094	0.985	0.985	1.085	1.035
515	1.096	0.988	0.988	1.087	1.037
520	1.093	0.984	0.984	1.089	1.036
525	1.090	0.985	0.985	1.086	1.035
530	1.088	0.985	0.985	1.087	1.033
535	1.088	0.986	0.986	1.084	1.034
540	1.089	0.988	0.988	1.088	1.037
545	1.094	0.988	0.988	1.090	1.037
550	1.095	0.990	0.990	1.093	1.040
555	1.092	0.990	0.990	1.091	1.038
560	1.094	0.992	0.980	1.096	1.041

Wav	Bss	Bsp	Bps	Bpp	Brr
565	1.092	0.986	0.979	1.089	1.036
570	1.092	0.989	0.982	1.093	1.039
575	1.094	0.982	0.983	1.089	1.037
580	1.098	0.989	0.982	1.088	1.039
585	1.098	0.982	0.983	1.082	1.036
590	1.096	0.985	0.983	1.084	1.037
595	1.093	0.986	0.982	1.085	1.036
600	1.095	0.983	0.985	1.089	1.038
605	1.095	0.984	0.986	1.090	1.039
610	1.103	0.990	0.986	1.086	1.041
615	1.101	0.989	0.984	1.088	1.041
620	1.098	0.986	0.985	1.092	1.040
625	1.092	0.989	0.986	1.089	1.039
630	1.094	0.990	0.987	1.088	1.040
635	1.098	0.989	0.987	1.090	1.041
640	1.107	0.988	0.986	1.081	1.041
645	1.099	0.987	0.988	1.092	1.041
650	1.096	0.984	0.982	1.086	1.037
655	1.098	0.991	0.984	1.083	1.039
660	1.098	0.994	0.984	1.081	1.039
665	1.103	0.988	0.983	1.084	1.040
670	1.109	0.993	0.985	1.086	1.043
675	1.105	0.988	0.988	1.088	1.042
680	1.106	0.990	0.990	1.089	1.044
685	1.105	0.988	0.987	1.091	1.043
690	1.104	0.987	0.995	1.097	1.046
695	1.101	0.996	0.981	1.089	1.042
700	1.102	1.000	0.987	1.096	1.046
705	1.098	0.992	0.984	1.081	1.039
710	1.121	0.997	0.999	1.086	1.051
715	1.106	0.991	0.995	1.094	1.046
720	1.101	0.982	0.989	1.091	1.041
725	1.104	0.989	0.986	1.090	1.042
730	1.099	0.986	0.986	1.082	1.038

0°/-30° BIDIRECTIONAL ABSOLUTE SPECTRAL REFLECTANCE FACTORS FOR $BaSO_4$

Wav	Bss	Bsp	Bps	Bpp	Brr
390	1.092	0.970	0.970	1.087	1.030
395	1.110	0.993	0.993	1.106	1.047
400	1.108	0.983	0.983	1.110	1.046
405	1.112	0.994	0.994	1.117	1.054
410	1.119	0.997	0.997	1.115	1.056
415	1.113	1.001	1.001	1.121	1.057
420	1.113	1.002	1.002	1.119	1.057
425	1.119	1.001	1.001	1.126	1.060
430	1.117	1.002	1.002	1.123	1.059
435	1.114	0.999	0.999	1.119	1.057
440	1.114	1.003	1.003	1.120	1.058
445	1.115	1.001	1.001	1.124	1.059
450	1.116	1.003	1.003	1.123	1.060
455	1.117	1.003	1.003	1.122	1.060
460	1.118	1.001	1.001	1.121	1.059
465	1.125	0.994	0.994	1.117	1.060
470	1.120	1.004	1.004	1.121	1.060
475	1.116	1.001	1.001	1.119	1.058
480	1.116	1.003	1.003	1.119	1.059
485	1.114	1.001	1.001	1.117	1.058
490	1.123	1.006	1.006	1.120	1.061
495	1.119	1.003	1.003	1.120	1.060
500	1.116	1.002	1.002	1.120	1.058
505	1.118	1.006	1.006	1.123	1.061
510	1.123	1.006	1.006	1.126	1.064
515	1.124	1.007	1.007	1.124	1.064
520	1.117	1.005	1.005	1.124	1.062
525	1.117	1.006	1.006	1.120	1.061
530	1.119	1.004	1.004	1.122	1.061
535	1.119	1.005	1.005	1.126	1.062
540	1.120	1.003	1.003	1.123	1.062
545	1.125	1.006	1.006	1.127	1.066
550	1.122	1.004	1.004	1.122	1.063
555	1.120	1.009	1.009	1.123	1.064
560	1.121	1.005	1.002	1.123	1.063
565	1.123	1.008	1.003	1.124	1.065
570	1.122	1.009	1.000	1.124	1.064
575	1.121	1.009	1.001	1.125	1.064
580	1.120	1.006	1.003	1.121	1.063
585	1.122	1.006	1.006	1.121	1.064
590	1.120	1.010	1.006	1.122	1.065
595	1.117	1.008	1.003	1.126	1.064
600	1.120	1.006	0.999	1.126	1.063
605	1.127	1.000	1.004	1.124	1.064
610	1.122	1.009	1.008	1.127	1.067
615	1.118	1.003	1.005	1.127	1.063
620	1.128	1.007	1.008	1.121	1.066
625	1.130	1.005	1.006	1.120	1.065
630	1.128	1.005	1.012	1.122	1.067
635	1.123	1.001	1.005	1.123	1.063
640	1.124	1.008	1.005	1.126	1.066
645	1.119	1.009	1.009	1.123	1.065
650	1.126	1.017	1.007	1.128	1.069
655	1.133	1.008	1.011	1.124	1.069
660	1.127	1.005	1.007	1.121	1.065
665	1.126	1.006	1.008	1.127	1.067
670	1.135	1.008	1.011	1.122	1.069
675	1.131	1.008	1.008	1.118	1.066
680	1.133	1.003	1.013	1.117	1.067
685	1.128	1.007	1.011	1.119	1.066
690	1.128	1.008	1.018	1.114	1.067
695	1.122	1.004	1.016	1.123	1.067
700	1.120	1.005	1.009	1.124	1.065
705	1.123	1.010	1.003	1.120	1.064
710	1.126	1.013	1.004	1.128	1.068
715	1.131	1.007	1.000	1.132	1.068
720	1.120	1.010	1.019	1.117	1.066
725	1.123	1.000	1.004	1.113	1.060
730	1.117	0.992	1.011	1.123	1.061

0°/-15° BIDIRECTIONAL ABSOLUTE SPECTRAL REFLECTANCE FACTORS FOR $BaSO_4$

Wav	Bss	Bsp	Bps	Bpp	Brr
390	1.124	0.994	0.994	1.136	1.058
395	1.137	0.996	0.996	1.144	1.068
400	1.125	0.997	0.997	1.141	1.065
405	1.135	1.004	1.004	1.157	1.074
410	1.139	1.008	1.008	1.153	1.076
415	1.140	1.008	1.008	1.155	1.077
420	1.137	1.010	1.010	1.158	1.077
425	1.139	1.011	1.011	1.160	1.079
430	1.140	1.011	1.011	1.159	1.078
435	1.140	1.009	1.009	1.162	1.079
440	1.138	1.010	1.010	1.157	1.076
445	1.139	1.008	1.008	1.157	1.077
450	1.142	1.008	1.008	1.158	1.078
455	1.139	1.009	1.009	1.157	1.077
460	1.140	1.009	1.009	1.158	1.078
465	1.148	1.005	1.005	1.155	1.079
470	1.141	1.008	1.008	1.161	1.079
475	1.139	1.009	1.009	1.157	1.078
480	1.137	1.008	1.008	1.161	1.078
485	1.138	1.007	1.007	1.161	1.079
490	1.140	1.010	1.010	1.165	1.081
495	1.138	1.012	1.012	1.161	1.079
500	1.137	1.011	1.011	1.159	1.079
505	1.140	1.014	1.014	1.161	1.080
510	1.142	1.012	1.012	1.163	1.081
515	1.142	1.014	1.014	1.159	1.081
520	1.147	1.010	1.010	1.161	1.082
525	1.145	1.011	1.011	1.157	1.081
530	1.140	1.009	1.009	1.161	1.080
535	1.140	1.012	1.012	1.160	1.081
540	1.144	1.009	1.009	1.164	1.081
545	1.145	1.012	1.012	1.161	1.081
550	1.141	1.011	1.011	1.166	1.082
555	1.141	1.009	1.009	1.166	1.082
560	1.139	1.010	1.007	1.162	1.080

Wav	Bss	Bsp	Bps	Bpp	Brr
565	1.145	1.012	1.009	1.165	1.082
570	1.145	1.013	1.011	1.164	1.083
575	1.141	1.010	1.010	1.164	1.081
580	1.145	1.013	1.009	1.169	1.084
585	1.147	1.012	1.011	1.162	1.083
590	1.147	1.012	1.013	1.163	1.084
595	1.145	1.010	1.014	1.170	1.085
600	1.150	1.010	1.007	1.167	1.084
605	1.144	1.008	1.012	1.162	1.082
610	1.137	1.014	1.011	1.170	1.083
615	1.141	1.009	1.011	1.170	1.083
620	1.139	1.004	1.014	1.165	1.081
625	1.146	1.010	1.012	1.169	1.084
630	1.154	1.010	1.013	1.167	1.086
635	1.153	1.010	1.011	1.158	1.083
640	1.148	1.006	1.012	1.162	1.082
645	1.144	1.009	1.011	1.166	1.083
650	1.151	1.010	1.015	1.164	1.085
655	1.151	1.010	1.015	1.168	1.086
660	1.145	1.014	1.010	1.161	1.083
665	1.143	1.009	1.013	1.174	1.085
670	1.143	1.013	1.013	1.165	1.083
675	1.149	1.007	1.016	1.169	1.085
680	1.138	1.009	1.017	1.152	1.079
685	1.147	1.007	1.014	1.163	1.083
690	1.157	1.006	1.021	1.164	1.087
695	1.152	1.004	1.018	1.169	1.086
700	1.153	1.015	1.014	1.174	1.089
705	1.143	1.010	1.017	1.167	1.084
710	1.148	1.014	1.014	1.174	1.088
715	1.153	1.005	1.022	1.170	1.087
720	1.141	1.007	1.010	1.172	1.082
725	1.147	1.011	1.013	1.158	1.082
730	1.149	1.001	1.017	1.166	1.083

0°/ 15° BIDIRECTIONAL ABSOLUTE SPECTRAL REFLECTANCE FACTORS FOR $BaSO_4$

Wav	Bss	Bsp	Bps	Bpp	Brr
390	1.116	0.987	0.987	1.123	1.052
395	1.130	0.987	0.987	1.144	1.063
400	1.125	0.994	0.994	1.147	1.064
405	1.135	1.001	1.001	1.153	1.073
410	1.136	1.005	1.005	1.153	1.073
415	1.140	1.006	1.006	1.155	1.076
420	1.137	1.008	1.008	1.154	1.075
425	1.140	1.011	1.011	1.161	1.079
430	1.140	1.005	1.005	1.159	1.076
435	1.137	1.005	1.005	1.160	1.076
440	1.135	1.008	1.008	1.157	1.075
445	1.137	1.005	1.005	1.158	1.075
450	1.142	1.006	1.006	1.158	1.077
455	1.137	1.006	1.006	1.157	1.076
460	1.140	1.007	1.007	1.158	1.077
465	1.147	1.002	1.002	1.153	1.078
470	1.141	1.004	1.004	1.161	1.077
475	1.139	1.007	1.007	1.156	1.077
480	1.136	1.007	1.007	1.159	1.077
485	1.138	1.004	1.004	1.160	1.077
490	1.138	1.008	1.008	1.164	1.080
495	1.137	1.008	1.008	1.160	1.077
500	1.136	1.007	1.007	1.159	1.077
505	1.140	1.011	1.011	1.160	1.079
510	1.142	1.008	1.008	1.160	1.079
515	1.140	1.011	1.011	1.157	1.079
520	1.145	1.004	1.004	1.161	1.079
525	1.144	1.009	1.009	1.156	1.079
530	1.138	1.005	1.005	1.157	1.077
535	1.140	1.007	1.007	1.159	1.079
540	1.141	1.008	1.008	1.161	1.079
545	1.142	1.010	1.010	1.161	1.080
550	1.141	1.009	1.009	1.166	1.081
555	1.137	1.007	1.007	1.165	1.080
560	1.136	1.009	1.008	1.162	1.078

Wav	Bss	Bsp	Bps	Bpp	Brr
565	1.143	1.008	1.007	1.165	1.081
570	1.145	1.008	1.010	1.164	1.082
575	1.138	1.005	1.008	1.164	1.079
580	1.144	1.010	1.007	1.166	1.082
585	1.147	1.009	1.007	1.162	1.081
590	1.145	1.011	1.010	1.162	1.082
595	1.144	1.007	1.012	1.170	1.083
600	1.150	1.008	1.007	1.165	1.082
605	1.143	1.005	1.011	1.164	1.081
610	1.137	1.010	1.010	1.168	1.081
615	1.141	1.008	1.009	1.170	1.082
620	1.139	1.005	1.013	1.163	1.080
625	1.145	1.007	1.013	1.171	1.084
630	1.153	1.008	1.011	1.166	1.085
635	1.148	1.005	1.013	1.161	1.082
640	1.145	1.008	1.010	1.163	1.081
645	1.142	1.006	1.013	1.161	1.080
650	1.149	1.006	1.015	1.162	1.083
655	1.148	1.012	1.014	1.166	1.085
660	1.143	1.012	1.009	1.163	1.082
665	1.143	1.004	1.011	1.168	1.081
670	1.143	1.006	1.015	1.167	1.083
675	1.140	1.007	1.014	1.169	1.083
680	1.137	1.004	1.014	1.155	1.077
685	1.150	1.010	1.014	1.162	1.084
690	1.158	1.007	1.018	1.155	1.085
695	1.153	1.005	1.017	1.167	1.085
700	1.147	1.015	1.015	1.166	1.086
705	1.146	1.004	1.004	1.164	1.080
710	1.143	1.004	1.012	1.167	1.082
715	1.146	1.000	1.023	1.177	1.087
720	1.140	1.003	1.008	1.172	1.081
725	1.141	1.010	1.013	1.169	1.083
730	1.142	1.004	1.008	1.156	1.078

0°/ 30° BIDIRECTIONAL ABSOLUTE SPECTRAL REFLECTANCE FACTORS FOR $BaSO_4$

Wav	Bss	Bsp	Bps	Bpp	Brr
390	1.086	0.986	0.986	1.095	1.034
395	1.097	0.988	0.988	1.107	1.043
400	1.102	0.985	0.985	1.107	1.043
405	1.104	0.992	0.992	1.112	1.049
410	1.114	0.995	0.995	1.114	1.053
415	1.110	0.998	0.998	1.116	1.054
420	1.107	0.999	0.999	1.118	1.054
425	1.113	0.999	0.999	1.120	1.056
430	1.112	0.999	0.999	1.121	1.055
435	1.111	0.997	0.997	1.117	1.054
440	1.110	1.000	1.000	1.118	1.055
445	1.112	0.998	0.998	1.120	1.055
450	1.113	1.001	1.001	1.120	1.057
455	1.113	1.001	1.001	1.120	1.057
460	1.114	0.999	0.999	1.118	1.056
465	1.120	0.993	0.993	1.115	1.057
470	1.115	1.001	1.001	1.120	1.057
475	1.110	0.999	0.999	1.117	1.055
480	1.110	1.000	1.000	1.116	1.055
485	1.109	1.000	1.000	1.113	1.054
490	1.118	1.002	1.002	1.117	1.057
495	1.115	1.000	1.000	1.120	1.057
500	1.113	1.000	1.000	1.116	1.055
505	1.114	1.003	1.003	1.120	1.057
510	1.117	1.003	1.003	1.123	1.060
515	1.119	1.003	1.003	1.123	1.061
520	1.111	1.005	1.005	1.122	1.059
525	1.110	1.004	1.004	1.118	1.057
530	1.113	1.003	1.003	1.119	1.057
535	1.113	1.002	1.002	1.122	1.058
540	1.117	1.001	1.001	1.118	1.059
545	1.120	1.005	1.005	1.123	1.062
550	1.116	1.003	1.003	1.121	1.060
555	1.115	1.006	1.006	1.119	1.060
560	1.117	1.005	0.999	1.121	1.060
565	1.115	1.006	1.000	1.121	1.061
570	1.118	1.008	0.998	1.121	1.061
575	1.114	1.007	0.996	1.124	1.060
580	1.116	1.006	0.998	1.121	1.060
585	1.116	1.003	0.999	1.117	1.059
590	1.112	1.008	1.002	1.119	1.060
595	1.114	1.005	1.000	1.121	1.060
600	1.115	1.003	0.996	1.124	1.060
605	1.123	1.000	1.000	1.124	1.062
610	1.116	1.005	1.006	1.125	1.063
615	1.115	1.002	1.002	1.125	1.061
620	1.125	1.003	1.006	1.124	1.064
625	1.124	1.002	1.002	1.119	1.062
630	1.126	1.003	1.006	1.118	1.063
635	1.119	0.998	1.002	1.116	1.059
640	1.121	1.006	1.003	1.121	1.063
645	1.111	1.007	1.006	1.119	1.061
650	1.118	1.008	1.005	1.122	1.063
655	1.126	1.004	1.006	1.119	1.064
660	1.127	1.002	1.002	1.115	1.062
665	1.119	1.009	1.001	1.125	1.063
670	1.124	1.002	1.008	1.121	1.064
675	1.129	1.009	1.004	1.116	1.065
680	1.130	1.001	1.010	1.114	1.064
685	1.121	1.004	1.008	1.117	1.063
690	1.121	1.011	1.015	1.116	1.066
695	1.122	0.994	1.015	1.121	1.063
700	1.115	1.001	0.998	1.117	1.058
705	1.117	1.002	1.002	1.121	1.060
710	1.125	1.010	0.994	1.126	1.064
715	1.122	0.998	1.000	1.127	1.062
720	1.116	1.001	1.012	1.126	1.064
725	1.124	0.992	1.003	1.114	1.059
730	1.127	0.996	0.998	1.115	1.059

0°/ 45° BIDIRECTIONAL ABSOLUTE SPECTRAL REFLECTANCE FACTORS FOR BaSO4

Wav	Bss	Bsp	Bps	Bpp	Brr
390	1.061	0.949	0.949	1.062	1.003
395	1.076	0.966	0.966	1.075	1.019
400	1.073	0.964	0.964	1.077	1.019
405	1.081	0.970	0.970	1.078	1.024
410	1.086	0.977	0.977	1.079	1.028
415	1.088	0.979	0.979	1.085	1.030
420	1.088	0.978	0.978	1.080	1.028
425	1.083	0.977	0.977	1.087	1.028
430	1.084	0.979	0.979	1.084	1.029
435	1.086	0.979	0.979	1.082	1.028
440	1.084	0.979	0.979	1.079	1.028
445	1.086	0.979	0.979	1.082	1.028
450	1.088	0.980	0.980	1.083	1.030
455	1.085	0.981	0.981	1.083	1.030
460	1.089	0.982	0.982	1.082	1.031
465	1.092	0.973	0.973	1.078	1.029
470	1.086	0.982	0.982	1.084	1.030
475	1.088	0.980	0.980	1.080	1.029
480	1.088	0.983	0.983	1.081	1.031
485	1.088	0.981	0.981	1.082	1.031
490	1.089	0.981	0.981	1.088	1.032
495	1.087	0.982	0.982	1.090	1.032
500	1.088	0.983	0.983	1.090	1.033
505	1.090	0.980	0.980	1.086	1.032
510	1.091	0.983	0.983	1.083	1.032
515	1.092	0.983	0.983	1.085	1.033
520	1.090	0.983	0.983	1.086	1.033
525	1.087	0.982	0.982	1.083	1.032
530	1.083	0.982	0.982	1.085	1.030
535	1.084	0.983	0.983	1.082	1.031
540	1.086	0.984	0.984	1.088	1.033
545	1.091	0.986	0.986	1.089	1.035
550	1.092	0.986	0.986	1.090	1.036
555	1.089	0.988	0.988	1.088	1.034
560	1.092	0.989	0.976	1.094	1.038

Wav	Bss	Bsp	Bps	Bpp	Brr
565	1.089	0.982	0.973	1.087	1.033
570	1.090	0.986	0.978	1.090	1.036
575	1.091	0.980	0.977	1.089	1.034
580	1.094	0.986	0.976	1.086	1.035
585	1.095	0.980	0.977	1.080	1.033
590	1.093	0.984	0.977	1.083	1.034
595	1.092	0.983	0.976	1.082	1.033
600	1.090	0.983	0.980	1.088	1.035
605	1.093	0.979	0.980	1.087	1.035
610	1.097	0.989	0.981	1.081	1.037
615	1.101	0.984	0.979	1.086	1.038
620	1.096	0.987	0.979	1.089	1.038
625	1.089	0.985	0.980	1.086	1.035
630	1.095	0.985	0.984	1.085	1.037
635	1.094	0.987	0.980	1.088	1.038
640	1.102	0.983	0.984	1.086	1.039
645	1.095	0.984	0.985	1.090	1.038
650	1.092	0.980	0.976	1.079	1.032
655	1.093	0.987	0.982	1.081	1.036
660	1.097	0.989	0.980	1.079	1.036
665	1.100	0.984	0.976	1.083	1.036
670	1.104	0.991	0.980	1.088	1.041
675	1.101	0.982	0.979	1.090	1.038
680	1.100	0.985	0.990	1.086	1.040
685	1.104	0.982	0.980	1.087	1.038
690	1.107	0.993	0.992	1.090	1.046
695	1.090	0.987	0.976	1.088	1.035
700	1.102	0.998	0.982	1.087	1.042
705	1.098	0.986	0.988	1.090	1.041
710	1.112	0.994	0.985	1.087	1.045
715	1.097	0.979	0.990	1.090	1.039
720	1.106	0.981	0.993	1.093	1.043
725	1.097	0.985	0.981	1.082	1.036
730	1.094	0.984	0.985	1.084	1.037

0°/ 60° BIDIRECTIONAL ABSOLUTE SPECTRAL REFLECTANCE FACTORS FOR $BaSO_4$

Wav	Bss	Bsp	Bps	Bpp	Brr
390	1.035	0.910	0.910	1.023	0.969
395	1.041	0.929	0.929	1.029	0.979
400	1.038	0.937	0.937	1.030	0.980
405	1.045	0.940	0.940	1.035	0.986
410	1.047	0.939	0.939	1.036	0.987
415	1.049	0.945	0.945	1.041	0.990
420	1.048	0.943	0.943	1.038	0.989
425	1.046	0.944	0.944	1.042	0.990
430	1.047	0.947	0.947	1.040	0.990
435	1.047	0.943	0.943	1.039	0.989
440	1.042	0.943	0.943	1.037	0.987
445	1.047	0.944	0.944	1.036	0.988
450	1.044	0.945	0.945	1.038	0.989
455	1.044	0.946	0.946	1.039	0.989
460	1.048	0.946	0.946	1.041	0.991
465	1.052	0.940	0.940	1.038	0.991
470	1.049	0.947	0.947	1.044	0.992
475	1.050	0.944	0.944	1.041	0.991
480	1.048	0.945	0.945	1.039	0.991
485	1.046	0.949	0.949	1.042	0.992
490	1.048	0.948	0.948	1.044	0.993
495	1.048	0.947	0.947	1.044	0.993
500	1.047	0.945	0.945	1.042	0.992
505	1.052	0.949	0.949	1.041	0.993
510	1.049	0.948	0.948	1.044	0.994
515	1.052	0.946	0.946	1.045	0.994
520	1.053	0.949	0.949	1.044	0.995
525	1.052	0.949	0.949	1.044	0.994
530	1.050	0.951	0.951	1.044	0.994
535	1.049	0.952	0.952	1.045	0.995
540	1.049	0.950	0.950	1.043	0.994
545	1.055	0.950	0.950	1.045	0.997
550	1.051	0.951	0.951	1.048	0.997
555	1.054	0.953	0.953	1.045	0.997
560	1.051	0.956	0.936	1.043	0.996

Wav	Bss	Bsp	Bps	Bpp	Brr
565	1.051	0.952	0.938	1.044	0.996
570	1.056	0.952	0.937	1.044	0.997
575	1.060	0.953	0.937	1.044	0.998
580	1.053	0.952	0.936	1.048	0.997
585	1.054	0.951	0.936	1.045	0.997
590	1.057	0.952	0.937	1.045	0.998
595	1.053	0.951	0.942	1.045	0.998
600	1.050	0.955	0.937	1.046	0.997
605	1.053	0.957	0.941	1.040	0.998
610	1.055	0.950	0.945	1.043	0.998
615	1.051	0.950	0.938	1.042	0.995
620	1.053	0.954	0.942	1.042	0.998
625	1.053	0.953	0.941	1.045	0.998
630	1.055	0.952	0.940	1.047	0.999
635	1.053	0.954	0.937	1.043	0.997
640	1.057	0.953	0.935	1.039	0.996
645	1.061	0.952	0.941	1.043	0.999
650	1.057	0.952	0.937	1.042	0.997
655	1.054	0.958	0.940	1.051	1.001
660	1.055	0.960	0.941	1.047	1.001
665	1.048	0.944	0.941	1.042	0.994
670	1.057	0.959	0.941	1.049	1.002
675	1.051	0.950	0.946	1.037	0.996
680	1.058	0.956	0.949	1.038	1.000
685	1.059	0.954	0.940	1.041	0.999
690	1.062	0.957	0.944	1.039	1.000
695	1.064	0.953	0.949	1.044	1.002
700	1.057	0.959	0.945	1.040	1.000
705	1.064	0.956	0.947	1.042	1.002
710	1.059	0.959	0.941	1.046	1.001
715	1.058	0.957	0.957	1.041	1.004
720	1.063	0.950	0.950	1.036	1.000
725	1.057	0.958	0.939	1.043	0.999
730	1.057	0.946	0.946	1.046	0.999

0°/ 75° BIDIRECTIONAL ABSOLUTE SPECTRAL REFLECTANCE FACTORS FOR $BaSO_4$

Wav	Bss	Bsp	Bps	Bpp	Brr
390	0.963	0.859	0.859	0.947	0.901
395	0.979	0.872	0.872	0.959	0.913
400	0.969	0.872	0.872	0.955	0.909
405	0.981	0.874	0.874	0.964	0.916
410	0.982	0.875	0.875	0.965	0.918
415	0.981	0.881	0.881	0.967	0.919
420	0.980	0.879	0.879	0.966	0.918
425	0.982	0.877	0.877	0.968	0.919
430	0.978	0.880	0.880	0.965	0.918
435	0.980	0.879	0.879	0.966	0.919
440	0.978	0.880	0.880	0.968	0.919
445	0.983	0.877	0.877	0.966	0.919
450	0.982	0.880	0.880	0.968	0.920
455	0.980	0.881	0.881	0.968	0.920
460	0.980	0.882	0.882	0.970	0.921
465	0.988	0.876	0.876	0.963	0.921
470	0.982	0.881	0.881	0.967	0.921
475	0.984	0.883	0.883	0.970	0.923
480	0.980	0.882	0.882	0.969	0.921
485	0.981	0.884	0.884	0.969	0.922
490	0.984	0.885	0.885	0.972	0.924
495	0.983	0.884	0.884	0.973	0.925
500	0.984	0.885	0.885	0.971	0.924
505	0.985	0.887	0.887	0.972	0.925
510	0.988	0.886	0.886	0.976	0.927
515	0.986	0.887	0.887	0.973	0.926
520	0.988	0.886	0.886	0.975	0.928
525	0.987	0.889	0.889	0.975	0.928
530	0.985	0.888	0.888	0.977	0.927
535	0.985	0.889	0.889	0.976	0.928
540	0.989	0.891	0.891	0.978	0.930
545	0.989	0.893	0.893	0.976	0.930
550	0.988	0.892	0.892	0.975	0.929
555	0.989	0.892	0.892	0.978	0.930
560	0.988	0.892	0.865	0.978	0.931
565	0.982	0.893	0.864	0.979	0.929
570	0.988	0.896	0.868	0.980	0.933
575	0.988	0.894	0.865	0.980	0.932
580	0.993	0.896	0.865	0.980	0.933
585	0.993	0.895	0.865	0.980	0.933
590	0.993	0.894	0.864	0.981	0.933
595	0.989	0.893	0.865	0.977	0.931
600	0.990	0.896	0.864	0.979	0.932
605	0.994	0.892	0.864	0.982	0.933
610	0.992	0.893	0.864	0.985	0.933
615	0.989	0.893	0.866	0.983	0.933
620	0.990	0.894	0.869	0.984	0.934
625	0.992	0.894	0.869	0.978	0.933
630	0.993	0.898	0.867	0.983	0.935
635	0.991	0.900	0.871	0.982	0.936
640	0.991	0.893	0.867	0.978	0.932
645	0.993	0.896	0.868	0.982	0.935
650	0.996	0.894	0.869	0.982	0.935
655	0.998	0.898	0.871	0.986	0.938
660	0.999	0.892	0.871	0.979	0.935
665	0.995	0.895	0.868	0.981	0.935
670	0.994	0.896	0.875	0.980	0.936
675	0.993	0.896	0.867	0.982	0.934
680	0.992	0.895	0.875	0.987	0.937
685	0.996	0.898	0.865	0.978	0.934
690	0.993	0.897	0.870	0.973	0.933
695	0.990	0.897	0.864	0.978	0.933
700	1.002	0.892	0.875	0.981	0.938
705	0.996	0.894	0.875	0.984	0.937
710	0.996	0.900	0.873	0.981	0.937
715	0.995	0.894	0.868	0.983	0.935
720	0.984	0.899	0.882	0.987	0.938
725	0.999	0.903	0.869	0.986	0.939
730	0.999	0.884	0.882	0.981	0.936

-15°/-75° BIDIRECTIONAL ABSOLUTE SPECTRAL REFLECTANCE FACTORS FOR $BaSO_4$

Wav	Bss	Bsp	Bps	Bpp	Brr
390	0.956	0.848	0.848	0.968	0.900
395	0.970	0.871	0.871	0.968	0.913
400	0.968	0.873	0.873	0.966	0.912
405	0.969	0.873	0.873	0.983	0.918
410	0.975	0.875	0.875	0.979	0.919
415	0.973	0.877	0.877	0.981	0.920
420	0.974	0.877	0.877	0.983	0.921
425	0.973	0.881	0.881	0.983	0.922
430	0.971	0.879	0.879	0.981	0.920
435	0.969	0.879	0.879	0.980	0.920
440	0.972	0.878	0.878	0.983	0.921
445	0.971	0.877	0.877	0.979	0.919
450	0.973	0.880	0.880	0.981	0.921
455	0.972	0.881	0.881	0.982	0.921
460	0.972	0.878	0.878	0.982	0.921
465	0.979	0.876	0.876	0.977	0.923
470	0.974	0.883	0.883	0.982	0.923
475	0.974	0.880	0.880	0.982	0.923
480	0.975	0.884	0.884	0.984	0.924
485	0.976	0.885	0.885	0.984	0.925
490	0.975	0.886	0.886	0.985	0.926
495	0.977	0.883	0.883	0.986	0.926
500	0.976	0.884	0.884	0.985	0.925
505	0.977	0.885	0.885	0.986	0.926
510	0.977	0.887	0.887	0.987	0.927
515	0.975	0.886	0.886	0.987	0.927
520	0.974	0.885	0.885	0.988	0.927
525	0.975	0.888	0.888	0.989	0.928
530	0.981	0.887	0.887	0.990	0.930
535	0.981	0.888	0.888	0.988	0.929
540	0.980	0.889	0.889	0.990	0.930
545	0.981	0.891	0.891	0.991	0.931
550	0.980	0.892	0.892	0.993	0.932
555	0.981	0.891	0.891	0.994	0.932
560	0.978	0.888	0.862	0.991	0.930

Wav	Bss	Bsp	Bps	Bpp	Brr
565	0.982	0.889	0.863	0.995	0.932
570	0.984	0.891	0.867	0.993	0.934
575	0.979	0.889	0.865	0.991	0.931
580	0.983	0.893	0.864	0.996	0.934
585	0.980	0.890	0.867	0.997	0.934
590	0.983	0.893	0.863	0.992	0.933
595	0.983	0.891	0.867	0.991	0.933
600	0.981	0.889	0.866	0.991	0.932
605	0.984	0.892	0.866	0.991	0.933
610	0.978	0.891	0.867	0.987	0.931
615	0.980	0.891	0.865	0.989	0.931
620	0.982	0.891	0.870	0.990	0.933
625	0.979	0.891	0.867	0.993	0.933
630	0.979	0.888	0.868	0.992	0.932
635	0.981	0.891	0.867	1.000	0.935
640	0.980	0.890	0.869	0.993	0.933
645	0.982	0.887	0.867	0.991	0.932
650	0.986	0.893	0.870	0.989	0.934
655	0.985	0.893	0.868	0.990	0.934
660	0.980	0.888	0.869	0.987	0.931
665	0.978	0.890	0.872	0.992	0.933
670	0.974	0.889	0.871	0.995	0.932
675	0.981	0.886	0.868	0.998	0.933
680	0.988	0.897	0.870	0.992	0.937
685	0.982	0.894	0.864	0.989	0.932
690	0.986	0.900	0.867	0.986	0.935
695	0.985	0.890	0.867	0.993	0.934
700	0.974	0.887	0.866	0.988	0.929
705	0.976	0.890	0.865	0.997	0.932
710	0.987	0.893	0.871	0.991	0.935
715	0.983	0.892	0.874	0.976	0.931
720	0.984	0.898	0.871	0.987	0.935
725	0.979	0.898	0.867	0.993	0.934
730	0.974	0.894	0.866	0.982	0.929

-15°/-60° BIDIRECTIONAL ABSOLUTE SPECTRAL REFLECTANCE FACTORS FOR $BaSO_4$

Wav	Bss	Bsp	Bps	Bpp	Brr
390	1.027	0.912	0.912	1.041	0.970
395	1.045	0.935	0.935	1.051	0.988
400	1.042	0.930	0.930	1.042	0.982
405	1.046	0.941	0.941	1.054	0.992
410	1.049	0.938	0.938	1.054	0.991
415	1.051	0.941	0.941	1.057	0.994
420	1.049	0.942	0.942	1.059	0.994
425	1.049	0.944	0.944	1.056	0.994
430	1.048	0.943	0.943	1.058	0.994
435	1.049	0.943	0.943	1.058	0.993
440	1.044	0.942	0.942	1.052	0.991
445	1.051	0.944	0.944	1.055	0.994
450	1.051	0.943	0.943	1.057	0.994
455	1.047	0.944	0.944	1.057	0.994
460	1.050	0.944	0.944	1.053	0.994
465	1.053	0.938	0.938	1.050	0.994
470	1.050	0.944	0.944	1.058	0.995
475	1.051	0.943	0.943	1.055	0.995
480	1.048	0.942	0.942	1.058	0.994
485	1.050	0.943	0.943	1.056	0.995
490	1.049	0.946	0.946	1.059	0.997
495	1.052	0.945	0.945	1.056	0.996
500	1.051	0.947	0.947	1.057	0.997
505	1.050	0.947	0.947	1.057	0.997
510	1.052	0.946	0.946	1.058	0.997
515	1.052	0.948	0.948	1.062	0.999
520	1.053	0.948	0.948	1.060	0.999
525	1.055	0.946	0.946	1.060	0.999
530	1.050	0.945	0.945	1.058	0.996
535	1.052	0.950	0.950	1.063	1.000
540	1.050	0.951	0.951	1.058	0.998
545	1.049	0.951	0.951	1.059	0.998
550	1.056	0.952	0.952	1.062	1.001
555	1.054	0.949	0.949	1.062	0.999
560	1.059	0.948	0.932	1.059	0.999

Wav	Bss	Bsp	Bps	Bpp	Brr
565	1.059	0.952	0.933	1.061	1.001
570	1.057	0.950	0.935	1.062	1.001
575	1.056	0.951	0.933	1.063	1.001
580	1.059	0.951	0.934	1.065	1.002
585	1.055	0.948	0.940	1.057	1.000
590	1.056	0.946	0.942	1.062	1.001
595	1.061	0.947	0.937	1.061	1.001
600	1.058	0.952	0.939	1.063	1.003
605	1.058	0.952	0.942	1.063	1.004
610	1.053	0.946	0.940	1.060	1.000
615	1.053	0.949	0.942	1.064	1.002
620	1.052	0.948	0.939	1.055	0.999
625	1.054	0.948	0.941	1.054	0.999
630	1.058	0.945	0.941	1.053	0.999
635	1.058	0.952	0.941	1.062	1.003
640	1.050	0.954	0.935	1.059	1.000
645	1.053	0.951	0.935	1.056	0.999
650	1.059	0.953	0.944	1.060	1.004
655	1.052	0.953	0.944	1.065	1.003
660	1.059	0.946	0.941	1.056	1.000
665	1.059	0.949	0.940	1.062	1.003
670	1.061	0.952	0.934	1.054	1.000
675	1.057	0.942	0.934	1.052	0.996
680	1.055	0.942	0.946	1.057	1.000
685	1.059	0.958	0.937	1.062	1.004
690	1.066	0.947	0.950	1.056	1.005
695	1.066	0.952	0.938	1.055	1.003
700	1.061	0.951	0.951	1.061	1.006
705	1.061	0.955	0.938	1.055	1.002
710	1.065	0.955	0.947	1.053	1.005
715	1.063	0.956	0.946	1.064	1.007
720	1.062	0.958	0.946	1.067	1.008
725	1.062	0.948	0.937	1.047	0.999
730	1.061	0.943	0.941	1.060	1.001

-15°/-45° BIDIRECTIONAL ABSOLUTE SPECTRAL REFLECTANCE FACTORS FOR $BaSO_4$

Wav	Bss	Bsp	Bps	Bpp	Brr
390	1.070	0.970	0.970	1.073	1.015
395	1.087	0.973	0.973	1.089	1.028
400	1.087	0.968	0.968	1.093	1.027
405	1.086	0.972	0.972	1.098	1.030
410	1.095	0.977	0.977	1.103	1.036
415	1.095	0.982	0.982	1.104	1.038
420	1.096	0.981	0.981	1.107	1.037
425	1.094	0.980	0.980	1.102	1.037
430	1.094	0.979	0.979	1.107	1.037
435	1.096	0.980	0.980	1.102	1.036
440	1.090	0.979	0.979	1.105	1.037
445	1.092	0.979	0.979	1.104	1.037
450	1.096	0.978	0.978	1.102	1.036
455	1.096	0.978	0.978	1.105	1.038
460	1.096	0.978	0.978	1.110	1.039
465	1.101	0.976	0.976	1.102	1.040
470	1.098	0.982	0.982	1.109	1.040
475	1.098	0.980	0.980	1.103	1.039
480	1.096	0.979	0.979	1.103	1.038
485	1.097	0.982	0.982	1.106	1.039
490	1.098	0.981	0.981	1.107	1.040
495	1.095	0.980	0.980	1.106	1.039
500	1.101	0.982	0.982	1.100	1.039
505	1.101	0.980	0.980	1.104	1.041
510	1.097	0.983	0.983	1.105	1.040
515	1.098	0.982	0.982	1.108	1.041
520	1.097	0.983	0.983	1.105	1.040
525	1.099	0.982	0.982	1.103	1.041
530	1.100	0.982	0.982	1.107	1.042
535	1.100	0.985	0.985	1.106	1.042
540	1.099	0.981	0.981	1.109	1.042
545	1.103	0.984	0.984	1.105	1.043
550	1.103	0.984	0.984	1.109	1.044
555	1.102	0.985	0.985	1.103	1.043
560	1.098	0.984	0.982	1.106	1.042

Wav	Bss	Bsp	Bps	Bpp	Brr
565	1.100	0.983	0.978	1.108	1.042
570	1.102	0.984	0.983	1.106	1.044
575	1.105	0.983	0.978	1.102	1.042
580	1.105	0.985	0.983	1.108	1.045
585	1.100	0.984	0.978	1.103	1.041
590	1.105	0.984	0.982	1.112	1.045
595	1.101	0.988	0.982	1.105	1.044
600	1.102	0.986	0.979	1.104	1.043
605	1.098	0.980	0.978	1.111	1.042
610	1.103	0.981	0.980	1.110	1.043
615	1.098	0.983	0.980	1.107	1.042
620	1.100	0.980	0.981	1.108	1.042
625	1.102	0.982	0.980	1.105	1.042
630	1.102	0.984	0.980	1.107	1.044
635	1.105	0.987	0.980	1.109	1.045
640	1.106	0.982	0.982	1.103	1.044
645	1.101	0.986	0.982	1.106	1.044
650	1.106	0.990	0.984	1.107	1.047
655	1.104	0.983	0.986	1.105	1.045
660	1.102	0.986	0.982	1.108	1.045
665	1.102	0.986	0.984	1.103	1.044
670	1.105	0.985	0.988	1.107	1.046
675	1.100	0.983	0.986	1.102	1.043
680	1.109	0.986	0.981	1.098	1.043
685	1.103	0.981	0.986	1.104	1.044
690	1.107	0.983	0.984	1.111	1.046
695	1.101	0.987	0.980	1.108	1.044
700	1.107	0.978	0.985	1.100	1.042
705	1.105	0.987	0.983	1.101	1.044
710	1.124	0.988	0.996	1.107	1.054
715	1.108	0.992	0.994	1.095	1.047
720	1.113	0.985	0.976	1.117	1.048
725	1.110	0.986	0.987	1.106	1.047
730	1.109	0.995	0.980	1.097	1.045

-15°/-30° BIDIRECTIONAL ABSOLUTE SPECTRAL REFLECTANCE FACTORS FOR $BaSO_4$

Wav	Bss	Bsp	Bps	Bpp	Brr
390	1.105	0.980	0.980	1.120	1.042
395	1.119	0.989	0.989	1.140	1.056
400	1.118	0.982	0.982	1.137	1.054
405	1.121	0.985	0.985	1.149	1.060
410	1.130	0.991	0.991	1.150	1.065
415	1.127	0.990	0.990	1.156	1.066
420	1.127	0.992	0.992	1.155	1.065
425	1.130	0.992	0.992	1.157	1.066
430	1.129	0.995	0.995	1.155	1.067
435	1.125	0.993	0.993	1.152	1.064
440	1.123	0.993	0.993	1.154	1.064
445	1.130	0.994	0.994	1.155	1.066
450	1.125	0.993	0.993	1.152	1.064
455	1.124	0.994	0.994	1.152	1.064
460	1.127	0.991	0.991	1.154	1.066
465	1.132	0.989	0.989	1.146	1.065
470	1.131	0.994	0.994	1.154	1.066
475	1.125	0.992	0.992	1.152	1.064
480	1.126	0.993	0.993	1.154	1.066
485	1.121	0.994	0.994	1.154	1.065
490	1.129	0.995	0.995	1.154	1.067
495	1.133	0.997	0.997	1.153	1.068
500	1.132	0.995	0.995	1.150	1.067
505	1.127	0.995	0.995	1.151	1.066
510	1.128	0.992	0.992	1.158	1.067
515	1.128	0.996	0.996	1.161	1.069
520	1.128	0.991	0.991	1.156	1.066
525	1.129	0.994	0.994	1.160	1.069
530	1.130	0.994	0.994	1.161	1.069
535	1.130	0.996	0.996	1.160	1.069
540	1.127	0.999	0.999	1.163	1.069
545	1.128	0.999	0.999	1.160	1.070
550	1.130	1.001	1.001	1.157	1.070
555	1.130	0.994	0.994	1.157	1.068
560	1.127	0.993	0.993	1.162	1.069

Wav	Bss	Bsp	Bps	Bpp	Brr
565	1.127	0.994	0.992	1.158	1.068
570	1.128	0.997	0.993	1.152	1.068
575	1.128	0.993	0.989	1.155	1.066
580	1.126	0.998	0.990	1.164	1.070
585	1.129	0.998	0.989	1.163	1.070
590	1.128	0.995	0.993	1.165	1.070
595	1.134	0.993	0.993	1.157	1.069
600	1.131	0.992	0.991	1.162	1.069
605	1.130	0.989	0.993	1.159	1.067
610	1.134	0.996	0.995	1.162	1.072
615	1.131	0.996	0.990	1.154	1.068
620	1.136	0.993	0.988	1.157	1.069
625	1.138	0.989	0.994	1.156	1.069
630	1.138	0.995	0.997	1.157	1.072
635	1.134	0.990	0.991	1.159	1.068
640	1.135	0.991	0.995	1.158	1.070
645	1.133	0.995	0.995	1.159	1.070
650	1.135	0.992	0.996	1.163	1.072
655	1.130	0.990	0.999	1.163	1.070
660	1.131	0.996	0.998	1.162	1.072
665	1.133	0.999	0.992	1.156	1.070
670	1.134	0.992	0.995	1.153	1.069
675	1.125	0.999	0.999	1.160	1.071
680	1.138	0.994	0.997	1.162	1.073
685	1.134	0.995	0.999	1.159	1.072
690	1.140	0.993	0.994	1.161	1.072
695	1.130	0.994	0.999	1.154	1.069
700	1.114	0.994	0.996	1.159	1.066
705	1.133	0.992	0.991	1.151	1.067
710	1.129	1.005	0.995	1.161	1.072
715	1.132	0.996	0.996	1.161	1.071
720	1.131	0.987	1.002	1.155	1.069
725	1.130	0.997	0.984	1.151	1.065
730	1.123	0.990	0.993	1.162	1.067

-15°/ 0° BIDIRECTIONAL ABSOLUTE SPECTRAL REFLECTANCE FACTORS FOR $BaSO_4$

Wav	Bss	Bsp	Bps	Bpp	Brr
390	1.125	0.974	0.974	1.130	1.050
395	1.138	1.001	1.001	1.144	1.070
400	1.131	1.000	1.000	1.152	1.068
405	1.139	1.004	1.004	1.157	1.076
410	1.144	1.009	1.009	1.158	1.078
415	1.143	1.011	1.011	1.163	1.080
420	1.143	1.009	1.009	1.163	1.079
425	1.143	1.011	1.011	1.167	1.082
430	1.145	1.011	1.011	1.164	1.081
435	1.147	1.013	1.013	1.162	1.081
440	1.146	1.011	1.011	1.165	1.081
445	1.144	1.010	1.010	1.161	1.079
450	1.143	1.010	1.010	1.165	1.080
455	1.143	1.009	1.009	1.162	1.080
460	1.146	1.008	1.008	1.162	1.081
465	1.151	1.004	1.004	1.158	1.081
470	1.141	1.013	1.013	1.165	1.081
475	1.145	1.010	1.010	1.164	1.082
480	1.146	1.011	1.011	1.162	1.082
485	1.143	1.010	1.010	1.165	1.081
490	1.147	1.010	1.010	1.169	1.084
495	1.145	1.010	1.010	1.170	1.083
500	1.145	1.009	1.009	1.168	1.082
505	1.142	1.014	1.014	1.166	1.083
510	1.146	1.012	1.012	1.165	1.083
515	1.149	1.012	1.012	1.164	1.084
520	1.145	1.016	1.016	1.162	1.083
525	1.145	1.011	1.011	1.165	1.082
530	1.147	1.011	1.011	1.168	1.083
535	1.143	1.013	1.013	1.168	1.082
540	1.147	1.014	1.014	1.166	1.084
545	1.149	1.013	1.013	1.169	1.086
550	1.154	1.016	1.016	1.172	1.088
555	1.147	1.009	1.009	1.176	1.086
560	1.154	1.015	1.009	1.168	1.086

Wav	Bss	Bsp	Bps	Bpp	Brr
565	1.151	1.018	1.007	1.164	1.085
570	1.146	1.010	1.009	1.164	1.082
575	1.141	1.008	1.008	1.167	1.081
580	1.152	1.011	1.011	1.165	1.085
585	1.149	1.009	1.011	1.168	1.084
590	1.150	1.011	1.013	1.174	1.087
595	1.152	1.008	1.017	1.173	1.088
600	1.148	1.010	1.014	1.173	1.086
605	1.151	1.013	1.013	1.169	1.086
610	1.151	1.008	1.012	1.173	1.086
615	1.149	1.010	1.016	1.175	1.088
620	1.150	1.016	1.011	1.176	1.088
625	1.142	1.008	1.012	1.163	1.081
630	1.147	1.011	1.006	1.169	1.083
635	1.153	1.018	1.011	1.165	1.087
640	1.150	1.014	1.013	1.160	1.084
645	1.153	1.010	1.010	1.169	1.086
650	1.156	1.016	1.012	1.170	1.089
655	1.162	1.016	1.017	1.175	1.092
660	1.157	1.017	1.014	1.165	1.088
665	1.154	1.010	1.009	1.163	1.084
670	1.157	1.005	1.009	1.171	1.086
675	1.160	1.009	1.012	1.171	1.088
680	1.156	1.015	1.014	1.177	1.090
685	1.148	1.007	1.016	1.171	1.085
690	1.158	1.014	1.019	1.173	1.091
695	1.151	1.005	1.014	1.162	1.083
700	1.160	1.012	1.012	1.174	1.090
705	1.149	1.014	1.010	1.166	1.085
710	1.156	1.017	1.018	1.172	1.091
715	1.166	1.009	1.029	1.177	1.095
720	1.160	1.022	1.008	1.186	1.094
725	1.152	1.013	1.021	1.160	1.087
730	1.139	1.002	1.017	1.161	1.080

-15°/ 15° BIDIRECTIONAL ABSOLUTE SPECTRAL REFLECTANCE FACTORS FOR $BaSO_4$

Wav	Bss	Bsp	Bps	Bpp	Brr
390	1.103	1.004	1.004	1.105	1.047
395	1.118	0.992	0.992	1.119	1.056
400	1.114	0.996	0.996	1.121	1.056
405	1.123	1.002	1.002	1.124	1.062
410	1.126	1.011	1.011	1.124	1.065
415	1.128	1.010	1.010	1.133	1.069
420	1.131	1.008	1.008	1.135	1.069
425	1.130	1.013	1.013	1.133	1.071
430	1.126	1.013	1.013	1.131	1.069
435	1.125	1.012	1.012	1.134	1.069
440	1.125	1.012	1.012	1.132	1.068
445	1.125	1.007	1.007	1.133	1.069
450	1.127	1.010	1.010	1.135	1.070
455	1.129	1.011	1.011	1.134	1.070
460	1.132	1.011	1.011	1.132	1.071
465	1.138	1.005	1.005	1.126	1.071
470	1.128	1.012	1.012	1.135	1.071
475	1.132	1.014	1.014	1.131	1.071
480	1.133	1.010	1.010	1.135	1.073
485	1.131	1.013	1.013	1.135	1.073
490	1.131	1.012	1.012	1.138	1.074
495	1.129	1.011	1.011	1.132	1.070
500	1.128	1.013	1.013	1.135	1.072
505	1.130	1.012	1.012	1.135	1.072
510	1.131	1.013	1.013	1.131	1.071
515	1.135	1.016	1.016	1.133	1.074
520	1.132	1.013	1.013	1.134	1.072
525	1.133	1.013	1.013	1.137	1.074
530	1.135	1.012	1.012	1.138	1.074
535	1.131	1.016	1.016	1.135	1.073
540	1.135	1.018	1.018	1.133	1.075
545	1.139	1.013	1.013	1.135	1.075
550	1.133	1.014	1.014	1.139	1.075
555	1.133	1.013	1.013	1.138	1.074
560	1.129	1.018	1.013	1.137	1.074

Wav	Bss	Bsp	Bps	Bpp	Brr
565	1.129	1.011	1.016	1.133	1.072
570	1.131	1.009	1.015	1.138	1.073
575	1.130	1.013	1.013	1.137	1.073
580	1.135	1.019	1.019	1.137	1.078
585	1.133	1.013	1.016	1.131	1.073
590	1.138	1.016	1.012	1.137	1.076
595	1.141	1.018	1.013	1.136	1.077
600	1.140	1.020	1.017	1.140	1.079
605	1.134	1.019	1.019	1.131	1.076
610	1.136	1.019	1.019	1.135	1.077
615	1.137	1.013	1.019	1.136	1.076
620	1.133	1.011	1.012	1.136	1.073
625	1.130	1.011	1.013	1.138	1.073
630	1.136	1.020	1.017	1.133	1.076
635	1.136	1.024	1.015	1.135	1.078
640	1.135	1.018	1.024	1.133	1.078
645	1.133	1.012	1.022	1.126	1.073
650	1.136	1.010	1.022	1.139	1.077
655	1.143	1.014	1.024	1.139	1.080
660	1.150	1.017	1.021	1.141	1.082
665	1.138	1.017	1.021	1.137	1.078
670	1.135	1.016	1.031	1.136	1.080
675	1.140	1.015	1.026	1.128	1.077
680	1.139	1.022	1.022	1.135	1.080
685	1.135	1.024	1.027	1.132	1.080
690	1.139	1.021	1.021	1.142	1.081
695	1.137	1.013	1.013	1.141	1.076
700	1.143	1.016	1.015	1.140	1.078
705	1.144	1.021	1.025	1.144	1.083
710	1.149	1.019	1.022	1.144	1.084
715	1.150	1.004	1.032	1.134	1.080
720	1.142	1.023	1.044	1.133	1.085
725	1.151	1.009	1.027	1.131	1.080
730	1.147	1.014	1.039	1.132	1.083

-15°/ 30° BIDIRECTIONAL ABSOLUTE SPECTRAL REFLECTANCE FACTORS FOR $BaSO_4$

Wav	Bss	Bsp	Bps	Bpp	Brr
390	1.094	0.971	0.971	1.078	1.029
395	1.100	0.985	0.985	1.089	1.041
400	1.102	0.994	0.994	1.094	1.044
405	1.108	1.001	1.001	1.101	1.051
410	1.107	0.996	0.996	1.106	1.052
415	1.113	1.004	1.004	1.105	1.055
420	1.111	1.003	1.003	1.107	1.054
425	1.113	1.005	1.005	1.111	1.057
430	1.110	1.006	1.006	1.107	1.055
435	1.113	1.004	1.004	1.107	1.055
440	1.107	1.004	1.004	1.108	1.055
445	1.111	1.006	1.006	1.106	1.056
450	1.111	1.006	1.006	1.112	1.058
455	1.109	1.006	1.006	1.109	1.056
460	1.115	1.005	1.005	1.106	1.057
465	1.120	1.001	1.001	1.103	1.057
470	1.112	1.007	1.007	1.108	1.057
475	1.114	1.005	1.005	1.105	1.056
480	1.114	1.005	1.005	1.107	1.057
485	1.113	1.004	1.004	1.109	1.057
490	1.115	1.008	1.008	1.110	1.059
495	1.116	1.009	1.009	1.107	1.059
500	1.117	1.008	1.008	1.108	1.059
505	1.115	1.009	1.009	1.112	1.059
510	1.115	1.011	1.011	1.113	1.061
515	1.114	1.010	1.010	1.112	1.060
520	1.118	1.007	1.007	1.109	1.059
525	1.121	1.010	1.010	1.109	1.061
530	1.120	1.008	1.008	1.108	1.061
535	1.119	1.009	1.009	1.110	1.062
540	1.117	1.009	1.009	1.108	1.061
545	1.120	1.007	1.007	1.112	1.061
550	1.120	1.013	1.013	1.111	1.063
555	1.123	1.011	1.011	1.111	1.062
560	1.124	1.011	1.004	1.107	1.062

Wav	Bss	Bsp	Bps	Bpp	Brr
565	1.119	1.010	1.006	1.109	1.061
570	1.114	1.011	1.006	1.107	1.059
575	1.115	1.012	1.010	1.105	1.060
580	1.126	1.006	1.011	1.107	1.062
585	1.123	1.009	1.008	1.106	1.061
590	1.122	1.005	1.003	1.108	1.060
595	1.118	1.012	1.007	1.107	1.061
600	1.115	1.011	1.010	1.116	1.063
605	1.119	1.011	1.008	1.109	1.062
610	1.119	1.004	1.016	1.108	1.062
615	1.119	1.011	1.006	1.114	1.062
620	1.123	1.014	1.006	1.108	1.063
625	1.121	1.012	1.010	1.109	1.063
630	1.119	1.008	1.010	1.107	1.061
635	1.115	1.012	1.004	1.102	1.058
640	1.121	1.013	1.005	1.113	1.063
645	1.121	1.007	1.007	1.114	1.062
650	1.119	1.018	1.010	1.111	1.065
655	1.124	1.015	1.012	1.113	1.066
660	1.124	1.013	1.010	1.113	1.065
665	1.126	1.007	1.011	1.108	1.063
670	1.123	1.015	1.014	1.110	1.065
675	1.127	1.010	1.014	1.112	1.066
680	1.137	1.012	1.017	1.112	1.069
685	1.130	1.016	1.014	1.112	1.068
690	1.132	1.022	1.020	1.109	1.071
695	1.130	1.010	1.015	1.106	1.065
700	1.135	1.011	1.012	1.116	1.068
705	1.126	1.016	1.015	1.113	1.068
710	1.133	1.020	1.011	1.107	1.068
715	1.130	1.019	1.016	1.108	1.068
720	1.118	1.013	1.013	1.107	1.063
725	1.131	1.002	1.008	1.113	1.064
730	1.126	1.011	1.006	1.115	1.064

-15°/ 45° BIDIRECTIONAL ABSOLUTE SPECTRAL REFLECTANCE FACTORS FOR $BaSO_4$

Wav	Bss	Bsp	Bps	Bpp	Brr
390	1.077	0.962	0.962	1.042	1.008
395	1.094	0.971	0.971	1.062	1.023
400	1.086	0.969	0.969	1.068	1.022
405	1.093	0.982	0.982	1.074	1.031
410	1.100	0.984	0.984	1.078	1.035
415	1.096	0.987	0.987	1.076	1.034
420	1.092	0.986	0.986	1.077	1.033
425	1.099	0.988	0.988	1.081	1.036
430	1.097	0.987	0.987	1.079	1.035
435	1.100	0.986	0.986	1.078	1.035
440	1.099	0.989	0.989	1.079	1.036
445	1.098	0.988	0.988	1.081	1.036
450	1.098	0.987	0.987	1.082	1.036
455	1.097	0.990	0.990	1.084	1.037
460	1.099	0.989	0.989	1.079	1.036
465	1.104	0.982	0.982	1.074	1.036
470	1.102	0.990	0.990	1.082	1.038
475	1.100	0.989	0.989	1.083	1.038
480	1.097	0.990	0.990	1.084	1.038
485	1.101	0.993	0.993	1.082	1.039
490	1.100	0.992	0.992	1.081	1.040
495	1.101	0.993	0.993	1.081	1.040
500	1.101	0.991	0.991	1.079	1.038
505	1.101	0.991	0.991	1.082	1.039
510	1.100	0.993	0.993	1.085	1.041
515	1.103	0.994	0.994	1.084	1.041
520	1.102	0.992	0.992	1.083	1.040
525	1.106	0.995	0.995	1.089	1.043
530	1.105	0.995	0.995	1.084	1.042
535	1.106	0.990	0.990	1.085	1.042
540	1.106	0.991	0.991	1.085	1.041
545	1.109	0.992	0.992	1.089	1.044
550	1.106	0.992	0.992	1.088	1.042
555	1.106	0.994	0.994	1.083	1.042
560	1.107	0.997	0.987	1.084	1.044

Wav	Bss	Bsp	Bps	Bpp	Brr
565	1.106	0.992	0.987	1.081	1.042
570	1.105	0.992	0.985	1.083	1.041
575	1.107	0.993	0.988	1.082	1.042
580	1.106	0.994	0.992	1.085	1.044
585	1.103	0.991	0.988	1.083	1.041
590	1.108	0.993	0.989	1.084	1.043
595	1.109	0.996	0.987	1.089	1.045
600	1.108	0.997	0.987	1.084	1.044
605	1.109	0.994	0.986	1.083	1.043
610	1.109	0.989	0.990	1.087	1.043
615	1.103	0.991	0.987	1.087	1.042
620	1.108	0.993	0.988	1.082	1.043
625	1.104	0.998	0.993	1.081	1.044
630	1.107	0.993	0.991	1.086	1.044
635	1.114	0.996	0.985	1.082	1.044
640	1.117	1.002	0.993	1.086	1.050
645	1.111	0.997	0.989	1.088	1.046
650	1.116	1.004	0.994	1.083	1.049
655	1.113	0.997	0.997	1.084	1.048
660	1.105	1.002	0.997	1.082	1.047
665	1.114	0.994	0.998	1.082	1.047
670	1.111	1.002	0.995	1.078	1.047
675	1.115	1.000	0.998	1.086	1.050
680	1.116	0.999	0.993	1.081	1.047
685	1.105	0.997	0.992	1.090	1.046
690	1.111	0.994	0.991	1.093	1.047
695	1.114	0.997	0.979	1.086	1.044
700	1.098	0.996	0.996	1.086	1.044
705	1.110	1.005	0.992	1.083	1.048
710	1.115	1.005	0.991	1.085	1.049
715	1.112	0.997	0.990	1.082	1.045
720	1.119	0.999	0.992	1.081	1.048
725	1.116	1.004	1.001	1.078	1.050
730	1.101	0.997	1.000	1.075	1.043

-15°/ 60° BIDIRECTIONAL ABSOLUTE SPECTRAL REFLECTANCE FACTORS FOR BaSO4

Wav	Bss	Bsp	Bps	Bpp	Brr
390	1.050	0.944	0.944	1.012	0.981
395	1.067	0.939	0.939	1.031	0.992
400	1.063	0.946	0.946	1.034	0.992
405	1.074	0.949	0.949	1.039	0.999
410	1.073	0.948	0.948	1.044	1.001
415	1.075	0.954	0.954	1.047	1.003
420	1.076	0.955	0.955	1.043	1.003
425	1.077	0.956	0.956	1.048	1.005
430	1.075	0.950	0.950	1.044	1.002
435	1.075	0.957	0.957	1.046	1.004
440	1.075	0.958	0.958	1.045	1.003
445	1.079	0.957	0.957	1.047	1.004
450	1.077	0.955	0.955	1.050	1.005
455	1.075	0.956	0.956	1.049	1.005
460	1.080	0.955	0.955	1.048	1.006
465	1.086	0.952	0.952	1.042	1.005
470	1.079	0.956	0.956	1.050	1.006
475	1.079	0.956	0.956	1.047	1.006
480	1.079	0.959	0.959	1.049	1.007
485	1.076	0.959	0.959	1.049	1.007
490	1.080	0.959	0.959	1.054	1.009
495	1.081	0.960	0.960	1.051	1.009
500	1.080	0.960	0.960	1.051	1.009
505	1.081	0.959	0.959	1.049	1.009
510	1.081	0.959	0.959	1.052	1.009
515	1.081	0.958	0.958	1.049	1.008
520	1.078	0.960	0.960	1.051	1.008
525	1.077	0.961	0.961	1.051	1.009
530	1.077	0.963	0.963	1.051	1.010
535	1.081	0.960	0.960	1.053	1.010
540	1.086	0.959	0.959	1.056	1.012
545	1.083	0.960	0.960	1.056	1.011
550	1.085	0.964	0.964	1.057	1.013
555	1.087	0.966	0.966	1.049	1.012
560	1.085	0.965	0.947	1.054	1.013

Wav	Bss	Bsp	Bps	Bpp	Brr
565	1.085	0.967	0.947	1.054	1.013
570	1.085	0.967	0.947	1.056	1.014
575	1.087	0.966	0.953	1.058	1.016
580	1.089	0.965	0.952	1.065	1.018
585	1.082	0.967	0.950	1.057	1.014
590	1.085	0.962	0.952	1.056	1.014
595	1.088	0.964	0.952	1.059	1.016
600	1.085	0.964	0.946	1.055	1.012
605	1.085	0.961	0.949	1.060	1.014
610	1.089	0.964	0.949	1.056	1.015
615	1.085	0.969	0.953	1.051	1.015
620	1.091	0.966	0.954	1.057	1.017
625	1.087	0.964	0.951	1.053	1.014
630	1.086	0.967	0.956	1.050	1.015
635	1.084	0.964	0.952	1.053	1.013
640	1.087	0.967	0.957	1.058	1.017
645	1.086	0.968	0.953	1.058	1.016
650	1.094	0.973	0.954	1.057	1.020
655	1.085	0.967	0.954	1.054	1.015
660	1.081	0.963	0.952	1.064	1.015
665	1.083	0.962	0.956	1.060	1.015
670	1.084	0.968	0.966	1.051	1.017
675	1.089	0.963	0.958	1.052	1.016
680	1.091	0.964	0.964	1.054	1.019
685	1.091	0.964	0.957	1.063	1.019
690	1.083	0.970	0.955	1.066	1.018
695	1.087	0.963	0.950	1.062	1.015
700	1.083	0.963	0.961	1.051	1.014
705	1.089	0.961	0.953	1.052	1.014
710	1.093	0.973	0.961	1.059	1.021
715	1.091	0.961	0.963	1.054	1.017
720	1.094	0.976	0.963	1.058	1.023
725	1.091	0.973	0.953	1.056	1.018
730	1.096	0.975	0.961	1.054	1.022

-15°/ 75° BIDIRECTIONAL ABSOLUTE SPECTRAL REFLECTANCE FACTORS FOR $BaSO_4$

Wav	Bss	Bsp	Bps	Bpp	Brr
390	1.018	0.874	0.874	0.950	0.918
395	1.022	0.877	0.877	0.973	0.931
400	1.016	0.878	0.878	0.962	0.928
405	1.022	0.884	0.884	0.974	0.934
410	1.027	0.882	0.882	0.970	0.934
415	1.028	0.889	0.889	0.978	0.938
420	1.028	0.890	0.890	0.979	0.939
425	1.028	0.888	0.888	0.977	0.938
430	1.024	0.888	0.888	0.974	0.936
435	1.025	0.888	0.888	0.977	0.938
440	1.022	0.890	0.890	0.980	0.938
445	1.024	0.889	0.889	0.976	0.937
450	1.025	0.890	0.890	0.980	0.939
455	1.024	0.892	0.892	0.979	0.939
460	1.027	0.891	0.891	0.978	0.940
465	1.033	0.888	0.888	0.972	0.940
470	1.028	0.895	0.895	0.979	0.941
475	1.030	0.894	0.894	0.981	0.943
480	1.029	0.895	0.895	0.984	0.943
485	1.030	0.895	0.895	0.981	0.943
490	1.031	0.896	0.896	0.984	0.944
495	1.031	0.897	0.897	0.986	0.945
500	1.026	0.897	0.897	0.985	0.944
505	1.029	0.896	0.896	0.985	0.944
510	1.031	0.901	0.901	0.985	0.946
515	1.031	0.898	0.898	0.989	0.947
520	1.030	0.896	0.896	0.990	0.946
525	1.032	0.900	0.900	0.986	0.947
530	1.034	0.902	0.902	0.986	0.948
535	1.032	0.902	0.902	0.989	0.948
540	1.032	0.903	0.903	0.992	0.949
545	1.032	0.904	0.904	0.989	0.950
550	1.031	0.906	0.906	0.990	0.950
555	1.032	0.902	0.902	0.986	0.949
560	1.038	0.902	0.874	0.990	0.951

Wav	Bss	Bsp	Bps	Bpp	Brr
565	1.035	0.904	0.875	0.992	0.952
570	1.035	0.905	0.875	0.992	0.951
575	1.035	0.907	0.874	0.994	0.953
580	1.037	0.907	0.877	0.994	0.954
585	1.033	0.904	0.876	0.991	0.951
590	1.035	0.905	0.878	0.991	0.952
595	1.039	0.902	0.877	0.991	0.952
600	1.038	0.904	0.879	0.996	0.954
605	1.043	0.905	0.878	0.993	0.955
610	1.038	0.905	0.881	0.996	0.955
615	1.036	0.907	0.879	0.993	0.954
620	1.037	0.907	0.876	0.993	0.953
625	1.039	0.908	0.882	0.992	0.955
630	1.042	0.902	0.884	0.993	0.955
635	1.038	0.909	0.880	0.994	0.955
640	1.037	0.909	0.880	0.996	0.956
645	1.039	0.912	0.879	0.996	0.956
650	1.041	0.908	0.885	0.994	0.957
655	1.039	0.909	0.886	0.995	0.958
660	1.035	0.909	0.886	0.998	0.957
665	1.036	0.908	0.883	1.000	0.957
670	1.042	0.904	0.882	0.995	0.956
675	1.037	0.908	0.884	0.996	0.956
680	1.047	0.911	0.875	0.997	0.957
685	1.038	0.909	0.879	0.993	0.955
690	1.039	0.913	0.881	0.993	0.956
695	1.047	0.909	0.888	0.989	0.958
700	1.044	0.906	0.889	0.994	0.958
705	1.042	0.905	0.879	0.988	0.953
710	1.043	0.910	0.882	0.985	0.955
715	1.038	0.912	0.890	0.995	0.959
720	1.039	0.917	0.881	0.992	0.957
725	1.033	0.914	0.891	0.998	0.959
730	1.035	0.912	0.883	1.002	0.958

-30°/-75° BIDIRECTIONAL ABSOLUTE SPECTRAL REFLECTANCE FACTORS FOR $BaSO_4$

Wav	Bss	Bsp	Bps	Bpp	Brr
390	0.959	0.858	0.858	0.975	0.905
395	0.977	0.865	0.865	0.993	0.920
400	0.971	0.861	0.861	0.998	0.916
405	0.976	0.871	0.871	1.004	0.924
410	0.978	0.869	0.869	1.001	0.923
415	0.978	0.868	0.868	1.005	0.924
420	0.973	0.871	0.871	1.005	0.923
425	0.976	0.873	0.873	1.003	0.924
430	0.979	0.870	0.870	1.008	0.925
435	0.976	0.871	0.871	1.006	0.924
440	0.975	0.873	0.873	1.004	0.924
445	0.976	0.873	0.873	1.002	0.924
450	0.975	0.873	0.873	1.003	0.924
455	0.976	0.874	0.874	1.003	0.924
460	0.974	0.872	0.872	1.003	0.924
465	0.981	0.867	0.867	0.998	0.925
470	0.979	0.875	0.875	1.006	0.927
475	0.979	0.875	0.875	1.004	0.927
480	0.980	0.874	0.874	1.007	0.928
485	0.978	0.875	0.875	1.004	0.927
490	0.979	0.876	0.876	1.007	0.928
495	0.980	0.877	0.877	1.008	0.929
500	0.979	0.876	0.876	1.008	0.929
505	0.980	0.877	0.877	1.013	0.930
510	0.980	0.877	0.877	1.010	0.930
515	0.983	0.876	0.876	1.007	0.929
520	0.981	0.878	0.878	1.010	0.930
525	0.982	0.880	0.880	1.008	0.930
530	0.979	0.879	0.879	1.009	0.930
535	0.982	0.879	0.879	1.010	0.930
540	0.984	0.879	0.879	1.013	0.933
545	0.985	0.881	0.881	1.010	0.933
550	0.985	0.883	0.883	1.013	0.934
555	0.987	0.883	0.883	1.013	0.936
560	0.983	0.880	0.856	1.014	0.933
565	0.986	0.880	0.857	1.012	0.933
570	0.989	0.883	0.859	1.013	0.936
575	0.983	0.879	0.857	1.013	0.933
580	0.987	0.885	0.859	1.015	0.936
585	0.986	0.879	0.855	1.013	0.933
590	0.984	0.878	0.855	1.014	0.933
595	0.981	0.880	0.854	1.013	0.932
600	0.979	0.882	0.858	1.012	0.933
605	0.983	0.882	0.859	1.008	0.933
610	0.986	0.883	0.859	1.009	0.934
615	0.986	0.882	0.857	1.014	0.935
620	0.983	0.882	0.856	1.010	0.933
625	0.981	0.881	0.852	1.002	0.929
630	0.983	0.880	0.861	1.003	0.932
635	0.981	0.884	0.858	1.009	0.933
640	0.983	0.880	0.856	1.007	0.932
645	0.980	0.883	0.857	1.006	0.931
650	0.981	0.885	0.864	1.012	0.935
655	0.982	0.884	0.862	1.011	0.935
660	0.976	0.880	0.863	1.014	0.933
665	0.982	0.877	0.852	1.001	0.928
670	0.983	0.878	0.856	1.006	0.931
675	0.983	0.877	0.856	1.007	0.931
680	0.979	0.875	0.852	1.007	0.928
685	0.975	0.878	0.857	1.006	0.929
690	0.978	0.878	0.853	1.009	0.929
695	0.967	0.882	0.855	1.008	0.928
700	0.972	0.880	0.861	1.008	0.930
705	0.981	0.878	0.857	1.009	0.931
710	0.979	0.882	0.860	1.004	0.931
715	0.986	0.883	0.863	1.003	0.934
720	0.977	0.876	0.852	1.009	0.928
725	0.980	0.879	0.854	0.996	0.927
730	0.979	0.874	0.855	1.009	0.929

-30°/-60° BIDIRECTIONAL ABSOLUTE SPECTRAL REFLECTANCE FACTORS FOR $BaSO_4$

Wav	Bss	Bsp	Bps	Bpp	Brr
390	1.024	0.909	0.909	1.044	0.966
395	1.050	0.919	0.919	1.069	0.987
400	1.042	0.921	0.921	1.066	0.985
405	1.051	0.924	0.924	1.075	0.991
410	1.051	0.930	0.930	1.075	0.994
415	1.056	0.932	0.932	1.076	0.995
420	1.051	0.927	0.927	1.078	0.993
425	1.053	0.933	0.933	1.080	0.997
430	1.054	0.933	0.933	1.078	0.995
435	1.055	0.933	0.933	1.079	0.996
440	1.052	0.930	0.930	1.078	0.994
445	1.052	0.932	0.932	1.080	0.994
450	1.053	0.928	0.928	1.080	0.994
455	1.051	0.932	0.932	1.078	0.995
460	1.056	0.933	0.933	1.077	0.996
465	1.061	0.926	0.926	1.073	0.996
470	1.055	0.931	0.931	1.080	0.996
475	1.053	0.930	0.930	1.078	0.995
480	1.055	0.933	0.933	1.076	0.996
485	1.051	0.931	0.931	1.078	0.995
490	1.055	0.935	0.935	1.078	0.996
495	1.056	0.935	0.935	1.079	0.997
500	1.056	0.934	0.934	1.079	0.997
505	1.057	0.935	0.935	1.078	0.998
510	1.058	0.934	0.934	1.083	0.999
515	1.058	0.935	0.935	1.080	0.998
520	1.057	0.935	0.935	1.083	0.999
525	1.057	0.932	0.932	1.080	0.998
530	1.058	0.935	0.935	1.080	0.998
535	1.058	0.932	0.932	1.084	0.999
540	1.057	0.935	0.935	1.081	0.999
545	1.058	0.934	0.934	1.079	0.999
550	1.056	0.937	0.937	1.088	1.001
555	1.058	0.934	0.934	1.083	0.999
560	1.060	0.935	0.921	1.081	0.999

Wav	Bss	Bsp	Bps	Bpp	Brr
565	1.056	0.937	0.924	1.080	0.999
570	1.061	0.937	0.921	1.080	1.000
575	1.057	0.938	0.924	1.083	1.001
580	1.060	0.936	0.924	1.084	1.001
585	1.058	0.936	0.927	1.079	1.000
590	1.059	0.933	0.925	1.086	1.001
595	1.055	0.931	0.922	1.083	0.998
600	1.059	0.932	0.926	1.083	1.000
605	1.056	0.938	0.925	1.085	1.001
610	1.059	0.938	0.924	1.088	1.002
615	1.060	0.934	0.924	1.083	1.000
620	1.058	0.936	0.927	1.079	1.000
625	1.058	0.943	0.929	1.076	1.001
630	1.061	0.940	0.924	1.074	1.000
635	1.055	0.937	0.929	1.079	1.000
640	1.059	0.935	0.919	1.083	0.999
645	1.058	0.933	0.919	1.077	0.997
650	1.064	0.931	0.923	1.083	1.000
655	1.060	0.935	0.932	1.080	1.002
660	1.056	0.934	0.926	1.079	0.999
665	1.056	0.932	0.929	1.076	0.998
670	1.057	0.948	0.926	1.072	1.001
675	1.058	0.935	0.921	1.082	0.999
680	1.062	0.928	0.926	1.079	0.999
685	1.060	0.930	0.924	1.071	0.996
690	1.061	0.937	0.922	1.076	0.999
695	1.055	0.935	0.924	1.078	0.998
700	1.057	0.943	0.918	1.069	0.996
705	1.060	0.932	0.915	1.075	0.995
710	1.053	0.933	0.926	1.071	0.996
715	1.049	0.939	0.932	1.078	0.999
720	1.052	0.930	0.928	1.088	0.999
725	1.053	0.940	0.922	1.076	0.998
730	1.055	0.935	0.917	1.062	0.992

-30°/-45° BIDIRECTIONAL ABSOLUTE SPECTRAL REFLECTANCE FACTORS FOR BaSO4

Wav	Bss	Bsp	Bps	Bpp	Brr
390	1.089	0.929	0.929	1.123	1.016
395	1.092	0.959	0.959	1.120	1.029
400	1.090	0.946	0.946	1.116	1.024
405	1.102	0.956	0.956	1.129	1.035
410	1.102	0.959	0.959	1.129	1.036
415	1.102	0.965	0.965	1.128	1.037
420	1.100	0.965	0.965	1.133	1.037
425	1.097	0.961	0.961	1.133	1.036
430	1.099	0.959	0.959	1.132	1.035
435	1.102	0.961	0.961	1.132	1.036
440	1.101	0.960	0.960	1.131	1.036
445	1.103	0.962	0.962	1.133	1.038
450	1.104	0.959	0.959	1.132	1.037
455	1.099	0.962	0.962	1.132	1.035
460	1.103	0.961	0.961	1.133	1.038
465	1.110	0.954	0.954	1.129	1.038
470	1.100	0.960	0.960	1.133	1.037
475	1.101	0.962	0.962	1.133	1.038
480	1.097	0.963	0.963	1.133	1.037
485	1.105	0.963	0.963	1.132	1.039
490	1.103	0.962	0.962	1.137	1.039
495	1.101	0.961	0.961	1.136	1.038
500	1.103	0.959	0.959	1.136	1.038
505	1.104	0.962	0.962	1.137	1.040
510	1.103	0.960	0.960	1.140	1.040
515	1.101	0.960	0.960	1.138	1.038
520	1.102	0.962	0.962	1.137	1.039
525	1.106	0.964	0.964	1.143	1.042
530	1.102	0.961	0.961	1.145	1.041
535	1.102	0.961	0.961	1.136	1.039
540	1.104	0.959	0.959	1.137	1.039
545	1.100	0.960	0.960	1.137	1.039
550	1.107	0.959	0.959	1.138	1.040
555	1.103	0.959	0.959	1.133	1.037
560	1.099	0.959	0.956	1.139	1.038

Wav	Bss	Bsp	Bps	Bpp	Brr
565	1.102	0.960	0.954	1.145	1.040
570	1.105	0.957	0.954	1.141	1.039
575	1.097	0.958	0.956	1.138	1.037
580	1.107	0.963	0.955	1.137	1.041
585	1.104	0.959	0.950	1.136	1.037
590	1.106	0.957	0.958	1.138	1.040
595	1.108	0.962	0.955	1.139	1.041
600	1.110	0.962	0.957	1.140	1.042
605	1.105	0.960	0.957	1.142	1.041
610	1.107	0.959	0.960	1.139	1.042
615	1.103	0.960	0.957	1.139	1.040
620	1.097	0.959	0.957	1.136	1.037
625	1.103	0.963	0.957	1.135	1.039
630	1.101	0.957	0.962	1.129	1.037
635	1.101	0.961	0.953	1.141	1.039
640	1.103	0.963	0.950	1.136	1.038
645	1.102	0.961	0.952	1.139	1.039
650	1.103	0.961	0.951	1.135	1.038
655	1.104	0.960	0.959	1.139	1.040
660	1.103	0.964	0.961	1.131	1.040
665	1.103	0.956	0.960	1.143	1.041
670	1.102	0.961	0.957	1.139	1.040
675	1.101	0.952	0.957	1.133	1.036
680	1.108	0.954	0.965	1.141	1.042
685	1.108	0.955	0.951	1.139	1.038
690	1.099	0.956	0.956	1.131	1.035
695	1.094	0.957	0.959	1.130	1.035
700	1.111	0.959	0.957	1.130	1.039
705	1.092	0.956	0.961	1.136	1.036
710	1.104	0.959	0.950	1.132	1.036
715	1.103	0.954	0.963	1.139	1.040
720	1.109	0.950	0.946	1.129	1.033
725	1.113	0.965	0.960	1.125	1.041
730	1.109	0.950	0.957	1.131	1.037

-30°/-15° BIDIRECTIONAL ABSOLUTE SPECTRAL REFLECTANCE FACTORS FOR $BaSO_4$

Wav	Bss	Bsp	Bps	Bpp	Brr
390	1.099	0.959	0.959	1.127	1.038
395	1.124	0.976	0.976	1.142	1.054
400	1.118	0.970	0.970	1.140	1.051
405	1.128	0.986	0.986	1.151	1.062
410	1.126	0.986	0.986	1.152	1.061
415	1.130	0.990	0.990	1.157	1.065
420	1.129	0.988	0.988	1.157	1.065
425	1.130	0.989	0.989	1.159	1.066
430	1.129	0.992	0.992	1.161	1.067
435	1.127	0.993	0.993	1.155	1.065
440	1.125	0.990	0.990	1.157	1.064
445	1.130	0.989	0.989	1.156	1.065
450	1.127	0.988	0.988	1.155	1.065
455	1.126	0.991	0.991	1.156	1.064
460	1.127	0.990	0.990	1.159	1.066
465	1.134	0.983	0.983	1.153	1.066
470	1.127	0.990	0.990	1.157	1.065
475	1.129	0.993	0.993	1.156	1.067
480	1.134	0.991	0.991	1.157	1.068
485	1.130	0.994	0.994	1.160	1.069
490	1.132	0.993	0.993	1.160	1.069
495	1.128	0.994	0.994	1.160	1.068
500	1.128	0.990	0.990	1.160	1.067
505	1.130	0.990	0.990	1.161	1.068
510	1.134	0.991	0.991	1.160	1.069
515	1.130	0.991	0.991	1.163	1.069
520	1.131	0.989	0.989	1.166	1.070
525	1.132	0.992	0.992	1.164	1.070
530	1.126	0.991	0.991	1.166	1.068
535	1.126	0.990	0.990	1.165	1.067
540	1.132	0.991	0.991	1.162	1.069
545	1.135	0.996	0.996	1.165	1.072
550	1.133	0.994	0.994	1.167	1.071
555	1.132	0.991	0.991	1.164	1.070
560	1.127	0.991	0.994	1.165	1.069
565	1.127	0.992	0.992	1.164	1.069
570	1.131	0.993	0.998	1.163	1.071
575	1.132	0.990	0.988	1.165	1.069
580	1.130	0.988	0.992	1.162	1.068
585	1.128	0.988	0.990	1.165	1.068
590	1.122	0.991	0.990	1.164	1.067
595	1.127	0.990	0.993	1.168	1.070
600	1.134	0.990	0.987	1.163	1.069
605	1.130	0.998	0.987	1.162	1.069
610	1.132	0.986	0.984	1.157	1.065
615	1.135	0.990	0.991	1.157	1.068
620	1.134	0.990	0.993	1.159	1.069
625	1.138	0.992	0.992	1.154	1.069
630	1.131	0.986	0.997	1.166	1.070
635	1.125	0.989	0.990	1.165	1.067
640	1.130	0.987	0.997	1.164	1.070
645	1.124	0.983	0.993	1.158	1.065
650	1.137	0.986	0.999	1.170	1.073
655	1.140	0.992	0.991	1.167	1.073
660	1.143	0.985	0.999	1.164	1.073
665	1.144	0.985	0.995	1.157	1.070
670	1.139	0.990	0.995	1.168	1.073
675	1.133	0.995	0.996	1.169	1.073
680	1.136	0.996	0.995	1.162	1.072
685	1.143	0.987	0.991	1.163	1.071
690	1.139	0.982	0.991	1.164	1.069
695	1.135	0.987	1.007	1.172	1.075
700	1.126	0.988	1.005	1.169	1.072
705	1.136	1.000	0.995	1.167	1.074
710	1.143	0.987	0.996	1.163	1.072
715	1.144	0.987	0.999	1.166	1.074
720	1.138	0.990	0.994	1.157	1.070
725	1.150	0.985	0.999	1.162	1.074
730	1.124	0.985	1.006	1.169	1.071

-30°/ 0° BIDIRECTIONAL ABSOLUTE SPECTRAL REFLECTANCE FACTORS FOR $BaSO_4$

Wav	Bss	Bsp	Bps	Bpp	Brr
390	1.087	0.965	0.965	1.096	1.028
395	1.111	0.993	0.993	1.111	1.051
400	1.104	0.985	0.985	1.110	1.046
405	1.116	0.991	0.991	1.119	1.054
410	1.116	0.994	0.994	1.120	1.055
415	1.120	0.995	0.995	1.126	1.059
420	1.123	0.999	0.999	1.123	1.060
425	1.121	0.998	0.998	1.125	1.060
430	1.112	0.995	0.995	1.125	1.057
435	1.116	0.995	0.995	1.126	1.059
440	1.113	0.998	0.998	1.123	1.058
445	1.117	0.999	0.999	1.124	1.059
450	1.117	1.000	1.000	1.123	1.059
455	1.119	0.999	0.999	1.128	1.061
460	1.119	0.998	0.998	1.127	1.061
465	1.128	0.993	0.993	1.121	1.062
470	1.121	0.999	0.999	1.128	1.061
475	1.121	0.999	0.999	1.128	1.062
480	1.125	1.000	1.000	1.129	1.064
485	1.122	0.998	0.998	1.125	1.061
490	1.122	0.998	0.998	1.125	1.061
495	1.123	1.004	1.004	1.129	1.065
500	1.122	1.004	1.004	1.128	1.064
505	1.126	1.002	1.002	1.127	1.064
510	1.124	1.000	1.000	1.125	1.063
515	1.122	1.000	1.000	1.133	1.064
520	1.120	0.999	0.999	1.128	1.062
525	1.121	1.001	1.001	1.130	1.063
530	1.121	1.003	1.003	1.131	1.065
535	1.119	1.003	1.003	1.126	1.064
540	1.121	1.004	1.004	1.125	1.063
545	1.125	1.001	1.001	1.129	1.064
550	1.123	1.005	1.005	1.125	1.064
555	1.123	1.004	1.004	1.128	1.065
560	1.123	1.003	1.003	1.128	1.065

Wav	Bss	Bsp	Bps	Bpp	Brr
565	1.124	1.000	1.001	1.122	1.062
570	1.127	1.005	1.004	1.125	1.065
575	1.125	1.003	1.004	1.129	1.065
580	1.126	1.000	0.999	1.125	1.063
585	1.128	1.002	1.001	1.123	1.064
590	1.129	1.003	1.008	1.125	1.066
595	1.126	1.007	1.006	1.130	1.067
600	1.122	1.005	1.010	1.130	1.067
605	1.130	1.003	1.007	1.130	1.067
610	1.130	1.001	1.001	1.131	1.066
615	1.131	0.999	1.008	1.130	1.067
620	1.137	1.005	1.004	1.134	1.070
625	1.131	1.004	1.008	1.133	1.069
630	1.129	1.006	1.003	1.126	1.066
635	1.124	0.999	1.004	1.131	1.064
640	1.129	1.003	1.007	1.127	1.067
645	1.129	1.004	1.012	1.120	1.066
650	1.127	1.003	1.014	1.127	1.068
655	1.130	1.008	1.010	1.126	1.068
660	1.133	1.000	1.013	1.118	1.066
665	1.124	1.000	1.019	1.114	1.064
670	1.127	0.994	1.010	1.124	1.064
675	1.128	1.005	1.014	1.121	1.067
680	1.125	0.995	1.009	1.125	1.063
685	1.131	1.001	1.013	1.128	1.068
690	1.125	1.006	1.022	1.129	1.070
695	1.129	1.006	1.016	1.123	1.068
700	1.117	1.003	1.011	1.121	1.063
705	1.123	1.008	1.011	1.127	1.067
710	1.146	1.006	1.017	1.107	1.069
715	1.116	0.999	1.016	1.122	1.063
720	1.129	1.004	0.994	1.132	1.065
725	1.144	0.996	1.003	1.121	1.066
730	1.133	1.005	0.995	1.126	1.065

-30°/ 15° BIDIRECTIONAL ABSOLUTE SPECTRAL REFLECTANCE FACTORS FOR $BaSO_4$

Wav	Bss	Bsp	Bps	Bpp	Brr
390	1.087	0.984	0.984	1.082	1.027
395	1.103	0.989	0.989	1.093	1.043
400	1.103	0.988	0.988	1.090	1.042
405	1.109	0.992	0.992	1.103	1.049
410	1.112	0.996	0.996	1.106	1.052
415	1.116	1.003	1.003	1.107	1.055
420	1.115	1.000	1.000	1.107	1.054
425	1.120	1.002	1.002	1.107	1.056
430	1.113	1.000	1.000	1.107	1.054
435	1.116	1.004	1.004	1.110	1.056
440	1.117	1.005	1.005	1.108	1.057
445	1.114	1.004	1.004	1.108	1.056
450	1.113	1.005	1.005	1.109	1.056
455	1.114	1.007	1.007	1.109	1.057
460	1.120	1.005	1.005	1.108	1.058
465	1.126	1.000	1.000	1.104	1.060
470	1.116	1.006	1.006	1.109	1.058
475	1.118	1.004	1.004	1.103	1.057
480	1.116	1.006	1.006	1.108	1.057
485	1.120	1.006	1.006	1.109	1.059
490	1.122	1.008	1.008	1.115	1.062
495	1.121	1.007	1.007	1.116	1.061
500	1.120	1.006	1.006	1.112	1.060
505	1.120	1.006	1.006	1.110	1.060
510	1.123	1.003	1.003	1.113	1.061
515	1.123	1.007	1.007	1.114	1.062
520	1.119	1.006	1.006	1.106	1.059
525	1.121	1.006	1.006	1.108	1.059
530	1.120	1.005	1.005	1.106	1.058
535	1.123	1.005	1.005	1.110	1.060
540	1.119	1.005	1.005	1.114	1.061
545	1.123	1.007	1.007	1.113	1.061
550	1.126	1.006	1.006	1.110	1.062
555	1.129	1.008	1.008	1.110	1.063
560	1.129	1.008	1.006	1.113	1.064

Wav	Bss	Bsp	Bps	Bpp	Brr
565	1.126	1.005	1.005	1.110	1.062
570	1.122	1.007	1.007	1.111	1.062
575	1.123	1.009	1.007	1.111	1.063
580	1.119	1.006	1.007	1.116	1.062
585	1.119	1.007	1.005	1.115	1.062
590	1.125	1.004	1.005	1.118	1.063
595	1.127	1.006	1.008	1.106	1.062
600	1.123	1.008	1.003	1.119	1.063
605	1.119	1.010	1.008	1.111	1.062
610	1.128	1.008	1.008	1.108	1.063
615	1.129	1.003	1.010	1.107	1.062
620	1.130	1.001	1.008	1.111	1.063
625	1.130	1.005	1.011	1.105	1.063
630	1.120	1.004	1.009	1.103	1.059
635	1.119	1.012	1.006	1.113	1.063
640	1.122	1.006	1.011	1.110	1.063
645	1.115	1.007	1.010	1.111	1.061
650	1.129	1.006	1.015	1.109	1.065
655	1.128	1.002	1.012	1.110	1.063
660	1.132	1.008	1.005	1.106	1.062
665	1.122	1.004	1.013	1.112	1.063
670	1.131	1.009	1.015	1.116	1.068
675	1.135	1.003	1.010	1.111	1.065
680	1.121	1.015	1.011	1.118	1.067
685	1.129	1.010	1.016	1.111	1.067
690	1.124	1.006	1.006	1.105	1.060
695	1.129	1.000	1.011	1.099	1.060
700	1.135	1.011	1.018	1.098	1.066
705	1.116	1.009	1.016	1.105	1.062
710	1.129	1.022	1.021	1.114	1.072
715	1.129	1.022	1.026	1.110	1.072
720	1.122	1.008	1.017	1.109	1.064
725	1.137	1.013	1.011	1.103	1.066
730	1.134	1.002	1.015	1.110	1.065

-30°/ 30° BIDIRECTIONAL ABSOLUTE SPECTRAL REFLECTANCE FACTORS FOR $BaSO_4$

Wav	Bss	Bsp	Bps	Bpp	Brr
390	1.093	0.970	0.970	1.051	1.018
395	1.102	0.987	0.987	1.090	1.040
400	1.103	0.987	0.987	1.080	1.036
405	1.111	0.987	0.987	1.090	1.044
410	1.113	0.993	0.993	1.086	1.045
415	1.114	0.998	0.998	1.093	1.050
420	1.118	0.996	0.996	1.090	1.049
425	1.114	1.000	1.000	1.096	1.051
430	1.110	0.998	0.998	1.096	1.050
435	1.117	1.003	1.003	1.095	1.052
440	1.113	0.999	0.999	1.092	1.050
445	1.114	0.997	0.997	1.092	1.050
450	1.114	1.000	1.000	1.098	1.052
455	1.115	0.999	0.999	1.096	1.050
460	1.116	1.001	1.001	1.097	1.052
465	1.124	0.999	0.999	1.089	1.053
470	1.119	1.001	1.001	1.093	1.053
475	1.118	1.001	1.001	1.091	1.052
480	1.117	1.000	1.000	1.094	1.052
485	1.117	1.002	1.002	1.094	1.053
490	1.120	0.997	0.997	1.101	1.054
495	1.119	1.001	1.001	1.100	1.054
500	1.119	0.999	0.999	1.098	1.054
505	1.119	0.998	0.998	1.098	1.054
510	1.119	1.002	1.002	1.098	1.055
515	1.119	1.000	1.000	1.100	1.054
520	1.120	0.999	0.999	1.098	1.054
525	1.122	1.003	1.003	1.100	1.056
530	1.118	1.002	1.002	1.096	1.054
535	1.119	1.001	1.001	1.095	1.054
540	1.120	1.002	1.002	1.097	1.056
545	1.120	1.003	1.003	1.095	1.055
550	1.123	1.005	1.005	1.098	1.058
555	1.121	1.005	1.005	1.099	1.058
560	1.121	1.003	0.997	1.102	1.056

Wav	Bss	Bsp	Bps	Bpp	Brr
565	1.121	1.001	1.001	1.099	1.056
570	1.125	1.004	1.005	1.102	1.059
575	1.120	1.003	1.004	1.102	1.057
580	1.121	1.004	1.004	1.102	1.058
585	1.122	1.004	1.005	1.096	1.057
590	1.119	1.002	1.000	1.098	1.055
595	1.122	1.002	0.999	1.098	1.055
600	1.124	1.006	1.003	1.099	1.058
605	1.125	1.006	1.004	1.100	1.059
610	1.124	1.001	1.001	1.108	1.059
615	1.126	1.001	1.009	1.098	1.058
620	1.127	1.011	1.005	1.100	1.061
625	1.130	1.008	1.004	1.103	1.061
630	1.132	1.012	1.011	1.097	1.063
635	1.133	1.008	1.010	1.098	1.062
640	1.127	1.011	1.009	1.101	1.062
645	1.125	1.008	1.009	1.097	1.060
650	1.137	1.004	1.010	1.103	1.064
655	1.137	1.005	1.014	1.094	1.062
660	1.136	1.005	1.007	1.090	1.059
665	1.129	1.006	1.011	1.091	1.059
670	1.126	1.004	1.017	1.103	1.062
675	1.134	1.005	1.008	1.099	1.062
680	1.128	1.005	1.006	1.102	1.060
685	1.125	1.008	1.010	1.107	1.063
690	1.137	1.012	1.014	1.095	1.064
695	1.141	1.007	1.018	1.104	1.067
700	1.127	1.005	1.012	1.095	1.060
705	1.137	1.008	1.021	1.098	1.066
710	1.136	1.011	1.017	1.113	1.069
715	1.140	1.013	1.015	1.111	1.070
720	1.140	1.005	1.004	1.110	1.065
725	1.146	1.025	1.006	1.111	1.072
730	1.147	0.997	1.014	1.095	1.064

-30°/ 45° BIDIRECTIONAL ABSOLUTE SPECTRAL REFLECTANCE FACTORS FOR $BaSO_4$

Wav	Bss	Bsp	Bps	Bpp	Brr
390	1.091	0.942	0.942	1.058	1.009
395	1.109	0.974	0.974	1.066	1.027
400	1.108	0.971	0.971	1.070	1.028
405	1.113	0.976	0.976	1.078	1.034
410	1.114	0.980	0.980	1.078	1.037
415	1.119	0.986	0.986	1.078	1.040
420	1.116	0.982	0.982	1.080	1.037
425	1.120	0.984	0.984	1.084	1.041
430	1.115	0.982	0.982	1.082	1.037
435	1.115	0.983	0.983	1.082	1.039
440	1.118	0.983	0.983	1.083	1.039
445	1.121	0.986	0.986	1.079	1.041
450	1.116	0.985	0.985	1.083	1.040
455	1.118	0.983	0.983	1.084	1.040
460	1.121	0.987	0.987	1.086	1.043
465	1.130	0.980	0.980	1.080	1.043
470	1.118	0.987	0.987	1.083	1.041
475	1.123	0.986	0.986	1.087	1.043
480	1.122	0.986	0.986	1.086	1.043
485	1.120	0.987	0.987	1.087	1.044
490	1.119	0.984	0.984	1.089	1.044
495	1.121	0.988	0.988	1.090	1.045
500	1.121	0.989	0.989	1.091	1.046
505	1.123	0.990	0.990	1.088	1.046
510	1.126	0.991	0.991	1.086	1.047
515	1.126	0.989	0.989	1.083	1.045
520	1.125	0.991	0.991	1.084	1.046
525	1.125	0.991	0.991	1.088	1.047
530	1.120	0.989	0.989	1.091	1.045
535	1.124	0.993	0.993	1.088	1.047
540	1.129	0.991	0.991	1.088	1.049
545	1.123	0.992	0.992	1.087	1.047
550	1.124	0.990	0.990	1.085	1.045
555	1.118	0.991	0.991	1.085	1.043
560	1.122	0.989	0.981	1.091	1.046

Wav	Bss	Bsp	Bps	Bpp	Brr
565	1.127	0.993	0.983	1.085	1.047
570	1.123	0.992	0.983	1.086	1.046
575	1.123	0.989	0.987	1.091	1.048
580	1.126	0.991	0.984	1.088	1.047
585	1.130	0.993	0.986	1.088	1.049
590	1.130	0.994	0.992	1.089	1.051
595	1.127	0.994	0.992	1.090	1.051
600	1.129	0.989	0.994	1.091	1.051
605	1.127	0.987	0.989	1.091	1.049
610	1.128	0.992	0.987	1.094	1.050
615	1.132	0.996	0.987	1.089	1.051
620	1.132	0.995	0.991	1.099	1.054
625	1.134	0.994	0.987	1.095	1.053
630	1.127	0.988	0.993	1.093	1.050
635	1.128	0.997	0.995	1.094	1.054
640	1.122	0.993	0.991	1.097	1.051
645	1.126	0.992	0.988	1.083	1.047
650	1.134	0.991	0.988	1.089	1.051
655	1.146	0.991	0.992	1.088	1.054
660	1.141	0.989	0.993	1.092	1.054
665	1.138	0.992	0.996	1.079	1.051
670	1.127	0.990	0.996	1.093	1.051
675	1.134	0.991	0.997	1.086	1.052
680	1.126	0.997	0.993	1.087	1.051
685	1.128	1.009	0.984	1.097	1.054
690	1.137	0.999	0.988	1.094	1.054
695	1.139	0.999	0.995	1.094	1.057
700	1.140	0.992	1.000	1.092	1.056
705	1.130	0.985	0.987	1.087	1.047
710	1.139	0.998	1.000	1.094	1.058
715	1.129	1.005	0.996	1.096	1.057
720	1.125	0.996	0.989	1.093	1.051
725	1.144	1.011	0.993	1.090	1.059
730	1.133	0.995	0.979	1.081	1.047

-30°/ 60° BIDIRECTIONAL ABSOLUTE SPECTRAL REFLECTANCE FACTORS FOR $BaSO_4$

Wav	Bss	Bsp	Bps	Bpp	Brr
390	1.099	0.921	0.921	1.034	0.989
395	1.112	0.945	0.945	1.046	1.008
400	1.109	0.941	0.941	1.051	1.005
405	1.118	0.947	0.947	1.060	1.014
410	1.119	0.947	0.947	1.058	1.016
415	1.119	0.949	0.949	1.064	1.018
420	1.123	0.951	0.951	1.064	1.019
425	1.125	0.952	0.952	1.066	1.021
430	1.124	0.955	0.955	1.067	1.021
435	1.124	0.955	0.955	1.067	1.021
440	1.119	0.954	0.954	1.064	1.018
445	1.125	0.954	0.954	1.064	1.020
450	1.124	0.955	0.955	1.069	1.021
455	1.124	0.957	0.957	1.064	1.021
460	1.122	0.956	0.956	1.064	1.020
465	1.131	0.951	0.951	1.060	1.022
470	1.125	0.958	0.958	1.069	1.023
475	1.126	0.956	0.956	1.067	1.023
480	1.127	0.957	0.957	1.066	1.023
485	1.128	0.958	0.958	1.071	1.025
490	1.130	0.957	0.957	1.070	1.025
495	1.126	0.957	0.957	1.069	1.024
500	1.122	0.960	0.960	1.066	1.023
505	1.129	0.958	0.958	1.070	1.025
510	1.133	0.960	0.960	1.071	1.026
515	1.132	0.960	0.960	1.075	1.028
520	1.127	0.960	0.960	1.076	1.027
525	1.127	0.959	0.959	1.076	1.028
530	1.128	0.961	0.961	1.075	1.028
535	1.135	0.962	0.962	1.075	1.030
540	1.134	0.960	0.960	1.072	1.028
545	1.132	0.961	0.961	1.071	1.029
550	1.133	0.962	0.962	1.072	1.030
555	1.134	0.969	0.969	1.072	1.031
560	1.137	0.964	0.949	1.075	1.031
565	1.130	0.968	0.950	1.068	1.029
570	1.136	0.964	0.949	1.072	1.030
575	1.136	0.965	0.948	1.072	1.030
580	1.138	0.969	0.947	1.078	1.033
585	1.132	0.963	0.951	1.073	1.030
590	1.133	0.964	0.959	1.077	1.033
595	1.132	0.963	0.955	1.078	1.032
600	1.139	0.961	0.955	1.079	1.034
605	1.132	0.965	0.954	1.077	1.032
610	1.137	0.964	0.950	1.083	1.033
615	1.140	0.960	0.952	1.078	1.032
620	1.143	0.962	0.952	1.084	1.035
625	1.138	0.968	0.953	1.073	1.033
630	1.138	0.961	0.954	1.074	1.032
635	1.139	0.968	0.954	1.081	1.036
640	1.136	0.964	0.956	1.089	1.036
645	1.141	0.968	0.957	1.084	1.038
650	1.145	0.964	0.956	1.086	1.038
655	1.149	0.966	0.960	1.087	1.040
660	1.148	0.966	0.954	1.084	1.038
665	1.144	0.965	0.956	1.074	1.035
670	1.143	0.976	0.951	1.073	1.036
675	1.152	0.966	0.962	1.083	1.041
680	1.149	0.973	0.964	1.078	1.041
685	1.138	0.968	0.958	1.084	1.037
690	1.149	0.967	0.959	1.087	1.041
695	1.142	0.972	0.964	1.083	1.040
700	1.131	0.974	0.963	1.088	1.039
705	1.135	0.967	0.955	1.083	1.035
710	1.145	0.966	0.962	1.085	1.040
715	1.142	0.969	0.974	1.086	1.043
720	1.150	0.959	0.953	1.101	1.041
725	1.138	0.967	0.962	1.084	1.038
730	1.145	0.959	0.970	1.087	1.040

-30°/ 75° BIDIRECTIONAL ABSOLUTE SPECTRAL REFLECTANCE FACTORS FOR BaSO4

Wav	Bss	Bsp	Bps	Bpp	Brr
390	1.105	0.869	0.869	0.970	0.948
395	1.110	0.885	0.885	1.001	0.963
400	1.108	0.879	0.879	0.998	0.961
405	1.114	0.889	0.889	1.008	0.969
410	1.115	0.892	0.892	1.008	0.970
415	1.117	0.891	0.891	1.015	0.972
420	1.117	0.895	0.895	1.016	0.974
425	1.118	0.895	0.895	1.015	0.973
430	1.122	0.894	0.894	1.015	0.974
435	1.119	0.893	0.893	1.014	0.973
440	1.119	0.894	0.894	1.019	0.975
445	1.119	0.892	0.892	1.017	0.974
450	1.122	0.895	0.895	1.016	0.975
455	1.120	0.898	0.898	1.017	0.976
460	1.121	0.895	0.895	1.014	0.975
465	1.127	0.891	0.891	1.011	0.976
470	1.124	0.898	0.898	1.019	0.978
475	1.125	0.898	0.898	1.018	0.979
480	1.123	0.898	0.898	1.019	0.979
485	1.121	0.900	0.900	1.019	0.978
490	1.127	0.900	0.900	1.019	0.980
495	1.124	0.901	0.901	1.020	0.980
500	1.126	0.904	0.904	1.019	0.981
505	1.128	0.902	0.902	1.020	0.981
510	1.131	0.904	0.904	1.023	0.983
515	1.128	0.905	0.905	1.022	0.983
520	1.127	0.903	0.903	1.026	0.983
525	1.126	0.903	0.903	1.026	0.983
530	1.127	0.907	0.907	1.027	0.984
535	1.131	0.903	0.903	1.026	0.984
540	1.133	0.907	0.907	1.027	0.987
545	1.130	0.907	0.907	1.028	0.987
550	1.132	0.910	0.910	1.030	0.988
555	1.133	0.909	0.909	1.029	0.988
560	1.129	0.908	0.881	1.029	0.987
565	1.130	0.906	0.881	1.030	0.987
570	1.132	0.909	0.882	1.027	0.987
575	1.132	0.908	0.883	1.029	0.988
580	1.132	0.908	0.882	1.027	0.987
585	1.133	0.912	0.881	1.033	0.990
590	1.136	0.906	0.884	1.032	0.989
595	1.135	0.909	0.881	1.027	0.988
600	1.138	0.909	0.882	1.031	0.990
605	1.134	0.911	0.881	1.028	0.988
610	1.134	0.910	0.883	1.034	0.990
615	1.129	0.911	0.882	1.033	0.989
620	1.136	0.904	0.883	1.033	0.989
625	1.131	0.912	0.884	1.030	0.989
630	1.134	0.911	0.889	1.027	0.990
635	1.129	0.912	0.885	1.029	0.989
640	1.126	0.903	0.883	1.036	0.987
645	1.133	0.909	0.882	1.030	0.989
650	1.135	0.910	0.890	1.025	0.990
655	1.137	0.909	0.890	1.029	0.991
660	1.134	0.915	0.891	1.022	0.990
665	1.141	0.911	0.888	1.029	0.992
670	1.136	0.920	0.883	1.040	0.995
675	1.132	0.911	0.881	1.037	0.990
680	1.141	0.907	0.887	1.036	0.993
685	1.132	0.911	0.887	1.033	0.991
690	1.138	0.918	0.892	1.036	0.996
695	1.138	0.910	0.887	1.029	0.991
700	1.132	0.926	0.893	1.029	0.995
705	1.140	0.905	0.891	1.036	0.993
710	1.134	0.910	0.874	1.031	0.987
715	1.142	0.907	0.890	1.029	0.992
720	1.141	0.917	0.885	1.037	0.995
725	1.135	0.913	0.889	1.044	0.995
730	1.146	0.911	0.898	1.042	0.999

-45°/-75° BIDIRECTIONAL ABSOLUTE SPECTRAL REFLECTANCE FACTORS FOR $BaSO_4$

Wav	Bss	Bsp	Bps	Bpp	Brr
390	0.981	0.833	0.833	1.023	0.912
395	0.994	0.863	0.863	1.043	0.936
400	0.994	0.855	0.855	1.042	0.932
405	1.004	0.857	0.857	1.048	0.938
410	1.007	0.861	0.861	1.053	0.941
415	1.008	0.864	0.864	1.050	0.942
420	1.004	0.867	0.867	1.052	0.943
425	1.008	0.866	0.866	1.050	0.942
430	1.004	0.862	0.862	1.048	0.938
435	1.000	0.865	0.865	1.050	0.940
440	1.002	0.865	0.865	1.051	0.940
445	1.001	0.862	0.862	1.049	0.939
450	1.001	0.867	0.867	1.049	0.941
455	1.004	0.869	0.869	1.050	0.942
460	1.003	0.866	0.866	1.047	0.940
465	1.010	0.861	0.861	1.044	0.942
470	1.007	0.866	0.866	1.050	0.942
475	1.004	0.867	0.867	1.049	0.942
480	1.004	0.868	0.868	1.050	0.943
485	1.008	0.866	0.866	1.047	0.942
490	1.004	0.866	0.866	1.051	0.942
495	1.005	0.866	0.866	1.049	0.942
500	1.006	0.866	0.866	1.048	0.941
505	1.006	0.868	0.868	1.049	0.943
510	1.005	0.869	0.869	1.053	0.943
515	1.006	0.868	0.868	1.050	0.942
520	1.005	0.867	0.867	1.052	0.943
525	1.003	0.871	0.871	1.055	0.944
530	1.003	0.873	0.873	1.051	0.944
535	1.005	0.867	0.867	1.052	0.943
540	1.010	0.868	0.868	1.055	0.946
545	1.003	0.867	0.867	1.051	0.943
550	1.005	0.870	0.870	1.054	0.944
555	1.008	0.865	0.865	1.053	0.944
560	1.002	0.865	0.848	1.053	0.942
565	1.002	0.869	0.851	1.050	0.943
570	1.006	0.868	0.846	1.054	0.944
575	0.998	0.867	0.849	1.049	0.941
580	1.005	0.870	0.849	1.053	0.945
585	1.001	0.865	0.849	1.050	0.941
590	1.003	0.869	0.849	1.055	0.944
595	0.994	0.865	0.850	1.048	0.939
600	1.004	0.864	0.851	1.041	0.940
605	1.002	0.863	0.848	1.044	0.939
610	0.999	0.866	0.853	1.046	0.941
615	0.999	0.864	0.848	1.048	0.940
620	0.999	0.865	0.850	1.047	0.940
625	1.007	0.864	0.849	1.051	0.943
630	1.005	0.864	0.851	1.047	0.942
635	1.000	0.861	0.849	1.046	0.939
640	0.997	0.867	0.845	1.048	0.939
645	1.004	0.861	0.846	1.047	0.940
650	1.008	0.866	0.853	1.048	0.944
655	0.998	0.864	0.848	1.049	0.940
660	0.992	0.867	0.842	1.047	0.937
665	0.999	0.856	0.847	1.043	0.936
670	1.006	0.853	0.854	1.046	0.940
675	0.995	0.856	0.849	1.040	0.935
680	0.995	0.856	0.843	1.046	0.935
685	0.992	0.858	0.846	1.047	0.936
690	0.995	0.861	0.843	1.043	0.935
695	0.995	0.858	0.853	1.049	0.939
700	0.999	0.854	0.854	1.050	0.939
705	0.999	0.866	0.844	1.041	0.938
710	0.995	0.859	0.854	1.038	0.936
715	0.996	0.855	0.844	1.042	0.934
720	1.005	0.860	0.843	1.034	0.935
725	1.009	0.875	0.841	1.025	0.938
730	0.978	0.869	0.845	1.033	0.931

-45°/-60° BIDIRECTIONAL ABSOLUTE SPECTRAL REFLECTANCE FACTORS FOR $BaSO_4$

Wav	Bss	Bsp	Bps	Bpp	Brr
390	1.055	0.890	0.890	1.104	0.983
395	1.076	0.910	0.910	1.112	1.000
400	1.060	0.906	0.906	1.112	0.992
405	1.077	0.906	0.906	1.123	1.002
410	1.078	0.910	0.910	1.123	1.003
415	1.080	0.911	0.911	1.128	1.006
420	1.076	0.914	0.914	1.128	1.004
425	1.075	0.912	0.912	1.129	1.005
430	1.073	0.910	0.910	1.128	1.003
435	1.074	0.913	0.913	1.122	1.002
440	1.075	0.913	0.913	1.127	1.004
445	1.078	0.915	0.915	1.122	1.004
450	1.078	0.910	0.910	1.125	1.004
455	1.074	0.912	0.912	1.126	1.004
460	1.075	0.908	0.908	1.124	1.002
465	1.081	0.906	0.906	1.122	1.003
470	1.075	0.913	0.913	1.125	1.004
475	1.078	0.914	0.914	1.127	1.006
480	1.078	0.910	0.910	1.126	1.005
485	1.077	0.911	0.911	1.127	1.005
490	1.075	0.912	0.912	1.129	1.005
495	1.077	0.911	0.911	1.131	1.005
500	1.074	0.911	0.911	1.128	1.004
505	1.070	0.909	0.909	1.129	1.002
510	1.075	0.912	0.912	1.128	1.004
515	1.072	0.909	0.909	1.127	1.003
520	1.073	0.906	0.906	1.126	1.002
525	1.077	0.911	0.911	1.128	1.005
530	1.076	0.910	0.910	1.128	1.004
535	1.073	0.908	0.908	1.127	1.003
540	1.073	0.911	0.911	1.126	1.004
545	1.074	0.911	0.911	1.129	1.004
550	1.076	0.912	0.912	1.136	1.007
555	1.076	0.914	0.914	1.125	1.005
560	1.076	0.908	0.902	1.128	1.004

Wav	Bss	Bsp	Bps	Bpp	Brr
565	1.073	0.909	0.906	1.127	1.004
570	1.076	0.910	0.903	1.127	1.004
575	1.073	0.905	0.902	1.125	1.001
580	1.069	0.911	0.903	1.127	1.002
585	1.073	0.905	0.899	1.130	1.002
590	1.071	0.904	0.902	1.128	1.001
595	1.070	0.909	0.903	1.124	1.001
600	1.069	0.906	0.902	1.122	1.000
605	1.067	0.900	0.900	1.126	0.998
610	1.066	0.903	0.904	1.121	0.999
615	1.070	0.905	0.901	1.120	0.999
620	1.069	0.904	0.907	1.123	1.001
625	1.066	0.910	0.908	1.125	1.002
630	1.078	0.900	0.897	1.129	1.001
635	1.072	0.903	0.898	1.123	0.999
640	1.070	0.906	0.901	1.126	1.001
645	1.060	0.906	0.901	1.121	0.997
650	1.067	0.903	0.896	1.124	0.997
655	1.066	0.901	0.901	1.117	0.996
660	1.071	0.903	0.895	1.119	0.997
665	1.070	0.899	0.904	1.119	0.998
670	1.062	0.903	0.907	1.120	0.998
675	1.067	0.901	0.900	1.121	0.997
680	1.066	0.907	0.895	1.120	0.997
685	1.065	0.904	0.895	1.124	0.997
690	1.059	0.899	0.892	1.133	0.996
695	1.071	0.903	0.895	1.125	0.999
700	1.072	0.898	0.882	1.126	0.994
705	1.067	0.894	0.897	1.123	0.995
710	1.069	0.891	0.903	1.128	0.998
715	1.078	0.891	0.901	1.108	0.995
720	1.074	0.900	0.885	1.111	0.993
725	1.072	0.883	0.894	1.113	0.991
730	1.057	0.896	0.906	1.111	0.993

-45°/-30° BIDIRECTIONAL ABSOLUTE SPECTRAL REFLECTANCE FACTORS FOR $BaSO_4$

Wav	Bss	Bsp	Bps	Bpp	Brr
390	1.070	0.929	0.929	1.109	1.007
395	1.095	0.943	0.943	1.120	1.026
400	1.097	0.940	0.940	1.129	1.026
405	1.098	0.944	0.944	1.133	1.031
410	1.103	0.945	0.945	1.137	1.035
415	1.105	0.953	0.953	1.137	1.037
420	1.107	0.954	0.954	1.138	1.039
425	1.104	0.954	0.954	1.137	1.038
430	1.101	0.954	0.954	1.142	1.038
435	1.105	0.956	0.956	1.141	1.039
440	1.102	0.954	0.954	1.142	1.037
445	1.104	0.951	0.951	1.138	1.037
450	1.105	0.953	0.953	1.144	1.039
455	1.104	0.955	0.955	1.141	1.039
460	1.104	0.954	0.954	1.138	1.037
465	1.111	0.951	0.951	1.130	1.038
470	1.108	0.956	0.956	1.141	1.040
475	1.108	0.954	0.954	1.145	1.041
480	1.108	0.958	0.958	1.144	1.042
485	1.107	0.955	0.955	1.144	1.040
490	1.107	0.954	0.954	1.145	1.041
495	1.105	0.956	0.956	1.144	1.041
500	1.108	0.953	0.953	1.144	1.041
505	1.110	0.951	0.951	1.142	1.039
510	1.110	0.951	0.951	1.146	1.040
515	1.114	0.953	0.953	1.144	1.043
520	1.107	0.954	0.954	1.144	1.041
525	1.105	0.953	0.953	1.143	1.038
530	1.101	0.955	0.955	1.145	1.039
535	1.105	0.952	0.952	1.147	1.040
540	1.109	0.954	0.954	1.142	1.040
545	1.111	0.950	0.950	1.149	1.043
550	1.112	0.953	0.953	1.143	1.040
555	1.107	0.951	0.951	1.141	1.039
560	1.109	0.950	0.955	1.140	1.039

Wav	Bss	Bsp	Bps	Bpp	Brr
565	1.105	0.951	0.953	1.146	1.039
570	1.108	0.946	0.952	1.147	1.038
575	1.110	0.948	0.957	1.146	1.040
580	1.111	0.954	0.956	1.147	1.042
585	1.103	0.950	0.957	1.142	1.038
590	1.098	0.948	0.953	1.144	1.036
595	1.107	0.947	0.952	1.136	1.036
600	1.104	0.947	0.954	1.142	1.037
605	1.109	0.947	0.955	1.146	1.039
610	1.104	0.948	0.959	1.149	1.040
615	1.107	0.950	0.953	1.144	1.039
620	1.105	0.946	0.951	1.146	1.037
625	1.112	0.947	0.957	1.137	1.038
630	1.112	0.948	0.965	1.137	1.041
635	1.105	0.946	0.960	1.140	1.038
640	1.110	0.949	0.957	1.137	1.038
645	1.102	0.947	0.955	1.142	1.036
650	1.104	0.957	0.957	1.142	1.040
655	1.107	0.943	0.953	1.144	1.037
660	1.112	0.947	0.956	1.146	1.040
665	1.108	0.949	0.960	1.149	1.042
670	1.115	0.956	0.966	1.152	1.047
675	1.116	0.943	0.954	1.139	1.038
680	1.105	0.947	0.958	1.142	1.038
685	1.115	0.946	0.954	1.130	1.036
690	1.100	0.943	0.950	1.140	1.033
695	1.099	0.951	0.955	1.138	1.036
700	1.104	0.942	0.956	1.142	1.036
705	1.104	0.946	0.969	1.151	1.043
710	1.109	0.953	0.965	1.146	1.043
715	1.116	0.956	0.953	1.151	1.044
720	1.106	0.944	0.965	1.129	1.036
725	1.114	0.948	0.955	1.147	1.041
730	1.103	0.951	0.959	1.151	1.041

-45°/-15° BIDIRECTIONAL ABSOLUTE SPECTRAL REFLECTANCE FACTORS FOR $BaSO_4$

Wav	Bss	Bsp	Bps	Bpp	Brr
390	1.058	0.929	0.929	1.052	0.993
395	1.086	0.957	0.957	1.101	1.024
400	1.077	0.960	0.960	1.085	1.019
405	1.083	0.956	0.956	1.103	1.026
410	1.089	0.963	0.963	1.099	1.028
415	1.088	0.962	0.962	1.103	1.030
420	1.087	0.963	0.963	1.105	1.030
425	1.091	0.966	0.966	1.106	1.032
430	1.090	0.965	0.965	1.105	1.031
435	1.088	0.962	0.962	1.104	1.029
440	1.091	0.965	0.965	1.105	1.032
445	1.087	0.962	0.962	1.104	1.030
450	1.089	0.965	0.965	1.105	1.031
455	1.094	0.967	0.967	1.106	1.034
460	1.091	0.965	0.965	1.104	1.032
465	1.099	0.962	0.962	1.102	1.034
470	1.090	0.967	0.967	1.109	1.034
475	1.093	0.969	0.969	1.105	1.035
480	1.092	0.969	0.969	1.105	1.034
485	1.088	0.966	0.966	1.103	1.032
490	1.094	0.967	0.967	1.108	1.035
495	1.095	0.968	0.968	1.104	1.034
500	1.093	0.970	0.970	1.106	1.035
505	1.094	0.967	0.967	1.107	1.035
510	1.094	0.967	0.967	1.110	1.036
515	1.089	0.969	0.969	1.109	1.034
520	1.097	0.971	0.971	1.106	1.036
525	1.095	0.971	0.971	1.108	1.036
530	1.095	0.973	0.973	1.104	1.036
535	1.093	0.971	0.971	1.106	1.035
540	1.098	0.971	0.971	1.105	1.036
545	1.091	0.970	0.970	1.107	1.035
550	1.095	0.967	0.967	1.103	1.034
555	1.093	0.967	0.967	1.105	1.034
560	1.093	0.967	0.972	1.104	1.034
565	1.095	0.967	0.976	1.104	1.036
570	1.093	0.967	0.971	1.107	1.035
575	1.092	0.964	0.974	1.104	1.033
580	1.096	0.968	0.973	1.108	1.036
585	1.095	0.961	0.972	1.101	1.032
590	1.092	0.966	0.978	1.105	1.035
595	1.094	0.967	0.969	1.109	1.035
600	1.095	0.966	0.972	1.106	1.035
605	1.089	0.965	0.966	1.104	1.031
610	1.100	0.963	0.967	1.096	1.032
615	1.099	0.969	0.975	1.100	1.036
620	1.099	0.967	0.976	1.108	1.037
625	1.096	0.969	0.969	1.105	1.035
630	1.095	0.972	0.978	1.103	1.037
635	1.096	0.958	0.976	1.100	1.033
640	1.099	0.971	0.972	1.098	1.035
645	1.091	0.968	0.970	1.099	1.032
650	1.093	0.968	0.979	1.094	1.033
655	1.099	0.970	0.969	1.103	1.035
660	1.102	0.962	0.972	1.099	1.034
665	1.103	0.962	0.971	1.104	1.035
670	1.090	0.967	0.968	1.098	1.031
675	1.103	0.958	0.973	1.110	1.036
680	1.093	0.965	0.977	1.103	1.035
685	1.098	0.965	0.969	1.099	1.033
690	1.099	0.965	0.980	1.111	1.039
695	1.109	0.969	0.969	1.098	1.036
700	1.109	0.965	0.990	1.096	1.040
705	1.096	0.964	0.986	1.104	1.037
710	1.100	0.979	0.976	1.097	1.038
715	1.114	0.963	0.993	1.109	1.045
720	1.102	0.971	0.977	1.115	1.042
725	1.114	0.970	0.981	1.087	1.038
730	1.099	0.957	0.985	1.088	1.032

-45°/ 0° BIDIRECTIONAL ABSOLUTE SPECTRAL REFLECTANCE FACTORS FOR BaSO4

Wav	Bss	Bsp	Bps	Bpp	Brr
390	1.055	0.937	0.937	1.051	0.996
395	1.081	0.959	0.959	1.068	1.019
400	1.078	0.953	0.953	1.069	1.016
405	1.084	0.963	0.963	1.082	1.024
410	1.082	0.967	0.967	1.078	1.025
415	1.086	0.968	0.968	1.083	1.028
420	1.088	0.971	0.971	1.084	1.029
425	1.091	0.969	0.969	1.087	1.031
430	1.089	0.970	0.970	1.087	1.031
435	1.089	0.972	0.972	1.087	1.030
440	1.090	0.973	0.973	1.089	1.032
445	1.090	0.974	0.974	1.089	1.033
450	1.091	0.971	0.971	1.085	1.030
455	1.091	0.976	0.976	1.083	1.032
460	1.094	0.971	0.971	1.083	1.032
465	1.098	0.969	0.969	1.080	1.033
470	1.093	0.975	0.975	1.087	1.033
475	1.096	0.975	0.975	1.087	1.035
480	1.093	0.972	0.972	1.086	1.032
485	1.090	0.972	0.972	1.086	1.032
490	1.092	0.971	0.971	1.090	1.033
495	1.092	0.974	0.974	1.088	1.033
500	1.089	0.978	0.978	1.085	1.033
505	1.095	0.981	0.981	1.085	1.036
510	1.094	0.976	0.976	1.088	1.035
515	1.095	0.976	0.976	1.088	1.033
520	1.094	0.974	0.974	1.088	1.033
525	1.090	0.975	0.975	1.085	1.032
530	1.094	0.976	0.976	1.086	1.034
535	1.093	0.973	0.973	1.087	1.032
540	1.091	0.973	0.973	1.086	1.032
545	1.093	0.972	0.972	1.086	1.034
550	1.098	0.978	0.978	1.088	1.038
555	1.098	0.973	0.973	1.089	1.036
560	1.097	0.975	0.981	1.087	1.035

Wav	Bss	Bsp	Bps	Bpp	Brr
565	1.097	0.974	0.979	1.089	1.035
570	1.094	0.976	0.980	1.090	1.035
575	1.091	0.975	0.983	1.084	1.033
580	1.095	0.979	0.985	1.083	1.035
585	1.089	0.976	0.983	1.085	1.033
590	1.094	0.973	0.981	1.085	1.033
595	1.091	0.971	0.981	1.085	1.032
600	1.100	0.973	0.983	1.084	1.035
605	1.095	0.977	0.985	1.083	1.035
610	1.091	0.983	0.987	1.083	1.036
615	1.094	0.977	0.988	1.084	1.036
620	1.098	0.976	0.989	1.084	1.037
625	1.098	0.971	0.991	1.082	1.035
630	1.094	0.981	0.985	1.080	1.035
635	1.082	0.975	0.989	1.086	1.033
640	1.091	0.973	0.985	1.084	1.033
645	1.100	0.973	0.984	1.091	1.037
650	1.097	0.976	0.989	1.093	1.039
655	1.090	0.973	0.986	1.084	1.033
660	1.103	0.977	0.988	1.082	1.037
665	1.095	0.971	0.989	1.086	1.035
670	1.098	0.973	0.991	1.082	1.036
675	1.093	0.967	0.980	1.073	1.028
680	1.096	0.979	0.994	1.089	1.039
685	1.103	0.973	0.984	1.091	1.038
690	1.094	0.970	0.989	1.088	1.036
695	1.104	0.975	0.994	1.079	1.038
700	1.100	0.993	0.989	1.088	1.043
705	1.094	0.984	0.988	1.084	1.038
710	1.109	0.990	0.989	1.080	1.042
715	1.111	0.987	0.991	1.098	1.047
720	1.098	0.979	0.994	1.083	1.039
725	1.097	0.966	0.989	1.092	1.036
730	1.107	0.980	0.988	1.098	1.043

-45°/ 15° BIDIRECTIONAL ABSOLUTE SPECTRAL REFLECTANCE FACTORS FOR $BaSO_4$

Wav	Bss	Bsp	Bps	Bpp	Brr
390	1.059	0.944	0.944	1.434	1.094
395	1.089	0.959	0.959	1.241	1.064
400	1.087	0.956	0.956	1.219	1.057
405	1.097	0.968	0.968	1.220	1.065
410	1.096	0.971	0.971	1.201	1.060
415	1.095	0.973	0.973	1.195	1.060
420	1.097	0.973	0.973	1.176	1.056
425	1.100	0.975	0.975	1.169	1.056
430	1.097	0.973	0.973	1.168	1.053
435	1.098	0.975	0.975	1.157	1.052
440	1.099	0.978	0.978	1.158	1.053
445	1.103	0.976	0.976	1.152	1.052
450	1.102	0.977	0.977	1.144	1.051
455	1.097	0.983	0.983	1.142	1.050
460	1.100	0.975	0.975	1.125	1.045
465	1.110	0.973	0.973	1.117	1.047
470	1.101	0.980	0.980	1.125	1.047
475	1.099	0.980	0.980	1.132	1.048
480	1.098	0.978	0.978	1.129	1.046
485	1.099	0.979	0.979	1.131	1.048
490	1.097	0.980	0.980	1.131	1.048
495	1.099	0.978	0.978	1.135	1.048
500	1.103	0.979	0.979	1.140	1.052
505	1.103	0.978	0.978	1.141	1.051
510	1.103	0.980	0.980	1.141	1.051
515	1.106	0.981	0.981	1.143	1.053
520	1.106	0.985	0.985	1.147	1.055
525	1.105	0.982	0.982	1.151	1.055
530	1.105	0.982	0.982	1.154	1.056
535	1.104	0.980	0.980	1.156	1.057
540	1.099	0.984	0.984	1.166	1.058
545	1.098	0.983	0.983	1.166	1.059
550	1.103	0.981	0.981	1.165	1.060
555	1.104	0.981	0.981	1.166	1.059
560	1.098	0.974	0.987	1.168	1.057

Wav	Bss	Bsp	Bps	Bpp	Brr
565	1.098	0.979	0.988	1.172	1.059
570	1.104	0.978	0.981	1.176	1.060
575	1.102	0.979	0.987	1.178	1.062
580	1.104	0.982	0.991	1.181	1.064
585	1.097	0.981	0.988	1.184	1.062
590	1.092	0.984	0.985	1.188	1.062
595	1.101	0.979	0.983	1.194	1.064
600	1.098	0.981	0.987	1.208	1.069
605	1.101	0.976	0.983	1.214	1.068
610	1.095	0.981	0.989	1.213	1.069
615	1.105	0.982	0.992	1.221	1.075
620	1.110	0.978	0.986	1.217	1.073
625	1.111	0.986	0.987	1.225	1.077
630	1.111	0.984	0.990	1.230	1.079
635	1.111	0.979	0.987	1.245	1.081
640	1.108	0.978	0.990	1.268	1.086
645	1.105	0.983	0.993	1.263	1.086
650	1.113	0.987	0.989	1.282	1.093
655	1.112	0.983	0.991	1.290	1.094
660	1.109	0.981	0.986	1.287	1.091
665	1.111	0.987	0.989	1.294	1.095
670	1.109	0.979	0.981	1.315	1.096
675	1.110	0.981	0.985	1.306	1.095
680	1.115	0.988	0.995	1.287	1.096
685	1.106	0.990	0.996	1.327	1.105
690	1.104	0.980	0.994	1.329	1.102
695	1.103	0.992	0.995	1.331	1.105
700	1.111	0.996	0.991	1.347	1.111
705	1.108	0.988	0.998	1.327	1.105
710	1.114	0.992	0.999	1.428	1.133
715	1.118	0.985	0.998	1.377	1.119
720	1.100	0.996	0.992	1.330	1.105
725	1.114	0.995	0.996	1.363	1.117
730	1.109	0.980	1.005	1.447	1.135

-45°/ 30° BIDIRECTIONAL ABSOLUTE SPECTRAL REFLECTANCE FACTORS FOR BaSO4

Wav	Bss	Bsp	Bps	Bpp	Brr
390	1.079	0.942	0.942	1.045	1.000
395	1.110	0.966	0.966	1.068	1.027
400	1.103	0.961	0.961	1.056	1.020
405	1.113	0.969	0.969	1.069	1.029
410	1.114	0.969	0.969	1.076	1.032
415	1.111	0.973	0.973	1.081	1.035
420	1.116	0.979	0.979	1.075	1.035
425	1.118	0.975	0.975	1.073	1.035
430	1.115	0.976	0.976	1.082	1.036
435	1.114	0.976	0.976	1.080	1.037
440	1.117	0.982	0.982	1.077	1.038
445	1.116	0.979	0.979	1.077	1.036
450	1.113	0.979	0.979	1.081	1.037
455	1.115	0.979	0.979	1.080	1.038
460	1.120	0.979	0.979	1.079	1.039
465	1.127	0.974	0.974	1.074	1.039
470	1.122	0.981	0.981	1.081	1.041
475	1.120	0.976	0.976	1.079	1.039
480	1.126	0.979	0.979	1.081	1.042
485	1.120	0.982	0.982	1.082	1.041
490	1.120	0.980	0.980	1.078	1.039
495	1.127	0.978	0.978	1.079	1.041
500	1.124	0.978	0.978	1.080	1.041
505	1.125	0.985	0.985	1.084	1.043
510	1.125	0.983	0.983	1.082	1.042
515	1.122	0.979	0.979	1.081	1.041
520	1.126	0.981	0.981	1.085	1.044
525	1.120	0.980	0.980	1.085	1.043
530	1.118	0.985	0.985	1.088	1.044
535	1.120	0.984	0.984	1.084	1.042
540	1.117	0.987	0.987	1.088	1.043
545	1.126	0.987	0.987	1.087	1.045
550	1.121	0.981	0.981	1.079	1.041
555	1.119	0.983	0.983	1.083	1.042
560	1.120	0.986	0.986	1.080	1.043

Wav	Bss	Bsp	Bps	Bpp	Brr
565	1.123	0.980	0.984	1.087	1.043
570	1.124	0.978	0.981	1.088	1.043
575	1.125	0.979	0.981	1.080	1.041
580	1.128	0.982	0.989	1.081	1.045
585	1.123	0.975	0.987	1.078	1.041
590	1.121	0.978	0.982	1.084	1.041
595	1.128	0.977	0.977	1.086	1.042
600	1.124	0.980	0.984	1.083	1.043
605	1.123	0.978	0.983	1.086	1.043
610	1.125	0.982	0.989	1.090	1.047
615	1.122	0.983	0.987	1.085	1.044
620	1.125	0.982	0.990	1.088	1.046
625	1.134	0.985	0.991	1.079	1.047
630	1.127	0.977	0.988	1.080	1.043
635	1.128	0.984	0.983	1.083	1.045
640	1.132	0.977	0.988	1.081	1.044
645	1.136	0.980	0.992	1.078	1.046
650	1.147	0.981	0.991	1.090	1.052
655	1.136	0.986	0.991	1.085	1.050
660	1.139	0.988	0.990	1.089	1.052
665	1.127	0.974	0.990	1.085	1.044
670	1.130	0.978	0.988	1.086	1.045
675	1.133	0.982	0.991	1.087	1.048
680	1.132	0.985	0.996	1.077	1.048
685	1.118	0.980	0.993	1.080	1.043
690	1.128	0.988	0.995	1.086	1.049
695	1.134	0.983	0.988	1.086	1.048
700	1.136	0.991	1.001	1.084	1.053
705	1.127	0.974	0.996	1.088	1.046
710	1.132	0.987	0.989	1.095	1.051
715	1.131	1.000	1.000	1.091	1.056
720	1.146	0.986	0.982	1.096	1.053
725	1.145	0.992	0.999	1.085	1.055
730	1.131	0.982	1.000	1.087	1.050

-45°/ 45° BIDIRECTIONAL ABSOLUTE SPECTRAL REFLECTANCE FACTORS FOR BaSO4

Wav	Bss	Bsp	Bps	Bpp	Brr
390	1.113	0.927	0.927	1.054	1.004
395	1.133	0.957	0.957	1.067	1.026
400	1.139	0.950	0.950	1.068	1.024
405	1.145	0.961	0.961	1.077	1.035
410	1.143	0.962	0.962	1.084	1.036
415	1.150	0.966	0.966	1.086	1.040
420	1.148	0.966	0.966	1.086	1.039
425	1.150	0.964	0.964	1.088	1.041
430	1.149	0.965	0.965	1.087	1.040
435	1.145	0.966	0.966	1.088	1.039
440	1.148	0.968	0.968	1.091	1.042
445	1.151	0.967	0.967	1.090	1.043
450	1.149	0.970	0.970	1.091	1.043
455	1.152	0.971	0.971	1.089	1.044
460	1.154	0.971	0.971	1.091	1.045
465	1.161	0.965	0.965	1.090	1.046
470	1.155	0.974	0.974	1.093	1.047
475	1.156	0.968	0.968	1.094	1.046
480	1.152	0.968	0.968	1.092	1.045
485	1.157	0.972	0.972	1.099	1.049
490	1.155	0.973	0.973	1.096	1.047
495	1.159	0.972	0.972	1.095	1.047
500	1.160	0.968	0.968	1.093	1.046
505	1.159	0.974	0.974	1.095	1.050
510	1.158	0.972	0.972	1.095	1.049
515	1.156	0.973	0.973	1.096	1.049
520	1.151	0.971	0.971	1.092	1.044
525	1.154	0.975	0.975	1.094	1.047
530	1.159	0.973	0.973	1.094	1.047
535	1.159	0.968	0.968	1.097	1.048
540	1.163	0.972	0.972	1.095	1.049
545	1.154	0.972	0.972	1.097	1.048
550	1.161	0.971	0.971	1.100	1.052
555	1.157	0.972	0.972	1.096	1.050
560	1.157	0.970	0.973	1.098	1.049

Wav	Bss	Bsp	Bps	Bpp	Brr
565	1.157	0.974	0.970	1.099	1.050
570	1.165	0.982	0.972	1.094	1.053
575	1.154	0.977	0.970	1.095	1.049
580	1.159	0.973	0.972	1.099	1.051
585	1.167	0.972	0.972	1.099	1.052
590	1.160	0.967	0.973	1.099	1.050
595	1.167	0.971	0.971	1.100	1.052
600	1.155	0.973	0.974	1.109	1.053
605	1.164	0.969	0.975	1.106	1.054
610	1.166	0.975	0.974	1.101	1.054
615	1.163	0.977	0.974	1.105	1.055
620	1.163	0.976	0.976	1.104	1.054
625	1.168	0.974	0.978	1.095	1.054
630	1.167	0.973	0.975	1.099	1.054
635	1.168	0.975	0.980	1.100	1.056
640	1.167	0.974	0.980	1.104	1.056
645	1.168	0.972	0.969	1.101	1.052
650	1.170	0.974	0.977	1.103	1.056
655	1.175	0.976	0.981	1.102	1.059
660	1.174	0.974	0.977	1.107	1.058
665	1.169	0.972	0.975	1.097	1.054
670	1.160	0.971	0.977	1.104	1.053
675	1.172	0.976	0.976	1.102	1.057
680	1.176	0.975	0.972	1.107	1.058
685	1.179	0.976	0.974	1.106	1.058
690	1.177	0.973	0.973	1.099	1.055
695	1.172	0.981	0.978	1.098	1.057
700	1.174	0.988	0.979	1.100	1.060
705	1.180	0.984	0.988	1.114	1.067
710	1.178	0.978	0.988	1.121	1.066
715	1.180	0.989	0.995	1.116	1.070
720	1.182	0.988	0.996	1.108	1.068
725	1.190	0.979	0.981	1.103	1.063
730	1.178	0.977	0.981	1.099	1.059

-45°/ 60° BIDIRECTIONAL ABSOLUTE SPECTRAL REFLECTANCE FACTORS FOR $BaSO_4$

Wav	Bss	Bsp	Bps	Bpp	Brr
390	1.184	0.901	0.901	1.054	1.006
395	1.203	0.925	0.925	1.084	1.033
400	1.192	0.924	0.924	1.077	1.029
405	1.213	0.934	0.934	1.093	1.041
410	1.214	0.939	0.939	1.089	1.042
415	1.216	0.938	0.938	1.095	1.044
420	1.209	0.938	0.938	1.101	1.044
425	1.212	0.940	0.940	1.098	1.045
430	1.214	0.942	0.942	1.097	1.045
435	1.212	0.944	0.944	1.098	1.046
440	1.211	0.944	0.944	1.103	1.048
445	1.215	0.941	0.941	1.100	1.047
450	1.219	0.943	0.943	1.101	1.049
455	1.218	0.944	0.944	1.105	1.050
460	1.217	0.943	0.943	1.107	1.051
465	1.222	0.939	0.939	1.103	1.051
470	1.220	0.946	0.946	1.112	1.054
475	1.219	0.946	0.946	1.109	1.052
480	1.222	0.947	0.947	1.110	1.053
485	1.221	0.948	0.948	1.108	1.054
490	1.222	0.944	0.944	1.110	1.053
495	1.220	0.949	0.949	1.112	1.055
500	1.221	0.946	0.946	1.110	1.054
505	1.223	0.945	0.945	1.110	1.055
510	1.230	0.949	0.949	1.111	1.056
515	1.227	0.950	0.950	1.112	1.056
520	1.224	0.946	0.946	1.111	1.054
525	1.223	0.950	0.950	1.112	1.055
530	1.223	0.948	0.948	1.113	1.055
535	1.224	0.945	0.945	1.110	1.054
540	1.226	0.946	0.946	1.112	1.056
545	1.227	0.945	0.945	1.111	1.055
550	1.231	0.950	0.950	1.117	1.060
555	1.230	0.954	0.954	1.113	1.059
560	1.221	0.952	0.937	1.113	1.056

Wav	Bss	Bsp	Bps	Bpp	Brr
565	1.228	0.951	0.935	1.117	1.058
570	1.228	0.951	0.942	1.113	1.059
575	1.221	0.948	0.941	1.114	1.056
580	1.229	0.952	0.944	1.112	1.059
585	1.224	0.949	0.940	1.114	1.057
590	1.225	0.947	0.942	1.112	1.057
595	1.227	0.946	0.937	1.116	1.057
600	1.237	0.954	0.940	1.120	1.063
605	1.235	0.949	0.939	1.115	1.060
610	1.238	0.957	0.942	1.111	1.062
615	1.225	0.954	0.942	1.118	1.060
620	1.225	0.953	0.947	1.119	1.061
625	1.233	0.948	0.943	1.117	1.060
630	1.232	0.951	0.948	1.115	1.061
635	1.239	0.949	0.948	1.122	1.064
640	1.236	0.949	0.949	1.118	1.063
645	1.243	0.951	0.947	1.127	1.067
650	1.243	0.958	0.951	1.123	1.069
655	1.235	0.950	0.948	1.128	1.065
660	1.231	0.946	0.943	1.129	1.062
665	1.234	0.955	0.948	1.124	1.065
670	1.241	0.957	0.945	1.117	1.065
675	1.231	0.951	0.944	1.115	1.060
680	1.243	0.955	0.938	1.129	1.066
685	1.229	0.950	0.950	1.127	1.064
690	1.229	0.947	0.949	1.123	1.062
695	1.231	0.957	0.946	1.130	1.066
700	1.223	0.964	0.954	1.124	1.066
705	1.233	0.958	0.953	1.122	1.067
710	1.240	0.963	0.956	1.133	1.073
715	1.246	0.966	0.950	1.137	1.075
720	1.236	0.966	0.947	1.131	1.070
725	1.241	0.958	0.947	1.133	1.070
730	1.248	0.950	0.945	1.133	1.069

-45°/ 75° BIDIRECTIONAL ABSOLUTE SPECTRAL REFLECTANCE FACTORS FOR $BaSO_4$

Wav	Bss	Bsp	Bps	Bpp	Brr
390	1.299	0.861	0.861	1.066	1.021
395	1.312	0.890	0.890	1.099	1.044
400	1.301	0.885	0.885	1.106	1.038
405	1.311	0.891	0.891	1.112	1.046
410	1.325	0.893	0.893	1.108	1.049
415	1.323	0.896	0.896	1.114	1.051
420	1.323	0.900	0.900	1.111	1.051
425	1.321	0.899	0.899	1.116	1.052
430	1.321	0.899	0.899	1.113	1.051
435	1.322	0.899	0.899	1.116	1.052
440	1.319	0.899	0.899	1.118	1.053
445	1.325	0.902	0.902	1.118	1.055
450	1.326	0.903	0.903	1.121	1.056
455	1.328	0.905	0.905	1.124	1.058
460	1.325	0.901	0.901	1.121	1.056
465	1.332	0.900	0.900	1.116	1.058
470	1.328	0.906	0.906	1.123	1.059
475	1.332	0.905	0.905	1.123	1.060
480	1.336	0.907	0.907	1.127	1.063
485	1.331	0.905	0.905	1.123	1.060
490	1.336	0.904	0.904	1.123	1.061
495	1.339	0.907	0.907	1.127	1.063
500	1.333	0.908	0.908	1.128	1.062
505	1.335	0.907	0.907	1.128	1.063
510	1.338	0.908	0.908	1.130	1.064
515	1.339	0.908	0.908	1.131	1.064
520	1.341	0.909	0.909	1.130	1.065
525	1.342	0.912	0.912	1.130	1.067
530	1.333	0.915	0.915	1.131	1.065
535	1.334	0.909	0.909	1.128	1.063
540	1.337	0.908	0.908	1.130	1.065
545	1.336	0.912	0.912	1.131	1.066
550	1.343	0.913	0.913	1.129	1.068
555	1.343	0.911	0.911	1.129	1.067
560	1.347	0.908	0.878	1.131	1.066
565	1.349	0.910	0.884	1.131	1.068
570	1.349	0.910	0.886	1.133	1.069
575	1.346	0.907	0.882	1.131	1.067
580	1.348	0.914	0.886	1.130	1.070
585	1.342	0.913	0.887	1.131	1.068
590	1.340	0.913	0.888	1.130	1.068
595	1.342	0.909	0.883	1.131	1.067
600	1.343	0.913	0.881	1.134	1.068
605	1.347	0.909	0.889	1.126	1.068
610	1.348	0.909	0.891	1.134	1.070
615	1.348	0.910	0.887	1.137	1.070
620	1.358	0.911	0.888	1.136	1.073
625	1.350	0.911	0.891	1.130	1.071
630	1.352	0.913	0.889	1.131	1.071
635	1.349	0.914	0.893	1.132	1.072
640	1.347	0.909	0.890	1.128	1.069
645	1.346	0.913	0.892	1.130	1.071
650	1.359	0.918	0.893	1.137	1.077
655	1.351	0.911	0.885	1.143	1.072
660	1.349	0.913	0.889	1.127	1.070
665	1.347	0.911	0.885	1.138	1.070
670	1.352	0.923	0.890	1.143	1.077
675	1.343	0.907	0.891	1.132	1.068
680	1.359	0.917	0.892	1.137	1.076
685	1.358	0.912	0.893	1.133	1.074
690	1.368	0.915	0.890	1.128	1.075
695	1.366	0.911	0.888	1.131	1.074
700	1.359	0.907	0.901	1.151	1.080
705	1.369	0.910	0.893	1.135	1.077
710	1.364	0.925	0.903	1.143	1.084
715	1.372	0.910	0.895	1.156	1.083
720	1.363	0.921	0.881	1.137	1.076
725	1.369	0.913	0.898	1.146	1.082
730	1.365	0.925	0.888	1.135	1.078

-60°/-75° BIDIRECTIONAL ABSOLUTE SPECTRAL REFLECTANCE FACTORS FOR BaSO4

Wav	Bss	Bsp	Bps	Bpp	Brr
390	1.043	0.822	0.822	1.139	0.960
395	1.082	0.874	0.874	1.148	0.992
400	1.071	0.862	0.862	1.147	0.982
405	1.080	0.857	0.857	1.146	0.983
410	1.080	0.863	0.863	1.161	0.989
415	1.080	0.868	0.868	1.156	0.988
420	1.076	0.868	0.868	1.154	0.986
425	1.080	0.868	0.868	1.155	0.989
430	1.074	0.856	0.856	1.153	0.983
435	1.074	0.862	0.862	1.155	0.984
440	1.080	0.860	0.860	1.158	0.986
445	1.074	0.862	0.862	1.154	0.984
450	1.073	0.859	0.859	1.156	0.983
455	1.076	0.865	0.865	1.159	0.987
460	1.075	0.864	0.864	1.153	0.985
465	1.078	0.857	0.857	1.153	0.986
470	1.074	0.862	0.862	1.160	0.986
475	1.074	0.861	0.861	1.159	0.986
480	1.075	0.865	0.865	1.160	0.988
485	1.073	0.861	0.861	1.155	0.984
490	1.070	0.858	0.858	1.156	0.983
495	1.070	0.860	0.860	1.160	0.984
500	1.074	0.857	0.857	1.154	0.982
505	1.074	0.856	0.856	1.155	0.983
510	1.071	0.861	0.861	1.157	0.983
515	1.076	0.861	0.861	1.156	0.984
520	1.075	0.860	0.860	1.150	0.982
525	1.068	0.860	0.860	1.154	0.981
530	1.072	0.860	0.860	1.160	0.984
535	1.065	0.856	0.856	1.155	0.980
540	1.060	0.859	0.859	1.161	0.981
545	1.068	0.858	0.858	1.154	0.980
550	1.069	0.856	0.856	1.157	0.981
555	1.067	0.856	0.856	1.153	0.979
560	1.062	0.850	0.844	1.152	0.977
565	1.062	0.855	0.842	1.150	0.977
570	1.061	0.850	0.840	1.142	0.973
575	1.058	0.855	0.840	1.143	0.974
580	1.063	0.857	0.834	1.149	0.976
585	1.058	0.852	0.837	1.145	0.973
590	1.057	0.856	0.831	1.151	0.974
595	1.054	0.850	0.835	1.148	0.972
600	1.059	0.844	0.832	1.147	0.971
605	1.058	0.844	0.840	1.144	0.971
610	1.051	0.850	0.838	1.144	0.971
615	1.053	0.846	0.835	1.150	0.971
620	1.048	0.850	0.833	1.146	0.969
625	1.048	0.842	0.830	1.146	0.966
630	1.052	0.847	0.836	1.145	0.970
635	1.052	0.844	0.834	1.146	0.969
640	1.060	0.843	0.827	1.139	0.967
645	1.051	0.849	0.825	1.140	0.966
650	1.046	0.845	0.828	1.142	0.965
655	1.054	0.839	0.832	1.143	0.967
660	1.050	0.842	0.826	1.143	0.965
665	1.052	0.825	0.821	1.145	0.960
670	1.048	0.837	0.834	1.143	0.966
675	1.048	0.833	0.827	1.138	0.962
680	1.049	0.837	0.834	1.141	0.965
685	1.046	0.832	0.836	1.129	0.961
690	1.038	0.844	0.830	1.138	0.962
695	1.050	0.836	0.827	1.145	0.964
700	1.058	0.845	0.836	1.130	0.967
705	1.053	0.831	0.828	1.140	0.963
710	1.052	0.834	0.821	1.151	0.965
715	1.043	0.839	0.824	1.134	0.960
720	1.018	0.825	0.833	1.140	0.954
725	1.047	0.852	0.835	1.148	0.970
730	1.055	0.850	0.828	1.135	0.967

-60°/-45° BIDIRECTIONAL ABSOLUTE SPECTRAL REFLECTANCE FACTORS FOR $BaSO_4$

Wav	Bss	Bsp	Bps	Bpp	Brr
390	1.064	0.880	0.880	1.096	0.984
395	1.089	0.915	0.915	1.124	1.009
400	1.084	0.900	0.900	1.133	1.007
405	1.080	0.901	0.901	1.139	1.007
410	1.097	0.905	0.905	1.132	1.012
415	1.092	0.906	0.906	1.144	1.014
420	1.091	0.911	0.911	1.141	1.015
425	1.095	0.911	0.911	1.144	1.016
430	1.089	0.911	0.911	1.143	1.013
435	1.089	0.910	0.910	1.142	1.013
440	1.095	0.911	0.911	1.144	1.016
445	1.093	0.908	0.908	1.142	1.014
450	1.094	0.912	0.912	1.145	1.017
455	1.095	0.917	0.917	1.151	1.020
460	1.094	0.914	0.914	1.149	1.018
465	1.099	0.909	0.909	1.140	1.019
470	1.091	0.914	0.914	1.147	1.018
475	1.094	0.912	0.912	1.143	1.016
480	1.097	0.914	0.914	1.147	1.019
485	1.098	0.911	0.911	1.148	1.019
490	1.094	0.909	0.909	1.143	1.015
495	1.095	0.911	0.911	1.147	1.017
500	1.091	0.911	0.911	1.146	1.016
505	1.094	0.913	0.913	1.146	1.017
510	1.093	0.913	0.913	1.149	1.017
515	1.089	0.910	0.910	1.146	1.015
520	1.087	0.908	0.908	1.143	1.012
525	1.088	0.909	0.909	1.139	1.012
530	1.094	0.911	0.911	1.151	1.018
535	1.088	0.906	0.906	1.144	1.011
540	1.089	0.907	0.907	1.145	1.013
545	1.088	0.907	0.907	1.145	1.013
550	1.091	0.909	0.909	1.147	1.015
555	1.090	0.911	0.911	1.144	1.015
560	1.090	0.907	0.912	1.147	1.014

Wav	Bss	Bsp	Bps	Bpp	Brr
565	1.086	0.908	0.909	1.148	1.013
570	1.080	0.905	0.912	1.142	1.010
575	1.082	0.910	0.911	1.148	1.013
580	1.081	0.905	0.909	1.147	1.010
585	1.084	0.902	0.910	1.143	1.010
590	1.085	0.909	0.909	1.149	1.013
595	1.083	0.901	0.911	1.148	1.011
600	1.084	0.904	0.909	1.149	1.012
605	1.086	0.904	0.910	1.147	1.012
610	1.083	0.900	0.917	1.142	1.011
615	1.081	0.898	0.913	1.136	1.007
620	1.089	0.901	0.913	1.144	1.012
625	1.084	0.902	0.911	1.139	1.009
630	1.080	0.896	0.908	1.137	1.005
635	1.085	0.894	0.912	1.150	1.010
640	1.076	0.892	0.907	1.134	1.002
645	1.077	0.909	0.913	1.131	1.007
650	1.087	0.898	0.916	1.135	1.009
655	1.075	0.900	0.910	1.135	1.005
660	1.082	0.894	0.906	1.133	1.004
665	1.075	0.896	0.905	1.127	1.001
670	1.079	0.903	0.903	1.128	1.003
675	1.078	0.893	0.907	1.141	1.005
680	1.082	0.903	0.910	1.141	1.009
685	1.077	0.893	0.912	1.150	1.008
690	1.083	0.903	0.911	1.141	1.009
695	1.083	0.917	0.908	1.140	1.012
700	1.084	0.897	0.901	1.147	1.007
705	1.068	0.887	0.919	1.146	1.005
710	1.083	0.907	0.922	1.136	1.012
715	1.098	0.904	0.910	1.130	1.010
720	1.062	0.918	0.909	1.152	1.010
725	1.071	0.891	0.924	1.140	1.006
730	1.103	0.901	0.906	1.120	1.008

-60°/-30° BIDIRECTIONAL ABSOLUTE SPECTRAL REFLECTANCE FACTORS FOR $BaSO_4$

Wav	Bss	Bsp	Bps	Bpp	Brr
390	1.010	0.850	0.850	1.057	0.946
395	1.037	0.919	0.919	1.070	0.988
400	1.053	0.899	0.899	1.065	0.981
405	1.048	0.907	0.907	1.075	0.988
410	1.062	0.914	0.914	1.079	0.993
415	1.052	0.912	0.912	1.078	0.990
420	1.058	0.917	0.917	1.081	0.993
425	1.057	0.914	0.914	1.084	0.994
430	1.056	0.920	0.920	1.083	0.994
435	1.053	0.913	0.913	1.077	0.992
440	1.057	0.920	0.920	1.086	0.997
445	1.061	0.918	0.918	1.082	0.995
450	1.058	0.920	0.920	1.086	0.997
455	1.066	0.924	0.924	1.090	1.002
460	1.060	0.919	0.919	1.085	0.998
465	1.067	0.917	0.917	1.076	0.999
470	1.060	0.917	0.917	1.085	0.997
475	1.060	0.919	0.919	1.084	0.998
480	1.065	0.920	0.920	1.088	0.999
485	1.063	0.919	0.919	1.087	0.999
490	1.061	0.920	0.920	1.084	0.998
495	1.060	0.919	0.919	1.087	0.998
500	1.056	0.919	0.919	1.084	0.996
505	1.061	0.920	0.920	1.083	0.998
510	1.064	0.919	0.919	1.082	0.999
515	1.065	0.918	0.918	1.080	0.998
520	1.060	0.920	0.920	1.078	0.996
525	1.057	0.920	0.920	1.081	0.997
530	1.057	0.918	0.918	1.083	0.997
535	1.055	0.917	0.917	1.083	0.996
540	1.055	0.917	0.917	1.080	0.995
545	1.056	0.916	0.916	1.082	0.996
550	1.056	0.919	0.919	1.080	0.996
555	1.057	0.919	0.919	1.084	0.997
560	1.060	0.915	0.931	1.075	0.996

Wav	Bss	Bsp	Bps	Bpp	Brr
565	1.054	0.919	0.925	1.080	0.995
570	1.053	0.918	0.924	1.079	0.993
575	1.057	0.915	0.927	1.080	0.995
580	1.062	0.921	0.930	1.082	0.999
585	1.061	0.919	0.926	1.079	0.997
590	1.059	0.914	0.926	1.076	0.994
595	1.046	0.914	0.930	1.076	0.992
600	1.057	0.921	0.930	1.073	0.995
605	1.049	0.914	0.924	1.076	0.991
610	1.058	0.912	0.930	1.081	0.995
615	1.048	0.919	0.926	1.073	0.991
620	1.062	0.921	0.930	1.081	0.999
625	1.056	0.916	0.927	1.075	0.993
630	1.054	0.916	0.933	1.078	0.995
635	1.053	0.913	0.928	1.079	0.993
640	1.048	0.911	0.924	1.082	0.992
645	1.050	0.917	0.932	1.082	0.996
650	1.053	0.910	0.921	1.076	0.990
655	1.052	0.915	0.930	1.077	0.993
660	1.043	0.914	0.939	1.071	0.992
665	1.063	0.907	0.930	1.074	0.994
670	1.047	0.921	0.937	1.070	0.994
675	1.049	0.908	0.916	1.080	0.988
680	1.062	0.912	0.924	1.082	0.995
685	1.052	0.910	0.934	1.073	0.992
690	1.058	0.918	0.930	1.073	0.995
695	1.060	0.911	0.929	1.082	0.995
700	1.070	0.927	0.923	1.076	0.999
705	1.062	0.909	0.920	1.066	0.989
710	1.065	0.913	0.931	1.074	0.996
715	1.063	0.916	0.926	1.077	0.996
720	1.057	0.906	0.934	1.069	0.991
725	1.057	0.912	0.924	1.070	0.991
730	1.059	0.898	0.944	1.064	0.991

-60°/-15° BIDIRECTIONAL ABSOLUTE SPECTRAL REFLECTANCE FACTORS FOR $BaSO_4$

Wav	Bss	Bsp	Bps	Bpp	Brr
390	0.991	0.885	0.885	1.007	0.947
395	1.032	0.916	0.916	1.037	0.976
400	1.030	0.913	0.913	1.029	0.970
405	1.034	0.914	0.914	1.035	0.976
410	1.046	0.912	0.912	1.045	0.983
415	1.043	0.920	0.920	1.049	0.984
420	1.044	0.922	0.922	1.050	0.985
425	1.044	0.923	0.923	1.056	0.988
430	1.044	0.921	0.921	1.047	0.985
435	1.045	0.923	0.923	1.053	0.988
440	1.048	0.927	0.927	1.055	0.990
445	1.050	0.923	0.923	1.052	0.989
450	1.052	0.923	0.923	1.051	0.989
455	1.053	0.928	0.928	1.056	0.993
460	1.050	0.924	0.924	1.052	0.990
465	1.058	0.919	0.919	1.051	0.992
470	1.055	0.929	0.929	1.056	0.994
475	1.048	0.927	0.927	1.057	0.992
480	1.053	0.928	0.928	1.054	0.993
485	1.047	0.927	0.927	1.054	0.990
490	1.049	0.925	0.925	1.057	0.991
495	1.047	0.928	0.928	1.054	0.991
500	1.058	0.928	0.928	1.051	0.993
505	1.052	0.929	0.929	1.054	0.993
510	1.050	0.934	0.934	1.052	0.992
515	1.051	0.926	0.926	1.055	0.992
520	1.049	0.920	0.920	1.052	0.989
525	1.050	0.925	0.925	1.056	0.990
530	1.049	0.926	0.926	1.053	0.991
535	1.050	0.924	0.924	1.054	0.990
540	1.051	0.926	0.926	1.054	0.992
545	1.052	0.923	0.923	1.054	0.989
550	1.055	0.931	0.931	1.060	0.996
555	1.051	0.926	0.926	1.059	0.993
560	1.049	0.923	0.934	1.054	0.990

Wav	Bss	Bsp	Bps	Bpp	Brr
565	1.049	0.923	0.934	1.055	0.990
570	1.053	0.924	0.934	1.051	0.991
575	1.049	0.922	0.938	1.052	0.990
580	1.056	0.923	0.941	1.050	0.993
585	1.050	0.925	0.938	1.046	0.990
590	1.044	0.931	0.941	1.047	0.991
595	1.048	0.921	0.936	1.048	0.988
600	1.050	0.924	0.931	1.057	0.990
605	1.051	0.927	0.935	1.045	0.989
610	1.046	0.924	0.935	1.051	0.989
615	1.039	0.920	0.937	1.051	0.987
620	1.046	0.921	0.941	1.056	0.991
625	1.046	0.928	0.939	1.053	0.991
630	1.052	0.919	0.940	1.051	0.991
635	1.049	0.921	0.943	1.041	0.988
640	1.047	0.918	0.939	1.042	0.987
645	1.055	0.925	0.941	1.041	0.991
650	1.056	0.924	0.939	1.044	0.991
655	1.049	0.920	0.945	1.053	0.992
660	1.046	0.928	0.941	1.050	0.991
665	1.042	0.920	0.944	1.044	0.988
670	1.055	0.917	0.943	1.038	0.988
675	1.053	0.915	0.931	1.049	0.987
680	1.048	0.934	0.951	1.051	0.996
685	1.041	0.924	0.942	1.055	0.990
690	1.048	0.934	0.946	1.038	0.991
695	1.041	0.922	0.937	1.047	0.986
700	1.064	0.921	0.956	1.041	0.996
705	1.054	0.940	0.940	1.062	0.999
710	1.057	0.935	0.957	1.035	0.996
715	1.050	0.928	0.941	1.059	0.994
720	1.056	0.926	0.941	1.058	0.995
725	1.056	0.934	0.931	1.040	0.990
730	1.057	0.908	0.935	1.059	0.990

-60°/ 0° BIDIRECTIONAL ABSOLUTE SPECTRAL REFLECTANCE FACTORS FOR $BaSO_4$

Wav	Bss	Bsp	Bps	Bpp	Brr
390	1.030	0.858	0.858	0.984	0.938
395	1.047	0.917	0.917	1.022	0.979
400	1.032	0.905	0.905	1.029	0.971
405	1.042	0.912	0.912	1.031	0.978
410	1.046	0.923	0.923	1.028	0.982
415	1.052	0.923	0.923	1.034	0.985
420	1.045	0.925	0.925	1.038	0.985
425	1.052	0.930	0.930	1.037	0.988
430	1.046	0.919	0.919	1.037	0.984
435	1.048	0.929	0.929	1.036	0.987
440	1.053	0.929	0.929	1.039	0.989
445	1.056	0.928	0.928	1.034	0.988
450	1.055	0.928	0.928	1.043	0.990
455	1.058	0.932	0.932	1.044	0.993
460	1.054	0.926	0.926	1.042	0.990
465	1.061	0.924	0.924	1.039	0.992
470	1.054	0.931	0.931	1.042	0.991
475	1.059	0.929	0.929	1.043	0.994
480	1.055	0.932	0.932	1.045	0.994
485	1.058	0.932	0.932	1.041	0.994
490	1.055	0.933	0.933	1.041	0.993
495	1.050	0.933	0.933	1.045	0.992
500	1.055	0.933	0.933	1.045	0.993
505	1.055	0.930	0.930	1.042	0.992
510	1.057	0.930	0.930	1.044	0.993
515	1.057	0.933	0.933	1.045	0.994
520	1.061	0.931	0.931	1.045	0.994
525	1.057	0.930	0.930	1.045	0.994
530	1.058	0.938	0.938	1.046	0.996
535	1.052	0.935	0.935	1.038	0.992
540	1.054	0.929	0.929	1.044	0.992
545	1.054	0.934	0.934	1.041	0.993
550	1.056	0.935	0.935	1.042	0.995
555	1.059	0.932	0.932	1.041	0.994
560	1.049	0.934	0.939	1.040	0.991
565	1.058	0.935	0.939	1.045	0.994
570	1.060	0.926	0.939	1.040	0.991
575	1.057	0.927	0.939	1.042	0.991
580	1.051	0.932	0.940	1.040	0.991
585	1.050	0.925	0.945	1.040	0.990
590	1.052	0.932	0.944	1.046	0.994
595	1.054	0.924	0.947	1.041	0.991
600	1.048	0.930	0.945	1.035	0.990
605	1.053	0.933	0.945	1.039	0.993
610	1.058	0.925	0.951	1.043	0.994
615	1.060	0.926	0.945	1.042	0.993
620	1.065	0.932	0.948	1.038	0.996
625	1.059	0.929	0.946	1.041	0.994
630	1.055	0.923	0.944	1.040	0.990
635	1.053	0.932	0.947	1.043	0.994
640	1.056	0.924	0.942	1.047	0.992
645	1.057	0.923	0.946	1.042	0.992
650	1.062	0.923	0.950	1.050	0.997
655	1.046	0.926	0.947	1.040	0.990
660	1.067	0.934	0.947	1.032	0.995
665	1.059	0.927	0.948	1.023	0.989
670	1.066	0.928	0.948	1.027	0.992
675	1.058	0.931	0.947	1.030	0.991
680	1.051	0.934	0.949	1.040	0.994
685	1.059	0.925	0.946	1.036	0.992
690	1.063	0.919	0.956	1.041	0.994
695	1.048	0.935	0.956	1.038	0.994
700	1.058	0.929	0.951	1.058	0.999
705	1.050	0.930	0.952	1.042	0.994
710	1.063	0.950	0.964	1.051	1.007
715	1.060	0.935	0.959	1.053	1.001
720	1.064	0.962	0.947	1.031	1.001
725	1.064	0.923	0.969	1.050	1.002
730	1.088	0.926	0.961	1.038	1.004

-60°/ 15° BIDIRECTIONAL ABSOLUTE SPECTRAL REFLECTANCE FACTORS FOR $BaSO_4$

Wav	Bss	Bsp	Bps	Bpp	Brr
390	1.026	0.866	0.866	0.976	0.945
395	1.056	0.928	0.928	1.014	0.982
400	1.061	0.916	0.916	1.025	0.980
405	1.061	0.924	0.924	1.033	0.988
410	1.070	0.916	0.916	1.030	0.987
415	1.068	0.929	0.929	1.035	0.991
420	1.074	0.930	0.930	1.041	0.995
425	1.074	0.926	0.926	1.037	0.994
430	1.066	0.926	0.926	1.034	0.990
435	1.071	0.926	0.926	1.035	0.992
440	1.070	0.928	0.928	1.040	0.995
445	1.072	0.931	0.931	1.040	0.995
450	1.077	0.932	0.932	1.039	0.997
455	1.075	0.938	0.938	1.045	1.001
460	1.073	0.931	0.931	1.041	0.998
465	1.078	0.929	0.929	1.039	0.999
470	1.076	0.932	0.932	1.043	0.999
475	1.075	0.935	0.935	1.046	1.000
480	1.078	0.937	0.937	1.046	1.001
485	1.078	0.936	0.936	1.043	1.000
490	1.077	0.934	0.934	1.043	0.999
495	1.075	0.933	0.933	1.046	0.999
500	1.076	0.934	0.934	1.046	1.000
505	1.074	0.930	0.930	1.045	0.999
510	1.076	0.929	0.929	1.049	0.999
515	1.077	0.934	0.934	1.043	1.000
520	1.073	0.931	0.931	1.040	0.997
525	1.079	0.937	0.937	1.047	1.002
530	1.084	0.934	0.934	1.044	1.003
535	1.076	0.931	0.931	1.042	0.998
540	1.069	0.931	0.931	1.041	0.997
545	1.075	0.937	0.937	1.042	1.000
550	1.079	0.934	0.934	1.049	1.002
555	1.075	0.937	0.937	1.045	1.000
560	1.070	0.932	0.947	1.041	0.997

Wav	Bss	Bsp	Bps	Bpp	Brr
565	1.081	0.931	0.946	1.042	1.000
570	1.082	0.935	0.943	1.042	1.001
575	1.075	0.931	0.943	1.040	0.997
580	1.073	0.928	0.950	1.041	0.998
585	1.073	0.933	0.944	1.040	0.997
590	1.083	0.930	0.949	1.044	1.002
595	1.082	0.938	0.949	1.036	1.001
600	1.076	0.934	0.940	1.041	0.998
605	1.077	0.931	0.944	1.037	0.997
610	1.074	0.932	0.944	1.045	0.999
615	1.073	0.937	0.950	1.045	1.001
620	1.086	0.936	0.955	1.034	1.003
625	1.073	0.933	0.947	1.050	1.001
630	1.083	0.934	0.950	1.042	1.002
635	1.073	0.933	0.960	1.044	1.003
640	1.074	0.932	0.954	1.036	0.999
645	1.072	0.936	0.945	1.039	0.998
650	1.081	0.933	0.960	1.036	1.002
655	1.077	0.944	0.956	1.047	1.006
660	1.079	0.930	0.959	1.048	1.004
665	1.080	0.929	0.958	1.033	1.000
670	1.072	0.937	0.957	1.036	1.001
675	1.074	0.933	0.953	1.036	0.999
680	1.079	0.941	0.970	1.041	1.008
685	1.072	0.942	0.959	1.040	1.004
690	1.088	0.931	0.950	1.034	1.001
695	1.063	0.929	0.943	1.036	0.993
700	1.094	0.947	0.955	1.047	1.011
705	1.087	0.951	0.962	1.036	1.009
710	1.083	0.937	0.971	1.023	1.003
715	1.078	0.954	0.971	1.069	1.018
720	1.076	0.943	0.953	1.059	1.008
725	1.079	0.940	0.990	1.056	1.016
730	1.074	0.937	0.967	1.050	1.007

-60°/ 30° BIDIRECTIONAL ABSOLUTE SPECTRAL REFLECTANCE FACTORS FOR $BaSO_4$

Wav	Bss	Bsp	Bps	Bpp	Brr
390	1.080	0.909	0.909	1.027	0.979
395	1.106	0.917	0.917	1.039	0.998
400	1.107	0.923	0.923	1.037	0.998
405	1.107	0.922	0.922	1.046	1.001
410	1.115	0.927	0.927	1.048	1.005
415	1.114	0.928	0.928	1.053	1.007
420	1.114	0.930	0.930	1.057	1.010
425	1.115	0.934	0.934	1.055	1.011
430	1.113	0.932	0.932	1.050	1.008
435	1.114	0.938	0.938	1.055	1.011
440	1.119	0.931	0.931	1.057	1.013
445	1.122	0.937	0.937	1.055	1.013
450	1.122	0.933	0.933	1.060	1.013
455	1.124	0.938	0.938	1.064	1.018
460	1.126	0.934	0.934	1.058	1.015
465	1.128	0.932	0.932	1.059	1.017
470	1.123	0.936	0.936	1.062	1.016
475	1.124	0.937	0.937	1.060	1.016
480	1.122	0.937	0.937	1.058	1.016
485	1.128	0.938	0.938	1.061	1.018
490	1.126	0.935	0.935	1.063	1.017
495	1.127	0.940	0.940	1.064	1.019
500	1.122	0.935	0.935	1.065	1.017
505	1.124	0.939	0.939	1.063	1.018
510	1.119	0.938	0.938	1.064	1.016
515	1.123	0.935	0.935	1.064	1.016
520	1.123	0.938	0.938	1.063	1.015
525	1.122	0.943	0.943	1.064	1.018
530	1.125	0.943	0.943	1.065	1.020
535	1.126	0.933	0.933	1.061	1.017
540	1.125	0.940	0.940	1.064	1.019
545	1.123	0.938	0.938	1.065	1.019
550	1.128	0.940	0.940	1.063	1.019
555	1.127	0.936	0.936	1.059	1.016
560	1.126	0.937	0.944	1.067	1.018

Wav	Bss	Bsp	Bps	Bpp	Brr
565	1.128	0.937	0.942	1.067	1.019
570	1.126	0.938	0.944	1.065	1.018
575	1.117	0.936	0.942	1.058	1.013
580	1.131	0.935	0.952	1.056	1.018
585	1.123	0.939	0.951	1.061	1.019
590	1.121	0.932	0.945	1.063	1.015
595	1.127	0.933	0.946	1.065	1.018
600	1.129	0.934	0.944	1.062	1.017
605	1.123	0.933	0.947	1.058	1.015
610	1.117	0.937	0.946	1.063	1.016
615	1.124	0.936	0.953	1.059	1.018
620	1.130	0.937	0.947	1.063	1.019
625	1.125	0.938	0.953	1.060	1.019
630	1.121	0.930	0.949	1.059	1.015
635	1.130	0.941	0.951	1.067	1.022
640	1.131	0.929	0.951	1.066	1.019
645	1.126	0.932	0.951	1.062	1.018
650	1.122	0.935	0.955	1.071	1.021
655	1.130	0.941	0.954	1.062	1.022
660	1.133	0.935	0.956	1.073	1.024
665	1.125	0.946	0.949	1.064	1.021
670	1.135	0.933	0.944	1.079	1.023
675	1.130	0.941	0.952	1.074	1.024
680	1.135	0.946	0.956	1.072	1.027
685	1.139	0.940	0.949	1.069	1.024
690	1.137	0.937	0.961	1.072	1.027
695	1.139	0.931	0.954	1.068	1.023
700	1.122	0.941	0.947	1.082	1.023
705	1.134	0.940	0.949	1.094	1.029
710	1.132	0.958	0.957	1.079	1.031
715	1.153	0.963	0.960	1.060	1.034
720	1.144	0.940	0.951	1.074	1.027
725	1.149	0.945	0.974	1.048	1.029
730	1.128	0.949	0.983	1.073	1.033

-60°/ 45° BIDIRECTIONAL ABSOLUTE SPECTRAL REFLECTANCE FACTORS FOR BaSO4

Wav	Bss	Bsp	Bps	Bpp	Brr
390	1.171	0.873	0.873	1.027	0.989
395	1.201	0.929	0.929	1.075	1.035
400	1.197	0.917	0.917	1.082	1.028
405	1.196	0.925	0.925	1.083	1.032
410	1.206	0.921	0.921	1.084	1.035
415	1.212	0.925	0.925	1.098	1.040
420	1.207	0.923	0.923	1.097	1.039
425	1.207	0.925	0.925	1.097	1.040
430	1.200	0.928	0.928	1.099	1.039
435	1.209	0.928	0.928	1.101	1.042
440	1.208	0.936	0.936	1.103	1.044
445	1.212	0.932	0.932	1.101	1.044
450	1.215	0.929	0.929	1.105	1.046
455	1.218	0.935	0.935	1.111	1.050
460	1.216	0.933	0.933	1.104	1.047
465	1.226	0.933	0.933	1.098	1.050
470	1.215	0.936	0.936	1.104	1.048
475	1.216	0.933	0.933	1.109	1.049
480	1.218	0.931	0.931	1.116	1.050
485	1.216	0.935	0.935	1.112	1.051
490	1.220	0.933	0.933	1.114	1.052
495	1.225	0.935	0.935	1.113	1.052
500	1.223	0.931	0.931	1.109	1.051
505	1.218	0.937	0.937	1.106	1.050
510	1.217	0.935	0.935	1.112	1.050
515	1.216	0.932	0.932	1.103	1.046
520	1.221	0.937	0.937	1.106	1.050
525	1.223	0.937	0.937	1.108	1.051
530	1.222	0.938	0.938	1.110	1.054
535	1.223	0.933	0.933	1.109	1.052
540	1.224	0.935	0.935	1.111	1.052
545	1.216	0.931	0.931	1.108	1.049
550	1.215	0.936	0.936	1.112	1.049
555	1.226	0.933	0.933	1.110	1.053
560	1.221	0.930	0.939	1.115	1.051

Wav	Bss	Bsp	Bps	Bpp	Brr
565	1.223	0.933	0.939	1.111	1.052
570	1.222	0.931	0.939	1.114	1.052
575	1.225	0.934	0.939	1.113	1.053
580	1.218	0.933	0.943	1.108	1.050
585	1.222	0.930	0.943	1.109	1.051
590	1.227	0.936	0.942	1.112	1.054
595	1.234	0.929	0.941	1.109	1.053
600	1.228	0.930	0.942	1.107	1.052
605	1.233	0.934	0.943	1.119	1.057
610	1.236	0.938	0.944	1.124	1.061
615	1.231	0.936	0.945	1.113	1.056
620	1.234	0.932	0.948	1.115	1.057
625	1.235	0.937	0.945	1.113	1.057
630	1.235	0.936	0.940	1.118	1.057
635	1.231	0.929	0.949	1.112	1.055
640	1.225	0.938	0.937	1.111	1.053
645	1.225	0.934	0.945	1.104	1.052
650	1.247	0.939	0.939	1.104	1.057
655	1.233	0.938	0.935	1.118	1.056
660	1.238	0.934	0.944	1.117	1.058
665	1.239	0.937	0.947	1.113	1.059
670	1.247	0.934	0.944	1.124	1.062
675	1.244	0.924	0.944	1.114	1.056
680	1.250	0.934	0.938	1.107	1.057
685	1.247	0.940	0.952	1.115	1.063
690	1.236	0.933	0.954	1.122	1.061
695	1.234	0.943	0.944	1.119	1.060
700	1.244	0.943	0.941	1.119	1.062
705	1.246	0.933	0.967	1.119	1.066
710	1.257	0.933	0.962	1.121	1.068
715	1.261	0.951	0.961	1.114	1.072
720	1.228	0.952	0.967	1.110	1.064
725	1.250	0.942	0.957	1.127	1.069
730	1.251	0.936	0.949	1.124	1.065

-60°/ 60° BIDIRECTIONAL ABSOLUTE SPECTRAL REFLECTANCE FACTORS FOR BaSO4

Wav	Bss	Bsp	Bps	Bpp	Brr
390	1.372	0.878	0.878	1.157	1.070
395	1.392	0.916	0.916	1.189	1.101
400	1.394	0.916	0.916	1.184	1.099
405	1.395	0.909	0.909	1.184	1.099
410	1.402	0.918	0.918	1.192	1.106
415	1.402	0.919	0.919	1.194	1.108
420	1.399	0.923	0.923	1.199	1.108
425	1.407	0.924	0.924	1.198	1.111
430	1.410	0.921	0.921	1.200	1.113
435	1.406	0.923	0.923	1.198	1.111
440	1.415	0.928	0.928	1.203	1.115
445	1.410	0.926	0.926	1.200	1.114
450	1.411	0.923	0.923	1.207	1.116
455	1.416	0.934	0.934	1.214	1.122
460	1.421	0.929	0.929	1.210	1.121
465	1.432	0.924	0.924	1.209	1.123
470	1.427	0.930	0.930	1.218	1.125
475	1.430	0.929	0.929	1.216	1.126
480	1.421	0.931	0.931	1.216	1.123
485	1.428	0.929	0.929	1.215	1.125
490	1.419	0.925	0.925	1.220	1.122
495	1.420	0.927	0.927	1.219	1.123
500	1.430	0.930	0.930	1.214	1.125
505	1.432	0.932	0.932	1.219	1.127
510	1.429	0.930	0.930	1.220	1.126
515	1.431	0.933	0.933	1.216	1.126
520	1.427	0.936	0.936	1.217	1.125
525	1.430	0.931	0.931	1.219	1.125
530	1.422	0.935	0.935	1.220	1.126
535	1.428	0.923	0.923	1.213	1.122
540	1.431	0.925	0.925	1.211	1.123
545	1.428	0.923	0.923	1.212	1.122
550	1.433	0.927	0.927	1.216	1.126
555	1.437	0.927	0.927	1.217	1.127
560	1.430	0.921	0.923	1.219	1.123

Wav	Bss	Bsp	Bps	Bpp	Brr
565	1.426	0.927	0.928	1.218	1.125
570	1.433	0.928	0.925	1.220	1.126
575	1.426	0.926	0.925	1.217	1.124
580	1.431	0.933	0.923	1.214	1.125
585	1.429	0.925	0.925	1.210	1.122
590	1.422	0.928	0.931	1.213	1.123
595	1.418	0.928	0.925	1.208	1.120
600	1.421	0.933	0.927	1.219	1.125
605	1.422	0.929	0.926	1.217	1.124
610	1.437	0.932	0.930	1.222	1.130
615	1.438	0.936	0.931	1.214	1.130
620	1.440	0.932	0.929	1.224	1.131
625	1.441	0.929	0.928	1.220	1.129
630	1.444	0.926	0.936	1.226	1.133
635	1.438	0.933	0.936	1.221	1.132
640	1.446	0.930	0.932	1.228	1.134
645	1.454	0.929	0.935	1.226	1.136
650	1.479	0.924	0.930	1.221	1.138
655	1.468	0.930	0.932	1.224	1.138
660	1.442	0.926	0.941	1.224	1.133
665	1.455	0.923	0.937	1.224	1.135
670	1.442	0.926	0.931	1.225	1.131
675	1.458	0.933	0.927	1.226	1.136
680	1.459	0.932	0.935	1.220	1.136
685	1.454	0.928	0.939	1.221	1.136
690	1.454	0.925	0.934	1.219	1.133
695	1.469	0.920	0.942	1.227	1.139
700	1.471	0.949	0.926	1.231	1.145
705	1.459	0.933	0.949	1.235	1.144
710	1.462	0.941	0.945	1.235	1.146
715	1.481	0.932	0.927	1.242	1.146
720	1.464	0.913	0.931	1.261	1.142
725	1.487	0.943	0.936	1.219	1.146
730	1.488	0.927	0.944	1.244	1.151

-60°/ 75° BIDIRECTIONAL ABSOLUTE SPECTRAL REFLECTANCE FACTORS FOR BaSO4

Wav	Bss	Bsp	Bps	Bpp	Brr
390	1.826	0.875	0.875	1.357	1.226
395	1.864	0.907	0.907	1.409	1.267
400	1.844	0.899	0.899	1.396	1.254
405	1.856	0.902	0.902	1.410	1.266
410	1.870	0.909	0.909	1.414	1.271
415	1.876	0.910	0.910	1.413	1.273
420	1.871	0.911	0.911	1.410	1.271
425	1.881	0.912	0.912	1.414	1.275
430	1.872	0.911	0.911	1.416	1.273
435	1.874	0.911	0.911	1.417	1.273
440	1.880	0.917	0.917	1.422	1.278
445	1.893	0.915	0.915	1.425	1.281
450	1.896	0.912	0.912	1.423	1.282
455	1.893	0.918	0.918	1.426	1.284
460	1.895	0.915	0.915	1.428	1.284
465	1.908	0.913	0.913	1.425	1.287
470	1.903	0.919	0.919	1.426	1.287
475	1.905	0.919	0.919	1.427	1.288
480	1.897	0.918	0.918	1.427	1.285
485	1.892	0.913	0.913	1.425	1.282
490	1.895	0.914	0.914	1.419	1.281
495	1.896	0.917	0.917	1.424	1.283
500	1.900	0.918	0.918	1.420	1.284
505	1.911	0.917	0.917	1.423	1.289
510	1.917	0.918	0.918	1.430	1.291
515	1.929	0.915	0.915	1.424	1.292
520	1.921	0.910	0.910	1.428	1.289
525	1.915	0.918	0.918	1.429	1.290
530	1.919	0.922	0.922	1.428	1.292
535	1.928	0.918	0.918	1.432	1.294
540	1.917	0.915	0.915	1.432	1.291
545	1.930	0.916	0.916	1.431	1.294
550	1.934	0.920	0.920	1.436	1.297
555	1.944	0.919	0.919	1.433	1.300
560	1.940	0.915	0.899	1.443	1.299

Wav	Bss	Bsp	Bps	Bpp	Brr
565	1.940	0.914	0.904	1.444	1.300
570	1.932	0.920	0.898	1.438	1.297
575	1.940	0.917	0.900	1.435	1.298
580	1.941	0.914	0.899	1.444	1.300
585	1.943	0.915	0.897	1.449	1.301
590	1.948	0.918	0.905	1.447	1.304
595	1.958	0.917	0.898	1.444	1.304
600	1.959	0.916	0.903	1.438	1.304
605	1.956	0.916	0.897	1.435	1.301
610	1.945	0.917	0.907	1.434	1.301
615	1.952	0.917	0.904	1.441	1.304
620	1.971	0.919	0.900	1.446	1.309
625	1.968	0.919	0.909	1.457	1.313
630	1.978	0.921	0.900	1.447	1.312
635	1.980	0.921	0.904	1.456	1.315
640	1.987	0.923	0.898	1.452	1.315
645	1.984	0.928	0.901	1.447	1.315
650	1.999	0.923	0.911	1.447	1.320
655	1.968	0.928	0.910	1.463	1.317
660	1.992	0.916	0.900	1.457	1.316
665	2.001	0.918	0.903	1.444	1.317
670	1.986	0.924	0.910	1.440	1.315
675	1.978	0.918	0.900	1.448	1.311
680	1.991	0.923	0.907	1.454	1.319
685	1.994	0.922	0.904	1.449	1.317
690	2.009	0.927	0.912	1.454	1.326
695	1.993	0.915	0.906	1.448	1.315
700	2.014	0.902	0.899	1.451	1.317
705	2.019	0.935	0.908	1.454	1.329
710	2.015	0.913	0.909	1.467	1.326
715	2.013	0.936	0.908	1.473	1.332
720	2.007	0.899	0.883	1.455	1.311
725	2.007	0.925	0.915	1.460	1.327
730	2.026	0.914	0.920	1.449	1.327

-75°/-60° BIDIRECTIONAL ABSOLUTE SPECTRAL REFLECTANCE FACTORS FOR $BaSO_4$

Wav	Bss	Bsp	Bps	Bpp	Brr
390	1.004	0.795	0.795	1.089	0.922
395	1.128	0.861	0.861	1.190	1.015
400	1.098	0.867	0.867	1.182	1.007
405	1.101	0.873	0.873	1.187	1.010
410	1.114	0.862	0.862	1.198	1.012
415	1.111	0.860	0.860	1.187	1.007
420	1.106	0.866	0.866	1.194	1.010
425	1.112	0.867	0.867	1.196	1.012
430	1.100	0.857	0.857	1.188	1.006
435	1.113	0.864	0.864	1.196	1.011
440	1.112	0.872	0.872	1.201	1.014
445	1.112	0.867	0.867	1.201	1.014
450	1.106	0.865	0.865	1.196	1.010
455	1.118	0.878	0.878	1.205	1.022
460	1.108	0.867	0.867	1.192	1.012
465	1.123	0.865	0.865	1.186	1.016
470	1.115	0.869	0.869	1.197	1.015
475	1.113	0.870	0.870	1.198	1.016
480	1.118	0.867	0.867	1.199	1.015
485	1.110	0.867	0.867	1.196	1.014
490	1.102	0.865	0.865	1.200	1.011
495	1.100	0.859	0.859	1.198	1.007
500	1.105	0.868	0.868	1.200	1.013
505	1.109	0.869	0.869	1.196	1.014
510	1.105	0.866	0.866	1.190	1.010
515	1.096	0.868	0.868	1.190	1.007
520	1.103	0.857	0.857	1.193	1.007
525	1.104	0.865	0.865	1.191	1.009
530	1.103	0.868	0.868	1.194	1.010
535	1.093	0.853	0.853	1.187	1.002
540	1.098	0.864	0.864	1.199	1.009
545	1.104	0.855	0.855	1.191	1.005
550	1.110	0.861	0.861	1.191	1.008
555	1.100	0.858	0.858	1.192	1.005
560	1.092	0.853	0.869	1.190	1.001

Wav	Bss	Bsp	Bps	Bpp	Brr
565	1.099	0.856	0.871	1.189	1.004
570	1.096	0.851	0.862	1.185	0.999
575	1.095	0.850	0.868	1.189	1.001
580	1.086	0.863	0.867	1.197	1.004
585	1.093	0.858	0.861	1.186	0.999
590	1.095	0.859	0.863	1.193	1.002
595	1.088	0.857	0.865	1.191	1.000
600	1.083	0.849	0.869	1.179	0.995
605	1.097	0.854	0.870	1.190	1.003
610	1.092	0.846	0.874	1.189	1.000
615	1.092	0.851	0.864	1.178	0.996
620	1.093	0.866	0.860	1.190	1.002
625	1.084	0.846	0.866	1.182	0.995
630	1.071	0.842	0.855	1.186	0.989
635	1.089	0.843	0.855	1.187	0.994
640	1.091	0.852	0.859	1.179	0.995
645	1.083	0.848	0.869	1.178	0.994
650	1.084	0.847	0.860	1.188	0.995
655	1.089	0.836	0.865	1.184	0.994
660	1.091	0.844	0.848	1.183	0.991
665	1.089	0.841	0.856	1.186	0.993
670	1.080	0.842	0.863	1.188	0.993
675	1.078	0.829	0.865	1.156	0.982
680	1.080	0.846	0.874	1.177	0.994
685	1.091	0.849	0.876	1.183	1.000
690	1.093	0.840	0.856	1.178	0.992
695	1.074	0.842	0.863	1.175	0.989
700	1.071	0.844	0.871	1.169	0.989
705	1.102	0.825	0.868	1.168	0.991
710	1.096	0.834	0.871	1.183	0.996
715	1.070	0.837	0.869	1.172	0.987
720	1.086	0.849	0.858	1.181	0.993
725	1.092	0.827	0.873	1.127	0.980
730	1.092	0.836	0.818	1.144	0.973

-75°/-45° BIDIRECTIONAL ABSOLUTE SPECTRAL REFLECTANCE FACTORS FOR $BaSO_4$

Wav	Bss	Bsp	Bps	Bpp	Brr
390	0.924	0.764	0.764	0.939	0.849
395	1.012	0.849	0.849	1.081	0.951
400	1.004	0.849	0.849	1.047	0.939
405	1.012	0.835	0.835	1.049	0.939
410	1.020	0.849	0.849	1.058	0.949
415	1.013	0.849	0.849	1.063	0.947
420	1.017	0.855	0.855	1.067	0.950
425	1.014	0.849	0.849	1.064	0.948
430	1.014	0.849	0.849	1.068	0.949
435	1.014	0.845	0.845	1.067	0.948
440	1.017	0.850	0.850	1.062	0.950
445	1.013	0.849	0.849	1.061	0.946
450	1.014	0.857	0.857	1.065	0.952
455	1.025	0.864	0.864	1.071	0.958
460	1.019	0.855	0.855	1.067	0.954
465	1.023	0.851	0.851	1.062	0.953
470	1.018	0.856	0.856	1.062	0.951
475	1.024	0.852	0.852	1.066	0.953
480	1.022	0.856	0.856	1.064	0.953
485	1.019	0.854	0.854	1.064	0.953
490	1.021	0.853	0.853	1.058	0.952
495	1.022	0.850	0.850	1.065	0.953
500	1.023	0.850	0.850	1.068	0.953
505	1.019	0.851	0.851	1.065	0.952
510	1.015	0.856	0.856	1.056	0.949
515	1.017	0.853	0.853	1.064	0.950
520	1.016	0.841	0.841	1.057	0.947
525	1.019	0.849	0.849	1.064	0.951
530	1.021	0.856	0.856	1.059	0.951
535	1.013	0.846	0.846	1.058	0.947
540	1.023	0.853	0.853	1.064	0.952
545	1.017	0.849	0.849	1.055	0.948
550	1.013	0.847	0.847	1.064	0.949
555	1.021	0.847	0.847	1.060	0.951
560	1.014	0.847	0.863	1.055	0.945
565	1.009	0.848	0.863	1.059	0.945
570	0.997	0.846	0.863	1.049	0.939
575	1.010	0.847	0.864	1.055	0.944
580	1.010	0.846	0.868	1.060	0.946
585	1.009	0.845	0.870	1.058	0.945
590	1.009	0.845	0.871	1.055	0.945
595	1.009	0.845	0.865	1.052	0.943
600	1.009	0.844	0.867	1.052	0.943
605	1.007	0.840	0.859	1.060	0.942
610	1.016	0.846	0.879	1.058	0.950
615	1.013	0.848	0.868	1.058	0.947
620	1.015	0.845	0.867	1.052	0.945
625	1.014	0.849	0.876	1.059	0.949
630	1.007	0.838	0.873	1.051	0.942
635	1.010	0.849	0.874	1.049	0.945
640	1.013	0.831	0.860	1.048	0.938
645	0.998	0.841	0.879	1.044	0.940
650	1.009	0.854	0.877	1.047	0.947
655	1.010	0.850	0.881	1.052	0.948
660	0.988	0.848	0.867	1.042	0.936
665	1.016	0.834	0.871	1.034	0.939
670	0.996	0.830	0.864	1.039	0.932
675	0.998	0.833	0.850	1.050	0.933
680	1.025	0.858	0.865	1.053	0.950
685	1.016	0.842	0.874	1.047	0.945
690	1.021	0.852	0.861	1.067	0.950
695	0.973	0.825	0.870	1.055	0.931
700	1.010	0.826	0.861	1.067	0.941
705	1.009	0.828	0.860	1.050	0.937
710	1.007	0.838	0.864	1.051	0.940
715	1.013	0.835	0.879	1.088	0.954
720	0.999	0.857	0.907	1.064	0.957
725	1.027	0.858	0.877	1.069	0.958
730	1.007	0.855	0.877	1.037	0.944

-75°/-30° BIDIRECTIONAL ABSOLUTE SPECTRAL REFLECTANCE FACTORS FOR $BaSO_4$

Wav	Bss	Bsp	Bps	Bpp	Brr
390	0.907	0.758	0.758	0.916	0.838
395	0.993	0.857	0.857	0.992	0.927
400	0.960	0.831	0.831	0.988	0.905
405	0.984	0.843	0.843	0.997	0.919
410	0.971	0.841	0.841	0.998	0.918
415	0.975	0.836	0.836	1.004	0.918
420	0.984	0.846	0.846	0.998	0.921
425	0.977	0.838	0.838	1.001	0.918
430	0.966	0.838	0.838	1.002	0.915
435	0.974	0.842	0.842	0.999	0.918
440	0.978	0.845	0.845	1.005	0.921
445	0.975	0.846	0.846	1.002	0.921
450	0.977	0.843	0.843	1.010	0.922
455	0.980	0.851	0.851	1.012	0.928
460	0.981	0.851	0.851	1.004	0.925
465	0.987	0.844	0.844	1.007	0.926
470	0.982	0.847	0.847	1.009	0.926
475	0.982	0.847	0.847	1.008	0.926
480	0.981	0.849	0.849	1.007	0.926
485	0.981	0.849	0.849	1.005	0.925
490	0.981	0.842	0.842	1.005	0.923
495	0.977	0.849	0.849	1.009	0.924
500	0.978	0.846	0.846	1.009	0.924
505	0.982	0.846	0.846	1.007	0.925
510	0.986	0.847	0.847	1.006	0.926
515	0.981	0.848	0.848	1.008	0.925
520	0.979	0.847	0.847	1.003	0.923
525	0.981	0.844	0.844	1.008	0.925
530	0.981	0.852	0.852	1.003	0.925
535	0.973	0.844	0.844	1.001	0.920
540	0.979	0.845	0.845	0.997	0.923
545	0.983	0.850	0.850	1.000	0.924
550	0.978	0.843	0.843	0.996	0.920
555	0.975	0.848	0.848	1.007	0.925
560	0.974	0.840	0.865	0.998	0.919
565	0.976	0.841	0.864	0.996	0.919
570	0.977	0.834	0.859	1.002	0.918
575	0.965	0.845	0.854	0.997	0.915
580	0.967	0.838	0.867	1.003	0.919
585	0.963	0.838	0.865	1.001	0.917
590	0.975	0.838	0.864	0.999	0.919
595	0.974	0.837	0.861	0.995	0.917
600	0.974	0.841	0.867	0.994	0.919
605	0.970	0.837	0.874	1.004	0.921
610	0.970	0.841	0.874	1.000	0.921
615	0.970	0.843	0.865	1.001	0.920
620	0.976	0.836	0.868	0.994	0.919
625	0.970	0.843	0.864	0.990	0.917
630	0.959	0.832	0.864	0.996	0.913
635	0.972	0.845	0.868	1.003	0.922
640	0.973	0.829	0.870	0.996	0.917
645	0.970	0.843	0.874	1.005	0.923
650	0.963	0.828	0.864	0.997	0.913
655	0.969	0.840	0.871	0.998	0.920
660	0.976	0.833	0.868	0.998	0.918
665	0.945	0.844	0.867	0.979	0.909
670	0.971	0.820	0.873	0.990	0.914
675	0.944	0.849	0.867	0.987	0.912
680	0.996	0.842	0.866	1.006	0.928
685	0.985	0.858	0.882	0.999	0.931
690	0.971	0.854	0.876	1.014	0.929
695	0.973	0.842	0.881	1.004	0.925
700	0.979	0.823	0.873	0.998	0.918
705	0.971	0.815	0.869	1.003	0.914
710	0.973	0.832	0.886	0.998	0.922
715	0.976	0.845	0.900	1.007	0.932
720	0.986	0.846	0.891	1.007	0.933
725	0.974	0.835	0.896	0.997	0.926
730	0.987	0.811	0.899	1.001	0.924

-75°/-15° BIDIRECTIONAL ABSOLUTE SPECTRAL REFLECTANCE FACTORS FOR BaSO4

Wav	Bss	Bsp	Bps	Bpp	Brr
390	0.895	0.765	0.765	0.847	0.823
395	0.964	0.861	0.861	0.979	0.911
400	0.950	0.853	0.853	0.945	0.900
405	0.977	0.835	0.835	0.955	0.906
410	0.967	0.847	0.847	0.972	0.913
415	0.970	0.832	0.832	0.968	0.908
420	0.963	0.845	0.845	0.970	0.910
425	0.968	0.833	0.833	0.967	0.906
430	0.963	0.841	0.841	0.970	0.909
435	0.961	0.836	0.836	0.970	0.906
440	0.970	0.836	0.836	0.974	0.912
445	0.974	0.848	0.848	0.974	0.915
450	0.967	0.841	0.841	0.969	0.911
455	0.977	0.851	0.851	0.988	0.922
460	0.974	0.847	0.847	0.981	0.916
465	0.976	0.841	0.841	0.970	0.916
470	0.970	0.846	0.846	0.974	0.915
475	0.971	0.842	0.842	0.972	0.914
480	0.973	0.845	0.845	0.982	0.917
485	0.973	0.847	0.847	0.976	0.917
490	0.977	0.848	0.848	0.977	0.917
495	0.971	0.847	0.847	0.980	0.917
500	0.973	0.847	0.847	0.978	0.918
505	0.973	0.843	0.843	0.972	0.915
510	0.969	0.848	0.848	0.974	0.915
515	0.972	0.846	0.846	0.972	0.914
520	0.966	0.842	0.842	0.973	0.912
525	0.973	0.853	0.853	0.973	0.917
530	0.971	0.854	0.854	0.974	0.918
535	0.971	0.846	0.846	0.975	0.915
540	0.972	0.847	0.847	0.982	0.918
545	0.974	0.842	0.842	0.974	0.915
550	0.972	0.845	0.845	0.977	0.915
555	0.966	0.850	0.850	0.973	0.914
560	0.969	0.839	0.868	0.966	0.910

Wav	Bss	Bsp	Bps	Bpp	Brr
565	0.964	0.847	0.867	0.965	0.911
570	0.967	0.842	0.873	0.970	0.913
575	0.960	0.838	0.871	0.971	0.910
580	0.964	0.848	0.864	0.973	0.912
585	0.963	0.840	0.866	0.984	0.913
590	0.963	0.851	0.868	0.966	0.912
595	0.954	0.847	0.875	0.972	0.912
600	0.957	0.837	0.868	0.971	0.908
605	0.965	0.842	0.871	0.967	0.911
610	0.964	0.843	0.859	0.981	0.912
615	0.972	0.848	0.867	0.970	0.914
620	0.963	0.849	0.880	0.969	0.916
625	0.963	0.850	0.863	0.970	0.911
630	0.967	0.834	0.868	0.963	0.908
635	0.981	0.844	0.870	0.970	0.917
640	0.956	0.835	0.861	0.982	0.909
645	0.970	0.846	0.875	0.975	0.916
650	0.976	0.851	0.874	0.990	0.923
655	0.962	0.850	0.870	0.974	0.914
660	0.961	0.840	0.856	0.957	0.904
665	0.946	0.838	0.865	0.951	0.900
670	0.970	0.838	0.878	0.985	0.918
675	0.965	0.841	0.871	0.964	0.910
680	0.983	0.867	0.885	0.985	0.930
685	0.977	0.851	0.882	0.972	0.920
690	0.964	0.829	0.883	0.975	0.913
695	0.959	0.828	0.864	0.982	0.908
700	0.977	0.842	0.859	0.977	0.914
705	0.961	0.849	0.869	0.975	0.914
710	0.965	0.867	0.892	0.984	0.927
715	0.947	0.848	0.883	0.993	0.918
720	0.970	0.882	0.882	0.957	0.923
725	0.929	0.840	0.866	0.986	0.905
730	0.931	0.846	0.895	0.968	0.910

-75°/ 0° BIDIRECTIONAL ABSOLUTE SPECTRAL REFLECTANCE FACTORS FOR $BaSO_4$

Wav	Bss	Bsp	Bps	Bpp	Brr
390	0.901	0.721	0.721	0.876	0.820
395	0.979	0.862	0.862	0.948	0.917
400	0.960	0.824	0.824	0.947	0.897
405	0.972	0.837	0.837	0.948	0.902
410	0.974	0.843	0.843	0.958	0.908
415	0.979	0.841	0.841	0.949	0.907
420	0.981	0.835	0.835	0.960	0.909
425	0.977	0.841	0.841	0.951	0.909
430	0.977	0.839	0.839	0.954	0.906
435	0.979	0.837	0.837	0.957	0.909
440	0.990	0.848	0.848	0.959	0.916
445	0.980	0.839	0.839	0.961	0.911
450	0.986	0.840	0.840	0.962	0.913
455	0.986	0.851	0.851	0.970	0.921
460	0.984	0.853	0.853	0.963	0.919
465	0.989	0.844	0.844	0.965	0.919
470	0.984	0.847	0.847	0.968	0.918
475	0.984	0.846	0.846	0.967	0.917
480	0.993	0.851	0.851	0.965	0.920
485	0.989	0.849	0.849	0.969	0.921
490	0.986	0.846	0.846	0.963	0.917
495	0.980	0.845	0.845	0.961	0.914
500	0.983	0.848	0.848	0.972	0.919
505	0.981	0.850	0.850	0.969	0.919
510	0.984	0.847	0.847	0.976	0.919
515	0.985	0.847	0.847	0.967	0.918
520	0.979	0.846	0.846	0.963	0.915
525	0.993	0.853	0.853	0.966	0.921
530	0.991	0.846	0.846	0.972	0.921
535	0.984	0.849	0.849	0.965	0.917
540	0.979	0.845	0.845	0.963	0.914
545	0.984	0.845	0.845	0.960	0.914
550	0.974	0.857	0.857	0.967	0.917
555	0.982	0.855	0.855	0.970	0.919
560	0.977	0.847	0.870	0.963	0.914
565	0.980	0.846	0.876	0.965	0.917
570	0.982	0.843	0.872	0.954	0.913
575	0.977	0.842	0.873	0.959	0.913
580	0.979	0.852	0.871	0.962	0.916
585	0.974	0.841	0.875	0.960	0.913
590	0.985	0.847	0.874	0.961	0.917
595	0.980	0.841	0.872	0.958	0.913
600	0.974	0.848	0.872	0.969	0.916
605	0.971	0.842	0.878	0.965	0.914
610	0.978	0.852	0.878	0.963	0.918
615	0.979	0.843	0.886	0.958	0.916
620	0.976	0.854	0.886	0.962	0.920
625	0.978	0.845	0.885	0.970	0.919
630	0.971	0.837	0.867	0.960	0.909
635	0.989	0.851	0.878	0.972	0.922
640	0.976	0.843	0.886	0.963	0.917
645	0.992	0.843	0.882	0.963	0.920
650	0.990	0.840	0.879	0.965	0.919
655	0.970	0.852	0.879	0.978	0.920
660	0.981	0.848	0.877	0.959	0.916
665	0.967	0.844	0.874	0.965	0.912
670	0.969	0.851	0.888	0.977	0.921
675	0.982	0.832	0.867	0.955	0.909
680	0.991	0.851	0.870	0.972	0.921
685	0.984	0.856	0.882	0.966	0.922
690	0.978	0.848	0.876	0.978	0.920
695	0.976	0.847	0.885	0.963	0.918
700	0.971	0.861	0.863	0.961	0.914
705	0.999	0.848	0.898	0.962	0.927
710	0.968	0.834	0.861	0.966	0.907
715	1.000	0.867	0.892	0.994	0.938
720	0.958	0.852	0.873	0.990	0.918
725	0.996	0.878	0.895	0.938	0.927
730	0.976	0.838	0.857	0.974	0.911

-75°/ 15° BIDIRECTIONAL ABSOLUTE SPECTRAL REFLECTANCE FACTORS FOR $BaSO_4$

Wav	Bss	Bsp	Bps	Bpp	Brr
390	0.964	0.735	0.735	0.901	0.849
395	1.025	0.863	0.863	0.962	0.929
400	1.002	0.847	0.847	0.961	0.916
405	1.024	0.841	0.841	0.942	0.915
410	1.017	0.839	0.839	0.962	0.921
415	1.020	0.841	0.841	0.957	0.919
420	1.014	0.848	0.848	0.957	0.921
425	1.030	0.847	0.847	0.960	0.924
430	1.014	0.849	0.849	0.959	0.922
435	1.014	0.843	0.843	0.958	0.919
440	1.016	0.855	0.855	0.964	0.927
445	1.023	0.849	0.849	0.967	0.926
450	1.022	0.842	0.842	0.964	0.924
455	1.023	0.854	0.854	0.975	0.932
460	1.021	0.854	0.854	0.969	0.928
465	1.030	0.846	0.846	0.966	0.930
470	1.024	0.851	0.851	0.974	0.930
475	1.027	0.852	0.852	0.973	0.933
480	1.026	0.855	0.855	0.972	0.932
485	1.030	0.861	0.861	0.974	0.936
490	1.022	0.849	0.849	0.973	0.930
495	1.023	0.852	0.852	0.975	0.932
500	1.026	0.853	0.853	0.969	0.931
505	1.023	0.848	0.848	0.975	0.931
510	1.024	0.853	0.853	0.971	0.932
515	1.016	0.853	0.853	0.970	0.929
520	1.016	0.852	0.852	0.973	0.929
525	1.018	0.854	0.854	0.974	0.930
530	1.021	0.856	0.856	0.975	0.933
535	1.022	0.852	0.852	0.969	0.929
540	1.019	0.849	0.849	0.972	0.928
545	1.019	0.846	0.846	0.968	0.928
550	1.019	0.849	0.849	0.976	0.930
555	1.029	0.848	0.848	0.973	0.932
560	1.021	0.838	0.874	0.963	0.924

Wav	Bss	Bsp	Bps	Bpp	Brr
565	1.023	0.846	0.879	0.969	0.929
570	1.014	0.843	0.862	0.971	0.923
575	1.019	0.848	0.872	0.965	0.926
580	1.031	0.864	0.884	0.978	0.939
585	1.015	0.851	0.884	0.974	0.931
590	1.022	0.850	0.875	0.979	0.931
595	1.017	0.848	0.878	0.969	0.928
600	1.021	0.850	0.876	0.965	0.928
605	1.026	0.854	0.879	0.958	0.929
610	1.029	0.850	0.876	0.972	0.931
615	1.029	0.848	0.882	0.975	0.934
620	1.025	0.853	0.887	0.961	0.931
625	1.023	0.857	0.882	0.963	0.931
630	1.008	0.849	0.886	0.960	0.926
635	1.017	0.847	0.885	0.969	0.929
640	1.015	0.862	0.889	0.971	0.934
645	1.019	0.859	0.885	0.964	0.932
650	1.050	0.856	0.880	0.981	0.942
655	1.026	0.850	0.885	0.973	0.934
660	1.023	0.848	0.883	0.969	0.931
665	1.016	0.848	0.875	0.950	0.922
670	1.032	0.862	0.880	0.958	0.933
675	1.018	0.851	0.870	0.962	0.925
680	1.026	0.872	0.903	0.976	0.944
685	1.031	0.839	0.891	0.982	0.936
690	1.015	0.868	0.887	0.967	0.934
695	1.019	0.872	0.870	0.955	0.929
700	1.053	0.876	0.873	0.973	0.943
705	1.023	0.855	0.895	0.969	0.935
710	1.046	0.867	0.899	0.991	0.951
715	1.029	0.863	0.918	0.972	0.945
720	1.002	0.847	0.885	1.000	0.933
725	1.014	0.887	0.899	0.934	0.933
730	1.017	0.863	0.875	0.980	0.934

-75°/ 30° BIDIRECTIONAL ABSOLUTE SPECTRAL REFLECTANCE FACTORS FOR $BaSO_4$

Wav	Bss	Bsp	Bps	Bpp	Brr
390	1.015	0.742	0.742	0.864	0.858
395	1.126	0.840	0.840	0.968	0.950
400	1.098	0.842	0.842	0.995	0.951
405	1.105	0.849	0.849	0.990	0.949
410	1.113	0.851	0.851	0.986	0.954
415	1.103	0.847	0.847	0.992	0.951
420	1.112	0.853	0.853	0.992	0.956
425	1.107	0.849	0.849	0.985	0.950
430	1.102	0.852	0.852	0.988	0.951
435	1.108	0.851	0.851	0.994	0.955
440	1.112	0.849	0.849	0.998	0.957
445	1.107	0.849	0.849	0.998	0.957
450	1.109	0.855	0.855	0.997	0.959
455	1.114	0.859	0.859	1.005	0.964
460	1.115	0.858	0.858	1.005	0.963
465	1.128	0.856	0.856	1.000	0.966
470	1.121	0.859	0.859	1.004	0.964
475	1.117	0.860	0.860	0.998	0.964
480	1.115	0.856	0.856	1.004	0.963
485	1.120	0.863	0.863	1.007	0.967
490	1.125	0.860	0.860	1.006	0.967
495	1.120	0.859	0.859	1.004	0.965
500	1.120	0.862	0.862	1.011	0.968
505	1.124	0.856	0.856	1.003	0.965
510	1.127	0.860	0.860	1.006	0.967
515	1.116	0.859	0.859	1.005	0.964
520	1.110	0.853	0.853	1.008	0.962
525	1.113	0.856	0.856	1.005	0.963
530	1.114	0.866	0.866	1.006	0.965
535	1.113	0.858	0.858	1.004	0.963
540	1.109	0.858	0.858	1.006	0.963
545	1.112	0.853	0.853	1.001	0.961
550	1.117	0.853	0.853	1.002	0.962
555	1.116	0.860	0.860	0.998	0.963
560	1.105	0.862	0.874	0.990	0.958
565	1.106	0.860	0.877	1.003	0.962
570	1.108	0.853	0.876	0.998	0.959
575	1.104	0.859	0.878	1.003	0.961
580	1.111	0.863	0.870	1.002	0.961
585	1.104	0.856	0.885	1.006	0.963
590	1.112	0.856	0.879	0.998	0.961
595	1.123	0.852	0.877	1.009	0.965
600	1.124	0.851	0.878	1.003	0.964
605	1.114	0.859	0.877	1.010	0.965
610	1.102	0.861	0.881	1.007	0.963
615	1.120	0.853	0.882	1.008	0.966
620	1.113	0.854	0.891	1.012	0.968
625	1.118	0.854	0.887	1.000	0.965
630	1.111	0.848	0.873	0.995	0.957
635	1.121	0.855	0.882	1.004	0.966
640	1.109	0.851	0.885	1.001	0.962
645	1.120	0.866	0.884	1.007	0.969
650	1.115	0.870	0.895	1.003	0.971
655	1.110	0.856	0.888	1.011	0.966
660	1.115	0.849	0.883	1.015	0.965
665	1.111	0.858	0.880	1.013	0.965
670	1.121	0.868	0.885	0.998	0.968
675	1.112	0.839	0.883	1.008	0.960
680	1.119	0.856	0.878	1.026	0.970
685	1.126	0.869	0.886	1.011	0.973
690	1.127	0.867	0.878	1.014	0.971
695	1.106	0.870	0.885	0.994	0.964
700	1.124	0.870	0.883	1.021	0.974
705	1.136	0.845	0.892	1.018	0.973
710	1.132	0.849	0.889	1.020	0.973
715	1.114	0.871	0.909	0.991	0.971
720	1.114	0.863	0.900	1.010	0.972
725	1.143	0.867	0.875	0.998	0.971
730	1.078	0.885	0.901	1.024	0.972

-75°/ 45° BIDIRECTIONAL ABSOLUTE SPECTRAL REFLECTANCE FACTORS FOR BaSO4
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Wav	Bss	Bsp	Bps	Bpp	Brr
390	1.251	0.765	0.765	1.015	0.948
395	1.318	0.854	0.854	1.069	1.031
400	1.302	0.851	0.851	1.068	1.022
405	1.321	0.853	0.853	1.095	1.038
410	1.308	0.858	0.858	1.084	1.033
415	1.314	0.864	0.864	1.102	1.036
420	1.321	0.861	0.861	1.097	1.038
425	1.322	0.860	0.860	1.096	1.038
430	1.311	0.865	0.865	1.088	1.035
435	1.322	0.854	0.854	1.091	1.036
440	1.330	0.870	0.870	1.099	1.044
445	1.325	0.862	0.862	1.101	1.042
450	1.332	0.866	0.866	1.097	1.044
455	1.341	0.878	0.878	1.110	1.053
460	1.338	0.865	0.865	1.105	1.048
465	1.343	0.867	0.867	1.099	1.051
470	1.332	0.872	0.872	1.104	1.049
475	1.338	0.868	0.868	1.104	1.048
480	1.334	0.873	0.873	1.101	1.048
485	1.342	0.871	0.871	1.109	1.051
490	1.343	0.862	0.862	1.100	1.048
495	1.334	0.869	0.869	1.099	1.047
500	1.327	0.866	0.866	1.098	1.044
505	1.331	0.865	0.865	1.106	1.048
510	1.338	0.872	0.872	1.113	1.052
515	1.330	0.870	0.870	1.107	1.049
520	1.332	0.868	0.868	1.106	1.048
525	1.340	0.870	0.870	1.115	1.054
530	1.343	0.870	0.870	1.109	1.052
535	1.332	0.864	0.864	1.108	1.047
540	1.333	0.864	0.864	1.105	1.048
545	1.323	0.868	0.868	1.108	1.046
550	1.334	0.869	0.869	1.105	1.050
555	1.337	0.871	0.871	1.107	1.051
560	1.324	0.864	0.879	1.106	1.044
565	1.331	0.869	0.881	1.105	1.046
570	1.333	0.862	0.890	1.104	1.047
575	1.333	0.866	0.886	1.103	1.047
580	1.341	0.866	0.884	1.106	1.049
585	1.335	0.862	0.884	1.104	1.046
590	1.330	0.862	0.888	1.101	1.045
595	1.332	0.857	0.889	1.097	1.044
600	1.331	0.861	0.889	1.109	1.048
605	1.326	0.863	0.887	1.110	1.047
610	1.338	0.871	0.887	1.112	1.052
615	1.340	0.872	0.887	1.124	1.055
620	1.346	0.872	0.887	1.114	1.055
625	1.346	0.865	0.899	1.113	1.056
630	1.341	0.868	0.883	1.092	1.046
635	1.344	0.875	0.884	1.111	1.054
640	1.339	0.867	0.898	1.096	1.050
645	1.342	0.877	0.891	1.101	1.053
650	1.345	0.863	0.901	1.087	1.049
655	1.360	0.865	0.893	1.102	1.055
660	1.349	0.861	0.888	1.117	1.054
665	1.336	0.864	0.893	1.098	1.048
670	1.331	0.870	0.888	1.125	1.054
675	1.350	0.870	0.895	1.093	1.052
680	1.361	0.873	0.899	1.123	1.064
685	1.343	0.862	0.903	1.104	1.053
690	1.331	0.863	0.890	1.120	1.051
695	1.360	0.877	0.913	1.116	1.067
700	1.400	0.853	0.879	1.097	1.057
705	1.333	0.872	0.887	1.118	1.052
710	1.350	0.865	0.873	1.110	1.050
715	1.351	0.862	0.912	1.133	1.064
720	1.338	0.872	0.873	1.098	1.046
725	1.381	0.871	0.891	1.130	1.068
730	1.359	0.874	0.901	1.104	1.059

-75°/ 60° BIDIRECTIONAL ABSOLUTE SPECTRAL REFLECTANCE FACTORS FOR $BaSO_4$

Wav	Bss	Bsp	Bps	Bpp	Brr
390	1.857	0.787	0.787	1.310	1.200
395	1.873	0.897	0.897	1.383	1.266
400	1.890	0.887	0.887	1.364	1.255
405	1.892	0.879	0.879	1.382	1.260
410	1.890	0.888	0.888	1.395	1.266
415	1.883	0.884	0.884	1.387	1.263
420	1.897	0.890	0.890	1.401	1.269
425	1.918	0.887	0.887	1.403	1.275
430	1.910	0.881	0.881	1.396	1.269
435	1.898	0.886	0.886	1.396	1.267
440	1.908	0.894	0.894	1.406	1.275
445	1.918	0.886	0.886	1.409	1.277
450	1.917	0.894	0.894	1.405	1.279
455	1.920	0.900	0.900	1.407	1.282
460	1.914	0.890	0.890	1.411	1.279
465	1.930	0.890	0.890	1.403	1.282
470	1.918	0.891	0.891	1.405	1.278
475	1.923	0.889	0.889	1.410	1.281
480	1.925	0.895	0.895	1.411	1.284
485	1.925	0.895	0.895	1.414	1.283
490	1.930	0.890	0.890	1.408	1.282
495	1.939	0.896	0.896	1.414	1.286
500	1.938	0.900	0.900	1.417	1.288
505	1.937	0.895	0.895	1.414	1.287
510	1.938	0.894	0.894	1.407	1.285
515	1.938	0.891	0.891	1.401	1.283
520	1.927	0.894	0.894	1.401	1.278
525	1.932	0.894	0.894	1.408	1.283
530	1.927	0.893	0.893	1.411	1.284
535	1.931	0.887	0.887	1.406	1.281
540	1.928	0.894	0.894	1.408	1.284
545	1.945	0.890	0.890	1.405	1.286
550	1.954	0.893	0.893	1.416	1.291
555	1.971	0.898	0.898	1.421	1.297
560	1.963	0.884	0.893	1.422	1.291

Wav	Bss	Bsp	Bps	Bpp	Brr
565	1.972	0.895	0.900	1.424	1.298
570	1.952	0.888	0.896	1.406	1.285
575	1.955	0.886	0.900	1.415	1.289
580	1.960	0.884	0.897	1.405	1.286
585	1.955	0.891	0.891	1.406	1.286
590	1.963	0.886	0.904	1.414	1.292
595	1.950	0.888	0.901	1.412	1.288
600	1.955	0.884	0.902	1.421	1.290
605	1.950	0.890	0.894	1.414	1.287
610	1.951	0.892	0.909	1.426	1.294
615	1.956	0.888	0.905	1.394	1.286
620	1.957	0.898	0.902	1.390	1.287
625	1.942	0.887	0.899	1.394	1.281
630	1.944	0.886	0.902	1.387	1.280
635	1.949	0.886	0.914	1.401	1.288
640	1.967	0.874	0.902	1.411	1.289
645	1.968	0.888	0.900	1.411	1.291
650	1.990	0.887	0.905	1.413	1.299
655	1.997	0.884	0.907	1.430	1.304
660	2.009	0.889	0.900	1.414	1.303
665	1.990	0.876	0.899	1.415	1.295
670	2.013	0.898	0.915	1.411	1.309
675	1.974	0.864	0.904	1.411	1.288
680	1.979	0.893	0.905	1.424	1.300
685	1.986	0.898	0.915	1.414	1.304
690	2.024	0.879	0.903	1.396	1.300
695	2.057	0.898	0.903	1.424	1.321
700	2.021	0.880	0.901	1.420	1.305
705	2.036	0.885	0.911	1.451	1.321
710	2.044	0.893	0.889	1.451	1.319
715	2.034	0.915	0.914	1.432	1.323
720	2.022	0.848	0.893	1.408	1.292
725	2.018	0.897	0.902	1.390	1.302
730	2.039	0.920	0.907	1.433	1.325

-75°/ 75° BIDIRECTIONAL ABSOLUTE SPECTRAL REFLECTANCE FACTORS FOR BaSO4

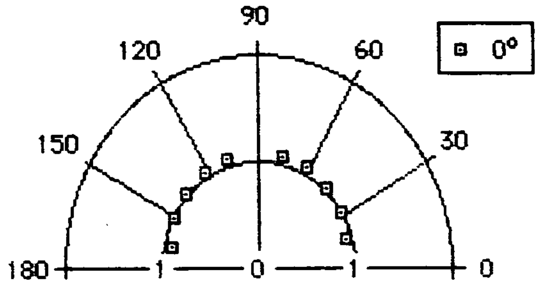
Wav	Bss	Bsp	Bps	Bpp	Brr
390	4.247	0.923	0.923	2.644	2.187
395	4.304	1.000	1.000	2.725	2.253
400	4.312	0.969	0.969	2.738	2.248
405	4.336	0.984	0.984	2.731	2.259
410	4.369	0.986	0.986	2.733	2.266
415	4.383	0.986	0.986	2.758	2.274
420	4.399	0.992	0.992	2.753	2.282
425	4.433	0.990	0.990	2.777	2.295
430	4.445	0.999	0.999	2.805	2.306
435	4.455	0.996	0.996	2.822	2.313
440	4.460	0.997	0.997	2.816	2.313
445	4.499	0.994	0.994	2.825	2.327
450	4.533	0.994	0.994	2.838	2.336
455	4.545	1.002	1.002	2.844	2.347
460	4.573	0.994	0.994	2.845	2.351
465	4.610	0.997	0.997	2.842	2.360
470	4.622	1.007	1.007	2.865	2.371
475	4.631	1.000	1.000	2.874	2.375
480	4.671	0.999	0.999	2.886	2.389
485	4.688	1.005	1.005	2.903	2.399
490	4.710	1.001	1.001	2.910	2.405
495	4.740	1.002	1.002	2.906	2.410
500	4.753	1.010	1.010	2.924	2.420
505	4.776	1.008	1.008	2.929	2.428
510	4.822	1.010	1.010	2.953	2.446
515	4.865	1.010	1.010	2.967	2.460
520	4.901	1.007	1.007	2.977	2.468
525	4.936	1.014	1.014	2.987	2.484
530	4.965	1.017	1.017	3.014	2.500
535	5.000	1.016	1.016	3.019	2.508
540	5.037	1.015	1.015	3.043	2.525
545	5.103	1.013	1.013	3.076	2.548
550	5.161	1.018	1.018	3.099	2.572
555	5.200	1.022	1.022	3.132	2.591
560	5.242	1.016	1.009	3.173	2.610

Wav	Bss	Bsp	Bps	Bpp	Brr
565	5.283	1.018	1.014	3.163	2.619
570	5.333	1.015	1.011	3.178	2.634
575	5.368	1.021	1.013	3.193	2.649
580	5.432	1.029	1.012	3.222	2.674
585	5.463	1.021	1.013	3.237	2.683
590	5.503	1.030	1.025	3.245	2.701
595	5.556	1.033	1.018	3.249	2.714
600	5.616	1.033	1.017	3.291	2.740
605	5.660	1.028	1.019	3.305	2.753
610	5.680	1.038	1.030	3.293	2.760
615	5.728	1.034	1.025	3.295	2.770
620	5.796	1.034	1.027	3.325	2.795
625	5.861	1.038	1.031	3.362	2.823
630	5.925	1.027	1.018	3.374	2.836
635	5.974	1.036	1.034	3.414	2.865
640	6.029	1.025	1.039	3.442	2.884
645	6.086	1.048	1.047	3.460	2.910
650	6.207	1.059	1.039	3.527	2.958
655	6.299	1.053	1.052	3.549	2.988
660	6.411	1.053	1.047	3.593	3.026
665	6.491	1.058	1.046	3.651	3.062
670	6.578	1.047	1.069	3.691	3.096
675	6.672	1.058	1.059	3.702	3.123
680	6.686	1.054	1.049	3.759	3.137
685	6.817	1.059	1.057	3.781	3.179
690	6.986	1.089	1.078	3.842	3.249
695	7.024	1.060	1.062	3.880	3.257
700	7.085	1.086	1.087	3.889	3.286
705	7.126	1.079	1.088	3.969	3.316
710	7.177	1.088	1.059	3.981	3.326
715	7.316	1.111	1.098	4.052	3.394
720	7.444	1.091	1.072	4.019	3.406
725	7.446	1.101	1.120	4.049	3.429
730	7.581	1.042	1.071	4.123	3.454

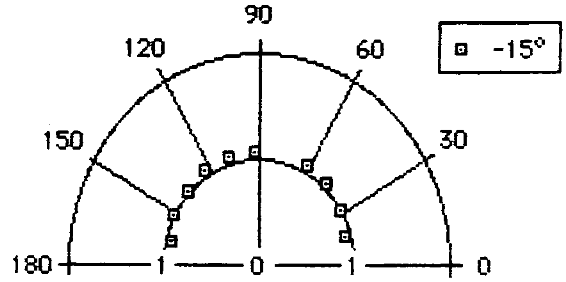
Appendix 31

$BaSO_4$ / Gonio Plots, β_{rr}, 555nm, Six Incidence Angles

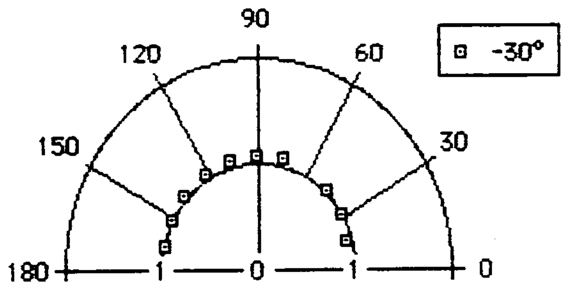
BaS04, βrr, 555nm



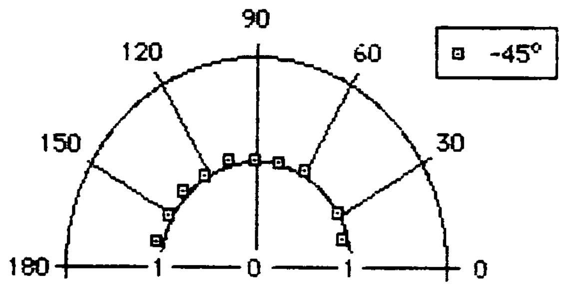
BaS04, βrr, 555nm



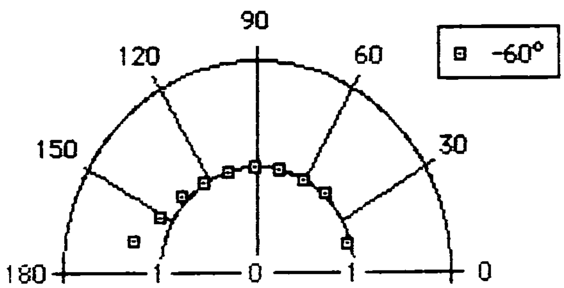
BaS04, βrr, 555nm



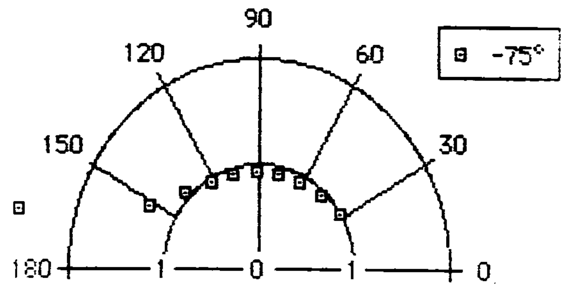
BaS04, βrr, 555nm



BaS04, βrr, 555nm



BaS04, βrr ,555nm



NOTE: 90° was added to all angles because the polar plot software could not take negative angles (therefore, the incidence angles shown in the rectangles are the ones used in practice but -15°, for example, is seen as 75° on the plots above).

Appendix 32

Halon Reflectance Factors

(60 angle combinations)

0°/-75° 1/60
0°/-60° 2/60
0°/-45° 3/60
0°/-30° 4/60
0°/-15° 5/60
0°/+15° 6/60
0°/+30° 7/60
0°/+45° 8/60
0°/+60° 9/60
0°/+75° 10/60

-15°/-75° 11/60
-15°/-60° 12/60
-15°/-45° 13/60
-15°/-30° 14/60
-15°/0° 15/60
-15°/+15° 16/60
-15°/+30° 17/60
-15°/+45° 18/60
-15°/+60° 19/60
-15°/+75° 20/60

-30°/-75° 21/60
-30°/-60° 22/60
-30°/-45° 23/60
-30°/-15° 24/60
-30°/0° 25/60
-30°/+15° 26/60
-30°/+30° 27/60
-30°/+45° 28/60
-30°/+60° 29/60
-30°/+75° 30/60

-45°/-75° 31/60
-45°/-60° 32/60
-45°/-30° 33/60
-45°/-15° 34/60
-45°/0° 35/60
-45°/+15° 36/60
-45°/+30° 37/60
-45°/+45° 38/60
-45°/+60° 39/60
-45°/+75° 40/60

-60°/-75° 41/60
-60°/-45° 42/60
-60°/-30° 43/60
-60°/-15° 44/60
-60°/0° 45/60
-60°/+15° 46/60
-60°/+30° 47/60
-60°/+45° 48/60
-60°/+60° 49/60
-60°/+75° 50/60

-75°/-60° 51/60
-75°/-45° 52/60
-75°/-30° 53/60
-75°/-15° 54/60
-75°/0° 55/60
-75°/+15° 56/60
-75°/+30° 57/60
-75°/+45° 58/60
-75°/+60° 59/60
-75°/+75° 60/60

0°/-75° BIDIRECTIONAL ABSOLUTE SPECTRAL REFLECTANCE FACTORS

WAV.	Bss		Bsp		Bps		Bpp		Brr	
[nm]	mean	coeff. var.	mean	coeff. var.	mean	coeff. var.	mean	coeff. var.	mean	coeff. var.
390	0.962	0.88	0.831	1.89	0.791	2.05	0.884	2.26	0.867	1.60
395	0.979	1.30	0.850	2.08	0.809	1.71	0.902	1.72	0.885	1.63
400	0.974	1.46	0.850	1.64	0.804	1.58	0.900	1.53	0.882	1.48
405	0.982	1.68	0.853	1.62	0.811	1.71	0.912	1.44	0.890	1.55
410	0.983	1.58	0.854	1.38	0.811	1.74	0.909	1.53	0.889	1.50
415	0.984	1.75	0.858	1.65	0.811	1.81	0.913	1.64	0.891	1.65
420	0.983	1.64	0.855	1.80	0.810	1.88	0.912	1.65	0.890	1.68
425	0.984	1.75	0.857	1.67	0.811	1.99	0.912	1.93	0.891	1.77
430	0.981	1.78	0.855	1.56	0.808	1.87	0.912	1.69	0.889	1.67
435	0.982	1.71	0.856	1.67	0.808	1.94	0.910	1.78	0.889	1.71
440	0.982	1.76	0.855	1.76	0.810	1.91	0.912	1.89	0.890	1.77
445	0.983	1.74	0.855	1.85	0.809	1.89	0.910	1.69	0.889	1.73
450	0.983	1.82	0.854	1.80	0.807	1.95	0.909	1.94	0.888	1.81
455	0.983	1.79	0.855	1.83	0.808	1.95	0.910	1.89	0.889	1.79
460	0.984	1.77	0.854	1.64	0.808	1.86	0.909	1.85	0.889	1.72
465	0.989	1.80	0.849	1.60	0.813	1.95	0.904	1.80	0.889	1.73
470	0.984	1.61	0.855	1.61	0.808	1.79	0.910	1.73	0.889	1.62
475	0.985	1.69	0.852	1.70	0.809	1.79	0.909	1.74	0.889	1.67
480	0.986	1.69	0.852	1.65	0.808	1.80	0.909	1.75	0.889	1.66
485	0.985	1.65	0.852	1.66	0.808	1.78	0.910	1.76	0.889	1.65
490	0.985	1.72	0.853	1.74	0.808	1.88	0.909	1.72	0.889	1.70
495	0.985	1.52	0.852	1.75	0.808	1.84	0.909	1.74	0.889	1.65
500	0.985	1.64	0.852	1.66	0.807	1.79	0.908	1.76	0.888	1.65
505	0.986	1.66	0.853	1.64	0.808	1.73	0.909	1.84	0.889	1.65
510	0.987	1.61	0.853	1.71	0.807	1.79	0.909	1.94	0.889	1.69
515	0.987	1.53	0.853	1.62	0.806	1.74	0.909	1.69	0.889	1.58
520	0.986	1.44	0.851	1.60	0.807	1.57	0.909	1.58	0.888	1.49
525	0.986	1.49	0.852	1.72	0.806	1.63	0.908	1.65	0.888	1.56
530	0.987	1.50	0.852	1.53	0.805	1.57	0.908	1.68	0.888	1.51
535	0.987	1.55	0.851	1.55	0.805	1.57	0.908	1.51	0.888	1.48
540	0.988	1.46	0.852	1.54	0.807	1.61	0.908	1.59	0.888	1.49
545	0.988	1.33	0.851	1.54	0.806	1.59	0.909	1.69	0.889	1.46
550	0.989	1.48	0.852	1.64	0.806	1.53	0.909	1.50	0.889	1.48
555	0.988	1.26	0.851	1.42	0.805	1.36	0.907	1.61	0.888	1.35
560	0.989	1.30	0.850	1.61	0.805	1.38	0.907	1.58	0.888	1.41
565	0.989	1.32	0.851	1.59	0.805	1.46	0.907	1.66	0.888	1.45
570	0.989	1.17	0.851	1.46	0.804	1.42	0.907	1.42	0.888	1.31
575	0.988	1.42	0.850	1.49	0.805	1.49	0.908	1.56	0.888	1.43
580	0.991	1.29	0.850	1.54	0.805	1.35	0.909	1.32	0.889	1.32
585	0.991	1.32	0.849	1.56	0.806	1.54	0.908	1.64	0.888	1.45
590	0.991	1.24	0.851	1.65	0.806	1.23	0.909	1.61	0.889	1.38
595	0.993	1.28	0.850	1.68	0.805	1.51	0.907	1.53	0.889	1.43
600	0.993	1.23	0.849	1.53	0.806	1.37	0.908	1.55	0.889	1.36
605	0.994	1.22	0.847	1.52	0.806	1.30	0.907	1.69	0.889	1.37
610	0.993	1.25	0.850	1.65	0.806	1.30	0.907	1.65	0.889	1.40
615	0.993	1.25	0.849	1.60	0.805	1.29	0.906	1.50	0.888	1.34
620	0.995	1.28	0.850	1.77	0.807	1.16	0.908	1.49	0.890	1.37
625	0.995	1.15	0.849	1.72	0.808	1.54	0.907	1.81	0.890	1.48
630	0.996	1.25	0.849	1.83	0.807	1.53	0.907	1.78	0.890	1.53
635	0.994	1.25	0.847	1.88	0.804	1.31	0.907	1.67	0.888	1.45
640	0.994	1.33	0.850	1.78	0.807	1.52	0.906	1.70	0.889	1.50
645	0.995	1.47	0.849	1.65	0.806	1.53	0.905	1.86	0.889	1.55
650	0.997	1.32	0.849	1.97	0.808	1.33	0.906	1.74	0.890	1.51
655	0.997	1.47	0.848	1.76	0.805	1.49	0.908	1.95	0.889	1.61
660	1.001	0.99	0.849	1.72	0.804	1.43	0.907	1.89	0.890	1.41
665	0.998	1.17	0.848	1.98	0.806	1.37	0.905	1.82	0.889	1.50
670	0.998	1.49	0.849	1.52	0.805	1.49	0.906	1.98	0.889	1.54
675	0.996	1.27	0.847	1.63	0.806	1.28	0.905	1.76	0.888	1.43
680	0.997	1.45	0.845	1.73	0.804	1.38	0.903	1.95	0.888	1.56
685	1.001	1.35	0.846	1.84	0.804	1.53	0.905	2.30	0.889	1.65
690	1.001	1.35	0.846	2.21	0.806	1.12	0.905	2.18	0.889	1.63
695	0.999	1.47	0.848	1.80	0.806	1.31	0.906	1.87	0.890	1.53
700	1.003	1.57	0.847	1.75	0.810	1.27	0.905	2.04	0.891	1.55
705	0.998	1.38	0.849	2.09	0.803	1.67	0.908	2.56	0.890	1.80
710	1.000	1.49	0.848	2.21	0.808	1.71	0.902	1.84	0.890	1.70
715	0.996	1.11	0.845	1.99	0.809	1.13	0.906	2.41	0.889	1.56
720	1.000	1.05	0.845	1.36	0.802	0.80	0.906	2.06	0.888	1.23
725	1.002	1.71	0.848	2.24	0.808	1.67	0.908	2.32	0.892	1.86
730	1.003	1.36	0.844	1.76	0.806	1.58	0.905	2.60	0.889	1.65

0°/-60° BIDIRECTIONAL ABSOLUTE SPECTRAL REFLECTANCE FACTORS

WAV.	Bss		Bsp		Bps		Bpp		Brr	
[nm]	mean	coeff. var.	mean	coeff. var.	mean	coeff. var.	mean	coeff. var.	mean	coeff. var.
390	1.016	0.75	0.914	0.86	0.878	1.24	0.971	1.76	0.945	0.92
395	1.034	0.67	0.929	0.99	0.894	0.83	0.985	0.75	0.961	0.70
400	1.028	0.91	0.927	0.95	0.891	0.92	0.989	1.01	0.959	0.88
405	1.039	1.05	0.934	0.91	0.900	1.10	0.995	0.75	0.967	0.91
410	1.041	1.17	0.937	0.63	0.901	1.19	0.997	0.91	0.969	0.94
415	1.044	1.17	0.939	0.94	0.901	1.39	1.002	1.04	0.971	1.08
420	1.046	1.36	0.941	1.02	0.899	1.38	1.003	1.11	0.972	1.18
425	1.045	1.10	0.941	1.04	0.901	1.44	1.003	1.17	0.973	1.14
430	1.044	1.35	0.941	1.15	0.900	1.43	1.004	1.20	0.972	1.23
435	1.045	1.23	0.940	1.16	0.900	1.45	1.002	1.31	0.972	1.24
440	1.044	1.53	0.940	1.05	0.900	1.59	1.003	1.36	0.972	1.34
445	1.046	1.41	0.938	1.20	0.900	1.52	1.002	1.31	0.972	1.31
450	1.046	1.31	0.940	1.13	0.900	1.47	1.002	1.35	0.972	1.26
455	1.044	1.28	0.940	1.09	0.899	1.39	1.002	1.33	0.971	1.22
460	1.046	1.35	0.938	1.15	0.900	1.41	1.001	1.21	0.971	1.24
465	1.052	1.22	0.933	1.14	0.905	1.39	0.996	1.17	0.972	1.19
470	1.047	1.13	0.938	1.11	0.899	1.27	1.002	1.21	0.972	1.14
475	1.047	1.31	0.936	1.13	0.899	1.30	1.000	1.11	0.971	1.17
480	1.046	1.25	0.937	1.09	0.900	1.33	1.000	1.14	0.971	1.16
485	1.047	1.02	0.936	1.04	0.898	1.18	1.000	1.10	0.970	1.04
490	1.048	1.04	0.935	1.07	0.899	1.26	1.001	1.15	0.971	1.08
495	1.049	1.00	0.936	1.01	0.897	1.19	0.999	1.11	0.970	1.03
500	1.048	0.99	0.935	0.95	0.897	1.11	0.999	0.99	0.970	0.97
505	1.048	1.16	0.936	1.01	0.897	1.14	1.000	1.10	0.970	1.07
510	1.048	1.13	0.935	0.92	0.897	1.16	1.001	1.08	0.970	1.04
515	1.048	0.91	0.934	0.72	0.898	1.18	1.000	1.07	0.970	0.93
520	1.048	0.96	0.934	0.76	0.897	1.04	0.999	0.94	0.969	0.89
525	1.046	1.03	0.934	0.80	0.895	1.02	0.999	1.06	0.968	0.94
530	1.046	0.88	0.934	0.73	0.895	0.93	1.000	1.01	0.969	0.85
535	1.046	0.86	0.933	0.64	0.896	0.92	0.999	0.91	0.969	0.80
540	1.049	0.83	0.933	0.72	0.895	0.98	0.998	0.87	0.969	0.81
545	1.050	0.76	0.934	0.70	0.895	0.81	0.998	0.89	0.969	0.74
550	1.049	0.74	0.933	0.71	0.895	0.85	0.998	0.89	0.969	0.76
555	1.050	0.71	0.933	0.65	0.895	0.93	0.998	0.87	0.969	0.73
560	1.050	0.72	0.931	0.67	0.895	0.85	0.997	0.79	0.968	0.72
565	1.049	0.71	0.931	0.57	0.895	0.76	0.997	0.82	0.968	0.68
570	1.051	0.85	0.932	0.66	0.895	0.86	0.998	0.76	0.969	0.73
575	1.049	0.79	0.931	0.46	0.895	0.69	0.996	0.82	0.968	0.67
580	1.051	0.70	0.932	0.67	0.894	0.67	0.997	0.78	0.969	0.67
585	1.052	0.64	0.930	0.42	0.894	0.64	0.997	0.81	0.968	0.59
590	1.052	0.71	0.931	0.48	0.894	0.77	0.999	0.75	0.969	0.63
595	1.052	0.71	0.931	0.72	0.894	0.70	0.998	0.69	0.969	0.66
600	1.053	0.72	0.931	0.74	0.895	0.61	0.998	0.90	0.969	0.69
605	1.055	0.54	0.931	0.71	0.895	0.72	0.998	1.00	0.970	0.67
610	1.054	0.56	0.929	0.80	0.895	0.80	0.998	0.99	0.969	0.72
615	1.053	0.59	0.929	0.63	0.895	0.55	0.998	0.95	0.968	0.64
620	1.056	0.53	0.930	0.78	0.894	0.60	0.998	0.79	0.969	0.64
625	1.057	0.72	0.931	0.60	0.895	0.74	0.998	0.81	0.970	0.67
630	1.059	0.78	0.931	0.71	0.897	0.68	1.000	1.05	0.972	0.74
635	1.056	0.71	0.929	0.55	0.895	0.66	0.998	0.94	0.969	0.61
640	1.058	0.75	0.931	0.90	0.897	0.99	0.999	0.95	0.971	0.85
645	1.058	0.62	0.932	0.53	0.896	0.56	1.000	0.84	0.971	0.57
650	1.060	0.68	0.931	1.01	0.898	0.80	0.998	0.91	0.972	0.78
655	1.058	0.61	0.929	0.58	0.897	0.71	0.998	0.80	0.970	0.60
660	1.062	0.88	0.930	0.72	0.896	0.83	0.997	0.97	0.971	0.80
665	1.060	0.74	0.930	1.03	0.897	0.69	1.000	1.00	0.972	0.81
670	1.063	0.53	0.931	1.09	0.900	0.43	0.997	1.06	0.973	0.66
675	1.064	0.90	0.929	1.07	0.897	0.69	0.996	0.84	0.971	0.83
680	1.062	0.72	0.928	0.88	0.896	0.92	0.996	0.92	0.971	0.80
685	1.064	0.95	0.930	0.87	0.896	0.66	1.000	1.29	0.972	0.87
690	1.064	0.71	0.931	1.31	0.894	0.92	1.000	0.90	0.972	0.89
695	1.063	0.27	0.930	0.69	0.895	0.81	1.001	1.23	0.972	0.64
700	1.066	0.23	0.934	0.99	0.898	0.60	1.000	1.56	0.975	0.70
705	1.062	0.71	0.932	1.02	0.898	0.74	0.997	1.06	0.972	0.80
710	1.067	0.78	0.928	1.34	0.899	0.97	0.999	1.22	0.973	1.03
715	1.067	0.80	0.928	1.20	0.899	0.80	0.996	1.26	0.973	0.83
720	1.068	0.76	0.936	0.73	0.899	1.21	0.993	0.44	0.974	0.61
725	1.066	0.85	0.928	1.01	0.896	0.86	0.997	0.73	0.972	0.78
730	1.065	0.46	0.926	1.13	0.897	0.58	0.998	1.09	0.971	0.72

0°/-45° BIDIRECTIONAL ABSOLUTE SPECTRAL REFLECTANCE FACTORS

WAV. [nm]	Bss mean	Bss coeff. var.	Bsp mean	Bsp coeff. var.	Bps mean	Bps coeff. var.	Bpp mean	Bpp coeff. var.	Brr mean	Brr coeff. var.
390	1.043	1.00	0.949	0.95	0.927	0.80	1.024	0.97	0.986	0.84
395	1.069	0.78	0.967	0.88	0.946	1.08	1.041	0.87	1.005	0.83
400	1.064	0.87	0.967	0.65	0.941	1.20	1.041	0.84	1.003	0.79
405	1.072	1.14	0.976	0.74	0.953	1.29	1.055	0.96	1.014	0.97
410	1.077	1.18	0.977	0.76	0.954	1.09	1.054	0.68	1.015	0.90
415	1.079	0.95	0.980	0.74	0.954	1.30	1.057	0.86	1.018	0.92
420	1.077	1.19	0.980	1.02	0.954	1.15	1.059	0.82	1.018	0.99
425	1.079	1.33	0.981	0.95	0.955	1.25	1.060	1.11	1.019	1.10
430	1.077	1.27	0.982	1.03	0.953	1.38	1.061	1.05	1.018	1.12
435	1.078	1.20	0.981	1.19	0.952	1.38	1.058	1.20	1.017	1.17
440	1.077	1.29	0.981	1.10	0.953	1.36	1.060	1.10	1.018	1.16
445	1.080	1.35	0.980	1.03	0.953	1.44	1.059	1.09	1.018	1.17
450	1.080	1.19	0.979	1.11	0.953	1.35	1.059	1.16	1.018	1.15
455	1.079	1.23	0.980	1.06	0.953	1.32	1.059	1.02	1.018	1.10
460	1.080	1.28	0.978	1.06	0.954	1.30	1.058	1.03	1.017	1.11
465	1.086	1.13	0.973	0.97	0.959	1.30	1.053	0.99	1.018	1.05
470	1.080	1.20	0.979	0.99	0.951	1.15	1.059	1.03	1.017	1.04
475	1.079	1.07	0.977	0.94	0.953	1.35	1.058	1.09	1.017	1.06
480	1.080	1.00	0.977	0.97	0.952	1.19	1.058	1.00	1.017	0.99
485	1.080	0.92	0.976	0.86	0.952	1.24	1.057	0.92	1.016	0.93
490	1.081	1.00	0.976	0.95	0.953	1.24	1.058	0.94	1.017	0.98
495	1.081	1.00	0.975	0.99	0.951	1.16	1.057	0.93	1.016	0.97
500	1.079	1.00	0.975	0.82	0.951	1.13	1.057	0.92	1.016	0.93
505	1.081	0.84	0.976	0.83	0.951	1.05	1.058	0.94	1.016	0.87
510	1.081	0.99	0.976	0.80	0.950	0.98	1.058	0.92	1.016	0.87
515	1.081	0.87	0.974	0.74	0.951	0.96	1.058	0.78	1.016	0.79
520	1.081	0.74	0.974	0.65	0.949	0.90	1.058	0.60	1.015	0.67
525	1.081	0.94	0.973	0.63	0.949	0.82	1.057	0.84	1.015	0.76
530	1.080	0.79	0.974	0.68	0.947	0.91	1.057	0.78	1.014	0.73
535	1.079	0.69	0.973	0.68	0.948	0.72	1.057	0.62	1.014	0.62
540	1.081	0.77	0.973	0.64	0.948	0.91	1.057	0.63	1.015	0.69
545	1.082	0.67	0.973	0.56	0.948	0.83	1.057	0.53	1.015	0.61
550	1.082	0.70	0.972	0.61	0.948	0.83	1.056	0.45	1.014	0.60
555	1.082	0.69	0.972	0.55	0.948	0.70	1.055	0.45	1.014	0.55
560	1.083	0.78	0.972	0.55	0.948	0.68	1.055	0.57	1.014	0.61
565	1.083	0.61	0.972	0.45	0.947	0.77	1.055	0.55	1.014	0.55
570	1.083	0.56	0.970	0.65	0.946	0.80	1.055	0.54	1.014	0.57
575	1.082	0.72	0.969	0.52	0.946	0.64	1.056	0.42	1.013	0.54
580	1.083	0.73	0.972	0.48	0.946	0.76	1.056	0.63	1.014	0.60
585	1.084	0.59	0.971	0.61	0.948	0.75	1.056	0.64	1.015	0.60
590	1.085	0.33	0.972	0.49	0.948	0.74	1.057	0.71	1.015	0.53
595	1.087	0.46	0.970	0.66	0.949	0.72	1.057	0.61	1.015	0.56
600	1.088	0.51	0.970	0.67	0.948	0.64	1.058	0.37	1.016	0.46
605	1.088	0.82	0.970	0.47	0.949	0.77	1.055	0.53	1.016	0.59
610	1.089	0.65	0.970	0.60	0.950	0.65	1.057	0.56	1.016	0.53
615	1.088	0.72	0.969	0.58	0.947	0.57	1.057	0.55	1.015	0.52
620	1.090	0.38	0.970	0.73	0.948	0.81	1.058	0.71	1.017	0.57
625	1.091	0.33	0.970	0.66	0.948	0.75	1.060	0.61	1.017	0.53
630	1.092	0.53	0.970	0.66	0.952	0.83	1.058	0.91	1.018	0.69
635	1.089	0.65	0.970	0.69	0.950	0.72	1.058	0.63	1.017	0.59
640	1.094	0.75	0.970	0.76	0.948	0.79	1.057	0.77	1.017	0.66
645	1.092	0.59	0.970	0.63	0.951	0.56	1.056	0.58	1.017	0.52
650	1.092	0.41	0.969	0.77	0.949	0.56	1.056	0.66	1.017	0.56
655	1.093	0.54	0.970	0.69	0.950	0.80	1.057	0.71	1.017	0.63
660	1.096	0.52	0.971	0.79	0.949	0.80	1.058	0.77	1.018	0.59
665	1.095	0.56	0.968	0.79	0.952	0.66	1.057	0.61	1.018	0.57
670	1.099	0.66	0.971	0.66	0.952	0.83	1.059	0.88	1.020	0.73
675	1.095	0.38	0.969	0.95	0.949	1.06	1.057	0.84	1.018	0.73
680	1.094	0.31	0.967	0.66	0.950	0.96	1.054	0.94	1.016	0.59
685	1.096	0.59	0.967	0.75	0.946	0.72	1.057	0.79	1.017	0.63
690	1.100	0.74	0.970	1.13	0.948	0.51	1.056	1.05	1.019	0.75
695	1.102	0.47	0.972	0.93	0.951	0.90	1.061	0.64	1.021	0.61
700	1.100	0.31	0.970	0.79	0.954	0.82	1.062	1.01	1.022	0.53
705	1.100	0.64	0.971	1.02	0.948	0.95	1.056	0.85	1.019	0.78
710	1.100	0.29	0.969	1.02	0.948	0.97	1.060	0.69	1.019	0.66
715	1.101	0.85	0.972	0.92	0.953	0.75	1.060	0.91	1.021	0.81
720	1.097	0.83	0.974	0.82	0.956	0.74	1.061	1.12	1.022	0.73
725	1.102	0.74	0.971	0.66	0.949	0.90	1.059	0.83	1.020	0.71
730	1.103	0.64	0.967	1.26	0.949	0.45	1.059	1.03	1.019	0.74

0°/-30° BIDIRECTIONAL ABSOLUTE SPECTRAL REFLECTANCE FACTORS

WAV.	Bss		Bsp		Bps		Bpp		Brr	
[nm]	mean	coeff. var.	mean	coeff. var.	mean	coeff. var.	mean	coeff. var.	mean	coeff. var.
390	1.073	0.52	0.973	1.00	0.965	1.04	1.063	0.28	1.018	0.62
395	1.091	0.98	0.988	0.76	0.980	0.99	1.085	0.92	1.036	0.83
400	1.086	0.84	0.989	0.59	0.975	0.71	1.087	0.79	1.035	0.65
405	1.097	0.97	0.998	0.69	0.987	1.04	1.096	0.86	1.044	0.86
410	1.100	0.95	0.999	0.86	0.987	0.89	1.096	0.72	1.045	0.77
415	1.104	1.08	1.003	0.73	0.987	1.18	1.102	0.77	1.049	0.89
420	1.102	1.11	1.002	0.91	0.988	1.43	1.102	1.12	1.048	1.08
425	1.103	1.16	1.004	0.99	0.988	1.26	1.104	0.99	1.050	1.05
430	1.101	1.25	1.004	0.97	0.988	1.18	1.104	0.94	1.049	1.03
435	1.103	1.23	1.002	1.00	0.986	1.24	1.103	1.11	1.049	1.08
440	1.103	1.43	1.003	0.97	0.986	1.34	1.104	1.16	1.049	1.17
445	1.104	1.39	1.003	0.94	0.986	1.19	1.103	1.09	1.049	1.09
450	1.103	1.39	1.002	0.99	0.986	1.24	1.104	1.19	1.049	1.15
455	1.102	1.27	1.002	1.10	0.985	1.27	1.103	1.14	1.048	1.14
460	1.104	1.17	1.000	0.94	0.987	1.17	1.103	1.10	1.048	1.05
465	1.112	1.19	0.995	0.99	0.992	1.07	1.097	1.08	1.049	1.04
470	1.105	1.07	1.002	0.94	0.986	1.11	1.105	0.99	1.049	0.96
475	1.105	1.18	1.000	0.95	0.986	1.07	1.102	0.89	1.048	0.97
480	1.106	1.11	1.000	1.02	0.986	1.18	1.103	0.93	1.049	1.00
485	1.105	1.02	0.999	0.95	0.985	1.08	1.103	0.95	1.048	0.93
490	1.107	1.07	0.999	0.86	0.986	1.01	1.104	0.87	1.049	0.89
495	1.105	0.96	0.998	0.88	0.983	1.09	1.104	0.90	1.048	0.90
500	1.105	1.02	0.998	0.77	0.984	0.98	1.102	0.92	1.047	0.87
505	1.105	0.97	0.998	0.85	0.985	0.99	1.104	0.86	1.048	0.87
510	1.106	0.93	0.998	0.78	0.984	0.97	1.104	0.78	1.048	0.81
515	1.105	0.88	0.997	0.69	0.983	0.91	1.102	0.71	1.047	0.74
520	1.106	0.75	0.997	0.75	0.983	0.91	1.103	0.64	1.047	0.68
525	1.106	0.76	0.996	0.70	0.982	0.83	1.102	0.68	1.046	0.69
530	1.107	0.75	0.997	0.75	0.980	0.68	1.103	0.72	1.047	0.67
535	1.107	0.74	0.996	0.63	0.981	0.75	1.102	0.65	1.047	0.65
540	1.106	0.74	0.996	0.56	0.982	0.81	1.103	0.76	1.047	0.68
545	1.107	0.74	0.995	0.67	0.982	0.61	1.102	0.67.	1.046	0.60
550	1.107	0.62	0.995	0.52	0.982	0.62	1.101	0.50	1.046	0.47
555	1.106	0.52	0.994	0.50	0.981	0.68	1.101	0.52	1.046	0.49
560	1.109	0.66	0.993	0.57	0.981	0.63	1.102	0.41	1.046	0.51
565	1.107	0.66	0.992	0.47	0.980	0.51	1.101	0.42	1.045	0.46
570	1.110	0.58	0.992	0.65	0.980	0.57	1.101	0.51	1.046	0.52
575	1.108	0.76	0.993	0.68	0.980	0.64	1.101	0.42	1.045	0.57
580	1.108	0.58	0.994	0.73	0.981	0.51	1.101	0.36	1.046	0.51
585	1.110	0.57	0.993	0.68	0.981	0.62	1.103	0.47	1.047	0.53
590	1.109	0.61	0.993	0.52	0.982	0.37	1.104	0.65	1.047	0.48
595	1.112	0.41	0.992	0.44	0.981	0.57	1.103	0.62	1.047	0.44
600	1.112	0.53	0.992	0.34	0.982	0.54	1.104	0.48	1.048	0.42
605	1.112	0.70	0.992	0.67	0.981	0.51	1.104	0.25	1.047	0.50
610	1.114	0.54	0.990	0.69	0.984	0.57	1.104	0.67	1.048	0.56
615	1.115	0.52	0.992	0.51	0.980	0.48	1.104	0.54	1.048	0.46
620	1.116	0.42	0.993	0.58	0.981	0.74	1.105	0.49	1.049	0.53
625	1.116	0.52	0.994	0.60	0.982	0.69	1.108	0.46	1.050	0.51
630	1.118	0.61	0.993	0.57	0.984	0.59	1.105	0.68	1.050	0.55
635	1.115	0.20	0.991	0.64	0.981	0.58	1.103	0.72	1.048	0.46
640	1.118	0.57	0.991	0.42	0.983	0.54	1.103	0.73	1.049	0.49
645	1.118	0.64	0.993	0.84	0.984	0.33	1.104	0.64	1.050	0.57
650	1.122	0.69	0.994	0.59	0.985	0.59	1.105	0.56	1.051	0.55
655	1.118	0.47	0.991	0.82	0.987	0.68	1.104	0.45	1.050	0.53
660	1.120	0.55	0.993	0.80	0.983	0.53	1.105	0.69	1.050	0.54
665	1.121	0.80	0.991	0.78	0.985	0.47	1.106	0.67	1.051	0.64
670	1.122	0.90	0.993	0.65	0.985	0.51	1.105	0.70	1.051	0.60
675	1.120	0.64	0.991	0.81	0.984	0.65	1.104	0.94	1.050	0.70
680	1.120	0.96	0.990	0.56	0.981	0.59	1.100	0.77	1.048	0.66
685	1.122	0.74	0.992	0.79	0.983	0.66	1.105	0.78	1.051	0.70
690	1.126	0.76	0.992	0.53	0.986	0.76	1.105	0.82	1.052	0.67
695	1.126	0.84	0.994	0.87	0.984	0.77	1.109	0.91	1.053	0.75
700	1.130	0.63	0.993	1.02	0.993	0.79	1.112	0.77	1.057	0.72
705	1.125	0.95	0.992	0.99	0.988	0.68	1.107	0.70	1.053	0.69
710	1.126	0.97	0.991	1.19	0.986	0.71	1.103	0.67	1.051	0.80
715	1.129	0.61	0.993	0.36	0.988	1.10	1.107	1.14	1.054	0.67
720	1.129	0.71	0.995	0.81	0.986	0.49	1.107	0.98	1.054	0.52
725	1.130	0.48	0.991	0.37	0.983	0.51	1.105	0.92	1.052	0.47
730	1.131	1.03	0.985	0.71	0.983	0.64	1.106	0.93	1.051	0.58

0°/-15° BIDIRECTIONAL ABSOLUTE SPECTRAL REFLECTANCE FACTORS

WAV. [nm]	Bss mean	Bss coeff. var.	Bsp mean	Bsp coeff. var.	Bps mean	Bps coeff. var.	Bpp mean	Bpp coeff. var.	Brr mean	Brr coeff. var.
390	1.096	0.78	0.991	0.90	0.976	1.20	1.106	0.44	1.042	0.45
395	1.118	0.74	1.003	0.43	0.997	0.80	1.119	0.78	1.059	0.61
400	1.115	0.81	1.001	0.53	0.996	0.93	1.123	0.88	1.059	0.67
405	1.123	1.01	1.012	0.56	1.007	1.02	1.137	0.71	1.070	0.72
410	1.128	0.76	1.012	0.87	1.007	0.89	1.139	0.68	1.071	0.70
415	1.128	0.87	1.016	0.86	1.008	1.14	1.141	0.85	1.074	0.87
420	1.129	1.00	1.016	0.89	1.008	1.25	1.143	0.84	1.074	0.95
425	1.132	1.02	1.018	0.91	1.007	1.44	1.145	0.92	1.076	1.01
430	1.129	1.00	1.016	0.88	1.007	1.34	1.147	0.82	1.075	0.95
435	1.129	1.11	1.016	0.94	1.006	1.37	1.144	1.02	1.074	1.04
440	1.129	1.27	1.017	0.97	1.006	1.29	1.146	1.05	1.074	1.08
445	1.131	1.16	1.015	0.96	1.007	1.39	1.143	0.95	1.074	1.06
450	1.131	1.04	1.015	0.99	1.007	1.35	1.145	1.06	1.074	1.05
455	1.130	1.10	1.015	0.89	1.004	1.35	1.144	1.03	1.073	1.04
460	1.131	1.03	1.014	0.82	1.007	1.21	1.145	0.95	1.074	0.95
465	1.138	1.13	1.008	0.88	1.013	1.25	1.138	0.83	1.074	0.97
470	1.131	0.94	1.013	0.81	1.007	1.22	1.143	0.73	1.074	0.87
475	1.131	0.92	1.012	0.89	1.006	1.26	1.143	0.83	1.073	0.91
480	1.132	0.83	1.012	0.71	1.005	1.17	1.145	0.95	1.074	0.86
485	1.133	0.93	1.010	0.78	1.005	1.09	1.144	0.78	1.073	0.84
490	1.134	1.02	1.011	0.69	1.007	1.19	1.146	0.80	1.075	0.87
495	1.132	0.94	1.010	0.73	1.005	1.12	1.144	0.72	1.073	0.83
500	1.133	0.96	1.010	0.70	1.004	0.99	1.145	0.64	1.073	0.76
505	1.132	0.93	1.010	0.71	1.004	1.00	1.146	0.64	1.073	0.75
510	1.133	0.77	1.010	0.65	1.004	0.90	1.146	0.71	1.073	0.70
515	1.134	0.63	1.010	0.59	1.003	0.90	1.145	0.70	1.073	0.64
520	1.133	0.53	1.008	0.44	1.003	0.79	1.144	0.62	1.072	0.51
525	1.133	0.57	1.008	0.44	1.002	0.80	1.145	0.54	1.072	0.53
530	1.133	0.60	1.008	0.54	1.000	0.79	1.145	0.39	1.072	0.52
535	1.132	0.43	1.008	0.50	1.001	0.83	1.143	0.53	1.071	0.48
540	1.132	0.52	1.008	0.66	1.003	0.75	1.145	0.56	1.072	0.52
545	1.136	0.59	1.007	0.39	1.001	0.73	1.145	0.49	1.072	0.46
550	1.135	0.52	1.007	0.42	1.001	0.71	1.145	0.56	1.072	0.47
555	1.134	0.46	1.006	0.42	1.000	0.62	1.143	0.41	1.071	0.38
560	1.136	0.45	1.005	0.46	1.001	0.67	1.145	0.56	1.072	0.40
565	1.134	0.53	1.006	0.40	1.000	0.44	1.144	0.65	1.071	0.41
570	1.135	0.39	1.005	0.65	0.998	0.49	1.145	0.45	1.071	0.42
575	1.134	0.27	1.005	0.55	0.999	0.53	1.144	0.42	1.071	0.32
580	1.136	0.38	1.006	0.41	1.001	0.41	1.144	0.30	1.072	0.29
585	1.136	0.34	1.004	0.46	1.001	0.50	1.146	0.24	1.072	0.35
590	1.139	0.45	1.005	0.29	1.000	0.47	1.146	0.42	1.073	0.33
595	1.138	0.31	1.004	0.30	1.001	0.34	1.144	0.59	1.072	0.30
600	1.140	0.26	1.005	0.48	1.004	0.39	1.147	0.59	1.074	0.34
605	1.139	0.31	1.003	0.56	1.002	0.43	1.145	0.44	1.072	0.30
610	1.138	0.29	1.003	0.45	1.003	0.44	1.147	0.32	1.073	0.25
615	1.139	0.17	1.004	0.50	1.002	0.46	1.146	0.53	1.073	0.30
620	1.142	0.40	1.004	0.43	1.003	0.51	1.147	0.50	1.074	0.36
625	1.144	0.44	1.005	0.53	1.002	0.53	1.149	0.55	1.075	0.39
630	1.145	0.42	1.005	0.39	1.004	0.58	1.149	0.45	1.076	0.40
635	1.142	0.29	1.002	0.42	1.001	0.79	1.149	0.33	1.074	0.40
640	1.145	0.42	1.004	0.61	1.002	0.42	1.151	0.38	1.075	0.36
645	1.146	0.63	1.005	0.43	1.004	0.74	1.149	0.53	1.076	0.52
650	1.144	0.57	1.002	0.60	1.005	0.63	1.151	0.50	1.076	0.48
655	1.145	0.56	1.003	0.63	1.005	0.67	1.150	0.50	1.076	0.52
660	1.148	0.55	1.006	0.60	1.003	0.55	1.152	0.70	1.077	0.48
665	1.148	0.44	1.003	0.50	1.003	0.68	1.149	1.02	1.076	0.51
670	1.152	0.47	1.003	0.78	1.006	0.72	1.153	0.54	1.078	0.45
675	1.152	0.61	1.003	0.85	1.004	0.45	1.151	0.58	1.078	0.56
680	1.147	0.44	0.999	0.49	1.002	0.72	1.148	0.60	1.074	0.45
685	1.149	0.55	1.001	0.70	1.002	0.51	1.149	0.71	1.075	0.51
690	1.155	0.69	1.001	0.79	1.007	0.40	1.152	0.74	1.079	0.48
695	1.153	0.49	1.005	0.79	1.006	0.92	1.153	0.21	1.079	0.49
700	1.150	0.67	1.005	0.65	1.005	0.93	1.154	0.48	1.079	0.58
705	1.152	1.01	1.001	0.70	1.003	0.64	1.152	1.02	1.077	0.81
710	1.158	0.90	1.003	0.81	1.003	0.82	1.152	0.72	1.079	0.69
715	1.154	0.71	1.004	0.44	1.006	1.08	1.150	0.67	1.078	0.60
720	1.148	0.82	1.005	0.55	1.006	0.74	1.157	0.93	1.079	0.66
725	1.156	0.66	0.998	1.01	1.006	0.83	1.150	0.77	1.078	0.68
730	1.150	0.25	1.002	0.68	1.004	0.61	1.153	1.16	1.077	0.57

0°/ 15° BIDIRECTIONAL ABSOLUTE SPECTRAL REFLECTANCE FACTORS

WAV. [nm]	Bss mean	Bss coeff. var.	Bsp mean	Bsp coeff. var.	Bps mean	Bps coeff. var.	Bpp mean	Bpp coeff. var.	Brr mean	Brr coeff. var.
390	1.099	0.70	0.988	0.42	0.981	0.66	1.107	1.26	1.044	0.48
395	1.117	0.57	1.005	0.48	0.999	0.58	1.126	0.65	1.062	0.50
400	1.115	0.85	1.003	0.78	0.995	0.88	1.127	0.95	1.060	0.82
405	1.124	0.86	1.012	0.83	1.006	0.95	1.138	0.70	1.070	0.75
410	1.125	0.84	1.012	0.52	1.007	0.94	1.139	0.79	1.070	0.70
415	1.128	0.81	1.016	0.61	1.007	0.93	1.142	0.78	1.073	0.74
420	1.128	1.11	1.017	0.72	1.008	1.01	1.143	0.91	1.074	0.90
425	1.130	1.06	1.019	0.73	1.008	1.17	1.146	0.97	1.075	0.93
430	1.128	1.02	1.018	0.79	1.007	1.18	1.146	0.98	1.075	0.94
435	1.128	1.11	1.017	0.82	1.007	1.23	1.144	0.94	1.074	0.97
440	1.130	1.10	1.017	0.86	1.006	1.15	1.146	1.07	1.075	1.00
445	1.130	1.04	1.016	0.82	1.006	1.23	1.144	0.97	1.074	0.97
450	1.129	1.11	1.016	0.87	1.006	1.23	1.144	0.90	1.074	0.98
455	1.130	1.13	1.015	0.87	1.005	1.09	1.144	0.95	1.073	0.96
460	1.130	1.07	1.013	0.76	1.006	1.08	1.145	0.92	1.074	0.91
465	1.138	1.08	1.008	0.87	1.013	1.09	1.138	0.92	1.074	0.94
470	1.131	1.02	1.015	0.79	1.006	1.02	1.145	0.70	1.074	0.82
475	1.131	0.90	1.012	0.79	1.007	1.07	1.144	0.69	1.073	0.80
480	1.132	0.95	1.011	0.68	1.005	0.93	1.146	0.86	1.073	0.81
485	1.131	0.94	1.011	0.73	1.005	0.95	1.143	0.77	1.073	0.79
490	1.134	0.93	1.011	0.69	1.005	1.04	1.146	0.80	1.074	0.81
495	1.132	0.95	1.010	0.61	1.004	0.93	1.145	0.74	1.073	0.75
500	1.132	0.92	1.010	0.68	1.003	0.86	1.144	0.76	1.072	0.74
505	1.132	0.88	1.010	0.65	1.004	0.82	1.146	0.75	1.073	0.72
510	1.132	0.91	1.010	0.65	1.004	0.76	1.146	0.67	1.073	0.69
515	1.132	0.71	1.009	0.67	1.003	0.67	1.146	0.57	1.072	0.60
520	1.133	0.57	1.008	0.49	1.003	0.71	1.144	0.52	1.072	0.49
525	1.132	0.53	1.008	0.55	1.002	0.63	1.144	0.61	1.072	0.52
530	1.132	0.58	1.009	0.60	1.000	0.68	1.145	0.50	1.071	0.53
535	1.133	0.57	1.008	0.60	1.001	0.71	1.143	0.32	1.071	0.48
540	1.133	0.64	1.007	0.67	1.003	0.60	1.146	0.36	1.072	0.51
545	1.136	0.62	1.007	0.46	1.001	0.47	1.144	0.31	1.072	0.39
550	1.134	0.47	1.007	0.54	1.000	0.66	1.145	0.19	1.072	0.40
555	1.133	0.59	1.005	0.43	1.000	0.49	1.143	0.36	1.070	0.37
560	1.134	0.30	1.005	0.59	1.000	0.57	1.145	0.48	1.071	0.39
565	1.134	0.44	1.006	0.47	1.000	0.31	1.144	0.33	1.071	0.35
570	1.134	0.43	1.005	0.74	0.998	0.44	1.143	0.54	1.070	0.46
575	1.135	0.46	1.005	0.59	1.000	0.53	1.143	0.31	1.071	0.40
580	1.137	0.36	1.005	0.57	1.000	0.60	1.145	0.29	1.072	0.38
585	1.137	0.45	1.004	0.50	1.000	0.46	1.144	0.58	1.071	0.45
590	1.139	0.40	1.005	0.30	1.000	0.33	1.146	0.50	1.072	0.29
595	1.137	0.49	1.004	0.41	1.001	0.46	1.144	0.58	1.071	0.41
600	1.139	0.47	1.003	0.57	1.003	0.46	1.147	0.42	1.073	0.38
605	1.138	0.21	1.004	0.47	1.002	0.45	1.146	0.40	1.073	0.31
610	1.137	0.49	1.004	0.25	1.003	0.41	1.147	0.29	1.073	0.28
615	1.141	0.58	1.003	0.65	1.001	0.48	1.145	0.28	1.073	0.40
620	1.141	0.60	1.003	0.63	1.002	0.49	1.150	0.37	1.074	0.46
625	1.141	0.48	1.005	0.65	1.001	0.62	1.150	0.49	1.074	0.48
630	1.143	0.47	1.005	0.45	1.003	0.50	1.147	0.56	1.075	0.43
635	1.142	0.32	1.003	0.45	1.002	0.65	1.148	0.25	1.074	0.33
640	1.146	0.16	1.003	0.83	1.002	0.45	1.150	0.54	1.075	0.38
645	1.147	0.48	1.005	0.64	1.004	0.61	1.150	0.62	1.076	0.52
650	1.150	0.63	1.003	0.50	1.006	0.68	1.150	0.72	1.077	0.52
655	1.146	0.68	1.003	0.68	1.004	0.51	1.150	0.59	1.076	0.53
660	1.151	0.63	1.007	0.71	1.003	0.37	1.148	0.77	1.077	0.54
665	1.147	0.48	1.003	0.56	1.002	0.76	1.149	0.56	1.075	0.48
670	1.149	0.65	1.006	0.70	1.004	0.48	1.151	0.45	1.078	0.50
675	1.149	0.69	1.003	0.69	1.004	0.71	1.151	0.57	1.077	0.55
680	1.147	0.72	1.001	0.48	1.002	0.42	1.149	0.92	1.075	0.50
685	1.149	0.64	1.003	0.65	1.004	0.60	1.150	0.90	1.076	0.63
690	1.154	0.80	1.004	0.43	1.007	0.61	1.152	0.66	1.079	0.58
695	1.155	0.54	1.000	0.80	1.004	0.86	1.156	0.69	1.079	0.64
700	1.148	0.63	0.998	0.87	1.009	0.69	1.158	0.55	1.078	0.61
705	1.153	0.86	1.000	0.55	0.999	0.90	1.153	0.50	1.076	0.60
710	1.154	0.99	1.001	0.82	1.006	0.87	1.154	0.76	1.079	0.71
715	1.155	0.27	1.001	0.80	1.005	0.64	1.152	0.62	1.078	0.44
720	1.152	0.52	1.006	0.96	1.012	0.50	1.161	0.24	1.083	0.42
725	1.150	0.63	1.005	0.78	1.007	0.32	1.150	1.03	1.078	0.41
730	1.157	0.51	0.998	0.64	1.006	0.32	1.150	0.98	1.078	0.51

0°/ 30° BIDIRECTIONAL ABSOLUTE SPECTRAL REFLECTANCE FACTORS

WAV.	Bss		Bsp		Bps		Bpp		Brr	
[nm]	mean	coeff. var.	mean	coeff. var.	mean	coeff. var.	mean	coeff. var.	mean	coeff. var.
390	1.071	0.59	0.975	1.24	0.960	0.66	1.069	0.48	1.019	0.63
395	1.091	0.75	0.990	0.48	0.978	0.90	1.082	0.86	1.035	0.71
400	1.088	0.59	0.990	0.66	0.974	0.65	1.085	0.61	1.034	0.54
405	1.096	0.69	0.998	0.80	0.985	0.92	1.095	0.82	1.044	0.75
410	1.100	0.85	0.999	0.79	0.985	1.28	1.096	0.71	1.045	0.86
415	1.103	1.11	1.003	0.91	0.987	1.13	1.101	0.78	1.049	0.94
420	1.103	0.95	1.003	0.92	0.987	1.23	1.101	1.11	1.049	1.00
425	1.103	1.07	1.005	1.04	0.989	1.16	1.102	0.86	1.050	0.98
430	1.103	1.16	1.005	1.11	0.986	1.37	1.104	0.96	1.049	1.10
435	1.104	1.14	1.004	0.99	0.986	1.30	1.102	0.96	1.049	1.05
440	1.104	1.13	1.004	0.91	0.985	1.36	1.103	1.07	1.049	1.07
445	1.105	1.22	1.002	1.01	0.986	1.36	1.102	1.06	1.049	1.11
450	1.104	1.18	1.003	0.86	0.985	1.26	1.103	1.08	1.049	1.05
455	1.103	1.12	1.002	1.01	0.985	1.29	1.102	1.08	1.048	1.07
460	1.105	0.92	1.001	0.81	0.987	1.15	1.102	0.98	1.049	0.92
465	1.112	1.01	0.995	0.92	0.992	1.16	1.097	0.98	1.049	0.97
470	1.106	1.02	1.001	1.02	0.985	1.16	1.104	0.96	1.049	0.99
475	1.106	1.02	0.999	0.97	0.986	1.15	1.100	1.01	1.048	0.98
480	1.106	1.07	1.000	0.90	0.985	1.19	1.102	0.97	1.048	0.98
485	1.106	0.96	0.999	0.97	0.985	1.10	1.102	0.93	1.048	0.93
490	1.107	1.03	0.999	0.91	0.986	1.15	1.102	0.86	1.048	0.94
495	1.105	0.94	0.998	0.97	0.983	1.15	1.102	0.80	1.047	0.92
500	1.106	0.86	0.996	0.91	0.984	1.01	1.102	0.80	1.047	0.85
505	1.107	0.72	0.998	0.80	0.985	1.11	1.103	0.80	1.048	0.82
510	1.106	0.79	0.998	0.71	0.984	0.99	1.103	0.73	1.048	0.77
515	1.106	0.77	0.997	0.64	0.983	0.85	1.102	0.69	1.047	0.68
520	1.105	0.77	0.996	0.71	0.984	0.84	1.100	0.69	1.046	0.68
525	1.107	0.67	0.995	0.63	0.982	0.74	1.100	0.52	1.046	0.59
530	1.107	0.71	0.997	0.63	0.980	0.69	1.100	0.59	1.046	0.60
535	1.107	0.75	0.996	0.56	0.981	0.77	1.101	0.49	1.046	0.60
540	1.108	0.62	0.996	0.59	0.982	0.86	1.102	0.56	1.047	0.63
545	1.107	0.66	0.995	0.64	0.981	0.72	1.101	0.49	1.046	0.55
550	1.108	0.41	0.994	0.53	0.982	0.53	1.101	0.45	1.047	0.40
555	1.107	0.38	0.992	0.56	0.981	0.63	1.100	0.33	1.045	0.41
560	1.110	0.40	0.992	0.59	0.980	0.62	1.100	0.47	1.046	0.46
565	1.110	0.47	0.992	0.45	0.979	0.58	1.100	0.47	1.045	0.44
570	1.110	0.49	0.993	0.62	0.978	0.71	1.100	0.50	1.045	0.51
575	1.109	0.29	0.992	0.64	0.980	0.53	1.101	0.38	1.045	0.40
580	1.110	0.44	0.994	0.65	0.981	0.50	1.100	0.41	1.046	0.46
585	1.110	0.48	0.992	0.63	0.981	0.59	1.100	0.59	1.046	0.50
590	1.112	0.16	0.992	0.50	0.982	0.50	1.103	0.51	1.047	0.36
595	1.112	0.26	0.992	0.45	0.980	0.61	1.101	0.48	1.046	0.40
600	1.114	0.34	0.991	0.54	0.981	0.78	1.103	0.33	1.047	0.44
605	1.114	0.32	0.993	0.41	0.981	0.70	1.102	0.49	1.047	0.44
610	1.116	0.45	0.990	0.62	0.983	0.98	1.104	0.41	1.048	0.56
615	1.114	0.38	0.991	0.49	0.980	0.59	1.103	0.38	1.047	0.41
620	1.115	0.57	0.992	0.59	0.981	0.56	1.103	0.53	1.048	0.54
625	1.117	0.51	0.992	0.63	0.983	0.65	1.105	0.53	1.049	0.50
630	1.121	0.53	0.991	0.71	0.983	0.70	1.104	0.71	1.050	0.59
635	1.116	0.30	0.989	0.46	0.981	0.54	1.102	0.40	1.047	0.38
640	1.119	0.47	0.991	0.49	0.981	0.72	1.103	0.57	1.049	0.51
645	1.120	0.42	0.993	0.69	0.981	0.63	1.105	0.47	1.050	0.48
650	1.122	0.72	0.990	0.62	0.984	0.60	1.107	0.39	1.051	0.55
655	1.120	0.43	0.991	0.77	0.984	0.82	1.103	0.47	1.050	0.57
660	1.121	0.32	0.992	0.68	0.984	0.56	1.103	0.63	1.050	0.49
665	1.122	0.47	0.991	0.75	0.984	0.40	1.102	0.33	1.050	0.46
670	1.122	0.65	0.993	0.50	0.984	0.74	1.105	0.35	1.051	0.49
675	1.123	0.52	0.987	0.76	0.984	0.83	1.103	0.59	1.049	0.59
680	1.123	0.53	0.990	0.67	0.982	0.57	1.101	0.66	1.049	0.55
685	1.121	0.56	0.991	0.87	0.984	0.63	1.102	0.85	1.049	0.64
690	1.128	0.86	0.992	0.98	0.989	0.73	1.103	0.53	1.053	0.72
695	1.127	0.45	0.991	1.12	0.986	0.87	1.105	0.85	1.052	0.77
700	1.129	0.61	0.992	0.74	0.988	0.93	1.105	1.00	1.054	0.71
705	1.124	0.74	0.990	0.86	0.984	0.74	1.105	0.49	1.051	0.66
710	1.128	0.41	0.993	1.14	0.983	0.95	1.102	0.62	1.051	0.66
715	1.129	0.79	0.991	0.69	0.988	0.60	1.106	0.92	1.053	0.67
720	1.126	0.56	0.991	0.78	0.984	0.43	1.112	0.64	1.054	0.54
725	1.128	0.72	0.988	1.04	0.979	0.72	1.105	0.72	1.050	0.64
730	1.125	0.63	0.989	1.09	0.981	0.96	1.104	0.52	1.050	0.53

0°/ 45° BIDIRECTIONAL ABSOLUTE SPECTRAL REFLECTANCE FACTORS

WAV. [nm]	Bss mean	Bss coeff. var.	Bsp mean	Bsp coeff. var.	Bps mean	Bps coeff. var.	Bpp mean	Bpp coeff. var.	Brr mean	Brr coeff. var.
390	1.049	0.50	0.954	0.52	0.922	0.46	1.016	0.94	0.985	0.54
395	1.064	0.57	0.969	0.55	0.944	0.96	1.041	0.60	1.004	0.54
400	1.063	0.58	0.966	0.74	0.941	0.76	1.045	0.91	1.004	0.69
405	1.072	0.80	0.977	0.78	0.952	1.05	1.052	0.78	1.013	0.81
410	1.076	0.91	0.976	0.78	0.953	1.10	1.052	0.68	1.014	0.82
415	1.077	0.91	0.980	0.69	0.953	1.05	1.057	0.74	1.017	0.80
420	1.076	1.08	0.981	0.75	0.954	1.10	1.059	0.81	1.017	0.90
425	1.079	1.23	0.981	0.87	0.954	1.24	1.060	0.94	1.018	1.03
430	1.076	1.00	0.981	0.78	0.952	1.14	1.060	0.92	1.018	0.91
435	1.077	1.15	0.981	0.96	0.952	1.31	1.059	1.01	1.017	1.05
440	1.078	1.12	0.981	0.84	0.952	1.35	1.060	1.09	1.018	1.04
445	1.079	1.15	0.981	0.98	0.952	1.34	1.058	1.08	1.018	1.09
450	1.079	1.22	0.980	0.95	0.952	1.30	1.059	1.04	1.017	1.09
455	1.079	1.03	0.980	0.91	0.952	1.22	1.059	1.02	1.017	1.00
460	1.080	1.03	0.979	0.89	0.953	1.27	1.057	0.89	1.017	0.98
465	1.085	1.08	0.973	0.93	0.958	1.20	1.052	0.89	1.017	0.98
470	1.080	1.02	0.979	0.84	0.951	1.12	1.059	0.87	1.017	0.92
475	1.079	0.91	0.977	0.82	0.952	1.30	1.058	1.02	1.016	0.97
480	1.079	0.79	0.977	0.81	0.950	1.26	1.058	0.93	1.016	0.89
485	1.079	0.81	0.977	0.69	0.951	1.14	1.057	0.80	1.016	0.81
490	1.079	0.92	0.977	0.77	0.953	1.24	1.058	0.72	1.017	0.87
495	1.079	0.88	0.976	0.68	0.950	1.11	1.057	0.82	1.016	0.83
500	1.079	0.73	0.976	0.72	0.949	1.11	1.057	0.70	1.015	0.78
505	1.080	0.74	0.977	0.69	0.950	0.95	1.058	0.68	1.016	0.73
510	1.081	0.80	0.976	0.71	0.949	1.00	1.058	0.75	1.016	0.77
515	1.081	0.73	0.975	0.59	0.949	1.02	1.058	0.62	1.016	0.69
520	1.081	0.62	0.974	0.53	0.948	0.89	1.057	0.64	1.015	0.61
525	1.080	0.66	0.973	0.51	0.948	0.80	1.056	0.75	1.014	0.63
530	1.079	0.56	0.973	0.61	0.946	0.81	1.056	0.71	1.014	0.61
535	1.079	0.46	0.973	0.54	0.947	0.76	1.056	0.64	1.014	0.53
540	1.081	0.45	0.974	0.53	0.948	0.71	1.057	0.58	1.015	0.49
545	1.081	0.45	0.973	0.50	0.947	0.73	1.057	0.51	1.015	0.50
550	1.081	0.42	0.973	0.50	0.946	0.63	1.056	0.40	1.014	0.43
555	1.082	0.51	0.972	0.62	0.947	0.64	1.055	0.52	1.014	0.52
560	1.082	0.60	0.973	0.45	0.946	0.65	1.056	0.44	1.014	0.50
565	1.082	0.59	0.971	0.38	0.946	0.67	1.054	0.38	1.013	0.46
570	1.083	0.38	0.971	0.56	0.946	0.73	1.054	0.45	1.013	0.47
575	1.083	0.46	0.970	0.44	0.946	0.57	1.054	0.50	1.013	0.44
580	1.084	0.35	0.971	0.53	0.946	0.55	1.056	0.54	1.014	0.44
585	1.083	0.40	0.971	0.40	0.948	0.61	1.056	0.46	1.014	0.42
590	1.085	0.38	0.971	0.31	0.947	0.59	1.057	0.38	1.015	0.33
595	1.087	0.34	0.970	0.44	0.947	0.83	1.056	0.54	1.015	0.46
600	1.087	0.28	0.970	0.37	0.949	0.45	1.057	0.52	1.016	0.34
605	1.088	0.26	0.968	0.44	0.947	0.70	1.056	0.57	1.015	0.36
610	1.087	0.39	0.969	0.46	0.949	0.65	1.057	0.38	1.015	0.44
615	1.086	0.43	0.969	0.60	0.946	0.68	1.056	0.46	1.014	0.47
620	1.087	0.39	0.969	0.50	0.947	0.59	1.058	0.64	1.015	0.48
625	1.089	0.52	0.970	0.43	0.947	0.77	1.057	0.65	1.016	0.52
630	1.091	0.40	0.970	0.49	0.949	0.79	1.058	0.64	1.017	0.51
635	1.089	0.44	0.968	0.68	0.948	0.78	1.056	0.51	1.015	0.53
640	1.091	0.33	0.969	0.55	0.948	0.74	1.056	0.48	1.016	0.45
645	1.092	0.33	0.971	0.50	0.949	0.78	1.057	0.63	1.017	0.50
650	1.093	0.20	0.972	0.74	0.949	0.63	1.058	0.46	1.018	0.45
655	1.095	0.32	0.970	0.75	0.949	0.71	1.057	0.54	1.018	0.51
660	1.095	0.49	0.969	0.59	0.948	0.68	1.059	0.37	1.018	0.36
665	1.093	0.40	0.969	0.65	0.951	0.77	1.056	0.43	1.017	0.48
670	1.099	0.58	0.970	0.58	0.951	0.87	1.057	1.06	1.019	0.63
675	1.094	0.63	0.969	0.93	0.951	0.72	1.058	0.75	1.018	0.63
680	1.092	0.45	0.970	0.64	0.949	0.79	1.055	0.94	1.016	0.55
685	1.096	0.36	0.970	0.71	0.948	0.72	1.057	0.84	1.018	0.50
690	1.099	0.31	0.968	0.52	0.951	0.56	1.059	0.99	1.019	0.43
695	1.098	0.54	0.970	0.70	0.950	0.60	1.060	0.50	1.019	0.50
700	1.098	0.42	0.972	0.58	0.954	0.69	1.058	1.02	1.021	0.60
705	1.097	0.89	0.974	0.85	0.949	0.76	1.057	0.77	1.019	0.64
710	1.097	0.60	0.969	0.78	0.949	0.90	1.055	0.89	1.018	0.66
715	1.099	0.59	0.967	0.59	0.950	0.80	1.059	1.20	1.019	0.65
720	1.101	0.22	0.969	1.12	0.948	0.73	1.066	0.89	1.021	0.58
725	1.103	0.55	0.970	0.55	0.949	0.30	1.057	1.36	1.020	0.60
730	1.101	0.75	0.967	0.78	0.951	0.52	1.061	0.79	1.020	0.61

0°/ 60° BIDIRECTIONAL ABSOLUTE SPECTRAL REFLECTANCE FACTORS

WAV. [nm]	Bss mean	Bss coeff. var.	Bsp mean	Bsp coeff. var.	Bps mean	Bps coeff. var.	Bpp mean	Bpp coeff. var.	Brr mean	Brr coeff. var.
390	1.012	0.41	0.918	0.68	0.879	1.36	0.964	1.37	0.943	0.62
395	1.035	0.99	0.928	1.04	0.894	0.53	0.986	0.80	0.961	0.75
400	1.030	0.66	0.927	0.83	0.892	1.05	0.989	0.80	0.960	0.77
405	1.041	0.82	0.935	0.86	0.900	1.01	0.995	0.66	0.968	0.79
410	1.042	0.85	0.937	0.82	0.900	1.08	0.998	0.79	0.969	0.82
415	1.046	1.06	0.940	0.90	0.902	1.27	1.001	0.87	0.972	0.97
420	1.045	1.32	0.940	1.00	0.901	1.25	1.003	0.80	0.972	1.05
425	1.047	1.01	0.942	0.97	0.901	1.42	1.002	1.15	0.973	1.07
430	1.044	0.99	0.940	1.14	0.900	1.38	1.004	0.99	0.972	1.07
435	1.045	1.16	0.941	0.99	0.900	1.39	1.001	1.10	0.972	1.11
440	1.046	1.19	0.940	1.08	0.901	1.43	1.003	1.17	0.972	1.16
445	1.047	1.12	0.939	1.12	0.901	1.47	1.002	1.10	0.972	1.15
450	1.046	1.23	0.940	1.07	0.900	1.49	1.002	1.14	0.972	1.17
455	1.045	1.09	0.939	1.00	0.899	1.45	1.002	1.04	0.971	1.09
460	1.049	1.10	0.938	0.99	0.900	1.41	1.001	1.07	0.972	1.09
465	1.052	1.11	0.933	1.10	0.905	1.39	0.996	0.95	0.972	1.09
470	1.047	1.05	0.938	1.01	0.900	1.31	1.003	1.01	0.972	1.05
475	1.048	1.10	0.937	0.95	0.899	1.31	1.000	0.93	0.971	1.03
480	1.047	1.08	0.937	1.04	0.899	1.32	1.001	0.95	0.971	1.05
485	1.047	0.95	0.937	0.88	0.898	1.22	1.000	0.87	0.971	0.93
490	1.048	0.83	0.937	0.90	0.899	1.30	1.001	0.91	0.971	0.93
495	1.048	0.97	0.936	0.87	0.897	1.19	1.001	0.88	0.970	0.93
500	1.048	0.89	0.936	0.77	0.897	1.19	0.999	0.83	0.970	0.88
505	1.048	0.94	0.936	0.91	0.898	1.06	1.001	0.92	0.971	0.91
510	1.049	0.86	0.936	0.75	0.897	1.18	1.001	0.90	0.971	0.88
515	1.049	0.63	0.935	0.72	0.899	1.16	1.000	0.83	0.971	0.79
520	1.049	0.76	0.935	0.74	0.897	1.07	0.999	0.71	0.970	0.78
525	1.048	0.78	0.935	0.60	0.896	0.97	0.999	0.72	0.969	0.73
530	1.048	0.65	0.935	0.67	0.895	0.95	0.999	0.78	0.969	0.71
535	1.047	0.56	0.933	0.60	0.895	0.92	0.999	0.83	0.968	0.68
540	1.048	0.58	0.933	0.70	0.896	0.79	0.998	0.79	0.969	0.68
545	1.049	0.68	0.934	0.73	0.895	0.87	0.999	0.77	0.969	0.71
550	1.050	0.60	0.934	0.58	0.896	0.95	0.998	0.42	0.969	0.57
555	1.049	0.42	0.933	0.59	0.896	0.79	0.998	0.68	0.969	0.56
560	1.050	0.51	0.932	0.70	0.895	0.79	0.997	0.58	0.969	0.57
565	1.049	0.49	0.932	0.72	0.895	0.68	0.997	0.74	0.968	0.62
570	1.051	0.45	0.933	0.51	0.895	0.86	0.997	0.59	0.969	0.55
575	1.050	0.41	0.931	0.40	0.895	0.63	0.997	0.49	0.968	0.44
580	1.053	0.39	0.933	0.52	0.895	0.78	0.999	0.47	0.970	0.46
585	1.051	0.31	0.930	0.51	0.894	0.66	0.998	0.50	0.968	0.44
590	1.052	0.59	0.931	0.51	0.896	0.62	0.999	0.41	0.970	0.46
595	1.051	0.58	0.930	0.68	0.894	0.69	0.997	0.65	0.968	0.60
600	1.053	0.37	0.931	0.55	0.896	0.73	0.997	0.47	0.969	0.48
605	1.054	0.37	0.931	0.74	0.895	0.69	0.997	0.61	0.969	0.54
610	1.054	0.46	0.931	0.38	0.897	0.55	1.000	0.64	0.970	0.43
615	1.053	0.48	0.930	0.49	0.895	0.69	0.997	0.56	0.969	0.52
620	1.057	0.21	0.930	0.79	0.895	0.56	0.998	0.72	0.970	0.53
625	1.056	0.64	0.931	0.80	0.895	0.78	0.998	0.66	0.970	0.68
630	1.056	0.42	0.931	0.75	0.896	0.73	0.997	1.03	0.970	0.67
635	1.056	0.39	0.930	0.71	0.896	0.59	0.998	0.66	0.970	0.54
640	1.057	0.60	0.932	0.66	0.895	0.93	1.000	0.72	0.971	0.67
645	1.060	0.21	0.930	0.87	0.896	0.65	0.998	0.83	0.971	0.57
650	1.061	0.49	0.931	0.63	0.896	1.03	0.997	0.71	0.971	0.63
655	1.058	0.36	0.930	0.76	0.896	0.76	0.997	0.67	0.970	0.54
660	1.062	0.35	0.930	0.55	0.896	0.89	0.999	0.64	0.972	0.51
665	1.062	0.26	0.930	1.16	0.895	0.68	0.998	0.99	0.971	0.72
670	1.060	0.33	0.931	0.90	0.894	0.82	0.999	0.67	0.971	0.62
675	1.064	0.49	0.929	1.00	0.896	0.80	0.998	0.94	0.972	0.73
680	1.063	0.77	0.929	1.02	0.896	0.72	0.995	0.57	0.971	0.70
685	1.062	0.79	0.930	0.85	0.895	0.84	0.999	0.99	0.971	0.80
690	1.065	0.40	0.931	1.02	0.899	0.85	0.997	0.95	0.973	0.73
695	1.063	0.49	0.933	1.00	0.895	0.71	1.001	0.90	0.973	0.66
700	1.065	0.31	0.933	0.95	0.899	0.58	1.004	0.79	0.975	0.53
705	1.063	0.54	0.931	0.96	0.897	0.97	0.995	0.60	0.972	0.69
710	1.063	0.68	0.928	1.16	0.899	0.89	0.995	1.23	0.971	0.91
715	1.062	0.47	0.930	0.84	0.897	0.92	0.997	0.71	0.972	0.57
720	1.063	0.85	0.930	1.44	0.894	0.67	1.000	0.55	0.972	0.65
725	1.068	0.86	0.931	1.25	0.894	0.76	0.994	1.00	0.972	0.90
730	1.067	0.63	0.929	1.26	0.900	0.70	1.000	1.35	0.974	0.75

0°/ 75° BIDIRECTIONAL ABSOLUTE SPECTRAL REFLECTANCE FACTORS

WAV. [nm]	Bss mean	Bss coeff. var.	Bsp mean	Bsp coeff. var.	Bps mean	Bps coeff. var.	Bpp mean	Bpp coeff. var.	Brr mean	Brr coeff. var.
390	0.964	1.18	0.838	1.02	0.792	1.21	0.879	1.58	0.868	1.02
395	0.981	0.87	0.850	1.54	0.809	1.19	0.909	1.33	0.887	1.16
400	0.976	1.08	0.848	1.32	0.807	1.28	0.906	1.47	0.884	1.22
405	0.984	1.55	0.856	1.10	0.813	1.10	0.912	1.20	0.891	1.20
410	0.984	1.30	0.855	1.35	0.813	1.42	0.913	1.43	0.891	1.32
415	0.985	1.44	0.858	1.30	0.814	1.47	0.915	1.27	0.893	1.31
420	0.984	1.46	0.858	1.35	0.812	1.55	0.914	1.39	0.892	1.39
425	0.985	1.47	0.857	1.44	0.812	1.73	0.915	1.49	0.892	1.47
430	0.983	1.45	0.856	1.31	0.810	1.54	0.915	1.36	0.891	1.35
435	0.983	1.40	0.856	1.43	0.810	1.62	0.912	1.39	0.890	1.40
440	0.983	1.47	0.857	1.40	0.810	1.71	0.914	1.68	0.891	1.50
445	0.984	1.49	0.855	1.41	0.810	1.71	0.912	1.60	0.890	1.49
450	0.984	1.50	0.856	1.42	0.808	1.76	0.913	1.50	0.890	1.49
455	0.984	1.43	0.856	1.40	0.809	1.83	0.913	1.52	0.890	1.47
460	0.986	1.50	0.854	1.44	0.810	1.63	0.911	1.49	0.890	1.45
465	0.991	1.63	0.849	1.42	0.814	1.60	0.906	1.49	0.890	1.49
470	0.985	1.48	0.855	1.36	0.809	1.58	0.912	1.49	0.890	1.42
475	0.986	1.47	0.853	1.35	0.809	1.55	0.911	1.44	0.890	1.40
480	0.986	1.58	0.853	1.39	0.808	1.65	0.911	1.45	0.890	1.46
485	0.986	1.42	0.854	1.29	0.809	1.49	0.910	1.53	0.890	1.38
490	0.987	1.51	0.853	1.40	0.810	1.54	0.911	1.51	0.890	1.43
495	0.986	1.27	0.853	1.48	0.808	1.59	0.911	1.44	0.889	1.38
500	0.986	1.39	0.852	1.47	0.808	1.50	0.910	1.44	0.889	1.39
505	0.988	1.46	0.853	1.49	0.809	1.54	0.911	1.45	0.890	1.43
510	0.987	1.42	0.853	1.55	0.809	1.48	0.912	1.53	0.890	1.44
515	0.988	1.31	0.853	1.40	0.809	1.44	0.911	1.35	0.890	1.32
520	0.988	1.27	0.852	1.35	0.808	1.49	0.911	1.27	0.890	1.28
525	0.987	1.34	0.852	1.32	0.808	1.33	0.910	1.28	0.889	1.26
530	0.987	1.38	0.853	1.18	0.807	1.41	0.910	1.38	0.889	1.28
535	0.989	1.35	0.852	1.29	0.807	1.37	0.910	1.20	0.889	1.24
540	0.989	1.26	0.852	1.28	0.808	1.41	0.910	1.33	0.890	1.26
545	0.990	1.14	0.851	1.28	0.807	1.27	0.911	1.41	0.890	1.21
550	0.991	1.14	0.852	1.27	0.807	1.35	0.910	1.24	0.890	1.19
555	0.990	0.97	0.850	1.17	0.806	1.28	0.910	1.22	0.889	1.09
560	0.992	1.11	0.852	1.25	0.806	1.25	0.909	1.32	0.890	1.16
565	0.991	1.12	0.852	1.33	0.806	1.25	0.909	1.34	0.890	1.20
570	0.991	1.02	0.850	1.23	0.805	1.13	0.909	1.01	0.889	1.04
575	0.991	1.18	0.849	1.18	0.807	1.10	0.911	1.40	0.889	1.15
580	0.993	1.01	0.852	1.41	0.808	1.02	0.911	1.29	0.891	1.13
585	0.993	1.04	0.851	1.37	0.807	1.23	0.909	1.24	0.890	1.16
590	0.995	0.98	0.852	1.50	0.807	1.27	0.910	1.23	0.891	1.18
595	0.994	0.99	0.851	1.48	0.806	1.26	0.909	1.34	0.890	1.20
600	0.995	1.17	0.849	1.39	0.807	1.03	0.911	1.30	0.891	1.17
605	0.995	1.08	0.848	1.25	0.807	1.02	0.908	1.53	0.890	1.17
610	0.994	1.00	0.851	1.64	0.808	0.94	0.909	1.43	0.891	1.20
615	0.995	0.91	0.849	1.25	0.806	1.26	0.907	1.24	0.889	1.10
620	0.995	1.09	0.849	1.45	0.808	1.07	0.909	1.43	0.890	1.20
625	0.995	1.20	0.850	1.22	0.806	1.24	0.909	1.34	0.890	1.19
630	0.997	1.12	0.848	1.39	0.807	1.23	0.908	1.58	0.890	1.27
635	0.995	1.19	0.849	1.50	0.806	1.09	0.909	1.48	0.890	1.26
640	0.995	1.14	0.851	1.55	0.807	1.31	0.908	1.58	0.890	1.31
645	0.997	1.29	0.850	1.65	0.808	1.23	0.908	1.46	0.891	1.34
650	0.999	1.40	0.849	1.52	0.809	1.03	0.911	1.51	0.892	1.32
655	0.998	1.08	0.849	1.58	0.806	1.03	0.910	1.42	0.891	1.22
660	1.000	1.02	0.848	1.75	0.806	1.22	0.910	1.72	0.891	1.35
665	0.999	1.04	0.848	1.76	0.808	1.12	0.907	1.52	0.890	1.28
670	1.003	1.50	0.849	1.59	0.808	1.19	0.909	1.71	0.892	1.44
675	0.999	1.15	0.849	1.64	0.807	1.36	0.907	1.64	0.891	1.36
680	0.999	0.91	0.847	1.46	0.807	1.21	0.905	1.54	0.889	1.21
685	0.999	1.37	0.848	1.58	0.807	1.25	0.906	1.56	0.890	1.35
690	1.005	1.26	0.847	1.54	0.809	0.84	0.906	2.00	0.892	1.31
695	1.003	1.35	0.848	0.99	0.807	1.30	0.907	1.15	0.891	1.15
700	1.004	1.19	0.852	1.73	0.807	0.89	0.912	1.47	0.894	1.24
705	0.998	0.86	0.844	1.92	0.808	1.03	0.908	1.63	0.890	1.29
710	0.998	1.17	0.848	2.06	0.807	1.50	0.907	2.17	0.890	1.62
715	1.001	1.40	0.847	1.21	0.808	0.70	0.905	1.62	0.890	1.18
720	1.004	1.02	0.852	1.64	0.806	1.40	0.904	1.15	0.892	1.06
725	1.000	1.13	0.849	1.79	0.808	0.96	0.907	1.97	0.891	1.36
730	1.003	1.29	0.842	2.27	0.809	1.57	0.900	1.76	0.888	1.59

-15°/-75° BIDIRECTIONAL ABSOLUTE SPECTRAL REFLECTANCE FACTORS

WAV.	Bss		Bsp		Bps		Bpp		Brr	
[nm]	mean	coeff. var.	mean	coeff. var.	mean	coeff. var.	mean	coeff. var.	mean	coeff. var.
390	0.897	1.07	0.810	1.17	0.762	1.42	0.866	1.84	0.834	1.26
395	0.912	1.27	0.827	1.72	0.790	1.56	0.886	1.65	0.854	1.46
400	0.908	1.44	0.828	1.28	0.787	1.96	0.885	1.48	0.852	1.46
405	0.916	1.44	0.831	1.77	0.795	1.55	0.893	1.71	0.859	1.56
410	0.915	1.77	0.833	1.42	0.794	1.78	0.894	1.93	0.859	1.66
415	0.918	1.58	0.834	1.75	0.793	1.89	0.896	1.94	0.860	1.72
420	0.916	1.79	0.833	1.74	0.792	1.89	0.897	2.12	0.860	1.82
425	0.917	1.60	0.834	1.89	0.792	1.99	0.896	1.98	0.860	1.79
430	0.915	1.83	0.833	1.71	0.791	1.84	0.897	2.06	0.859	1.79
435	0.916	1.78	0.833	1.79	0.790	2.00	0.895	2.09	0.859	1.85
440	0.915	1.88	0.834	1.99	0.790	2.02	0.896	2.15	0.859	1.94
445	0.916	1.84	0.832	1.91	0.790	2.09	0.894	2.06	0.858	1.90
450	0.915	1.78	0.832	1.81	0.789	2.12	0.895	2.17	0.858	1.89
455	0.915	1.79	0.833	1.92	0.789	2.03	0.895	2.16	0.858	1.90
460	0.917	1.77	0.831	1.93	0.789	2.09	0.894	2.26	0.858	1.93
465	0.921	1.75	0.826	1.90	0.794	2.03	0.889	2.12	0.858	1.88
470	0.917	1.62	0.831	1.84	0.789	1.99	0.895	2.21	0.858	1.84
475	0.917	1.66	0.830	1.87	0.789	1.88	0.894	2.21	0.858	1.83
480	0.917	1.62	0.830	1.90	0.788	1.89	0.894	2.13	0.857	1.81
485	0.916	1.56	0.830	1.86	0.789	1.82	0.894	2.13	0.857	1.77
490	0.917	1.68	0.830	1.90	0.788	1.98	0.894	2.13	0.857	1.84
495	0.916	1.60	0.830	1.77	0.788	1.88	0.894	2.09	0.857	1.76
500	0.916	1.61	0.829	1.72	0.788	1.83	0.894	2.13	0.857	1.75
505	0.917	1.58	0.830	1.73	0.788	1.89	0.895	2.12	0.857	1.76
510	0.918	1.69	0.830	1.83	0.788	1.95	0.895	2.21	0.858	1.84
515	0.918	1.57	0.829	1.89	0.787	1.83	0.895	1.97	0.857	1.74
520	0.918	1.55	0.828	1.83	0.787	1.76	0.895	2.09	0.857	1.73
525	0.917	1.44	0.828	1.74	0.786	1.75	0.894	1.89	0.857	1.63
530	0.916	1.50	0.830	1.74	0.786	1.70	0.894	1.80	0.856	1.62
535	0.917	1.38	0.828	1.65	0.785	1.64	0.893	2.13	0.856	1.62
540	0.919	1.42	0.829	1.67	0.786	1.61	0.894	1.91	0.857	1.57
545	0.918	1.52	0.828	1.75	0.786	1.73	0.894	2.00	0.856	1.68
550	0.919	1.37	0.829	1.61	0.787	1.56	0.893	1.90	0.857	1.55
555	0.918	1.35	0.828	1.78	0.787	1.60	0.894	1.84	0.857	1.58
560	0.919	1.28	0.828	1.75	0.786	1.69	0.894	1.99	0.857	1.59
565	0.919	1.32	0.827	1.73	0.787	1.74	0.894	1.93	0.857	1.60
570	0.920	1.10	0.827	1.64	0.786	1.45	0.894	1.79	0.857	1.43
575	0.919	1.16	0.826	1.74	0.785	1.52	0.894	2.01	0.856	1.54
580	0.920	1.21	0.827	1.83	0.785	1.50	0.894	1.80	0.857	1.51
585	0.920	1.29	0.826	1.63	0.786	1.55	0.894	2.03	0.856	1.55
590	0.921	1.07	0.827	1.63	0.787	1.66	0.896	2.06	0.858	1.53
595	0.920	1.34	0.826	1.82	0.785	1.73	0.894	1.91	0.856	1.62
600	0.922	0.98	0.826	1.78	0.788	1.64	0.895	1.92	0.858	1.51
605	0.924	1.21	0.825	2.02	0.787	1.44	0.894	1.89	0.858	1.57
610	0.923	1.17	0.826	1.71	0.787	1.53	0.897	1.97	0.858	1.52
615	0.922	1.10	0.825	1.86	0.786	1.45	0.895	2.08	0.857	1.55
620	0.922	1.15	0.826	1.75	0.786	1.55	0.895	1.80	0.857	1.48
625	0.924	1.03	0.826	1.83	0.786	1.41	0.896	2.18	0.858	1.53
630	0.925	1.12	0.826	1.82	0.786	1.56	0.893	2.02	0.858	1.56
635	0.922	1.20	0.825	1.83	0.787	1.57	0.895	1.99	0.857	1.57
640	0.926	1.14	0.825	2.04	0.786	1.54	0.896	2.30	0.858	1.66
645	0.923	1.30	0.827	2.01	0.788	1.59	0.896	2.33	0.858	1.71
650	0.927	1.28	0.826	2.09	0.787	1.61	0.899	2.13	0.860	1.67
655	0.924	1.42	0.826	2.07	0.786	1.38	0.894	2.04	0.857	1.64
660	0.926	1.64	0.825	2.12	0.786	1.56	0.896	2.38	0.858	1.83
665	0.925	1.33	0.824	2.21	0.787	1.42	0.892	2.24	0.857	1.71
670	0.928	1.23	0.825	2.03	0.786	1.39	0.894	2.35	0.858	1.66
675	0.927	1.18	0.824	1.83	0.787	1.51	0.894	2.72	0.858	1.72
680	0.924	1.02	0.824	1.67	0.786	1.42	0.891	2.19	0.856	1.49
685	0.925	1.34	0.825	2.22	0.785	1.56	0.895	2.33	0.857	1.78
690	0.925	1.25	0.821	2.23	0.785	1.72	0.895	2.49	0.857	1.83
695	0.928	1.31	0.823	2.24	0.786	1.81	0.897	2.10	0.858	1.77
700	0.928	1.24	0.823	1.46	0.791	1.35	0.902	2.52	0.861	1.53
705	0.923	1.55	0.824	1.77	0.784	1.81	0.893	2.11	0.856	1.71
710	0.927	1.59	0.823	2.22	0.785	1.81	0.892	1.84	0.857	1.75
715	0.927	1.26	0.825	1.98	0.786	1.78	0.893	1.97	0.858	1.62
720	0.931	1.23	0.822	2.70	0.790	1.68	0.899	2.27	0.860	1.79
725	0.927	1.58	0.823	2.40	0.788	2.11	0.893	3.08	0.858	2.14
730	0.928	1.30	0.818	2.50	0.782	1.74	0.892	2.81	0.855	1.92

-15°/-60° BIDIRECTIONAL ABSOLUTE SPECTRAL REFLECTANCE FACTORS

WAV. [nm]	Bss mean	Bss coeff. var.	Bsp mean	Bsp coeff. var.	Bps mean	Bps coeff. var.	Bop mean	Bop coeff. var.	Brr mean	Brr coeff. var.
390	0.969	1.13	0.890	0.95	0.860	1.04	0.965	1.50	0.921	0.98
395	0.987	0.79	0.909	0.69	0.878	1.27	0.981	0.89	0.939	0.84
400	0.984	1.18	0.908	0.51	0.876	1.06	0.983	1.05	0.938	0.91
405	0.993	0.93	0.914	0.59	0.884	1.19	0.991	0.87	0.946	0.86
410	0.995	1.03	0.917	0.85	0.885	1.01	0.991	1.13	0.947	0.96
415	0.997	1.05	0.919	0.92	0.886	1.18	0.996	1.03	0.950	1.02
420	0.995	1.40	0.920	1.03	0.884	1.30	0.997	1.25	0.949	1.21
425	0.997	1.30	0.922	0.93	0.886	1.45	0.998	1.28	0.951	1.20
430	0.996	1.40	0.922	0.93	0.886	1.35	0.999	1.36	0.951	1.22
435	0.997	1.43	0.921	1.10	0.883	1.29	0.997	1.38	0.950	1.26
440	0.996	1.50	0.920	1.09	0.884	1.44	0.999	1.37	0.950	1.31
445	0.998	1.54	0.918	1.04	0.885	1.47	0.997	1.28	0.949	1.29
450	0.997	1.56	0.918	1.02	0.884	1.44	0.997	1.44	0.949	1.32
455	0.996	1.48	0.919	1.05	0.883	1.33	0.998	1.60	0.949	1.32
460	0.998	1.43	0.918	1.07	0.884	1.34	0.997	1.41	0.949	1.27
465	1.002	1.36	0.912	1.03	0.889	1.35	0.992	1.31	0.949	1.23
470	0.998	1.29	0.918	0.89	0.883	1.37	0.998	1.28	0.949	1.17
475	0.997	1.38	0.917	0.91	0.884	1.33	0.997	1.44	0.949	1.22
480	0.996	1.37	0.916	0.96	0.882	1.33	0.997	1.19	0.948	1.17
485	0.997	1.37	0.916	0.90	0.883	1.27	0.996	1.24	0.948	1.16
490	0.997	1.24	0.915	0.94	0.883	1.24	0.997	1.27	0.948	1.14
495	0.996	1.20	0.916	1.03	0.881	1.18	0.996	1.33	0.947	1.14
500	0.997	1.06	0.915	0.95	0.881	1.17	0.997	1.20	0.947	1.05
505	0.998	1.10	0.915	0.83	0.881	1.21	0.997	1.16	0.948	1.04
510	0.999	1.09	0.915	0.86	0.880	1.22	0.997	1.13	0.948	1.04
515	0.997	1.03	0.914	0.87	0.880	1.11	0.996	1.10	0.947	1.00
520	0.997	0.93	0.913	0.67	0.881	1.11	0.995	1.00	0.947	0.89
525	0.998	1.10	0.913	0.72	0.879	0.99	0.996	1.00	0.946	0.92
530	0.997	0.95	0.913	0.62	0.878	0.89	0.997	0.95	0.946	0.82
535	0.998	0.90	0.912	0.73	0.878	0.96	0.995	1.02	0.946	0.87
540	0.999	0.97	0.913	0.73	0.879	0.75	0.997	1.12	0.947	0.86
545	0.999	0.97	0.912	0.57	0.878	0.91	0.995	0.81	0.946	0.79
550	0.999	0.79	0.912	0.68	0.878	0.75	0.996	0.74	0.946	0.71
555	0.999	0.83	0.912	0.55	0.879	0.77	0.995	0.93	0.946	0.74
560	0.999	0.59	0.912	0.67	0.879	0.98	0.995	0.84	0.946	0.74
565	0.999	0.82	0.912	0.63	0.878	0.55	0.994	0.87	0.946	0.69
570	0.999	0.71	0.910	0.40	0.877	0.79	0.995	0.92	0.945	0.67
575	0.999	0.65	0.910	0.49	0.877	0.65	0.996	0.88	0.946	0.63
580	1.000	0.68	0.910	0.33	0.878	0.68	0.997	0.79	0.946	0.59
585	1.001	0.75	0.910	0.50	0.878	0.67	0.996	0.83	0.946	0.66
590	1.004	0.72	0.911	0.58	0.878	0.56	0.997	0.78	0.947	0.63
595	1.000	0.66	0.911	0.56	0.878	0.54	0.994	0.94	0.946	0.62
600	1.005	0.68	0.912	0.55	0.878	0.53	0.998	0.86	0.948	0.62
605	1.004	0.57	0.910	0.54	0.879	0.74	0.996	0.95	0.947	0.66
610	1.001	0.77	0.909	0.71	0.878	0.57	0.996	1.10	0.946	0.75
615	1.002	0.47	0.908	0.79	0.876	0.57	0.996	0.98	0.946	0.64
620	1.004	0.66	0.909	0.68	0.878	0.62	0.999	1.03	0.948	0.71
625	1.006	0.85	0.911	0.74	0.878	0.37	1.000	0.89	0.949	0.67
630	1.006	0.69	0.910	0.87	0.879	0.57	1.000	1.15	0.949	0.78
635	1.003	0.64	0.910	0.64	0.878	0.72	0.999	0.88	0.948	0.67
640	1.004	0.81	0.910	0.60	0.877	0.60	0.999	1.15	0.948	0.75
645	1.006	0.65	0.909	0.64	0.880	0.80	0.997	0.91	0.948	0.69
650	1.008	0.53	0.908	0.99	0.879	0.58	0.997	0.86	0.948	0.70
655	1.007	0.80	0.909	0.72	0.881	0.59	0.998	1.04	0.948	0.72
660	1.006	0.69	0.909	0.83	0.880	0.61	0.994	0.83	0.947	0.71
665	1.009	0.65	0.908	0.79	0.881	0.65	0.996	1.11	0.949	0.74
670	1.012	0.79	0.911	0.67	0.879	0.92	1.002	1.03	0.951	0.76
675	1.009	0.89	0.908	0.75	0.881	0.40	0.997	0.78	0.949	0.65
680	1.007	0.58	0.905	0.74	0.878	0.39	0.999	1.28	0.947	0.70
685	1.010	0.86	0.910	0.90	0.879	0.66	0.997	1.12	0.949	0.80
690	1.013	0.74	0.904	1.50	0.879	0.67	0.999	1.23	0.949	0.93
695	1.010	0.61	0.910	0.57	0.879	0.85	1.000	1.11	0.950	0.64
700	1.013	0.83	0.911	0.94	0.883	0.62	0.998	1.34	0.951	0.82
705	1.008	0.94	0.908	0.99	0.877	0.83	0.997	1.60	0.948	0.98
710	1.015	0.74	0.909	1.01	0.878	1.09	0.999	1.02	0.950	0.91
715	1.012	1.05	0.908	0.83	0.881	0.29	1.002	1.28	0.951	0.79
720	1.011	1.47	0.915	0.95	0.881	1.27	1.001	1.05	0.952	1.06
725	1.014	1.37	0.908	0.98	0.878	0.69	0.998	1.84	0.950	1.09
730	1.007	0.30	0.908	0.96	0.881	1.02	0.999	0.83	0.949	0.66

-15°/-45° BIDIRECTIONAL ABSOLUTE SPECTRAL REFLECTANCE FACTORS

WAV. [nm]	Bss mean	Bss coeff. var.	Bsp mean	Bsp coeff. var.	Bps mean	Bps coeff. var.	Bpp mean	Bpp coeff. var.	Brr mean	Brr coeff. var.
390	1.012	1.01	0.929	0.83	0.909	0.60	1.026	0.99	0.969	0.64
395	1.032	0.76	0.952	0.77	0.928	0.69	1.039	0.81	0.988	0.68
400	1.030	0.99	0.950	0.75	0.930	0.94	1.043	1.19	0.988	0.89
405	1.040	1.20	0.959	0.38	0.937	0.84	1.054	1.21	0.998	0.86
410	1.042	1.12	0.960	0.65	0.940	0.98	1.054	0.98	0.999	0.87
415	1.045	1.09	0.964	0.62	0.939	1.02	1.060	1.24	1.002	0.94
420	1.044	1.27	0.963	0.88	0.940	1.25	1.060	1.15	1.002	1.09
425	1.046	1.27	0.965	0.87	0.939	1.22	1.063	1.37	1.003	1.12
430	1.045	1.25	0.965	0.87	0.939	1.12	1.062	1.44	1.003	1.12
435	1.045	1.55	0.964	0.91	0.939	1.18	1.060	1.39	1.002	1.21
440	1.045	1.44	0.965	0.93	0.940	1.26	1.062	1.53	1.003	1.23
445	1.047	1.43	0.963	0.98	0.939	1.30	1.060	1.42	1.003	1.24
450	1.047	1.38	0.963	0.99	0.939	1.31	1.062	1.53	1.003	1.25
455	1.045	1.45	0.964	0.90	0.938	1.23	1.062	1.50	1.002	1.21
460	1.047	1.35	0.962	0.83	0.940	1.18	1.061	1.44	1.002	1.14
465	1.051	1.39	0.956	0.82	0.945	1.18	1.057	1.35	1.002	1.14
470	1.047	1.22	0.963	0.85	0.939	1.19	1.062	1.32	1.003	1.09
475	1.047	1.25	0.960	0.81	0.939	1.16	1.060	1.42	1.002	1.11
480	1.048	1.27	0.960	0.82	0.937	1.15	1.060	1.19	1.001	1.06
485	1.047	1.37	0.960	0.84	0.937	1.03	1.060	1.26	1.001	1.09
490	1.047	1.30	0.959	0.70	0.937	1.10	1.061	1.20	1.001	1.04
495	1.047	1.11	0.959	0.79	0.937	1.12	1.061	1.29	1.001	1.02
500	1.046	1.09	0.959	0.68	0.936	0.95	1.060	1.16	1.000	0.93
505	1.046	1.05	0.958	0.72	0.937	0.92	1.061	1.09	1.000	0.91
510	1.047	1.12	0.958	0.56	0.936	0.92	1.061	1.25	1.001	0.92
515	1.047	0.96	0.957	0.55	0.935	0.88	1.060	1.16	1.000	0.84
520	1.046	0.88	0.956	0.47	0.935	0.83	1.059	0.94	0.999	0.73
525	1.047	0.83	0.957	0.43	0.935	0.59	1.060	0.89	1.000	0.65
530	1.046	0.86	0.958	0.34	0.933	0.54	1.060	0.98	1.000	0.65
535	1.047	0.76	0.957	0.43	0.934	0.50	1.059	0.83	0.999	0.60
540	1.048	0.84	0.956	0.43	0.934	0.69	1.060	0.83	0.999	0.67
545	1.048	0.89	0.956	0.44	0.933	0.66	1.060	0.80	0.999	0.66
550	1.048	0.73	0.955	0.38	0.934	0.65	1.061	0.82	0.999	0.60
555	1.049	0.76	0.955	0.33	0.932	0.63	1.060	0.81	0.999	0.59
560	1.048	0.66	0.956	0.26	0.933	0.49	1.059	0.81	0.999	0.49
565	1.050	0.68	0.954	0.26	0.934	0.50	1.059	0.62	0.999	0.49
570	1.049	0.62	0.954	0.24	0.933	0.40	1.058	0.77	0.999	0.48
575	1.047	0.53	0.955	0.17	0.933	0.35	1.057	0.56	0.998	0.37
580	1.050	0.71	0.953	0.26	0.934	0.36	1.058	0.71	0.999	0.48
585	1.050	0.65	0.954	0.30	0.934	0.41	1.060	0.85	1.000	0.52
590	1.052	0.52	0.955	0.24	0.933	0.36	1.061	0.73	1.000	0.41
595	1.052	0.55	0.953	0.40	0.932	0.42	1.060	0.86	0.999	0.50
600	1.053	0.72	0.953	0.21	0.935	0.48	1.062	0.66	1.001	0.49
605	1.052	0.70	0.953	0.14	0.933	0.35	1.061	0.88	1.000	0.48
610	1.053	0.43	0.952	0.34	0.935	0.46	1.063	1.00	1.001	0.51
615	1.054	0.63	0.952	0.41	0.933	0.13	1.061	0.63	1.000	0.39
620	1.056	0.54	0.954	0.24	0.933	0.37	1.063	0.65	1.002	0.40
625	1.057	0.72	0.954	0.32	0.934	0.33	1.064	0.94	1.002	0.48
630	1.058	0.61	0.955	0.35	0.934	0.48	1.064	0.83	1.003	0.52
635	1.056	0.50	0.953	0.17	0.933	0.21	1.064	0.68	1.002	0.35
640	1.058	0.44	0.952	0.42	0.933	0.40	1.065	0.80	1.002	0.44
645	1.058	0.65	0.952	0.37	0.936	0.46	1.064	1.11	1.003	0.59
650	1.059	0.78	0.954	0.39	0.934	0.49	1.063	0.96	1.003	0.59
655	1.060	0.59	0.952	0.52	0.938	0.50	1.064	0.81	1.003	0.57
660	1.062	0.54	0.955	0.23	0.935	0.38	1.061	0.91	1.003	0.48
665	1.059	0.57	0.950	0.41	0.937	0.46	1.062	0.76	1.002	0.51
670	1.061	0.88	0.953	0.91	0.937	0.31	1.064	0.83	1.004	0.62
675	1.060	0.48	0.952	0.79	0.935	0.47	1.061	0.62	1.002	0.52
680	1.061	0.47	0.951	0.57	0.934	0.53	1.060	1.00	1.002	0.54
685	1.059	0.73	0.952	0.71	0.936	0.76	1.064	0.82	1.003	0.71
690	1.062	0.73	0.950	0.42	0.936	0.57	1.065	0.96	1.003	0.55
695	1.063	0.67	0.955	0.43	0.934	0.28	1.066	1.13	1.004	0.50
700	1.064	0.11	0.958	0.49	0.937	0.66	1.067	0.80	1.007	0.45
705	1.060	1.05	0.953	0.48	0.935	0.70	1.066	1.04	1.003	0.76
710	1.067	1.20	0.950	0.49	0.935	0.74	1.061	0.99	1.003	0.76
715	1.062	1.12	0.947	0.79	0.938	0.41	1.063	0.94	1.003	0.76
720	1.062	0.64	0.955	0.60	0.934	0.52	1.069	0.81	1.005	0.50
725	1.067	1.26	0.951	0.62	0.935	1.06	1.061	1.65	1.003	1.04
730	1.062	1.17	0.951	0.47	0.934	0.63	1.059	1.31	1.002	0.82

-15°/-30° BIDIRECTIONAL ABSOLUTE SPECTRAL REFLECTANCE FACTORS

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WAV. [nm]	Bss mean	Bss coeff. var.	Bsp mean	Bsp coeff. var.	Bps mean	Bps coeff. var.	Bpp mean	Bpp coeff. var.	Brr mean	Brr coeff. var.
390	1.060	0.59	0.959	1.39	0.946	0.79	1.079	1.09	1.011	0.55
395	1.079	0.92	0.976	0.36	0.970	1.03	1.098	0.80	1.031	0.73
400	1.076	1.00	0.977	0.60	0.966	0.80	1.098	0.82	1.029	0.76
405	1.084	1.08	0.986	0.62	0.977	1.06	1.110	0.83	1.039	0.82
410	1.087	1.16	0.990	0.91	0.976	1.07	1.110	0.93	1.041	0.96
415	1.090	1.16	0.991	0.79	0.979	1.15	1.115	0.96	1.044	0.97
420	1.089	1.26	0.992	1.07	0.977	1.34	1.115	1.02	1.043	1.10
425	1.092	1.44	0.993	1.14	0.977	1.40	1.117	1.15	1.045	1.20
430	1.090	1.25	0.993	1.07	0.977	1.22	1.117	1.25	1.044	1.13
435	1.091	1.31	0.990	1.16	0.976	1.25	1.116	1.26	1.043	1.19
440	1.090	1.29	0.993	1.12	0.976	1.49	1.117	1.21	1.044	1.21
445	1.093	1.41	0.991	1.06	0.976	1.38	1.116	1.24	1.044	1.22
450	1.091	1.46	0.991	1.07	0.976	1.39	1.118	1.09	1.044	1.20
455	1.091	1.41	0.990	1.02	0.975	1.30	1.118	1.32	1.043	1.21
460	1.092	1.44	0.988	1.01	0.977	1.30	1.117	1.33	1.044	1.22
465	1.098	1.39	0.983	1.04	0.981	1.38	1.111	1.18	1.043	1.20
470	1.093	1.36	0.990	1.05	0.976	1.34	1.118	1.27	1.044	1.20
475	1.091	1.43	0.987	0.99	0.976	1.28	1.115	1.18	1.043	1.17
480	1.091	1.16	0.987	0.92	0.975	1.30	1.117	1.22	1.042	1.10
485	1.091	1.21	0.986	0.84	0.975	1.25	1.116	1.10	1.042	1.06
490	1.093	1.08	0.986	0.89	0.976	1.24	1.117	1.03	1.043	1.01
495	1.092	1.11	0.986	0.90	0.973	1.14	1.117	1.24	1.042	1.05
500	1.091	1.08	0.985	0.82	0.973	1.07	1.116	1.06	1.041	0.96
505	1.092	1.04	0.986	0.78	0.974	1.03	1.117	0.86	1.042	0.88
510	1.093	1.03	0.985	0.70	0.973	0.99	1.117	1.01	1.042	0.89
515	1.093	0.89	0.983	0.74	0.973	1.07	1.117	0.75	1.041	0.82
520	1.092	0.93	0.984	0.60	0.972	0.86	1.117	0.80	1.041	0.76
525	1.092	0.87	0.983	0.56	0.972	0.90	1.117	0.75	1.041	0.73
530	1.092	0.89	0.984	0.50	0.971	0.74	1.115	0.73	1.040	0.68
535	1.093	0.81	0.982	0.56	0.970	0.81	1.117	0.92	1.040	0.72
540	1.094	0.77	0.983	0.56	0.971	0.69	1.116	0.60	1.041	0.61
545	1.093	0.70	0.981	0.52	0.973	0.71	1.117	0.73	1.041	0.62
550	1.094	0.73	0.981	0.49	0.971	0.55	1.118	0.71	1.041	0.57
555	1.092	0.60	0.980	0.47	0.970	0.70	1.116	0.66	1.040	0.57
560	1.095	0.71	0.979	0.51	0.971	0.66	1.117	0.49	1.041	0.55
565	1.095	0.60	0.980	0.45	0.970	0.54	1.117	0.70	1.041	0.51
570	1.095	0.70	0.980	0.39	0.970	0.49	1.117	0.56	1.040	0.50
575	1.094	0.58	0.979	0.48	0.970	0.43	1.117	0.51	1.040	0.46
580	1.096	0.55	0.981	0.33	0.970	0.48	1.119	0.55	1.042	0.41
585	1.096	0.62	0.980	0.41	0.971	0.51	1.118	0.45	1.041	0.43
590	1.098	0.35	0.979	0.19	0.971	0.43	1.120	0.66	1.042	0.38
595	1.100	0.65	0.979	0.44	0.970	0.58	1.117	0.58	1.041	0.51
600	1.101	0.42	0.979	0.42	0.972	0.53	1.120	0.45	1.043	0.42
605	1.100	0.47	0.978	0.30	0.972	0.44	1.118	0.61	1.042	0.39
610	1.101	0.73	0.980	0.34	0.972	0.47	1.120	0.42	1.043	0.46
615	1.100	0.66	0.977	0.49	0.971	0.48	1.119	0.28	1.042	0.43
620	1.101	0.31	0.979	0.53	0.974	0.54	1.121	0.29	1.044	0.39
625	1.103	0.46	0.980	0.50	0.973	0.49	1.120	0.62	1.044	0.47
630	1.104	0.59	0.977	0.33	0.973	0.45	1.122	0.62	1.044	0.43
635	1.100	0.46	0.977	0.35	0.971	0.47	1.120	0.55	1.042	0.38
640	1.103	0.69	0.978	0.48	0.974	0.39	1.121	0.71	1.044	0.48
645	1.105	0.70	0.979	0.39	0.973	0.52	1.124	0.68	1.045	0.54
650	1.108	0.54	0.980	0.56	0.974	0.32	1.123	0.59	1.046	0.47
655	1.106	0.52	0.976	0.50	0.974	0.66	1.125	0.71	1.045	0.54
660	1.104	0.82	0.978	0.53	0.972	0.77	1.123	0.73	1.044	0.67
665	1.106	0.57	0.978	0.58	0.974	0.58	1.123	0.51	1.045	0.48
670	1.109	0.70	0.979	0.62	0.974	0.70	1.123	0.97	1.046	0.70
675	1.105	0.81	0.978	0.39	0.973	0.79	1.121	0.82	1.044	0.64
680	1.105	0.64	0.974	0.37	0.974	0.61	1.120	0.87	1.043	0.54
685	1.109	0.82	0.977	0.42	0.971	0.76	1.121	1.26	1.044	0.76
690	1.112	0.70	0.982	0.74	0.976	0.50	1.125	0.87	1.049	0.62
695	1.113	0.38	0.977	0.69	0.974	0.89	1.126	0.78	1.047	0.60
700	1.112	0.76	0.980	0.61	0.977	0.39	1.131	1.41	1.050	0.66
705	1.113	0.77	0.977	0.71	0.974	0.71	1.122	0.72	1.046	0.68
710	1.111	1.13	0.979	0.53	0.977	0.91	1.123	1.36	1.048	0.93
715	1.111	1.09	0.973	0.84	0.977	0.62	1.126	1.44	1.047	0.89
720	1.117	0.92	0.984	0.25	0.975	0.94	1.122	0.74	1.049	0.47
725	1.114	0.72	0.975	0.63	0.975	0.76	1.122	0.76	1.047	0.63
730	1.110	0.63	0.979	0.98	0.972	0.62	1.120	0.99	1.045	0.60

−15°/ 0° BIDIRECTIONAL ABSOLUTE SPECTRAL REFLECTANCE FACTORS

WAV.	Bss		Bsp		Bps		Bpp		Brr	
[nm]	mean	coeff. var.	mean	coeff. var.	mean	coeff. var.	mean	coeff. var.	mean	coeff. var.
390	1.099	1.17	0.977	1.19	0.984	0.61	1.099	0.89	1.040	0.84
395	1.113	0.70	0.999	0.96	0.998	1.07	1.120	0.95	1.058	0.87
400	1.112	0.84	0.997	0.85	0.995	0.83	1.124	0.92	1.057	0.79
405	1.120	1.14	1.006	0.92	1.007	1.02	1.133	1.03	1.067	0.99
410	1.123	1.01	1.007	0.76	1.007	1.08	1.135	1.10	1.068	0.95
415	1.126	1.01	1.014	0.98	1.009	1.18	1.140	1.10	1.072	1.02
420	1.127	1.26	1.012	0.93	1.009	1.36	1.141	1.18	1.072	1.12
425	1.128	1.18	1.014	1.08	1.010	1.28	1.143	1.29	1.074	1.16
430	1.126	1.31	1.012	1.12	1.009	1.38	1.142	1.25	1.072	1.22
435	1.128	1.37	1.012	1.14	1.007	1.47	1.143	1.38	1.072	1.28
440	1.128	1.47	1.013	1.32	1.009	1.40	1.144	1.40	1.074	1.34
445	1.129	1.40	1.011	1.16	1.009	1.52	1.143	1.46	1.073	1.31
450	1.129	1.42	1.013	1.14	1.009	1.52	1.143	1.31	1.073	1.29
455	1.127	1.28	1.012	1.15	1.007	1.40	1.142	1.37	1.072	1.24
460	1.131	1.32	1.009	1.10	1.009	1.34	1.143	1.29	1.073	1.20
465	1.137	1.13	1.003	1.10	1.014	1.31	1.137	1.18	1.073	1.12
470	1.129	1.20	1.010	0.98	1.009	1.35	1.144	1.27	1.073	1.15
475	1.129	1.19	1.008	1.10	1.008	1.27	1.142	1.35	1.072	1.17
480	1.129	1.15	1.008	1.09	1.008	1.18	1.142	1.18	1.072	1.09
485	1.130	1.02	1.007	0.97	1.007	1.23	1.142	1.13	1.072	1.04
490	1.131	1.17	1.007	0.93	1.007	1.18	1.144	0.98	1.072	1.01
495	1.129	1.03	1.006	0.95	1.006	1.22	1.143	1.21	1.071	1.05
500	1.129	0.93	1.006	0.98	1.005	1.16	1.141	1.11	1.070	0.99
505	1.130	0.99	1.006	1.02	1.006	1.13	1.143	1.25	1.071	1.05
510	1.131	0.92	1.007	0.97	1.006	1.16	1.143	0.90	1.072	0.94
515	1.131	0.84	1.005	0.80	1.005	0.98	1.143	0.74	1.071	0.79
520	1.130	0.84	1.005	0.71	1.004	0.93	1.143	0.84	1.071	0.78
525	1.131	0.93	1.004	0.77	1.004	0.85	1.141	0.75	1.070	0.78
530	1.131	0.83	1.005	0.72	1.003	0.78	1.143	0.79	1.070	0.74
535	1.130	0.87	1.004	0.68	1.003	0.86	1.142	0.88	1.070	0.78
540	1.132	0.73	1.003	0.65	1.004	0.86	1.144	0.90	1.071	0.73
545	1.132	0.61	1.002	0.65	1.003	0.64	1.144	0.68	1.070	0.59
550	1.133	0.66	1.003	0.72	1.004	0.75	1.142	0.52	1.071	0.59
555	1.133	0.61	1.001	0.52	1.003	0.82	1.143	0.55	1.070	0.58
560	1.133	0.67	1.001	0.59	1.002	0.60	1.144	0.55	1.070	0.56
565	1.134	0.73	1.000	0.53	1.003	0.56	1.143	0.65	1.070	0.57
570	1.135	0.62	1.001	0.63	1.001	0.71	1.142	0.61	1.070	0.61
575	1.135	0.50	1.001	0.67	1.001	0.72	1.143	0.56	1.070	0.57
580	1.136	0.55	1.001	0.63	1.002	0.74	1.142	0.49	1.070	0.57
585	1.136	0.51	1.000	0.62	1.003	0.55	1.142	0.61	1.070	0.54
590	1.137	0.40	1.002	0.58	1.005	0.45	1.144	0.45	1.072	0.43
595	1.137	0.37	1.000	0.60	1.004	0.48	1.144	0.54	1.071	0.46
600	1.140	0.38	1.001	0.60	1.004	0.58	1.148	0.46	1.073	0.45
605	1.141	0.42	1.000	0.63	1.004	0.68	1.145	0.60	1.072	0.52
610	1.141	0.46	0.999	0.66	1.006	0.46	1.148	0.66	1.073	0.51
615	1.140	0.41	0.998	0.66	1.004	0.61	1.147	0.69	1.072	0.56
620	1.141	0.41	1.001	0.71	1.005	0.51	1.150	0.39	1.074	0.44
625	1.144	0.71	0.999	0.72	1.006	0.54	1.150	0.68	1.075	0.63
630	1.145	0.77	1.001	0.74	1.005	0.48	1.147	0.82	1.075	0.68
635	1.142	0.43	1.000	0.53	1.003	0.59	1.146	0.64	1.073	0.50
640	1.145	0.58	1.000	0.57	1.008	0.63	1.146	0.65	1.075	0.55
645	1.149	0.64	1.001	0.83	1.007	0.76	1.151	0.63	1.077	0.67
650	1.147	0.75	1.002	0.52	1.008	0.73	1.149	0.81	1.077	0.67
655	1.146	0.70	0.998	0.92	1.007	0.83	1.149	0.95	1.075	0.74
660	1.145	0.46	1.000	0.74	1.004	0.66	1.148	0.82	1.074	0.56
665	1.148	0.53	0.998	0.83	1.009	0.65	1.148	0.82	1.076	0.55
670	1.144	0.54	0.999	0.57	1.007	0.72	1.148	0.95	1.075	0.63
675	1.148	0.53	0.999	0.58	1.008	0.60	1.148	0.78	1.076	0.56
680	1.147	0.56	0.995	0.76	1.007	0.61	1.145	0.70	1.074	0.61
685	1.150	0.94	0.997	0.95	1.004	0.71	1.147	1.02	1.075	0.83
690	1.154	0.31	1.002	1.44	1.007	0.76	1.149	0.80	1.078	0.77
695	1.152	0.58	0.999	0.97	1.007	0.76	1.152	0.75	1.077	0.69
700	1.151	0.78	1.000	1.34	1.007	0.79	1.157	1.17	1.079	0.86
705	1.152	0.41	1.002	1.00	1.006	0.93	1.149	0.52	1.077	0.64
710	1.156	0.54	1.001	0.87	1.010	0.56	1.153	1.30	1.080	0.75
715	1.156	0.39	1.000	0.69	1.008	1.06	1.152	0.78	1.079	0.66
720	1.154	0.09	0.994	0.76	1.005	0.45	1.150	1.20	1.076	0.46
725	1.152	0.30	0.996	1.16	1.006	0.86	1.151	0.92	1.076	0.73
730	1.147	0.33	0.998	0.70	1.010	0.96	1.150	0.85	1.076	0.54

-15°/ 15° BIDIRECTIONAL ABSOLUTE SPECTRAL REFLECTANCE FACTORS

WAV.	Bss		Bsp		Bps		Bpp		Brr	
[nm]	mean	coeff. var.	mean	coeff. var.	mean	coeff. var.	mean	coeff. var.	mean	coeff. var.
390	1.088	0.37	0.985	0.73	0.979	1.42	1.077	0.54	1.033	0.50
395	1.109	0.64	1.001	0.88	0.993	0.82	1.095	0.83	1.050	0.67
400	1.107	0.84	0.997	0.59	0.993	1.05	1.094	0.85	1.048	0.76
405	1.120	1.01	1.004	0.64	1.003	1.03	1.108	0.92	1.059	0.81
410	1.123	1.19	1.005	0.59	1.002	1.10	1.108	0.80	1.059	0.83
415	1.123	1.19	1.009	0.87	1.004	1.32	1.113	1.04	1.062	1.02
420	1.127	1.18	1.011	1.02	1.005	1.25	1.115	1.14	1.064	1.05
425	1.127	1.21	1.012	1.02	1.005	1.32	1.116	1.02	1.065	1.04
430	1.126	1.11	1.012	0.95	1.004	1.25	1.116	1.20	1.064	1.03
435	1.127	1.32	1.012	0.91	1.004	1.28	1.115	1.39	1.065	1.13
440	1.127	1.37	1.010	1.14	1.003	1.46	1.118	1.30	1.064	1.20
445	1.129	1.41	1.010	1.07	1.004	1.47	1.115	1.39	1.065	1.22
450	1.130	1.49	1.012	0.99	1.004	1.50	1.116	1.29	1.065	1.20
455	1.130	1.33	1.011	0.88	1.003	1.37	1.117	1.30	1.065	1.12
460	1.131	1.30	1.009	0.87	1.004	1.43	1.115	1.26	1.065	1.11
465	1.138	1.24	1.004	0.91	1.011	1.34	1.109	1.30	1.066	1.10
470	1.134	1.39	1.008	1.00	1.004	1.33	1.115	1.32	1.065	1.06
475	1.131	1.21	1.008	0.92	1.004	1.27	1.114	1.15	1.064	1.00
480	1.131	1.31	1.007	0.83	1.003	1.28	1.115	1.12	1.064	1.02
485	1.131	1.11	1.007	0.89	1.003	1.22	1.115	1.07	1.064	0.97
490	1.133	1.29	1.008	0.83	1.003	1.19	1.116	1.06	1.065	0.98
495	1.131	1.12	1.007	0.72	1.001	1.19	1.115	0.98	1.063	0.92
500	1.129	1.09	1.005	0.73	1.001	1.18	1.114	0.87	1.062	0.89
505	1.132	1.13	1.004	0.75	1.002	1.09	1.116	0.96	1.063	0.90
510	1.129	0.94	1.005	0.67	1.001	1.07	1.115	0.99	1.063	0.84
515	1.131	1.13	1.005	0.67	1.000	0.96	1.114	0.97	1.062	0.81
520	1.130	0.90	1.004	0.59	1.000	0.93	1.116	0.87	1.062	0.75
525	1.131	1.00	1.007	1.00	0.998	0.81	1.115	0.81	1.063	0.72
530	1.129	0.83	1.006	0.74	0.998	0.94	1.115	0.67	1.062	0.69
535	1.129	0.86	1.005	0.67	0.998	0.77	1.114	0.63	1.062	0.64
540	1.130	0.85	1.006	0.81	0.999	0.75	1.114	0.68	1.062	0.65
545	1.133	0.90	1.006	0.83	0.998	0.81	1.115	0.72	1.063	0.66
550	1.130	0.75	1.005	0.93	0.999	0.71	1.114	0.60	1.062	0.58
555	1.131	0.69	1.004	0.84	0.998	0.67	1.114	0.48	1.061	0.50
560	1.131	0.73	1.006	0.99	0.998	0.71	1.114	0.54	1.062	0.61
565	1.131	0.71	1.004	0.73	0.997	0.73	1.113	0.49	1.061	0.53
570	1.131	0.70	1.004	1.12	0.997	0.77	1.113	0.65	1.061	0.67
575	1.132	0.58	1.004	1.14	0.996	0.68	1.114	0.56	1.062	0.57
580	1.132	0.84	1.004	0.76	0.998	0.74	1.113	0.58	1.062	0.63
585	1.133	0.60	1.000	0.65	0.999	0.67	1.115	0.46	1.062	0.54
590	1.135	0.58	1.002	0.54	1.000	0.68	1.117	0.39	1.063	0.47
595	1.135	0.58	1.000	0.52	0.998	0.57	1.115	0.57	1.062	0.44
600	1.134	0.48	1.000	0.64	1.000	0.54	1.116	0.54	1.063	0.47
605	1.136	0.64	1.000	0.55	0.998	0.50	1.115	0.78	1.062	0.53
610	1.140	0.99	1.001	0.69	1.000	0.76	1.118	0.60	1.065	0.64
615	1.136	0.84	1.001	0.39	0.999	0.56	1.117	0.60	1.063	0.49
620	1.141	0.81	1.002	0.74	1.000	0.60	1.117	0.49	1.065	0.53
625	1.140	0.46	1.000	0.49	1.002	0.66	1.120	0.63	1.065	0.48
630	1.141	0.63	1.002	0.60	1.003	0.59	1.119	0.35	1.066	0.50
635	1.141	0.71	0.998	0.48	1.000	0.68	1.119	0.60	1.064	0.58
640	1.140	0.54	1.005	1.18	1.001	0.70	1.118	0.47	1.066	0.61
645	1.145	0.78	1.001	0.81	1.004	0.63	1.122	0.71	1.068	0.66
650	1.146	0.88	0.998	0.94	1.001	0.64	1.121	0.82	1.067	0.73
655	1.143	0.75	1.000	0.72	1.003	0.74	1.120	0.80	1.066	0.64
660	1.145	0.38	1.001	0.56	1.002	0.60	1.117	0.70	1.066	0.40
665	1.145	0.60	0.999	0.59	1.006	0.71	1.118	0.75	1.067	0.58
670	1.143	0.78	1.000	0.78	1.006	0.94	1.116	0.83	1.066	0.78
675	1.143	0.56	0.997	1.05	1.004	0.68	1.119	0.71	1.066	0.68
680	1.145	0.59	0.999	0.82	1.003	0.79	1.119	0.50	1.066	0.60
685	1.151	0.76	1.003	1.40	1.004	0.95	1.120	0.95	1.069	0.87
690	1.155	0.91	1.001	0.85	1.006	0.77	1.121	0.70	1.071	0.69
695	1.146	0.85	1.003	0.68	1.004	0.87	1.121	0.78	1.068	0.66
700	1.148	0.76	1.003	1.05	1.012	0.64	1.125	1.33	1.072	0.80
705	1.144	1.00	0.999	0.91	1.002	0.92	1.121	0.90	1.066	0.82
710	1.149	1.36	1.001	0.60	1.004	1.25	1.119	0.76	1.068	0.87
715	1.146	0.79	1.003	0.48	1.004	0.95	1.118	0.94	1.068	0.70
720	1.149	0.93	1.001	0.78	1.006	1.00	1.122	0.94	1.069	0.81
725	1.146	0.32	0.996	0.80	1.005	0.83	1.117	1.20	1.066	0.70
730	1.147	1.10	0.998	0.58	1.005	1.03	1.121	0.83	1.068	0.71

-15°/ 30° BIDIRECTIONAL ABSOLUTE SPECTRAL REFLECTANCE FACTORS

WAV. [nm]	Bss mean	Bss coeff. var.	Bsp mean	Bsp coeff. var.	Bps mean	Bps coeff. var.	Bpp mean	Bpp coeff. var.	Brr mean	Brr coeff. var.
390	1.089	0.91	0.970	1.25	0.960	0.71	1.048	0.86	1.017	0.72
395	1.107	0.64	0.988	0.96	0.979	0.87	1.067	0.92	1.035	0.75
400	1.105	1.06	0.990	0.78	0.979	0.98	1.070	0.95	1.036	0.89
405	1.113	1.04	0.998	0.79	0.985	0.91	1.082	1.08	1.044	0.89
410	1.119	1.28	0.999	1.15	0.986	1.24	1.084	0.84	1.047	1.06
415	1.122	1.05	1.003	1.14	0.989	1.15	1.088	1.14	1.050	1.06
420	1.122	1.23	1.004	1.03	0.989	1.29	1.090	1.00	1.051	1.08
425	1.123	1.18	1.005	1.21	0.989	1.38	1.092	1.22	1.052	1.20
430	1.124	1.24	1.005	1.31	0.990	1.43	1.092	1.22	1.052	1.23
435	1.123	1.23	1.004	1.27	0.988	1.47	1.090	1.34	1.051	1.26
440	1.123	1.48	1.005	1.36	0.989	1.53	1.092	1.38	1.052	1.38
445	1.124	1.32	1.004	1.25	0.989	1.42	1.090	1.28	1.052	1.27
450	1.123	1.37	1.004	1.34	0.989	1.48	1.093	1.17	1.052	1.29
455	1.123	1.43	1.004	1.15	0.988	1.40	1.091	1.21	1.052	1.24
460	1.125	1.36	1.002	1.12	0.990	1.33	1.090	1.27	1.052	1.22
465	1.132	1.22	0.996	1.22	0.995	1.38	1.085	1.23	1.052	1.21
470	1.126	1.20	1.003	1.26	0.989	1.34	1.092	1.15	1.052	1.18
475	1.126	1.16	0.999	1.11	0.988	1.27	1.090	1.20	1.051	1.13
480	1.126	1.12	1.000	1.07	0.988	1.36	1.090	1.16	1.051	1.12
485	1.127	1.15	1.000	1.06	0.988	1.29	1.089	1.04	1.051	1.09
490	1.128	1.14	1.000	1.12	0.988	1.32	1.090	1.07	1.052	1.11
495	1.126	1.20	0.999	1.19	0.987	1.27	1.088	1.08	1.050	1.13
500	1.127	1.07	0.999	1.04	0.986	1.14	1.089	0.90	1.050	0.99
505	1.128	0.98	0.998	0.99	0.987	1.19	1.090	1.00	1.051	0.99
510	1.126	0.95	0.999	0.84	0.987	1.17	1.089	1.02	1.050	0.94
515	1.126	0.89	0.998	0.88	0.985	1.14	1.089	0.85	1.049	0.89
520	1.127	0.96	0.997	0.96	0.986	0.87	1.088	0.73	1.049	0.82
525	1.126	0.70	0.997	0.83	0.984	0.84	1.089	0.66	1.049	0.70
530	1.125	0.89	0.999	0.73	0.983	0.79	1.088	0.54	1.049	0.69
535	1.126	0.77	0.995	0.79	0.984	0.83	1.088	0.88	1.048	0.77
540	1.128	0.74	0.997	0.90	0.984	0.81	1.088	0.78	1.049	0.76
545	1.129	0.63	0.995	0.74	0.983	0.94	1.087	0.67	1.048	0.70
550	1.128	0.46	0.995	0.78	0.983	0.74	1.086	0.63	1.048	0.61
555	1.128	0.49	0.994	0.78	0.983	0.75	1.086	0.67	1.048	0.62
560	1.129	0.60	0.993	0.76	0.983	0.77	1.085	0.47	1.047	0.58
565	1.129	0.58	0.993	0.66	0.983	0.74	1.084	0.37	1.047	0.53
570	1.129	0.62	0.993	0.81	0.982	0.66	1.086	0.43	1.048	0.56
575	1.130	0.47	0.993	0.63	0.983	0.72	1.086	0.57	1.048	0.55
580	1.131	0.49	0.996	0.70	0.983	0.73	1.087	0.44	1.049	0.52
585	1.131	0.37	0.994	0.82	0.983	0.53	1.087	0.50	1.049	0.49
590	1.132	0.42	0.995	0.61	0.985	0.38	1.089	0.48	1.050	0.39
595	1.135	0.33	0.996	0.77	0.984	0.59	1.088	0.54	1.050	0.50
600	1.137	0.38	0.994	0.69	0.986	0.53	1.091	0.43	1.052	0.47
605	1.136	0.43	0.992	0.71	0.984	0.63	1.088	0.39	1.050	0.50
610	1.136	0.56	0.993	0.55	0.986	0.68	1.087	0.68	1.051	0.58
615	1.135	0.38	0.992	0.57	0.984	0.72	1.089	0.59	1.050	0.50
620	1.138	0.58	0.994	0.64	0.987	0.78	1.089	0.65	1.052	0.60
625	1.139	0.59	0.994	0.53	0.987	0.67	1.091	0.81	1.053	0.59
630	1.139	0.40	0.995	0.83	0.987	0.69	1.090	0.80	1.053	0.63
635	1.136	0.14	0.993	0.73	0.985	0.66	1.089	0.57	1.051	0.44
640	1.139	0.41	0.994	0.51	0.987	0.62	1.090	0.68	1.053	0.52
645	1.141	0.48	0.994	0.65	0.987	0.64	1.093	0.80	1.054	0.59
650	1.144	0.60	0.995	0.86	0.990	1.05	1.089	0.77	1.054	0.75
655	1.141	0.59	0.993	0.79	0.989	0.67	1.089	0.64	1.053	0.63
660	1.142	0.51	0.994	1.05	0.987	0.87	1.091	0.40	1.053	0.64
665	1.142	0.64	0.991	0.67	0.988	0.80	1.091	0.69	1.053	0.64
670	1.142	0.79	0.993	0.59	0.989	1.12	1.090	0.78	1.054	0.77
675	1.147	0.55	0.991	0.98	0.987	0.80	1.089	0.73	1.054	0.71
680	1.147	0.81	0.993	0.72	0.987	0.65	1.086	0.72	1.053	0.67
685	1.147	0.88	0.995	0.82	0.987	0.91	1.091	0.67	1.055	0.78
690	1.151	0.82	0.996	1.17	0.988	0.92	1.092	0.82	1.057	0.88
695	1.148	0.80	0.995	0.99	0.988	0.90	1.092	1.21	1.056	0.89
700	1.154	0.48	0.995	0.33	0.991	0.97	1.095	0.45	1.059	0.45
705	1.147	0.88	0.995	0.91	0.989	1.42	1.092	0.67	1.056	0.90
710	1.149	0.92	0.996	0.86	0.993	0.91	1.088	0.82	1.056	0.82
715	1.151	0.82	0.994	0.90	0.985	0.96	1.094	0.86	1.056	0.80
720	1.149	0.78	0.992	1.50	0.992	0.68	1.089	0.75	1.055	0.78
725	1.154	0.79	0.994	1.13	0.989	0.64	1.091	0.81	1.057	0.76
730	1.146	0.39	0.990	0.70	0.991	0.96	1.094	0.67	1.055	0.59

-15°/ 45° BIDIRECTIONAL ABSOLUTE SPECTRAL REFLECTANCE FACTORS

WAV. [nm]	Bss mean	Bss coeff. var.	Bsp mean	Bsp coeff. var.	Bps mean	Bps coeff. var.	Bpp mean	Bpp coeff. var.	Brr mean	Brr coeff. var.
390	1.084	1.78	0.955	0.26	0.932	1.09	1.022	1.13	0.998	1.05
395	1.107	0.73	0.973	0.52	0.952	0.79	1.039	1.19	1.018	0.74
400	1.104	1.00	0.972	0.76	0.951	1.19	1.039	0.58	1.017	0.82
405	1.115	1.12	0.981	0.90	0.957	1.27	1.049	0.95	1.026	0.97
410	1.118	1.09	0.983	0.96	0.960	1.24	1.051	0.79	1.028	0.96
415	1.122	1.12	0.987	1.00	0.962	1.20	1.056	1.17	1.032	1.08
420	1.122	1.19	0.986	1.10	0.960	1.46	1.057	1.04	1.031	1.12
425	1.124	1.48	0.988	1.33	0.963	1.33	1.058	1.20	1.033	1.28
430	1.122	1.45	0.989	1.26	0.961	1.46	1.059	1.27	1.033	1.30
435	1.123	1.40	0.987	1.15	0.960	1.40	1.057	1.26	1.032	1.25
440	1.126	1.55	0.989	1.17	0.961	1.45	1.060	1.37	1.034	1.34
445	1.127	1.51	0.986	1.33	0.962	1.41	1.058	1.29	1.033	1.34
450	1.125	1.45	0.988	1.29	0.961	1.55	1.060	1.23	1.033	1.33
455	1.123	1.26	0.987	1.26	0.960	1.49	1.058	1.36	1.032	1.29
460	1.126	1.21	0.986	1.22	0.961	1.42	1.057	1.03	1.032	1.18
465	1.132	1.29	0.981	1.17	0.967	1.36	1.051	1.17	1.033	1.20
470	1.126	1.25	0.986	1.20	0.962	1.29	1.058	1.24	1.033	1.19
475	1.126	1.26	0.984	1.13	0.961	1.39	1.056	1.25	1.032	1.21
480	1.127	1.12	0.985	1.04	0.960	1.30	1.055	1.22	1.032	1.12
485	1.126	1.16	0.985	1.14	0.960	1.30	1.056	1.16	1.032	1.15
490	1.127	1.22	0.985	1.23	0.961	1.26	1.058	1.04	1.033	1.13
495	1.126	1.25	0.984	1.08	0.959	1.09	1.055	1.14	1.031	1.10
500	1.128	1.13	0.983	0.91	0.959	1.10	1.055	1.06	1.031	1.01
505	1.129	1.09	0.981	1.08	0.960	1.16	1.055	0.97	1.031	1.03
510	1.129	1.05	0.983	0.88	0.959	1.15	1.056	1.00	1.031	0.98
515	1.129	1.06	0.982	0.85	0.958	0.97	1.056	0.91	1.031	0.90
520	1.128	0.90	0.981	0.75	0.957	1.07	1.056	0.92	1.030	0.86
525	1.126	0.85	0.980	0.84	0.957	0.94	1.053	0.81	1.029	0.81
530	1.127	0.77	0.982	0.76	0.956	0.85	1.054	0.76	1.029	0.73
535	1.126	0.67	0.981	0.79	0.956	0.90	1.053	0.71	1.029	0.72
540	1.129	0.66	0.980	0.93	0.957	0.78	1.055	0.67	1.030	0.72
545	1.131	0.74	0.980	0.79	0.957	0.95	1.054	0.60	1.030	0.72
550	1.131	0.60	0.981	0.70	0.956	0.85	1.055	0.60	1.031	0.65
555	1.131	0.58	0.979	0.64	0.957	0.65	1.053	0.47	1.030	0.55
560	1.133	0.66	0.979	0.71	0.956	0.68	1.053	0.50	1.030	0.61
565	1.132	0.36	0.979	0.50	0.955	0.72	1.053	0.48	1.030	0.48
570	1.131	0.45	0.978	0.64	0.955	0.53	1.053	0.38	1.029	0.48
575	1.131	0.58	0.977	0.63	0.956	0.76	1.052	0.46	1.029	0.58
580	1.134	0.50	0.979	0.62	0.957	0.78	1.052	0.62	1.031	0.57
585	1.132	0.60	0.978	0.63	0.957	0.57	1.054	0.71	1.030	0.60
590	1.134	0.57	0.978	0.64	0.957	0.50	1.054	0.53	1.031	0.50
595	1.134	0.52	0.978	0.64	0.956	0.47	1.053	0.61	1.030	0.52
600	1.139	0.69	0.976	0.71	0.958	0.63	1.054	0.60	1.032	0.62
605	1.137	0.62	0.977	0.72	0.956	0.60	1.051	0.39	1.030	0.56
610	1.140	0.54	0.977	0.51	0.957	0.50	1.053	0.73	1.032	0.51
615	1.138	0.34	0.978	0.73	0.956	0.63	1.053	0.68	1.031	0.54
620	1.137	0.27	0.977	0.77	0.959	0.65	1.053	0.45	1.032	0.48
625	1.140	0.32	0.978	0.75	0.958	0.55	1.052	0.52	1.032	0.48
630	1.143	0.49	0.980	0.71	0.960	0.57	1.053	0.38	1.034	0.48
635	1.139	0.40	0.977	0.65	0.959	0.44	1.051	0.63	1.031	0.50
640	1.140	0.34	0.979	0.62	0.957	0.69	1.054	0.43	1.033	0.47
645	1.144	0.72	0.978	0.94	0.961	0.56	1.054	0.83	1.034	0.73
650	1.143	0.57	0.978	0.88	0.960	0.60	1.054	1.01	1.034	0.68
655	1.141	0.71	0.977	0.80	0.960	0.62	1.058	0.88	1.034	0.68
660	1.145	0.95	0.977	0.70	0.956	1.01	1.056	0.71	1.033	0.80
665	1.148	0.80	0.980	0.55	0.962	0.84	1.054	0.86	1.036	0.72
670	1.149	0.73	0.980	0.94	0.961	1.10	1.054	0.65	1.036	0.82
675	1.148	0.33	0.977	0.72	0.962	0.67	1.053	0.93	1.035	0.61
680	1.150	0.90	0.975	0.74	0.960	0.36	1.053	0.89	1.035	0.67
685	1.148	1.21	0.980	0.68	0.959	0.85	1.056	0.78	1.036	0.84
690	1.150	0.53	0.981	0.89	0.964	0.81	1.053	0.95	1.037	0.74
695	1.151	0.53	0.979	1.18	0.962	0.58	1.056	1.02	1.037	0.75
700	1.148	0.21	0.978	0.46	0.960	0.90	1.059	0.66	1.036	0.48
705	1.151	0.69	0.975	1.17	0.963	1.01	1.054	0.94	1.036	0.81
710	1.150	1.26	0.983	0.49	0.960	1.20	1.053	0.88	1.037	0.93
715	1.152	0.50	0.976	0.84	0.962	0.65	1.057	1.06	1.037	0.66
720	1.150	0.40	0.982	1.26	0.961	0.52	1.060	0.29	1.038	0.54
725	1.156	0.84	0.982	1.16	0.960	1.17	1.057	1.28	1.039	1.03
730	1.154	0.36	0.981	1.06	0.962	1.05	1.054	0.97	1.038	0.75

-15°/ 60° BIDIRECTIONAL ABSOLUTE SPECTRAL REFLECTANCE FACTORS

WAV. [nm]	Bss mean	Bss coeff. var.	Bsp mean	Bsp coeff. var.	Bps mean	Bps coeff. var.	Bpp mean	Bpp coeff. var.	Brr mean	Brr coeff. var.
390	1.084	0.70	0.926	1.41	0.887	1.46	0.986	0.47	0.971	0.88
395	1.103	0.96	0.938	1.31	0.908	1.11	1.003	0.33	0.988	0.86
400	1.100	1.02	0.938	0.78	0.906	1.30	1.003	1.10	0.987	0.99
405	1.112	1.32	0.947	0.79	0.912	1.07	1.014	0.92	0.996	1.00
410	1.116	1.09	0.946	1.10	0.914	1.28	1.015	1.11	0.998	1.08
415	1.118	1.29	0.952	0.93	0.915	1.38	1.017	0.97	1.001	1.09
420	1.117	1.41	0.953	1.11	0.914	1.67	1.017	1.30	1.000	1.29
425	1.119	1.41	0.954	1.17	0.915	1.46	1.020	1.27	1.002	1.25
430	1.117	1.43	0.953	1.22	0.915	1.50	1.020	1.25	1.001	1.28
435	1.118	1.37	0.953	1.23	0.914	1.58	1.018	1.23	1.001	1.29
440	1.120	1.44	0.953	1.28	0.915	1.62	1.019	1.26	1.002	1.33
445	1.120	1.37	0.953	1.35	0.914	1.63	1.019	1.39	1.002	1.37
450	1.120	1.53	0.952	1.22	0.914	1.59	1.019	1.33	1.001	1.36
455	1.120	1.40	0.953	1.22	0.913	1.53	1.020	1.29	1.002	1.31
460	1.122	1.36	0.951	1.14	0.915	1.49	1.018	1.13	1.002	1.24
465	1.128	1.17	0.945	1.16	0.920	1.56	1.012	1.12	1.002	1.20
470	1.122	1.23	0.952	1.15	0.915	1.51	1.018	1.14	1.002	1.21
475	1.122	1.26	0.949	1.24	0.914	1.52	1.017	1.27	1.001	1.27
480	1.122	1.29	0.949	1.15	0.914	1.40	1.018	1.21	1.001	1.21
485	1.122	1.30	0.950	1.12	0.914	1.45	1.016	1.17	1.001	1.19
490	1.124	1.28	0.949	1.13	0.914	1.37	1.017	1.13	1.001	1.16
495	1.122	1.18	0.949	1.02	0.913	1.39	1.016	1.08	1.000	1.11
500	1.122	1.10	0.948	0.92	0.912	1.31	1.015	0.99	0.999	1.03
505	1.124	1.28	0.949	0.93	0.913	1.22	1.016	1.07	1.000	1.08
510	1.125	1.16	0.949	0.97	0.912	1.22	1.015	1.21	1.000	1.09
515	1.125	1.08	0.948	0.89	0.911	1.22	1.015	1.08	1.000	1.00
520	1.125	0.82	0.947	0.78	0.911	0.99	1.014	0.84	0.999	0.79
525	1.123	0.91	0.947	0.63	0.910	1.03	1.015	0.81	0.999	0.78
530	1.124	0.76	0.948	0.72	0.909	0.99	1.014	0.68	0.999	0.71
535	1.125	0.68	0.946	0.92	0.909	0.99	1.012	0.69	0.998	0.75
540	1.127	0.89	0.946	0.83	0.910	0.99	1.013	0.78	0.999	0.81
545	1.128	1.00	0.945	0.73	0.910	0.96	1.013	0.86	0.999	0.83
550	1.128	0.71	0.945	0.71	0.909	0.94	1.012	0.69	0.998	0.71
555	1.128	0.60	0.945	0.76	0.909	0.88	1.013	0.66	0.999	0.69
560	1.129	0.65	0.945	0.69	0.909	1.06	1.012	0.67	0.999	0.70
565	1.128	0.86	0.943	0.67	0.909	0.88	1.012	0.60	0.998	0.71
570	1.129	0.77	0.944	0.63	0.910	0.97	1.011	0.57	0.998	0.70
575	1.127	0.74	0.943	0.62	0.909	0.78	1.010	0.63	0.997	0.65
580	1.130	0.72	0.944	0.70	0.908	0.83	1.012	0.79	0.998	0.69
585	1.130	0.65	0.943	0.75	0.909	0.69	1.011	0.66	0.998	0.64
590	1.132	0.78	0.945	0.57	0.911	0.80	1.013	0.62	1.000	0.63
595	1.130	0.67	0.944	0.68	0.911	0.79	1.012	0.68	0.999	0.65
600	1.132	0.67	0.944	0.79	0.910	0.54	1.014	0.72	1.000	0.61
605	1.133	0.69	0.944	0.66	0.910	0.72	1.013	0.71	1.000	0.63
610	1.135	0.45	0.943	0.63	0.911	0.79	1.013	0.65	1.000	0.59
615	1.134	0.47	0.945	0.57	0.907	0.62	1.009	0.58	0.999	0.52
620	1.138	0.57	0.944	0.83	0.912	0.77	1.011	0.67	1.001	0.66
625	1.139	0.59	0.944	0.78	0.912	0.94	1.012	0.85	1.002	0.71
630	1.141	0.62	0.945	1.00	0.912	0.86	1.012	0.94	1.003	0.79
635	1.138	0.44	0.944	0.71	0.909	0.90	1.013	0.69	1.001	0.63
640	1.143	0.79	0.944	0.56	0.910	0.73	1.012	0.68	1.002	0.65
645	1.139	0.52	0.945	0.82	0.910	1.09	1.013	0.70	1.002	0.70
650	1.140	0.55	0.946	1.00	0.912	0.85	1.010	0.58	1.002	0.65
655	1.141	0.47	0.944	0.93	0.912	0.92	1.013	0.97	1.003	0.69
660	1.144	0.60	0.945	0.85	0.913	0.62	1.014	1.02	1.004	0.67
665	1.144	0.64	0.942	0.55	0.913	0.75	1.014	0.98	1.003	0.65
670	1.145	0.62	0.943	0.71	0.912	0.95	1.013	0.84	1.004	0.70
675	1.144	0.77	0.943	0.93	0.912	0.69	1.011	0.65	1.003	0.72
680	1.143	0.58	0.942	0.81	0.910	0.93	1.010	0.90	1.001	0.73
685	1.143	1.01	0.943	0.80	0.913	0.90	1.009	0.80	1.002	0.85
690	1.148	0.83	0.941	1.22	0.911	1.06	1.010	0.90	1.003	0.95
695	1.150	0.96	0.943	1.04	0.910	1.01	1.012	1.12	1.004	0.94
700	1.153	0.69	0.945	1.03	0.910	0.28	1.017	0.48	1.006	0.47
705	1.148	0.94	0.944	0.86	0.912	1.18	1.010	1.32	1.003	0.99
710	1.152	1.21	0.943	0.92	0.915	1.16	1.011	0.93	1.005	1.00
715	1.154	0.64	0.942	1.13	0.911	1.03	1.013	1.00	1.005	0.90
720	1.155	0.89	0.945	0.94	0.914	1.14	1.017	1.24	1.008	0.86
725	1.153	0.92	0.942	1.07	0.909	1.05	1.013	1.18	1.004	0.88
730	1.156	0.75	0.938	0.99	0.921	1.57	1.012	1.35	1.007	0.91

-15°/ 75° BIDIRECTIONAL ABSOLUTE SPECTRAL REFLECTANCE FACTORS

WAV. [nm]	Bss mean	Bss coeff. var.	Bsp mean	Bsp coeff. var.	Bps mean	Bps coeff. var.	Bpp mean	Bpp coeff. var.	Brr mean	Brr coeff. var.
390	1.065	1.41	0.855	1.57	0.813	1.31	0.931	1.85	0.916	1.40
395	1.087	1.59	0.869	1.63	0.830	1.62	0.945	1.25	0.933	1.43
400	1.081	1.67	0.867	1.47	0.826	1.67	0.948	1.50	0.931	1.49
405	1.094	1.54	0.874	1.65	0.834	1.83	0.953	1.53	0.938	1.55
410	1.093	1.77	0.875	1.63	0.833	1.75	0.952	1.50	0.939	1.58
415	1.096	1.76	0.878	1.64	0.834	1.81	0.957	1.49	0.941	1.62
420	1.095	1.83	0.878	1.74	0.833	1.93	0.957	1.54	0.941	1.70
425	1.096	1.72	0.879	1.68	0.834	1.91	0.958	1.81	0.942	1.70
430	1.096	1.87	0.878	1.85	0.833	1.95	0.957	1.51	0.941	1.72
435	1.097	1.85	0.877	1.80	0.832	1.94	0.956	1.62	0.941	1.73
440	1.096	1.84	0.878	1.90	0.832	2.12	0.958	1.69	0.941	1.81
445	1.098	1.79	0.877	1.74	0.832	2.00	0.956	1.66	0.941	1.73
450	1.098	1.99	0.877	1.77	0.832	2.01	0.957	1.72	0.941	1.80
455	1.097	1.91	0.877	1.66	0.832	1.95	0.956	1.67	0.941	1.73
460	1.099	1.94	0.876	1.71	0.833	1.99	0.955	1.61	0.941	1.74
465	1.105	1.80	0.871	1.70	0.836	1.94	0.951	1.59	0.941	1.69
470	1.102	1.76	0.877	1.74	0.832	1.91	0.956	1.44	0.942	1.65
475	1.099	1.69	0.875	1.72	0.832	1.91	0.955	1.60	0.940	1.66
480	1.101	1.72	0.875	1.78	0.831	1.82	0.955	1.70	0.940	1.68
485	1.100	1.53	0.875	1.69	0.831	1.84	0.954	1.54	0.940	1.58
490	1.101	1.65	0.875	1.67	0.832	1.82	0.955	1.56	0.941	1.60
495	1.101	1.61	0.875	1.76	0.830	1.93	0.954	1.32	0.940	1.58
500	1.102	1.58	0.874	1.68	0.830	1.75	0.954	1.40	0.940	1.53
505	1.103	1.54	0.874	1.70	0.831	1.64	0.954	1.38	0.940	1.49
510	1.103	1.52	0.874	1.63	0.831	1.74	0.955	1.36	0.941	1.48
515	1.103	1.58	0.874	1.64	0.830	1.72	0.955	1.47	0.940	1.52
520	1.105	1.49	0.874	1.67	0.830	1.56	0.954	1.40	0.941	1.46
525	1.104	1.41	0.874	1.49	0.828	1.61	0.953	1.23	0.940	1.37
530	1.104	1.41	0.874	1.60	0.828	1.62	0.953	1.26	0.940	1.40
535	1.104	1.38	0.872	1.47	0.828	1.49	0.952	1.43	0.939	1.38
540	1.106	1.30	0.873	1.32	0.829	1.56	0.953	1.34	0.940	1.31
545	1.108	1.20	0.872	1.55	0.828	1.47	0.953	1.31	0.940	1.31
550	1.107	1.31	0.872	1.54	0.828	1.53	0.954	1.20	0.940	1.33
555	1.107	1.16	0.870	1.46	0.829	1.44	0.953	1.26	0.940	1.26
560	1.109	1.30	0.871	1.50	0.828	1.29	0.951	1.16	0.940	1.25
565	1.109	1.22	0.871	1.51	0.828	1.29	0.951	1.31	0.940	1.27
570	1.110	1.05	0.871	1.35	0.827	1.34	0.951	1.19	0.940	1.15
575	1.108	1.03	0.871	1.38	0.827	1.35	0.951	1.03	0.939	1.14
580	1.113	0.98	0.873	1.30	0.829	1.16	0.950	1.09	0.941	1.07
585	1.112	1.00	0.870	1.48	0.828	1.17	0.952	1.05	0.941	1.12
590	1.115	1.03	0.871	1.29	0.830	1.30	0.952	1.26	0.942	1.13
595	1.114	1.04	0.871	1.44	0.828	1.28	0.951	1.24	0.941	1.18
600	1.115	1.02	0.870	1.34	0.830	0.88	0.952	1.16	0.942	1.04
605	1.113	0.97	0.870	1.50	0.829	1.31	0.950	1.17	0.941	1.17
610	1.115	1.06	0.870	1.37	0.831	1.26	0.951	1.07	0.942	1.11
615	1.115	0.84	0.870	1.47	0.828	1.19	0.949	1.07	0.941	1.07
620	1.118	1.07	0.871	1.48	0.828	1.24	0.951	0.91	0.942	1.11
625	1.116	1.02	0.870	1.55	0.828	1.10	0.950	0.99	0.941	1.08
630	1.118	1.26	0.870	1.68	0.829	1.24	0.951	1.41	0.942	1.31
635	1.118	1.17	0.870	1.38	0.829	1.11	0.950	1.18	0.941	1.14
640	1.119	1.10	0.869	1.50	0.829	1.20	0.950	1.29	0.942	1.21
645	1.121	1.27	0.868	1.52	0.829	1.27	0.950	1.33	0.942	1.29
650	1.125	1.12	0.871	1.72	0.831	1.42	0.949	1.28	0.944	1.28
655	1.120	1.12	0.870	1.66	0.830	1.37	0.949	1.32	0.942	1.29
660	1.124	1.15	0.871	1.58	0.831	1.37	0.950	1.29	0.944	1.26
665	1.121	1.10	0.868	1.71	0.831	1.26	0.948	1.19	0.942	1.23
670	1.123	1.23	0.870	1.78	0.830	1.43	0.950	1.67	0.943	1.44
675	1.121	0.96	0.867	1.88	0.830	1.62	0.947	1.27	0.941	1.29
680	1.121	1.19	0.870	1.98	0.832	1.71	0.947	1.59	0.943	1.49
685	1.126	1.10	0.870	1.76	0.827	1.49	0.945	1.42	0.942	1.37
690	1.129	1.30	0.868	1.85	0.828	1.65	0.945	1.61	0.942	1.50
695	1.126	1.29	0.872	1.77	0.830	1.36	0.950	1.60	0.945	1.39
700	1.129	0.86	0.870	1.84	0.828	1.20	0.952	1.14	0.945	1.15
705	1.123	1.15	0.867	1.79	0.833	1.05	0.947	1.43	0.942	1.21
710	1.128	0.73	0.868	2.11	0.827	1.86	0.947	1.93	0.942	1.46
715	1.124	1.07	0.866	2.04	0.827	1.59	0.948	1.60	0.941	1.40
720	1.124	1.73	0.869	1.66	0.827	1.20	0.949	1.99	0.942	1.53
725	1.134	1.47	0.869	2.09	0.830	1.31	0.947	1.73	0.945	1.55
730	1.121	1.31	0.865	2.64	0.831	1.72	0.949	1.35	0.942	1.54

-30°/-75° BIDIRECTIONAL ABSOLUTE SPECTRAL REFLECTANCE FACTORS

WAV. [nm]	Bss mean	Bss coeff. var.	Bsp mean	Bsp coeff. var.	Bps mean	Bps coeff. var.	Bpp mean	Bpp coeff. var.	Brr mean	Brr coeff. var.
390	0.855	0.51	0.786	2.07	0.756	1.74	0.867	1.18	0.816	1.25
395	0.874	1.28	0.810	1.74	0.777	1.50	0.891	1.62	0.838	1.44
400	0.869	1.68	0.808	1.70	0.776	1.38	0.887	1.87	0.835	1.60
405	0.877	1.64	0.814	1.87	0.781	1.77	0.897	1.64	0.843	1.66
410	0.881	1.57	0.816	1.64	0.783	1.83	0.895	1.86	0.844	1.66
415	0.880	1.69	0.817	1.78	0.781	1.82	0.900	1.89	0.845	1.73
420	0.880	1.88	0.817	1.95	0.782	2.02	0.899	2.15	0.845	1.92
425	0.879	1.83	0.816	1.91	0.782	2.07	0.901	2.22	0.844	1.92
430	0.877	1.93	0.816	1.94	0.779	2.09	0.901	2.10	0.843	1.94
435	0.878	1.91	0.815	1.91	0.779	1.98	0.899	2.28	0.843	1.94
440	0.877	1.99	0.816	1.99	0.779	1.95	0.902	2.29	0.843	1.98
445	0.879	1.89	0.815	2.06	0.778	2.07	0.899	2.19	0.843	1.97
450	0.878	1.99	0.814	2.06	0.778	2.14	0.899	2.26	0.843	2.03
455	0.878	1.94	0.816	2.10	0.778	2.11	0.901	2.21	0.844	2.01
460	0.879	1.91	0.813	1.98	0.779	2.14	0.899	2.06	0.843	1.94
465	0.884	1.89	0.808	2.05	0.783	2.05	0.894	2.10	0.842	1.95
470	0.879	1.85	0.814	2.03	0.777	1.92	0.901	2.18	0.843	1.91
475	0.879	1.77	0.812	1.97	0.778	2.04	0.899	2.08	0.842	1.88
480	0.877	1.67	0.812	1.90	0.777	1.94	0.899	2.12	0.841	1.83
485	0.879	1.62	0.811	1.94	0.777	1.91	0.899	2.35	0.842	1.87
490	0.878	1.76	0.811	1.90	0.777	1.95	0.900	2.27	0.841	1.89
495	0.878	1.65	0.811	1.92	0.776	1.89	0.900	2.18	0.841	1.83
500	0.877	1.74	0.811	1.93	0.776	1.83	0.899	2.20	0.841	1.84
505	0.879	1.77	0.810	1.89	0.776	1.87	0.900	2.27	0.841	1.87
510	0.878	1.84	0.811	1.95	0.775	1.98	0.901	2.32	0.841	1.94
515	0.878	1.68	0.810	1.89	0.774	1.82	0.899	2.19	0.840	1.81
520	0.878	1.67	0.809	1.82	0.774	1.85	0.900	1.93	0.840	1.74
525	0.877	1.35	0.810	1.71	0.774	1.82	0.900	2.15	0.840	1.68
530	0.878	1.52	0.810	1.77	0.774	1.82	0.901	2.09	0.841	1.72
535	0.878	1.52	0.809	1.72	0.773	1.74	0.899	2.13	0.840	1.69
540	0.878	1.43	0.810	1.75	0.775	1.74	0.901	1.95	0.841	1.64
545	0.880	1.37	0.809	1.76	0.773	1.69	0.901	2.10	0.841	1.65
550	0.879	1.34	0.809	1.70	0.773	1.68	0.900	2.00	0.840	1.60
555	0.878	1.38	0.809	1.67	0.772	1.50	0.899	1.89	0.839	1.54
560	0.878	1.28	0.807	1.93	0.772	1.61	0.900	1.87	0.839	1.59
565	0.878	1.29	0.807	1.77	0.772	1.70	0.900	1.99	0.839	1.60
570	0.877	1.26	0.806	1.80	0.771	1.55	0.900	1.95	0.838	1.56
575	0.876	1.11	0.807	1.73	0.772	1.69	0.899	1.94	0.839	1.53
580	0.878	1.27	0.806	1.71	0.770	1.63	0.902	2.09	0.839	1.59
585	0.880	1.21	0.807	1.71	0.771	1.55	0.901	2.21	0.840	1.58
590	0.879	1.16	0.807	1.74	0.771	1.43	0.901	2.08	0.840	1.51
595	0.880	1.55	0.805	1.78	0.771	1.64	0.901	2.05	0.839	1.67
600	0.880	1.46	0.807	1.68	0.771	1.48	0.901	1.92	0.840	1.56
605	0.879	1.21	0.806	1.82	0.772	1.61	0.900	1.96	0.839	1.57
610	0.879	1.26	0.807	1.63	0.774	1.40	0.903	2.17	0.841	1.53
615	0.878	1.02	0.804	1.61	0.770	1.37	0.901	1.99	0.838	1.42
620	0.882	1.44	0.805	1.66	0.773	1.49	0.902	2.02	0.841	1.57
625	0.881	1.18	0.807	2.05	0.771	1.38	0.903	2.23	0.841	1.63
630	0.882	1.45	0.806	1.83	0.771	1.54	0.901	1.97	0.840	1.62
635	0.881	1.48	0.805	1.71	0.770	1.51	0.903	2.05	0.840	1.61
640	0.879	1.48	0.807	2.08	0.769	1.74	0.901	2.51	0.839	1.85
645	0.881	1.30	0.805	1.97	0.771	1.58	0.901	2.51	0.839	1.74
650	0.884	1.54	0.805	1.96	0.773	1.34	0.904	2.46	0.841	1.74
655	0.880	1.17	0.802	1.91	0.771	1.16	0.900	2.24	0.838	1.53
660	0.882	1.24	0.804	2.21	0.770	1.18	0.900	2.15	0.839	1.59
665	0.882	1.40	0.802	1.75	0.771	1.45	0.901	2.25	0.839	1.63
670	0.883	1.24	0.803	1.95	0.772	1.55	0.902	2.36	0.840	1.65
675	0.881	1.36	0.798	2.19	0.771	1.74	0.903	2.36	0.838	1.81
680	0.879	1.35	0.799	2.18	0.768	1.74	0.899	2.30	0.836	1.78
685	0.880	1.06	0.800	2.17	0.768	1.59	0.903	2.53	0.838	1.72
690	0.884	1.83	0.801	2.36	0.772	1.65	0.897	2.17	0.839	1.90
695	0.880	1.10	0.802	2.42	0.771	1.51	0.903	2.54	0.839	1.76
700	0.881	1.61	0.799	2.15	0.772	1.68	0.905	2.40	0.839	1.83
705	0.878	0.93	0.803	1.40	0.769	0.74	0.901	2.28	0.838	1.26
710	0.883	1.95	0.799	2.35	0.768	1.90	0.900	2.09	0.837	1.99
715	0.881	1.10	0.805	1.87	0.773	1.34	0.901	2.00	0.840	1.48
720	0.886	1.78	0.810	2.67	0.771	1.58	0.899	2.43	0.842	1.89
725	0.883	1.38	0.802	2.50	0.773	2.00	0.900	2.60	0.839	1.99
730	0.888	1.46	0.804	2.44	0.773	1.65	0.899	3.04	0.841	1.88

-30°/-60° BIDIRECTIONAL ABSOLUTE SPECTRAL REFLECTANCE FACTORS

WAV. [nm]	Bss mean	Bss coeff. var.	Bsp mean	Bsp coeff. var.	Bps mean	Bps coeff. var.	Bpp mean	Bpp coeff. var.	Brr mean	Brr coeff. var.
390	0.934	0.14	0.877	0.63	0.843	1.60	0.968	1.37	0.905	0.54
395	0.957	1.26	0.890	1.05	0.869	1.07	0.987	1.25	0.926	1.10
400	0.953	1.08	0.891	0.92	0.863	0.89	0.991	1.39	0.925	1.03
405	0.960	1.13	0.894	0.80	0.872	1.19	0.999	1.01	0.931	0.99
410	0.965	1.34	0.898	0.96	0.872	1.36	0.999	1.28	0.934	1.18
415	0.966	1.31	0.900	0.86	0.873	1.35	1.001	1.25	0.935	1.14
420	0.965	1.36	0.900	1.20	0.872	1.44	1.003	1.56	0.935	1.33
425	0.965	1.36	0.901	1.31	0.873	1.37	1.004	1.67	0.936	1.35
430	0.965	1.52	0.899	1.25	0.872	1.55	1.005	1.45	0.935	1.38
435	0.965	1.59	0.899	1.49	0.871	1.45	1.003	1.61	0.935	1.48
440	0.965	1.54	0.900	1.34	0.871	1.51	1.006	1.64	0.935	1.44
445	0.966	1.60	0.899	1.24	0.871	1.52	1.002	1.60	0.934	1.43
450	0.965	1.62	0.899	1.37	0.870	1.46	1.005	1.62	0.935	1.46
455	0.965	1.56	0.900	1.30	0.871	1.64	1.005	1.65	0.935	1.48
460	0.965	1.38	0.897	1.16	0.871	1.42	1.005	1.39	0.934	1.28
465	0.971	1.33	0.892	1.14	0.876	1.43	0.999	1.55	0.934	1.31
470	0.966	1.44	0.897	1.19	0.870	1.36	1.005	1.55	0.934	1.32
475	0.967	1.48	0.896	1.25	0.870	1.35	1.003	1.50	0.934	1.34
480	0.966	1.45	0.895	1.19	0.869	1.37	1.003	1.41	0.933	1.30
485	0.965	1.45	0.894	1.22	0.869	1.34	1.003	1.43	0.933	1.31
490	0.965	1.24	0.894	1.11	0.869	1.38	1.003	1.44	0.933	1.24
495	0.964	1.37	0.894	1.07	0.868	1.36	1.003	1.34	0.932	1.23
500	0.965	1.21	0.893	1.00	0.867	1.16	1.003	1.34	0.932	1.13
505	0.965	1.18	0.893	1.01	0.868	1.13	1.004	1.33	0.933	1.11
510	0.967	1.20	0.894	1.10	0.867	1.28	1.004	1.51	0.933	1.21
515	0.965	1.18	0.891	1.00	0.866	1.07	1.003	1.22	0.931	1.07
520	0.965	1.16	0.891	0.98	0.865	1.01	1.004	1.13	0.931	1.02
525	0.965	0.99	0.891	0.84	0.864	1.19	1.004	1.03	0.931	0.97
530	0.965	0.94	0.891	0.86	0.865	1.05	1.003	0.97	0.931	0.90
535	0.965	0.93	0.890	0.83	0.864	1.03	1.002	0.98	0.930	0.90
540	0.965	0.79	0.891	0.78	0.865	0.95	1.003	1.00	0.931	0.84
545	0.966	0.97	0.890	0.80	0.864	0.92	1.001	1.09	0.930	0.90
550	0.966	0.78	0.890	0.81	0.864	0.89	1.003	0.82	0.931	0.78
555	0.965	0.80	0.889	0.60	0.864	0.91	1.001	0.93	0.930	0.75
560	0.964	0.75	0.889	0.67	0.862	0.84	1.002	0.89	0.929	0.73
565	0.966	0.78	0.888	0.68	0.862	0.78	1.003	0.94	0.930	0.74
570	0.967	0.77	0.888	0.88	0.863	0.65	1.002	0.77	0.930	0.72
575	0.965	0.66	0.887	0.69	0.862	0.80	1.003	0.95	0.929	0.73
580	0.967	0.76	0.887	0.54	0.862	0.68	1.004	0.75	0.930	0.64
585	0.966	0.67	0.886	0.75	0.864	0.54	1.004	0.88	0.930	0.66
590	0.968	0.65	0.888	0.53	0.865	0.62	1.005	0.71	0.931	0.59
595	0.967	0.75	0.885	0.72	0.863	0.84	1.004	0.93	0.930	0.77
600	0.967	0.55	0.885	0.59	0.863	0.75	1.005	0.95	0.930	0.67
605	0.968	0.73	0.888	0.72	0.861	0.72	1.003	0.87	0.930	0.72
610	0.969	0.67	0.887	0.83	0.863	0.60	1.003	0.69	0.931	0.66
615	0.967	0.85	0.886	0.74	0.862	0.77	1.004	0.70	0.930	0.72
620	0.970	0.82	0.886	0.47	0.863	0.64	1.006	0.66	0.931	0.61
625	0.969	0.82	0.887	0.68	0.863	0.81	1.005	0.60	0.931	0.67
630	0.972	0.59	0.885	0.73	0.863	0.67	1.006	0.80	0.932	0.65
635	0.969	0.29	0.886	0.76	0.862	0.83	1.005	0.60	0.930	0.56
640	0.970	0.39	0.884	0.67	0.864	0.62	1.003	0.65	0.930	0.54
645	0.971	0.47	0.886	0.54	0.863	0.63	1.005	0.75	0.931	0.57
650	0.973	0.55	0.885	0.70	0.865	0.76	1.007	1.09	0.932	0.70
655	0.969	0.84	0.884	0.72	0.861	0.55	1.005	0.94	0.930	0.69
660	0.975	0.93	0.887	0.66	0.862	0.81	1.005	1.00	0.932	0.79
665	0.973	0.88	0.883	0.83	0.863	0.53	1.004	1.04	0.931	0.72
670	0.970	0.60	0.886	1.17	0.864	0.70	1.007	0.86	0.932	0.78
675	0.969	0.98	0.884	0.87	0.862	0.56	1.003	1.04	0.930	0.79
680	0.972	0.50	0.880	1.09	0.861	0.55	1.003	1.29	0.929	0.77
685	0.973	0.65	0.881	1.10	0.861	0.51	1.005	0.93	0.930	0.72
690	0.974	0.65	0.881	0.83	0.865	0.76	1.006	1.62	0.932	0.86
695	0.973	0.47	0.883	0.67	0.864	0.55	1.006	1.21	0.932	0.63
700	0.971	0.34	0.882	0.87	0.870	0.76	1.010	1.29	0.933	0.57
705	0.975	0.91	0.882	0.95	0.860	1.50	1.007	0.70	0.931	0.89
710	0.977	0.81	0.887	1.10	0.861	0.85	1.004	1.47	0.932	0.92
715	0.977	1.03	0.882	1.02	0.862	0.86	1.002	1.26	0.931	0.90
720	0.976	0.95	0.887	0.54	0.865	0.79	1.009	1.39	0.934	0.69
725	0.972	1.49	0.881	0.52	0.859	0.47	1.009	1.34	0.930	0.88
730	0.970	1.56	0.884	0.85	0.865	0.91	1.005	0.84	0.931	0.94

-30°/-45° BIDIRECTIONAL ABSOLUTE SPECTRAL REFLECTANCE FACTORS

WAV. [nm]	Bss mean	Bss coeff. var.	Bsp mean	Bsp coeff. var.	Bps mean	Bps coeff. var.	Bpp mean	Bpp coeff. var.	Brr mean	Brr coeff. var.
390	0.997	1.24	0.908	1.05	0.901	1.08	1.032	1.01	0.960	0.90
395	1.015	0.95	0.938	0.55	0.919	1.10	1.058	0.91	0.982	0.72
400	1.011	0.93	0.932	0.81	0.920	1.00	1.057	1.30	0.980	0.91
405	1.019	0.91	0.939	1.26	0.925	1.22	1.064	1.35	0.987	1.06
410	1.019	1.15	0.941	1.09	0.929	1.26	1.065	1.08	0.988	0.98
415	1.022	1.03	0.944	0.86	0.928	1.16	1.069	1.18	0.991	0.91
420	1.021	0.94	0.944	1.14	0.926	1.31	1.071	1.17	0.991	1.00
425	1.023	1.11	0.946	1.21	0.927	1.47	1.071	1.26	0.992	1.12
430	1.020	1.21	0.944	1.36	0.926	1.35	1.071	1.48	0.990	1.17
435	1.021	1.25	0.944	1.23	0.925	1.52	1.068	1.45	0.990	1.18
440	1.021	1.11	0.945	1.23	0.926	1.48	1.073	1.30	0.991	1.11
445	1.020	1.33	0.943	1.21	0.926	1.47	1.069	1.42	0.989	1.15
450	1.021	1.16	0.943	1.33	0.926	1.46	1.071	1.40	0.990	1.14
455	1.022	1.13	0.943	1.32	0.926	1.42	1.071	1.35	0.991	1.11
460	1.023	1.22	0.941	1.15	0.926	1.38	1.070	1.32	0.990	1.09
465	1.027	1.28	0.936	1.14	0.931	1.43	1.066	1.17	0.990	1.06
470	1.023	1.21	0.942	1.20	0.926	1.34	1.070	1.42	0.990	1.06
475	1.023	1.17	0.939	1.35	0.926	1.37	1.070	1.23	0.990	1.09
480	1.020	1.26	0.938	1.02	0.924	1.23	1.072	1.31	0.989	1.03
485	1.022	1.17	0.939	1.01	0.924	1.35	1.067	1.55	0.988	0.99
490	1.021	1.09	0.938	1.09	0.923	1.39	1.071	1.18	0.988	0.96
495	1.022	1.17	0.938	1.23	0.923	1.27	1.070	1.19	0.988	1.08
500	1.023	1.08	0.937	0.98	0.923	1.15	1.071	1.09	0.989	0.95
505	1.025	0.93	0.937	0.98	0.923	1.20	1.072	0.98	0.989	0.89
510	1.024	1.03	0.937	1.01	0.923	1.20	1.070	1.10	0.989	0.90
515	1.024	0.86	0.935	0.89	0.921	1.06	1.070	1.10	0.988	0.81
520	1.026	0.70	0.935	0.82	0.922	0.88	1.070	1.10	0.988	0.73
525	1.025	0.76	0.935	0.79	0.921	0.90	1.070	0.96	0.988	0.75
530	1.026	0.87	0.936	0.69	0.919	0.86	1.072	1.06	0.988	0.74
535	1.026	0.79	0.933	0.69	0.918	0.86	1.071	1.02	0.987	0.74
540	1.026	0.67	0.933	0.66	0.919	0.81	1.070	1.09	0.987	0.68
545	1.026	0.73	0.934	0.66	0.919	0.70	1.069	0.87	0.987	0.63
550	1.026	0.69	0.934	0.65	0.919	0.70	1.074	0.83	0.988	0.66
555	1.027	0.76	0.932	0.72	0.919	0.70	1.072	0.92	0.987	0.66
560	1.026	0.63	0.932	0.69	0.919	0.69	1.070	1.13	0.987	0.62
565	1.026	0.55	0.930	0.60	0.917	0.64	1.070	0.87	0.986	0.51
570	1.027	0.61	0.931	0.61	0.917	0.66	1.073	0.57	0.987	0.52
575	1.027	0.75	0.929	0.44	0.917	0.67	1.076	0.77	0.987	0.60
580	1.028	0.66	0.931	0.46	0.917	0.63	1.075	0.65	0.988	0.52
585	1.028	0.66	0.931	0.60	0.917	0.54	1.074	0.67	0.987	0.51
590	1.030	0.29	0.933	0.49	0.919	0.66	1.071	0.79	0.988	0.38
595	1.028	0.30	0.930	0.40	0.918	0.67	1.072	0.94	0.987	0.38
600	1.030	0.76	0.928	0.53	0.918	0.54	1.076	0.42	0.988	0.48
605	1.030	0.45	0.929	0.60	0.916	0.49	1.074	0.68	0.987	0.51
610	1.031	0.75	0.931	0.72	0.919	0.55	1.072	1.00	0.988	0.58
615	1.031	0.59	0.928	0.42	0.918	0.40	1.075	0.67	0.988	0.47
620	1.034	0.75	0.929	0.63	0.919	0.59	1.076	0.99	0.989	0.69
625	1.034	0.63	0.929	0.63	0.918	0.61	1.077	0.75	0.990	0.57
630	1.033	0.56	0.928	0.64	0.920	0.54	1.075	0.84	0.989	0.57
635	1.032	0.46	0.929	0.36	0.918	0.46	1.080	0.78	0.990	0.44
640	1.032	0.81	0.929	0.68	0.919	0.63	1.079	0.60	0.990	0.60
645	1.035	0.56	0.931	0.45	0.921	0.68	1.075	0.91	0.990	0.54
650	1.036	0.67	0.929	0.92	0.921	0.71	1.078	0.84	0.991	0.70
655	1.034	0.84	0.927	0.75	0.923	0.92	1.079	0.90	0.991	0.72
660	1.037	0.73	0.930	0.47	0.921	0.81	1.075	0.87	0.991	0.56
665	1.038	0.73	0.927	0.77	0.920	0.63	1.074	0.74	0.990	0.60
670	1.036	0.64	0.930	0.59	0.921	0.70	1.075	0.65	0.991	0.57
675	1.038	0.77	0.927	0.93	0.917	0.95	1.072	0.84	0.989	0.78
680	1.038	1.09	0.928	0.64	0.919	0.69	1.074	0.96	0.990	0.73
685	1.039	0.90	0.929	0.80	0.921	0.79	1.076	1.02	0.991	0.76
690	1.040	0.81	0.933	0.95	0.918	0.88	1.076	1.35	0.992	0.87
695	1.041	1.09	0.929	1.02	0.919	0.65	1.081	1.12	0.992	0.83
700	1.045	0.72	0.928	1.14	0.924	0.61	1.086	1.20	0.996	0.81
705	1.040	0.93	0.931	1.19	0.919	0.77	1.075	1.01	0.991	0.88
710	1.041	0.80	0.927	0.65	0.922	0.69	1.079	1.11	0.992	0.68
715	1.046	1.10	0.929	0.37	0.918	0.73	1.080	1.04	0.993	0.66
720	1.038	0.22	0.932	0.82	0.918	1.34	1.079	0.82	0.992	0.65
725	1.041	0.75	0.929	0.66	0.920	0.73	1.074	1.56	0.991	0.75
730	1.038	0.59	0.920	1.42	0.924	0.73	1.082	0.96	0.991	0.85

-30°/-15° BIDIRECTIONAL ABSOLUTE SPECTRAL REFLECTANCE FACTORS

WAV. [nm]	Bss mean	Bss coeff. var.	Bsp mean	Bsp coeff. var.	Bps mean	Bps coeff. var.	Bpp mean	Bpp coeff. var.	Brr mean	Brr coeff. var.
390	1.059	0.63	0.943	0.87	0.956	0.99	1.076	0.89	1.009	0.70
395	1.078	1.40	0.968	0.73	0.978	0.63	1.095	1.16	1.030	0.89
400	1.073	0.99	0.968	0.73	0.971	0.98	1.096	0.85	1.027	0.83
405	1.084	1.23	0.978	0.95	0.982	1.07	1.108	0.90	1.038	0.99
410	1.087	1.12	0.979	0.95	0.984	1.30	1.110	0.93	1.040	1.02
415	1.090	1.21	0.983	0.74	0.987	1.24	1.115	1.04	1.044	1.00
420	1.090	1.14	0.983	1.12	0.984	1.27	1.115	1.29	1.043	1.14
425	1.092	1.39	0.984	1.15	0.986	1.41	1.118	1.28	1.045	1.24
430	1.090	1.27	0.984	1.24	0.984	1.32	1.119	1.24	1.044	1.21
435	1.090	1.47	0.983	1.32	0.986	1.38	1.118	1.38	1.044	1.32
440	1.092	1.55	0.984	1.37	0.987	1.39	1.119	1.52	1.045	1.39
445	1.092	1.42	0.984	1.14	0.985	1.45	1.118	1.38	1.045	1.29
450	1.094	1.43	0.985	1.26	0.986	1.40	1.119	1.37	1.046	1.31
455	1.093	1.37	0.984	1.24	0.985	1.37	1.121	1.47	1.046	1.29
460	1.095	1.35	0.982	1.18	0.986	1.32	1.119	1.27	1.046	1.22
465	1.099	1.44	0.976	1.17	0.992	1.32	1.113	1.17	1.045	1.22
470	1.095	1.28	0.982	1.09	0.987	1.32	1.121	1.24	1.046	1.17
475	1.095	1.30	0.981	1.24	0.987	1.35	1.119	1.23	1.045	1.21
480	1.094	1.30	0.981	1.10	0.985	1.29	1.118	1.16	1.045	1.14
485	1.095	1.27	0.980	1.12	0.985	1.35	1.119	1.17	1.045	1.16
490	1.095	1.28	0.979	1.12	0.985	1.30	1.120	1.17	1.045	1.17
495	1.093	1.19	0.978	1.15	0.984	1.33	1.118	1.35	1.044	1.19
500	1.094	1.20	0.979	0.97	0.985	1.17	1.118	1.18	1.044	1.08
505	1.094	1.18	0.978	0.87	0.983	1.03	1.119	1.17	1.044	1.02
510	1.096	1.09	0.978	0.93	0.984	1.02	1.120	1.12	1.044	0.98
515	1.095	1.12	0.977	0.87	0.982	0.97	1.119	0.97	1.043	0.93
520	1.094	1.02	0.976	0.80	0.983	0.84	1.117	0.88	1.043	0.83
525	1.094	0.96	0.975	0.75	0.981	0.88	1.118	0.90	1.042	0.84
530	1.093	0.83	0.976	0.89	0.981	0.90	1.119	0.85	1.042	0.81
535	1.094	0.73	0.975	0.90	0.981	0.90	1.117	0.88	1.042	0.80
540	1.096	0.91	0.975	0.74	0.981	0.73	1.119	0.84	1.043	0.76
545	1.096	0.84	0.974	0.78	0.980	0.75	1.118	0.59	1.042	0.68
550	1.095	0.82	0.975	0.72	0.979	0.77	1.120	0.93	1.042	0.74
555	1.097	0.74	0.974	0.69	0.980	0.63	1.119	0.87	1.042	0.66
560	1.098	0.75	0.973	0.71	0.980	0.69	1.120	0.90	1.043	0.69
565	1.098	0.54	0.973	0.74	0.980	0.70	1.120	0.46	1.043	0.54
570	1.098	0.63	0.973	0.80	0.979	0.70	1.119	0.69	1.042	0.65
575	1.098	0.64	0.971	0.59	0.979	0.58	1.119	0.61	1.042	0.57
580	1.098	0.74	0.973	0.58	0.980	0.62	1.120	0.70	1.043	0.61
585	1.098	0.71	0.972	0.39	0.981	0.52	1.121	0.75	1.043	0.55
590	1.099	0.45	0.972	0.50	0.981	0.50	1.123	0.58	1.044	0.44
595	1.099	0.61	0.972	0.68	0.981	0.64	1.121	0.52	1.043	0.56
600	1.100	0.45	0.973	0.74	0.983	0.63	1.122	0.35	1.044	0.51
605	1.100	0.79	0.972	0.78	0.982	0.71	1.121	0.48	1.044	0.65
610	1.103	0.64	0.971	0.81	0.984	0.57	1.122	0.43	1.045	0.54
615	1.101	0.74	0.971	0.62	0.978	0.54	1.120	0.64	1.042	0.60
620	1.100	0.72	0.970	0.48	0.982	0.55	1.124	0.59	1.044	0.52
625	1.104	0.70	0.971	0.70	0.981	0.51	1.121	0.69	1.044	0.60
630	1.104	0.85	0.973	0.67	0.984	0.58	1.123	0.81	1.046	0.69
635	1.103	0.62	0.971	0.54	0.982	0.33	1.124	0.79	1.045	0.50
640	1.107	0.53	0.970	0.44	0.984	0.51	1.125	0.97	1.046	0.56
645	1.110	0.65	0.973	0.79	0.983	0.62	1.124	0.80	1.047	0.65
650	1.109	0.94	0.975	0.84	0.985	0.57	1.124	1.02	1.048	0.76
655	1.107	0.74	0.971	0.70	0.983	0.74	1.124	0.83	1.046	0.71
660	1.106	0.95	0.970	0.61	0.985	0.88	1.124	0.72	1.046	0.75
665	1.110	0.63	0.969	0.43	0.984	0.85	1.124	1.10	1.047	0.68
670	1.110	0.88	0.972	0.43	0.983	0.78	1.127	0.70	1.048	0.65
675	1.109	0.68	0.970	1.15	0.984	0.70	1.125	0.84	1.047	0.74
680	1.111	0.66	0.971	0.75	0.982	0.54	1.122	0.66	1.047	0.55
685	1.108	0.91	0.971	0.71	0.983	0.51	1.126	1.04	1.047	0.74
690	1.116	0.98	0.975	0.71	0.987	0.70	1.125	0.67	1.051	0.71
695	1.110	1.24	0.971	0.97	0.985	1.13	1.126	0.83	1.048	0.94
700	1.113	0.84	0.969	1.06	0.987	1.12	1.130	1.43	1.050	0.95
705	1.110	0.76	0.966	1.00	0.987	1.06	1.126	0.91	1.047	0.75
710	1.116	0.75	0.969	0.62	0.982	0.86	1.128	1.40	1.049	0.80
715	1.114	1.15	0.974	0.93	0.987	0.91	1.132	1.44	1.052	0.92
720	1.112	0.99	0.966	0.77	0.987	0.57	1.127	1.14	1.048	0.62
725	1.113	0.91	0.972	0.96	0.987	0.74	1.122	0.81	1.048	0.79
730	1.111	0.62	0.970	1.04	0.990	0.96	1.125	0.50	1.049	0.66

-30°/ 0° BIDIRECTIONAL ABSOLUTE SPECTRAL REFLECTANCE FACTORS

WAV. [nm]	Bss mean	Bss coeff. var.	Bsp mean	Bsp coeff. var.	Bps mean	Bps coeff. var.	Bpp mean	Bpp coeff. var.	Brr mean	Brr coeff. var.
390	1.067	0.93	0.954	1.38	0.965	0.84	1.051	1.47	1.009	0.90
395	1.086	0.94	0.975	0.26	0.984	0.79	1.081	1.12	1.031	0.64
400	1.085	1.15	0.973	0.70	0.979	1.01	1.079	0.88	1.029	0.85
405	1.095	1.12	0.982	0.91	0.991	0.95	1.091	0.51	1.040	0.72
410	1.099	1.05	0.986	0.85	0.994	1.14	1.092	0.86	1.043	0.85
415	1.120	3.18	0.990	0.78	0.993	1.16	1.098	1.03	1.050	0.93
420	1.106	1.35	0.989	0.99	0.994	1.36	1.098	1.01	1.047	0.98
425	1.107	1.35	0.992	1.08	0.995	1.41	1.101	1.23	1.049	1.08
430	1.106	1.26	0.991	1.10	0.993	1.45	1.102	1.07	1.048	1.06
435	1.107	1.32	0.990	1.23	0.994	1.53	1.101	1.17	1.048	1.13
440	1.106	1.36	0.991	1.09	0.994	1.37	1.102	1.24	1.048	1.07
445	1.107	1.37	0.990	1.13	0.994	1.37	1.101	1.16	1.048	1.11
450	1.108	1.37	0.990	1.14	0.996	1.49	1.101	1.16	1.049	1.13
455	1.109	1.28	0.990	1.03	0.995	1.42	1.101	1.19	1.049	1.06
460	1.108	1.17	0.989	0.96	0.996	1.41	1.101	1.04	1.048	1.05
465	1.113	1.19	0.983	1.00	1.001	1.30	1.097	1.08	1.049	1.08
470	1.110	1.08	0.989	1.04	0.996	1.33	1.103	1.01	1.050	0.96
475	1.108	0.96	0.987	1.07	0.996	1.31	1.100	1.09	1.048	0.99
480	1.108	1.09	0.987	1.00	0.995	1.33	1.102	0.93	1.048	0.93
485	1.109	1.08	0.985	1.04	0.995	1.21	1.101	0.97	1.047	0.94
490	1.110	1.11	0.986	0.90	0.994	1.24	1.101	0.93	1.048	0.96
495	1.109	0.96	0.985	0.91	0.991	1.27	1.100	1.00	1.046	0.90
500	1.107	0.85	0.985	1.00	0.992	1.16	1.099	0.98	1.046	0.90
505	1.108	1.03	0.985	0.93	0.993	1.06	1.100	0.94	1.047	0.90
510	1.108	1.01	0.985	0.87	0.993	1.04	1.101	1.00	1.047	0.86
515	1.108	0.94	0.984	0.82	0.991	1.12	1.100	0.79	1.046	0.82
520	1.109	0.89	0.983	0.84	0.991	0.93	1.099	0.68	1.046	0.73
525	1.110	0.97	0.982	0.66	0.990	0.94	1.098	0.63	1.045	0.66
530	1.110	0.89	0.983	0.69	0.990	0.93	1.099	0.77	1.045	0.66
535	1.109	0.54	0.981	0.71	0.989	0.83	1.100	0.60	1.045	0.58
540	1.110	0.72	0.982	0.65	0.990	0.73	1.101	0.62	1.046	0.54
545	1.108	0.55	0.982	0.66	0.989	0.79	1.100	0.59	1.045	0.58
550	1.108	0.77	0.982	0.73	0.990	0.79	1.099	0.50	1.045	0.59
555	1.108	0.75	0.980	0.66	0.989	0.77	1.098	0.45	1.043	0.52
560	1.109	0.75	0.980	0.71	0.988	0.65	1.099	0.47	1.044	0.49
565	1.108	0.41	0.979	0.55	0.987	0.67	1.097	0.47	1.043	0.43
570	1.110	0.27	0.980	0.69	0.988	0.46	1.098	0.52	1.044	0.38
575	1.109	0.65	0.978	0.55	0.988	0.62	1.099	0.52	1.044	0.38
580	1.112	0.74	0.980	0.64	0.990	0.50	1.100	0.35	1.045	0.42
585	1.111	0.66	0.979	0.63	0.989	0.66	1.100	0.44	1.045	0.55
590	1.113	0.58	0.981	0.38	0.989	0.61	1.102	0.43	1.046	0.34
595	1.113	0.39	0.978	0.42	0.989	0.48	1.099	0.41	1.045	0.30
600	1.114	0.48	0.979	0.63	0.990	0.37	1.101	0.61	1.046	0.44
605	1.113	0.52	0.978	0.61	0.990	0.39	1.098	0.46	1.045	0.45
610	1.114	0.47	0.979	0.72	0.993	0.47	1.100	0.50	1.046	0.47
615	1.114	0.51	0.976	0.54	0.991	0.55	1.100	0.58	1.045	0.46
620	1.115	0.55	0.979	0.45	0.992	0.54	1.100	0.45	1.047	0.44
625	1.114	0.49	0.979	0.65	0.990	0.50	1.104	0.53	1.047	0.49
630	1.117	0.56	0.981	0.59	0.994	0.62	1.101	0.60	1.048	0.53
635	1.115	0.64	0.977	0.50	0.991	0.70	1.102	0.47	1.046	0.52
640	1.117	0.48	0.979	0.41	0.994	0.67	1.102	0.74	1.048	0.52
645	1.118	0.60	0.977	0.43	0.994	0.74	1.105	0.56	1.048	0.54
650	1.124	0.50	0.980	0.62	0.995	0.81	1.102	0.74	1.050	0.58
655	1.123	0.73	0.976	0.65	0.996	0.59	1.105	0.41	1.050	0.51
660	1.124	0.47	0.979	0.59	0.991	0.73	1.103	0.34	1.049	0.47
665	1.122	0.67	0.978	0.41	0.995	0.56	1.104	0.46	1.050	0.47
670	1.126	0.44	0.979	0.80	0.993	0.86	1.103	0.40	1.050	0.53
675	1.124	0.81	0.978	0.84	0.995	0.92	1.105	0.24	1.050	0.60
680	1.123	0.69	0.977	0.77	0.993	0.56	1.100	0.87	1.048	0.47
685	1.121	0.52	0.978	0.80	0.995	0.86	1.103	0.62	1.049	0.61
690	1.127	0.41	0.975	0.83	0.995	0.48	1.103	0.90	1.050	0.51
695	1.123	0.62	0.976	0.65	0.995	1.07	1.104	0.59	1.050	0.65
700	1.124	0.47	0.981	0.81	0.996	0.86	1.108	1.16	1.053	0.72
705	1.124	0.77	0.978	1.00	0.993	1.08	1.101	0.62	1.049	0.76
710	1.126	0.51	0.982	1.04	0.991	0.99	1.104	0.93	1.051	0.74
715	1.129	0.88	0.974	1.13	0.993	0.50	1.107	0.96	1.051	0.75
720	1.129	0.72	0.975	0.63	0.993	0.72	1.110	0.55	1.052	0.46
725	1.127	0.75	0.975	1.08	0.992	0.39	1.103	1.20	1.049	0.69
730	1.126	1.02	0.977	0.64	0.993	0.74	1.103	0.74	1.050	0.71

-30°/ 15° BIDIRECTIONAL ABSOLUTE SPECTRAL REFLECTANCE FACTORS

WAV.	Bss		Bsp		Bps		Bpp		Brr	
[nm]	mean	coeff. var.	mean	coeff. var.	mean	coeff. var.	mean	coeff. var.	mean	coeff. var.
390	1.083	1.17	0.955	0.66	0.965	1.18	1.047	1.27	1.012	0.80
395	1.106	0.59	0.979	0.91	0.982	0.64	1.071	0.71	1.035	0.66
400	1.102	0.98	0.979	0.91	0.981	0.89	1.072	1.01	1.034	0.80
405	1.113	0.95	0.987	0.80	0.991	0.95	1.079	0.70	1.042	0.77
410	1.117	0.95	0.987	1.00	0.994	1.07	1.081	1.04	1.045	0.94
415	1.121	1.14	0.992	0.92	0.994	1.02	1.088	1.01	1.049	0.95
420	1.121	1.27	0.995	1.07	0.994	1.35	1.089	1.15	1.050	1.14
425	1.123	1.35	0.996	1.14	0.997	1.30	1.089	1.06	1.051	1.15
430	1.122	1.23	0.995	1.26	0.994	1.34	1.089	1.27	1.050	1.19
435	1.122	1.41	0.995	1.30	0.996	1.37	1.089	1.22	1.050	1.25
440	1.122	1.25	0.996	1.29	0.995	1.21	1.091	1.21	1.051	1.15
445	1.123	1.51	0.994	1.13	0.995	1.40	1.089	1.16	1.051	1.24
450	1.125	1.39	0.995	1.21	0.996	1.25	1.089	1.07	1.051	1.17
455	1.124	1.35	0.995	1.14	0.995	1.31	1.090	1.19	1.051	1.19
460	1.126	1.31	0.993	1.21	0.996	1.25	1.089	1.07	1.051	1.16
465	1.131	1.23	0.987	1.16	1.003	1.18	1.083	1.10	1.051	1.12
470	1.126	1.31	0.994	1.17	0.996	1.18	1.090	1.30	1.051	1.18
475	1.126	1.27	0.992	1.09	0.997	1.21	1.089	1.27	1.051	1.15
480	1.127	1.27	0.991	1.15	0.996	1.20	1.088	1.16	1.051	1.14
485	1.127	1.17	0.991	1.11	0.995	1.28	1.088	1.10	1.050	1.10
490	1.126	1.16	0.990	1.02	0.996	1.24	1.089	1.05	1.050	1.07
495	1.127	1.23	0.990	1.09	0.994	1.12	1.089	1.03	1.050	1.07
500	1.126	1.03	0.990	1.10	0.994	1.03	1.088	1.01	1.049	0.97
505	1.127	0.89	0.989	1.03	0.994	1.09	1.088	1.07	1.050	0.94
510	1.128	1.00	0.989	0.82	0.994	0.99	1.089	0.92	1.050	0.87
515	1.126	0.99	0.988	0.77	0.993	0.90	1.087	0.75	1.048	0.79
520	1.127	0.78	0.987	0.79	0.993	0.81	1.088	0.58	1.049	0.66
525	1.126	0.85	0.987	0.68	0.992	0.67	1.087	0.65	1.048	0.65
530	1.125	0.98	0.988	0.68	0.991	0.80	1.086	0.59	1.048	0.69
535	1.126	0.89	0.986	0.70	0.990	0.67	1.085	0.53	1.047	0.64
540	1.126	0.90	0.987	0.59	0.990	0.72	1.085	0.65	1.047	0.68
545	1.127	0.86	0.987	0.67	0.992	0.62	1.086	0.50	1.048	0.61
550	1.129	0.65	0.985	0.66	0.991	0.69	1.086	0.45	1.047	0.54
555	1.127	0.59	0.985	0.58	0.990	0.54	1.085	0.68	1.047	0.55
560	1.127	0.69	0.984	0.58	0.989	0.53	1.085	0.46	1.046	0.53
565	1.128	0.70	0.983	0.47	0.990	0.58	1.084	0.56	1.046	0.52
570	1.128	0.52	0.984	0.66	0.989	0.81	1.085	0.51	1.047	0.58
575	1.129	0.49	0.983	0.59	0.990	0.57	1.084	0.64	1.047	0.52
580	1.131	0.44	0.984	0.51	0.992	0.45	1.086	0.59	1.048	0.42
585	1.132	0.52	0.984	0.61	0.991	0.47	1.085	0.49	1.048	0.48
590	1.133	0.48	0.985	0.48	0.992	0.57	1.088	0.69	1.049	0.48
595	1.133	0.64	0.983	0.68	0.992	0.51	1.085	0.35	1.048	0.44
600	1.137	0.43	0.984	0.55	0.992	0.39	1.088	0.57	1.050	0.40
605	1.135	0.54	0.983	0.58	0.992	0.45	1.086	0.53	1.049	0.45
610	1.137	0.69	0.985	0.64	0.994	0.48	1.088	0.32	1.051	0.46
615	1.135	0.73	0.982	0.67	0.991	0.50	1.085	0.53	1.048	0.56
620	1.136	0.51	0.983	0.77	0.995	0.45	1.086	0.55	1.050	0.50
625	1.138	0.82	0.984	0.52	0.994	0.54	1.090	0.59	1.051	0.59
630	1.142	0.45	0.986	0.38	0.993	0.53	1.089	0.55	1.052	0.46
635	1.139	0.42	0.984	0.60	0.993	0.43	1.087	0.51	1.051	0.43
640	1.140	0.48	0.986	0.51	0.994	0.50	1.089	0.56	1.053	0.46
645	1.141	0.52	0.984	0.58	0.995	0.42	1.088	0.57	1.052	0.47
650	1.145	0.67	0.984	0.67	0.995	0.65	1.092	0.68	1.054	0.63
655	1.143	0.81	0.984	0.84	0.994	0.63	1.090	0.85	1.053	0.69
660	1.143	0.54	0.984	0.80	0.993	0.36	1.091	0.96	1.053	0.58
665	1.148	0.60	0.983	0.89	0.997	0.64	1.091	0.39	1.055	0.54
670	1.148	0.64	0.984	0.46	0.997	0.83	1.088	0.52	1.054	0.58
675	1.146	0.67	0.980	0.76	0.996	0.75	1.089	0.54	1.053	0.62
680	1.144	0.85	0.982	0.67	0.995	0.56	1.087	0.74	1.052	0.66
685	1.143	0.98	0.982	0.87	0.997	0.83	1.087	0.81	1.052	0.82
690	1.150	0.56	0.985	0.60	0.999	0.86	1.088	0.62	1.056	0.60
695	1.146	0.57	0.985	0.44	0.995	0.63	1.089	0.70	1.054	0.49
700	1.154	0.49	0.983	0.71	1.001	1.01	1.095	0.75	1.058	0.52
705	1.147	0.84	0.986	0.79	0.997	0.69	1.088	1.13	1.054	0.77
710	1.149	0.81	0.986	1.51	0.999	1.01	1.089	1.33	1.055	1.11
715	1.147	0.61	0.985	0.84	0.998	0.65	1.088	0.84	1.055	0.69
720	1.152	0.44	0.986	1.92	0.996	0.64	1.093	0.61	1.057	0.86
725	1.148	1.37	0.987	0.88	1.000	0.63	1.089	1.22	1.056	0.81
730	1.149	1.22	0.980	1.21	0.997	0.55	1.088	0.89	1.054	0.80

-30°/ 30° BIDIRECTIONAL ABSOLUTE SPECTRAL REFLECTANCE FACTORS

WAV.	Bss		Bsp		Bps		Bpp		Brr	
[nm]	mean	coeff. var.	mean	coeff. var.	mean	coeff. var.	mean	coeff. var.	mean	coeff. var.
390	1.110	0.15	0.961	0.80	0.954	0.85	1.027	0.25	1.013	0.35
395	1.135	0.85	0.980	0.55	0.974	0.83	1.055	0.66	1.036	0.56
400	1.128	1.15	0.980	0.85	0.973	0.88	1.058	1.05	1.035	0.85
405	1.140	1.13	0.987	0.74	0.985	1.03	1.069	0.81	1.045	0.85
410	1.145	1.18	0.990	0.82	0.984	1.07	1.070	0.87	1.047	0.94
415	1.150	1.13	0.994	0.83	0.987	1.12	1.075	0.99	1.052	0.96
420	1.151	1.28	0.993	0.91	0.987	1.25	1.076	1.14	1.052	1.09
425	1.154	1.41	0.996	1.08	0.988	1.48	1.079	1.17	1.054	1.22
430	1.152	1.39	0.995	1.13	0.987	1.32	1.078	1.04	1.053	1.16
435	1.151	1.32	0.996	1.08	0.987	1.48	1.077	1.24	1.053	1.22
440	1.153	1.45	0.996	1.11	0.988	1.35	1.079	1.22	1.054	1.22
445	1.154	1.50	0.995	1.09	0.988	1.44	1.078	1.24	1.054	1.25
450	1.155	1.59	0.996	1.17	0.988	1.34	1.078	1.26	1.054	1.25
455	1.155	1.56	0.996	1.10	0.988	1.26	1.079	1.19	1.055	1.21
460	1.158	1.44	0.995	1.03	0.989	1.22	1.077	1.34	1.055	1.19
465	1.163	1.29	0.988	0.98	0.994	1.18	1.072	1.20	1.054	1.11
470	1.157	1.21	0.994	1.06	0.989	1.08	1.079	1.25	1.055	1.08
475	1.159	1.33	0.993	0.95	0.988	1.27	1.077	1.14	1.054	1.12
480	1.158	1.46	0.993	1.03	0.988	1.21	1.077	1.08	1.054	1.13
485	1.158	1.41	0.992	0.97	0.988	1.24	1.076	1.16	1.053	1.13
490	1.159	1.19	0.991	0.95	0.988	1.21	1.077	1.15	1.054	1.06
495	1.158	1.14	0.991	1.01	0.986	1.20	1.077	1.10	1.053	1.06
500	1.159	1.16	0.991	0.99	0.985	1.08	1.076	1.01	1.053	1.01
505	1.158	1.13	0.991	0.90	0.986	0.91	1.078	1.02	1.053	0.94
510	1.158	1.13	0.990	0.74	0.986	1.07	1.078	1.00	1.053	0.94
515	1.157	1.11	0.989	0.69	0.984	1.11	1.075	0.94	1.051	0.91
520	1.160	0.91	0.989	0.79	0.984	0.93	1.077	0.81	1.052	0.75
525	1.158	0.90	0.988	0.71	0.984	1.00	1.075	0.70	1.051	0.74
530	1.159	1.05	0.990	0.78	0.984	0.96	1.074	0.73	1.052	0.80
535	1.160	0.98	0.987	0.68	0.982	0.77	1.074	0.94	1.051	0.77
540	1.160	0.86	0.988	0.59	0.984	0.79	1.074	0.80	1.051	0.70
545	1.160	0.86	0.988	0.67	0.982	0.93	1.074	0.70	1.051	0.75
550	1.162	0.72	0.986	0.61	0.982	0.77	1.074	0.77	1.051	0.67
555	1.161	0.60	0.986	0.56	0.982	0.72	1.072	0.85	1.050	0.64
560	1.162	0.76	0.987	0.56	0.982	0.58	1.072	0.57	1.051	0.56
565	1.162	0.94	0.985	0.47	0.981	0.53	1.074	0.55	1.051	0.56
570	1.163	0.78	0.985	0.50	0.982	0.53	1.073	0.59	1.051	0.49
575	1.162	0.61	0.984	0.63	0.982	0.56	1.071	0.68	1.050	0.54
580	1.162	0.48	0.985	0.50	0.983	0.71	1.073	0.64	1.051	0.54
585	1.164	0.75	0.985	0.57	0.983	0.67	1.072	0.67	1.051	0.61
590	1.167	0.56	0.986	0.53	0.983	0.41	1.076	0.66	1.053	0.49
595	1.166	0.59	0.986	0.48	0.983	0.48	1.075	0.59	1.053	0.43
600	1.167	0.68	0.986	0.45	0.985	0.34	1.074	0.72	1.053	0.45
605	1.170	0.62	0.985	0.38	0.983	0.59	1.073	0.58	1.053	0.47
610	1.171	0.35	0.985	0.47	0.986	0.49	1.076	0.53	1.054	0.44
615	1.171	0.55	0.984	0.61	0.984	0.53	1.073	0.42	1.053	0.47
620	1.171	0.52	0.984	0.69	0.986	0.72	1.074	0.48	1.054	0.57
625	1.171	0.43	0.987	0.41	0.985	0.48	1.077	0.55	1.055	0.41
630	1.173	0.78	0.985	0.41	0.986	0.53	1.076	0.61	1.055	0.51
635	1.173	0.29	0.985	0.43	0.985	0.40	1.073	0.51	1.054	0.35
640	1.177	0.66	0.988	0.73	0.986	0.50	1.075	0.74	1.056	0.57
645	1.179	0.41	0.989	0.55	0.987	0.74	1.074	0.54	1.057	0.37
650	1.175	0.71	0.987	0.47	0.989	0.78	1.075	0.76	1.057	0.54
655	1.177	0.50	0.985	0.62	0.988	0.81	1.076	0.68	1.057	0.58
660	1.178	0.59	0.983	0.49	0.988	0.82	1.076	0.36	1.056	0.47
665	1.181	0.99	0.983	0.26	0.989	0.57	1.076	0.64	1.057	0.59
670	1.178	0.40	0.987	0.63	0.990	0.55	1.078	0.65	1.058	0.51
675	1.178	0.67	0.984	0.33	0.986	0.56	1.075	0.99	1.056	0.57
680	1.179	0.38	0.982	0.42	0.987	0.45	1.071	0.75	1.055	0.45
685	1.182	0.85	0.982	1.01	0.990	0.59	1.076	1.04	1.057	0.81
690	1.185	0.69	0.985	0.59	0.989	0.69	1.075	1.02	1.058	0.67
695	1.184	0.97	0.989	0.51	0.993	0.94	1.076	0.62	1.060	0.64
700	1.186	1.19	0.989	0.95	0.989	0.70	1.078	0.62	1.061	0.74
705	1.180	0.91	0.990	1.00	0.988	0.70	1.076	0.60	1.058	0.73
710	1.188	0.59	0.986	1.09	0.989	1.05	1.076	0.54	1.060	0.76
715	1.187	0.63	0.985	0.22	0.989	0.90	1.079	1.06	1.060	0.58
720	1.183	0.53	0.990	1.33	0.986	0.73	1.071	1.25	1.058	0.74
725	1.188	0.83	0.986	0.81	0.991	1.20	1.078	0.89	1.061	0.67
730	1.188	0.61	0.986	1.40	0.988	0.77	1.075	0.83	1.059	0.66

-30°/ 45° BIDIRECTIONAL ABSOLUTE SPECTRAL REFLECTANCE FACTORS

WAV. [nm]	Bss mean	Bss coeff. var.	Bsp mean	Bsp coeff. var.	Bps mean	Bps coeff. var.	Bpp mean	Bpp coeff. var.	Brr mean	Brr coeff. var.
390	1.149	1.18	0.952	1.88	0.932	1.06	1.034	0.77	1.017	0.92
395	1.173	1.25	0.971	0.80	0.956	1.16	1.047	1.28	1.037	1.04
400	1.171	1.16	0.969	0.84	0.953	0.90	1.050	0.96	1.036	0.83
405	1.179	1.03	0.980	0.91	0.965	1.10	1.060	1.04	1.046	0.94
410	1.186	1.28	0.981	0.94	0.966	1.05	1.061	0.95	1.048	0.98
415	1.188	1.40	0.986	1.10	0.967	1.30	1.065	0.73	1.051	1.07
420	1.188	1.34	0.987	0.95	0.968	1.46	1.065	1.02	1.052	1.13
425	1.193	1.62	0.989	1.09	0.968	1.32	1.068	1.16	1.055	1.22
430	1.191	1.58	0.987	1.25	0.969	1.41	1.069	1.35	1.054	1.32
435	1.190	1.49	0.988	1.31	0.968	1.41	1.068	1.36	1.053	1.30
440	1.191	1.43	0.989	1.27	0.969	1.50	1.068	1.37	1.054	1.30
445	1.193	1.48	0.988	1.27	0.968	1.52	1.067	1.35	1.054	1.35
450	1.194	1.57	0.987	1.31	0.969	1.50	1.069	1.43	1.055	1.38
455	1.194	1.46	0.989	1.25	0.967	1.44	1.069	1.34	1.055	1.31
460	1.196	1.44	0.987	1.10	0.970	1.42	1.067	1.21	1.055	1.22
465	1.203	1.41	0.982	1.12	0.974	1.45	1.062	1.22	1.055	1.24
470	1.198	1.46	0.988	1.07	0.969	1.40	1.068	1.22	1.055	1.23
475	1.197	1.29	0.985	1.15	0.968	1.33	1.067	1.22	1.054	1.16
480	1.196	1.14	0.985	1.09	0.967	1.28	1.067	1.11	1.054	1.09
485	1.196	1.22	0.985	1.10	0.968	1.27	1.066	1.18	1.054	1.13
490	1.199	1.34	0.983	1.07	0.969	1.35	1.068	1.18	1.055	1.16
495	1.197	1.35	0.984	1.06	0.966	1.29	1.065	1.14	1.053	1.16
500	1.197	1.14	0.983	0.97	0.967	1.19	1.066	0.97	1.053	1.01
505	1.198	1.26	0.982	0.91	0.968	1.27	1.066	0.94	1.053	1.04
510	1.199	1.35	0.983	0.95	0.967	1.18	1.067	0.94	1.054	1.07
515	1.196	1.18	0.981	0.90	0.965	1.23	1.064	0.87	1.052	0.99
520	1.195	1.03	0.980	0.92	0.965	0.87	1.064	0.90	1.051	0.86
525	1.197	0.91	0.981	0.78	0.964	0.98	1.064	0.85	1.052	0.82
530	1.200	0.96	0.981	0.81	0.963	1.06	1.066	0.80	1.052	0.85
535	1.203	1.08	0.980	0.78	0.963	1.04	1.063	0.63	1.052	0.83
540	1.203	0.99	0.980	0.79	0.964	1.01	1.063	0.64	1.052	0.79
545	1.204	0.79	0.979	0.69	0.963	0.82	1.063	0.64	1.052	0.68
550	1.205	0.60	0.980	0.79	0.964	0.88	1.064	0.65	1.053	0.64
555	1.202	0.72	0.977	0.68	0.964	0.76	1.061	0.58	1.051	0.62
560	1.202	0.73	0.978	0.57	0.964	0.61	1.060	0.83	1.051	0.60
565	1.202	0.70	0.978	0.67	0.963	0.83	1.062	0.78	1.051	0.66
570	1.205	0.81	0.977	0.72	0.962	0.62	1.062	0.70	1.051	0.66
575	1.203	0.76	0.978	0.57	0.961	0.68	1.061	0.28	1.051	0.54
580	1.206	0.75	0.980	0.51	0.963	0.77	1.063	0.46	1.053	0.58
585	1.206	0.78	0.979	0.74	0.963	0.82	1.062	0.57	1.052	0.69
590	1.208	0.62	0.980	0.67	0.966	0.56	1.063	0.69	1.054	0.53
595	1.208	0.46	0.977	0.62	0.964	0.87	1.062	0.58	1.053	0.55
600	1.209	0.67	0.978	0.64	0.964	0.58	1.064	0.53	1.054	0.47
605	1.210	0.72	0.979	0.64	0.965	0.45	1.061	0.62	1.054	0.55
610	1.211	0.81	0.980	0.44	0.964	0.47	1.064	0.59	1.055	0.52
615	1.213	0.87	0.978	0.50	0.964	0.51	1.060	0.53	1.054	0.52
620	1.211	0.65	0.979	0.61	0.964	0.75	1.063	0.85	1.054	0.63
625	1.214	0.66	0.980	0.66	0.966	0.53	1.064	0.60	1.056	0.57
630	1.216	0.37	0.979	0.94	0.965	0.71	1.062	0.76	1.056	0.63
635	1.215	0.55	0.975	0.55	0.967	0.70	1.062	0.61	1.055	0.58
640	1.218	0.57	0.979	0.54	0.965	0.67	1.062	0.38	1.056	0.47
645	1.218	0.47	0.978	0.77	0.967	0.77	1.063	0.76	1.057	0.64
650	1.224	0.76	0.977	0.62	0.970	0.87	1.065	0.39	1.059	0.59
655	1.220	0.64	0.978	0.89	0.969	0.81	1.062	0.68	1.057	0.69
660	1.222	0.45	0.978	0.67	0.969	0.52	1.064	0.43	1.058	0.48
665	1.223	1.05	0.975	0.75	0.968	0.78	1.061	1.00	1.057	0.85
670	1.222	0.92	0.980	1.13	0.967	0.52	1.061	1.13	1.057	0.88
675	1.225	0.63	0.976	0.72	0.969	1.28	1.062	1.27	1.058	0.91
680	1.225	0.76	0.977	0.76	0.968	0.66	1.062	0.86	1.058	0.72
685	1.225	1.00	0.976	0.40	0.968	0.79	1.063	0.78	1.058	0.69
690	1.232	0.79	0.978	0.91	0.971	1.15	1.064	0.84	1.061	0.89
695	1.229	0.75	0.979	0.75	0.969	0.79	1.063	0.52	1.060	0.65
700	1.227	0.72	0.983	0.88	0.971	0.84	1.068	0.97	1.062	0.76
705	1.228	1.02	0.982	0.92	0.965	1.33	1.065	0.83	1.060	0.95
710	1.226	1.16	0.975	1.29	0.970	1.20	1.063	1.14	1.059	1.13
715	1.234	1.15	0.980	0.92	0.973	0.55	1.061	0.99	1.062	0.85
720	1.230	1.08	0.975	0.95	0.971	0.79	1.064	0.43	1.060	0.65
725	1.237	1.44	0.978	0.74	0.966	0.91	1.065	1.71	1.062	1.11
730	1.236	0.65	0.968	1.08	0.968	0.59	1.069	1.15	1.060	0.77

-30°/ 60° BIDIRECTIONAL ABSOLUTE SPECTRAL REFLECTANCE FACTORS

WAV. [nm]	Bss mean	Bss coeff. var.	Bsp mean	Bsp coeff. var.	Bps mean	Bps coeff. var.	Bpp mean	Bpp coeff. var.	Brr mean	Brr coeff. var.
390	1.194	0.83	0.933	0.53	0.902	1.29	1.021	0.85	1.012	0.79
395	1.221	1.40	0.949	0.60	0.923	0.95	1.044	0.68	1.034	0.83
400	1.217	1.30	0.948	0.67	0.919	1.08	1.045	1.38	1.032	0.99
405	1.230	1.35	0.958	0.79	0.929	0.92	1.055	1.05	1.043	0.93
410	1.231	1.18	0.959	1.03	0.930	1.17	1.055	1.26	1.044	1.05
415	1.236	1.45	0.962	1.02	0.933	1.36	1.060	1.19	1.048	1.15
420	1.235	1.54	0.964	1.24	0.931	1.41	1.061	1.23	1.048	1.26
425	1.238	1.43	0.966	1.16	0.932	1.45	1.063	1.35	1.050	1.25
430	1.237	1.63	0.964	1.17	0.932	1.50	1.065	1.33	1.050	1.28
435	1.239	1.58	0.963	1.17	0.932	1.57	1.063	1.40	1.049	1.32
440	1.241	1.46	0.965	1.20	0.932	1.49	1.065	1.18	1.051	1.26
445	1.242	1.48	0.966	1.29	0.933	1.55	1.063	1.40	1.051	1.33
450	1.242	1.47	0.966	1.28	0.933	1.44	1.065	1.31	1.051	1.29
455	1.241	1.42	0.964	1.16	0.932	1.56	1.065	1.20	1.050	1.23
460	1.245	1.54	0.964	1.19	0.934	1.40	1.064	1.32	1.052	1.28
465	1.252	1.50	0.958	1.15	0.938	1.37	1.059	1.23	1.052	1.23
470	1.245	1.37	0.964	1.26	0.933	1.28	1.066	1.29	1.052	1.19
475	1.246	1.45	0.961	1.17	0.932	1.39	1.062	1.27	1.051	1.23
480	1.247	1.39	0.962	1.04	0.931	1.42	1.062	1.16	1.050	1.16
485	1.246	1.35	0.962	1.14	0.931	1.34	1.064	1.25	1.051	1.17
490	1.247	1.35	0.962	1.06	0.932	1.35	1.063	1.19	1.051	1.15
495	1.247	1.37	0.961	0.97	0.931	1.34	1.062	1.18	1.050	1.11
500	1.248	1.27	0.960	0.87	0.931	1.27	1.062	1.08	1.050	1.02
505	1.249	1.24	0.959	0.91	0.931	1.19	1.062	1.08	1.050	1.02
510	1.250	1.30	0.960	0.90	0.930	1.11	1.062	1.02	1.050	1.00
515	1.249	1.20	0.959	0.87	0.928	1.16	1.061	1.07	1.049	0.98
520	1.251	1.06	0.957	0.80	0.928	1.04	1.061	1.11	1.049	0.89
525	1.249	1.08	0.958	0.83	0.927	0.95	1.061	0.97	1.049	0.84
530	1.250	1.04	0.958	0.74	0.927	0.86	1.061	0.82	1.049	0.74
535	1.250	1.11	0.955	0.75	0.926	0.94	1.060	0.93	1.048	0.80
540	1.251	0.81	0.957	0.87	0.929	0.99	1.060	0.92	1.049	0.77
545	1.253	0.92	0.957	0.87	0.928	0.81	1.060	0.88	1.049	0.77
550	1.255	1.03	0.956	0.85	0.928	0.81	1.060	1.06	1.050	0.80
555	1.255	0.83	0.956	0.55	0.927	0.72	1.059	0.90	1.049	0.65
560	1.255	0.92	0.954	0.69	0.927	0.76	1.059	0.79	1.049	0.71
565	1.257	0.89	0.955	0.71	0.927	0.63	1.057	0.74	1.049	0.65
570	1.258	0.94	0.955	0.74	0.926	0.85	1.056	0.63	1.049	0.68
575	1.256	0.90	0.954	0.67	0.925	0.80	1.057	0.61	1.048	0.62
580	1.259	0.75	0.955	0.62	0.925	0.73	1.059	0.55	1.050	0.57
585	1.259	0.64	0.954	0.64	0.926	0.94	1.058	0.81	1.049	0.68
590	1.262	0.62	0.953	0.57	0.930	0.63	1.059	0.71	1.051	0.53
595	1.264	0.75	0.953	0.67	0.927	0.69	1.058	0.66	1.050	0.58
600	1.265	0.70	0.955	0.54	0.928	0.33	1.058	0.51	1.051	0.47
605	1.267	0.56	0.954	0.50	0.928	0.75	1.057	0.57	1.052	0.53
610	1.267	0.60	0.954	0.49	0.929	0.59	1.060	0.80	1.053	0.51
615	1.265	0.50	0.953	0.63	0.928	0.47	1.058	0.67	1.051	0.46
620	1.271	0.58	0.955	0.68	0.930	0.45	1.059	0.52	1.054	0.48
625	1.274	0.40	0.955	0.85	0.929	0.60	1.059	0.71	1.054	0.53
630	1.273	0.40	0.956	0.80	0.928	0.80	1.059	0.54	1.054	0.50
635	1.270	0.71	0.955	0.68	0.928	0.72	1.060	0.62	1.053	0.55
640	1.274	0.59	0.956	0.58	0.928	0.71	1.061	0.38	1.055	0.40
645	1.277	0.97	0.955	0.78	0.930	0.47	1.059	0.34	1.055	0.58
650	1.279	0.79	0.957	1.12	0.932	0.96	1.061	0.70	1.057	0.81
655	1.280	0.78	0.953	0.77	0.930	0.48	1.060	0.46	1.056	0.55
660	1.283	0.91	0.956	0.49	0.931	0.33	1.058	0.60	1.057	0.55
665	1.280	0.63	0.957	0.85	0.932	0.43	1.058	0.35	1.057	0.52
670	1.280	1.00	0.956	0.74	0.931	0.57	1.057	0.86	1.056	0.73
675	1.282	0.70	0.956	0.75	0.929	1.05	1.061	0.84	1.057	0.78
680	1.281	0.38	0.952	0.77	0.930	0.77	1.057	0.86	1.055	0.61
685	1.286	0.61	0.956	1.06	0.929	1.03	1.056	0.88	1.057	0.83
690	1.285	1.13	0.955	0.98	0.929	0.82	1.059	0.61	1.057	0.81
695	1.287	0.68	0.954	0.86	0.931	0.93	1.055	0.51	1.057	0.62
700	1.288	0.74	0.959	0.74	0.936	0.93	1.069	0.43	1.063	0.54
705	1.290	0.53	0.954	1.03	0.931	0.89	1.061	1.07	1.059	0.76
710	1.294	1.02	0.955	1.22	0.928	0.74	1.057	0.89	1.058	0.90
715	1.290	0.65	0.956	0.79	0.935	0.50	1.056	0.68	1.059	0.58
720	1.285	0.80	0.959	0.98	0.933	0.79	1.058	1.04	1.059	0.63
725	1.289	0.69	0.953	1.07	0.930	1.00	1.059	1.11	1.058	0.71
730	1.289	0.45	0.957	1.25	0.930	0.78	1.056	0.61	1.058	0.55

-30°/ 75° BIDIRECTIONAL ABSOLUTE SPECTRAL REFLECTANCE FACTORS

WAV. [nm]	Bss mean	Bss coeff. var.	Bsp mean	Bsp coeff. var.	Bps mean	Bps coeff. var.	Bpp mean	Bpp coeff. var.	Brr mean	Brr coeff. var.
390	1.252	1.69	0.875	1.45	0.837	1.02	1.028	1.46	0.998	1.05
395	1.274	1.66	0.893	0.89	0.860	1.52	1.039	1.09	1.016	1.09
400	1.272	1.91	0.896	1.27	0.856	1.70	1.045	0.94	1.017	1.30
405	1.286	1.76	0.902	1.05	0.863	1.32	1.053	0.93	1.026	1.15
410	1.288	1.70	0.902	1.22	0.865	1.51	1.053	0.95	1.027	1.20
415	1.292	1.78	0.906	1.27	0.865	1.60	1.060	1.04	1.031	1.30
420	1.291	1.75	0.906	1.20	0.864	1.74	1.061	1.17	1.031	1.30
425	1.294	1.80	0.907	1.38	0.865	1.67	1.063	1.38	1.032	1.40
430	1.291	1.81	0.907	1.38	0.866	1.67	1.062	1.39	1.031	1.38
435	1.293	1.96	0.905	1.45	0.864	1.67	1.061	1.58	1.031	1.51
440	1.295	1.99	0.907	1.42	0.864	1.93	1.064	1.47	1.032	1.57
445	1.297	2.04	0.905	1.42	0.864	1.76	1.061	1.41	1.032	1.52
450	1.298	2.01	0.905	1.44	0.863	1.81	1.062	1.42	1.032	1.54
455	1.297	1.96	0.906	1.46	0.863	1.81	1.063	1.38	1.032	1.50
460	1.299	1.82	0.903	1.41	0.865	1.59	1.061	1.18	1.032	1.35
465	1.307	1.97	0.900	1.32	0.870	1.65	1.056	1.31	1.033	1.41
470	1.302	1.91	0.905	1.41	0.864	1.58	1.063	1.34	1.033	1.39
475	1.303	1.81	0.903	1.37	0.865	1.63	1.063	1.07	1.033	1.35
480	1.304	1.53	0.902	1.32	0.863	1.60	1.062	0.92	1.033	1.21
485	1.305	1.66	0.903	1.31	0.864	1.65	1.062	1.15	1.033	1.25
490	1.307	1.55	0.904	1.30	0.863	1.63	1.062	1.05	1.034	1.23
495	1.305	1.63	0.902	1.39	0.862	1.58	1.062	1.19	1.033	1.28
500	1.307	1.51	0.901	1.35	0.861	1.47	1.061	1.11	1.033	1.19
505	1.307	1.48	0.902	1.24	0.862	1.41	1.062	1.19	1.033	1.14
510	1.308	1.59	0.902	1.27	0.862	1.36	1.062	1.24	1.033	1.22
515	1.311	1.44	0.901	1.37	0.860	1.46	1.062	1.06	1.034	1.20
520	1.313	1.18	0.900	1.17	0.861	1.43	1.061	0.97	1.034	1.03
525	1.312	1.26	0.901	1.18	0.860	1.38	1.062	0.93	1.034	1.02
530	1.314	1.50	0.901	1.19	0.860	1.37	1.061	1.14	1.034	1.13
535	1.313	1.36	0.899	1.20	0.859	1.29	1.059	1.04	1.033	1.05
540	1.312	1.23	0.899	1.16	0.859	1.13	1.061	1.01	1.033	0.97
545	1.315	1.40	0.900	1.03	0.860	1.24	1.060	1.01	1.034	0.94
550	1.317	1.25	0.900	1.18	0.860	1.26	1.059	0.85	1.034	0.91
555	1.317	1.18	0.899	0.95	0.859	1.09	1.060	0.88	1.034	0.81
560	1.319	1.09	0.898	1.09	0.859	1.15	1.060	0.85	1.034	0.85
565	1.321	1.00	0.898	1.10	0.860	1.12	1.061	0.88	1.035	0.73
570	1.321	0.93	0.897	1.05	0.859	1.38	1.058	1.18	1.034	0.82
575	1.324	0.97	0.896	0.87	0.859	1.30	1.059	0.91	1.035	0.78
580	1.325	0.74	0.898	0.95	0.858	1.00	1.060	0.75	1.035	0.60
585	1.326	0.85	0.896	0.98	0.859	1.24	1.060	0.79	1.035	0.76
590	1.329	0.87	0.897	0.94	0.859	0.97	1.061	0.63	1.036	0.70
595	1.329	0.79	0.897	1.03	0.858	1.10	1.062	0.63	1.036	0.73
600	1.331	0.93	0.898	0.95	0.860	1.20	1.059	0.77	1.037	0.76
605	1.332	0.96	0.897	1.09	0.859	1.07	1.059	0.84	1.037	0.78
610	1.331	1.02	0.897	1.15	0.859	1.20	1.059	0.51	1.036	0.89
615	1.331	1.00	0.895	0.98	0.858	1.06	1.057	0.70	1.035	0.81
620	1.335	1.05	0.897	1.07	0.860	0.93	1.059	0.53	1.038	0.73
625	1.337	0.93	0.896	0.98	0.861	1.15	1.058	0.91	1.038	0.73
630	1.339	0.88	0.897	1.12	0.860	1.02	1.058	0.49	1.038	0.68
635	1.335	0.88	0.895	1.33	0.862	1.03	1.057	0.42	1.037	0.64
640	1.335	1.06	0.896	1.40	0.858	1.07	1.058	0.54	1.037	0.77
645	1.340	0.74	0.897	1.56	0.860	1.17	1.059	0.61	1.039	0.82
650	1.344	0.71	0.898	1.03	0.860	0.79	1.058	0.39	1.040	0.58
655	1.339	0.64	0.895	1.10	0.860	1.17	1.056	0.85	1.037	0.66
660	1.339	1.04	0.896	0.88	0.861	0.96	1.058	0.57	1.038	0.68
665	1.340	0.89	0.895	1.34	0.859	1.27	1.058	0.40	1.038	0.82
670	1.343	1.13	0.895	1.40	0.860	0.87	1.057	0.90	1.039	0.92
675	1.341	1.05	0.894	1.42	0.859	1.08	1.057	0.91	1.038	0.88
680	1.341	0.69	0.893	1.29	0.857	0.84	1.054	0.60	1.036	0.62
685	1.341	0.72	0.893	1.26	0.859	1.01	1.058	1.11	1.038	0.85
690	1.349	0.75	0.896	1.39	0.861	1.31	1.056	0.89	1.040	0.81
695	1.352	1.03	0.892	1.43	0.859	1.31	1.056	0.66	1.040	0.78
700	1.353	0.64	0.895	1.26	0.861	1.05	1.061	1.07	1.042	0.67
705	1.349	1.02	0.896	1.11	0.854	0.88	1.056	0.95	1.039	0.70
710	1.351	1.17	0.897	1.58	0.859	1.52	1.059	1.82	1.041	1.22
715	1.352	1.06	0.898	1.71	0.856	1.16	1.053	1.44	1.040	1.10
720	1.355	1.10	0.889	1.02	0.858	0.80	1.056	1.27	1.040	0.71
725	1.358	0.77	0.895	1.45	0.857	1.50	1.058	1.10	1.042	0.82
730	1.354	0.95	0.894	1.91	0.857	1.30	1.055	1.56	1.040	0.98

-45°/-75° BIDIRECTIONAL ABSOLUTE SPECTRAL REFLECTANCE FACTORS

WAV. [nm]	Bss mean	Bss coeff. var.	Bsp mean	Bsp coeff. var.	Bps mean	Bps coeff. var.	Bpp mean	Bpp coeff. var.	Brr mean	Brr coeff. var.
390	0.837	0.79	0.780	1.50	0.749	1.38	0.882	1.82	0.812	1.21
395	0.864	1.43	0.799	2.14	0.781	1.54	0.915	1.74	0.840	1.59
400	0.857	1.70	0.795	1.90	0.773	1.97	0.911	2.11	0.834	1.79
405	0.866	1.79	0.800	2.04	0.777	1.83	0.918	2.18	0.840	1.84
410	0.865	1.48	0.800	1.78	0.776	1.88	0.921	2.03	0.841	1.71
415	0.868	1.63	0.803	1.59	0.778	2.14	0.923	2.33	0.843	1.81
420	0.867	1.53	0.801	1.95	0.774	2.03	0.923	2.28	0.841	1.83
425	0.868	1.91	0.804	1.99	0.776	2.10	0.923	2.29	0.843	1.97
430	0.866	1.82	0.800	1.85	0.774	2.13	0.923	2.25	0.841	1.91
435	0.866	1.79	0.799	2.11	0.773	2.17	0.922	2.24	0.840	1.97
440	0.867	1.80	0.800	2.29	0.774	2.21	0.925	2.50	0.841	2.09
445	0.866	1.92	0.799	1.95	0.772	2.23	0.921	2.40	0.840	2.01
450	0.865	2.07	0.799	2.10	0.772	2.08	0.923	2.42	0.840	2.06
455	0.868	1.98	0.802	2.12	0.774	2.17	0.925	2.34	0.842	2.04
460	0.866	1.80	0.797	1.97	0.772	2.18	0.923	2.33	0.840	1.96
465	0.870	1.85	0.792	1.94	0.776	2.28	0.918	2.39	0.839	2.00
470	0.866	1.82	0.796	1.95	0.771	2.07	0.923	2.37	0.839	1.95
475	0.866	1.81	0.796	2.00	0.771	2.19	0.922	2.33	0.839	1.98
480	0.865	1.72	0.794	1.98	0.769	2.18	0.922	2.21	0.838	1.92
485	0.864	1.85	0.794	2.05	0.770	2.06	0.923	2.33	0.838	1.96
490	0.863	1.80	0.793	1.91	0.769	2.03	0.921	2.32	0.837	1.91
495	0.864	1.77	0.792	2.03	0.768	2.15	0.923	2.32	0.837	1.95
500	0.863	1.60	0.792	1.91	0.767	2.15	0.921	2.41	0.836	1.90
505	0.864	1.59	0.791	1.99	0.768	2.11	0.922	2.26	0.836	1.87
510	0.862	1.79	0.792	2.04	0.767	2.03	0.922	2.28	0.836	1.92
515	0.862	1.78	0.791	2.03	0.766	2.07	0.922	2.32	0.835	1.94
520	0.861	1.56	0.790	1.94	0.765	2.01	0.921	2.25	0.834	1.83
525	0.863	1.59	0.790	1.91	0.765	1.98	0.922	2.30	0.835	1.83
530	0.863	1.44	0.792	2.20	0.765	1.94	0.922	2.08	0.836	1.81
535	0.861	1.46	0.788	1.92	0.763	1.89	0.921	2.42	0.833	1.80
540	0.862	1.58	0.788	1.62	0.763	1.79	0.922	2.33	0.834	1.73
545	0.862	1.58	0.788	1.90	0.762	1.78	0.922	2.16	0.834	1.75
550	0.862	1.46	0.788	1.86	0.763	1.85	0.922	2.31	0.834	1.75
555	0.863	1.47	0.786	1.82	0.762	1.83	0.921	2.14	0.833	1.71
560	0.861	1.55	0.785	1.92	0.761	1.96	0.920	2.14	0.832	1.78
565	0.861	1.44	0.786	1.83	0.761	1.95	0.921	1.97	0.832	1.69
570	0.860	1.25	0.785	1.85	0.760	1.56	0.919	2.09	0.831	1.59
575	0.860	1.37	0.785	1.88	0.761	1.83	0.921	1.98	0.832	1.66
580	0.861	1.28	0.786	1.66	0.760	1.68	0.921	1.95	0.832	1.55
585	0.860	1.41	0.784	1.76	0.760	1.68	0.921	2.17	0.832	1.65
590	0.860	1.38	0.782	1.97	0.761	1.79	0.924	2.20	0.832	1.73
595	0.861	1.34	0.784	1.83	0.760	1.54	0.921	2.13	0.831	1.61
600	0.861	1.43	0.783	1.79	0.760	1.83	0.921	2.09	0.831	1.68
605	0.860	1.35	0.782	2.00	0.760	1.79	0.920	2.27	0.830	1.74
610	0.860	1.56	0.782	1.91	0.761	1.86	0.923	2.14	0.832	1.75
615	0.860	1.53	0.782	1.97	0.759	1.68	0.922	2.28	0.831	1.76
620	0.860	1.47	0.784	1.63	0.759	1.82	0.923	2.43	0.832	1.72
625	0.861	1.41	0.782	1.84	0.758	1.64	0.922	2.29	0.831	1.69
630	0.861	1.57	0.782	2.21	0.759	2.01	0.921	2.31	0.831	1.90
635	0.860	1.23	0.781	2.00	0.758	1.68	0.922	2.22	0.830	1.67
640	0.860	1.21	0.781	2.05	0.758	1.78	0.922	2.31	0.830	1.72
645	0.861	1.46	0.779	2.62	0.758	1.68	0.923	2.22	0.830	1.86
650	0.864	1.18	0.779	2.14	0.757	1.81	0.924	2.24	0.831	1.69
655	0.859	1.51	0.779	1.87	0.758	1.77	0.920	2.46	0.829	1.78
660	0.860	0.93	0.777	2.01	0.756	1.64	0.920	2.72	0.828	1.69
665	0.859	1.61	0.775	2.09	0.755	1.71	0.922	2.76	0.828	1.88
670	0.861	1.26	0.779	2.36	0.759	1.95	0.920	2.76	0.830	1.92
675	0.858	1.48	0.775	2.00	0.757	1.97	0.919	2.79	0.827	1.91
680	0.858	1.26	0.776	1.96	0.753	1.98	0.920	2.36	0.826	1.72
685	0.861	1.53	0.775	2.12	0.753	1.90	0.923	1.88	0.828	1.73
690	0.863	1.40	0.778	1.75	0.754	2.18	0.922	1.86	0.829	1.59
695	0.863	1.37	0.775	1.83	0.753	1.65	0.920	2.41	0.828	1.68
700	0.862	1.31	0.780	2.74	0.755	1.77	0.925	2.75	0.831	1.95
705	0.858	1.51	0.778	1.91	0.754	1.56	0.924	2.49	0.828	1.66
710	0.864	1.75	0.776	2.85	0.754	2.08	0.921	2.34	0.829	2.10
715	0.864	0.99	0.774	2.06	0.758	1.53	0.923	2.42	0.830	1.61
720	0.857	1.70	0.779	1.85	0.756	1.43	0.926	3.08	0.830	1.85
725	0.859	1.57	0.780	2.31	0.755	2.04	0.924	3.08	0.829	2.03
730	0.858	1.45	0.775	3.10	0.755	0.77	0.917	3.47	0.826	2.03

-45°/-60° BIDIRECTIONAL ABSOLUTE SPECTRAL REFLECTANCE FACTORS

WAV. [nm]	Bss mean	Bss coeff. var.	Bsp mean	Bsp coeff. var.	Bps mean	Bps coeff. var.	Bpp mean	Bpp coeff. var.	Brr mean	Brr coeff. var.
390	0.922	0.96	0.846	2.04	0.832	1.35	0.987	1.52	0.897	1.36
395	0.947	1.17	0.874	0.81	0.858	0.80	1.011	0.79	0.922	0.82
400	0.944	0.92	0.865	0.66	0.852	1.34	1.011	0.85	0.918	0.83
405	0.951	1.14	0.874	0.65	0.859	1.17	1.019	1.24	0.926	1.00
410	0.955	1.07	0.874	1.01	0.861	1.17	1.021	1.25	0.928	1.07
415	0.956	1.08	0.878	0.88	0.860	1.39	1.024	1.46	0.930	1.14
420	0.955	1.29	0.877	1.19	0.860	1.43	1.024	1.44	0.929	1.26
425	0.957	1.29	0.878	0.91	0.860	1.55	1.026	1.38	0.930	1.20
430	0.954	1.38	0.875	1.27	0.860	1.52	1.025	1.42	0.928	1.31
435	0.955	1.35	0.875	1.34	0.858	1.52	1.026	1.60	0.928	1.38
440	0.956	1.49	0.877	1.32	0.859	1.62	1.027	1.79	0.930	1.48
445	0.956	1.37	0.875	1.36	0.860	1.50	1.027	1.59	0.929	1.37
450	0.956	1.52	0.875	1.30	0.858	1.42	1.026	1.65	0.929	1.40
455	0.957	1.53	0.877	1.17	0.859	1.47	1.027	1.60	0.930	1.37
460	0.956	1.46	0.874	1.14	0.857	1.27	1.025	1.68	0.928	1.31
465	0.960	1.33	0.868	1.15	0.862	1.43	1.021	1.49	0.928	1.28
470	0.957	1.24	0.873	1.17	0.858	1.29	1.025	1.50	0.928	1.23
475	0.957	1.26	0.871	1.15	0.857	1.49	1.027	1.70	0.928	1.33
480	0.955	1.48	0.871	0.96	0.856	1.42	1.025	1.65	0.927	1.30
485	0.956	1.37	0.870	0.98	0.855	1.36	1.027	1.69	0.927	1.27
490	0.954	1.38	0.868	1.09	0.855	1.38	1.025	1.54	0.925	1.27
495	0.954	1.32	0.868	1.06	0.854	1.26	1.024	1.48	0.925	1.21
500	0.954	1.34	0.867	1.03	0.852	1.10	1.024	1.40	0.924	1.15
505	0.954	1.09	0.867	0.91	0.853	1.20	1.025	1.45	0.925	1.10
510	0.953	1.32	0.867	0.96	0.853	1.30	1.026	1.44	0.925	1.18
515	0.952	1.26	0.865	0.95	0.851	1.30	1.024	1.44	0.923	1.16
520	0.953	1.14	0.864	0.83	0.851	1.12	1.024	1.10	0.923	0.99
525	0.952	1.05	0.865	0.67	0.849	1.12	1.024	1.10	0.923	0.92
530	0.954	0.88	0.866	0.80	0.849	1.13	1.025	1.28	0.924	0.95
535	0.951	0.82	0.864	0.72	0.849	1.04	1.024	1.27	0.922	0.90
540	0.953	0.90	0.864	0.69	0.849	1.09	1.025	1.32	0.923	0.94
545	0.953	0.93	0.863	0.70	0.850	1.01	1.026	1.26	0.923	0.90
550	0.954	0.89	0.863	0.81	0.848	0.96	1.024	1.19	0.922	0.88
555	0.952	0.97	0.861	0.78	0.847	1.07	1.024	0.98	0.921	0.89
560	0.950	0.98	0.859	0.63	0.846	0.89	1.023	1.06	0.919	0.82
565	0.951	0.72	0.858	0.72	0.846	0.97	1.024	1.00	0.920	0.80
570	0.950	0.90	0.858	0.57	0.845	0.90	1.023	0.83	0.919	0.74
575	0.951	0.79	0.858	0.59	0.845	0.86	1.024	0.84	0.919	0.70
580	0.951	0.68	0.859	0.61	0.844	0.63	1.023	0.91	0.919	0.63
585	0.952	0.61	0.859	0.65	0.844	0.89	1.024	0.92	0.920	0.71
590	0.953	0.59	0.858	0.67	0.845	0.78	1.026	1.27	0.920	0.77
595	0.950	0.49	0.858	0.78	0.843	0.74	1.024	1.05	0.919	0.71
600	0.952	0.39	0.857	0.66	0.846	0.73	1.025	1.03	0.920	0.61
605	0.954	0.41	0.856	0.65	0.845	0.85	1.024	0.90	0.920	0.63
610	0.954	0.62	0.856	0.67	0.846	0.91	1.026	0.79	0.920	0.69
615	0.953	0.68	0.856	0.72	0.845	0.72	1.024	1.23	0.919	0.75
620	0.953	0.71	0.855	0.75	0.844	0.74	1.027	1.25	0.920	0.79
625	0.953	0.90	0.855	0.94	0.846	0.63	1.027	1.08	0.921	0.79
630	0.955	0.84	0.856	0.90	0.843	0.90	1.028	1.27	0.921	0.90
635	0.954	0.68	0.854	0.72	0.843	0.73	1.025	0.98	0.919	0.71
640	0.955	0.76	0.854	0.89	0.844	1.06	1.025	1.13	0.919	0.88
645	0.954	0.62	0.854	1.18	0.844	0.85	1.028	1.07	0.920	0.85
650	0.958	0.48	0.857	0.77	0.845	1.13	1.027	1.45	0.922	0.86
655	0.958	0.52	0.851	0.83	0.844	0.57	1.028	1.15	0.920	0.71
660	0.955	0.57	0.852	0.95	0.844	0.43	1.026	1.38	0.919	0.72
665	0.956	0.76	0.851	0.95	0.842	0.85	1.030	1.34	0.920	0.88
670	0.956	0.93	0.850	1.47	0.844	0.73	1.030	1.18	0.920	0.96
675	0.953	0.79	0.849	0.69	0.843	0.56	1.030	1.63	0.919	0.82
680	0.957	0.83	0.849	1.15	0.844	0.92	1.027	1.43	0.919	1.00
685	0.955	1.05	0.849	0.71	0.842	0.90	1.025	1.18	0.918	0.86
690	0.954	1.00	0.854	0.95	0.843	1.02	1.028	1.10	0.920	0.91
695	0.954	0.45	0.855	0.94	0.841	0.83	1.026	1.77	0.919	0.87
700	0.955	0.75	0.854	1.66	0.842	1.11	1.032	1.35	0.921	1.07
705	0.957	0.85	0.850	1.53	0.845	0.61	1.027	1.32	0.920	0.97
710	0.962	0.75	0.852	1.34	0.843	0.87	1.030	1.34	0.922	0.92
715	0.956	0.81	0.854	1.10	0.845	0.62	1.029	1.67	0.921	0.90
720	0.956	0.76	0.862	0.94	0.842	1.64	1.032	0.53	0.923	0.78
725	0.954	1.46	0.853	1.80	0.843	1.70	1.028	1.90	0.919	1.50
730	0.960	0.43	0.855	0.84	0.840	1.59	1.026	2.06	0.920	1.11

-45°/-30° BIDIRECTIONAL ABSOLUTE SPECTRAL REFLECTANCE FACTORS

WAV. [nm]	Bss mean	Bss coeff. var.	Bsp mean	Bsp coeff. var.	Bps mean	Bps coeff. var.	Bpp mean	Bpp coeff. var.	Brr mean	Brr coeff. var.
390	0.991	1.23	0.905	0.47	0.906	1.09	1.036	0.89	0.959	0.58
395	1.016	0.74	0.923	0.50	0.932	0.63	1.060	0.56	0.983	0.50
400	1.014	0.90	0.921	0.60	0.925	1.01	1.058	1.07	0.979	0.84
405	1.022	1.12	0.928	0.66	0.936	1.05	1.064	0.88	0.988	0.83
410	1.025	1.08	0.932	1.06	0.938	1.00	1.068	0.97	0.991	0.97
415	1.025	1.01	0.933	1.02	0.939	0.97	1.073	1.06	0.992	0.95
420	1.028	1.22	0.933	1.10	0.938	1.26	1.073	1.01	0.993	1.09
425	1.031	1.53	0.934	1.20	0.939	1.22	1.077	1.36	0.995	1.25
430	1.030	1.40	0.933	1.28	0.938	1.33	1.077	1.30	0.995	1.25
435	1.030	1.41	0.931	1.16	0.938	1.27	1.075	1.37	0.993	1.24
440	1.029	1.58	0.933	1.03	0.938	1.47	1.078	1.29	0.995	1.28
445	1.031	1.34	0.931	1.23	0.940	1.39	1.076	1.39	0.995	1.28
450	1.031	1.33	0.932	1.23	0.941	1.38	1.077	1.26	0.995	1.24
455	1.032	1.41	0.935	1.16	0.941	1.33	1.079	1.45	0.997	1.28
460	1.034	1.29	0.931	0.92	0.939	1.27	1.079	1.33	0.996	1.15
465	1.039	1.24	0.927	1.07	0.946	1.26	1.073	1.22	0.996	1.15
470	1.032	1.19	0.933	1.10	0.939	1.17	1.081	1.34	0.996	1.14
475	1.033	1.23	0.930	1.13	0.941	1.32	1.078	1.30	0.995	1.19
480	1.031	1.20	0.930	0.98	0.939	1.25	1.079	1.20	0.995	1.10
485	1.032	1.25	0.930	1.16	0.938	1.34	1.078	1.24	0.995	1.18
490	1.033	1.22	0.928	1.02	0.937	1.15	1.080	1.29	0.995	1.11
495	1.031	1.18	0.927	1.07	0.936	1.15	1.078	1.24	0.993	1.11
500	1.032	1.20	0.926	1.07	0.935	1.16	1.076	0.95	0.992	1.04
505	1.032	1.08	0.926	0.80	0.936	1.02	1.079	1.21	0.993	0.98
510	1.032	1.12	0.927	0.94	0.935	1.12	1.079	1.15	0.993	1.01
515	1.031	1.00	0.925	0.91	0.935	1.06	1.078	0.96	0.992	0.94
520	1.030	0.93	0.924	0.85	0.933	1.16	1.079	0.93	0.992	0.91
525	1.031	0.95	0.924	0.75	0.933	0.87	1.077	0.87	0.991	0.80
530	1.032	0.84	0.926	0.58	0.933	0.90	1.079	0.99	0.992	0.78
535	1.030	0.93	0.922	0.81	0.932	0.81	1.074	0.75	0.990	0.78
540	1.031	0.74	0.922	0.69	0.932	0.69	1.076	0.80	0.990	0.69
545	1.032	0.84	0.922	0.73	0.932	0.85	1.076	0.94	0.991	0.76
550	1.032	0.69	0.923	0.63	0.933	0.68	1.077	0.81	0.991	0.65
555	1.034	0.81	0.922	0.63	0.931	0.76	1.076	0.67	0.991	0.67
560	1.029	0.68	0.920	0.57	0.930	0.49	1.076	0.59	0.989	0.55
565	1.032	0.82	0.919	0.67	0.931	0.70	1.078	0.68	0.990	0.65
570	1.031	0.82	0.919	0.79	0.930	0.86	1.078	0.56	0.990	0.68
575	1.031	0.67	0.918	0.53	0.930	0.61	1.077	0.69	0.989	0.57
580	1.033	0.60	0.920	0.64	0.929	0.65	1.077	0.58	0.990	0.58
585	1.031	0.60	0.919	0.57	0.929	0.55	1.078	0.58	0.989	0.52
590	1.032	0.91	0.920	0.65	0.932	0.63	1.080	0.61	0.991	0.64
595	1.032	0.90	0.916	0.66	0.930	0.60	1.078	0.66	0.989	0.64
600	1.035	0.73	0.920	0.53	0.931	0.49	1.081	0.85	0.992	0.60
605	1.036	0.57	0.917	0.46	0.930	0.56	1.080	0.35	0.991	0.42
610	1.035	0.99	0.918	0.48	0.931	0.89	1.081	0.49	0.991	0.66
615	1.037	0.83	0.917	0.63	0.931	0.70	1.079	0.81	0.991	0.63
620	1.038	0.98	0.917	0.50	0.932	0.49	1.080	0.53	0.992	0.51
625	1.038	0.48	0.919	0.76	0.934	0.63	1.082	0.71	0.993	0.57
630	1.036	0.77	0.916	0.79	0.930	0.83	1.082	0.45	0.991	0.65
635	1.037	0.65	0.917	0.45	0.932	0.38	1.081	0.84	0.992	0.49
640	1.039	0.55	0.916	0.49	0.932	0.55	1.081	0.72	0.992	0.54
645	1.040	0.71	0.921	0.66	0.935	0.57	1.084	0.61	0.995	0.57
650	1.037	0.92	0.920	0.88	0.934	0.54	1.082	0.71	0.993	0.71
655	1.040	0.98	0.916	0.71	0.933	0.77	1.081	0.67	0.993	0.75
660	1.040	0.80	0.918	0.86	0.933	0.38	1.083	0.78	0.993	0.56
665	1.045	0.86	0.914	0.57	0.934	0.79	1.080	0.51	0.994	0.66
670	1.044	0.96	0.917	0.69	0.936	0.60	1.082	0.99	0.995	0.69
675	1.042	0.75	0.914	0.87	0.934	0.78	1.083	0.57	0.993	0.70
680	1.041	0.85	0.915	1.05	0.934	0.47	1.077	0.99	0.992	0.67
685	1.041	0.67	0.916	0.40	0.932	0.73	1.080	1.24	0.992	0.67
690	1.046	1.26	0.917	1.07	0.934	0.53	1.080	1.31	0.994	0.86
695	1.043	0.86	0.918	1.05	0.932	0.33	1.080	0.74	0.993	0.63
700	1.041	0.76	0.918	0.94	0.934	0.66	1.085	0.58	0.995	0.50
705	1.048	1.39	0.914	1.01	0.932	0.83	1.085	1.35	0.995	1.07
710	1.048	1.53	0.915	0.95	0.930	0.96	1.092	0.90	0.996	0.84
715	1.041	0.43	0.918	1.13	0.941	0.74	1.084	0.66	0.996	0.61
720	1.042	0.66	0.919	1.69	0.943	0.52	1.088	1.67	0.998	0.78
725	1.051	0.76	0.913	1.32	0.933	0.17	1.086	1.47	0.996	0.81
730	1.046	1.29	0.917	1.32	0.938	0.76	1.087	1.17	0.997	0.72

-45°/-15° BIDIRECTIONAL ABSOLUTE SPECTRAL REFLECTANCE FACTORS

WAV. [nm]	Bss mean	Bss coeff. var.	Bsp mean	Bsp coeff. var.	Bps mean	Bps coeff. var.	Bpp mean	Bpp coeff. var.	Brr mean	Brr coeff. var.
390	1.012	0.38	0.900	0.84	0.918	0.48	1.002	1.07	0.958	0.28
395	1.028	0.78	0.933	0.62	0.947	0.79	1.034	0.60	0.985	0.65
400	1.026	0.75	0.927	0.71	0.942	0.92	1.037	0.61	0.983	0.60
405	1.034	0.81	0.938	0.91	0.951	1.10	1.051	0.67	0.994	0.80
410	1.041	1.01	0.939	0.69	0.954	0.90	1.050	0.97	0.996	0.85
415	1.041	1.13	0.942	0.82	0.956	1.15	1.058	1.13	0.999	1.02
420	1.041	1.19	0.943	0.87	0.955	1.17	1.056	1.36	0.999	1.11
425	1.043	1.19	0.945	0.97	0.956	1.24	1.059	1.17	1.001	1.10
430	1.043	1.47	0.944	1.05	0.955	1.18	1.059	1.36	1.000	1.22
435	1.043	1.31	0.943	1.11	0.955	1.26	1.059	1.30	1.000	1.20
440	1.045	1.39	0.946	1.14	0.959	1.43	1.062	1.42	1.003	1.30
445	1.046	1.47	0.943	1.07	0.957	1.35	1.059	1.35	1.001	1.26
450	1.046	1.47	0.944	1.09	0.957	1.20	1.060	1.22	1.002	1.20
455	1.045	1.46	0.945	1.03	0.957	1.23	1.061	1.30	1.002	1.21
460	1.046	1.34	0.943	1.03	0.957	1.26	1.060	1.22	1.002	1.17
465	1.052	1.22	0.937	1.12	0.964	1.26	1.056	1.20	1.002	1.16
470	1.047	1.30	0.942	0.99	0.957	1.14	1.061	1.23	1.002	1.12
475	1.048	1.40	0.940	0.99	0.958	1.18	1.061	1.27	1.002	1.17
480	1.046	1.22	0.939	1.01	0.957	1.12	1.060	1.10	1.001	1.07
485	1.047	1.30	0.940	1.07	0.957	1.18	1.061	1.12	1.001	1.12
490	1.048	1.16	0.939	1.02	0.956	1.18	1.060	1.08	1.001	1.07
495	1.046	1.22	0.939	1.13	0.953	1.13	1.059	1.16	0.999	1.12
500	1.045	1.03	0.938	0.86	0.954	1.06	1.059	1.03	0.999	0.95
505	1.047	0.93	0.938	0.79	0.954	0.97	1.059	0.99	1.000	0.88
510	1.047	0.88	0.938	0.79	0.955	0.96	1.060	0.97	1.000	0.87
515	1.045	0.99	0.937	0.88	0.952	0.90	1.060	1.04	0.999	0.92
520	1.046	0.83	0.936	0.84	0.952	0.85	1.059	0.97	0.998	0.83
525	1.045	0.79	0.936	0.57	0.952	0.76	1.058	0.80	0.998	0.71
530	1.047	0.97	0.937	0.53	0.950	0.86	1.059	0.76	0.998	0.74
535	1.044	1.01	0.935	0.44	0.950	0.82	1.058	0.83	0.997	0.74
540	1.046	0.92	0.934	0.47	0.951	0.70	1.058	0.73	0.997	0.66
545	1.046	0.81	0.933	0.57	0.951	0.75	1.058	0.93	0.997	0.72
550	1.046	0.76	0.933	0.45	0.951	0.86	1.058	0.97	0.997	0.72
555	1.046	0.82	0.933	0.55	0.951	0.56	1.057	0.83	0.997	0.66
560	1.046	0.57	0.931	0.54	0.949	0.62	1.056	0.46	0.996	0.50
565	1.046	0.76	0.931	0.51	0.949	0.61	1.057	0.55	0.996	0.58
570	1.047	0.74	0.931	0.39	0.948	0.71	1.056	0.67	0.995	0.60
575	1.046	0.74	0.929	0.46	0.949	0.64	1.056	0.69	0.995	0.58
580	1.046	0.72	0.932	0.61	0.950	0.59	1.056	0.80	0.996	0.63
585	1.047	0.68	0.929	0.56	0.951	0.47	1.056	0.61	0.996	0.52
590	1.047	0.73	0.931	0.56	0.952	0.34	1.058	0.60	0.997	0.51
595	1.048	0.76	0.929	0.36	0.951	0.68	1.058	0.57	0.997	0.52
600	1.049	0.58	0.929	0.33	0.951	0.33	1.057	0.52	0.997	0.38
605	1.050	0.61	0.930	0.42	0.950	0.41	1.057	0.46	0.997	0.42
610	1.051	0.53	0.930	0.86	0.953	0.44	1.058	0.68	0.998	0.58
615	1.050	0.71	0.930	0.51	0.949	0.46	1.058	0.49	0.997	0.50
620	1.052	0.82	0.931	0.35	0.953	0.45	1.061	0.59	0.999	0.53
625	1.054	0.50	0.931	0.52	0.952	0.76	1.061	0.50	0.999	0.50
630	1.057	0.89	0.931	0.43	0.951	0.51	1.061	0.77	1.000	0.59
635	1.054	0.70	0.931	0.24	0.951	0.40	1.060	0.40	0.999	0.39
640	1.055	0.75	0.930	0.45	0.954	0.53	1.062	0.42	1.000	0.36
645	1.059	0.59	0.931	0.45	0.956	0.58	1.063	0.41	1.002	0.48
650	1.058	0.52	0.930	0.76	0.955	0.58	1.060	0.58	1.001	0.52
655	1.054	0.85	0.927	0.72	0.953	0.63	1.059	0.71	0.998	0.66
660	1.055	1.02	0.927	0.95	0.953	0.81	1.060	0.67	0.999	0.75
665	1.055	0.74	0.925	0.81	0.955	0.48	1.062	0.70	0.999	0.65
670	1.057	0.76	0.927	0.54	0.956	0.62	1.064	0.94	1.001	0.61
675	1.057	0.54	0.927	0.61	0.952	0.72	1.060	0.70	0.999	0.57
680	1.055	0.50	0.927	0.75	0.955	0.34	1.056	0.44	0.998	0.42
685	1.057	0.49	0.927	0.84	0.949	0.64	1.063	0.71	0.999	0.54
690	1.059	0.81	0.931	0.67	0.955	0.91	1.061	0.53	1.001	0.59
695	1.061	1.19	0.926	1.08	0.954	0.42	1.063	0.51	1.001	0.67
700	1.067	1.07	0.935	0.59	0.955	0.71	1.068	1.06	1.006	0.71
705	1.063	1.23	0.927	0.71	0.954	1.01	1.064	0.56	1.002	0.76
710	1.064	0.93	0.931	1.06	0.952	0.98	1.063	0.99	1.003	0.88
715	1.065	1.03	0.931	0.66	0.953	1.61	1.063	0.60	1.003	0.89
720	1.070	0.57	0.935	1.15	0.958	1.06	1.063	1.47	1.006	0.58
725	1.062	0.72	0.925	0.99	0.951	0.70	1.063	1.85	1.000	0.85
730	1.070	1.45	0.927	0.45	0.958	0.54	1.068	0.86	1.006	0.58

-45°/ 0° BIDIRECTIONAL ABSOLUTE SPECTRAL REFLECTANCE FACTORS

WAV. [nm]	Bss mean	Bss coeff. var.	Bsp mean	Bsp coeff. var.	Bps mean	Bps coeff. var.	Bpp mean	Bpp coeff. var.	Brr mean	Brr coeff. var.
390	1.029	1.14	0.910	1.41	0.928	0.30	0.998	0.85	0.966	0.85
395	1.061	0.69	0.940	0.62	0.962	0.88	1.032	0.54	0.999	0.63
400	1.054	0.78	0.938	0.70	0.959	1.36	1.033	0.76	0.996	0.84
405	1.069	1.26	0.949	0.71	0.968	1.01	1.046	0.75	1.008	0.88
410	1.070	1.11	0.955	1.00	0.970	1.23	1.049	0.28	1.011	0.84
415	1.076	1.19	0.956	0.54	0.970	1.18	1.052	0.65	1.013	0.88
420	1.074	1.39	0.957	0.70	0.971	1.35	1.054	0.98	1.014	1.06
425	1.076	1.36	0.959	0.74	0.972	1.55	1.056	0.91	1.016	1.11
430	1.078	1.41	0.960	0.68	0.972	1.22	1.057	1.16	1.017	1.09
435	1.078	1.47	0.959	0.81	0.973	1.40	1.055	0.91	1.016	1.12
440	1.078	1.34	0.960	0.96	0.974	1.40	1.060	1.17	1.018	1.18
445	1.080	1.46	0.959	0.91	0.974	1.56	1.057	0.79	1.017	1.13
450	1.080	1.41	0.958	0.95	0.973	1.36	1.058	1.20	1.017	1.20
455	1.079	1.49	0.960	0.95	0.974	1.50	1.059	1.06	1.018	1.22
460	1.080	1.27	0.958	1.01	0.974	1.48	1.057	0.96	1.017	1.14
465	1.086	1.29	0.953	0.75	0.980	1.41	1.052	0.95	1.018	1.08
470	1.081	1.24	0.957	0.76	0.974	1.27	1.058	0.87	1.018	1.01
475	1.082	1.35	0.957	0.90	0.975	1.38	1.058	0.87	1.018	1.09
480	1.080	1.35	0.954	0.71	0.974	1.27	1.057	0.82	1.016	1.01
485	1.081	1.19	0.955	0.67	0.974	1.24	1.057	0.97	1.017	0.99
490	1.082	1.16	0.954	0.65	0.972	1.24	1.056	0.91	1.016	0.95
495	1.081	1.03	0.953	0.67	0.971	1.18	1.056	0.86	1.015	0.90
500	1.079	1.13	0.953	0.61	0.970	1.09	1.055	0.78	1.014	0.86
505	1.079	1.13	0.952	0.65	0.970	1.19	1.055	0.88	1.014	0.92
510	1.079	0.86	0.952	0.44	0.970	1.12	1.055	0.65	1.014	0.74
515	1.080	1.14	0.950	0.43	0.968	1.02	1.054	0.62	1.013	0.79
520	1.080	1.00	0.950	0.44	0.968	0.91	1.053	0.61	1.013	0.70
525	1.078	0.58	0.950	0.42	0.968	0.85	1.052	0.72	1.012	0.60
530	1.078	0.72	0.951	0.42	0.966	0.72	1.054	0.63	1.012	0.59
535	1.078	0.77	0.948	0.38	0.966	0.69	1.051	0.50	1.011	0.55
540	1.079	0.72	0.946	0.55	0.965	0.73	1.052	0.68	1.011	0.63
545	1.080	0.77	0.946	0.20	0.965	0.71	1.050	0.41	1.010	0.51
550	1.080	0.46	0.947	0.32	0.967	0.56	1.051	0.33	1.011	0.38
555	1.078	0.74	0.946	0.26	0.965	0.42	1.050	0.29	1.010	0.39
560	1.077	0.71	0.944	0.29	0.965	0.55	1.048	0.38	1.009	0.43
565	1.079	0.30	0.944	0.10	0.965	0.47	1.050	0.33	1.009	0.28
570	1.082	0.51	0.944	0.35	0.964	0.65	1.048	0.62	1.010	0.49
575	1.079	0.43	0.942	0.46	0.965	0.61	1.049	0.61	1.009	0.44
580	1.079	0.34	0.944	0.24	0.965	0.28	1.051	0.14	1.010	0.23
585	1.079	0.15	0.942	0.46	0.965	0.53	1.050	0.45	1.009	0.28
590	1.083	0.27	0.943	0.21	0.968	0.55	1.050	0.41	1.011	0.21
595	1.083	0.47	0.941	0.39	0.966	0.46	1.047	0.23	1.009	0.29
600	1.084	0.65	0.946	0.29	0.966	0.29	1.050	0.28	1.011	0.33
605	1.086	0.50	0.943	0.75	0.967	0.43	1.049	0.32	1.011	0.35
610	1.088	0.66	0.944	0.36	0.971	0.44	1.054	0.28	1.014	0.39
615	1.086	0.66	0.942	0.35	0.966	0.38	1.051	0.28	1.011	0.25
620	1.088	0.28	0.941	0.30	0.969	0.25	1.054	0.25	1.013	0.24
625	1.087	0.35	0.943	0.42	0.965	0.28	1.051	0.04	1.012	0.26
630	1.091	0.53	0.944	0.37	0.966	0.40	1.049	0.47	1.013	0.42
635	1.089	0.59	0.942	0.42	0.969	0.27	1.053	0.44	1.014	0.36
640	1.089	0.52	0.944	0.13	0.968	0.42	1.052	0.51	1.013	0.35
645	1.089	0.68	0.944	0.28	0.971	0.59	1.056	0.51	1.015	0.47
650	1.093	0.84	0.944	0.33	0.971	0.28	1.054	0.64	1.016	0.45
655	1.088	0.65	0.943	0.35	0.971	0.42	1.053	0.51	1.014	0.39
660	1.092	1.00	0.942	0.22	0.971	0.21	1.051	0.27	1.014	0.34
665	1.093	0.76	0.941	0.14	0.970	0.47	1.055	0.38	1.015	0.41
670	1.093	0.83	0.944	0.31	0.973	0.81	1.057	0.62	1.017	0.55
675	1.094	0.33	0.943	0.64	0.970	0.29	1.052	0.65	1.014	0.37
680	1.097	0.64	0.940	0.88	0.970	0.54	1.051	0.69	1.014	0.49
685	1.095	0.46	0.941	1.04	0.967	0.39	1.054	1.30	1.015	0.67
690	1.094	0.41	0.939	1.36	0.973	0.16	1.050	0.55	1.014	0.50
695	1.093	0.62	0.939	0.47	0.970	0.56	1.053	0.33	1.014	0.47
700	1.098	0.76	0.943	1.00	0.971	0.93	1.054	0.09	1.017	0.52
705	1.096	1.10	0.939	0.47	0.967	1.14	1.055	1.25	1.014	0.88
710	1.102	0.57	0.943	1.53	0.972	0.12	1.056	1.30	1.018	0.84
715	1.094	0.85	0.944	0.49	0.979	0.78	1.055	0.18	1.018	0.38
720	1.096	0.44	0.946	1.14	0.971	1.16	1.055	0.55	1.017	0.38
725	1.104	0.36	0.950	1.64	0.974	0.68	1.052	1.38	1.020	0.71
730	1.099	1.39	0.944	1.20	0.983	1.11	1.058	0.14	1.021	0.71

-45°/ 15° BIDIRECTIONAL ABSOLUTE SPECTRAL REFLECTANCE FACTORS

WAV. [nm]	Bss mean	Bss coeff. var.	Bsp mean	Bsp coeff. var.	Bps mean	Bps coeff. var.	Bpp mean	Bpp coeff. var.	Brr mean	Brr coeff. var.
390	1.075	0.35	0.924	1.34	0.938	1.64	0.997	1.81	0.984	0.60
395	1.098	0.74	0.952	0.82	0.965	0.98	1.030	0.88	1.011	0.60
400	1.097	0.68	0.946	0.80	0.960	0.73	1.027	1.45	1.008	0.80
405	1.110	0.96	0.955	0.57	0.972	0.93	1.039	0.97	1.019	0.77
410	1.111	1.04	0.958	0.61	0.972	0.92	1.042	1.55	1.021	0.91
415	1.115	0.87	0.962	0.91	0.976	1.07	1.048	1.36	1.025	0.96
420	1.117	1.14	0.966	1.07	0.974	1.11	1.050	1.28	1.027	1.07
425	1.118	1.20	0.964	1.02	0.975	1.26	1.051	1.54	1.027	1.19
430	1.118	1.39	0.963	1.17	0.975	1.36	1.050	1.62	1.027	1.28
435	1.120	1.39	0.962	1.16	0.977	1.54	1.049	1.60	1.027	1.35
440	1.122	1.47	0.964	1.13	0.977	1.38	1.053	1.29	1.029	1.22
445	1.122	1.42	0.964	1.00	0.977	1.36	1.050	1.65	1.028	1.29
450	1.122	1.55	0.964	1.23	0.977	1.41	1.051	1.68	1.029	1.41
455	1.123	1.41	0.965	1.07	0.977	1.41	1.054	1.45	1.030	1.28
460	1.124	1.23	0.962	1.07	0.978	1.35	1.051	1.40	1.029	1.20
465	1.129	1.24	0.957	0.95	0.983	1.36	1.047	1.32	1.029	1.15
470	1.123	1.20	0.963	1.11	0.977	1.40	1.053	1.45	1.029	1.22
475	1.123	1.23	0.960	1.12	0.978	1.39	1.051	1.52	1.028	1.24
480	1.123	1.35	0.960	0.99	0.976	1.19	1.050	1.32	1.027	1.16
485	1.125	1.25	0.961	1.01	0.977	1.18	1.050	1.43	1.028	1.17
490	1.123	1.24	0.959	0.89	0.977	1.14	1.050	1.35	1.027	1.12
495	1.122	1.24	0.960	0.99	0.975	1.25	1.049	1.34	1.027	1.14
500	1.124	1.20	0.959	0.89	0.973	0.89	1.048	1.32	1.026	1.03
505	1.124	1.06	0.959	0.88	0.975	0.98	1.049	1.20	1.027	0.96
510	1.126	1.16	0.958	0.81	0.974	1.00	1.048	1.29	1.026	1.00
515	1.124	0.88	0.957	0.76	0.972	1.03	1.047	1.27	1.025	0.93
520	1.124	0.92	0.955	0.72	0.973	0.92	1.046	1.14	1.025	0.87
525	1.123	0.72	0.957	0.64	0.972	0.74	1.047	1.16	1.025	0.75
530	1.123	0.66	0.958	0.64	0.971	0.75	1.046	1.24	1.025	0.74
535	1.124	0.67	0.954	0.73	0.970	0.91	1.046	1.05	1.024	0.80
540	1.125	0.67	0.955	0.67	0.971	0.97	1.047	1.10	1.025	0.81
545	1.125	0.90	0.954	0.62	0.971	0.84	1.043	1.11	1.023	0.84
550	1.125	0.63	0.955	0.68	0.971	0.70	1.044	1.05	1.024	0.71
555	1.126	0.65	0.952	0.84	0.970	0.76	1.044	0.95	1.023	0.75
560	1.126	0.72	0.950	0.57	0.970	0.78	1.043	0.73	1.022	0.64
565	1.125	0.86	0.951	0.50	0.971	0.60	1.044	0.78	1.023	0.64
570	1.125	0.67	0.952	0.66	0.970	0.62	1.042	0.72	1.022	0.64
575	1.125	0.82	0.952	0.57	0.969	0.64	1.042	1.09	1.022	0.72
580	1.129	0.53	0.953	0.62	0.971	0.46	1.041	0.78	1.024	0.52
585	1.129	0.39	0.951	0.57	0.971	0.45	1.042	0.93	1.023	0.54
590	1.132	0.59	0.952	0.33	0.972	0.59	1.045	0.75	1.025	0.53
595	1.132	0.54	0.952	0.47	0.971	0.57	1.043	1.06	1.025	0.62
600	1.130	0.54	0.950	0.41	0.970	0.41	1.045	0.68	1.024	0.45
605	1.132	0.62	0.952	0.64	0.971	0.55	1.044	0.87	1.025	0.62
610	1.135	0.54	0.951	0.73	0.973	0.42	1.046	0.62	1.027	0.55
615	1.130	0.41	0.951	0.49	0.970	0.42	1.044	0.76	1.024	0.49
620	1.134	0.55	0.952	0.53	0.971	0.49	1.046	1.00	1.026	0.55
625	1.132	0.24	0.953	0.60	0.974	0.57	1.047	1.14	1.027	0.60
630	1.134	0.84	0.951	0.49	0.973	0.32	1.046	1.00	1.026	0.63
635	1.131	0.57	0.949	0.56	0.971	0.59	1.044	0.96	1.024	0.56
640	1.138	0.47	0.951	0.48	0.975	0.25	1.042	0.88	1.027	0.43
645	1.138	0.53	0.951	0.60	0.977	0.77	1.047	0.89	1.028	0.59
650	1.146	0.53	0.953	0.96	0.977	0.73	1.046	1.01	1.030	0.74
655	1.140	0.81	0.949	0.43	0.975	0.89	1.046	0.99	1.028	0.74
660	1.141	0.48	0.952	0.65	0.974	0.54	1.044	1.25	1.028	0.63
665	1.142	0.29	0.951	0.80	0.978	0.67	1.046	0.80	1.029	0.52
670	1.148	0.52	0.952	0.50	0.979	0.68	1.047	1.00	1.032	0.57
675	1.144	0.77	0.948	0.64	0.972	0.79	1.044	1.03	1.027	0.74
680	1.145	0.38	0.948	0.53	0.977	0.79	1.043	1.00	1.028	0.64
685	1.143	0.64	0.953	0.83	0.975	0.53	1.042	1.12	1.028	0.72
690	1.149	0.62	0.952	0.58	0.973	0.83	1.047	1.48	1.031	0.76
695	1.148	0.61	0.951	0.89	0.973	0.76	1.044	0.98	1.029	0.77
700	1.150	0.83	0.952	0.56	0.980	1.01	1.051	0.99	1.033	0.79
705	1.148	0.58	0.951	0.95	0.978	0.61	1.043	1.42	1.030	0.76
710	1.151	1.04	0.949	0.97	0.978	0.87	1.047	1.97	1.031	1.09
715	1.150	0.96	0.951	0.86	0.983	0.58	1.047	1.08	1.033	0.77
720	1.145	0.78	0.950	0.52	0.979	0.47	1.046	1.40	1.030	0.53
725	1.150	0.80	0.952	1.56	0.979	0.51	1.042	1.36	1.031	0.99
730	1.153	0.31	0.950	0.44	0.980	0.59	1.047	2.21	1.033	0.78

-45°/ 30° BIDIRECTIONAL ABSOLUTE SPECTRAL REFLECTANCE FACTORS

WAV. [nm]	Bss		Bsp		Bps		Bpp		Brr	
	mean	coeff. var.	mean	coeff. var.	mean	coeff. var.	mean	coeff. var.	mean	coeff. var.
390	1.139	0.95	0.931	0.59	0.937	0.52	1.023	1.50	1.007	0.38
395	1.167	0.74	0.958	0.70	0.962	0.74	1.047	1.10	1.034	0.72
400	1.163	1.07	0.954	0.82	0.961	1.16	1.043	0.20	1.030	0.60
405	1.176	1.07	0.964	0.71	0.974	0.77	1.056	0.71	1.042	0.74
410	1.180	1.15	0.966	1.06	0.974	1.02	1.059	0.83	1.045	0.87
415	1.184	1.13	0.972	0.75	0.974	1.12	1.063	1.04	1.048	0.92
420	1.182	1.26	0.971	0.85	0.975	1.15	1.063	0.82	1.048	0.97
425	1.187	1.20	0.974	0.93	0.977	1.32	1.064	1.05	1.050	1.05
430	1.183	1.44	0.972	1.16	0.975	1.32	1.062	1.12	1.048	1.16
435	1.187	1.40	0.972	1.19	0.976	1.38	1.065	1.16	1.050	1.21
440	1.189	1.46	0.973	1.14	0.978	1.31	1.066	1.14	1.051	1.20
445	1.191	1.47	0.973	1.09	0.977	1.28	1.065	1.07	1.051	1.17
450	1.189	1.46	0.973	1.03	0.977	1.25	1.066	1.00	1.051	1.13
455	1.190	1.50	0.974	1.15	0.978	1.45	1.067	1.09	1.052	1.22
460	1.192	1.45	0.972	0.96	0.978	1.24	1.065	1.08	1.052	1.11
465	1.199	1.41	0.966	1.06	0.985	1.23	1.059	1.14	1.052	1.15
470	1.192	1.45	0.972	1.22	0.977	1.27	1.066	0.93	1.052	1.15
475	1.193	1.27	0.971	1.08	0.979	1.13	1.064	0.95	1.052	1.04
480	1.193	1.23	0.971	1.13	0.977	1.05	1.063	0.92	1.051	1.00
485	1.195	1.24	0.969	1.03	0.977	1.27	1.064	0.98	1.051	1.04
490	1.196	1.35	0.969	1.13	0.977	1.06	1.064	0.82	1.051	1.03
495	1.196	1.21	0.969	1.11	0.975	1.15	1.064	0.77	1.051	1.00
500	1.196	1.00	0.968	1.03	0.974	1.07	1.062	0.85	1.050	0.92
505	1.195	1.07	0.968	0.99	0.976	1.08	1.063	1.00	1.050	0.97
510	1.194	1.06	0.969	0.77	0.975	0.94	1.063	1.00	1.050	0.88
515	1.196	1.06	0.967	0.78	0.973	0.93	1.061	0.94	1.049	0.82
520	1.194	1.05	0.965	0.77	0.973	0.85	1.059	0.70	1.048	0.76
525	1.196	0.84	0.966	0.63	0.972	0.74	1.059	0.70	1.048	0.62
530	1.197	0.73	0.967	0.67	0.972	0.91	1.060	0.62	1.049	0.65
535	1.196	0.76	0.965	0.67	0.971	0.83	1.058	0.67	1.047	0.65
540	1.197	0.61	0.965	0.77	0.971	0.67	1.059	0.66	1.048	0.59
545	1.199	0.67	0.965	0.82	0.972	0.61	1.059	0.72	1.049	0.65
550	1.198	0.69	0.964	0.47	0.971	0.49	1.057	0.61	1.047	0.51
555	1.197	0.49	0.963	0.66	0.971	0.51	1.057	0.54	1.047	0.44
560	1.198	0.71	0.962	0.54	0.968	0.45	1.057	0.39	1.046	0.43
565	1.198	0.71	0.961	0.47	0.970	0.67	1.057	0.40	1.047	0.44
570	1.198	0.77	0.960	0.57	0.970	0.66	1.056	0.50	1.046	0.56
575	1.197	0.61	0.960	0.51	0.970	0.54	1.056	0.50	1.046	0.40
580	1.202	0.46	0.962	0.40	0.969	0.32	1.057	0.42	1.048	0.30
585	1.202	0.49	0.962	0.62	0.972	0.65	1.054	0.39	1.047	0.45
590	1.201	0.49	0.962	0.34	0.972	0.54	1.057	0.36	1.048	0.36
595	1.203	0.67	0.962	0.60	0.969	0.55	1.056	0.47	1.047	0.48
600	1.204	0.50	0.962	0.36	0.971	0.49	1.059	0.38	1.049	0.31
605	1.206	0.65	0.960	0.62	0.972	0.51	1.058	0.67	1.049	0.54
610	1.208	0.48	0.961	0.82	0.971	0.14	1.057	0.57	1.049	0.41
615	1.207	0.46	0.960	0.49	0.971	0.48	1.058	0.26	1.049	0.36
620	1.207	0.33	0.961	0.43	0.974	0.59	1.060	0.69	1.050	0.41
625	1.208	0.91	0.962	0.67	0.971	0.61	1.062	0.54	1.051	0.64
630	1.212	0.66	0.961	0.56	0.973	0.29	1.060	0.46	1.051	0.40
635	1.211	0.63	0.959	0.37	0.975	0.62	1.059	0.30	1.051	0.38
640	1.212	0.44	0.961	0.25	0.972	0.66	1.059	0.42	1.051	0.38
645	1.217	0.90	0.965	0.45	0.977	0.32	1.059	0.27	1.055	0.45
650	1.220	0.91	0.966	0.33	0.976	0.35	1.060	0.86	1.056	0.53
655	1.218	0.36	0.963	0.72	0.977	0.52	1.057	0.65	1.054	0.53
660	1.217	0.36	0.960	0.72	0.977	0.72	1.059	0.53	1.053	0.51
665	1.218	0.72	0.958	0.47	0.974	0.36	1.060	0.87	1.053	0.53
670	1.224	0.96	0.962	0.67	0.975	0.72	1.061	0.55	1.056	0.54
675	1.222	0.70	0.958	0.78	0.975	0.34	1.059	0.67	1.053	0.57
680	1.222	0.80	0.958	0.76	0.976	0.41	1.057	0.67	1.053	0.59
685	1.225	0.75	0.959	0.94	0.976	0.66	1.059	0.73	1.055	0.74
690	1.223	0.49	0.961	0.54	0.977	0.20	1.053	0.87	1.054	0.27
695	1.220	0.47	0.962	0.84	0.979	0.48	1.064	1.14	1.056	0.61
700	1.224	1.25	0.962	0.84	0.982	0.80	1.056	0.62	1.056	0.74
705	1.223	0.99	0.961	0.91	0.980	0.59	1.055	0.93	1.055	0.74
710	1.226	1.34	0.964	0.91	0.979	0.72	1.058	0.81	1.057	0.92
715	1.231	0.57	0.966	0.57	0.982	1.07	1.063	0.88	1.061	0.68
720	1.229	0.32	0.962	1.21	0.976	0.56	1.058	0.64	1.056	0.49
725	1.228	1.10	0.960	1.17	0.980	0.34	1.060	1.14	1.057	0.73
730	1.221	0.27	0.961	0.37	0.975	1.22	1.056	0.84	1.053	0.44

-45°/ 45° BIDIRECTIONAL ABSOLUTE SPECTRAL REFLECTANCE FACTORS

WAV. [nm]	Bss mean	Bss coeff. var.	Bsp mean	Bsp coeff. var.	Bps mean	Bps coeff. var.	Bpp mean	Bpp coeff. var.	Brr mean	Brr coeff. var.
390	1.236	1.26	0.935	0.29	0.931	0.56	1.051	0.67	1.038	0.54
395	1.262	0.78	0.961	0.49	0.955	0.69	1.069	0.74	1.062	0.48
400	1.259	1.15	0.961	0.61	0.955	0.98	1.072	0.96	1.062	0.80
405	1.276	1.22	0.968	0.72	0.961	0.57	1.081	0.75	1.071	0.71
410	1.280	1.33	0.968	0.94	0.966	1.35	1.083	1.10	1.074	1.05
415	1.285	1.46	0.974	0.96	0.969	1.17	1.087	0.98	1.079	0.99
420	1.287	1.64	0.974	0.76	0.966	1.29	1.090	1.18	1.079	1.12
425	1.288	1.63	0.977	0.88	0.969	1.22	1.091	1.23	1.081	1.18
430	1.289	1.82	0.975	1.28	0.968	1.32	1.092	1.18	1.081	1.29
435	1.290	1.82	0.974	1.11	0.968	1.32	1.091	1.18	1.081	1.26
440	1.292	1.71	0.977	0.99	0.970	1.26	1.093	1.08	1.083	1.15
445	1.294	1.80	0.976	1.13	0.969	1.30	1.093	1.26	1.083	1.26
450	1.296	1.58	0.976	1.24	0.968	1.37	1.094	1.29	1.084	1.26
455	1.296	1.46	0.977	1.01	0.969	1.29	1.094	1.18	1.084	1.12
460	1.298	1.40	0.974	0.91	0.969	1.22	1.092	1.10	1.083	1.05
465	1.305	1.42	0.970	0.94	0.975	1.17	1.087	1.01	1.084	1.05
470	1.300	1.39	0.975	1.10	0.971	1.23	1.094	0.97	1.085	1.06
475	1.300	1.38	0.974	1.03	0.971	1.33	1.092	1.05	1.084	1.08
480	1.299	1.40	0.973	1.05	0.969	1.25	1.091	0.95	1.083	1.07
485	1.299	1.25	0.973	1.02	0.969	1.24	1.092	0.96	1.083	1.03
490	1.300	1.40	0.972	0.85	0.968	1.19	1.092	1.09	1.083	1.06
495	1.298	1.42	0.972	0.96	0.967	1.08	1.092	1.13	1.082	1.06
500	1.301	1.22	0.971	0.81	0.967	1.11	1.092	0.90	1.083	0.93
505	1.303	1.13	0.972	0.81	0.967	1.03	1.092	1.09	1.083	0.90
510	1.303	1.32	0.972	0.84	0.966	1.00	1.091	0.96	1.083	0.96
515	1.306	1.32	0.970	0.88	0.964	0.86	1.092	0.87	1.083	0.91
520	1.305	1.20	0.969	0.68	0.964	0.81	1.090	0.70	1.082	0.75
525	1.303	1.13	0.969	0.56	0.964	0.83	1.088	0.62	1.081	0.70
530	1.306	1.20	0.970	0.61	0.963	1.10	1.087	0.64	1.082	0.78
535	1.304	1.02	0.968	0.58	0.962	0.83	1.089	0.67	1.081	0.67
540	1.305	0.68	0.967	0.55	0.963	0.80	1.090	0.93	1.081	0.63
545	1.306	0.53	0.967	0.56	0.962	0.68	1.088	0.78	1.081	0.55
550	1.311	0.50	0.965	0.65	0.963	0.73	1.087	1.02	1.081	0.64
555	1.310	0.52	0.967	0.53	0.962	0.73	1.088	0.73	1.082	0.50
560	1.310	0.64	0.965	0.57	0.962	0.54	1.087	0.70	1.081	0.46
565	1.311	0.54	0.965	0.42	0.962	0.43	1.089	0.70	1.082	0.34
570	1.314	0.41	0.964	0.74	0.961	0.55	1.087	0.51	1.082	0.46
575	1.311	0.46	0.963	0.53	0.961	0.42	1.086	0.62	1.080	0.37
580	1.314	0.51	0.965	0.38	0.961	0.52	1.086	0.58	1.082	0.39
585	1.313	0.72	0.963	0.47	0.963	0.55	1.087	0.68	1.081	0.45
590	1.316	0.34	0.965	0.56	0.965	0.16	1.087	0.55	1.083	0.22
595	1.317	0.48	0.965	0.45	0.962	0.40	1.086	0.53	1.082	0.31
600	1.319	0.44	0.965	0.48	0.963	0.28	1.088	0.44	1.084	0.26
605	1.317	0.46	0.964	0.51	0.963	0.46	1.088	0.50	1.083	0.33
610	1.322	0.49	0.965	0.36	0.964	0.35	1.091	0.63	1.085	0.34
615	1.319	0.61	0.965	0.20	0.962	0.54	1.089	0.47	1.083	0.41
620	1.325	0.67	0.967	0.53	0.962	0.74	1.090	0.46	1.086	0.50
625	1.327	0.62	0.967	0.66	0.964	0.65	1.089	0.78	1.087	0.59
630	1.329	0.95	0.967	0.45	0.964	0.65	1.088	0.74	1.087	0.62
635	1.326	0.31	0.966	0.29	0.966	0.65	1.088	0.62	1.087	0.35
640	1.327	0.64	0.966	0.55	0.965	0.71	1.087	0.56	1.086	0.48
645	1.331	0.46	0.966	0.35	0.967	0.48	1.088	0.81	1.088	0.40
650	1.329	0.54	0.964	0.33	0.968	0.46	1.090	0.82	1.088	0.47
655	1.328	0.88	0.963	0.33	0.966	0.50	1.087	0.47	1.086	0.44
660	1.333	0.47	0.965	0.48	0.964	0.51	1.091	0.75	1.088	0.46
665	1.333	0.62	0.964	0.69	0.965	0.54	1.087	0.79	1.087	0.59
670	1.335	0.58	0.962	0.68	0.969	0.80	1.090	0.87	1.089	0.63
675	1.337	0.92	0.965	0.85	0.966	0.89	1.088	0.66	1.089	0.77
680	1.342	0.60	0.963	0.70	0.964	0.30	1.086	0.71	1.089	0.49
685	1.337	0.88	0.962	0.35	0.966	0.56	1.087	0.66	1.088	0.51
690	1.345	1.27	0.966	0.85	0.967	0.45	1.086	1.00	1.091	0.82
695	1.342	0.74	0.962	0.68	0.968	0.60	1.087	1.04	1.090	0.56
700	1.342	0.43	0.976	0.66	0.971	0.66	1.089	0.54	1.094	0.42
705	1.340	0.46	0.969	0.40	0.968	0.54	1.088	1.13	1.091	0.46
710	1.347	1.11	0.968	1.15	0.969	1.14	1.090	0.86	1.094	0.85
715	1.349	0.87	0.966	1.09	0.969	0.38	1.091	0.91	1.094	0.71
720	1.351	0.84	0.961	0.62	0.966	0.65	1.096	0.96	1.093	0.55
725	1.346	0.83	0.970	1.01	0.970	0.14	1.082	0.75	1.092	0.57
730	1.345	1.22	0.965	0.77	0.968	0.68	1.092	0.37	1.092	0.62

-45°/ 60° BIDIRECTIONAL ABSOLUTE SPECTRAL REFLECTANCE FACTORS

WAV. [nm]	Bss		Bsp		Bps		Bpp		Brr	
	mean	coeff. var.	mean	coeff. var.	mean	coeff. var.	mean	coeff. var.	mean	coeff. var.
390	1.382	1.30	0.935	0.90	0.911	1.03	1.101	0.59	1.082	0.61
395	1.410	1.31	0.957	0.63	0.941	1.04	1.126	0.91	1.108	0.64
400	1.408	1.59	0.956	0.86	0.937	1.04	1.128	0.97	1.107	0.93
405	1.422	1.59	0.962	0.75	0.946	1.39	1.143	0.80	1.118	0.84
410	1.427	1.51	0.967	1.20	0.949	1.20	1.143	1.04	1.121	0.95
415	1.427	1.63	0.972	1.18	0.949	1.22	1.149	1.09	1.124	1.01
420	1.433	1.82	0.971	0.98	0.949	1.18	1.152	1.37	1.126	1.10
425	1.436	1.87	0.972	1.08	0.951	1.26	1.153	1.39	1.128	1.18
430	1.439	1.94	0.970	1.22	0.952	1.49	1.154	1.46	1.129	1.29
435	1.438	1.90	0.971	1.17	0.951	1.51	1.154	1.59	1.128	1.34
440	1.440	1.90	0.972	1.39	0.954	1.37	1.156	1.29	1.130	1.26
445	1.443	2.01	0.970	1.08	0.952	1.32	1.156	1.29	1.130	1.20
450	1.442	1.97	0.972	1.15	0.951	1.47	1.157	1.43	1.130	1.23
455	1.444	1.90	0.973	1.24	0.951	1.47	1.159	1.20	1.132	1.22
460	1.447	1.57	0.970	1.10	0.952	1.36	1.158	1.16	1.132	1.11
465	1.456	1.67	0.964	1.24	0.957	1.38	1.152	1.28	1.132	1.18
470	1.451	1.59	0.970	1.23	0.951	1.29	1.159	1.14	1.133	1.15
475	1.451	1.42	0.970	1.30	0.952	1.36	1.158	1.45	1.133	1.17
480	1.449	1.49	0.968	1.06	0.949	1.43	1.158	1.15	1.131	1.05
485	1.451	1.43	0.969	1.18	0.950	1.35	1.158	1.24	1.132	1.09
490	1.454	1.44	0.967	1.16	0.950	1.38	1.158	1.36	1.132	1.09
495	1.453	1.44	0.967	1.17	0.949	1.28	1.157	1.50	1.131	1.08
500	1.455	1.26	0.967	1.06	0.947	1.18	1.158	1.53	1.132	0.94
505	1.455	1.43	0.966	1.03	0.947	1.31	1.158	1.50	1.132	0.98
510	1.456	1.36	0.966	1.02	0.946	1.24	1.158	1.39	1.131	0.91
515	1.459	1.47	0.965	0.78	0.945	1.29	1.156	1.28	1.131	0.91
520	1.457	1.29	0.964	0.90	0.947	1.16	1.155	1.23	1.131	0.80
525	1.457	1.12	0.965	0.73	0.945	0.84	1.155	1.05	1.130	0.60
530	1.458	0.89	0.965	0.62	0.945	0.91	1.156	1.27	1.131	0.51
535	1.459	1.15	0.963	0.60	0.942	1.02	1.156	1.12	1.130	0.58
540	1.461	1.25	0.963	0.59	0.945	0.94	1.157	1.00	1.131	0.61
545	1.460	1.34	0.962	0.62	0.945	0.96	1.157	0.92	1.131	0.54
550	1.466	1.12	0.962	0.71	0.943	0.76	1.158	1.14	1.132	0.49
555	1.467	1.00	0.961	0.50	0.942	0.78	1.157	1.25	1.132	0.47
560	1.470	0.97	0.959	0.48	0.942	0.81	1.157	0.94	1.132	0.45
565	1.472	1.04	0.960	0.53	0.942	0.78	1.157	0.98	1.133	0.53
570	1.471	0.97	0.959	0.96	0.943	0.79	1.157	1.25	1.132	0.60
575	1.469	1.02	0.958	0.59	0.941	0.68	1.155	1.05	1.131	0.47
580	1.472	0.81	0.958	0.57	0.942	0.68	1.156	0.88	1.132	0.37
585	1.476	0.65	0.959	0.69	0.943	0.57	1.156	1.37	1.134	0.42
590	1.476	0.73	0.959	0.47	0.943	0.62	1.157	1.51	1.134	0.37
595	1.477	1.12	0.958	0.58	0.941	0.61	1.157	1.34	1.133	0.43
600	1.481	1.04	0.958	0.48	0.943	0.59	1.160	1.19	1.136	0.39
605	1.485	0.99	0.959	0.63	0.943	0.74	1.158	1.25	1.136	0.52
610	1.487	0.98	0.960	0.72	0.947	0.73	1.159	1.23	1.138	0.63
615	1.489	1.00	0.959	0.38	0.945	0.54	1.158	1.08	1.138	0.53
620	1.490	0.92	0.960	0.69	0.944	0.93	1.160	1.50	1.139	0.61
625	1.490	0.88	0.961	0.37	0.944	0.82	1.160	1.44	1.139	0.51
630	1.493	1.08	0.959	0.63	0.945	0.74	1.156	1.31	1.138	0.54
635	1.493	0.81	0.958	0.72	0.946	0.77	1.158	1.25	1.139	0.50
640	1.497	0.71	0.958	0.51	0.946	0.53	1.160	1.67	1.140	0.47
645	1.496	0.79	0.960	0.97	0.946	0.72	1.161	1.56	1.141	0.67
650	1.502	0.72	0.957	0.81	0.949	0.74	1.161	1.52	1.142	0.45
655	1.503	0.70	0.958	0.62	0.945	0.73	1.161	1.33	1.142	0.44
660	1.506	1.11	0.960	0.94	0.948	0.81	1.160	1.19	1.143	0.62
665	1.505	0.92	0.958	0.83	0.950	0.71	1.159	1.40	1.143	0.59
670	1.510	1.05	0.959	0.84	0.950	0.88	1.163	1.51	1.145	0.74
675	1.510	0.80	0.957	1.23	0.943	0.81	1.156	1.28	1.142	0.71
680	1.509	0.87	0.958	0.56	0.941	0.99	1.158	1.18	1.142	0.62
685	1.509	1.29	0.959	0.89	0.944	0.82	1.163	1.90	1.144	0.85
690	1.519	1.24	0.962	0.49	0.946	0.89	1.159	1.37	1.146	0.72
695	1.516	1.04	0.962	0.55	0.942	1.11	1.161	1.29	1.145	0.79
700	1.520	1.04	0.961	0.70	0.953	0.87	1.163	1.09	1.149	0.75
705	1.511	1.14	0.960	0.93	0.946	1.37	1.157	1.21	1.143	1.09
710	1.517	1.11	0.959	1.14	0.953	1.46	1.164	1.03	1.148	1.00
715	1.516	0.56	0.963	0.67	0.950	1.15	1.166	1.18	1.149	0.61
720	1.522	0.66	0.959	1.75	0.949	0.10	1.161	1.81	1.148	0.61
725	1.521	1.09	0.960	0.88	0.947	0.70	1.161	1.03	1.147	0.63
730	1.525	0.66	0.961	0.80	0.944	0.83	1.149	1.36	1.145	0.35

-45°/ 75° BIDIRECTIONAL ABSOLUTE SPECTRAL REFLECTANCE FACTORS

WAV. [nm]	Bss mean	Bss coeff. var.	Bsp mean	Bsp coeff. var.	Bps mean	Bps coeff. var.	Bpp mean	Bpp coeff. var.	Brr mean	Brr coeff. var.
390	1.591	1.85	0.904	2.21	0.877	1.70	1.231	1.42	1.150	0.97
395	1.623	1.96	0.934	0.63	0.904	1.25	1.253	1.59	1.178	0.89
400	1.614	2.08	0.931	1.38	0.903	0.99	1.252	1.86	1.175	1.10
405	1.631	2.14	0.938	1.06	0.909	1.24	1.267	1.53	1.186	0.97
410	1.640	2.13	0.942	1.21	0.909	1.31	1.270	1.83	1.190	1.10
415	1.644	2.17	0.945	1.33	0.910	1.57	1.276	1.81	1.194	1.20
420	1.648	2.45	0.946	1.22	0.911	1.56	1.277	1.96	1.195	1.27
425	1.649	2.25	0.947	1.11	0.912	1.72	1.281	1.94	1.197	1.26
430	1.648	2.06	0.945	1.31	0.908	1.57	1.282	1.91	1.196	1.22
435	1.655	2.22	0.945	1.34	0.909	1.80	1.282	2.02	1.198	1.34
440	1.659	2.34	0.944	1.34	0.911	1.82	1.285	1.87	1.200	1.42
445	1.662	2.29	0.944	1.49	0.911	1.66	1.284	1.88	1.200	1.37
450	1.663	2.27	0.945	1.53	0.910	1.79	1.285	1.83	1.201	1.39
455	1.663	2.11	0.947	1.42	0.911	1.67	1.286	2.01	1.202	1.28
460	1.667	2.04	0.943	1.34	0.911	1.65	1.287	2.02	1.202	1.27
465	1.682	1.94	0.937	1.37	0.916	1.65	1.283	1.89	1.204	1.21
470	1.676	1.98	0.944	1.12	0.910	1.63	1.292	2.10	1.205	1.15
475	1.675	2.02	0.943	1.20	0.911	1.64	1.292	2.10	1.205	1.10
480	1.679	1.91	0.941	1.32	0.908	1.47	1.290	1.85	1.205	1.04
485	1.678	1.92	0.941	1.26	0.908	1.52	1.289	2.01	1.204	1.06
490	1.681	2.10	0.939	1.24	0.909	1.45	1.289	2.05	1.204	1.07
495	1.680	1.90	0.939	1.08	0.907	1.57	1.290	2.07	1.204	1.10
500	1.681	1.85	0.939	1.24	0.906	1.40	1.294	1.97	1.205	1.13
505	1.684	1.86	0.940	1.28	0.907	1.35	1.293	2.08	1.206	1.09
510	1.688	1.87	0.939	1.24	0.908	1.46	1.295	2.09	1.207	1.08
515	1.687	1.77	0.937	1.20	0.905	1.40	1.293	1.93	1.205	0.98
520	1.688	1.72	0.937	0.94	0.904	1.27	1.292	2.10	1.205	0.88
525	1.691	1.92	0.937	1.02	0.904	1.22	1.293	2.03	1.206	1.00
530	1.696	1.81	0.937	1.12	0.904	1.21	1.295	2.13	1.208	0.99
535	1.695	1.72	0.935	1.03	0.902	1.20	1.295	2.10	1.207	0.94
540	1.697	1.60	0.934	0.78	0.904	1.18	1.295	1.94	1.208	0.71
545	1.700	1.61	0.934	0.94	0.903	1.00	1.295	1.92	1.208	0.69
550	1.702	1.58	0.934	1.09	0.902	1.05	1.293	2.28	1.208	0.70
555	1.703	1.25	0.934	0.85	0.902	1.05	1.297	2.27	1.209	0.53
560	1.704	1.38	0.930	0.66	0.901	0.92	1.296	2.63	1.208	0.55
565	1.705	1.25	0.932	0.81	0.901	0.88	1.295	2.17	1.208	0.54
570	1.707	1.16	0.931	0.85	0.900	0.96	1.296	2.33	1.208	0.50
575	1.713	1.27	0.929	0.80	0.900	0.97	1.299	2.36	1.210	0.52
580	1.715	0.89	0.931	0.76	0.902	0.77	1.299	2.40	1.212	0.51
585	1.718	0.86	0.932	0.80	0.901	0.87	1.301	2.31	1.213	0.49
590	1.719	1.00	0.931	0.87	0.902	1.00	1.299	2.32	1.213	0.41
595	1.719	0.98	0.929	0.75	0.899	0.97	1.297	2.53	1.211	0.39
600	1.724	0.92	0.930	0.77	0.903	0.73	1.299	2.73	1.214	0.46
605	1.726	0.85	0.929	0.60	0.901	0.93	1.299	2.62	1.214	0.46
610	1.726	0.94	0.932	0.93	0.901	0.77	1.302	2.73	1.215	0.56
615	1.729	1.07	0.932	0.74	0.901	0.80	1.303	2.68	1.216	0.52
620	1.734	0.82	0.933	0.63	0.902	0.82	1.305	2.64	1.218	0.53
625	1.740	1.12	0.928	1.33	0.902	0.73	1.304	2.65	1.219	0.57
630	1.739	1.20	0.931	1.02	0.903	0.65	1.303	2.52	1.219	0.50
635	1.737	1.09	0.928	1.00	0.900	0.82	1.301	2.77	1.216	0.68
640	1.742	1.33	0.930	0.74	0.902	0.69	1.303	2.88	1.219	0.54
645	1.746	0.81	0.930	1.00	0.903	1.27	1.300	2.68	1.220	0.53
650	1.753	0.89	0.928	1.14	0.903	1.06	1.301	2.56	1.221	0.71
655	1.754	0.99	0.927	0.87	0.901	1.09	1.305	2.74	1.222	0.52
660	1.758	1.01	0.929	1.21	0.899	0.79	1.303	2.35	1.222	0.38
665	1.757	0.90	0.927	0.69	0.900	0.84	1.299	2.10	1.221	0.20
670	1.758	0.79	0.928	0.87	0.903	0.75	1.306	2.22	1.224	0.31
675	1.756	0.89	0.922	1.04	0.900	0.73	1.301	1.94	1.220	0.33
680	1.759	0.68	0.924	0.67	0.898	0.97	1.300	2.03	1.220	0.48
685	1.761	0.77	0.924	1.25	0.895	1.04	1.301	2.67	1.220	0.63
690	1.769	0.86	0.928	1.26	0.901	1.11	1.301	3.04	1.225	0.65
695	1.770	0.75	0.924	1.03	0.903	0.36	1.303	2.52	1.225	0.64
700	1.772	0.99	0.937	1.02	0.900	0.74	1.305	3.06	1.229	0.74
705	1.766	1.11	0.930	1.58	0.898	1.34	1.297	3.10	1.223	1.22
710	1.764	0.90	0.927	1.24	0.898	1.24	1.301	2.77	1.223	0.82
715	1.765	0.69	0.930	1.18	0.899	0.94	1.301	2.74	1.224	0.78
720	1.770	0.53	0.925	0.27	0.901	1.42	1.302	2.75	1.225	0.78
725	1.774	0.85	0.932	1.60	0.899	1.64	1.301	2.99	1.227	0.70
730	1.775	1.02	0.923	1.92	0.900	1.99	1.301	2.48	1.225	0.81

-60°/-75° BIDIRECTIONAL ABSOLUTE SPECTRAL REFLECTANCE FACTORS

WAV.	Bss		Bsp		Bps		Bpp		Brr	
[nm]	mean	coeff. var.	mean	coeff. var.	mean	coeff. var.	mean	coeff. var.	mean	coeff. var.
390	0.855	1.10	0.747	2.80	0.736	2.06	0.928	2.52	0.816	1.64
395	0.893	1.27	0.799	1.88	0.780	1.81	0.970	1.82	0.861	1.55
400	0.884	1.22	0.792	1.75	0.776	1.94	0.965	1.83	0.854	1.56
405	0.887	1.23	0.795	1.68	0.780	1.58	0.974	1.66	0.859	1.43
410	0.893	1.25	0.792	1.87	0.781	1.46	0.977	1.15	0.861	1.29
415	0.893	1.35	0.793	1.55	0.777	1.44	0.974	2.24	0.859	1.52
420	0.889	1.25	0.795	1.50	0.780	1.58	0.975	1.80	0.860	1.43
425	0.891	1.53	0.794	1.88	0.777	2.09	0.975	1.85	0.860	1.70
430	0.888	1.57	0.790	1.29	0.774	1.94	0.976	1.92	0.857	1.57
435	0.889	1.47	0.791	1.56	0.773	1.97	0.974	2.16	0.857	1.65
440	0.890	1.53	0.789	1.80	0.776	1.94	0.978	2.16	0.858	1.72
445	0.887	1.30	0.788	1.74	0.772	1.92	0.975	2.33	0.855	1.68
450	0.887	1.36	0.787	1.97	0.770	1.97	0.976	2.24	0.855	1.74
455	0.890	1.48	0.791	1.70	0.774	1.89	0.979	2.18	0.859	1.69
460	0.887	1.35	0.786	1.58	0.770	2.06	0.974	2.14	0.854	1.65
465	0.892	1.41	0.781	1.58	0.776	1.84	0.971	2.13	0.855	1.62
470	0.887	1.13	0.785	1.78	0.769	1.80	0.976	2.22	0.854	1.60
475	0.886	1.44	0.782	1.72	0.768	1.88	0.974	2.19	0.853	1.68
480	0.885	1.42	0.782	1.72	0.767	1.85	0.974	2.15	0.852	1.64
485	0.885	1.38	0.781	1.59	0.767	1.78	0.972	2.06	0.851	1.58
490	0.883	1.35	0.778	1.56	0.765	1.80	0.973	2.15	0.850	1.59
495	0.881	1.25	0.777	1.74	0.762	1.76	0.972	2.28	0.848	1.62
500	0.882	1.36	0.776	1.74	0.762	1.81	0.972	2.43	0.848	1.69
505	0.881	1.24	0.776	1.77	0.762	1.71	0.973	2.36	0.848	1.62
510	0.880	1.36	0.775	1.98	0.760	1.98	0.972	1.99	0.847	1.69
515	0.877	1.35	0.773	1.77	0.758	1.84	0.970	2.08	0.845	1.63
520	0.877	1.05	0.770	1.67	0.756	1.93	0.970	2.14	0.843	1.56
525	0.878	1.28	0.771	1.72	0.757	1.65	0.971	2.22	0.844	1.59
530	0.878	1.14	0.773	1.50	0.756	1.45	0.972	2.11	0.845	1.42
535	0.874	1.33	0.769	1.75	0.753	1.76	0.968	2.24	0.841	1.63
540	0.875	0.97	0.770	1.68	0.755	1.76	0.969	1.95	0.842	1.47
545	0.875	1.11	0.767	1.53	0.753	1.74	0.969	2.15	0.841	1.51
550	0.875	1.10	0.767	1.46	0.753	1.77	0.967	2.28	0.840	1.53
555	0.875	1.12	0.766	1.70	0.752	1.74	0.967	2.13	0.840	1.53
560	0.872	0.91	0.764	1.67	0.751	1.88	0.964	2.22	0.838	1.53
565	0.874	0.98	0.764	1.77	0.752	1.75	0.967	2.40	0.839	1.57
570	0.871	1.03	0.762	1.69	0.749	1.38	0.967	2.19	0.837	1.43
575	0.871	0.79	0.762	1.62	0.748	1.55	0.968	1.88	0.837	1.33
580	0.871	1.08	0.762	1.80	0.748	1.67	0.966	2.08	0.837	1.51
585	0.871	0.94	0.762	1.72	0.748	1.68	0.966	1.96	0.837	1.43
590	0.871	0.87	0.762	1.63	0.748	1.57	0.969	2.49	0.837	1.47
595	0.872	0.99	0.760	1.68	0.746	1.49	0.964	2.32	0.835	1.48
600	0.871	1.03	0.758	2.00	0.746	1.64	0.966	2.18	0.835	1.56
605	0.870	0.96	0.757	1.82	0.747	2.03	0.965	2.28	0.835	1.62
610	0.871	1.02	0.756	1.79	0.746	1.20	0.967	2.23	0.835	1.41
615	0.872	1.25	0.756	1.83	0.744	1.85	0.967	2.31	0.835	1.65
620	0.871	1.14	0.759	1.93	0.745	1.82	0.968	2.66	0.836	1.72
625	0.870	0.89	0.757	1.75	0.745	1.84	0.966	2.32	0.834	1.53
630	0.869	1.24	0.755	1.89	0.743	2.25	0.963	2.24	0.832	1.73
635	0.868	1.05	0.757	1.59	0.741	1.41	0.966	2.15	0.833	1.40
640	0.869	1.22	0.752	1.87	0.739	1.61	0.964	2.65	0.831	1.68
645	0.870	1.22	0.754	1.91	0.741	1.78	0.962	2.82	0.832	1.76
650	0.869	0.80	0.753	1.60	0.744	1.93	0.964	3.08	0.832	1.66
655	0.867	1.18	0.753	1.92	0.741	1.67	0.961	2.26	0.831	1.59
660	0.869	1.35	0.755	1.80	0.737	1.25	0.966	3.17	0.832	1.64
665	0.871	1.01	0.747	2.22	0.738	1.95	0.959	2.85	0.829	1.80
670	0.864	0.83	0.751	1.62	0.742	2.15	0.963	2.76	0.830	1.65
675	0.864	0.95	0.748	1.97	0.736	2.08	0.960	2.14	0.827	1.59
680	0.871	1.11	0.747	2.62	0.743	2.05	0.964	2.29	0.831	1.80
685	0.868	1.25	0.748	1.78	0.738	1.86	0.963	3.25	0.829	1.83
690	0.869	1.13	0.751	2.34	0.739	2.22	0.959	2.65	0.830	1.89
695	0.866	0.87	0.745	2.10	0.735	2.49	0.958	2.63	0.826	1.82
700	0.867	1.18	0.753	2.46	0.738	2.09	0.965	2.34	0.831	1.66
705	0.864	1.23	0.743	2.48	0.738	2.39	0.972	3.84	0.829	2.12
710	0.873	0.92	0.748	3.04	0.734	1.74	0.967	3.41	0.830	1.99
715	0.867	1.84	0.746	2.32	0.741	2.47	0.963	2.21	0.829	1.94
720	0.864	1.53	0.747	3.57	0.734	2.39	0.965	3.10	0.827	2.14
725	0.863	1.69	0.751	2.07	0.734	2.71	0.964	3.05	0.828	2.02
730	0.870	2.17	0.741	2.48	0.733	1.13	0.969	3.62	0.828	2.10

-60°/-45° BIDIRECTIONAL ABSOLUTE SPECTRAL REFLECTANCE FACTORS

WAV. [nm]	Bss mean	Bss coeff. var.	Bsp mean	Bsp coeff. var.	Bps mean	Bps coeff. var.	Bpp mean	Bpp coeff. var.	Brr mean	Brr coeff. var.
390	0.923	1.82	0.814	0.60	0.825	0.36	0.965	2.97	0.882	0.93
395	0.951	1.32	0.862	0.93	0.876	0.93	1.012	0.45	0.925	0.82
400	0.944	0.88	0.859	0.57	0.866	1.00	1.011	1.12	0.920	0.77
405	0.958	0.79	0.862	0.63	0.875	1.31	1.020	0.87	0.929	0.73
410	0.958	1.22	0.864	0.73	0.875	1.13	1.021	1.10	0.930	0.94
415	0.958	0.96	0.868	0.91	0.875	1.24	1.027	1.11	0.932	0.98
420	0.961	1.40	0.868	1.12	0.875	1.12	1.026	1.41	0.932	1.17
425	0.962	1.28	0.868	0.82	0.875	1.54	1.030	1.33	0.934	1.18
430	0.958	1.15	0.867	0.85	0.873	1.70	1.029	1.73	0.932	1.28
435	0.960	1.35	0.866	1.05	0.873	1.64	1.030	1.47	0.932	1.30
440	0.961	1.33	0.869	1.10	0.875	1.59	1.031	1.51	0.934	1.29
445	0.961	1.14	0.866	0.95	0.875	1.36	1.029	1.43	0.932	1.16
450	0.960	1.42	0.866	1.00	0.875	1.56	1.030	1.35	0.933	1.24
455	0.966	1.49	0.871	0.97	0.879	1.61	1.034	1.44	0.937	1.30
460	0.963	1.47	0.865	0.98	0.877	1.39	1.033	1.41	0.934	1.23
465	0.968	1.27	0.861	0.95	0.882	1.34	1.028	1.17	0.934	1.13
470	0.962	1.42	0.866	1.06	0.875	1.34	1.033	1.21	0.934	1.20
475	0.964	1.39	0.864	1.03	0.876	1.49	1.033	1.20	0.934	1.21
480	0.964	1.13	0.865	1.03	0.874	1.30	1.033	1.02	0.934	1.07
485	0.963	1.20	0.863	1.14	0.874	1.38	1.033	1.35	0.933	1.20
490	0.961	1.08	0.861	0.92	0.871	1.44	1.031	1.41	0.931	1.13
495	0.961	1.26	0.860	1.05	0.871	1.30	1.031	1.34	0.931	1.17
500	0.960	1.02	0.861	0.88	0.870	1.21	1.030	1.31	0.930	1.04
505	0.961	1.09	0.860	0.82	0.870	1.22	1.030	1.27	0.930	1.04
510	0.959	1.12	0.858	0.99	0.869	1.09	1.030	1.22	0.929	1.04
515	0.958	1.14	0.857	0.78	0.867	1.07	1.028	1.09	0.927	0.95
520	0.957	0.93	0.855	0.47	0.868	1.05	1.026	1.03	0.927	0.81
525	0.958	0.95	0.856	0.67	0.867	1.06	1.028	1.02	0.927	0.87
530	0.959	0.86	0.857	0.56	0.867	1.00	1.029	1.07	0.928	0.81
535	0.954	1.00	0.853	0.78	0.863	1.00	1.026	0.98	0.924	0.89
540	0.956	0.71	0.853	0.44	0.864	0.92	1.027	1.02	0.925	0.69
545	0.956	0.61	0.853	0.73	0.864	0.86	1.028	1.30	0.925	0.82
550	0.958	0.83	0.853	0.59	0.863	1.00	1.027	1.09	0.925	0.80
555	0.955	0.63	0.853	0.54	0.864	0.78	1.029	0.73	0.925	0.61
560	0.954	0.64	0.849	0.58	0.862	0.66	1.026	1.19	0.923	0.69
565	0.956	0.83	0.850	0.62	0.862	0.91	1.028	0.76	0.924	0.72
570	0.954	0.71	0.848	0.35	0.860	0.76	1.027	0.82	0.922	0.62
575	0.955	0.75	0.848	0.36	0.860	0.70	1.028	0.91	0.923	0.61
580	0.955	0.66	0.850	0.42	0.862	0.67	1.028	0.67	0.924	0.47
585	0.956	0.44	0.849	0.57	0.862	0.56	1.028	0.49	0.924	0.47
590	0.955	0.35	0.848	0.72	0.861	0.78	1.027	1.02	0.923	0.66
595	0.955	0.45	0.846	0.57	0.861	0.90	1.029	0.78	0.923	0.60
600	0.958	0.85	0.848	0.76	0.861	0.68	1.025	1.16	0.923	0.78
605	0.958	0.67	0.848	0.47	0.862	0.81	1.028	0.60	0.924	0.60
610	0.958	0.91	0.847	0.44	0.862	0.87	1.031	0.97	0.924	0.74
615	0.957	0.27	0.847	0.68	0.859	0.97	1.027	0.63	0.922	0.57
620	0.960	0.53	0.848	0.33	0.863	0.64	1.030	0.48	0.925	0.43
625	0.960	0.66	0.845	0.74	0.863	0.61	1.031	1.09	0.925	0.68
630	0.959	0.86	0.845	0.73	0.858	1.10	1.031	0.87	0.923	0.83
635	0.960	0.32	0.844	0.37	0.862	1.03	1.028	1.01	0.923	0.62
640	0.960	0.63	0.844	0.74	0.861	0.95	1.030	1.27	0.924	0.83
645	0.959	0.47	0.845	0.68	0.864	0.64	1.031	1.22	0.925	0.68
650	0.963	0.54	0.847	1.02	0.867	0.49	1.029	1.44	0.926	0.65
655	0.961	0.51	0.848	0.66	0.862	0.71	1.029	0.70	0.925	0.46
660	0.960	0.61	0.845	0.75	0.862	0.59	1.028	1.15	0.924	0.68
665	0.959	0.65	0.840	0.97	0.860	0.55	1.028	1.07	0.922	0.74
670	0.960	0.40	0.845	0.79	0.859	0.47	1.032	1.50	0.924	0.68
675	0.958	0.69	0.842	0.46	0.860	0.85	1.032	0.93	0.923	0.59
680	0.961	0.67	0.845	0.28	0.858	0.84	1.029	0.95	0.923	0.53
685	0.962	0.78	0.846	0.79	0.861	1.09	1.035	0.76	0.926	0.68
690	0.963	0.82	0.849	1.21	0.860	0.59	1.030	1.72	0.926	0.96
695	0.960	1.06	0.841	0.66	0.861	0.49	1.033	0.76	0.924	0.53
700	0.961	0.39	0.845	1.07	0.867	1.02	1.030	1.27	0.926	0.85
705	0.964	1.27	0.845	0.98	0.861	1.72	1.028	0.87	0.925	0.95
710	0.965	1.14	0.842	1.33	0.865	1.68	1.036	0.70	0.927	0.86
715	0.964	0.74	0.842	0.94	0.865	0.91	1.036	1.42	0.927	0.50
720	0.967	1.18	0.833	1.78	0.873	1.01	1.040	2.23	0.928	0.55
725	0.960	1.02	0.850	0.84	0.852	0.52	1.026	2.38	0.922	0.94
730	0.962	1.53	0.840	1.01	0.851	0.61	1.032	1.47	0.921	0.76

-60°/-30° BIDIRECTIONAL ABSOLUTE SPECTRAL REFLECTANCE FACTORS

WAV. [nm]	Bss mean	Bss coeff. var.	Bsp mean	Bsp coeff. var.	Bps mean	Bps coeff. var.	Bpp mean	Bpp coeff. var.	Brr mean	Brr coeff. var.
390	0.925	0.75	0.829	1.31	0.845	0.14	0.936	1.31	0.884	0.43
395	0.956	0.87	0.872	0.19	0.893	1.05	0.989	0.94	0.928	0.62
400	0.949	0.90	0.854	0.55	0.881	0.86	0.988	0.63	0.918	0.67
405	0.956	1.00	0.871	0.81	0.889	1.08	0.991	1.49	0.927	1.06
410	0.960	0.96	0.872	0.66	0.890	1.27	0.992	0.97	0.929	0.85
415	0.964	1.20	0.874	0.97	0.890	1.13	0.999	0.96	0.932	0.98
420	0.965	1.28	0.873	1.02	0.891	1.29	1.001	1.28	0.932	1.10
425	0.966	1.13	0.876	1.08	0.891	1.32	1.001	1.00	0.933	1.05
430	0.962	1.00	0.876	1.27	0.891	1.58	1.002	1.33	0.933	1.21
435	0.964	1.23	0.873	1.09	0.892	1.39	1.000	1.12	0.932	1.14
440	0.966	1.27	0.878	1.08	0.894	1.33	1.003	1.53	0.935	1.24
445	0.967	1.24	0.874	1.07	0.892	1.34	1.001	1.24	0.934	1.15
450	0.968	1.31	0.874	1.10	0.892	1.42	1.002	1.26	0.934	1.21
455	0.971	1.22	0.880	0.97	0.896	1.28	1.008	1.18	0.939	1.11
460	0.968	1.34	0.874	0.86	0.894	1.40	1.004	1.22	0.935	1.15
465	0.975	1.18	0.870	0.79	0.899	1.40	0.999	1.15	0.936	1.07
470	0.969	1.24	0.874	1.10	0.893	1.30	1.005	1.17	0.935	1.14
475	0.970	1.12	0.873	0.99	0.894	1.37	1.004	1.21	0.935	1.11
480	0.969	1.18	0.873	0.89	0.892	1.31	1.003	1.07	0.934	1.05
485	0.969	1.18	0.873	1.03	0.892	1.19	1.004	1.05	0.934	1.04
490	0.968	1.18	0.870	0.99	0.890	1.36	1.002	1.02	0.933	1.07
495	0.967	0.92	0.869	0.94	0.890	1.30	1.002	0.97	0.932	0.98
500	0.966	0.99	0.869	0.95	0.889	1.17	1.002	0.83	0.932	0.94
505	0.967	1.03	0.869	0.83	0.890	1.15	1.003	0.82	0.932	0.90
510	0.966	0.87	0.869	0.94	0.888	1.13	1.004	1.22	0.932	0.98
515	0.963	0.97	0.866	0.78	0.886	1.02	1.001	0.99	0.929	0.89
520	0.964	1.02	0.866	0.81	0.884	1.05	0.998	0.75	0.928	0.87
525	0.964	0.72	0.866	0.68	0.886	0.98	0.999	0.85	0.929	0.76
530	0.965	0.70	0.868	0.43	0.886	0.90	1.001	0.89	0.930	0.67
535	0.961	0.71	0.864	0.57	0.884	0.96	0.998	0.87	0.927	0.72
540	0.964	0.64	0.864	0.60	0.884	0.64	0.998	0.81	0.927	0.61
545	0.964	0.60	0.863	0.58	0.883	1.20	0.998	0.88	0.927	0.77
550	0.964	0.64	0.865	0.66	0.884	1.04	0.998	0.73	0.928	0.73
555	0.964	0.73	0.862	0.60	0.882	0.87	0.999	0.71	0.927	0.67
560	0.963	0.76	0.860	0.84	0.881	0.86	0.996	0.50	0.925	0.70
565	0.960	0.66	0.861	0.46	0.882	0.83	0.995	0.32	0.925	0.53
570	0.962	0.37	0.858	0.49	0.880	0.57	0.995	0.52	0.924	0.42
575	0.962	0.48	0.857	0.40	0.882	0.76	0.997	0.57	0.925	0.51
580	0.963	0.64	0.859	0.59	0.881	0.81	0.997	0.82	0.925	0.65
585	0.963	0.65	0.856	0.30	0.883	0.81	0.998	0.61	0.925	0.54
590	0.963	0.57	0.861	0.56	0.884	0.95	0.999	0.63	0.926	0.64
595	0.963	0.58	0.858	0.71	0.881	0.78	0.998	0.45	0.925	0.55
600	0.966	0.45	0.856	0.37	0.881	0.90	0.998	0.59	0.925	0.50
605	0.963	0.60	0.858	0.79	0.880	0.81	0.994	0.47	0.924	0.61
610	0.965	0.99	0.860	0.66	0.886	0.72	1.001	0.97	0.928	0.77
615	0.964	0.72	0.856	0.43	0.883	0.76	0.999	0.87	0.925	0.62
620	0.966	0.40	0.858	0.70	0.886	0.60	0.997	0.53	0.927	0.39
625	0.970	0.31	0.857	0.68	0.882	0.98	0.999	0.88	0.927	0.62
630	0.967	0.66	0.855	0.64	0.882	0.77	0.998	1.04	0.926	0.63
635	0.967	0.46	0.856	0.59	0.883	0.85	1.000	0.69	0.926	0.59
640	0.968	0.54	0.855	0.53	0.882	0.79	0.996	0.75	0.925	0.55
645	0.968	0.30	0.859	0.16	0.882	0.79	1.000	0.46	0.927	0.32
650	0.969	0.52	0.857	0.63	0.883	0.98	1.001	0.68	0.927	0.59
655	0.964	0.28	0.854	0.34	0.883	0.58	1.002	0.67	0.926	0.43
660	0.974	0.72	0.858	0.79	0.884	0.80	1.001	1.28	0.929	0.83
665	0.971	0.66	0.856	0.58	0.879	1.02	1.003	1.00	0.927	0.66
670	0.972	0.75	0.859	0.65	0.888	0.95	0.998	1.42	0.929	0.79
675	0.970	0.53	0.854	0.65	0.881	1.07	0.998	0.74	0.925	0.68
680	0.973	0.68	0.855	1.26	0.888	1.28	1.000	0.93	0.929	0.81
685	0.971	0.69	0.861	0.63	0.883	0.65	1.000	0.90	0.929	0.63
690	0.975	1.25	0.857	0.19	0.885	0.73	1.004	1.41	0.930	0.79
695	0.967	0.50	0.850	1.14	0.879	0.97	1.002	0.80	0.925	0.75
700	0.979	1.25	0.861	0.67	0.885	0.46	1.005	0.91	0.932	0.49
705	0.973	0.59	0.855	1.22	0.885	1.49	0.998	1.17	0.928	0.91
710	0.976	0.57	0.855	0.46	0.888	1.05	1.003	1.50	0.930	0.72
715	0.975	0.94	0.859	1.08	0.885	1.08	1.011	0.92	0.933	0.81
720	0.972	1.03	0.862	1.70	0.884	1.72	0.993	1.53	0.928	0.89
725	0.972	0.95	0.866	1.57	0.886	0.95	0.997	0.87	0.930	0.72
730	0.973	0.58	0.857	1.07	0.895	0.98	1.001	2.01	0.932	0.44

-60°/-15° BIDIRECTIONAL ABSOLUTE SPECTRAL REFLECTANCE FACTORS
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WAV. [nm]	Bss mean	Bss coeff. var.	Bsp mean	Bsp coeff. var.	Bps mean	Bps coeff. var.	Bpp mean	Bpp coeff. var.	Brr mean	Brr coeff. var.
390	0.947	1.55	0.825	0.74	0.859	1.80	0.942	2.25	0.893	0.63
395	0.981	0.77	0.879	0.32	0.899	1.19	0.975	0.44	0.934	0.54
400	0.978	0.80	0.873	0.56	0.896	1.03	0.974	0.45	0.930	0.68
405	0.982	1.07	0.876	0.66	0.905	0.89	0.982	0.68	0.936	0.76
410	0.986	0.82	0.878	0.89	0.908	1.06	0.982	0.73	0.938	0.72
415	0.987	0.98	0.885	0.76	0.907	1.60	0.987	0.99	0.941	1.02
420	0.988	1.39	0.884	0.92	0.910	1.53	0.988	1.17	0.943	1.21
425	0.991	1.04	0.884	1.04	0.909	1.38	0.991	1.34	0.944	1.16
430	0.989	1.45	0.884	1.01	0.908	1.44	0.988	1.34	0.942	1.26
435	0.990	1.44	0.884	1.06	0.907	1.55	0.991	1.39	0.943	1.31
440	0.993	1.34	0.886	1.16	0.909	1.52	0.996	1.31	0.946	1.26
445	0.994	1.31	0.883	1.17	0.908	1.48	0.991	1.47	0.944	1.30
450	0.992	1.53	0.885	1.04	0.908	1.50	0.991	1.16	0.944	1.25
455	0.996	1.35	0.891	1.18	0.911	1.51	0.998	1.50	0.949	1.33
460	0.995	1.34	0.885	1.11	0.911	1.51	0.995	1.31	0.946	1.26
465	1.001	1.34	0.879	1.06	0.917	1.47	0.988	1.16	0.946	1.20
470	0.995	1.25	0.886	0.93	0.911	1.42	0.994	1.26	0.946	1.16
475	0.997	1.37	0.882	1.18	0.911	1.47	0.993	1.18	0.946	1.24
480	0.994	1.26	0.883	1.08	0.910	1.40	0.992	1.06	0.945	1.16
485	0.997	1.25	0.881	1.05	0.910	1.42	0.993	1.13	0.945	1.16
490	0.994	1.15	0.882	0.94	0.908	1.21	0.990	1.19	0.943	1.08
495	0.993	1.22	0.879	0.97	0.906	1.19	0.991	1.19	0.942	1.11
500	0.994	1.22	0.880	0.72	0.906	1.35	0.991	1.06	0.943	1.04
505	0.993	1.06	0.880	0.78	0.908	1.30	0.992	1.03	0.943	0.98
510	0.993	1.08	0.878	0.96	0.905	1.32	0.990	1.15	0.941	1.08
515	0.992	1.11	0.877	0.87	0.905	1.20	0.989	1.14	0.941	1.03
520	0.991	0.79	0.873	0.84	0.902	1.01	0.986	0.87	0.938	0.82
525	0.992	0.81	0.876	0.71	0.905	1.04	0.989	0.66	0.940	0.72
530	0.994	1.00	0.877	0.46	0.903	0.88	0.991	0.80	0.942	0.75
535	0.990	0.80	0.874	0.67	0.900	0.81	0.985	0.85	0.937	0.72
540	0.992	0.78	0.874	0.40	0.902	1.04	0.987	0.92	0.939	0.74
545	0.991	0.82	0.872	0.60	0.901	0.93	0.985	0.75	0.937	0.75
550	0.990	0.83	0.872	0.65	0.901	0.90	0.984	0.62	0.937	0.71
555	0.990	0.77	0.873	0.52	0.900	0.59	0.986	0.69	0.938	0.60
560	0.989	0.74	0.869	0.64	0.901	0.75	0.984	0.77	0.936	0.65
565	0.991	0.53	0.870	0.62	0.901	0.80	0.985	0.72	0.937	0.61
570	0.990	0.39	0.868	0.56	0.898	0.75	0.981	0.54	0.934	0.49
575	0.991	0.50	0.869	0.57	0.897	0.77	0.983	0.66	0.935	0.56
580	0.990	0.46	0.871	0.53	0.897	0.62	0.984	0.56	0.936	0.46
585	0.991	0.75	0.870	0.36	0.898	0.48	0.984	0.75	0.936	0.55
590	0.991	0.73	0.872	0.44	0.900	0.50	0.985	0.65	0.937	0.49
595	0.993	0.52	0.869	0.61	0.901	0.87	0.985	0.85	0.937	0.62
600	0.990	0.24	0.870	0.55	0.900	0.87	0.987	0.75	0.937	0.51
605	0.989	0.37	0.867	0.76	0.900	0.72	0.985	0.72	0.935	0.52
610	0.996	0.39	0.866	0.54	0.903	0.91	0.985	0.37	0.937	0.37
615	0.991	0.31	0.867	0.75	0.901	0.66	0.984	0.66	0.936	0.50
620	0.996	0.31	0.871	0.72	0.903	0.59	0.988	0.44	0.940	0.41
625	0.996	0.70	0.870	0.86	0.901	0.96	0.989	0.67	0.939	0.59
630	0.997	0.38	0.868	0.45	0.901	0.94	0.988	0.66	0.939	0.52
635	0.995	0.17	0.871	0.47	0.900	0.37	0.990	0.68	0.939	0.39
640	0.995	0.62	0.869	0.14	0.899	0.59	0.986	1.11	0.937	0.54
645	0.996	0.96	0.870	0.75	0.904	0.68	0.986	0.87	0.939	0.68
650	0.998	0.62	0.871	0.59	0.900	0.45	0.986	0.93	0.939	0.58
655	0.998	0.55	0.867	0.46	0.904	0.77	0.989	0.42	0.939	0.45
660	0.998	0.62	0.869	0.64	0.903	1.21	0.986	0.77	0.939	0.77
665	0.997	0.94	0.865	0.91	0.903	0.96	0.986	0.62	0.938	0.78
670	0.998	0.81	0.870	1.14	0.903	0.37	0.985	0.89	0.939	0.77
675	1.000	1.46	0.866	1.00	0.901	0.78	0.984	0.98	0.938	0.93
680	1.000	0.41	0.870	1.02	0.900	0.86	0.982	1.41	0.938	0.77
685	1.000	0.86	0.867	0.28	0.902	1.07	0.985	1.15	0.939	0.74
690	0.998	0.75	0.867	0.75	0.902	1.28	0.991	1.41	0.939	0.78
695	1.000	0.48	0.866	0.58	0.899	0.72	0.985	1.27	0.938	0.49
700	1.007	0.29	0.869	0.65	0.909	0.94	0.991	0.82	0.944	0.43
705	0.997	0.98	0.875	0.83	0.905	0.97	0.986	1.33	0.941	0.49
710	0.999	1.13	0.867	0.31	0.906	1.22	0.983	0.39	0.939	0.70
715	1.005	0.87	0.868	1.00	0.909	0.20	0.992	0.96	0.943	0.65
720	0.998	1.54	0.871	1.02	0.914	1.00	0.989	1.35	0.943	0.65
725	1.007	1.25	0.868	1.02	0.899	1.45	0.993	1.52	0.942	1.00
730	1.002	0.23	0.865	1.28	0.898	0.35	0.985	1.77	0.938	0.39

-60°/ 0° BIDIRECTIONAL ABSOLUTE SPECTRAL REFLECTANCE FACTORS

WAV. [nm]	Bss mean	Bss coeff. var.	Bsp mean	Bsp coeff. var.	Bps mean	Bps coeff. var.	Bpp mean	Bpp coeff. var.	Brr mean	Brr coeff. var.
390	0.987	1.02	0.855	2.15	0.875	1.68	0.932	1.92	0.912	1.26
395	1.025	0.88	0.887	0.43	0.913	0.84	0.978	1.55	0.951	0.54
400	1.017	1.02	0.881	0.58	0.910	1.05	0.974	0.81	0.946	0.65
405	1.023	1.17	0.890	0.60	0.915	0.98	0.979	0.98	0.952	0.82
410	1.031	0.95	0.893	0.94	0.921	1.31	0.982	0.85	0.957	0.98
415	1.033	1.19	0.897	0.53	0.920	1.16	0.989	1.03	0.960	0.88
420	1.033	1.37	0.897	0.63	0.922	1.34	0.989	1.13	0.960	1.06
425	1.037	1.23	0.897	1.06	0.922	1.37	0.991	1.11	0.962	1.14
430	1.034	1.19	0.895	0.94	0.922	1.32	0.989	0.97	0.960	1.04
435	1.036	1.30	0.896	1.05	0.920	1.56	0.990	1.31	0.960	1.24
440	1.038	1.15	0.899	0.97	0.924	1.49	0.993	1.28	0.964	1.17
445	1.039	1.34	0.896	1.13	0.923	1.67	0.992	1.24	0.962	1.28
450	1.040	1.21	0.896	1.11	0.923	1.55	0.993	1.20	0.963	1.19
455	1.042	1.35	0.901	1.00	0.927	1.37	0.994	1.12	0.966	1.17
460	1.041	1.36	0.896	0.94	0.925	1.44	0.992	1.25	0.964	1.20
465	1.047	1.34	0.891	1.05	0.931	1.41	0.986	1.09	0.964	1.18
470	1.043	1.29	0.896	0.90	0.924	1.32	0.993	1.02	0.964	1.10
475	1.042	1.21	0.896	0.94	0.925	1.24	0.991	1.07	0.963	1.07
480	1.040	1.14	0.896	0.96	0.924	1.11	0.992	1.13	0.963	1.04
485	1.041	1.16	0.894	0.94	0.923	1.32	0.992	1.13	0.962	1.09
490	1.041	1.15	0.892	0.89	0.922	1.22	0.991	1.15	0.962	1.05
495	1.040	0.97	0.891	0.83	0.920	1.36	0.990	1.23	0.960	1.05
500	1.039	1.09	0.892	0.74	0.922	1.35	0.989	1.06	0.961	1.00
505	1.043	1.05	0.892	0.68	0.922	1.22	0.991	0.79	0.962	0.88
510	1.041	1.03	0.892	0.80	0.921	1.22	0.990	0.87	0.961	0.94
515	1.039	0.81	0.890	0.74	0.920	1.10	0.987	0.88	0.959	0.84
520	1.038	0.89	0.888	0.65	0.917	1.12	0.984	0.75	0.957	0.80
525	1.040	0.96	0.888	0.65	0.917	1.09	0.987	0.84	0.958	0.85
530	1.041	1.00	0.891	0.72	0.918	0.94	0.989	0.77	0.960	0.79
535	1.038	0.75	0.885	0.64	0.915	0.82	0.984	0.73	0.956	0.69
540	1.038	0.87	0.887	0.43	0.917	1.02	0.985	0.78	0.957	0.71
545	1.039	1.00	0.885	0.60	0.916	0.84	0.983	0.74	0.956	0.72
550	1.038	1.02	0.885	0.54	0.915	0.81	0.984	0.70	0.955	0.73
555	1.038	0.73	0.884	0.38	0.915	0.73	0.983	0.77	0.955	0.61
560	1.037	0.69	0.883	0.44	0.914	0.70	0.981	0.57	0.954	0.57
565	1.036	0.79	0.883	0.44	0.914	0.68	0.982	0.67	0.954	0.60
570	1.039	0.71	0.882	0.58	0.912	0.87	0.980	0.76	0.953	0.62
575	1.037	0.54	0.883	0.51	0.912	0.86	0.982	0.73	0.953	0.60
580	1.040	0.43	0.884	0.26	0.913	0.88	0.984	0.88	0.955	0.56
585	1.041	0.62	0.883	0.52	0.914	0.70	0.980	0.67	0.955	0.57
590	1.044	0.48	0.883	0.45	0.916	0.57	0.982	0.82	0.956	0.52
595	1.043	0.44	0.882	0.67	0.916	0.46	0.982	0.91	0.956	0.56
600	1.044	0.34	0.883	0.58	0.916	0.71	0.983	0.65	0.956	0.51
605	1.039	0.39	0.881	0.52	0.912	0.78	0.980	0.80	0.953	0.55
610	1.044	0.45	0.883	0.67	0.916	0.68	0.982	0.45	0.956	0.51
615	1.040	0.41	0.880	0.34	0.915	0.79	0.982	0.55	0.954	0.45
620	1.047	0.29	0.884	0.45	0.917	0.70	0.985	0.55	0.958	0.45
625	1.044	0.64	0.882	0.37	0.916	0.58	0.985	0.63	0.957	0.51
630	1.047	0.65	0.882	0.14	0.917	0.61	0.984	0.79	0.958	0.53
635	1.044	0.51	0.881	0.60	0.916	0.86	0.982	0.90	0.955	0.65
640	1.048	0.20	0.881	0.51	0.915	0.69	0.981	0.32	0.956	0.34
645	1.048	0.51	0.883	0.66	0.918	1.03	0.983	0.48	0.958	0.63
650	1.054	0.31	0.885	0.51	0.917	0.83	0.985	0.52	0.960	0.52
655	1.045	0.52	0.881	0.79	0.921	1.12	0.982	0.86	0.957	0.73
660	1.048	0.28	0.882	0.57	0.922	0.74	0.979	0.62	0.958	0.43
665	1.047	0.54	0.874	0.45	0.915	0.99	0.978	0.43	0.954	0.54
670	1.052	0.52	0.880	0.21	0.919	0.58	0.985	1.01	0.959	0.50
675	1.046	0.91	0.876	0.87	0.915	0.36	0.980	1.02	0.954	0.68
680	1.049	0.83	0.879	0.85	0.921	0.85	0.979	0.48	0.957	0.64
685	1.055	0.88	0.883	0.49	0.919	0.71	0.983	1.23	0.960	0.75
690	1.052	0.82	0.883	1.32	0.921	0.62	0.984	1.36	0.960	0.93
695	1.051	0.41	0.879	1.63	0.924	0.49	0.982	0.67	0.959	0.66
700	1.056	0.73	0.881	1.03	0.930	0.25	0.980	0.75	0.962	0.16
705	1.055	0.49	0.876	1.53	0.918	1.24	0.983	1.15	0.958	0.96
710	1.051	1.06	0.889	1.30	0.928	0.48	0.985	1.74	0.963	1.07
715	1.054	0.63	0.882	1.02	0.925	1.15	0.991	1.25	0.963	0.73
720	1.065	1.01	0.892	1.16	0.923	1.66	0.992	0.56	0.968	0.80
725	1.058	1.00	0.874	0.70	0.922	1.45	0.979	1.68	0.958	1.01
730	1.062	1.08	0.877	0.63	0.927	0.83	0.990	0.70	0.964	0.33

-60°/ 15° BIDIRECTIONAL ABSOLUTE SPECTRAL REFLECTANCE FACTORS

WAV. [nm]	Bss mean	Bss coeff. var.	Bsp mean	Bsp coeff. var.	Bps mean	Bps coeff. var.	Bpp mean	Bpp coeff. var.	Brr mean	Brr coeff. var.
390	1.056	1.17	0.844	1.18	0.890	1.08	0.955	0.66	0.936	0.31
395	1.094	0.54	0.904	0.85	0.924	1.22	0.996	1.14	0.980	0.78
400	1.093	0.47	0.899	0.62	0.926	1.23	0.988	0.63	0.976	0.64
405	1.102	0.75	0.904	0.57	0.929	0.89	0.998	1.06	0.984	0.73
410	1.102	1.04	0.909	0.65	0.934	1.36	1.000	0.70	0.986	0.88
415	1.106	1.06	0.909	0.46	0.933	1.29	1.007	1.10	0.989	0.96
420	1.108	1.11	0.910	0.90	0.934	1.46	1.006	0.94	0.990	1.06
425	1.111	1.04	0.913	0.93	0.936	1.62	1.008	0.97	0.992	1.07
430	1.107	1.16	0.913	0.85	0.937	1.31	1.010	1.21	0.991	1.06
435	1.109	1.29	0.911	1.10	0.934	1.42	1.007	1.25	0.990	1.20
440	1.112	1.34	0.916	0.74	0.937	1.35	1.010	1.49	0.994	1.19
445	1.114	1.22	0.913	0.92	0.938	1.43	1.008	1.04	0.993	1.10
450	1.114	1.37	0.912	1.09	0.937	1.65	1.009	1.14	0.993	1.24
455	1.117	1.11	0.917	0.84	0.940	1.52	1.014	1.27	0.997	1.15
460	1.118	1.15	0.911	0.78	0.938	1.46	1.009	1.14	0.994	1.08
465	1.124	0.90	0.907	0.92	0.944	1.32	1.005	1.21	0.995	1.02
470	1.117	0.90	0.912	0.90	0.939	1.27	1.009	1.03	0.994	0.97
475	1.118	0.96	0.912	0.89	0.940	1.39	1.010	1.16	0.995	1.04
480	1.116	0.99	0.911	1.04	0.937	1.26	1.009	1.05	0.993	1.04
485	1.118	0.99	0.910	0.91	0.937	1.35	1.008	1.03	0.993	1.02
490	1.117	0.97	0.908	0.99	0.935	1.22	1.008	0.94	0.992	0.98
495	1.116	0.99	0.908	0.87	0.934	1.21	1.006	1.25	0.991	1.02
500	1.116	0.88	0.908	0.61	0.934	1.24	1.004	0.99	0.991	0.87
505	1.119	0.80	0.906	0.72	0.935	1.33	1.007	1.05	0.992	0.88
510	1.119	0.74	0.908	0.83	0.933	1.17	1.006	0.81	0.992	0.80
515	1.118	0.79	0.907	0.60	0.932	1.07	1.006	0.80	0.990	0.74
520	1.116	0.55	0.903	0.53	0.930	1.03	1.002	0.85	0.988	0.68
525	1.118	0.67	0.906	0.45	0.931	0.98	1.003	0.82	0.989	0.69
530	1.118	0.66	0.906	0.56	0.932	0.92	1.005	0.59	0.990	0.62
535	1.116	0.55	0.902	0.55	0.929	1.10	1.000	0.50	0.987	0.59
540	1.118	0.60	0.904	0.46	0.930	0.94	1.003	0.52	0.989	0.59
545	1.119	0.86	0.900	0.49	0.929	0.98	1.001	0.66	0.987	0.68
550	1.119	0.77	0.902	0.32	0.929	0.85	1.000	0.82	0.988	0.65
555	1.117	0.41	0.902	0.48	0.927	0.61	1.000	0.60	0.987	0.44
560	1.115	0.51	0.899	0.50	0.926	0.65	0.997	0.64	0.984	0.45
565	1.120	0.63	0.899	0.44	0.927	0.84	0.998	0.46	0.986	0.49
570	1.116	0.44	0.896	0.40	0.926	0.60	0.995	0.53	0.983	0.38
575	1.118	0.19	0.898	0.47	0.926	0.89	0.997	0.42	0.985	0.39
580	1.122	0.12	0.900	0.50	0.927	0.52	0.997	0.42	0.987	0.22
585	1.121	0.44	0.899	0.51	0.929	0.63	1.000	0.31	0.987	0.30
590	1.120	0.62	0.899	0.34	0.928	0.57	1.000	0.47	0.987	0.44
595	1.120	0.67	0.896	0.37	0.927	0.80	0.996	0.45	0.985	0.56
600	1.124	0.38	0.898	0.34	0.928	0.93	0.999	0.45	0.987	0.43
605	1.126	0.31	0.898	0.46	0.927	0.76	0.995	0.46	0.987	0.43
610	1.124	0.40	0.897	0.72	0.933	0.91	0.999	0.78	0.988	0.57
615	1.125	0.25	0.897	0.57	0.928	0.33	0.999	0.41	0.987	0.26
620	1.126	0.33	0.899	0.38	0.931	0.67	1.001	0.55	0.989	0.37
625	1.126	0.29	0.901	0.68	0.931	0.75	0.999	0.79	0.989	0.53
630	1.129	0.12	0.897	0.43	0.930	0.87	1.000	0.54	0.989	0.40
635	1.129	0.47	0.895	0.75	0.929	0.77	1.001	0.61	0.988	0.47
640	1.130	0.42	0.899	0.48	0.927	0.73	0.997	0.61	0.988	0.50
645	1.134	0.43	0.897	0.54	0.930	0.90	0.997	0.53	0.989	0.57
650	1.129	0.38	0.893	0.55	0.932	0.86	1.000	0.60	0.989	0.50
655	1.129	0.57	0.897	0.52	0.933	0.81	0.999	0.63	0.989	0.51
660	1.137	0.52	0.896	0.86	0.934	0.76	0.999	0.50	0.991	0.50
665	1.134	0.59	0.897	0.67	0.932	1.08	0.997	0.69	0.990	0.69
670	1.131	0.98	0.896	0.67	0.933	0.43	0.999	0.56	0.990	0.39
675	1.128	0.68	0.893	0.40	0.928	0.18	0.994	0.62	0.986	0.38
680	1.129	0.53	0.899	0.56	0.932	0.52	0.993	0.22	0.988	0.39
685	1.134	0.60	0.897	0.64	0.938	0.92	0.998	0.56	0.992	0.61
690	1.133	0.49	0.893	0.61	0.936	0.44	0.998	0.81	0.990	0.50
695	1.133	0.38	0.896	0.72	0.929	0.72	0.998	0.56	0.989	0.51
700	1.134	0.84	0.902	0.66	0.930	0.87	1.010	0.92	0.994	0.52
705	1.139	0.60	0.902	0.65	0.936	0.93	1.003	1.46	0.995	0.51
710	1.138	0.62	0.897	1.84	0.932	0.41	0.998	0.61	0.991	0.60
715	1.143	0.67	0.900	0.12	0.940	0.21	1.003	0.37	0.996	0.31
720	1.152	1.43	0.914	2.57	0.943	0.56	1.001	1.30	1.002	0.62
725	1.142	0.54	0.897	1.17	0.935	0.61	0.995	2.08	0.992	0.94
730	1.139	0.61	0.900	1.17	0.930	0.96	1.005	1.36	0.994	0.51

-60°/ 30° BIDIRECTIONAL ABSOLUTE SPECTRAL REFLECTANCE FACTORS

WAV. [nm]	Bss mean	Bss coeff. var.	Bsp mean	Bsp coeff. var.	Bps mean	Bps coeff. var.	Bpp mean	Bpp coeff. var.	Brr mean	Brr coeff. var.
390	1.171	1.10	0.875	1.89	0.913	3.65	0.993	2.94	0.988	0.37
395	1.209	0.82	0.925	0.71	0.934	2.06	1.036	0.55	1.026	0.66
400	1.204	1.65	0.917	0.46	0.928	1.72	1.039	0.39	1.022	0.91
405	1.219	1.20	0.922	0.96	0.941	1.14	1.042	0.65	1.031	0.94
410	1.223	0.83	0.925	0.72	0.945	1.20	1.047	0.84	1.035	0.76
415	1.226	1.18	0.927	0.55	0.949	0.91	1.050	0.65	1.038	0.68
420	1.228	1.23	0.931	0.83	0.944	1.45	1.052	0.94	1.039	1.08
425	1.230	1.21	0.929	0.66	0.948	1.15	1.054	0.87	1.040	0.86
430	1.230	1.32	0.932	0.74	0.948	1.10	1.054	1.16	1.041	0.98
435	1.232	1.52	0.930	1.01	0.950	1.21	1.054	1.09	1.041	1.10
440	1.237	1.49	0.935	1.14	0.952	1.33	1.059	0.97	1.046	1.07
445	1.237	1.51	0.931	1.04	0.949	1.37	1.054	1.06	1.043	1.19
450	1.238	1.31	0.929	0.90	0.945	1.56	1.055	1.19	1.042	1.16
455	1.239	1.35	0.935	0.97	0.953	1.24	1.059	1.04	1.046	1.07
460	1.240	1.44	0.931	0.99	0.948	1.69	1.055	0.91	1.044	1.17
465	1.249	1.16	0.926	0.78	0.957	1.20	1.050	0.82	1.046	0.93
470	1.242	1.23	0.932	0.80	0.955	1.20	1.056	0.95	1.046	0.92
475	1.244	1.29	0.931	0.82	0.951	1.38	1.055	0.99	1.045	1.02
480	1.245	1.28	0.930	0.76	0.950	1.07	1.055	0.74	1.045	0.86
485	1.244	1.08	0.927	0.90	0.947	1.16	1.056	0.79	1.043	0.86
490	1.246	1.09	0.926	0.65	0.948	1.11	1.054	0.91	1.043	0.87
495	1.244	1.05	0.926	0.75	0.946	1.12	1.054	0.69	1.042	0.84
500	1.244	0.81	0.927	0.79	0.946	1.05	1.053	0.70	1.042	0.75
505	1.244	1.09	0.926	0.54	0.946	1.27	1.055	0.86	1.042	0.89
510	1.246	0.88	0.926	0.43	0.945	1.08	1.054	0.92	1.042	0.79
515	1.245	0.89	0.926	0.43	0.945	0.91	1.050	0.90	1.041	0.74
520	1.245	0.79	0.923	0.60	0.941	0.92	1.050	0.88	1.040	0.68
525	1.245	1.05	0.924	0.52	0.944	0.94	1.050	0.62	1.041	0.71
530	1.246	0.89	0.925	0.18	0.946	0.75	1.051	0.47	1.042	0.52
535	1.244	0.89	0.921	0.59	0.941	0.94	1.049	0.36	1.039	0.65
540	1.245	0.75	0.920	0.55	0.941	0.76	1.051	0.50	1.039	0.46
545	1.248	0.51	0.920	0.55	0.937	1.24	1.048	0.38	1.038	0.57
550	1.248	0.46	0.921	0.65	0.940	0.92	1.049	0.29	1.040	0.50
555	1.251	0.60	0.920	0.41	0.940	0.78	1.047	0.28	1.040	0.45
560	1.249	0.44	0.918	0.23	0.932	1.62	1.046	0.26	1.036	0.52
565	1.246	0.73	0.917	0.36	0.941	0.43	1.048	0.51	1.038	0.35
570	1.246	0.56	0.917	0.42	0.939	0.56	1.045	0.46	1.037	0.30
575	1.244	0.53	0.916	0.58	0.939	0.70	1.044	0.37	1.036	0.38
580	1.247	0.24	0.918	0.52	0.940	0.36	1.047	0.37	1.038	0.22
585	1.252	0.55	0.918	0.42	0.940	0.52	1.047	0.34	1.039	0.37
590	1.253	0.62	0.918	0.45	0.941	0.56	1.047	0.31	1.040	0.44
595	1.255	0.70	0.918	0.39	0.941	0.70	1.045	0.33	1.040	0.46
600	1.256	0.39	0.917	0.32	0.942	0.48	1.046	0.24	1.040	0.28
605	1.256	0.54	0.915	0.49	0.938	0.31	1.043	0.41	1.038	0.41
610	1.262	0.37	0.918	0.52	0.941	0.44	1.048	0.65	1.042	0.27
615	1.259	0.64	0.915	0.71	0.938	0.69	1.045	0.40	1.039	0.55
620	1.260	0.75	0.920	0.49	0.944	0.83	1.049	0.25	1.043	0.43
625	1.260	0.39	0.920	0.37	0.941	0.84	1.046	0.45	1.042	0.45
630	1.257	0.85	0.916	0.37	0.943	0.64	1.045	0.47	1.040	0.55
635	1.258	0.47	0.914	0.32	0.942	0.68	1.045	0.56	1.040	0.38
640	1.263	0.92	0.914	0.42	0.942	0.51	1.045	0.39	1.041	0.41
645	1.265	0.50	0.917	0.56	0.943	0.71	1.045	0.30	1.043	0.36
650	1.269	0.27	0.919	0.48	0.945	0.95	1.042	0.33	1.044	0.39
655	1.261	0.50	0.918	0.36	0.943	0.54	1.047	0.41	1.042	0.27
660	1.261	0.38	0.915	0.54	0.942	0.53	1.045	0.26	1.041	0.33
665	1.264	0.81	0.914	0.87	0.943	0.80	1.040	0.31	1.040	0.58
670	1.266	0.50	0.918	0.80	0.944	0.94	1.040	1.05	1.042	0.63
675	1.266	0.78	0.912	0.46	0.941	0.94	1.039	0.75	1.040	0.68
680	1.272	1.07	0.914	1.12	0.947	0.88	1.043	0.73	1.044	0.55
685	1.272	0.82	0.920	0.40	0.943	1.27	1.046	0.28	1.045	0.60
690	1.280	0.92	0.916	0.60	0.946	0.81	1.049	0.79	1.048	0.52
695	1.272	0.74	0.914	0.98	0.948	0.27	1.049	0.46	1.046	0.50
700	1.276	0.61	0.916	0.20	0.942	1.08	1.054	0.21	1.047	0.07
705	1.275	0.57	0.915	0.94	0.946	1.08	1.046	0.42	1.046	0.63
710	1.278	0.28	0.916	0.55	0.941	1.30	1.047	0.84	1.046	0.44
715	1.277	0.90	0.912	0.53	0.956	0.89	1.039	1.50	1.046	0.39
720	1.276	0.77	0.919	1.86	0.945	0.80	1.053	1.24	1.048	0.56
725	1.287	0.48	0.923	1.82	0.954	1.00	1.046	1.32	1.053	0.72
730	1.276	1.07	0.924	0.89	0.951	1.29	1.045	1.12	1.049	0.62

-60°/ 45° BIDIRECTIONAL ABSOLUTE SPECTRAL REFLECTANCE FACTORS

WAV.	Bss		Bsp		Bps		Bpp		Brr	
[nm]	mean	coeff. var.	mean	coeff. var.	mean	coeff. var.	mean	coeff. var.	mean	coeff. var.
390	1.364	1.49	0.899	1.75	0.909	0.97	1.076	1.33	1.062	0.82
395	1.402	1.15	0.945	0.43	0.948	1.47	1.126	1.05	1.105	0.61
400	1.397	1.46	0.938	0.59	0.942	1.08	1.124	0.37	1.100	0.69
405	1.414	1.31	0.946	0.63	0.953	0.83	1.135	1.17	1.112	0.67
410	1.416	1.52	0.947	0.47	0.957	0.94	1.139	1.08	1.115	0.62
415	1.420	1.55	0.952	1.09	0.958	1.09	1.145	0.81	1.119	0.90
420	1.426	1.78	0.951	0.68	0.956	1.03	1.145	0.93	1.119	0.91
425	1.431	1.83	0.953	1.12	0.960	1.09	1.149	1.17	1.123	1.09
430	1.430	1.70	0.954	0.92	0.960	1.25	1.149	1.44	1.123	1.01
435	1.432	1.80	0.954	1.04	0.957	1.41	1.149	1.15	1.123	1.15
440	1.436	1.68	0.956	1.04	0.961	1.44	1.154	0.99	1.127	1.08
445	1.440	1.69	0.952	0.83	0.960	1.27	1.152	1.15	1.126	1.07
450	1.443	1.83	0.953	0.90	0.959	1.19	1.152	1.18	1.127	1.12
455	1.440	1.91	0.957	0.86	0.963	1.36	1.158	1.16	1.130	1.17
460	1.441	1.73	0.954	1.02	0.960	1.35	1.154	1.17	1.127	1.04
465	1.453	1.61	0.948	1.19	0.967	1.31	1.148	0.91	1.129	0.99
470	1.449	1.55	0.955	0.86	0.961	1.25	1.156	1.39	1.130	0.99
475	1.451	1.55	0.952	0.79	0.961	1.29	1.155	1.23	1.130	0.91
480	1.451	1.54	0.951	0.68	0.959	1.32	1.154	1.14	1.129	0.85
485	1.452	1.44	0.950	0.84	0.960	1.14	1.156	1.07	1.129	0.88
490	1.453	1.56	0.949	0.71	0.958	1.18	1.154	0.94	1.128	0.88
495	1.451	1.46	0.949	0.84	0.957	1.13	1.154	1.33	1.128	0.92
500	1.452	1.21	0.949	0.82	0.955	1.16	1.153	1.38	1.127	0.87
505	1.452	1.41	0.948	0.76	0.956	1.12	1.152	1.14	1.127	0.84
510	1.454	1.48	0.947	0.94	0.956	1.01	1.153	0.92	1.128	0.76
515	1.453	1.30	0.946	0.94	0.954	0.85	1.153	1.01	1.126	0.65
520	1.452	1.19	0.943	0.93	0.952	0.93	1.152	1.30	1.125	0.64
525	1.452	1.07	0.945	0.58	0.952	0.72	1.154	0.98	1.126	0.56
530	1.454	0.93	0.947	0.64	0.953	0.52	1.156	0.80	1.128	0.45
535	1.454	1.04	0.941	0.56	0.952	0.68	1.150	1.22	1.124	0.46
540	1.455	1.14	0.943	0.38	0.952	0.72	1.152	1.18	1.126	0.47
545	1.458	1.20	0.940	0.60	0.950	0.58	1.152	0.86	1.125	0.52
550	1.459	0.89	0.943	0.56	0.949	0.74	1.152	0.81	1.126	0.51
555	1.455	0.72	0.940	0.57	0.951	0.67	1.152	0.95	1.125	0.43
560	1.459	0.70	0.939	0.38	0.948	0.53	1.147	0.77	1.123	0.33
565	1.459	0.87	0.937	0.29	0.950	0.68	1.147	0.67	1.123	0.34
570	1.459	0.71	0.936	0.28	0.948	0.58	1.145	1.12	1.122	0.13
575	1.463	0.78	0.937	0.34	0.948	0.71	1.148	1.07	1.124	0.29
580	1.470	1.05	0.941	0.14	0.950	0.68	1.148	1.34	1.127	0.25
585	1.469	0.92	0.938	0.20	0.951	0.69	1.148	0.78	1.127	0.34
590	1.471	0.97	0.939	0.29	0.948	0.54	1.148	1.12	1.127	0.25
595	1.470	0.69	0.938	0.59	0.948	0.54	1.148	1.12	1.126	0.32
600	1.473	0.51	0.938	0.48	0.947	0.63	1.150	1.02	1.127	0.39
605	1.476	0.66	0.936	0.64	0.949	0.37	1.149	1.41	1.128	0.19
610	1.484	0.63	0.940	0.50	0.954	0.37	1.153	1.03	1.132	0.10
615	1.480	0.97	0.938	0.49	0.951	0.32	1.153	1.23	1.130	0.24
620	1.486	1.03	0.939	0.44	0.952	0.30	1.156	1.15	1.133	0.11
625	1.483	0.85	0.940	0.31	0.951	0.52	1.155	1.05	1.132	0.17
630	1.488	0.75	0.938	0.29	0.952	0.65	1.151	0.93	1.132	0.23
635	1.486	0.62	0.937	0.55	0.950	0.31	1.151	1.33	1.131	0.28
640	1.489	0.79	0.938	0.39	0.947	0.53	1.156	1.17	1.133	0.19
645	1.492	0.55	0.938	0.72	0.956	0.75	1.157	1.18	1.136	0.48
650	1.492	0.84	0.937	0.59	0.950	0.22	1.154	1.19	1.133	0.40
655	1.488	0.41	0.936	0.65	0.951	0.44	1.149	1.17	1.131	0.31
660	1.496	0.65	0.937	0.85	0.948	0.19	1.150	1.45	1.133	0.25
665	1.491	0.72	0.934	0.73	0.947	0.37	1.148	1.27	1.130	0.43
670	1.500	1.30	0.936	0.78	0.952	0.96	1.151	1.30	1.135	0.43
675	1.498	1.11	0.935	0.78	0.950	0.49	1.148	0.77	1.133	0.41
680	1.502	1.07	0.934	0.90	0.949	0.57	1.148	0.48	1.133	0.43
685	1.505	1.02	0.937	0.80	0.950	0.50	1.151	0.82	1.136	0.38
690	1.508	0.72	0.935	1.06	0.953	0.72	1.149	0.97	1.136	0.31
695	1.506	1.15	0.941	0.13	0.946	0.74	1.147	1.09	1.135	0.48
700	1.506	1.47	0.941	0.96	0.957	0.83	1.148	1.58	1.138	0.60
705	1.499	1.07	0.934	0.39	0.953	0.70	1.152	2.09	1.134	0.31
710	1.509	1.28	0.937	1.49	0.955	1.60	1.151	0.91	1.138	1.00
715	1.510	0.92	0.933	0.95	0.960	0.98	1.158	1.25	1.140	0.45
720	1.511	1.62	0.939	1.27	0.942	0.74	1.151	1.24	1.136	0.78
725	1.519	1.03	0.940	1.92	0.960	0.67	1.149	0.88	1.142	0.71
730	1.512	1.41	0.942	1.19	0.954	0.48	1.157	1.10	1.141	0.54

-60°/ 60° BIDIRECTIONAL ABSOLUTE SPECTRAL REFLECTANCE FACTORS

WAV. [nm]	Bss mean	Bss coeff. var.	Bsp mean	Bsp coeff. var.	Bps mean	Bps coeff. var.	Bpp mean	Bpp coeff. var.	Brr mean	Brr coeff. var.
390	1.702	2.38	0.942	1.38	0.926	0.78	1.271	1.00	1.210	0.75
395	1.735	2.40	0.978	1.21	0.964	0.39	1.314	1.00	1.247	0.63
400	1.732	2.16	0.968	0.85	0.955	1.07	1.311	1.79	1.241	0.69
405	1.755	2.10	0.973	0.58	0.965	0.89	1.325	1.47	1.255	0.68
410	1.759	2.35	0.975	0.48	0.968	1.12	1.330	1.76	1.258	0.94
415	1.762	2.06	0.978	0.65	0.970	0.95	1.335	1.75	1.261	0.78
420	1.765	2.24	0.978	0.81	0.970	1.10	1.340	1.74	1.263	0.85
425	1.773	2.32	0.981	0.99	0.971	1.21	1.343	1.92	1.267	1.03
430	1.777	2.38	0.977	0.91	0.968	1.25	1.344	2.14	1.266	1.02
435	1.781	2.26	0.979	1.10	0.968	1.15	1.347	1.83	1.269	1.03
440	1.781	2.42	0.980	0.81	0.972	1.25	1.354	1.44	1.272	1.10
445	1.787	2.55	0.980	0.86	0.972	1.26	1.353	1.73	1.273	1.17
450	1.795	2.57	0.980	1.18	0.971	1.41	1.355	1.81	1.275	1.24
455	1.797	2.29	0.985	0.96	0.974	1.41	1.358	1.96	1.278	1.11
460	1.798	2.28	0.980	0.67	0.973	1.26	1.357	1.97	1.277	0.93
465	1.809	2.22	0.975	0.87	0.978	1.11	1.351	1.80	1.278	0.85
470	1.801	1.99	0.981	0.79	0.973	1.16	1.360	1.80	1.279	0.74
475	1.804	2.01	0.978	0.81	0.974	1.21	1.360	1.70	1.279	0.72
480	1.804	1.94	0.977	0.74	0.971	1.10	1.360	1.85	1.278	0.75
485	1.809	1.94	0.976	0.71	0.971	1.02	1.359	2.26	1.279	0.66
490	1.811	1.79	0.975	0.58	0.967	1.17	1.358	2.13	1.278	0.73
495	1.813	2.14	0.974	0.81	0.967	1.22	1.357	2.08	1.277	0.89
500	1.811	2.09	0.974	0.70	0.969	1.14	1.357	1.83	1.278	0.84
505	1.810	2.32	0.974	0.73	0.967	1.07	1.358	1.75	1.277	0.85
510	1.815	2.06	0.974	0.60	0.968	1.19	1.361	1.97	1.280	0.77
515	1.815	1.79	0.971	0.65	0.964	1.07	1.359	2.23	1.277	0.59
520	1.817	1.86	0.970	0.36	0.963	0.92	1.363	2.20	1.278	0.61
525	1.818	1.86	0.969	0.67	0.962	0.66	1.366	2.69	1.279	0.56
530	1.821	1.98	0.971	0.74	0.964	0.90	1.366	2.48	1.281	0.56
535	1.825	1.73	0.968	0.47	0.960	1.01	1.365	2.39	1.280	0.52
540	1.829	1.58	0.967	0.36	0.961	0.86	1.366	2.14	1.281	0.53
545	1.830	1.44	0.967	0.39	0.961	0.73	1.366	2.01	1.281	0.57
550	1.834	1.54	0.967	0.30	0.960	0.78	1.364	1.88	1.281	0.53
555	1.842	1.25	0.966	0.82	0.963	0.91	1.366	2.00	1.284	0.48
560	1.844	1.26	0.964	0.47	0.961	0.83	1.365	2.64	1.284	0.35
565	1.846	1.58	0.962	0.21	0.960	0.85	1.366	2.52	1.283	0.33
570	1.846	1.15	0.963	0.35	0.960	0.61	1.364	2.36	1.283	0.29
575	1.847	1.58	0.964	0.14	0.958	0.36	1.364	2.26	1.283	0.23
580	1.848	1.62	0.965	0.41	0.960	0.45	1.368	2.55	1.285	0.18
585	1.849	1.34	0.963	0.33	0.958	0.55	1.368	2.32	1.285	0.13
590	1.855	1.64	0.964	0.24	0.959	0.21	1.368	2.04	1.287	0.21
595	1.858	1.63	0.962	0.28	0.959	0.35	1.370	2.62	1.287	0.20
600	1.859	1.23	0.962	0.63	0.962	0.53	1.374	2.90	1.289	0.30
605	1.853	1.28	0.963	0.45	0.961	0.44	1.374	3.11	1.288	0.38
610	1.858	1.18	0.963	0.55	0.961	0.32	1.375	3.16	1.289	0.58
615	1.855	0.84	0.960	0.47	0.961	0.59	1.372	2.74	1.287	0.53
620	1.863	0.88	0.962	0.41	0.962	0.94	1.374	3.12	1.290	0.58
625	1.875	1.02	0.965	0.16	0.962	0.92	1.380	2.90	1.295	0.47
630	1.879	0.90	0.963	0.51	0.962	1.03	1.377	2.94	1.295	0.43
635	1.878	0.94	0.965	0.32	0.963	0.58	1.376	3.09	1.296	0.28
640	1.881	1.07	0.961	0.42	0.963	0.58	1.380	2.92	1.296	0.34
645	1.887	1.45	0.963	1.10	0.960	0.28	1.380	2.44	1.298	0.25
650	1.882	1.23	0.965	0.29	0.958	0.78	1.380	2.87	1.296	0.31
655	1.880	1.29	0.964	0.63	0.961	0.64	1.382	2.73	1.297	0.37
660	1.891	1.11	0.962	0.74	0.962	0.96	1.380	2.37	1.299	0.37
665	1.894	1.13	0.958	0.57	0.962	0.61	1.379	2.33	1.298	0.40
670	1.894	1.19	0.966	0.56	0.960	0.66	1.382	2.17	1.301	0.45
675	1.898	1.45	0.957	0.46	0.956	0.61	1.376	2.94	1.297	0.61
680	1.895	1.14	0.963	0.99	0.959	0.16	1.368	2.88	1.296	0.28
685	1.901	1.45	0.962	0.64	0.959	1.03	1.374	3.50	1.299	0.79
690	1.911	1.15	0.957	0.77	0.962	0.60	1.377	3.19	1.302	0.37
695	1.905	1.14	0.963	0.48	0.959	0.88	1.382	3.09	1.302	0.39
700	1.916	1.16	0.960	0.62	0.965	0.73	1.394	2.66	1.309	0.02
705	1.917	1.36	0.959	0.69	0.965	0.86	1.389	3.46	1.308	0.83
710	1.924	1.00	0.973	0.62	0.961	0.51	1.385	3.34	1.311	0.29
715	1.928	1.23	0.972	0.68	0.969	0.55	1.388	3.92	1.315	0.67
720	1.922	0.66	0.968	1.89	0.960	0.69	1.392	2.49	1.310	0.71
725	1.915	0.24	0.964	0.55	0.959	1.41	1.390	2.34	1.307	0.67
730	1.921	1.14	0.961	1.26	0.965	1.31	1.377	4.00	1.306	0.54

-60°/ 75° BIDIRECTIONAL ABSOLUTE SPECTRAL REFLECTANCE FACTORS

WAV. [nm]	Bss mean	Bss coeff. var.	Bsp mean	Bsp coeff. var.	Bps mean	Bps coeff. var.	Bpp mean	Bpp coeff. var.	Brr mean	Brr coeff. var.
390	2.303	2.45	0.968	1.41	0.940	1.93	1.705	4.44	1.479	0.66
395	2.344	2.71	1.003	1.16	0.985	0.77	1.743	4.44	1.519	0.43
400	2.334	3.01	1.002	0.54	0.979	1.12	1.745	4.41	1.515	0.91
405	2.363	2.75	1.007	1.01	0.987	1.36	1.763	4.64	1.530	0.88
410	2.373	2.77	1.006	1.07	0.988	1.60	1.763	3.98	1.532	1.02
415	2.389	3.19	1.011	0.98	0.989	1.64	1.778	4.67	1.542	1.19
420	2.389	3.33	1.011	0.99	0.989	1.46	1.783	4.08	1.543	1.27
425	2.396	3.26	1.013	1.29	0.989	1.51	1.792	4.51	1.548	1.31
430	2.403	3.21	1.011	1.26	0.987	1.48	1.791	4.72	1.548	1.30
435	2.410	3.03	1.011	1.07	0.988	1.73	1.793	5.09	1.551	1.34
440	2.413	2.96	1.012	1.25	0.990	1.55	1.795	4.90	1.553	1.36
445	2.419	2.80	1.011	1.17	0.988	1.57	1.800	4.88	1.554	1.26
450	2.422	2.92	1.011	1.30	0.989	1.65	1.806	4.75	1.557	1.26
455	2.420	2.90	1.016	1.12	0.991	1.48	1.810	4.58	1.559	1.14
460	2.431	3.03	1.010	1.05	0.989	1.32	1.810	4.41	1.560	1.03
465	2.451	3.06	1.005	0.94	0.994	1.44	1.805	4.40	1.564	1.02
470	2.440	2.85	1.010	1.12	0.988	1.51	1.816	4.41	1.563	1.14
475	2.444	2.86	1.010	1.23	0.987	1.42	1.819	4.41	1.565	1.21
480	2.451	2.99	1.008	1.18	0.986	1.24	1.822	4.29	1.567	1.17
485	2.455	2.93	1.007	1.09	0.987	1.33	1.826	4.74	1.569	1.09
490	2.468	2.96	1.004	0.78	0.984	1.40	1.833	4.87	1.572	1.13
495	2.471	2.94	1.003	1.04	0.983	1.29	1.834	4.95	1.573	1.12
500	2.474	2.74	1.004	1.06	0.983	1.41	1.834	5.25	1.574	1.03
505	2.482	2.23	1.004	0.94	0.984	1.57	1.838	4.97	1.577	0.91
510	2.486	2.17	1.004	1.08	0.982	1.29	1.839	4.64	1.578	0.83
515	2.490	2.37	1.000	1.02	0.981	1.13	1.839	4.33	1.577	0.77
520	2.491	2.61	0.998	0.99	0.979	0.99	1.839	4.46	1.577	0.77
525	2.492	2.77	0.999	0.83	0.979	1.10	1.841	4.46	1.578	0.79
530	2.493	2.79	1.003	0.70	0.979	1.09	1.844	5.16	1.580	0.73
535	2.499	2.60	0.998	0.82	0.976	1.24	1.846	5.29	1.580	0.70
540	2.506	2.30	0.999	0.70	0.979	0.79	1.847	5.20	1.583	0.59
545	2.514	2.44	0.999	0.96	0.977	0.87	1.854	5.23	1.586	0.68
550	2.516	2.23	0.998	0.78	0.975	0.76	1.856	5.42	1.586	0.61
555	2.521	2.01	0.996	0.56	0.975	0.91	1.860	5.90	1.588	0.57
560	2.532	1.89	0.993	0.87	0.972	1.02	1.864	5.47	1.590	0.55
565	2.537	2.09	0.996	0.54	0.973	0.93	1.870	5.54	1.594	0.38
570	2.542	2.04	0.994	0.63	0.971	0.78	1.871	6.18	1.594	0.49
575	2.542	1.81	0.994	0.61	0.971	0.76	1.873	5.74	1.595	0.48
580	2.553	1.71	0.996	0.82	0.974	0.70	1.872	6.12	1.599	0.51
585	2.554	1.61	0.992	0.75	0.973	0.90	1.870	5.64	1.597	0.48
590	2.554	1.65	0.994	0.74	0.972	0.77	1.872	5.95	1.598	0.59
595	2.561	1.83	0.994	0.48	0.974	1.03	1.872	6.14	1.600	0.57
600	2.574	1.82	0.994	0.51	0.974	0.85	1.871	6.67	1.603	0.55
605	2.577	1.68	0.989	0.68	0.974	0.74	1.873	6.65	1.603	0.59
610	2.585	1.54	0.991	0.34	0.977	0.87	1.874	6.28	1.607	0.61
615	2.591	1.74	0.991	0.49	0.973	0.84	1.872	6.17	1.607	0.50
620	2.594	1.76	0.993	0.48	0.977	0.84	1.880	6.42	1.611	0.45
625	2.602	1.64	0.993	0.65	0.972	0.81	1.881	5.90	1.612	0.59
630	2.608	1.76	0.991	0.41	0.972	0.86	1.885	5.73	1.614	0.57
635	2.600	1.66	0.990	0.60	0.973	0.44	1.882	5.90	1.611	0.49
640	2.604	1.56	0.989	0.55	0.973	0.71	1.884	6.28	1.612	0.53
645	2.608	1.44	0.994	0.83	0.972	0.77	1.887	7.13	1.615	0.50
650	2.615	1.69	0.991	0.81	0.978	1.03	1.892	6.47	1.619	0.37
655	2.617	1.49	0.991	0.92	0.974	0.87	1.896	6.44	1.619	0.45
660	2.628	1.56	0.990	1.33	0.973	0.93	1.895	5.96	1.621	0.53
665	2.634	1.51	0.985	1.42	0.973	0.73	1.889	6.14	1.620	0.67
670	2.639	1.61	0.983	1.12	0.971	1.03	1.893	6.77	1.622	0.74
675	2.634	1.69	0.982	0.95	0.972	0.91	1.898	7.22	1.621	0.87
680	2.623	1.65	0.989	0.76	0.977	1.22	1.893	7.62	1.620	0.90
685	2.629	1.96	0.984	0.67	0.972	0.74	1.896	7.06	1.620	0.85
690	2.644	1.70	0.985	1.34	0.970	1.13	1.906	6.85	1.626	0.87
695	2.661	1.07	0.985	1.01	0.972	0.49	1.914	6.56	1.633	0.84
700	2.664	1.26	0.993	1.81	0.972	0.46	1.915	6.47	1.636	0.76
705	2.649	1.05	0.984	0.91	0.978	1.39	1.904	6.10	1.629	0.61
710	2.675	1.18	0.984	1.12	0.974	0.57	1.903	6.91	1.634	0.88
715	2.676	0.73	0.985	1.76	0.976	1.52	1.912	7.46	1.637	1.05
720	2.669	0.79	0.992	0.67	0.974	1.19	1.913	7.05	1.637	0.97
725	2.683	0.96	0.984	0.98	0.973	1.24	1.907	6.54	1.637	0.50
730	2.688	0.98	0.985	1.21	0.966	0.78	1.903	7.53	1.636	0.72

-75°/-60° BIDIRECTIONAL ABSOLUTE SPECTRAL REFLECTANCE FACTORS

WAV. [nm]	Bss mean	Bss coeff. var.	Bsp mean	Bsp coeff. var.	Bps mean	Bps coeff. var.	Bpp mean	Bpp coeff. var.	Brr mean	Brr coeff. var.
390	0.829	2.78	0.715	5.50	0.725	3.97	0.884	3.73	0.789	3.10
395	0.897	1.05	0.791	1.49	0.807	3.07	0.991	3.18	0.871	1.97
400	0.888	2.24	0.785	1.85	0.788	2.97	0.988	3.14	0.862	2.26
405	0.897	1.94	0.791	2.17	0.793	3.01	0.981	2.14	0.865	2.06
410	0.899	1.66	0.787	1.94	0.796	2.83	0.980	2.55	0.866	2.03
415	0.898	2.04	0.784	2.28	0.790	3.26	0.980	3.65	0.863	2.61
420	0.901	1.96	0.791	1.79	0.792	2.24	0.980	2.62	0.866	2.01
425	0.900	1.82	0.786	2.18	0.790	3.04	0.987	2.92	0.866	2.30
430	0.895	2.15	0.785	2.48	0.791	2.59	0.981	2.83	0.863	2.35
435	0.898	2.02	0.782	2.21	0.788	2.93	0.986	3.10	0.864	2.39
440	0.900	1.97	0.785	2.23	0.794	2.75	0.987	2.93	0.866	2.31
445	0.902	2.20	0.786	2.18	0.793	3.05	0.988	3.02	0.867	2.45
450	0.900	2.11	0.782	2.47	0.789	3.24	0.985	3.15	0.864	2.55
455	0.906	2.01	0.788	2.18	0.797	2.88	0.994	3.25	0.871	2.41
460	0.902	2.12	0.782	2.37	0.791	2.86	0.988	2.99	0.866	2.41
465	0.906	2.04	0.778	2.10	0.798	2.94	0.985	3.21	0.867	2.40
470	0.899	2.09	0.782	2.13	0.789	2.82	0.987	2.88	0.864	2.32
475	0.900	1.91	0.778	2.21	0.789	2.96	0.986	2.99	0.863	2.35
480	0.899	2.20	0.779	2.35	0.789	2.77	0.988	2.78	0.864	2.36
485	0.899	2.06	0.779	2.28	0.788	2.98	0.988	3.17	0.864	2.44
490	0.895	1.90	0.774	2.23	0.786	3.12	0.986	3.01	0.860	2.38
495	0.894	1.84	0.774	2.28	0.782	2.92	0.985	2.72	0.859	2.26
500	0.894	1.97	0.774	2.12	0.781	2.80	0.984	2.94	0.858	2.27
505	0.894	2.05	0.772	2.50	0.782	2.73	0.985	2.94	0.858	2.36
510	0.891	2.03	0.769	2.12	0.779	2.62	0.983	3.01	0.856	2.26
515	0.890	2.07	0.767	2.27	0.776	2.70	0.981	3.19	0.854	2.37
520	0.887	1.76	0.763	2.66	0.776	2.71	0.977	2.68	0.851	2.25
525	0.889	1.80	0.768	2.40	0.779	2.68	0.981	3.05	0.854	2.30
530	0.889	1.94	0.768	2.11	0.777	2.54	0.980	2.80	0.854	2.17
535	0.883	1.69	0.763	2.05	0.772	2.80	0.976	2.75	0.848	2.15
540	0.886	1.97	0.761	1.88	0.772	2.25	0.978	2.66	0.849	2.04
545	0.884	2.05	0.759	2.37	0.770	2.54	0.974	2.90	0.847	2.29
550	0.884	1.53	0.760	1.84	0.770	2.34	0.977	2.67	0.848	1.92
555	0.885	1.93	0.762	2.32	0.769	2.69	0.978	2.77	0.848	2.25
560	0.882	1.76	0.757	2.26	0.766	2.37	0.974	2.87	0.844	2.12
565	0.883	1.86	0.756	1.97	0.767	2.69	0.973	2.70	0.845	2.14
570	0.878	1.51	0.751	2.39	0.760	2.90	0.966	2.46	0.839	2.13
575	0.880	1.45	0.752	1.77	0.764	2.14	0.972	2.86	0.842	1.90
580	0.880	1.32	0.752	1.99	0.766	2.52	0.974	2.46	0.843	1.89
585	0.880	1.63	0.754	1.76	0.764	2.34	0.968	2.64	0.841	1.94
590	0.879	1.27	0.754	1.81	0.766	2.18	0.974	3.07	0.843	1.91
595	0.876	1.94	0.751	2.10	0.764	2.69	0.971	2.37	0.841	2.12
600	0.883	1.43	0.748	2.34	0.764	2.32	0.973	2.48	0.842	1.96
605	0.878	1.95	0.747	2.11	0.761	3.00	0.969	2.58	0.839	2.22
610	0.883	1.43	0.753	2.70	0.765	2.76	0.974	2.77	0.844	2.13
615	0.880	1.70	0.749	2.24	0.761	2.12	0.972	3.00	0.841	2.08
620	0.880	2.01	0.750	1.73	0.768	2.22	0.974	2.59	0.843	1.98
625	0.879	1.27	0.751	2.86	0.766	2.09	0.972	2.48	0.842	2.00
630	0.880	1.92	0.746	2.55	0.762	2.88	0.972	3.17	0.840	2.40
635	0.883	1.29	0.747	2.43	0.767	2.96	0.970	2.92	0.842	2.19
640	0.882	1.83	0.742	2.18	0.757	2.17	0.976	2.39	0.839	1.97
645	0.881	1.57	0.747	2.92	0.764	2.52	0.973	3.56	0.841	2.35
650	0.880	1.24	0.753	0.94	0.766	2.87	0.975	3.36	0.843	1.90
655	0.879	2.22	0.744	2.68	0.762	2.64	0.978	2.40	0.841	2.24
660	0.871	1.56	0.750	2.99	0.766	2.00	0.970	3.00	0.839	2.18
665	0.884	1.24	0.743	2.25	0.758	1.90	0.971	4.02	0.839	2.15
670	0.876	1.83	0.749	2.91	0.768	3.38	0.978	2.81	0.843	2.44
675	0.871	1.59	0.734	2.96	0.751	2.58	0.961	2.58	0.829	2.18
680	0.884	2.43	0.752	2.47	0.762	3.56	0.975	2.75	0.843	2.49
685	0.883	2.32	0.738	1.61	0.766	3.28	0.972	4.71	0.840	2.73
690	0.877	2.88	0.748	2.99	0.764	3.13	0.970	2.14	0.840	2.56
695	0.873	1.61	0.743	3.13	0.756	1.94	0.978	4.41	0.837	2.48
700	0.871	4.08	0.748	3.65	0.761	3.32	0.970	2.27	0.838	2.88
705	0.877	1.68	0.750	3.70	0.768	2.00	0.981	3.16	0.844	2.24
710	0.874	2.42	0.739	3.97	0.752	3.31	0.978	2.66	0.836	2.53
715	0.888	1.09	0.749	2.27	0.764	3.36	0.983	4.65	0.846	2.27
720	0.875	2.43	0.723	4.92	0.735	3.79	0.970	2.20	0.825	1.42
725	0.879	1.64	0.741	2.67	0.760	2.98	0.975	3.80	0.839	2.36
730	0.857	2.82	0.740	2.80	0.755	5.21	0.964	3.80	0.829	1.30

-75°/-45° BIDIRECTIONAL ABSOLUTE SPECTRAL REFLECTANCE FACTORS

WAV. [nm]	Bss mean	Bss coeff. var.	Bsp mean	Bsp coeff. var.	Bps mean	Bps coeff. var.	Bpp mean	Bpp coeff. var.	Brr mean	Brr coeff. var.
390	0.791	4.77	0.686	3.75	0.735	3.99	0.811	4.39	0.756	2.49
395	0.869	2.51	0.777	0.78	0.789	1.98	0.896	1.73	0.833	1.52
400	0.844	1.28	0.766	2.50	0.781	1.98	0.904	3.61	0.824	2.09
405	0.856	2.42	0.768	1.15	0.793	3.33	0.907	3.00	0.831	2.34
410	0.862	1.77	0.773	2.10	0.789	3.18	0.906	2.31	0.833	2.21
415	0.861	1.94	0.768	2.12	0.788	2.78	0.907	2.56	0.831	2.22
420	0.861	2.17	0.772	2.37	0.787	2.34	0.912	2.46	0.833	2.20
425	0.861	2.06	0.770	1.96	0.788	2.85	0.914	3.35	0.833	2.45
430	0.859	2.19	0.774	1.95	0.785	2.97	0.911	3.10	0.832	2.44
435	0.860	2.32	0.768	2.42	0.786	2.62	0.909	2.83	0.831	2.41
440	0.864	2.47	0.776	2.00	0.791	2.61	0.917	2.85	0.837	2.37
445	0.862	2.40	0.770	1.97	0.789	3.11	0.913	2.79	0.834	2.44
450	0.863	2.30	0.770	2.00	0.787	2.96	0.915	3.06	0.834	2.47
455	0.870	2.24	0.777	2.27	0.793	3.07	0.920	3.15	0.840	2.55
460	0.865	2.15	0.771	2.05	0.791	2.86	0.916	3.05	0.836	2.42
465	0.871	2.23	0.767	2.12	0.795	2.91	0.913	2.79	0.836	2.41
470	0.864	2.34	0.770	2.27	0.788	3.11	0.918	2.75	0.835	2.50
475	0.863	2.07	0.769	2.06	0.788	2.76	0.915	2.70	0.834	2.29
480	0.863	2.39	0.769	2.34	0.786	3.08	0.916	2.95	0.834	2.57
485	0.865	2.27	0.767	1.97	0.787	2.70	0.916	2.78	0.833	2.34
490	0.861	2.17	0.764	1.99	0.783	2.85	0.910	2.79	0.830	2.35
495	0.859	2.00	0.763	1.86	0.780	2.87	0.912	3.09	0.828	2.34
500	0.860	2.36	0.764	2.13	0.782	2.83	0.912	2.64	0.830	2.38
505	0.861	2.14	0.763	2.11	0.781	2.90	0.913	2.68	0.830	2.34
510	0.858	2.30	0.762	2.53	0.780	2.73	0.910	2.73	0.828	2.45
515	0.854	1.94	0.760	2.11	0.778	2.83	0.910	2.62	0.826	2.26
520	0.855	1.95	0.755	1.71	0.778	2.84	0.907	2.98	0.824	2.26
525	0.856	2.19	0.760	1.97	0.778	2.83	0.912	2.81	0.827	2.34
530	0.855	2.12	0.762	2.20	0.778	2.47	0.911	2.73	0.826	2.26
535	0.855	2.03	0.755	2.00	0.773	2.66	0.908	2.44	0.823	2.18
540	0.855	1.76	0.759	1.76	0.777	2.37	0.910	2.46	0.825	1.97
545	0.852	1.91	0.754	1.49	0.773	2.61	0.904	2.31	0.821	1.99
550	0.852	2.28	0.754	2.04	0.771	2.56	0.907	2.58	0.821	2.26
555	0.853	2.04	0.756	2.36	0.772	2.37	0.905	2.58	0.822	2.23
560	0.849	2.11	0.749	1.76	0.769	2.59	0.904	2.89	0.818	2.22
565	0.851	1.97	0.752	1.71	0.773	2.71	0.903	2.59	0.820	2.14
570	0.849	1.48	0.748	2.13	0.766	1.92	0.899	2.52	0.816	1.88
575	0.846	1.79	0.748	2.11	0.771	2.36	0.903	2.75	0.817	2.11
580	0.852	1.57	0.752	2.07	0.773	2.48	0.902	2.28	0.820	1.99
585	0.852	2.12	0.751	1.66	0.772	2.46	0.904	2.74	0.820	2.13
590	0.853	1.49	0.749	2.03	0.773	2.31	0.905	3.00	0.820	2.09
595	0.850	1.94	0.749	2.20	0.768	2.46	0.902	3.40	0.817	2.38
600	0.849	1.71	0.749	1.73	0.772	2.32	0.905	2.41	0.819	1.94
605	0.848	1.39	0.748	1.85	0.772	2.11	0.903	3.18	0.818	1.96
610	0.850	2.30	0.749	1.97	0.770	3.17	0.909	3.30	0.819	2.48
615	0.848	1.48	0.747	1.84	0.769	2.63	0.902	2.59	0.817	2.00
620	0.853	1.92	0.748	2.20	0.770	2.59	0.907	2.86	0.819	2.27
625	0.851	1.56	0.745	2.35	0.770	2.36	0.908	3.47	0.818	2.29
630	0.851	1.83	0.743	2.14	0.766	1.90	0.900	3.15	0.815	2.12
635	0.861	1.37	0.746	2.45	0.768	2.74	0.911	3.38	0.821	2.33
640	0.854	1.66	0.745	1.22	0.769	2.58	0.901	3.45	0.817	2.11
645	0.850	1.49	0.749	2.41	0.773	2.36	0.910	2.67	0.820	2.10
650	0.856	1.85	0.755	1.81	0.775	3.08	0.913	2.78	0.825	2.15
655	0.857	1.37	0.751	2.22	0.771	2.20	0.906	2.37	0.821	1.90
660	0.851	1.43	0.748	2.89	0.769	2.99	0.915	2.48	0.821	2.24
665	0.847	2.50	0.741	2.60	0.761	2.56	0.901	3.74	0.812	2.65
670	0.850	1.66	0.742	3.76	0.767	2.51	0.909	3.37	0.817	2.57
675	0.851	2.28	0.734	1.53	0.766	2.85	0.900	2.84	0.813	2.21
680	0.863	2.53	0.749	2.66	0.771	2.86	0.913	2.48	0.824	2.35
685	0.858	1.54	0.745	2.03	0.774	3.29	0.912	2.59	0.823	2.22
690	0.855	1.74	0.739	2.14	0.762	2.13	0.908	3.10	0.816	1.95
695	0.848	1.14	0.747	2.18	0.768	1.25	0.911	3.27	0.819	1.73
700	0.861	3.60	0.742	3.25	0.769	3.26	0.920	4.44	0.823	3.00
705	0.855	2.00	0.752	2.54	0.760	2.86	0.914	2.70	0.820	2.33
710	0.844	2.84	0.742	1.77	0.771	3.17	0.907	4.10	0.816	2.71
715	0.862	1.28	0.746	3.40	0.783	1.78	0.904	3.64	0.824	2.26
720	0.840	0.88	0.749	4.09	0.763	3.17	0.922	3.58	0.819	1.12
725	0.873	3.71	0.742	4.03	0.771	3.38	0.899	3.47	0.822	3.27
730	0.851	2.37	0.740	3.01	0.777	3.37	0.925	4.58	0.823	2.93

-75°/-30° BIDIRECTIONAL ABSOLUTE SPECTRAL REFLECTANCE FACTORS

WAV. [nm]	Bss mean	Bss coeff. var.	Bsp mean	Bsp coeff. var.	Bps mean	Bps coeff. var.	Bpp mean	Bpp coeff. var.	Brr mean	Brr coeff. var.
390	0.787	2.96	0.668	1.93	0.726	4.66	0.777	2.91	0.739	2.39
395	0.867	2.70	0.773	2.04	0.794	2.89	0.889	3.00	0.831	2.28
400	0.851	2.45	0.763	2.90	0.791	2.01	0.865	2.59	0.817	2.36
405	0.861	2.15	0.771	1.70	0.791	2.60	0.886	1.85	0.828	1.95
410	0.859	1.51	0.769	1.96	0.792	2.72	0.884	2.43	0.826	2.04
415	0.862	2.51	0.764	2.17	0.796	2.83	0.880	2.48	0.825	2.41
420	0.863	2.37	0.773	2.36	0.792	2.38	0.884	3.17	0.828	2.45
425	0.863	2.56	0.768	1.84	0.796	2.59	0.884	2.61	0.828	2.32
430	0.863	2.30	0.767	2.29	0.795	3.03	0.882	2.83	0.827	2.52
435	0.868	2.52	0.766	1.82	0.795	2.82	0.882	3.02	0.828	2.47
440	0.871	2.51	0.774	2.42	0.801	3.27	0.888	3.13	0.834	2.74
445	0.870	2.40	0.772	2.31	0.795	3.17	0.885	2.83	0.831	2.59
450	0.870	2.58	0.770	1.86	0.797	3.16	0.884	3.14	0.830	2.60
455	0.875	2.60	0.779	2.27	0.802	2.63	0.894	2.41	0.837	2.40
460	0.872	2.46	0.772	2.25	0.799	2.88	0.889	2.90	0.833	2.54
465	0.876	2.41	0.769	2.28	0.805	2.81	0.884	2.73	0.833	2.49
470	0.871	2.32	0.770	2.02	0.797	2.72	0.890	2.96	0.832	2.43
475	0.871	2.30	0.771	2.33	0.799	3.03	0.887	2.72	0.832	2.51
480	0.869	2.34	0.772	2.21	0.797	2.87	0.887	2.84	0.831	2.49
485	0.872	2.39	0.771	1.90	0.798	2.69	0.885	2.63	0.832	2.34
490	0.868	2.49	0.768	2.25	0.793	2.66	0.884	2.85	0.828	2.48
495	0.866	2.39	0.764	2.22	0.793	2.71	0.883	2.88	0.826	2.47
500	0.866	2.28	0.765	1.86	0.793	2.91	0.885	2.82	0.828	2.40
505	0.869	2.05	0.766	2.11	0.794	2.69	0.884	2.55	0.828	2.28
510	0.868	2.06	0.764	1.98	0.793	2.57	0.883	2.93	0.827	2.30
515	0.866	2.04	0.764	2.22	0.791	2.81	0.881	2.84	0.826	2.40
520	0.864	1.91	0.760	2.09	0.790	2.78	0.880	2.64	0.824	2.26
525	0.866	2.04	0.761	2.13	0.791	2.46	0.884	2.62	0.825	2.23
530	0.866	2.17	0.763	1.89	0.792	2.76	0.883	2.69	0.826	2.31
535	0.862	2.04	0.758	1.86	0.786	2.92	0.878	2.56	0.821	2.27
540	0.865	2.48	0.761	2.02	0.787	2.43	0.881	2.62	0.823	2.31
545	0.861	2.09	0.758	2.14	0.785	2.60	0.878	2.84	0.821	2.33
550	0.861	2.02	0.756	2.40	0.785	2.45	0.877	2.76	0.820	2.32
555	0.864	1.90	0.759	1.86	0.789	2.19	0.880	2.70	0.823	2.09
560	0.862	1.93	0.756	1.96	0.781	2.30	0.875	3.21	0.818	2.26
565	0.861	1.79	0.755	2.13	0.786	2.34	0.875	2.56	0.819	2.13
570	0.859	1.79	0.754	1.64	0.782	3.15	0.871	2.16	0.817	2.11
575	0.857	1.77	0.752	2.09	0.784	2.46	0.872	2.72	0.816	2.18
580	0.863	1.74	0.754	1.73	0.782	2.64	0.877	1.99	0.819	1.94
585	0.860	1.80	0.754	2.52	0.783	2.55	0.877	2.88	0.819	2.34
590	0.863	2.12	0.754	2.15	0.784	2.20	0.880	2.41	0.820	2.13
595	0.862	1.78	0.754	1.99	0.780	2.80	0.870	2.40	0.817	2.16
600	0.859	1.58	0.755	1.97	0.784	2.45	0.878	1.97	0.819	1.87
605	0.861	1.79	0.753	1.79	0.784	2.03	0.872	2.63	0.818	1.98
610	0.863	1.38	0.752	1.89	0.791	2.72	0.879	2.40	0.821	2.00
615	0.859	2.06	0.754	1.80	0.782	2.08	0.874	2.84	0.817	2.09
620	0.870	2.01	0.757	1.74	0.789	2.15	0.879	2.28	0.824	1.97
625	0.865	2.12	0.756	2.26	0.784	2.38	0.879	3.24	0.821	2.39
630	0.861	1.98	0.746	2.32	0.781	3.10	0.871	3.03	0.815	2.49
635	0.863	1.60	0.754	2.40	0.791	2.16	0.883	2.11	0.823	1.97
640	0.866	2.46	0.746	2.58	0.781	2.21	0.881	2.42	0.818	2.29
645	0.865	1.34	0.756	2.34	0.790	3.02	0.880	1.87	0.823	2.04
650	0.863	2.08	0.753	3.04	0.785	2.55	0.880	2.24	0.820	2.28
655	0.862	2.13	0.754	2.50	0.788	2.29	0.879	3.59	0.821	2.47
660	0.864	1.89	0.743	3.02	0.784	2.55	0.881	3.61	0.818	2.60
665	0.860	1.82	0.748	2.03	0.783	2.26	0.869	3.26	0.815	2.20
670	0.861	2.59	0.752	2.76	0.784	2.39	0.885	1.77	0.821	2.17
675	0.857	2.01	0.751	2.51	0.782	2.08	0.867	2.97	0.814	2.27
680	0.873	1.38	0.751	3.16	0.788	2.87	0.887	2.78	0.825	2.23
685	0.867	2.56	0.747	3.38	0.789	1.91	0.875	2.62	0.820	2.43
690	0.870	1.60	0.757	2.60	0.782	2.85	0.890	3.13	0.825	2.33
695	0.862	2.03	0.743	2.22	0.780	2.23	0.876	3.47	0.815	2.18
700	0.865	0.44	0.752	3.12	0.799	4.20	0.887	2.88	0.826	2.31
705	0.869	0.90	0.737	4.13	0.789	2.42	0.882	4.31	0.819	2.30
710	0.857	1.36	0.747	2.37	0.785	2.68	0.883	2.83	0.818	1.99
715	0.869	2.01	0.753	3.33	0.785	3.48	0.887	3.13	0.823	2.76
720	0.865	1.95	0.757	3.80	0.790	1.82	0.884	2.86	0.824	1.80
725	0.858	2.16	0.738	2.88	0.788	3.51	0.885	2.44	0.817	2.12
730	0.874	2.31	0.761	2.53	0.781	3.22	0.878	2.84	0.824	2.09

-75°/-15° BIDIRECTIONAL ABSOLUTE SPECTRAL REFLECTANCE FACTORS

WAV. [nm]	Bss mean	Bss coeff. var.	Bsp mean	Bsp coeff. var.	Bps mean	Bps coeff. var.	Bpp mean	Bpp coeff. var.	Brr mean	Brr coeff. var.
390	0.805	3.31	0.688	3.21	0.722	2.52	0.768	2.58	0.746	1.08
395	0.886	1.79	0.786	2.32	0.805	2.57	0.863	1.22	0.835	1.78
400	0.882	1.32	0.766	3.11	0.799	3.10	0.862	3.22	0.827	2.41
405	0.893	2.23	0.772	2.51	0.805	2.74	0.867	2.64	0.834	2.41
410	0.898	2.66	0.773	2.10	0.810	3.29	0.866	2.78	0.837	2.65
415	0.891	2.19	0.773	2.10	0.804	3.39	0.868	2.45	0.834	2.46
420	0.901	2.22	0.777	1.73	0.812	2.62	0.872	2.47	0.840	2.18
425	0.896	2.30	0.774	2.23	0.808	2.97	0.875	2.51	0.838	2.42
430	0.894	2.13	0.775	2.71	0.804	3.12	0.870	2.03	0.836	2.41
435	0.892	2.47	0.773	1.88	0.806	3.39	0.871	2.86	0.836	2.59
440	0.905	2.74	0.778	2.17	0.815	3.15	0.878	2.73	0.844	2.63
445	0.900	2.44	0.777	2.11	0.808	3.26	0.871	2.64	0.839	2.54
450	0.900	2.56	0.774	2.29	0.810	2.87	0.874	2.48	0.839	2.49
455	0.905	2.26	0.785	1.98	0.813	3.21	0.882	2.48	0.846	2.41
460	0.902	2.33	0.779	2.09	0.812	3.15	0.875	2.38	0.842	2.44
465	0.908	2.49	0.775	2.39	0.815	3.12	0.873	2.59	0.842	2.60
470	0.905	2.22	0.779	2.17	0.810	3.24	0.876	2.70	0.842	2.51
475	0.903	2.12	0.776	1.91	0.810	3.11	0.876	2.79	0.841	2.41
480	0.902	2.32	0.777	2.21	0.811	3.15	0.876	2.66	0.842	2.51
485	0.903	2.25	0.778	1.94	0.811	3.00	0.876	2.67	0.842	2.40
490	0.898	2.18	0.774	1.92	0.807	3.18	0.871	2.46	0.837	2.38
495	0.898	2.05	0.773	1.78	0.805	2.73	0.870	2.57	0.837	2.22
500	0.898	2.22	0.775	2.10	0.806	3.02	0.872	2.70	0.838	2.45
505	0.902	1.95	0.772	2.08	0.807	2.86	0.871	2.29	0.838	2.22
510	0.900	2.16	0.772	2.05	0.804	2.46	0.869	2.24	0.836	2.17
515	0.899	2.14	0.771	2.08	0.804	2.97	0.872	2.43	0.837	2.33
520	0.898	2.11	0.767	1.98	0.802	2.96	0.867	2.74	0.834	2.38
525	0.899	1.84	0.768	1.98	0.803	2.85	0.871	2.45	0.835	2.21
530	0.897	2.02	0.773	1.85	0.805	2.91	0.873	2.54	0.837	2.24
535	0.894	1.95	0.766	1.98	0.799	2.69	0.865	2.51	0.831	2.22
540	0.896	1.63	0.764	1.96	0.801	2.76	0.864	2.28	0.831	2.09
545	0.893	2.11	0.765	1.89	0.799	2.66	0.865	2.60	0.830	2.25
550	0.895	1.77	0.763	2.27	0.798	2.87	0.866	2.40	0.831	2.24
555	0.897	2.25	0.767	2.12	0.801	2.40	0.868	2.12	0.833	2.15
560	0.892	1.74	0.762	1.75	0.795	2.92	0.863	2.75	0.828	2.20
565	0.892	1.83	0.762	2.52	0.798	2.67	0.864	2.28	0.829	2.23
570	0.894	1.92	0.760	1.74	0.795	2.58	0.861	2.43	0.828	2.10
575	0.891	2.33	0.762	2.05	0.797	2.55	0.864	2.09	0.828	2.20
580	0.895	1.93	0.761	1.98	0.794	2.82	0.863	1.93	0.828	2.10
585	0.895	1.51	0.759	1.70	0.798	2.86	0.866	2.15	0.829	1.98
590	0.894	1.80	0.763	1.59	0.797	2.84	0.865	2.60	0.830	2.14
595	0.893	1.89	0.758	1.73	0.798	2.68	0.862	2.79	0.828	2.16
600	0.897	2.11	0.759	2.01	0.799	2.71	0.862	1.97	0.829	2.13
605	0.896	1.90	0.758	2.27	0.795	2.50	0.860	2.36	0.828	2.16
610	0.896	1.69	0.761	1.39	0.800	2.37	0.865	2.98	0.831	2.04
615	0.893	1.70	0.761	1.89	0.800	2.82	0.867	2.21	0.830	2.07
620	0.894	1.31	0.766	1.73	0.801	2.45	0.868	2.12	0.832	1.82
625	0.899	0.89	0.763	2.23	0.800	2.77	0.866	2.42	0.832	1.97
630	0.894	1.76	0.760	2.32	0.799	2.21	0.863	2.15	0.829	2.00
635	0.903	1.82	0.758	1.74	0.799	2.69	0.865	2.07	0.832	1.99
640	0.895	2.00	0.758	1.39	0.798	2.31	0.862	2.09	0.828	1.88
645	0.905	1.88	0.762	2.23	0.807	2.44	0.867	2.39	0.835	2.15
650	0.905	1.49	0.763	3.08	0.805	1.56	0.865	2.65	0.835	2.07
655	0.893	1.67	0.756	2.20	0.799	3.09	0.873	2.68	0.830	2.29
660	0.900	2.74	0.763	2.57	0.802	2.87	0.866	2.51	0.833	2.59
665	0.891	1.77	0.758	2.40	0.799	2.85	0.861	2.85	0.827	2.29
670	0.897	2.59	0.756	1.25	0.807	2.92	0.865	2.31	0.831	2.09
675	0.893	1.28	0.753	1.73	0.795	2.21	0.862	2.79	0.826	1.89
680	0.904	1.21	0.764	2.52	0.800	2.34	0.863	3.26	0.833	2.19
685	0.899	2.02	0.764	2.96	0.805	2.58	0.866	3.03	0.833	2.56
690	0.903	1.87	0.757	2.19	0.796	1.99	0.864	3.97	0.830	2.37
695	0.900	1.83	0.753	2.85	0.804	2.82	0.861	1.46	0.830	2.12
700	0.915	2.06	0.763	1.95	0.805	2.24	0.863	3.30	0.836	2.01
705	0.895	3.70	0.764	2.21	0.807	4.10	0.868	2.11	0.834	2.68
710	0.907	3.31	0.751	3.13	0.795	3.61	0.864	4.23	0.829	2.87
715	0.917	2.47	0.764	2.72	0.822	2.26	0.867	2.84	0.842	2.46
720	0.902	0.94	0.752	2.97	0.808	4.09	0.892	3.87	0.839	1.81
725	0.907	1.00	0.758	3.88	0.800	3.36	0.857	3.60	0.830	2.38
730	0.896	3.04	0.774	1.31	0.806	4.36	0.873	1.77	0.837	1.98

-75°/ 0° BIDIRECTIONAL ABSOLUTE SPECTRAL REFLECTANCE FACTORS

WAV. [nm]	Bss mean	Bss coeff. var.	Bsp mean	Bsp coeff. var.	Bps mean	Bps coeff. var.	Bpp mean	Bpp coeff. var.	Brr mean	Brr coeff. var.
390	0.875	2.39	0.693	3.56	0.729	2.37	0.781	4.79	0.770	2.28
395	0.949	1.35	0.791	2.95	0.819	3.56	0.884	3.22	0.861	2.64
400	0.952	2.01	0.782	3.09	0.809	3.24	0.882	3.24	0.856	2.72
405	0.954	2.36	0.788	1.27	0.820	2.59	0.877	2.20	0.860	2.00
410	0.955	1.63	0.789	1.20	0.821	3.11	0.877	2.37	0.861	1.92
415	0.955	2.25	0.787	1.21	0.821	2.64	0.879	2.48	0.861	2.09
420	0.955	1.88	0.790	2.00	0.819	2.54	0.886	2.42	0.863	2.12
425	0.956	2.32	0.788	1.96	0.822	2.69	0.882	2.55	0.862	2.34
430	0.956	2.33	0.787	2.33	0.821	2.82	0.881	2.38	0.861	2.38
435	0.958	2.36	0.787	2.09	0.820	2.55	0.883	2.40	0.862	2.28
440	0.962	2.52	0.794	2.56	0.826	3.01	0.886	2.24	0.867	2.51
445	0.961	2.35	0.793	2.27	0.826	2.98	0.883	2.05	0.866	2.35
450	0.961	2.69	0.793	2.02	0.825	3.13	0.884	2.38	0.866	2.50
455	0.972	2.56	0.799	2.30	0.830	2.68	0.891	2.28	0.873	2.40
460	0.966	1.82	0.792	1.81	0.826	2.90	0.887	2.48	0.868	2.18
465	0.973	2.44	0.788	2.11	0.834	2.64	0.883	2.39	0.869	2.35
470	0.968	2.00	0.792	1.84	0.827	2.50	0.887	2.19	0.869	2.05
475	0.968	2.09	0.791	2.11	0.828	2.59	0.885	2.34	0.868	2.21
480	0.968	1.91	0.792	1.90	0.827	2.78	0.885	2.08	0.868	2.11
485	0.967	2.04	0.792	1.91	0.825	2.80	0.886	2.36	0.867	2.22
490	0.962	2.27	0.786	1.96	0.824	2.83	0.881	2.45	0.863	2.31
495	0.962	2.00	0.786	1.69	0.822	2.87	0.880	2.26	0.863	2.15
500	0.966	2.28	0.786	1.97	0.825	2.70	0.884	2.22	0.865	2.24
505	0.963	2.04	0.787	1.70	0.822	2.81	0.881	2.28	0.863	2.15
510	0.965	2.30	0.785	1.85	0.821	2.50	0.882	2.29	0.863	2.20
515	0.962	1.83	0.783	1.90	0.822	2.64	0.879	2.31	0.861	2.11
520	0.961	1.90	0.781	1.87	0.818	2.51	0.877	2.46	0.859	2.13
525	0.963	2.11	0.785	1.97	0.820	2.66	0.878	2.24	0.862	2.18
530	0.963	2.17	0.784	1.64	0.821	2.48	0.878	1.92	0.862	2.00
535	0.960	1.43	0.781	1.63	0.816	2.56	0.873	2.02	0.857	1.84
540	0.963	1.96	0.780	1.41	0.818	2.49	0.876	2.03	0.859	1.92
545	0.963	2.05	0.779	1.59	0.817	2.66	0.873	2.37	0.858	2.11
550	0.964	1.49	0.778	1.70	0.818	2.61	0.872	2.35	0.858	1.97
555	0.962	1.85	0.776	1.90	0.819	2.21	0.874	2.23	0.858	1.99
560	0.960	1.98	0.775	1.39	0.812	2.87	0.870	1.85	0.854	1.94
565	0.960	1.83	0.776	2.20	0.814	2.45	0.872	2.19	0.856	2.06
570	0.959	1.72	0.772	1.84	0.812	2.51	0.867	2.39	0.853	2.03
575	0.956	1.93	0.774	1.81	0.813	2.42	0.870	2.14	0.853	2.04
580	0.961	1.58	0.777	1.46	0.816	1.91	0.873	2.09	0.856	1.68
585	0.961	1.52	0.777	1.97	0.818	2.70	0.872	2.41	0.857	2.05
590	0.958	1.58	0.775	1.53	0.815	2.32	0.875	2.56	0.855	1.92
595	0.959	1.86	0.773	1.97	0.812	2.60	0.871	2.02	0.854	2.04
600	0.960	2.31	0.778	1.29	0.814	2.35	0.871	1.98	0.856	1.94
605	0.962	1.44	0.776	1.10	0.816	2.64	0.870	2.23	0.856	1.74
610	0.968	1.84	0.778	1.89	0.818	2.31	0.875	2.12	0.860	1.90
615	0.961	1.66	0.776	1.80	0.812	1.82	0.872	2.14	0.855	1.79
620	0.964	1.93	0.778	2.16	0.823	2.25	0.873	2.58	0.859	2.12
625	0.963	1.74	0.778	2.04	0.818	2.04	0.874	1.96	0.858	1.85
630	0.964	1.61	0.774	1.63	0.814	1.94	0.864	2.29	0.854	1.81
635	0.967	1.59	0.776	1.66	0.815	2.95	0.871	1.92	0.857	1.94
640	0.964	1.89	0.774	2.46	0.808	2.60	0.871	2.40	0.854	2.18
645	0.970	1.64	0.778	2.46	0.817	2.25	0.875	2.63	0.860	2.13
650	0.971	1.82	0.776	2.63	0.819	2.34	0.872	1.49	0.859	1.98
655	0.971	1.46	0.780	1.63	0.822	2.01	0.875	2.04	0.862	1.69
660	0.966	0.70	0.770	1.63	0.820	3.48	0.870	2.82	0.857	1.88
665	0.958	1.25	0.772	1.77	0.817	2.52	0.872	2.08	0.855	1.79
670	0.971	2.32	0.774	2.35	0.822	3.05	0.871	2.62	0.859	2.25
675	0.969	1.94	0.773	2.18	0.815	3.09	0.863	2.24	0.855	2.27
680	0.977	1.52	0.778	1.88	0.826	1.86	0.875	1.84	0.864	1.57
685	0.966	1.68	0.777	2.27	0.819	1.57	0.870	2.43	0.858	1.83
690	0.980	1.99	0.771	2.06	0.828	3.04	0.876	2.33	0.864	2.20
695	0.959	1.58	0.767	3.09	0.824	1.68	0.872	3.01	0.856	2.17
700	0.984	2.45	0.773	3.70	0.832	1.26	0.876	2.41	0.866	2.15
705	0.983	1.47	0.772	3.54	0.824	3.21	0.866	2.81	0.861	2.41
710	0.973	2.48	0.765	3.55	0.809	3.32	0.876	2.80	0.856	2.18
715	0.985	1.21	0.770	2.68	0.832	2.17	0.872	0.74	0.865	1.37
720	0.977	1.85	0.767	3.82	0.824	2.16	0.875	2.54	0.861	2.04
725	0.983	2.43	0.769	2.23	0.818	2.54	0.863	3.61	0.858	2.08
730	0.968	2.26	0.768	1.89	0.832	5.46	0.873	2.52	0.860	1.65

-75°/ 15° BIDIRECTIONAL ABSOLUTE SPECTRAL REFLECTANCE FACTORS

WAV. [nm]	Bss mean	Bss coeff. var.	Bsp mean	Bsp coeff. var.	Bps mean	Bps coeff. var.	Bpp mean	Bpp coeff. var.	Brr mean	Brr coeff. var.
390	0.985	2.27	0.730	1.90	0.768	2.27	0.842	2.35	0.831	1.90
395	1.059	1.19	0.806	1.74	0.844	3.97	0.927	0.91	0.909	1.55
400	1.046	2.81	0.802	2.05	0.835	2.06	0.909	1.69	0.898	2.05
405	1.061	1.97	0.804	2.36	0.836	2.34	0.918	2.06	0.905	2.08
410	1.063	1.69	0.809	1.56	0.842	3.08	0.925	2.57	0.910	2.08
415	1.061	2.50	0.810	1.71	0.843	2.26	0.922	1.78	0.909	2.00
420	1.068	2.21	0.809	1.58	0.841	2.78	0.929	1.61	0.912	1.97
425	1.071	2.65	0.813	1.84	0.843	2.55	0.925	2.21	0.913	2.25
430	1.066	2.24	0.810	2.02	0.839	2.68	0.926	2.00	0.910	2.16
435	1.073	2.43	0.809	1.50	0.841	2.78	0.924	1.88	0.912	2.08
440	1.073	2.18	0.816	2.50	0.847	3.09	0.931	2.17	0.917	2.37
445	1.073	2.20	0.813	1.94	0.844	2.77	0.928	1.94	0.915	2.16
450	1.074	2.35	0.812	1.80	0.844	2.93	0.925	2.11	0.914	2.23
455	1.084	2.12	0.820	1.70	0.850	3.02	0.939	2.05	0.923	2.15
460	1.079	2.29	0.814	1.68	0.847	3.08	0.931	2.26	0.918	2.27
465	1.084	2.27	0.810	1.61	0.853	2.73	0.925	1.70	0.918	2.04
470	1.079	2.05	0.815	1.73	0.845	2.84	0.931	1.79	0.917	2.04
475	1.079	1.97	0.812	2.08	0.846	2.51	0.930	1.82	0.917	2.03
480	1.080	1.71	0.814	1.64	0.843	2.49	0.928	2.04	0.916	1.89
485	1.079	1.72	0.814	1.79	0.845	2.59	0.929	2.17	0.917	1.99
490	1.077	1.68	0.808	1.73	0.842	2.67	0.924	2.03	0.913	1.95
495	1.078	1.80	0.808	1.98	0.842	2.80	0.924	1.90	0.913	2.02
500	1.077	1.59	0.809	1.86	0.841	2.98	0.925	1.97	0.913	2.01
505	1.078	2.10	0.809	1.44	0.842	2.72	0.926	1.88	0.914	1.98
510	1.076	2.07	0.809	1.95	0.840	2.66	0.925	1.84	0.912	2.06
515	1.075	2.13	0.807	1.78	0.840	2.77	0.923	2.00	0.911	2.09
520	1.074	2.03	0.804	1.68	0.835	2.65	0.918	2.05	0.908	2.03
525	1.080	1.69	0.806	1.57	0.840	2.47	0.924	1.67	0.913	1.79
530	1.077	1.74	0.806	1.90	0.842	2.39	0.920	1.77	0.911	1.88
535	1.073	1.72	0.799	1.59	0.836	2.46	0.915	1.25	0.906	1.69
540	1.082	2.06	0.801	1.72	0.839	2.67	0.922	1.46	0.911	1.92
545	1.078	1.52	0.802	1.85	0.835	2.56	0.914	1.74	0.907	1.84
550	1.078	1.67	0.802	1.36	0.838	2.59	0.915	1.22	0.908	1.64
555	1.080	1.39	0.800	1.86	0.836	2.45	0.917	1.61	0.908	1.73
560	1.073	1.54	0.796	1.72	0.830	2.56	0.914	1.51	0.903	1.76
565	1.075	1.74	0.797	1.68	0.833	2.08	0.914	1.50	0.905	1.68
570	1.076	1.04	0.796	1.10	0.832	1.95	0.912	1.41	0.904	1.31
575	1.080	1.08	0.797	1.58	0.834	2.16	0.914	1.16	0.906	1.42
580	1.079	1.64	0.796	1.21	0.834	2.65	0.915	1.01	0.906	1.56
585	1.078	1.60	0.797	1.17	0.835	2.67	0.913	1.42	0.906	1.66
590	1.073	1.28	0.796	1.61	0.836	2.22	0.916	1.58	0.905	1.59
595	1.078	1.01	0.796	1.82	0.832	2.02	0.909	1.51	0.904	1.50
600	1.079	1.59	0.795	1.75	0.836	2.61	0.912	1.61	0.905	1.80
605	1.078	1.47	0.794	1.56	0.832	2.24	0.910	1.45	0.903	1.58
610	1.082	1.63	0.801	1.89	0.835	2.99	0.915	1.81	0.908	1.96
615	1.080	1.33	0.798	2.03	0.835	1.76	0.913	1.51	0.906	1.58
620	1.081	1.89	0.799	1.66	0.840	2.27	0.912	1.50	0.908	1.77
625	1.084	1.21	0.797	1.74	0.838	2.47	0.912	1.42	0.908	1.62
630	1.081	1.59	0.792	2.25	0.830	2.03	0.906	1.69	0.902	1.77
635	1.083	0.71	0.797	1.44	0.835	2.07	0.914	1.56	0.907	1.32
640	1.084	1.34	0.797	1.56	0.836	2.61	0.908	1.79	0.906	1.66
645	1.087	1.76	0.800	1.53	0.841	2.45	0.914	1.91	0.911	1.71
650	1.096	1.50	0.802	1.61	0.842	2.69	0.913	1.66	0.913	1.73
655	1.090	1.48	0.796	2.27	0.837	2.90	0.914	1.54	0.909	1.83
660	1.082	2.28	0.793	1.86	0.837	2.14	0.913	1.08	0.906	1.79
665	1.095	1.55	0.791	1.60	0.834	2.15	0.910	1.56	0.907	1.58
670	1.094	1.26	0.798	1.22	0.836	3.08	0.916	1.91	0.911	1.75
675	1.089	1.18	0.789	2.24	0.833	3.01	0.902	2.01	0.903	1.97
680	1.096	1.50	0.796	2.77	0.842	1.78	0.914	1.80	0.912	1.85
685	1.092	1.45	0.802	1.94	0.836	2.16	0.911	1.77	0.910	1.59
690	1.094	1.14	0.789	3.10	0.838	2.81	0.912	2.25	0.908	2.03
695	1.091	2.04	0.792	1.37	0.838	2.57	0.912	1.81	0.908	1.77
700	1.086	1.10	0.790	0.92	0.825	2.05	0.909	1.74	0.902	1.08
705	1.100	0.47	0.802	1.00	0.845	2.13	0.920	1.56	0.917	0.61
710	1.086	1.34	0.795	3.82	0.831	3.81	0.913	2.08	0.906	2.42
715	1.107	2.85	0.798	2.50	0.848	3.10	0.918	2.12	0.918	2.26
720	1.119	1.92	0.789	4.53	0.836	5.11	0.908	3.76	0.913	3.19
725	1.083	1.76	0.795	1.99	0.834	3.72	0.898	3.42	0.902	2.19
730	1.095	2.17	0.786	3.93	0.839	2.50	0.903	3.12	0.906	2.12

-75°/ 30° BIDIRECTIONAL ABSOLUTE SPECTRAL REFLECTANCE FACTORS

WAV. [nm]	Bss mean	Bss coeff. var.	Bsp mean	Bsp coeff. var.	Bps mean	Bps coeff. var.	Bpp mean	Bpp coeff. var.	Brr mean	Brr coeff. var.
390	1.178	2.32	0.734	1.62	0.793	0.54	0.922	2.07	0.907	0.64
395	1.254	2.57	0.835	2.81	0.868	1.95	1.026	1.76	0.996	1.81
400	1.236	2.06	0.831	2.20	0.854	1.99	1.009	0.84	0.983	1.60
405	1.253	2.69	0.835	1.25	0.864	2.26	1.023	1.49	0.994	1.80
410	1.255	1.86	0.840	1.48	0.870	2.51	1.024	1.98	0.997	1.75
415	1.256	2.49	0.844	1.51	0.868	2.51	1.030	0.88	0.999	1.80
420	1.260	2.26	0.850	1.35	0.868	2.36	1.031	1.27	1.002	1.72
425	1.264	2.55	0.844	2.28	0.869	2.47	1.026	1.28	1.001	2.07
430	1.263	2.38	0.843	1.38	0.868	2.20	1.029	1.23	1.001	1.71
435	1.266	2.69	0.842	1.07	0.872	2.50	1.031	1.05	1.003	1.75
440	1.273	2.79	0.847	1.75	0.877	2.67	1.036	1.72	1.008	2.16
445	1.275	2.66	0.845	1.63	0.871	2.77	1.034	1.45	1.006	2.01
450	1.275	2.35	0.845	1.82	0.872	2.39	1.034	1.53	1.007	1.94
455	1.281	2.39	0.853	1.48	0.879	2.77	1.042	1.12	1.014	1.88
460	1.276	2.12	0.845	1.40	0.873	2.69	1.037	1.26	1.008	1.80
465	1.286	2.31	0.842	1.52	0.879	2.51	1.031	1.51	1.010	1.89
470	1.280	2.29	0.846	1.39	0.874	2.68	1.038	1.54	1.010	1.88
475	1.287	2.30	0.848	1.56	0.876	2.45	1.034	1.22	1.011	1.80
480	1.289	2.26	0.844	1.43	0.876	2.48	1.036	1.52	1.011	1.78
485	1.288	2.29	0.846	1.59	0.875	2.34	1.037	1.26	1.011	1.79
490	1.284	2.16	0.842	1.41	0.869	2.19	1.030	1.23	1.006	1.69
495	1.280	2.20	0.840	1.32	0.869	2.34	1.028	1.47	1.004	1.75
500	1.283	2.10	0.840	0.95	0.870	2.18	1.032	1.33	1.006	1.58
505	1.282	2.03	0.840	1.38	0.868	2.42	1.032	1.26	1.005	1.69
510	1.282	1.93	0.841	1.69	0.867	2.09	1.031	0.92	1.005	1.56
515	1.280	1.74	0.838	1.53	0.867	2.23	1.028	1.08	1.003	1.57
520	1.281	2.22	0.835	1.65	0.867	2.29	1.027	0.83	1.002	1.70
525	1.283	2.04	0.839	1.30	0.866	2.29	1.030	1.05	1.004	1.54
530	1.285	2.02	0.838	1.46	0.867	2.48	1.031	0.86	1.005	1.60
535	1.281	2.25	0.832	1.42	0.860	2.54	1.024	0.91	0.999	1.63
540	1.282	2.19	0.832	1.21	0.863	2.14	1.029	0.97	1.001	1.56
545	1.280	2.05	0.834	1.53	0.861	2.48	1.025	0.78	1.000	1.61
550	1.285	1.69	0.830	1.41	0.858	2.16	1.024	0.43	0.999	1.36
555	1.286	1.61	0.835	1.25	0.862	1.99	1.028	0.70	1.003	1.30
560	1.281	1.45	0.830	1.18	0.859	2.22	1.022	0.61	0.998	1.28
565	1.285	1.59	0.831	1.84	0.865	2.18	1.023	0.97	1.001	1.51
570	1.284	1.60	0.828	1.14	0.856	2.32	1.019	0.43	0.997	1.27
575	1.286	1.57	0.827	1.19	0.859	2.07	1.021	1.02	0.998	1.34
580	1.294	1.63	0.829	0.73	0.862	1.95	1.023	0.94	1.002	1.24
585	1.292	1.68	0.828	0.87	0.860	1.76	1.022	0.81	1.000	1.15
590	1.293	1.72	0.832	1.77	0.861	2.10	1.027	0.63	1.003	1.42
595	1.290	1.61	0.824	1.26	0.856	2.10	1.021	0.47	0.998	1.23
600	1.290	1.26	0.829	1.19	0.860	1.80	1.021	0.64	1.000	0.94
605	1.292	1.37	0.829	1.74	0.859	1.87	1.019	0.54	1.000	1.19
610	1.289	1.71	0.828	1.67	0.865	1.75	1.020	0.92	1.001	1.34
615	1.287	1.45	0.831	1.55	0.860	1.80	1.020	1.08	0.999	1.33
620	1.295	0.90	0.831	1.82	0.862	1.78	1.022	1.11	1.002	1.09
625	1.293	1.16	0.826	1.09	0.863	1.83	1.021	1.35	1.001	1.15
630	1.292	1.21	0.824	0.85	0.863	1.87	1.013	0.54	0.998	1.04
635	1.305	1.33	0.829	1.14	0.862	2.56	1.020	0.45	1.004	1.28
640	1.296	1.82	0.824	1.38	0.863	2.14	1.018	0.80	1.000	1.46
645	1.299	2.10	0.826	1.09	0.861	2.47	1.021	0.24	1.002	1.40
650	1.296	1.51	0.831	1.70	0.863	2.42	1.029	1.00	1.005	1.28
655	1.306	1.97	0.826	1.35	0.868	1.86	1.021	1.18	1.005	1.35
660	1.306	1.04	0.828	2.43	0.858	2.76	1.017	0.89	1.002	1.01
665	1.303	1.81	0.826	1.84	0.857	1.82	1.015	0.60	1.000	1.17
670	1.306	1.18	0.824	2.92	0.869	2.03	1.021	1.36	1.005	1.59
675	1.306	1.51	0.812	0.72	0.859	2.08	1.019	1.36	0.999	1.05
680	1.311	1.63	0.826	1.16	0.872	1.80	1.024	0.73	1.008	1.10
685	1.313	0.41	0.828	0.80	0.863	2.08	1.023	1.07	1.006	0.75
690	1.307	1.19	0.834	2.32	0.860	1.09	1.024	1.27	1.006	1.16
695	1.299	0.76	0.813	1.50	0.861	3.21	1.018	1.95	0.998	1.38
700	1.301	0.85	0.840	2.60	0.866	1.69	1.019	0.84	1.006	0.92
705	1.307	1.83	0.836	1.48	0.867	2.66	1.018	0.38	1.007	1.26
710	1.310	1.83	0.806	2.92	0.866	2.13	1.020	0.67	1.001	1.27
715	1.315	1.39	0.827	2.04	0.860	3.47	1.030	1.01	1.008	1.19
720	1.335	2.98	0.835	3.12	0.860	2.33	1.033	1.79	1.016	1.92
725	1.305	1.00	0.821	1.66	0.881	2.85	1.015	1.24	1.006	1.10
730	1.352	2.14	0.833	4.77	0.871	1.78	1.015	2.51	1.018	1.84

-75°/ 45° BIDIRECTIONAL ABSOLUTE SPECTRAL REFLECTANCE FACTORS

WAV. [nm]	Bss mean	Bss coeff. var.	Bsp mean	Bsp coeff. var.	Bps mean	Bps coeff. var.	Bpp mean	Bpp coeff. var.	Brr mean	Brr coeff. var.
390	1.507	2.94	0.806	3.30	0.831	2.89	1.125	0.94	1.067	2.12
395	1.590	2.53	0.900	2.40	0.910	1.72	1.239	0.31	1.160	1.27
400	1.586	2.26	0.890	2.18	0.906	1.82	1.231	2.93	1.153	1.42
405	1.594	2.19	0.898	1.04	0.912	1.60	1.235	2.14	1.160	1.26
410	1.601	2.26	0.890	0.80	0.910	1.54	1.247	1.96	1.162	1.17
415	1.607	2.44	0.895	0.87	0.907	2.11	1.244	1.22	1.163	1.39
420	1.617	2.42	0.899	1.22	0.914	1.30	1.248	0.82	1.169	1.37
425	1.623	2.69	0.895	1.85	0.909	1.81	1.251	1.25	1.170	1.68
430	1.619	2.58	0.891	1.15	0.909	1.97	1.255	0.94	1.168	1.48
435	1.632	2.51	0.893	1.20	0.912	2.32	1.255	1.55	1.173	1.64
440	1.634	2.71	0.901	0.67	0.916	2.55	1.263	1.73	1.178	1.69
445	1.638	2.62	0.898	1.62	0.915	2.07	1.258	1.45	1.177	1.66
450	1.639	2.63	0.898	1.73	0.913	2.39	1.257	1.45	1.177	1.73
455	1.650	2.60	0.903	1.50	0.919	2.24	1.271	1.25	1.186	1.70
460	1.650	2.61	0.896	1.45	0.916	2.07	1.263	1.17	1.181	1.54
465	1.659	2.39	0.890	1.69	0.921	2.22	1.260	1.67	1.183	1.55
470	1.656	2.70	0.895	1.45	0.913	2.05	1.264	1.86	1.182	1.53
475	1.655	2.59	0.895	1.32	0.912	1.84	1.263	1.84	1.181	1.48
480	1.653	2.64	0.896	1.40	0.912	1.96	1.262	1.90	1.181	1.60
485	1.660	2.39	0.895	1.17	0.913	2.05	1.267	1.73	1.184	1.44
490	1.656	2.43	0.890	1.51	0.908	2.45	1.265	1.91	1.180	1.55
495	1.658	2.05	0.888	1.19	0.910	2.04	1.266	2.05	1.180	1.32
500	1.660	2.02	0.891	1.27	0.910	1.94	1.265	1.87	1.182	1.20
505	1.665	2.07	0.891	1.33	0.909	2.28	1.263	2.04	1.182	1.31
510	1.665	2.27	0.890	1.38	0.907	2.03	1.265	2.10	1.182	1.38
515	1.660	2.29	0.885	1.04	0.906	1.79	1.264	2.00	1.179	1.19
520	1.660	2.15	0.880	1.15	0.904	1.95	1.264	2.15	1.177	1.16
525	1.664	2.33	0.885	1.13	0.906	1.81	1.264	1.62	1.180	1.20
530	1.671	2.18	0.884	1.42	0.904	2.08	1.264	2.02	1.181	1.24
535	1.665	2.12	0.881	1.28	0.903	1.86	1.262	1.76	1.178	1.22
540	1.667	1.68	0.882	1.70	0.902	1.57	1.264	1.40	1.179	1.14
545	1.669	1.77	0.880	1.36	0.899	1.79	1.263	1.93	1.178	1.10
550	1.677	1.96	0.880	1.60	0.902	2.12	1.263	1.80	1.181	1.26
555	1.676	1.97	0.879	1.21	0.902	1.80	1.261	1.31	1.179	1.08
560	1.669	1.84	0.875	0.97	0.897	1.78	1.259	1.72	1.175	0.98
565	1.669	1.98	0.879	1.32	0.895	1.78	1.259	1.34	1.175	1.04
570	1.671	1.68	0.874	1.06	0.892	1.55	1.258	1.21	1.174	1.02
575	1.679	1.41	0.877	1.34	0.896	1.99	1.266	1.59	1.180	0.93
580	1.688	1.50	0.876	1.18	0.895	1.89	1.269	1.21	1.182	0.98
585	1.686	1.56	0.875	0.99	0.898	1.57	1.268	1.64	1.182	0.92
590	1.685	1.59	0.875	1.32	0.898	1.72	1.269	1.30	1.182	0.93
595	1.688	2.14	0.874	0.89	0.896	1.94	1.263	1.22	1.180	0.97
600	1.690	1.63	0.875	0.91	0.901	1.36	1.263	1.94	1.182	0.59
605	1.693	2.18	0.875	1.52	0.898	1.06	1.264	1.28	1.182	1.09
610	1.697	1.91	0.873	1.29	0.898	1.25	1.266	1.43	1.183	0.90
615	1.693	2.04	0.873	1.18	0.896	1.30	1.265	2.36	1.182	0.72
620	1.695	1.76	0.879	0.60	0.903	1.21	1.263	1.74	1.185	0.57
625	1.693	1.57	0.877	1.29	0.900	0.87	1.267	1.99	1.184	0.72
630	1.692	1.76	0.868	1.27	0.897	1.72	1.258	1.99	1.179	0.92
635	1.693	1.83	0.877	1.24	0.897	1.60	1.265	1.41	1.183	1.11
640	1.700	1.55	0.869	1.25	0.899	1.62	1.264	1.58	1.183	0.85
645	1.707	1.58	0.875	1.59	0.904	1.21	1.274	1.57	1.190	1.01
650	1.719	1.82	0.877	2.19	0.901	0.80	1.275	1.70	1.193	0.91
655	1.715	1.64	0.869	1.53	0.904	1.68	1.269	1.39	1.189	0.92
660	1.717	2.07	0.864	1.39	0.902	1.00	1.265	0.96	1.187	0.96
665	1.716	1.56	0.873	2.09	0.895	2.62	1.257	2.39	1.185	1.02
670	1.708	1.09	0.871	1.69	0.903	2.03	1.273	2.58	1.189	0.68
675	1.707	1.58	0.861	1.17	0.891	2.03	1.263	2.74	1.181	0.93
680	1.725	1.15	0.875	1.86	0.902	1.42	1.264	3.06	1.192	0.56
685	1.724	1.88	0.875	1.42	0.898	2.54	1.268	2.38	1.191	0.87
690	1.729	1.12	0.870	1.38	0.907	1.45	1.272	1.59	1.195	0.60
695	1.734	1.38	0.875	1.33	0.900	1.80	1.270	2.35	1.195	0.55
700	1.738	1.88	0.870	1.82	0.906	0.15	1.275	2.59	1.198	0.60
705	1.732	0.93	0.874	1.68	0.911	1.84	1.276	4.06	1.198	0.71
710	1.752	1.35	0.868	2.36	0.906	1.58	1.267	3.34	1.198	0.56
715	1.759	2.54	0.876	1.99	0.907	0.77	1.282	3.60	1.206	1.02
720	1.765	1.61	0.867	2.22	0.899	1.61	1.291	2.20	1.206	1.05
725	1.760	1.02	0.881	3.15	0.882	2.37	1.269	1.43	1.198	1.51
730	1.749	1.25	0.865	2.55	0.895	1.65	1.263	2.40	1.193	0.89

-75°/ 60° BIDIRECTIONAL ABSOLUTE SPECTRAL REFLECTANCE FACTORS

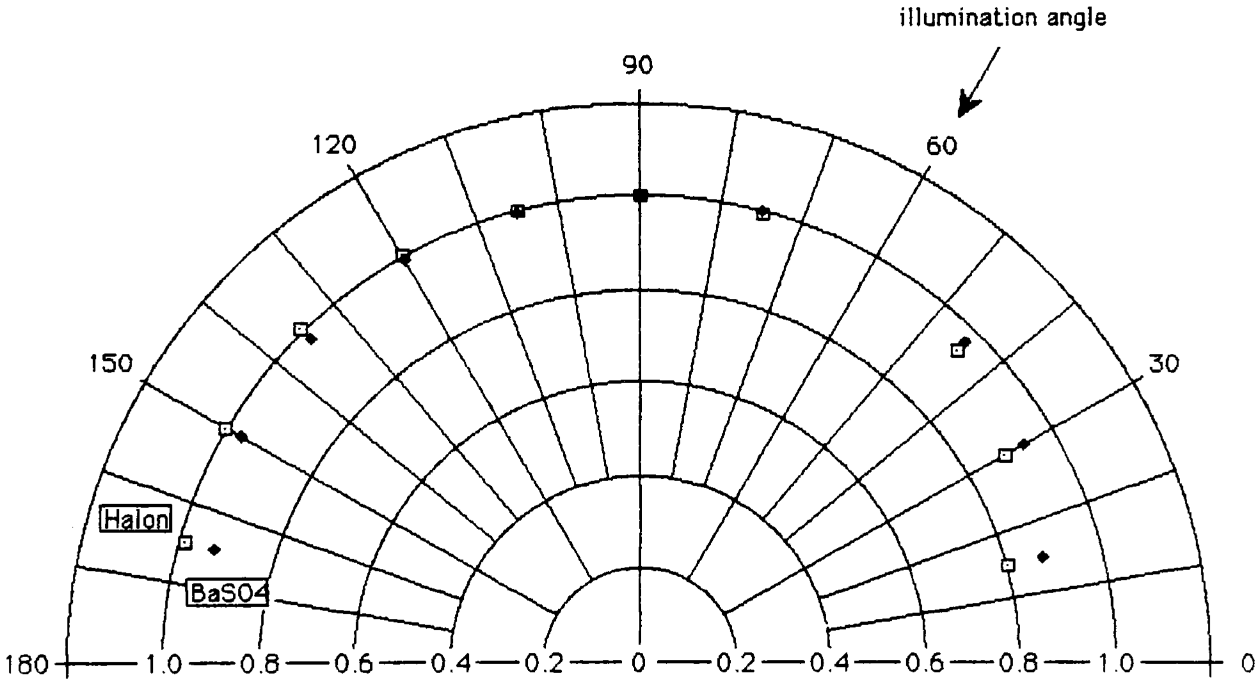
WAV. [nm]	Bss mean	Bss coeff. var.	Bsp mean	Bsp coeff. var.	Bps mean	Bps coeff. var.	Bpp mean	Bpp coeff. var.	Brr mean	Brr coeff. var.
390	2.253	2.94	0.895	3.03	0.904	1.76	1.628	3.15	1.420	0.57
395	2.321	3.31	0.977	0.60	0.984	1.94	1.717	3.37	1.500	1.19
400	2.301	3.29	0.971	0.88	0.970	1.36	1.707	3.23	1.487	1.11
405	2.330	2.98	0.974	1.24	0.981	0.97	1.729	4.46	1.504	1.00
410	2.342	2.82	0.975	1.61	0.983	1.03	1.738	4.35	1.509	1.13
415	2.347	2.80	0.974	1.12	0.981	1.66	1.757	3.30	1.515	1.22
420	2.360	2.95	0.978	0.96	0.980	1.65	1.759	3.92	1.519	1.09
425	2.372	2.99	0.975	0.92	0.981	1.74	1.764	4.36	1.523	1.08
430	2.379	3.16	0.975	0.80	0.981	1.46	1.770	3.85	1.526	1.16
435	2.385	3.36	0.977	1.14	0.980	1.50	1.770	3.67	1.528	1.37
440	2.392	3.36	0.980	0.83	0.986	1.79	1.781	3.63	1.535	1.37
445	2.396	3.34	0.980	1.05	0.983	1.43	1.783	3.72	1.536	1.34
450	2.392	3.03	0.977	0.94	0.980	1.63	1.788	4.55	1.534	1.19
455	2.400	3.00	0.986	1.06	0.989	1.54	1.800	3.76	1.544	1.27
460	2.407	2.83	0.977	0.84	0.985	1.70	1.795	3.74	1.541	1.11
465	2.427	2.95	0.972	0.87	0.990	1.59	1.789	4.07	1.544	1.03
470	2.419	3.10	0.977	0.92	0.984	1.32	1.803	4.12	1.546	0.94
475	2.429	3.08	0.974	0.88	0.983	1.49	1.805	3.93	1.548	0.94
480	2.428	2.95	0.974	1.22	0.980	1.32	1.807	4.28	1.547	0.90
485	2.434	3.05	0.976	1.15	0.981	1.22	1.811	4.15	1.550	1.00
490	2.435	2.84	0.971	1.07	0.978	1.00	1.807	4.24	1.548	0.96
495	2.441	2.79	0.968	0.99	0.974	1.33	1.805	4.71	1.547	0.98
500	2.446	2.71	0.969	0.70	0.978	1.07	1.806	4.46	1.550	0.84
505	2.454	2.84	0.970	0.83	0.978	1.49	1.814	4.78	1.554	0.96
510	2.464	2.80	0.971	0.82	0.976	1.22	1.819	4.40	1.558	1.03
515	2.467	2.72	0.967	0.64	0.977	1.27	1.817	5.03	1.557	0.99
520	2.471	2.35	0.964	0.41	0.970	0.97	1.815	5.17	1.555	0.65
525	2.469	2.37	0.966	0.65	0.974	1.16	1.817	4.95	1.557	0.64
530	2.472	2.29	0.969	0.74	0.973	1.03	1.822	5.36	1.559	0.52
535	2.466	2.11	0.963	0.42	0.969	1.06	1.818	5.56	1.554	0.38
540	2.468	2.15	0.964	0.63	0.971	0.98	1.820	5.75	1.556	0.41
545	2.468	2.09	0.962	0.81	0.967	0.64	1.817	5.51	1.553	0.42
550	2.472	2.11	0.965	0.74	0.966	1.12	1.816	5.54	1.555	0.64
555	2.481	1.95	0.960	0.75	0.968	0.82	1.825	5.63	1.559	0.37
560	2.481	1.78	0.957	0.47	0.963	0.55	1.825	5.65	1.557	0.32
565	2.493	1.76	0.957	0.39	0.964	0.66	1.830	5.62	1.561	0.36
570	2.502	1.90	0.955	0.38	0.962	0.89	1.838	5.96	1.564	0.38
575	2.506	2.07	0.953	0.73	0.962	1.20	1.842	6.15	1.566	0.62
580	2.515	1.77	0.958	1.14	0.963	1.13	1.853	6.43	1.572	0.70
585	2.521	1.79	0.954	0.40	0.965	1.00	1.840	5.48	1.570	0.59
590	2.523	2.06	0.957	0.74	0.966	0.73	1.844	5.02	1.573	0.57
595	2.519	2.03	0.951	0.38	0.963	0.97	1.840	4.79	1.568	0.45
600	2.528	2.13	0.954	0.53	0.963	0.82	1.847	5.24	1.573	0.42
605	2.542	2.03	0.952	0.32	0.964	0.72	1.850	5.09	1.577	0.24
610	2.551	1.90	0.952	0.48	0.967	0.97	1.857	6.13	1.582	0.43
615	2.552	2.39	0.954	0.81	0.964	0.82	1.848	6.73	1.579	0.55
620	2.567	2.35	0.955	0.84	0.968	1.07	1.859	6.60	1.587	0.94
625	2.573	2.31	0.958	1.06	0.965	0.81	1.857	6.17	1.588	0.76
630	2.573	1.85	0.952	0.76	0.962	1.43	1.856	5.92	1.586	0.90
635	2.567	1.49	0.950	0.90	0.969	1.08	1.856	5.20	1.586	0.46
640	2.577	1.09	0.950	0.88	0.962	1.12	1.857	4.81	1.587	0.22
645	2.578	1.30	0.952	0.70	0.965	0.51	1.866	4.41	1.590	0.47
650	2.584	1.54	0.953	0.56	0.967	0.76	1.877	5.65	1.595	0.51
655	2.580	1.67	0.949	0.29	0.964	1.38	1.872	6.03	1.592	0.55
660	2.582	1.51	0.949	1.32	0.964	1.07	1.869	5.98	1.591	0.60
665	2.589	1.12	0.951	0.93	0.959	0.70	1.871	5.04	1.593	0.74
670	2.591	1.13	0.957	0.67	0.963	0.56	1.875	5.26	1.596	0.57
675	2.594	1.25	0.949	1.14	0.961	0.23	1.856	6.62	1.590	0.57
680	2.599	1.69	0.961	1.48	0.968	1.38	1.858	6.38	1.596	0.99
685	2.598	1.47	0.962	1.23	0.961	1.84	1.873	7.11	1.598	0.99
690	2.625	1.75	0.952	1.06	0.966	0.74	1.879	6.51	1.605	0.76
695	2.614	1.18	0.944	1.30	0.961	0.90	1.871	7.38	1.598	1.07
700	2.628	1.63	0.952	0.65	0.973	1.62	1.887	5.68	1.610	0.43
705	2.627	1.54	0.954	1.58	0.964	0.66	1.892	7.51	1.609	0.57
710	2.640	2.60	0.945	1.42	0.959	1.40	1.890	6.27	1.609	0.73
715	2.642	1.91	0.958	1.13	0.973	0.48	1.889	5.99	1.615	0.26
720	2.648	2.03	0.961	1.46	0.977	2.10	1.872	6.49	1.615	0.76
725	2.630	1.77	0.945	2.01	0.949	3.09	1.879	6.01	1.601	0.33
730	2.658	2.62	0.951	2.46	0.962	2.95	1.890	7.98	1.615	1.02

-75°/ 75° BIDIRECTIONAL ABSOLUTE SPECTRAL REFLECTANCE FACTORS

WAV. [nm]	Bss mean	Bss coeff. var.	Bsp mean	Bsp coeff. var.	Bps mean	Bps coeff. var.	Bpp mean	Bpp coeff. var.	Brr mean	Brr coeff. var.
390	4.156	2.41	1.091	2.88	1.074	1.72	3.113	5.59	2.358	1.76
395	4.255	1.92	1.174	1.45	1.156	1.85	3.171	6.50	2.439	1.49
400	4.239	2.11	1.150	1.48	1.148	1.36	3.176	6.39	2.428	1.53
405	4.287	2.12	1.165	1.45	1.156	1.62	3.214	5.76	2.456	1.35
410	4.313	1.90	1.162	1.73	1.160	1.64	3.232	5.61	2.467	1.36
415	4.340	2.23	1.167	1.59	1.153	1.11	3.266	5.27	2.482	1.48
420	4.361	2.27	1.168	1.65	1.152	1.82	3.277	6.08	2.489	1.54
425	4.375	2.28	1.167	1.63	1.157	1.89	3.292	5.68	2.498	1.58
430	4.388	2.38	1.167	1.08	1.154	1.67	3.305	6.04	2.503	1.73
435	4.403	2.42	1.167	1.82	1.157	1.70	3.303	5.78	2.507	1.71
440	4.414	2.43	1.171	1.34	1.158	1.84	3.319	4.98	2.516	1.70
445	4.435	2.22	1.165	1.76	1.156	1.82	3.329	5.58	2.521	1.62
450	4.446	1.92	1.168	1.32	1.154	1.55	3.352	5.48	2.530	1.47
455	4.464	1.87	1.175	1.42	1.161	1.58	3.371	5.23	2.543	1.50
460	4.489	1.99	1.166	1.35	1.156	1.51	3.378	5.38	2.547	1.59
465	4.532	2.13	1.159	1.48	1.162	1.87	3.364	5.29	2.554	1.63
470	4.516	1.91	1.167	1.65	1.155	2.04	3.395	4.43	2.558	1.42
475	4.525	1.68	1.162	1.46	1.153	1.93	3.403	3.77	2.561	1.22
480	4.540	1.58	1.161	1.35	1.152	1.78	3.414	3.91	2.567	1.18
485	4.544	1.62	1.161	1.49	1.150	1.87	3.423	4.11	2.570	1.22
490	4.557	1.70	1.158	1.45	1.147	1.79	3.428	4.48	2.573	1.26
495	4.564	1.69	1.157	1.66	1.145	1.55	3.442	4.95	2.577	1.32
500	4.579	1.63	1.156	1.71	1.149	1.23	3.450	5.11	2.584	1.32
505	4.603	1.70	1.157	1.35	1.147	1.37	3.460	4.48	2.592	1.29
510	4.612	1.73	1.157	1.59	1.144	1.54	3.463	4.02	2.594	1.16
515	4.624	1.41	1.155	1.29	1.141	1.61	3.456	4.00	2.594	0.92
520	4.638	1.34	1.150	0.92	1.141	1.52	3.455	4.56	2.596	0.97
525	4.649	1.35	1.152	1.26	1.140	1.41	3.459	4.35	2.600	0.97
530	4.662	1.28	1.156	1.25	1.140	1.44	3.472	4.84	2.608	0.95
535	4.668	1.28	1.151	1.25	1.136	1.11	3.482	4.64	2.609	0.94
540	4.687	1.30	1.154	1.11	1.138	1.28	3.491	4.64	2.618	0.90
545	4.704	1.44	1.150	1.23	1.138	1.26	3.494	4.29	2.622	0.98
550	4.705	1.58	1.147	0.89	1.141	1.03	3.503	4.64	2.624	1.03
555	4.709	1.86	1.144	0.96	1.139	1.12	3.508	4.70	2.625	1.10
560	4.721	2.13	1.140	1.08	1.132	1.18	3.515	4.23	2.627	1.14
565	4.739	1.94	1.142	1.26	1.134	1.22	3.530	3.96	2.636	1.07
570	4.769	1.64	1.137	1.05	1.133	0.88	3.537	4.00	2.644	0.92
575	4.785	1.30	1.138	0.90	1.132	0.99	3.547	4.81	2.651	0.83
580	4.807	1.34	1.134	1.08	1.133	1.32	3.561	5.54	2.659	1.06
585	4.815	1.43	1.136	0.82	1.128	1.37	3.571	6.56	2.663	1.15
590	4.825	1.20	1.137	0.88	1.129	1.27	3.585	5.21	2.669	0.80
595	4.834	0.92	1.135	0.87	1.127	1.48	3.586	5.69	2.670	0.84
600	4.841	0.80	1.136	1.04	1.125	1.15	3.591	5.28	2.673	0.70
605	4.857	1.18	1.142	0.98	1.127	1.33	3.591	5.35	2.679	0.82
610	4.873	1.33	1.139	1.10	1.133	1.27	3.610	4.59	2.689	0.96
615	4.879	1.51	1.140	0.98	1.131	1.23	3.622	4.20	2.693	0.95
620	4.901	1.36	1.145	0.68	1.128	1.20	3.643	4.38	2.704	0.88
625	4.932	1.24	1.146	1.12	1.133	1.57	3.641	4.64	2.713	0.79
630	4.984	1.17	1.136	1.12	1.126	1.21	3.646	4.78	2.723	0.93
635	4.993	1.22	1.137	1.89	1.133	1.15	3.642	5.38	2.726	1.25
640	5.011	1.41	1.139	1.76	1.131	0.86	3.659	5.07	2.735	1.21
645	5.022	1.74	1.138	1.12	1.133	1.54	3.675	4.86	2.742	1.35
650	5.043	2.07	1.147	0.66	1.141	1.15	3.679	4.00	2.752	1.28
655	5.029	1.90	1.140	1.87	1.135	0.62	3.691	4.74	2.749	1.10
660	5.055	2.09	1.144	0.34	1.135	1.21	3.695	5.38	2.757	1.10
665	5.053	2.09	1.137	0.74	1.134	1.29	3.698	5.32	2.755	1.14
670	5.058	1.50	1.137	0.12	1.136	0.86	3.708	7.36	2.760	1.29
675	5.076	1.55	1.129	1.03	1.126	2.29	3.720	7.20	2.763	1.28
680	5.079	1.29	1.138	0.54	1.134	0.76	3.711	6.68	2.766	1.10
685	5.108	1.66	1.136	0.84	1.130	1.89	3.724	7.28	2.774	1.33
690	5.145	1.90	1.133	1.38	1.138	1.97	3.732	7.97	2.787	1.57
695	5.129	2.02	1.142	0.98	1.132	2.12	3.754	8.40	2.789	1.71
700	5.168	2.21	1.132	1.41	1.152	1.81	3.776	9.61	2.807	1.93
705	5.149	2.31	1.137	0.59	1.136	1.56	3.762	9.25	2.796	1.86
710	5.182	2.43	1.137	1.64	1.131	0.83	3.769	8.33	2.805	1.94
715	5.170	2.30	1.140	1.45	1.140	0.54	3.758	7.95	2.802	1.68
720	5.160	2.29	1.144	0.91	1.138	1.94	3.762	6.42	2.801	1.48
725	5.194	2.50	1.125	1.93	1.139	1.23	3.770	5.76	2.807	1.76
730	5.181	2.17	1.124	2.39	1.149	1.82	3.773	6.29	2.807	1.45

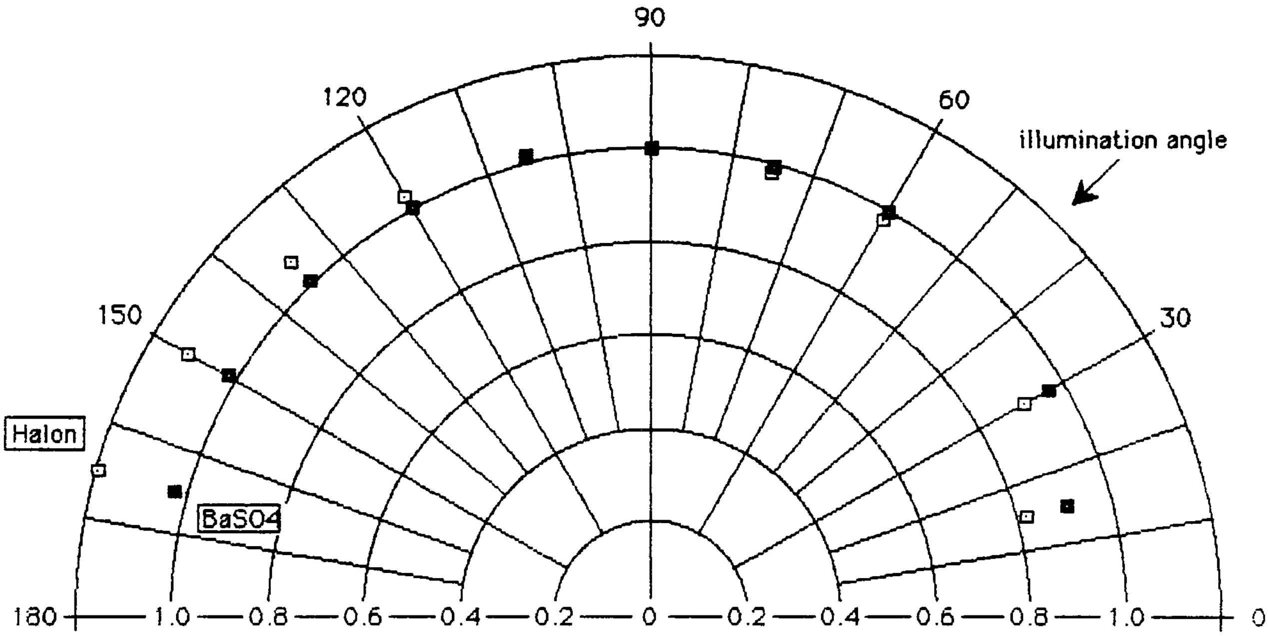
Appendix 33

BaSO4 vs HALON, ßrr, 555nm, -30° illumination

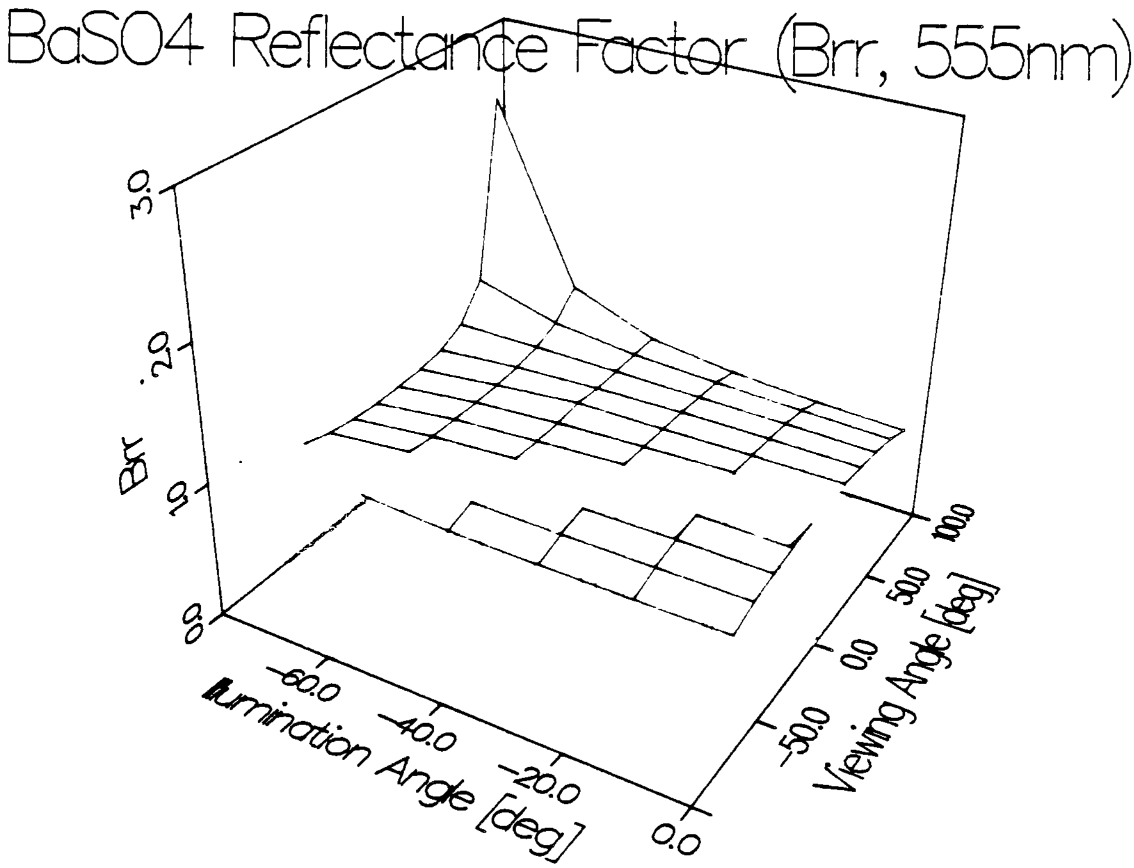


Appendix 34

BaSO4 vs HALON, ßrr, 555nm, -45° illumination



Appendix 35


BaSO4 Reflectance Factor (Brr, 555nm)
Brr
0.0
1.0
2.0
3.0
-60.0
-40.0
-20.0
0.0
Illumination Angle [deg]
-50.0
0.0
50.0
100.0
Viewing Angle [deg]