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A Study of performance differences between a hybrid and rapid access film system, and calibration strategies for an imagersetter

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A Study of Performance Differences between a Hybrid and Rapid Access Film System, and Calibration Strategies for an Imagesetter

by

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A thesis proposal submitted in partial fulfillment of the requirements for the degree of Master of Science in the School of Printing Management and Sciences in the College of Imaging Arts and Sciences of the Rochester Institute of Technology

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Abstract

An imagesetter can be calibrated by measuring solid density and using a linearizing program. An alternative method consists of adjusting exposure in order to optimize resolution. This method works well with a rapid access system; however, preliminary tests show that it may not be applicable to a hybrid system. This study had the following purposes: (1) to investigate the differences in response over the halftone range between a hybrid film and a rapid access film on a laser exposure imagesetter, (2) to evaluate the applicability of calibration and linearization methods using checkerboard patterns, (3)to determine a better method, if the checkerboard method is not adequate for the hybrid system, and (4) to explain the differences of the two films in terms of their fundamental characteristics.

An exposure series of continuous-tone gray scales and a test page with halftone scales were performed on an imagesetter using hybrid film and rapid access film, which were Kodak Imageset 2000 film and Kodak PagiSet film respectively.

From the continuous-tone exposure series, it was found that Imageset 2000 film has significantly higher contrast than PagiSet film. A linear relationship was found between laser intensity units of the imagesetter and exposure in terms of energy. The slope of these plots were a function of the laser beam.

From the test form's exposure series, it was found that matching the density of the 1x1 checkerboard to that of 50% reference tint on the UGRA/FOGRA PostScript Digital Control Strip is applicable for calibrating and linearizing common screen rulings within a tolerance of ±1% on PagiSet film. However, maximum density at practical exposure of Pagiset film is too

low. Overexposure is needed in order to obtain a satisfied maximum density; and therefore, a linearizing program is required to correct the non-linearity. For Imageset 2000 film, matching the density of the 2x2 checkerboard to that of 50% reference tint on the UGRA/FOGRA PostScript Digital Control Strip is applicable for calibrating and linearizing common screen rulings with a satisfied maximum density. Imageset 2000 film has a slightly lower modulation transfer function than PagiSet film. There was some evidence that showed chemical spread for Imageset 2000 film.

Chapter 1

Introduction

An imagesetter is an output device for a desktop publishing system and digital high-end scanner. The basic principle is that the laser beam generates laser spots on a light sensitive material which mostly is film today. As the laser sweeps across the film, the electronic signals from the raster image processor (RIP) control the beam when to turn on and off in order to create the image. When a halftone image is output, dot size has to be controlled in such a way that the produced dots on film are the same as those requested by the input program. Therefore, the imagesetter has to be calibrated and characterized. Most recommendations for calibration require that exposure is adjusted until a specified solid density on the film is obtained[1]. The next process, which is characterization, is to relate the input to the output dot area. This process can be done by outputting a halftone scale at the pre-determined solid density and measuring the percent dot areas on the halftone scale. If the output dot areas are not what was specified by the input side, the output dot areas have to be adjusted to obtain the correct results. This process is called linearization which is normally done by linearization software. The measured output dot areas are input into the software. These numbers are used for creating and installing a linearizing curve into the RIP.

However, it was found that solid density alone is not a sufficient criterion. For instance, in the situation of an underreplenished, weak developer, it is necessary to overexpose the film in order to obtain the required solid density[2]. This in turn causes dot gain.

Although spot size is strongly dependent upon the laser intensity, it is also influenced by mechanism of generating laser beam (rise and fall time)[3], film characteristics (modulation transfer function and spread function), spot size relative to addressability, and film processing (development time, developer activity, and developing temperature)[4]

Another way to calibrate an imagesetter is to use checkerboard patterns on the UGRA/FOGRA PostScript Control Strip: the 1x1, 2x2, 4x4 matrices and 50% tint patch. Optimum resolution is obtained when exposure is adjusted so that the 1x1 checkerboard and 50% tint patch have the same density. In theory, by calibrating an imagesetter this way, linearization may not be necessary for a linear film system such as rapid access. However, it was claimed that this method may not work for very high contrast films (hybrid system) because of the non-linear response for very small image detail[5].

This study investigated the performance differences between a film of hybrid technology (Kodak Imageset 2000 film) and a traditional rapid access film (PagiSet film) in terms of the sensitivity to dot size change and change in control element size as a function of exposure variation. It also attempted to explain the differences in terms of sensitometric contrast, film modulation transfer function (MTF), chemical spread, and to define the preferred control elements and control strategy for each system.

Statement of the Problems

The purposes of this study were to answer the following questions:

1. Is the exposure latitudes of these two film types different?
2. Is the linearity of these two film types different? If it is, does one need a different strategy for linearization?

3. Is the calibration method using checkerboard patterns applicable for both films? If not, how could it be modified or replaced?

Definition of Terms

Laser spot size: For optical reasons, the laser intensity profile reaching an emulsion is of Gaussian shape. Therefore, laser spot size can be specified by its standard deviation or by specifying its width at a given fraction of peak intensity.

Film spot size: The size of an exposed and developed spot on film created by a laser spot. Film spot size is strongly dependent upon the exposure. It is also modified by scattering of light in the emulsion and developing chemicals. Therefore, film spot size may not be same as laser spot size.

Checkerboard pattern: This term refers to a pattern of matrix of alternately black and white in both the horizontal and vertical directions. These elements may be either film spots or halftone dots. The finest checkerboard pattern is the 1x1 matrix which is made up of single film spots.

The Pixeldot Test Target: A PostScript test target that contains five percent dot areas (11.1%, 25%, 50%, 75%, and 88.9%) of tint patches at different halftone dot sizes. The halftone dots were made up of number of pixels that can be specified in the PostScript file. In this study, number of pixels per halftone dot ranges from 1 to 15. The difference in number of pixels indicates different screen ruling. At the addressability of 2,400 dpi; therefore, the pixel grid size is approximately 10.5 microns. The screen ruling of different halftone dot sizes can be calculated from the following equation.

$$\text{screen ruling} = \sqrt{2} \cdot 10.5 \times \text{number of pixels}$$

The RIT Digital Output Resolution Tester: A test target that contains reference tints, checkerboards, scan line patterns, and crosss scan line patterns at 25%, 50% and 75% dot areas.

Endnotes for Chapter 1

[1] Richard M. AdamII, Daniel J. Makuta, and Thomas A. Whiteman, "Calibrating PostScript Imagesetters," *GATF World* vol.3, issue 6 (1991): 33.

[2] Franz Sigg, *How to Calibrate and Linearize an Imagesetter Using the Digital UGRA/FOGRA Wedge* (Rochester, NY: Rochester Institute of Technology, 1995), 6. (unpublished)

[3] C.N. Nelson, "Prediction of Densities in Fine Detail in Photographic Images," *Photographic Science and Engineering,* vol. 15, no. 1 (January-February 1971), 82.

[4] Franz Sigg, *How to Calibrate and Linearize an Imagesetter Using the Digital UGRA/FOGRA Wedge* (Rochester, NY: Rochester Institute of Technology, 1995), 2, 14. (unpublished)

[5] Ibid., 9.

Chapter 2

Theoretical Bases

An imagesetter produces shades of gray by using halftone techniques. As shown in figure 1, the pixel grid is the basic addressability matrix of the imagesetter. A *halftone grid* is overlaid on top of the *pixel grid*. A certain percentage of pixels within a cell of the halftone grid is turned on to produce a shade of gray. An image is produced by sweeping a modulated laser beam across the page, moving the film up, and sweep again. This back-and-forth sweep is called scanning. When the laser beam is turned on, a black pixel is produced, when off, no black spot is produced.

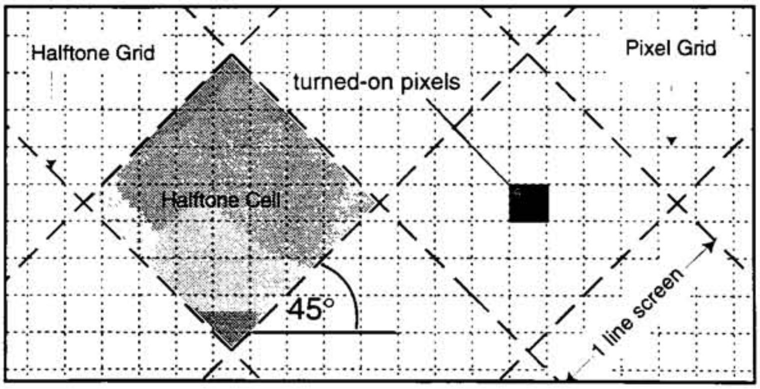


Figure 1. Definitions of pixel grid, halftone grid, halftone cell, screen angle (45°)and line screen

To produce tints, all halftone cells within a specified area are produced at the same gray value. Photographic halftones are produced by downloading a bitmapped image to the raster

image processor (RIP) of the imagesetter. The screening algorithm of the RIP converts the image file into raster data which determines which pixels on the pixel grid will be turned on or off in order to produce tones of the image. In the case of color separations, each color separation's screen angle is rotated with respect to the other to avoid a moire patterns. The screening algorithm may also adjusts the lines per inch of halftone grid to further avoid moire.[1]

To produce high-quality imagesetter output, especially color separations, accurate halftone dot sizes are required. An imagesetter has to be calibrated and linearized in order to obtain the same output percent dot areas as requested from the input side for the entire range of dot percentages.

Evaluation of the Conventional Graphic Arts Film's and Plate's Reproduction

In a photographic (analog) system, test targets such as the UGRA Wedge or RIT Microline Resolution Targets, are used to determine proper exposure and processing, exposure latitude, and resolving power. The main elements of these targets are microlines, and halftone patches.

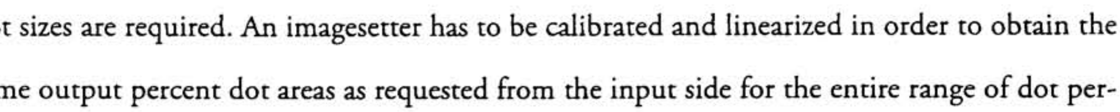


Figure 2. UGRA Control Wedge


Figure 3. RIT Microline Target

A microline target is a resolution-detectability target. Unlike traditional photographic resolution targets where the lines and spaces have the same width, the graphic arts resolution targets are designed so that the line-to space ratios are one-to-nine or one-to-four. With these

ratios, the lines are finer than dots, but are easier to see because they are lines which, therefore, cover a larger area.[2] It is also more convenient to evaluate the exposure for optimum resolution when plotting the finest, positive and negative microlines against relative log exposure. The crossing of the curve of positive lines and negative lines indicates optimum resolution and the exposure for optimum resolution of the system.

In order to evaluate a light sensitive system, it is necessary to go through an exposure series to see how positive and negative microlines change as a function of exposure. The graph of finest noticeable microlines plotted against relative log exposure, as shown in figure 4, provides a means to evaluate microline response to exposure. As exposure increases, more and more of the finer negative lines will be reproduced, while more and more of the finest positive lines may

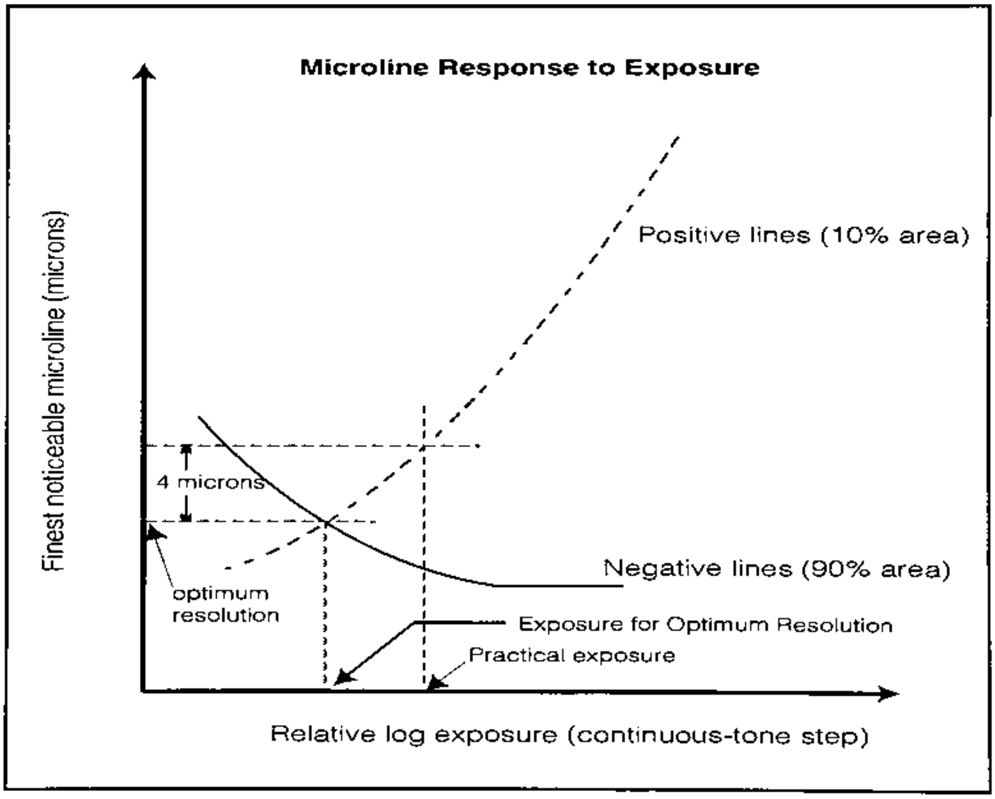


Figure 4. Microline Response Curve[3]

get lost. Optimum resolution is reached when the thickness of the just reproducible positive and negative lines are the same. At the exposure for optimum resolution, all 50% area patches should reproduce at 50% coverage (which corresponds to a density of 0.3). Therefore, the 50% tint patches of 150 lpi and 300 lpi of RIT Microline Resolution Target will look same in density.[4]

However, the exposure for optimum resolution is not necessarily a practical exposure because at this point, a light sensitive system is very sensitive to exposure variations. Such variations include dust and film edges for positive working systems or, for negative working systems, the light sensitive coating may not be properly hardened. Therefore, a slight overexposure is required for both systems.

Graphic Arts Film and Chemistry[5]

Unlike pictorial films which are low in contrast to allow a continuous tone scale, graphic arts films have a high contrast. In general, the higher the contrast, the more desirable a film is for graphic arts applications. The film-chemistry combinations, used to achieve this desirable high contrast, allow graphic arts films-chemistry pairings to be categorized into three groups: rapid access, lith, and hybrid.

Rapid Access film and processing generally results in the lowest contrast of the graphic arts choices. It, however, benefits from the simplest film-chemistry combination, with moderate tolerance for temperature and replenishment variations. In addition, the density produced is directly related to the exposure received and there is little, if any, interaction between adjacent exposed areas. Rapid access film-processing also tends to have a lower maximum density, at practical exposure levels, and a somewhat larger dot fringe that is associated with a softer sensitometric toe shape.

Lith film and processing was the traditional approach used to achieve a higher contrast from graphic arts films. Note that some films may be processed in more than one type of chemistry and as such may exhibit different characteristics in different film-chemistry pairings. Lith film-processing achieved this increase in contrast through the use of chemical effects produced as a result of the initial stages of development. One simple model, for some types of lith development, suggests that a more active developer is formed from the by products of development that migrates outward from the area of core development. This more active developer is able to develop areas with sub-threshold exposure resulting in a very hard edge with a very short transition or fringe area. The draw back to lith film-developer pairs is that these are generally a balance combination where both film and chemistry contribute to the chemical effects. In addition, the chemical balance, associated with time, temperature, and replenishment, is much more critical than is found in rapid access combinations. In lith development, there is interaction between areas of exposure and the density produced may not have a linear relationship to the exposure received. However, like rapid access films, density will only be produced in areas actually exposed (either directly or by light spread in the film emulsion).

Hybrid film and chemistry combinations represent an attempt to achieve the high contrast usually associated with lith development using simpler chemistry associated with rapid access development. Generally, some type of infectious development is present. In the simple explanations of this type of film-chemistry combination, chemical by products of the initial development of the core area may produce chemical fogging agents that make areas immediately adjacent to the exposed area also developable. As these products must diffuse through the emulsion the resultant density profile is usual very high with even a smaller fringe than is found with lith film-chemistry combinations. The drawback is that density may occur in areas where no exposure occurred. This is sometimes referred to as chemical spread. In many situations, particularly imagesetters, this may be compensated for in setup. The newer hybrid films attempt to restrict the magnitude of the diffusion of these chemical agent to minimize the physical magnitude of chemical spread.

Most graphic arts films reproduce a midtone dot change of less than 1%, and a solid density of more than 3.0 at optimum resolution.[6] However, the dot gain may occur in highlight area whereas the dot loss occurs in shadow area. (see figure 5). This is due to non-linear characteristics of the film. Two major graphic arts film-chemical systems used on an imagesetter

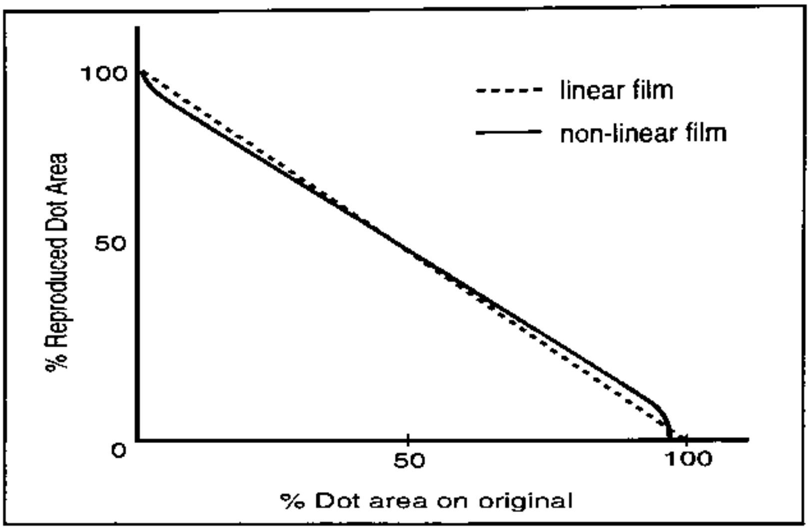


Figure 5. Suggested responses of linear and non-linear film

today are rapid access system and hybrid system. It is claimed that the hybrid system renders high solid density, high contrast and less fringe. However, it has possibly lower resolution, low exposure latitude and non-linear response. Rapid access, on the other hand, has lower contrast, less solid density and more fringe, but it gives higher exposure latitude and linear response to entire range of halftone dot areas.[7]

Evaluation of Digital Output Systems

Unlike the conventional photographic process, digital devices create halftone dots on film in accordance with the raster data by very high intensity laser spots. The actual laser spot size on film is the primary criterion for determining the quality of the image reproduced. The actual size of the spot depends on the following attributes.[8]

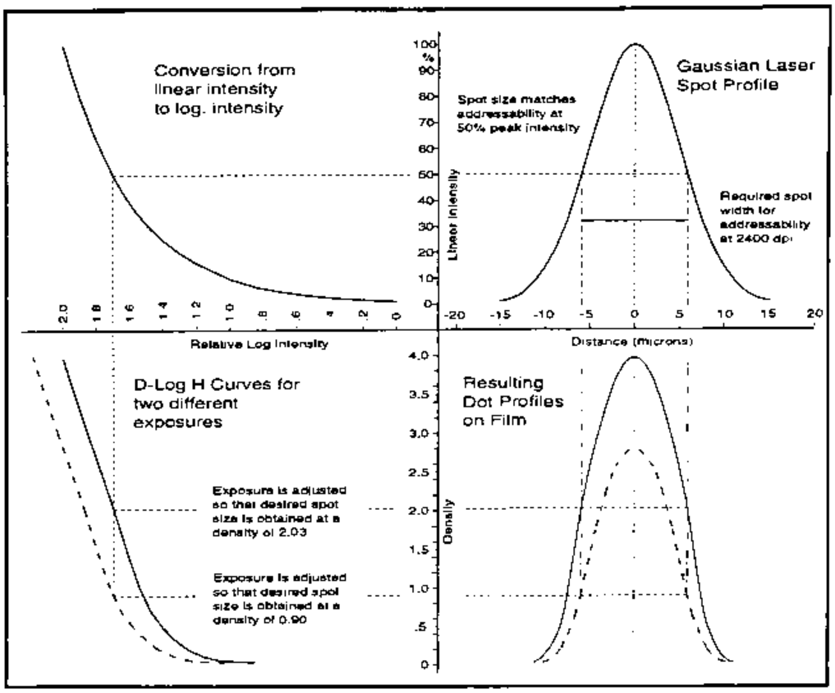


Figure 6. The dot size changes as a function of exposures[9]

1. Exposure: Figure 6 illustrates how spot size changes at different laser intensities. The laser intensity distribution is of Gaussian shape (normal distribution). The preferred exposure is at 50% exposure level, because the latent image of two adjacent spots add up to almost the same level as the peak of a single spot. Therefore, a solid, created by such lines, has essentially uniform density.[10] When altering the exposure, resulting dot size changes. It can be seen from this figure that laser intensity has a strong influence on spot size.
2. Addressability: A measure of how many spots an imagesetter can position within a linear inch.
3. Laser pot size: The laser spot size should be adjusted to correspond to the addressability. The laser intensity distribution of too large a spot size, relative to the addressability, will cause more latent image overlap, which in turn causes dot gain between adjacent film spots.

Figure 7 illustrates the different laser intensity distributions of three different spot sizes. The laser intensity distribution of these spot sizes are of Gaussian shape. Since the laser

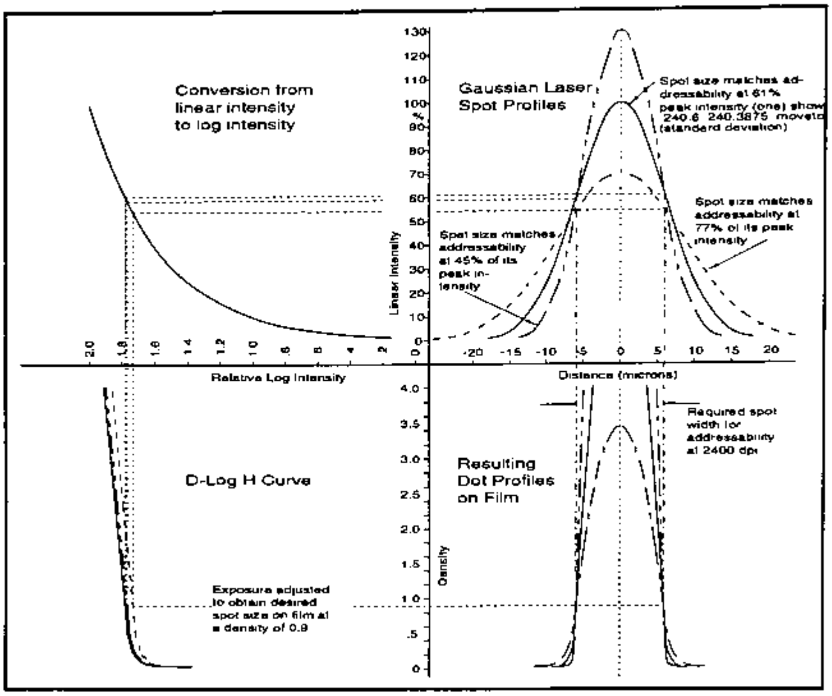


Figure 7. The dot size changes as a function of the spot sizes[11]

energy is the same, the areas under these curves are equal where as the amplitude and spread (standard deviation) are different. By using different exposures, different laser spot sizes can be compensated. But the softness of the resulting film spots will change.

4. Film: Light scattering during exposure results in a difference between aerial image and latent image. This inherent property can be mathematically described by modulation transfer function and spread function, which will be discussed later.
5. Film processing: The processing conditions that have influences on dot size are developing temperature, developing time, agitation. Furthermore, different chemical systems (hybrid and rapid access) also produce different results.
6. Mechanism of the imagesetter such as type of imagesetter: capstan and drum[12], imagesetter's optics, rise and fall time of laser[13], directional effects.

Using Maximum Density to Calibrate and Linearize an Imagesetter

Most recommendations for calibration and linearization of an imagesetter require the use of solid density of film as a judging criterion. Different manufacturers have different solid density recommendations for each type of films. To obtain the accurate solid density, a densitometer is necessary. Next task that has to be done is linearization so that dot percentage input is actually produced on the film. This is usually achieved by outputting a stepwedge of dot percentages, usually generated automatically by the calibration software, from 0 to 100. There are a number of calibration programs on the market. Some of them are vendor-supplied programs, while the others are stand-alone. All of these programs have the ability to download a transfer curve to the imagesetter's RIP. The basic steps are:[14]

1. Calibration: Set an imagesetter's exposure intensity control for specified density.
2. Characterization: Measure the dot areas on a halftone scale, enter these values into the linearizing program.
3. Linearization: Install a correction curve in the Raster Image Processor (RIP). This curve will precompensate the input to the imagesetter so that the output screen values agree within a small tolerances with the original input values. Different linearization curves may be needed for different screen rulings.[15]

However, solid density is not a good criterion for the final quality of imagesetter film. Normally, even a low density of 1.7 on film is enough to reproduce black on a positive working plate, or clear on a negative working plate. This can be seen by looking at step 11 of the UGRA control Wedge which has density of 1.65, it is almost never imaged on the plate. Nevertheless, for aesthetic reasons, and to have some safety factor, a density of 3.0 is desired.[16] Therefore, the maximum density such as a density of 4.0 or higher may be used, but it is not necessary.

The problem of using solid density for calibration is that, it does not indicate how well the dots reproduce. For some conditions, the exposure for optimum resolution is not obtained although the recommended solid density was obtained. For instance, in the situation of using too weak a developer (old or not properly replenished), it becomes necessary to overexpose halftones to obtain the specified maximum density. As a result, solid density is not a reliable criterion for calibrating an imagesetter. Instead, the criteria that should be considered are those that influence on how accurate the spot sizes and, subsequently, the halftone dot sizes will be produced. The checkerboard patterns are the tools that provide the results of how well a system reproduces either very fine dots at very fine screen ruling or regular halftone dot (such as 150 lpi). These patterns are incorporated into the UGRA/FOGRA PostScript Control Strip.

Using Checkerboard Patterns on the UGRA/FOGRA PostScript Control Strip to Calibrate and Linearize an Imagesetter

Another way to calibrate and linearize an imagesetter is to use the 1x1, 2x2, 4x4 checkerboard patterns and parallel line patterns. These patterns are currently available on the UGRA/FOGRA PostScript Control Strip which is a control strip programmed in PostScript.[17] It contains seven functional groups. The crucial groups used for calibrating and linearizing an imagesetter are the halftone wedge and the checkerboard panels, which are group number 5 and 6 respectively in figure 8. The halftone wedge consists of fifteen halftone steps

1 2 3 4 5 6 7

Figure 8. The UGRA/FOGRA PostScript Control Strip

used to evaluate tone reproduction. The checkerboard panels contain three control panels arranged in the form of 1x1-, 2x2-, and 4x4- matrices at a screen angle of 45 degrees. The 1x1

checkerboard pattern (figure 9) is a 50% tint made up of single laser spots. This pattern represents the highest resolution that an imagesetter is capable of producing because the laser alternately turns one pixel on and the next pixel off. The 2x2 and 4x4 checkerboards (figure 10 and 11 respectively) are 50% tint made up of matrices of 2x2 and 4x4 single laser spots respectively. Theoretically, when the relationship between addressability and spot size, and laser intensity are properly adjusted, the 1x1 checkerboard would look like figure 9 and one might think that a solid would look like figure 12.

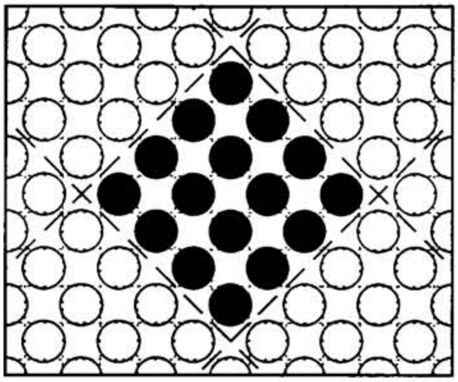


Figure 9. The 1x1 checkerboard (50% area coverage)[19]

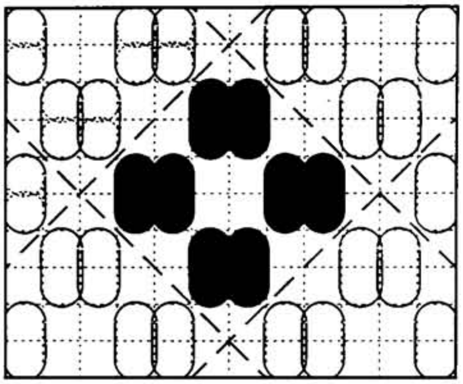


Figure 10. The 2x2 checkerboard (50% area coverage)[20]

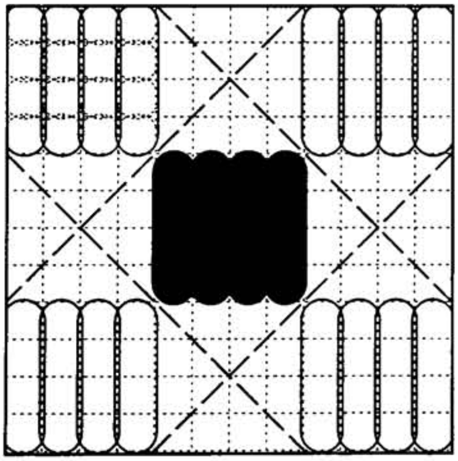


Figure 11. The 4x4 checkerboard (50% area coverage)[21]

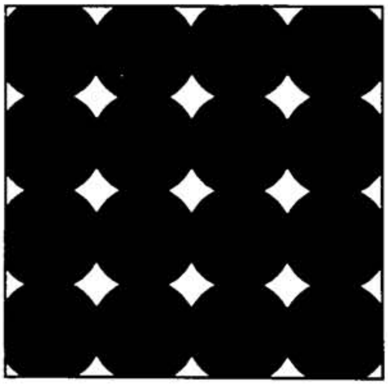


Figure 12. The theoretical model of solid area on film produced by laser spots[22]

There are two effects that make a solid fully solid.[18] First, the imagesetter does not expose separate laser spot. Instead, the laser is turned on as long as spots are needed in scanning direction; therefore, they produce scanning lines as shown in figure 13 rather than spots. Secondly,

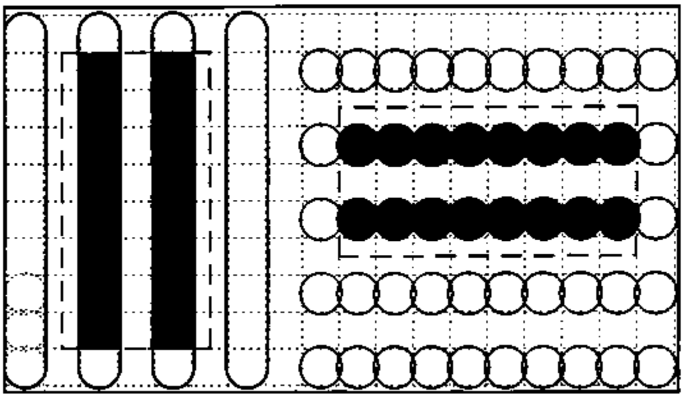


Figure 13. The 1:1 line-to-space, vertical and horizontal lines[23]

the laser spot intensity distribution is of Gaussian shape rather than sharp-edged. The energy at the tails of the Gaussian laser spot causes an underexposed, not developable latent image around each spot which will overlap and add up with those of other adjacent laser spots as depicted in figure 16 and 17. Therefore, the area coverage becomes larger.

The concept of optimum resolution applying to microlines for controlling plate making (analog system) can be applied to spot size for imagesetters (digital system). In an analog system, the exposure for optimum resolution for plate or film is obtained when both the positive and negative microlines are reproduced to the same finest line width. In a digital system, the exposure for optimum resolution is obtained when the 1x1 checkerboard reproduces 50% area coverage. For a linear film and chemical system, once the 1x1 checker board, which is the finest screen rulings at a given addressability, is calibrated, all other screen ruling will be calibrated as well. Hence, without using any calibration curve or a dot area meter, the exposure for optimum resolution can be visually judged by comparing the 1x1 matrix and a 50% halftone tint. The exposure for optimum resolution for an imagesetter is obtained when the density of 1x1 checkerboard and a 50% tint are identically reproduced. Nonetheless, there is some evidence

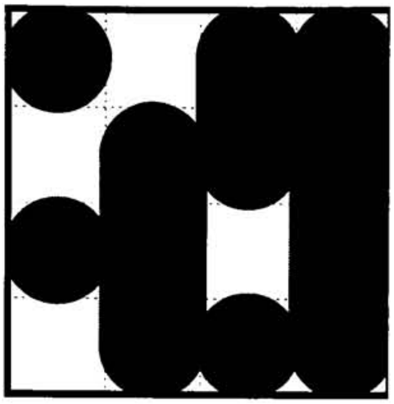


Figure 14. Theoretical model of adjacent dots[24]

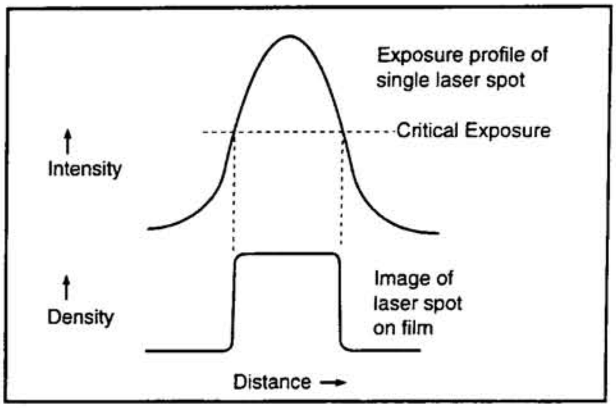


Figure 15. Exposure profile and image of single laser spot[25]

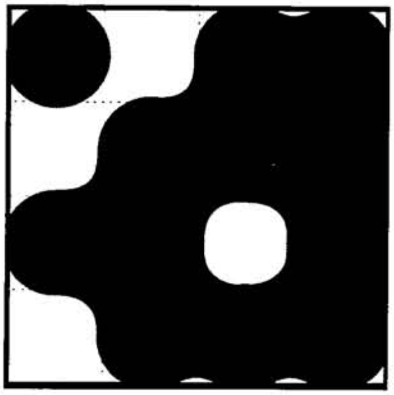


Figure 16. Actual model of adjacent dots[26]

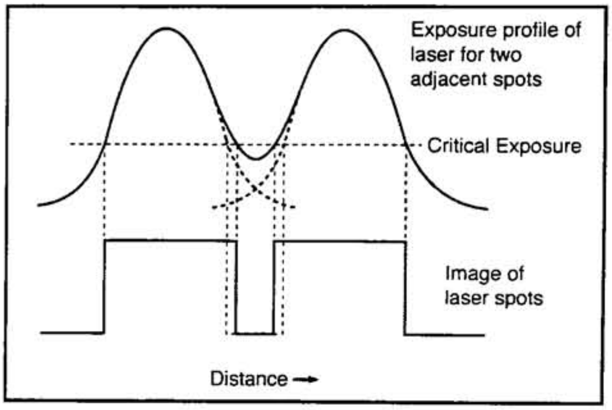


Figure 17. Exposure profile and image of two adjacent laser spots[27]

showing that this may not be true for a non-linear system which will be discussed later.[28] To find the exposure for optimum resolution, both analog and digital systems need an exposure series. At optimum resolution, both systems reproduce halftone dots without gain or loss.

Modulation Transfer Function and Spread Function

Ideally, a perfect system would reproduce minute image detail (high spatial frequency) as well as large subject areas with equal fidelity.[29] In practice, as the spatial frequency increases, the loss of modulation increases and clarity decreases.

The Spread Function

The unexposed emulsion is composed of small silver halide crystals, randomly dispersed in a supporting structure of effectively transparent gelatin. When the emulsion of photographic film is exposed, in addition to light absorption by the photographic grain, there are some mechanisms taking place, which are reflection and refraction. They result from the different refractive indices between silver halides, which is greater than 2.0; and gelatin, which is approximately 1.5. The incoming light is reflected at grain surfaces and refracted at non-parallel faces of emulsion crystals. These mechanisms cause scattering of light in the emulsion at exposure and spread out the aerial image. The spreading of the optical image results in exposure of emulsion grains outside the ideal image area. As a result, the latent image recorded in the film would be less sharp than the aerial image. The effects of this spreading on point and line images, and edge image are shown by figure 18 and 19.[30]

To measure the spreading of light, a microphotometer equipped with a tiny circular aperture is used. By scanning an image of an object point, an intensity profile called point spread function (PSF) could be obtained. Another scan which would be necessary in a two dimensional distribution is the line space function(LSF). It is given by scanning the image of an illuminated line object by a linear slit microphotometer, with line image and slit parallel. The LSF is the integral of the PSF in one direction.[33]

$$l(x) = \int_{-\infty}^{+\infty} p(x,y)\, \partial y \qquad (1)$$

where $l(x)$ = line spread function

$p(x,y)$ = point spread function

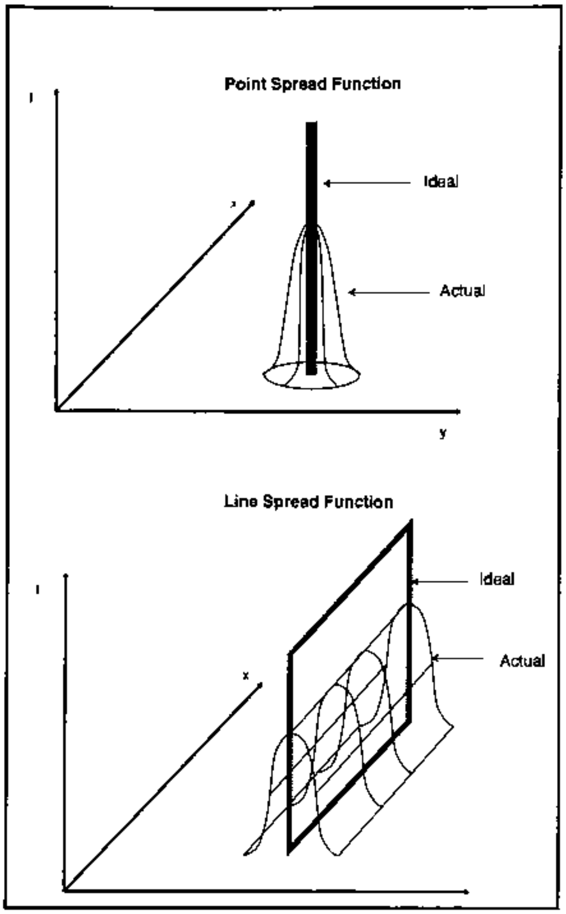


Figure 18. Spread of point and line image[31]

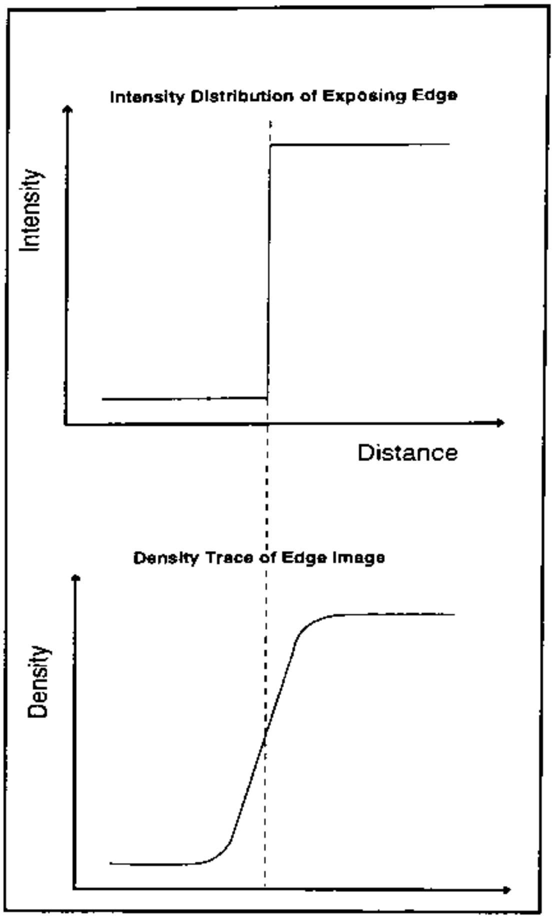


Figure 19. Intensity distribution repro-
duced density of edge[32]

Convolution

The object can be thought of an infinite number of point sources of varying luminance. The image formation can be regarded as the summation, or mathematically known as convolution, of each object point.

To determine the image distribution, the one dimensional image function, g(x), is computed by convoluting the object function, f(x), with the line spread function, l(x). If an object function, f(x), divided into very small elements, $\Delta\pi$, then

$$f(x) = \int f(\pi)\partial\pi. \qquad (2)$$

When this object is imaged by a photo-optical system of LSF, l(x); the resulting contribution of each element to the image function is

$$\partial g(x) = f(x-\pi)\, l(\pi)\, \partial\pi \qquad (3)$$

The total image function is[34]

$$g(x) = \int f(x-\pi)\, l(\pi)\, \partial\pi \qquad (4)$$

The Modulation Transfer Function (MTF)

The intensity (I) of an object usually varies from point to point. The ratio of maximum (Imax) and minimum (Imin) intensity indicates the optical contrast. However, a more general measure of a photographic system is intensity modulation (m).

$$m = \frac{Imax - Imin}{Imax + Imin} \qquad (5)$$

It was found that if a rectangular object pattern(square wave), such as a grating, is convoluted, the image pattern's modulation will be degraded as the spatial frequency increases. This loss of modulation (amplitude) for a sinusoidal pattern is measured by the ratio of image modulation and object modulation, which, at a certain spatial frequency, is called modulation transfer factor (M). [36]

$$M = \frac{m_{image}}{m_{object}} \qquad (6)$$

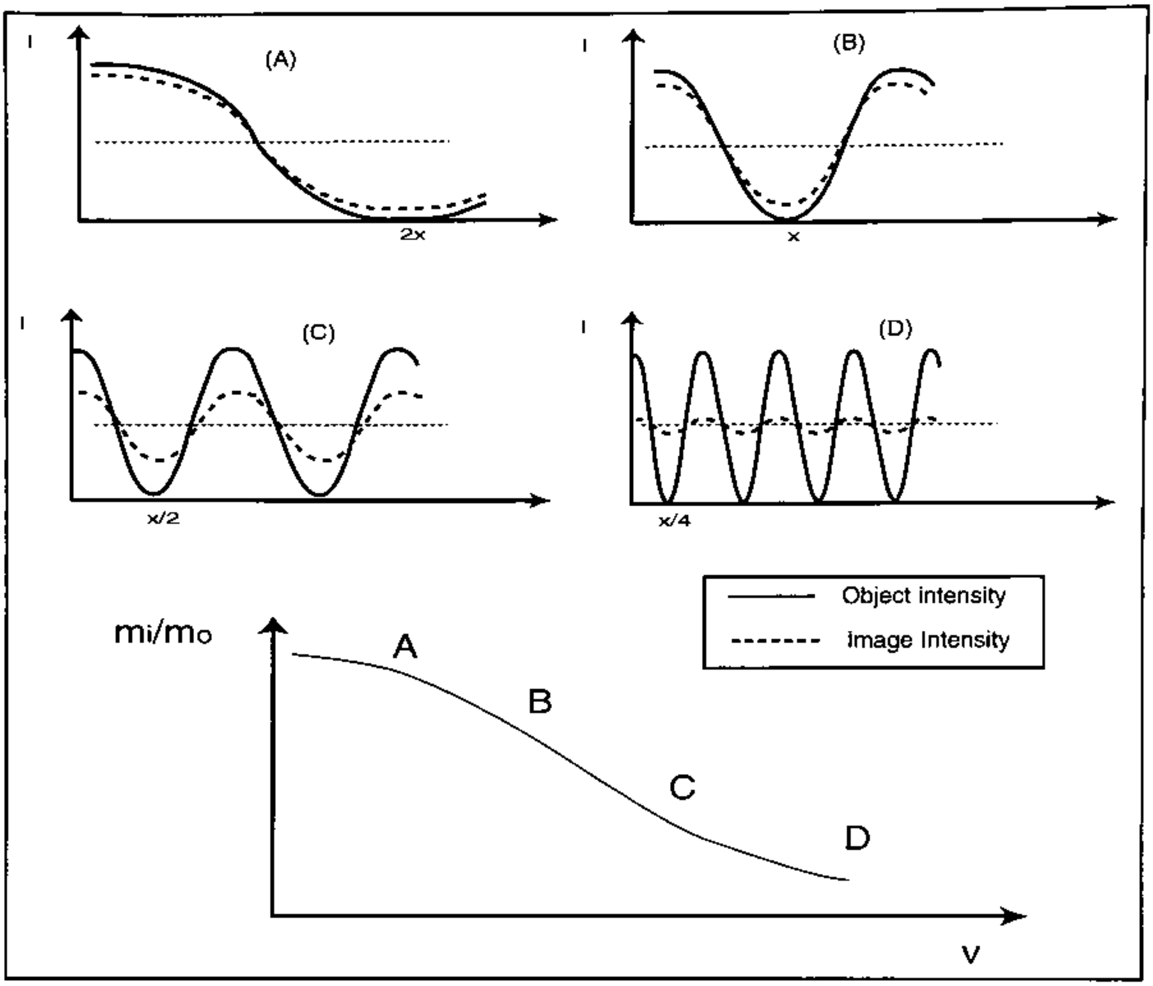


Figure 20. The loss of modulation transfer factor at different spatial frequency[35]

The result of plotting these modulation transfer factor at each spatial frequency is the modulation transfer function (MTF). To summarize the basic concept of the MTF, it indicates the decrease in amplitude or modulation caused by spread as a function of the spatial frequency.

Measurement of the MTF

In order to measure the MTF of a photographic material, a series of sinusoidal test patterns of constant amplitude with various spatial frequencies are scanned by a microdensito-

meter at each frequency to give a plot of the object function. The input or object modulation, m_{object}, can be found from $(I_{omax} - I_{omin})/(I_{omax} + I_{omin})$. Then, these sine wave patterns are exposed onto the emulsion of interest and developed. The images of these patterns on an exposed and developed emulsion, are measured using a microdensitometer. The maximum and minimum density, Dmax and Dmin, are then converted into the effective exposure values, Hmax and Hmin, by reflecting Dmax and Dmin to logH on the D-logE curve of film of interest. The output or image modulation, m_{image}, is $(H_{max} - H_{min})/(H_{max} + H_{min})$ for each frequency. Now, the MTF which is the ratio of output to input modulation is calculated

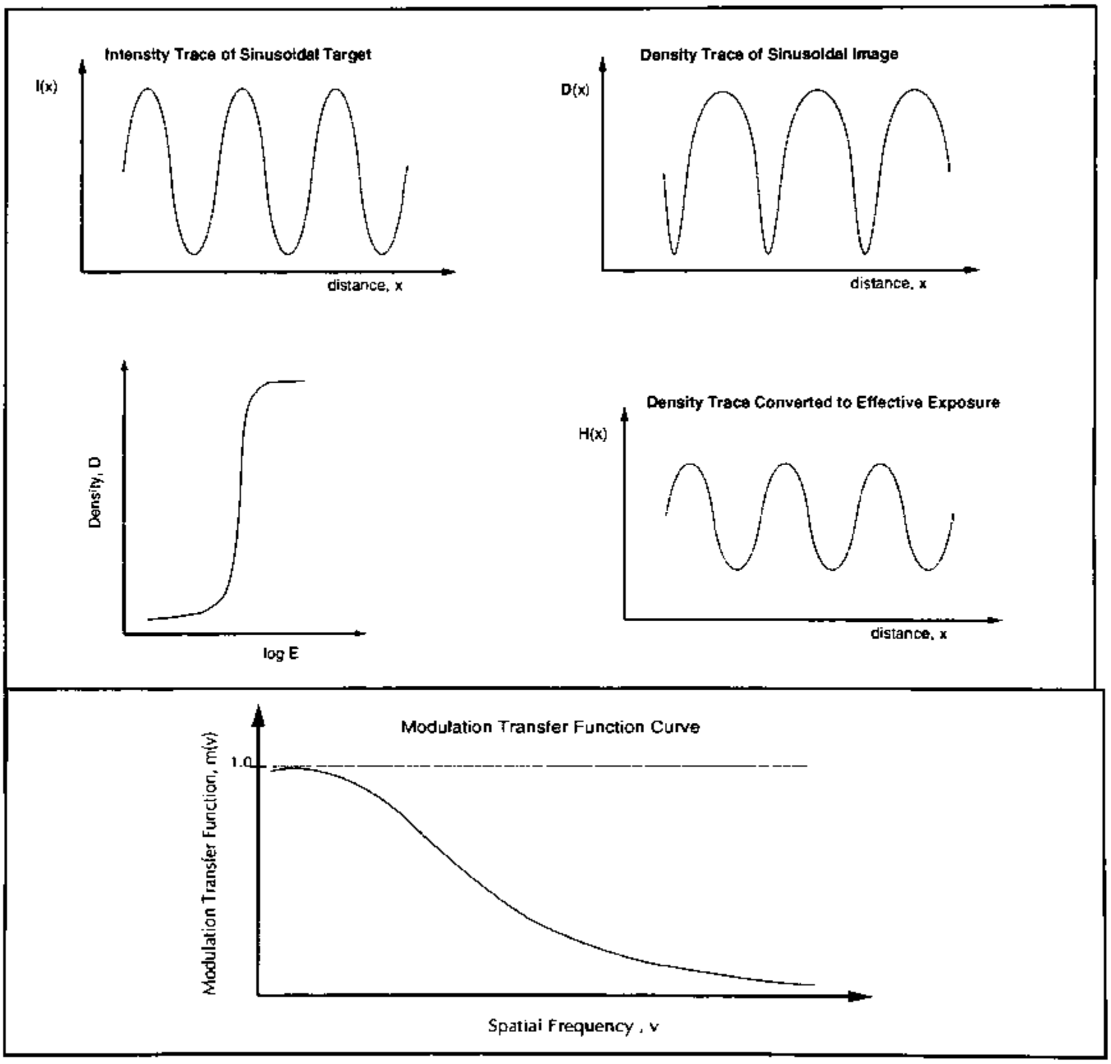


Figure 21. Determination of the MTF of sinusoidal target[38]

for each spatial frequency. Finally the MTF vs spatial frequency can be plotted. High MTF values in low frequencies indicate high acutance. Another indication from this plot is that the higher the frequency at a certain point of very low MTF, for example 0.1, the better the resolving power of the emulsion.[37]

Another way to measure the MTF is by the use of spread function method. The density or transmittance of an image of an edge trace from a scan of microdensitometer or microphotometer is converted into effective exposure using the macroscopic characteristic curve. Differentiation gives the LSF. Then Fourier transformation of the LSF gives the MTF as illustrated in figure 22.

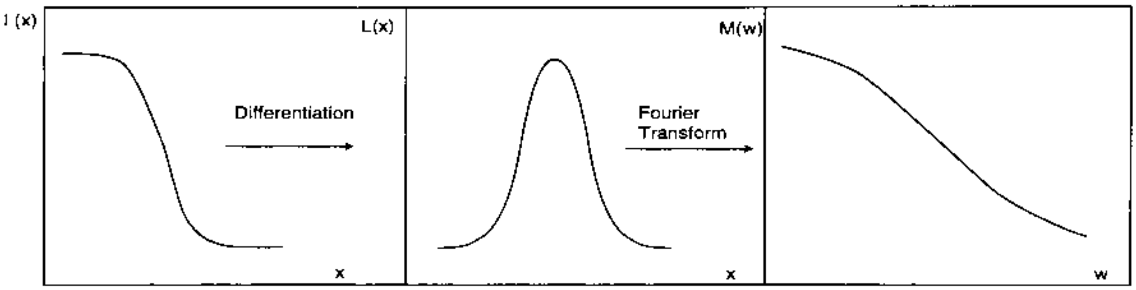


Figure 22. Derivation of the MTF from the edge response curve[39]

There are also many mathematical models which have been proposed to find the MTF.[40] An example of the model for the MTF and SF of photographic film which have been proved to work well for graphic arts films was proposed by Frieser in 1960 as follows:[41]

$$\text{MTF} \qquad m(v) = \frac{1}{(1+(\pi k v/2.3)^2)} \qquad (7)$$

$$\text{SF} \qquad I(x) = (2.3/k) * 10^{(-2|x|/k)} \qquad (8)$$

where	m	=	modulation
	I	=	intensity
	v	=	spatial frequency in cycles/mm
	x	=	distance in microns
	k	=	Frieser coefficient

When the light distribution at the edge of line is considered, the actual light distribution inside the emulsion can be calculated by convoluting the ideal edge intensity profile with the point spread function (see figure 23). The relationship of the intensity and distance is described by the following equations.[42]

$$I(x) = (1/2) * 10^{(x/k)} \quad \text{for } x = \text{-infinity to } 0 \qquad (9)$$

$$I(x) = 1 \quad (1/2) * 10^{(-x/k)} \quad \text{for } x = 0 \text{ to infinity} \qquad (10)$$

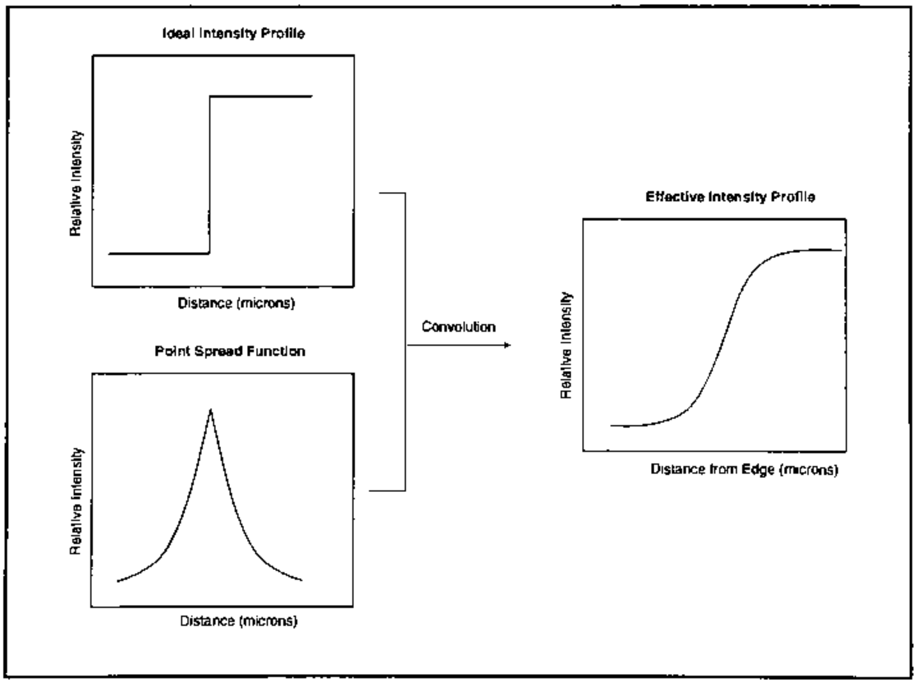


Figure 23. Effective edge intensity profile resulting from the convolution of ideal edge profile and the point spread function[43]

By using the above mathematical models, it has been shown that the MTF and SF of typical graphic arts products can be derived without the use of tools used in optical and photographic imaging.[44] The 150-lpi, circular dot tints of 30% and 70% dot area are exposed emulsion-to-emulsion onto the film of interest in a contact frame. A known-density step tablet is overlaid over the tints in order to create an exposure series. The density of the D-min, Dmax, and tint area are measured and used to calculate dot radius. A curve of dot radius change as a function of exposure is then plotted and the k value can be derived.

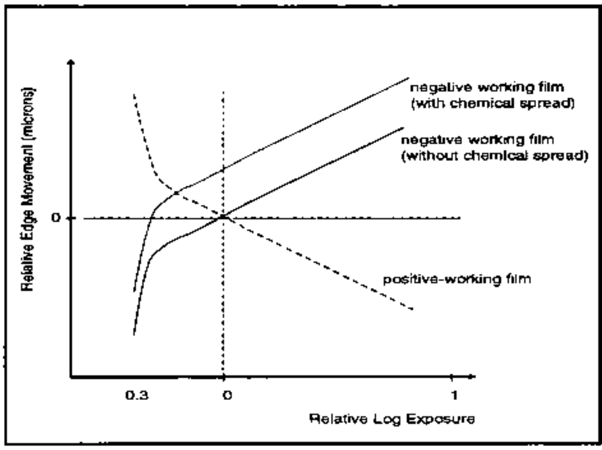


Figure 24. A plot of dot size change vs relative logE with and without chemical spread[45]

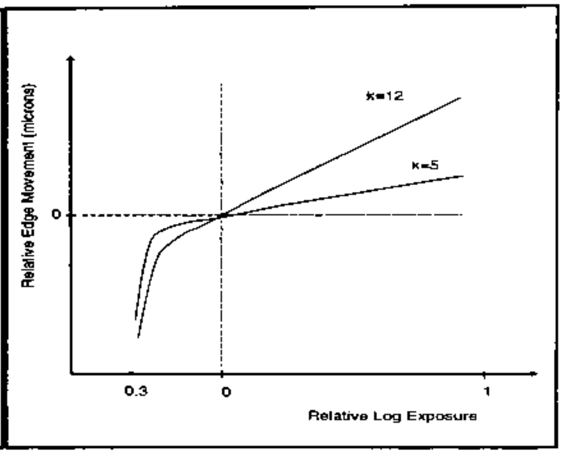


Figure 25. A plot of dot size change vs relative logE at different k values[46]

The Frieser coefficient, k, indicates the degree of spreading of the image, compared to the image that reaches the film. A system with higher k value has a larger spread than one with lower k values. In other words, the decrease of modulation transfer factor as a function of spatial frequency is faster. It was found that most of graphic arts products' MTF and SF fit the Frieser model with k value of 5 to 12.[49] Furthermore, a plot of dot size change vs relative LogE can indicate the presence of chemical spread as shown in figure 24.

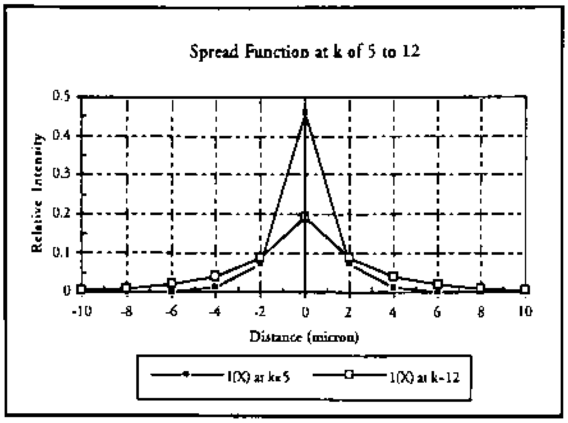


Figure 26. Spread function of emulsions of which k's are 5 and 12[47]

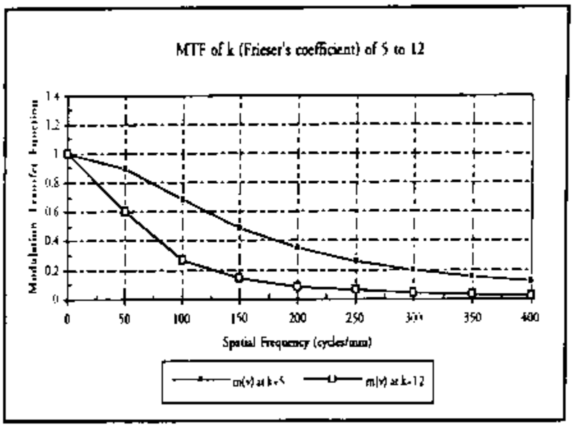


Figure 27. MTF of emulsions of which k's are 5 and 12[48]

Endnotes for Chapter 2

[1] Kodak Electronic Printing Systems, Inc., *Kodak Precision Imagesetter Linearization Software User's Guide* (Rochester, NY: Kodak Electronic Printing Systems, Inc., 1991), 15-17.

[2] Franz Sigg, "A Few Things about Microlines That Most People Do Not Know," in *TAGA Proceedings* (Rochester, NY: Technical Association of the Graphic Arts, 1988), 429-430.

[3] Ibid., 436.

[4] Ibid., 442.

[5] David Q. McDowell, electronic mail, April 24, 1996.

[6] Technical and Educational Center, Rochester Institute of Technology, RIT Microline Resolution Target (Rochester, NY: Technical and Educational Center, Rocheater Institute of Technology, n.d.), 4.

[7] Ibid., 2.

[8] Jim Hamilton, "Addressability and Spot Size" *Linotype-Hell's Technical Information* (Hauppauge, NY: Linotype-Hell Company, 1991), 1-2.

[9-11] David Q. McDowell and Franz Sigg, interview by author, November 2, 1995. Eastman Kodak Company, Rochester.

[12] Thad Mcllroy, "At Your Service: Does Your Service Bureau Have the Right Imagesetter for Your Needs? Here's How to Find out," *Publish* (May, 1993), 53.

[13] Leah Ziph Schatzberg, "A New Approach to the Design of Imagesetters Using Image Simulation Software," *SPIE* (1992).

[14] Kodak Electronic Printing Systems, Inc. *Kodak Precision Imagesetter Linearization Software User's Guide* (Rochester, NY: Kodak Electronic Printing Systems, Inc., 1991), 27.

[15] Franz Sigg, *How to Calibrate and Linearize an Imagesetter Using the Digital UGRA/FOGRA Wedge* (Rochester, NY: Rochester Institute of Technology, 1995), 1. (unpublished)

[16] Ibid., 6.

[17] EMPA/UGRA. *UGRA/FOGRA PostScript Control Strip 1990, Instruction for User* (St. Gallen, Switzerland: EMPA/UGRA, 1990), 10-11.

[18] Franz Sigg, *How to Calibrate and Linearize an Imagesetter Using the Digital UGRA/FOGRA Wedge* (Rochester, New York: Rochester Institute of Technology, 1995), 6-7. (unpublished)

[19-21] Ibid., 11.

[22] Ibid., 6.

[23] Ibid., 12.

[24-27] Ibid., 7.

[28] Ibid., 8.

[29] David Moffett and John Stanton, *The Use of Fourier Analyzed Squared Waves in the Determination of the Modulation Transfer Function of Photographic Materials* (Rochester, New York: Senior Project, Rochester Institute of Technology, 1978), 3.

[30] H.J. Wall and G.G. Attridge, *Basic Photo Science* 2nd ed. (New York: Focal Press, 1977), 265.

[31] Ibid., 267.

[32] Ibid., 269.

[33] Glen C. Elie, *Direct Measurement of the Optical Modulation Transfer Function of Non-Developed Emulsion* (Rochester, New York: Master Thesis, Rochester Institute of Technology, 1977), 4.

[34] Ibid., 4, 6.

[35] Sidney F. Ray, *Applied Photographic Optics* 2nd ed. (Oxford, England: Focal Press, 1994), 145.

[36] Ibid, 143.

[37] Glen C. Elie, *Direct Measurement of the Optical Modulation Transfer Function of Non-Developed Emulsion* (Rochester, New York: Master Thesis, Rochester Institute of Technology, 1977), 10, 12.

[38] Franz Sigg, interview by author, October 27, 1995. Rochester Institute of Technology, Rochester.

[39] J.C. Dainty and R. Shaw, *Image Science: Principle, Analysis, and Evaluation of Photographic-Type Imaging Process* (New York, NY: Academic Press, 1975), 245.

[40] H. Frieser "Spread Function and Contrast Transfer Function of Photographic Layers," *Photographic Science and Engineering* vol. 4, no. 6 (1960), 327.

[41] David Q. McDowell, "Measurement of MTF of Graphic Arts Products," in *TAGA Proceedings* (Rochester, NY: Technical Association of the Graphic Arts, 1994), 93.

[42] Ibid., 94.

[43] Ibid., 94-95.

[44] Ibid., 97.

[45] Ibid., 95-100.

[46] Ibid., 101.

[47] Ibid., 100.

[48] Ibid., 94.

[49] Ibid., 101.

Chapter 3

Review of Literature

Why is this topic important

Today, an imagesetter plays an important role in the quality of film. The images on film output by an imagesetter not only consist of type, but also halftone images. Repeatability and predictability of the results from an imagesetter is a must. As a result, the calibration is required to ensure that, for a particular set of exposure, film, and processing condition, the actual dot sizes obtained on the film are the same as the requested dot sizes. Therefore, to understand how an imagesetter works and how the films respond to the exposure and processing will answer the question as to what the appropriate calibration method should be.

What has been done in this area

David Moffett and John Stanton[1] conducted an experiment in 1978 in an effort to find an alternative using a square wave target instead of sinusoidal target. The sinusoidal target and square target produced by the authors were imaged onto Kodak Plus-X film. The resulting films were developed. Then the resulting images were scanned with the microdensitometer. The traces were analyzed and the MTFs were calculated and plotted against the frequencies. The results showed that there was variability associated with the

square wave method. Low frequency values (0 to 9)cycles/mm) generated with the square wave method were lower those determined sinusoidally for the same frequency range. On the other hand, higher frequency values (9 to 20 cycles/mm) generated with the square wave method were slightly higher than those obtained from sinusoidal method over the same range of frequencies. However, both methods yielded curves with the same general trend.

In 1980, Tom Montrois[2] presented his paper entitled "New way to Judge Test Exposure from the Laser Scanner". The test exposure series is performed to determine the optimum exposure for a given film-developer combination. All scanner adjustments such as focus, zoom, and laser current were fine-tuned before the test exposures were made. The halftone step-tablet created by the scanner under the control of test tape was made up of complementary dot areas in adjacent frames of positive and negative stripes. Using 20- to 30- power magnifier to judge the accuracy of reproducing the complementary 5% and 95% dot structure, the optimum exposure is the exposure where the black dot of 5% pattern exactly fits the hole of 95% pattern. This judging method relies on good operator's judgement and requires a strong magnifier.

In 1991, Michael Blum[3] and Michael Thorne investigated the calibration of PostScript-based color reproduction systems. The document management issues, variables associated with imagesetter calibration, PostScript halftones and their calibration through software, and implementation and problems of software calibration were discussed. While PostScript is theoretically device- and resolution- independent, some applications attach device-specific code, operators such as settransfer and setscreen within the document. Once the settransfer or calibration information is tied to the image, this color separation file is limited to be reuse. The calibration data may not be appropriate if output conditions change. Furthermore, calibration done in the color separation program will not effect the screen tints generated in the page makeup program.

PostScript is not only a page description language which should be device-independent, but also a print control language which, on the other hand, should be device-dependent. The authors suggested that the alternate approach is to remove all device-specific commands from a document and create an associated file to contain the device specific information. The document file and the print recorder then merged in a print manager and sent to appropriate PostScript output device.The print manager might also be used to monitor the current transfer curve.

In 1994, David Q. McDowell[4] conducted a study on the measurement of MTF of graphic arts products. The experiment was conducted in an attempt to predict the relationship between edge movement and intensity. An exposure series using 150-lpi circular dot screen tint of 30% and 70% dot area was created by overlaying the tints with a carbon step tablet of measured density. Dot radius was calculated from the density of Dmax, Dmin, and tint area. Then, dot radius change was plotted against exposure and the k value derived. It was found that the Frieser model for spread function (SF) works well for graphic arts films over the range tested. They all fell within a k value range of 5 to 12.

In 1995, Franz Sigg[5] investigated the calibration and linearization of an imagesetter using the UGRA/FOGRA PostScript Control Strip. The experiment was performed to compare two calibration methods: using maximum density on film and checkerboard patterns of UGRA/FOGRA PostScript Control Strip. The results showed that maximum density is not an adequate criterion for calibrating a certain imagesetter, emulsion, and processing condition, especially, in a condition of improperly maintained developer. On the other hand, calibration using 1x1 checkerboard pattern and 50% tint provided an accurate result for all screen rulings. It is also easier for daily operation basis because simply the visual judgement is required to compare 1x1 checkerboard and 50% tint. The author also explained the reason of why the 1x1, 2x2, and 4x4 checkerboard patterns are not exactly the same darkness. Other applications

of using checkerboard patterns include the examining of the evenness over whole image area and the laser focus.

Endnotes for Chapter 3

[1] David Moffett and John Stanton, *The Use of Fourier Analyzed Squared Waves in the Determination of the Modulation Transfer Function of Photographic Materials* (Rochester, New York: Senior Project, Rochester Institute of Technology, 1978).

[2] Tom Montrois, "New ways to Judge Test Exposures from the Laser Scanner," in *TAGA Proceedings* (Rochester, NY: Technical Association of the Graphic Arts, 1980), 39-57.

[3] Michael Blum and Michael Thorne, "Calibration of Postscript-Based Color Reproduction Systems," in *TAGA Proceedings* (Rochester, NY: Technical Association of the Graphic Arts, 1991), 36-47.

[4] David Q. McDowell, "Measurement of MTF of Graphic Arts Products," in *TAGA Proceedings* (Rochester, NY: Technical Association of the Graphic Arts, 1994), 92-102.

[5] Franz Sigg, *How to Calibrate and Linearize an Imagesetter Using the Digital UGRA/FOGRA Wedge* (Rochester, NY: Rochester Institute of Technology, 1995). (unpublished)

Chapter 4

The Hypotheses

Research Objectives

The purposes of this study were to :

1. Investigate the differences in response over the halftone dot range between film based on hybrid technology and one based on traditional rapid access technology using a laser exposure imagesetter.
2. Determine the differences in calibration and linearization (characterization) techniques appropriate to each film technology.
3. Evaluate the applicability of the linearized calibration technique using checkerboard patterns to each type of film.
4. Explain the differences in terms of fundamental characteristics such as the MTF, chemical spread and contrast.

Statement of Hypotheses

H1: When exposure is adjusted such that the 50% halftone for each screen ruling is 50%, all other dot areas are also what they should be within ±1% for hybrid film.

H2: When exposure is adjusted such that the 50% halftone for each screen ruling is 50%, all other dot areas are also what they should be within ±1% for rapid access film.

H3: When exposure is adjusted such that the density of the 1x1 checkerboard and a 50% reference tint is the same, all dot areas are also what they should be within $\pm$1% for hybrid film.

H4: When exposure is adjusted such that the density of the 1x1 checkerboard and a 50% reference tint is the same, all dot areas are also what they should be within $\pm$1% for rapid access film.

H5: There is no significant difference in the relationship between dot size change and exposure change between the tested hybrid system and rapid access system.

Limitations

1. Assume that the laser spot size matches the addressability.
2. Assume that imagesetter variables such as pixel placement errors are so small that they can be ignored.
3. Assume that the dot font is correctly reproduced. That means turned-on pixels in each halftone cell are same in percentage as specified dot area.

Delimitations

1. Two negative-working film and chemical systems, hybrid system and rapid access system, will be investigated.
2. The film samples of this study will be output at the addressability of 2,400 dpi.
3. The 100-, 150-, and 200-lpi conventional screens and Velvet screen at 21-micron element size will be investigated.
4. Imagesetter and processor variabilities are not investigated.

Chapter 5

Methodology

The objective of this research was to investigate whether there are performance differences between a film of hybrid technology and a traditional rapid access film in terms of the sensitivity to dot size change and change in control element size as a function of exposure variation. If there are differences, how can they be explained in terms of sensitometric contrast, film modulation transfer function (MTF), and chemical spread? Further, what are the preferred control elements and control strategy for each system? To obtain the quantitative data, an exposure series was performed for both film systems on one imagesetter. Solid density, and percent dot area of checkerboard patterns, parallel line patterns, and halftones will be measured. Then, these data were analyzed.

Equipment and materials

1. An Imagesetter: Agfa SelectSet 5000 with Agfa RIP Star 400
2. A hybrid system film: Kodak Imageset 2000 Film IHN (batch no. 01-1998 2617 821 017 13)
3. A rapid access film: Kodak PagiSet HN Film (batch no. 08-1997 2694 129 013 01)
4. Film Processor with developer which can be used for both films: Kreonite film processor with Kodak RA 2000 (1:2) Developer/Replenisher and Kodak 3000 Fixer/ Replenisher. Developing temperature was 95°F. Developing time was 30 seconds.

Replenishing rate was set at 50 ml/ sq.ft.

5. A test form containing

   (5.1) The UGRA/FOGRA PostScript Digital Control Strip

   (5.2) 100-, 150-, 200-lpi halftone scale, and Velvet-screened scale

   (5.3) The RIT Digital Output Resolution Tester

   (5.4) The RIT Pixeldot Test Target

6. Calibrated continuous-tone stepwedges. The half-inch wide stepwedges used have 28 density steps which range from 0.05 to 1.45 with 0.05 increments .

7. An X-Rite transmission densitometer

8. A custom-built dot area meter which is capable of reading dot area to one decimal.

Experimental Procedure and Data Collection

Determination of DlogE curves; and determination of relation between log exposure vs units of exposure.

In order to find the relation between laser intensity unit and relative logE, and the D-logE curves of both films, an exposure series of continuous-tone gray scales was done by exposing a solid area with the imagesetter through continuous-tone gray scales onto the films of interest. A solid area file of 3-inch x 15-inch was created in QuarkXPress and saved. The distances from starting end of film to the first, second, and third exposure were found out by outputting this Quark page three times. These distances were used to determine where gray scales would be placed on unexposed film. Three gray scales were taped emulsion-to-emulsion on unexposed film in the feeding cassette, using thin, clear tape in the darkroom. The first three exposures were done on Kodak Imageset 2000 film using laser intensities of 260, 280, and 300 units. Then the grayscales were detached in the darkroom and film was processed using Kodak RA 2000 (2:1) developer. The rest of

exposures in the series, which were 340, 380, 420, 460, 500, and 540, were performed using same procedure. Another exposure series was performed on Kodak PagiSet HN Film using laser intensities of 220, 260, 307, 362, 427, 504, and 595. After processing, the density on each step of both films was measured and then the plots of density vs laser intensity units were made.

To find the relationship between laser intensities and exposures, the original densities of each laser intensity that reproduced the density of 0.3, 1.0, 2.0 on film were found from DlogE graphs. Then a plot of these densities values and log laser intensities was made for each film

Exposure series

A test form was created in QuarkXPress. This test form contains the UGRA/FOGRA PostScript Digital Control Strip, the RIT Digital Output Resolution Tester, the RIT Pixeldot Test Target, and halftone scales with different screen rulings (see Appendix H).

(1) For each film, laser intensity was adjusted to reproduce the 50% patches of 100-lpi, 150-lpi, 200-lpi, and Velvet-screened scales as close to 50% dot area as possible. Then the dot areas on the halftone scales were measured. Requested dot areas were plotted against reproduced dot areas.

(2) For each film, laser intensity was adjusted to match the density of 1x1 checkerboard to 50% tint.

(3) The laser intensity was adjusted in order to obtain results from underexposure to overexposure. Each exposure step was different by a constant factor of 1.044.

(4) Measure maximum density (Dmax) and minimum density (Dmin) on film

(5) Measure percent dot area of the following test elements:

- the 100-lpi halftone scale

  the 150-lpi halftone scale

- the 200-lpi halftone scale

- Velvet-screened scale

Checkerboard patterns(line width in pixels x space in pixels):

25%—1x3, 2x6, 3x9, 4x12,

50%—1x1, 2x2, 3x3, 4x4,

75%—3x1, 6x2, 9x3, 12x4

Parallel line patches in scan and cross scan direction:

25%—1x3, 2x6, 3x9, 4x12,

50%—1x1, 2x2, 3x3, 4x4,

75%—3x1, 6x2, 9x3, 12x4

(6) Convert dot areas of 25% and 75% scan line, cross-scan line patterns and checkerboards into dot widths and line widths in terms of microns. Then calculate dot size difference (edge movement) of each exposure relative to the dot size at practical exposure.

(7) Plot for each film

(7.1) Dot area differences vs requested dot areas at the exposure where all 50% tints on halftone scales reproduced as closed to 50% as possible.

(7.2) Dot areas differences vs requested dot areas at the exposure where the density of 1x1 checkerboard matched that of 50% reference tint on the UGRA/FOGRA PostScript Digital Control Strip.

(7.3) Edge movement of 25% and 75% checkerboards and parallel line patterns vs exposures to find k values of spread function and MTF for both films.

Chapter 6

The Results

D-LogE Curves

Figure 28 shows the D-LogE curves for both films from gray scales exposures in the imagesetter. The measurements are shown in Table A3 and A4 in Appendix A.

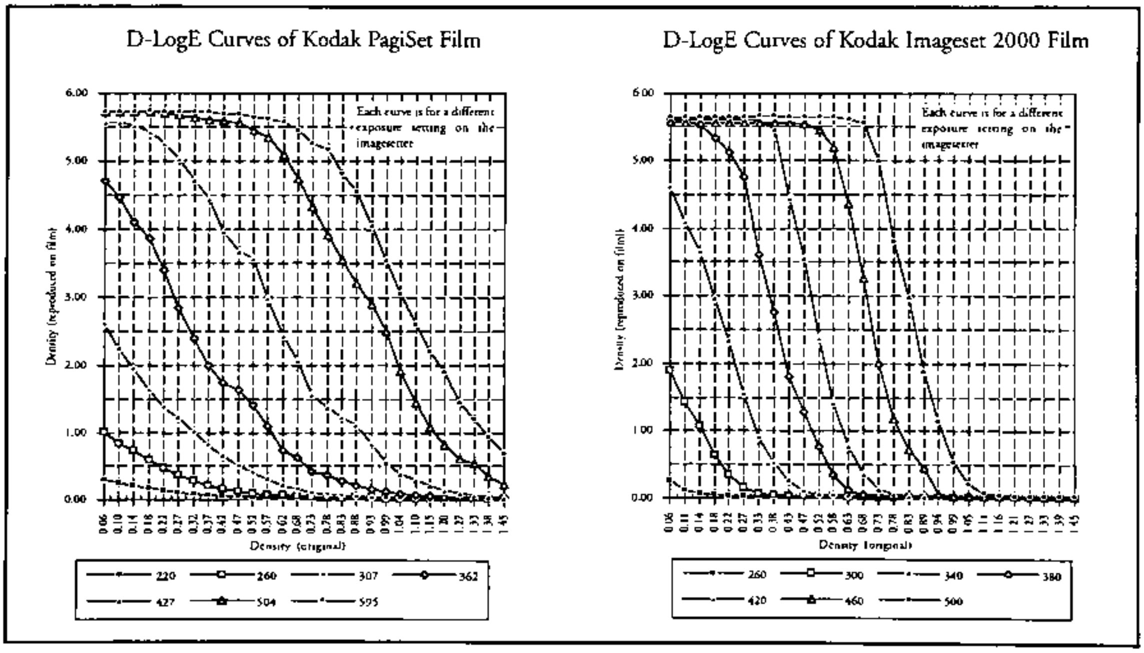


Figure 28. D-logE curves of Kodak PagiSet Film and Kodak Imageset 2000 Film

To find the gamma of both films, slopes of the straight line portion of the D-logE curves were calculated. Only curves that reproduced maximum density were used to

find regression lines. The average slope of the regression lines for Imageset 2000 film was 18.20 whereas that of PagiSet film was 7.75.

Relationship between Laser Intensity Units and Exposure

In order to examine the relationship between laser intensity units and exposure, the original densities of each laser intensity that were required to reproduce the density of 0.3, 1.0, and 2.0 on film were found from the above D-logE graphs. These original density values were plotted, for each film, against log laser intensities. Then regression analysis of these lines was performed (see Appendix A 3). Figure 29 shows the regression lines from the analysis. It was found that the relationship between log laser intensity unit and relative log exposure is linear. The slopes of lines of both graphs are approximately same because they are a function of the laser beam, and not of the films. However, the proximity between lines of Imageset 2000 film and those of PagiSet film are different due to the difference in film speed. The higher the film speed is, the closer the lines are. The average of slopes of these lines is 3.72. By knowing this slope, the difference of log exposures between two given laser intensity units can be calculated from the following equation:

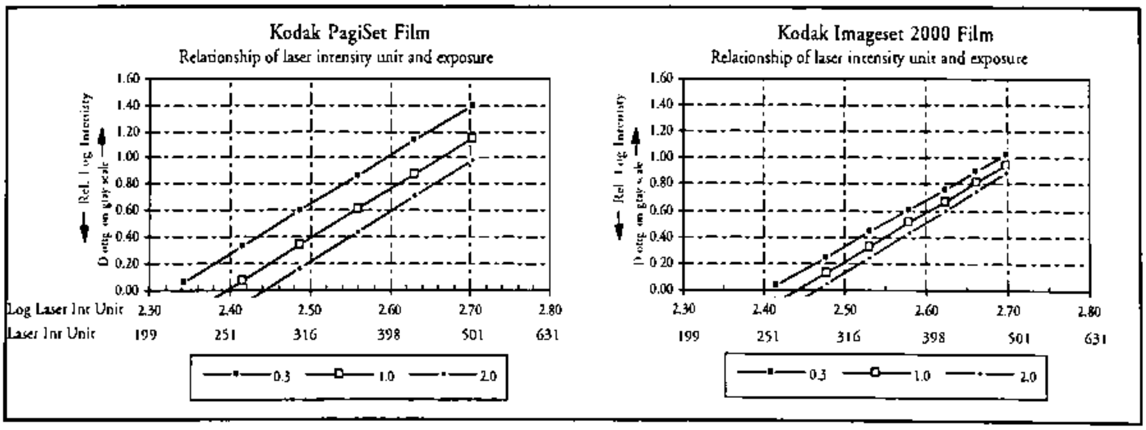


Figure 29. Relationship between Relative Log Intensity and Relative Log Laser Intensity Unit on Kodak PagiSet and Imageset 2000 film

$$\Delta \log E = S * \log(L2/L1)$$

where S = slope of lines of graphs shown in figure 29

L = laser intensity unit

This analysis made it possible to plot the graphs in terms of relative log exposure rather than just in arbitrary laser unit.

Linearity of Films at Practical Exposure

To examine the linearity of the film, halftone scales and the Pixeldot Test Target were output at what is called "practical exposure" at which the 50% patches of 100-lpi, 150-lpi, 200-lpi, and Velvet-screened scales reproduced as close to 50% dot area as pos-

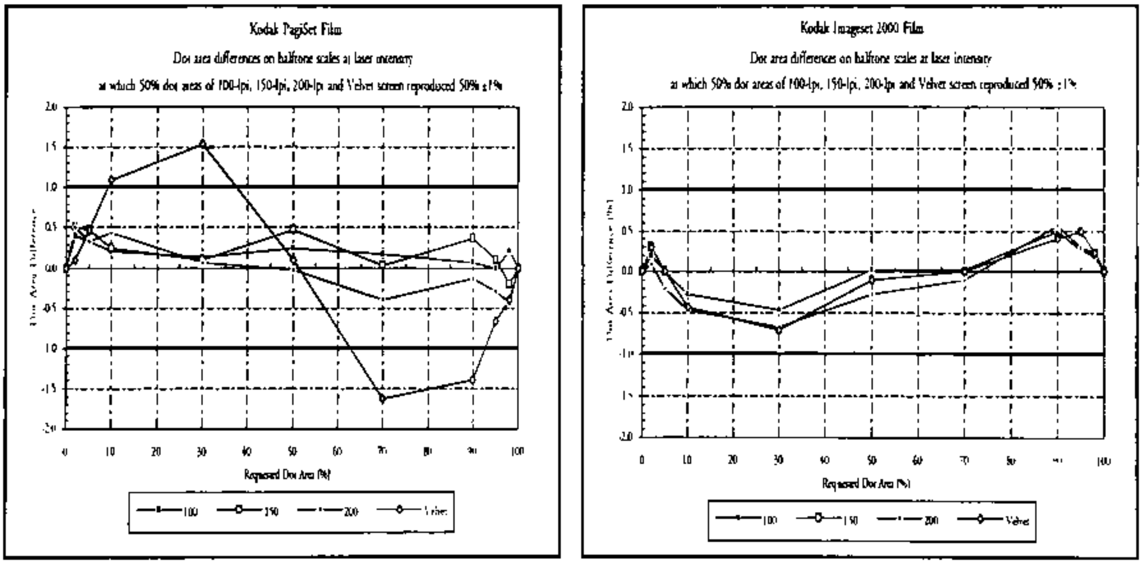


Figure 30. Dot gain and loss of halftone scales output on Kodak PagiSet film and Kodak Imageset 2000 film at practical exposure

sible. After each film was exposed and processed, dot area measurements of halftone scales and the test targets were taken. Then dot differences (dot gain or loss) were plotted against the requested dot areas (see figure 30).

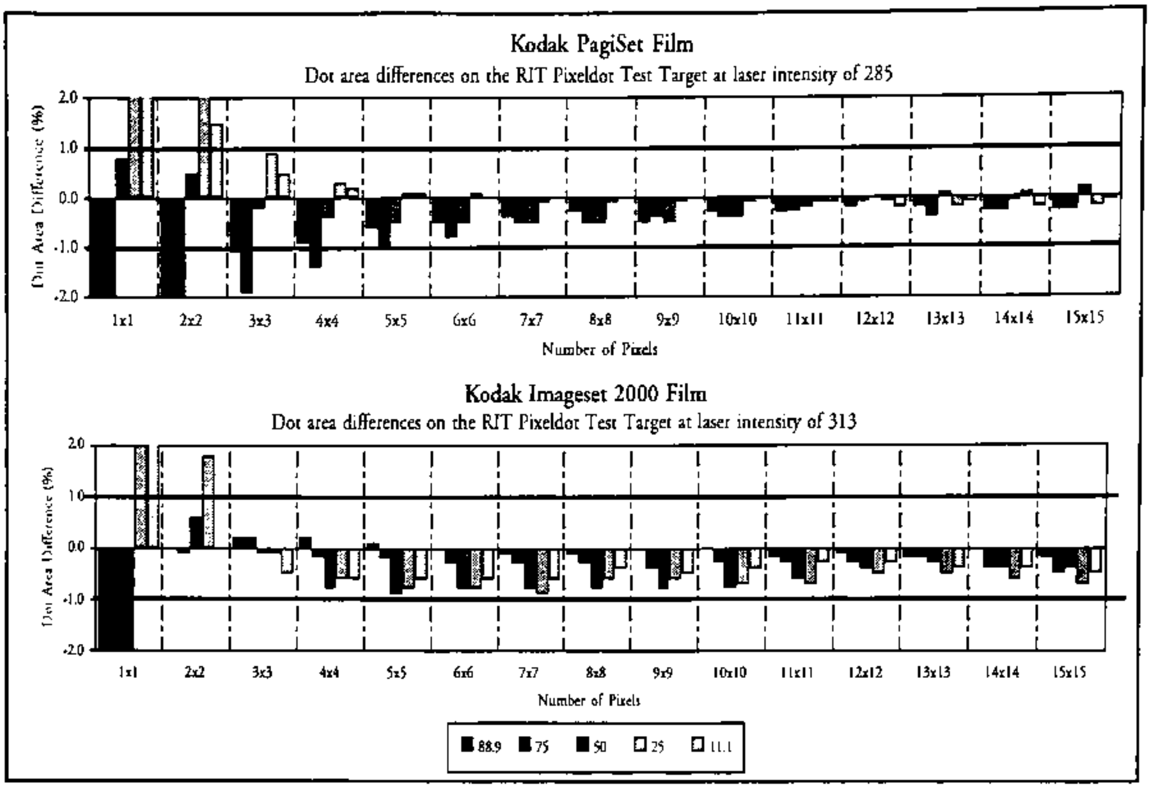


Figure 31. Dot differences of the Pixeldot Test Target at practical exposure for both films

For PagiSet film, the results from the halftone scale and the Pixeldot Test Target agreed in terms of the non-linearity of very small screen dots (see figure 31). All conventional halftone scales were linear within ±1%, but Velvet-screened scale was not. On the Pixeldot Test Target, the whole range of percent dot areas reproduced within ±1% for halftone patterns that made up of 5x5 pixels and larger.

For Imageset 2000 film, halftone scales of all screen rulings were linear while halftone patterns made up of 3x3 pixels or larger on the Pixeldot Test Target. This indicates that the Imageset 2000 film is more linear at very fine screen rulings than the Pagiset film. This non-linearity at fine screen ruling of PagiSet film is the contribution of the lower contrast of PagiSet film than that of Imageset 2000 film. However, dot areas of 1x1 checkerboard on Imageset 2000 film reproduced much lower than 50%. This resulted from the lower MTF of Imageset 2000 film which will discussed in the further section.

Applicability of the Calibration and Linearization Method for Both Films

The same test form was used to perform another exposure series. For each film, laser intensity was adjusted in order to visually match densities of 50% tint and 1x1 checkerboard of the UGRA/FOGRA PostScript Control Strip. The results from halftone scales are as shown in figure 32 and from the Pixeldot Test Target are as shown in figure 33.

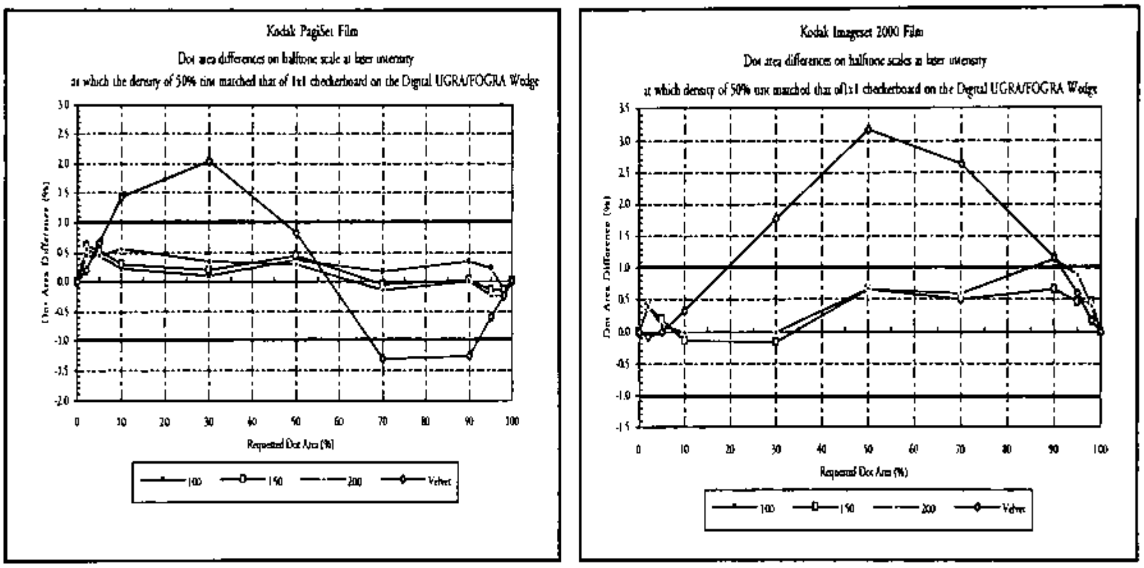


Figure 32. Dot gain and loss of halftone scales at the exposure of which the density of 50% tint visually matched that of 1x1 checkerboard on the UGRA/FOGRA PostScript Control Strip

For PagiSet film, the exposure of which the density of 50% tint visually matched that of 1x1 checkerboard on the UGRA/FOGRA PostScript Control Strip (laser intensity unit of 287) was very close to practical exposure (laser intensity unit of 285). The results of dot difference at both exposures were similar; that is, all conventional screen rulings reproduced a whole range of dot areas within 1%, but the Velvet screen did not. For the Imageset 2000 film, the two exposures were not as closed as those of PagiSet film. Unlike at practical exposure, Velvet screen on the Imageset film did not reproduce dot areas, especially in midtone,

within ±1%. In conclusion, only Velvet screen was not linear when the exposure was adjusted to matched density of 1x1 checkerboard and 50% tint.

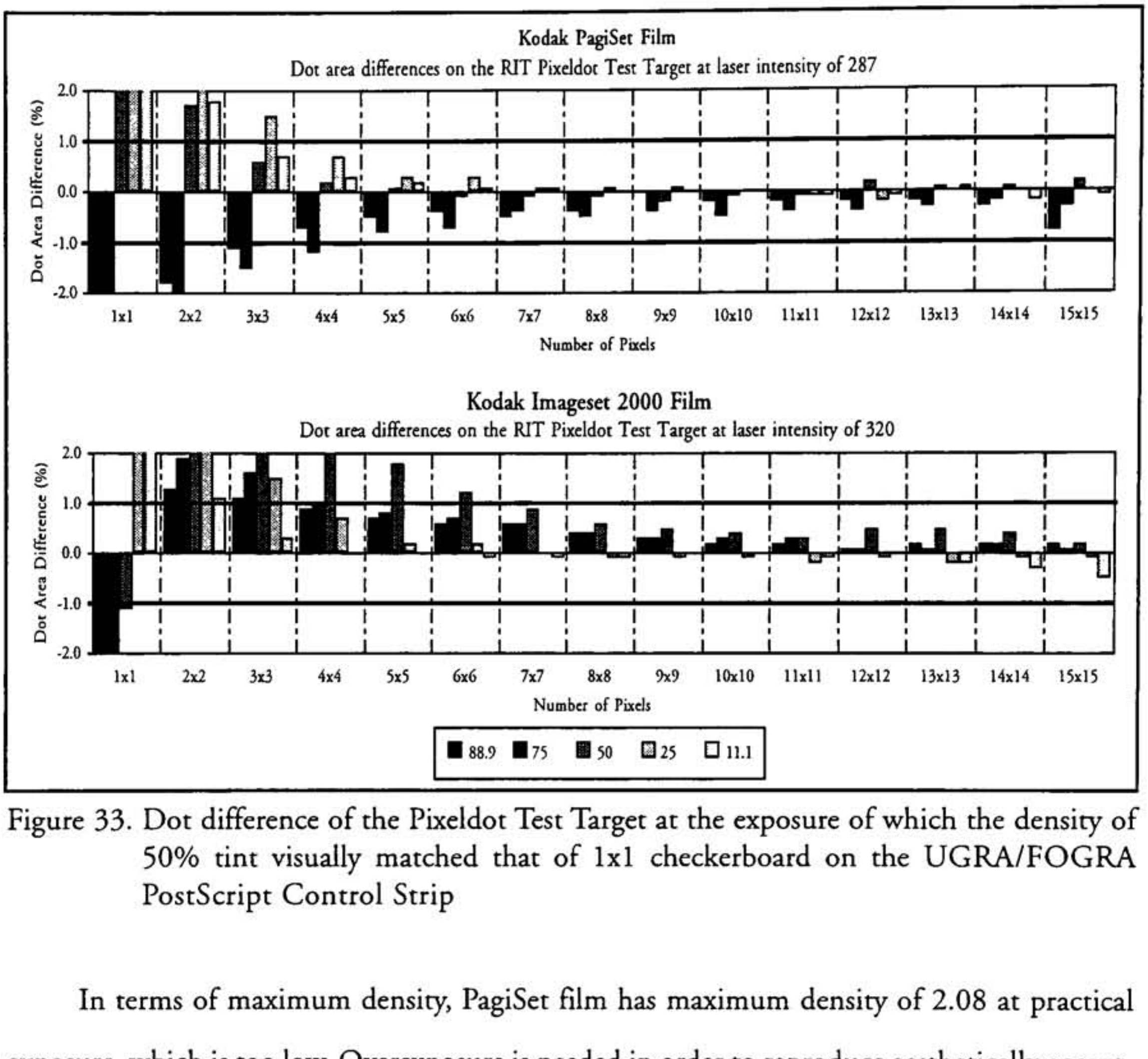


Figure 33. Dot difference of the Pixeldot Test Target at the exposure of which the density of 50% tint visually matched that of 1x1 checkerboard on the UGRA/FOGRA PostScript Control Strip

In terms of maximum density, PagiSet film has maximum density of 2.08 at practical exposure, which is too low. Overexposure is needed in order to reproduce aesthetically acceptable density (see figure 34). This increasing of exposure make halftone dots non-linear as shown in figure 35, and therefore, linearizing program is required. On the other hand, maximum density of Imageset 2000 film at practical exposure is 4.73 which is high enough.

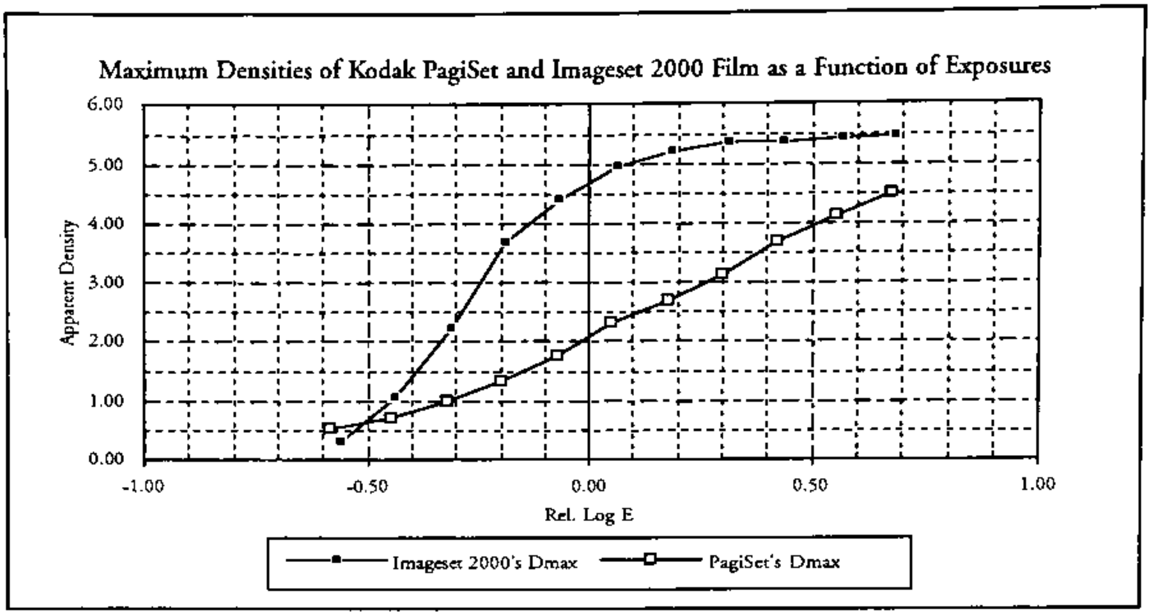


Figure 34. Maximum densities of the two films as a function of exposures

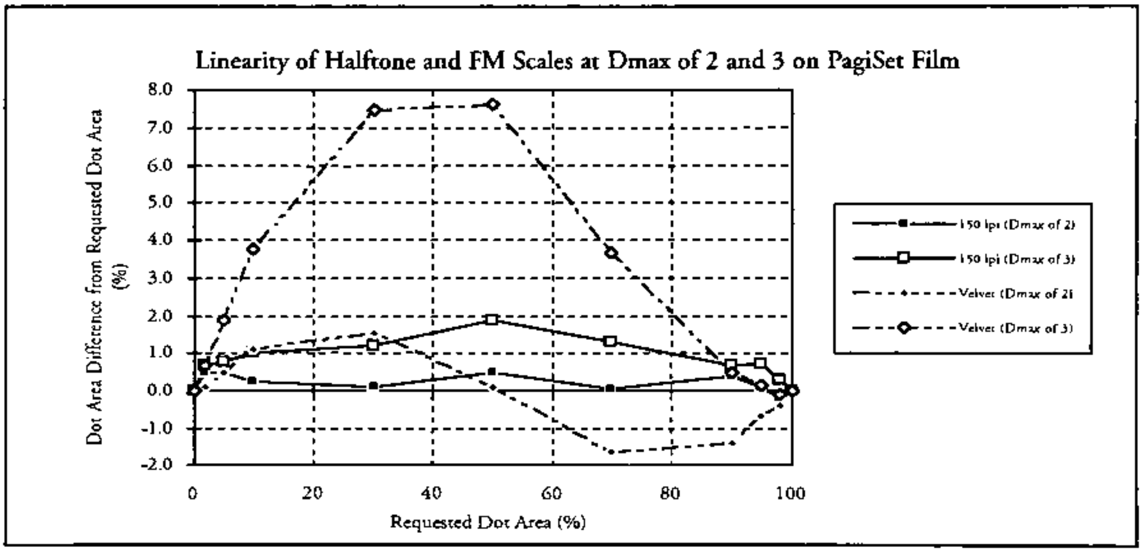


Figure 35. Linearity of halftone and FM Scales at Dmax of 2 and 3 on Pagiset film

Relationship between Dot Size Change and Exposure Change of Both Films

The dot area of test elements on the RIT Digital Output Resolution Tester were measured and used to calculate dot and line widths. In order to calculate edge move-

ment from dot area readings, simplifying assumptions about the shape and density of the image structures have to be made as follows.

1. Dot shape is square for all checkerboards.

2. Edges of lines are smooth.

3. Densities of dots or lines are the same as solid areas.

Then dot and line width differences at each exposure and that at practical exposure were calculated (see Appendix C(2))and plotted, for each test pattern, against relative log exposure. To find k of Frieser's equation, slopes of graphs at which relative log exposure is zero or higher for each test pattern were determined using a regression analysis. The results are as shown in table 3. By plotting actual dot differences and the theoretical lines from Frieser's equation, the results are as illustrated in figure 36.

Table 1. Y intercepts, slopes of regression lines and correlation coefficients

	PagiSet			Imageset 2000		
	y intercept	Slope	r	y intercept	Slope	r
Checkerboard	0.01	8.19	0.96	0.09	11.17	0.99
Scan lines	-0.02	7.99	0.98	0.03	11.25	0.99
Cross-scan lines	0.03	9.04	0.99	0.07	13.30	0.99

For all test patterns on both films, the correlation coefficients were very high and the y intercepts were very low. Consequently, the slopes of the regression lines were used to represent all dot and line widths for each test pattern.

The results in Table 3 shows that Imageset 2000 film has higher k values than Pagiset film at all test patterns. This means that changes in image size with exposure will be greater on Imageset 2000 film than PagiSet film. Due to the use of same imagesetter, the MTF of laser beam was constant. Because dot and line width differences were

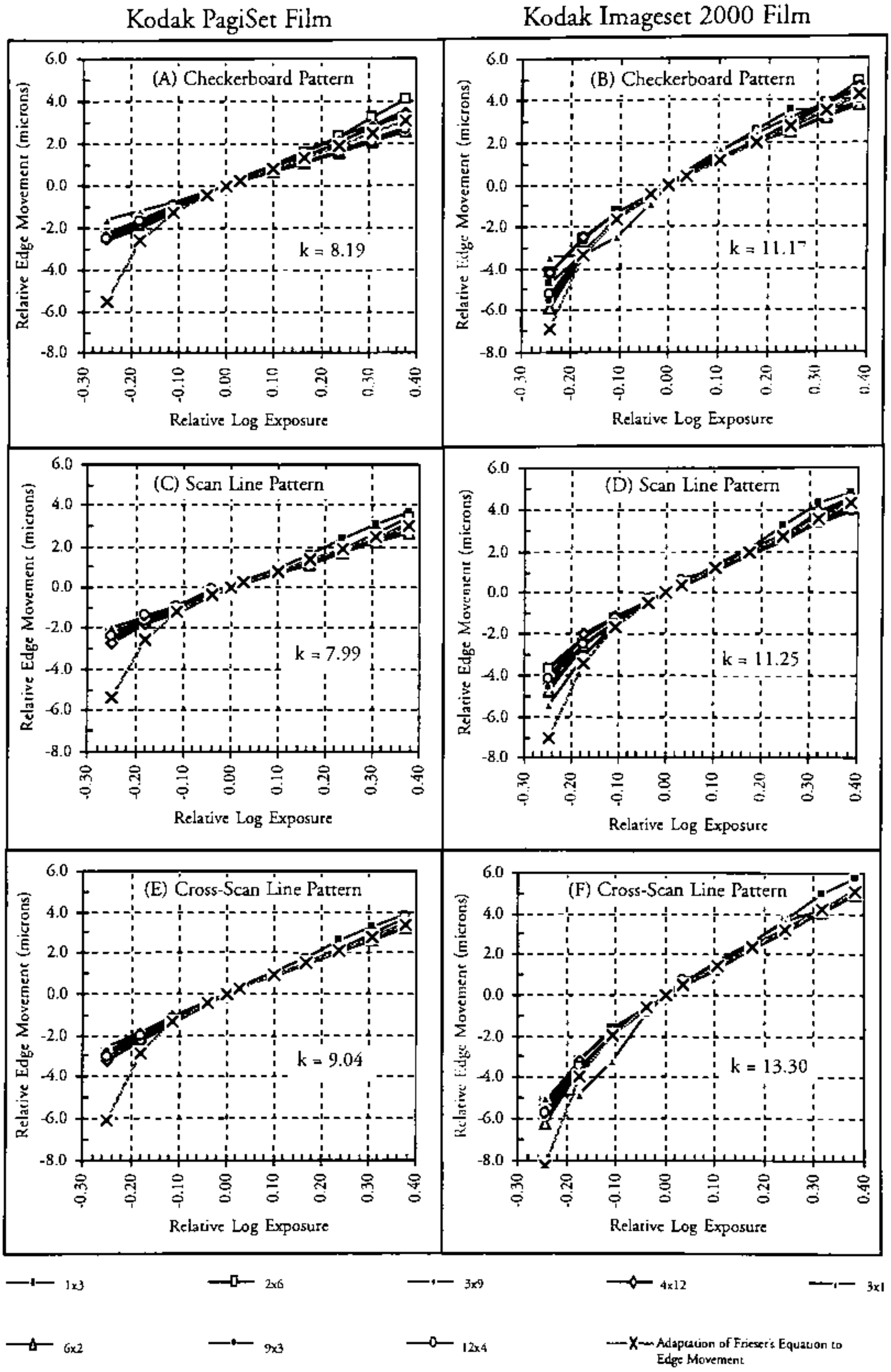
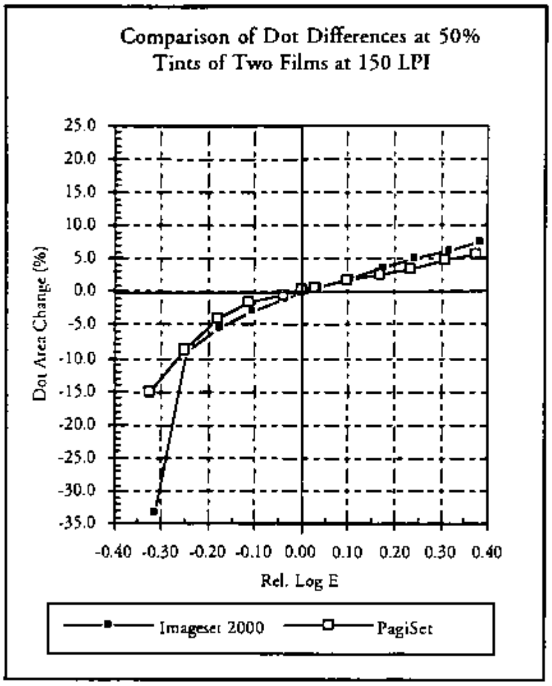


Figure 36. Dot and line width differences as a function of relative log exposure on different test patterns for both films

measured relative to that of practical exposure, and because the MTF of laser beam is constant the difference in k values is the result of film MTF. Hence, the difference in k values of two films is the contribution of film MTF. The comparison of both films' MTF is discussed in the next section.

Cross-scan line patterns output on both films have higher slope (k values) than the other two patterns. This is probably because of the contribution of laser-beam rise and fall time. When cross-scan lines are exposed, the laser beam turns on to generate a dot. Then the laser beam turns off and moves to the beginning of the next dot. During the laser beam movement, the beam did not completely turn off. Laser intensities in the exposure series were varied. The higher laser intensity had more fall-time exposure than the lower one. Spot size changes of cross-scan lines at high exposures were greater than at lower exposure. Consequently, cross-scan lines had a higher k value than either checkerboards which were less affected by rise and fall time, or scan direction lines which had no rise or fall time.

Figure 37 shows percent dot changes of 150-lpi halftone and Velvet FM screen as a function of relative log exposure on both film. Comparing different halftone dot sizes, the finer screen is more sensitive to the changes of exposure. This can be explained by border zone theory. The ratio of perimeter to area becomes smaller when the dot size is larger. Dot size change of bigger dot has less percent dot change than the smaller one. In terms of percent dot change of the two film, Imageset 2000 film has more dot gain than PagiSet film at overexposure and more dot loss at underexposure. In other words, PagiSet film has more exposure latitude than Imageset 2000 film. Figure 38 shows the exposure latitudes of dot differences within ±1% for both films. For 150-lpi screen, exposure latitude of Imageset 2000 film is approximately 0.09 while that PagiSet film is around 0.125. For 21-micron Velvet FM screen, exposure latitude of Imageset 2000 film is approximately 0.025 while that PagiSet film is around 0.038.



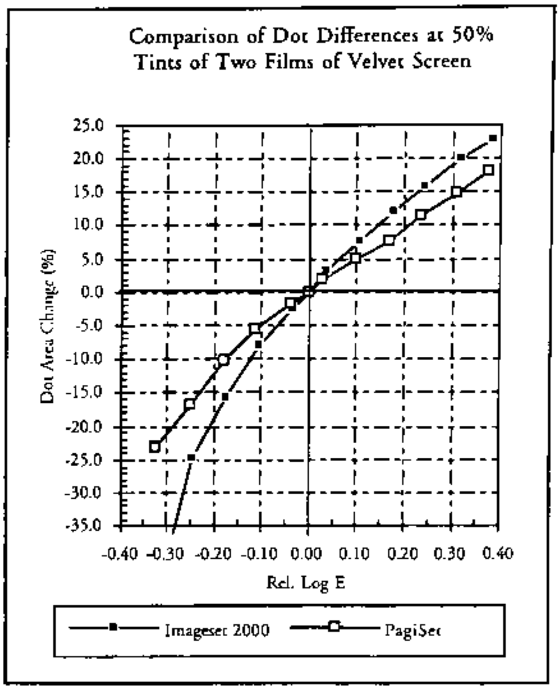
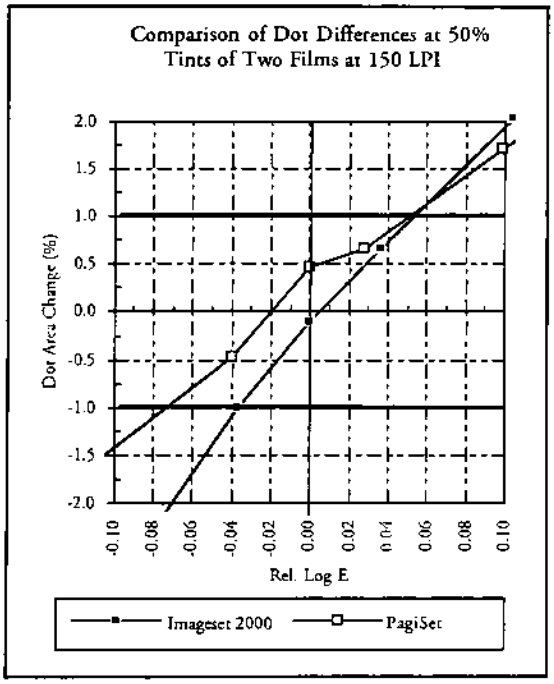


Figure 37. Percent dot area changes as a function of exposure on the two films



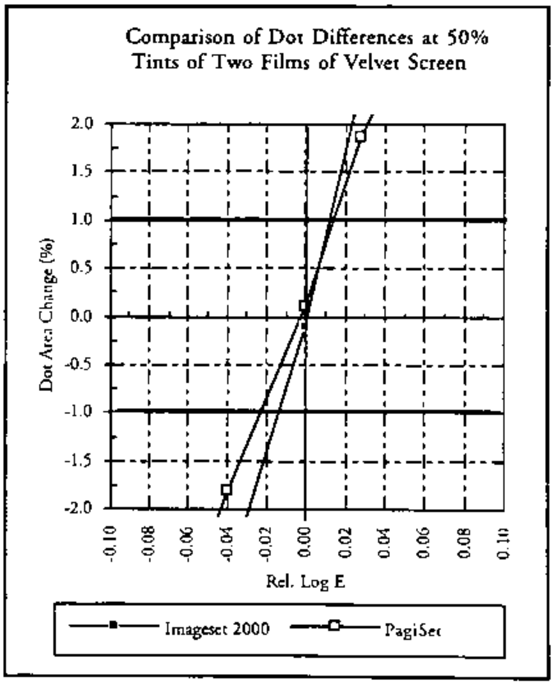


Figure 38. Exposure latitude of dot difference within ±1% from practical exposure

Comparison of MTF and Chemical Spread of the Two Films

The MTF of both films can be calculated from equations 9 and 10 in chapter 2. The data from calculation used to plot the spread functions and MTFs of films are shown in Table C(2)-27 and Table C(2)-28, respectively, of Appendix C(2). The curves are shown in figures 39 and 40. PagiSet film has a slightly higher MTF than Imageset 2000 film. In other words, Imageset 2000 film has more light scattering that makes very fine dots or lines disappear faster.

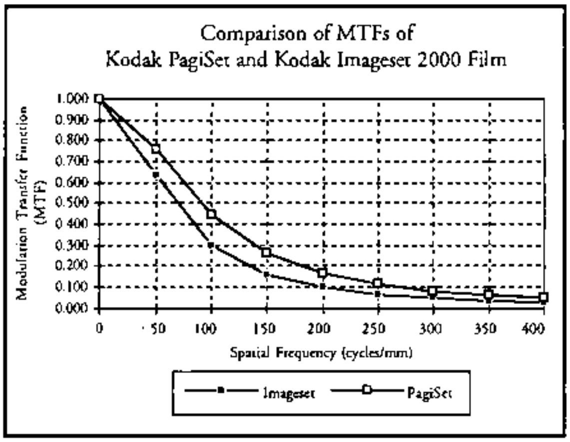


Figure 39. Comparison of MTFs of the two films

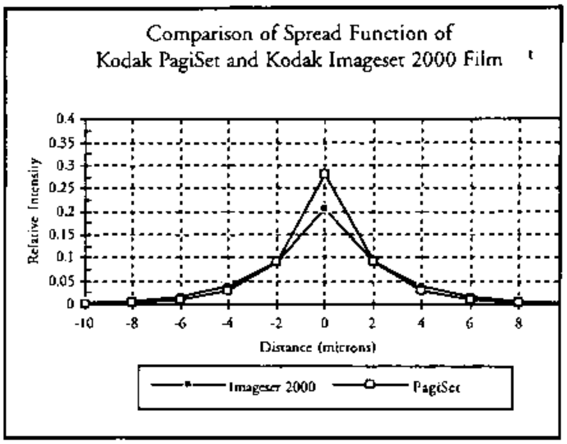


Figure 40. Comparison of spread functions of the two films

The graphs in figure 41 were used to investigate chemical spread. Chemical spread has more effect on small dots than on large ones. Therefore, the 3x1 checkerboard's graph of each film were compared to Frieser's curve. On PagiSet film, the curve shape of Frieser's curve matched very well the one of the 3x1 checkerboard. On the underexposed side, edge movements of experimental curves were less than the one calculated using Frieser's equation. This probably results from very low maximum densities of underexposed PagiSet film. There are low density lines in between scan lines as show in figure 42. This significantly uneven maximum density causes some inaccuracy of edge

movement calculations. Comparing the two underexposed solids, PagiSet film has consistent, alternate dark and light lines while Imageset 2000 film has more chaotic black and white lines. Therefore, the plots of relative edge movement at the exposures that gave such low maximum densities were disgarded.

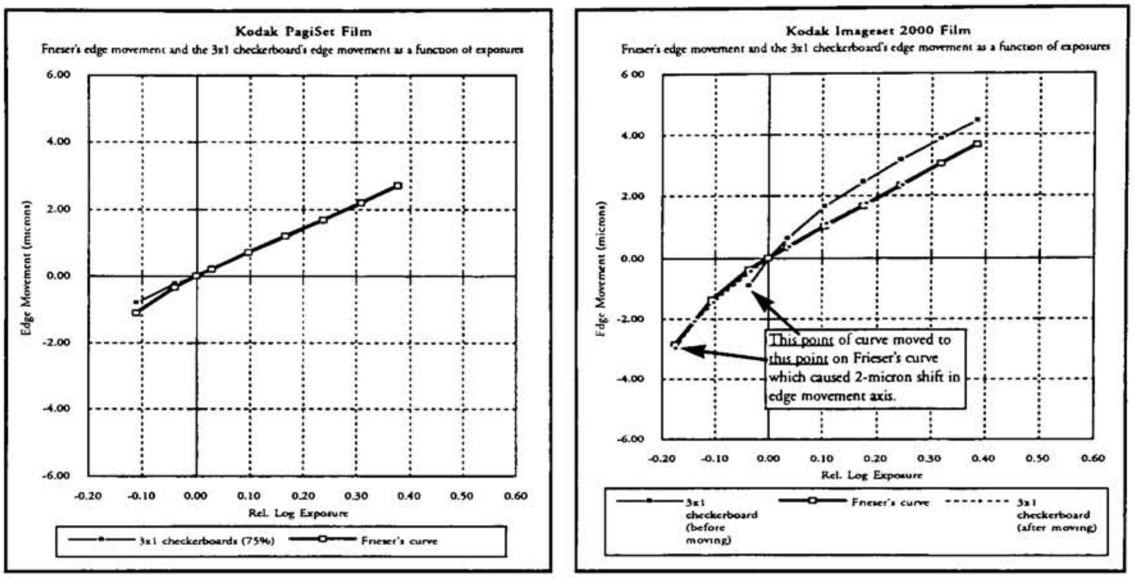


Figure 41. Matching curve shapes of Freiser's curve and 3x1 checkerboard's curve to find chemical spread

Kodak PagiSet Film at 255 units (relative log exposure of -0.18)

Kodak Imageset 2000 Film at 281 units (relative log exposure of -0.17)

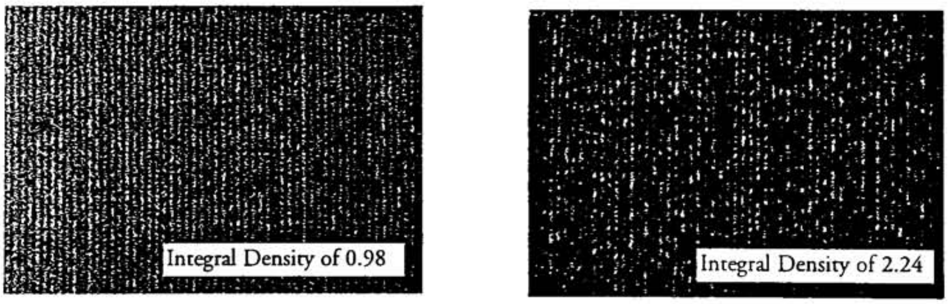


Figure 42. "Solid" patches of underexposed films

On Imageset 2000 film, Frieser's curve had the same curve shape as the actual 3x1 checkerboard's curve, but they were somewhat shifted relative to each other. This curve shift implies that there is chemical spread on Imageset 2000 film. Because the exposure axis is relative, the experimental curve can be moved relative to the Frieser's curve to match the curve shapes. In order to do that, the experimantal curve also had to be moved in the edge movement axis by two microns. Therefore, the chemical spread on Imageset 2000 film is approximately two microns.

Determination of Calibration and Linearization Techniques for Each Film

From the previous results, it can be seen that matching the density of the 1x1 checkerboard to one of the 50% reference tints is the best calibration and linearization strategy for PagiSet film. However, quarter tones and three-quarter tones of very fine halftone dot sizes (53 microns or smaller) were not linear within ±1%. This non-linearity is probably because of the lower contrast which is an inherent property of this film.

On the other hand, the same calibration and linearization procedure did not work for calibrating and linearizing Imageset 2000 film. At this exposure, the film was overexposed. However, it was found that at the practical exposure, the density of the 2x2 checkerboard matched that of the 50% tint on the UGRA/FOGRA PostScript Control Strip. Therefore, it can be said that the density of the 2x2 checkerboard can be used instead of that of 1x1 checkerboard for calibrating and linearizing an imagesetter. To verify this hypothesis, the test form was output on Kodak Imageset 2000 at the exposure where the density of 2x2 checkerboard matched the 50% tints. The results are shown in figure 43. All dot areas of all tested screen rulings reproduced within ±1%. At this exposure, the density of the 1x1 checkerboard was lighter than that of the 50% tint. This result agrees with the result that was shown in figure 31. This lower dot area repro-

duction of the 1x1 checkerboard is probably related the same chemical effect that produce chemical spread.

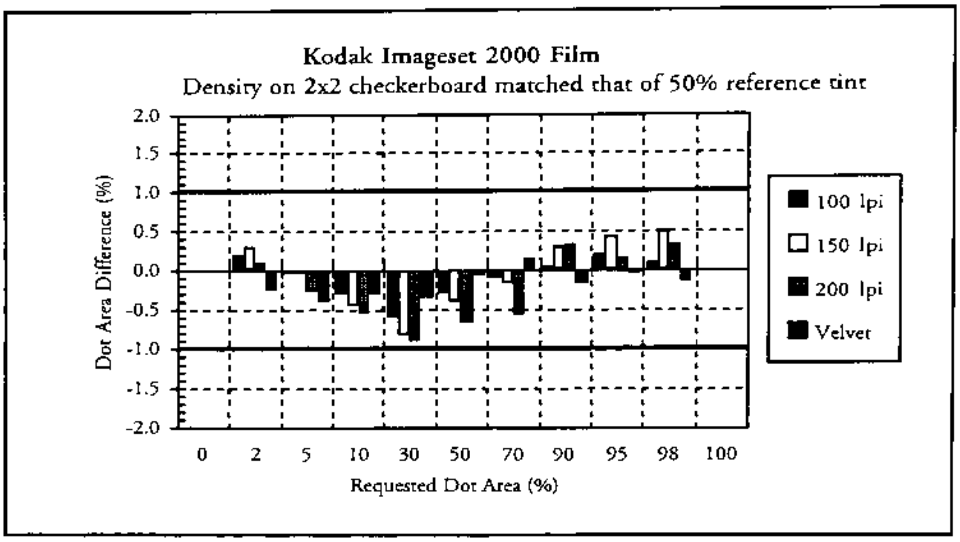


Figure 43. Matching density of 2x2 checkerboards and 50% tint on Kodak Imageset 2000 film

Chapter 7

Summary and Conclusion

Conclusion on Differences in Response over the Halftone Dot Range between the Two Films

For each film, when the exposure was adjusted so that 50% tint on all halftone scales reproduced 50%, all halftone scales were linear on Imageset 2000 film within ±1%. Therefore, hypothesis 1 is accepted. On the other hand, within ±1%, all conventional halftone scales on Pagiset film were linear, but the 21-micron FM Velvet-screened scale was not. Consequently, hypothesis 2 is rejected

Table 2. Maximum Dot Differences on Halftone Scales at Practical Exposure

Screen Ruling	Maximum Dot Difference on Halftone Scale (%)	
	PagiSet Film	Imageset 2000 Film
100-lpi	+0.4/ 0.0	+0.5/ -0.5
150-lpi	+0.5/ -0.2	+0.5/ -0.7
200-lpi	+0.5/ -0.4	+0.6/ -0.7
Velvet	+1.5/ -1.4	+0.5/ -0.7

Conclusion on the Applicability of the Linearized Calibration Technique

For each film, when the exposure was adjusted so that the density of 1x1 checker-board matched that of 50% reference tint on the UGRA/FOGRA PostScript Digital Control Strip, Velvet -screened scales on both Imageset 2000 and Pagiset film were not linear within ±1%. Therefore, both hypothesis 3 and 4 were rejected.

Table 3. Maximum dot differences on halftone scales when density of 1x1checkerboard matched that of 50% reference tint

Screen Ruling	Maximum Dot Difference on Halftone Scale (%)	
	Imageset 2000 Film	PagiSet Film
100-lpi	+0.7/ -0.2	+0.4/ -0.1
150-lpi	+0.7/ -0.2	+0.6/ -0.1
200-lpi	+1.1/ 0.0	+0.6/ -0.2
Velvet	+3.2/ -0.1	+2.0/ -1.3

However, if, for Imageset 2000 film, the 2x2 matrix is adjusted to match that of the 50% tint on the UGRA/FOGRA PostScript Digital Control Strip, all screen rulings were linear within ±1%.

Table 4. Maximum dot differences on halftone scales when the density of 2x2 checkerboard matched that of 50% reference tint for Imageset 2000 film

Screen Ruling	Maximum Dot Difference on Halftone Scale (%)
100-lpi	+0.2/ -0.6
150-lpi	+0.5/ -0.8
200-lpi	+0.3/ -0.9
Velvet	+0.2/ -0.4

Conclusion on the Relationship between Dot Size Change and Exposure Change between the Two Films

From the curves plotted between relative dot differences and relative log exposure, regression lines of test elements on Imageset 2000 film showed higher slope than those on PagiSet film. By conducting an F-test of two-way ANOVA without replication, slopes of two films are different at significant level of 95%. Therefore, Imageset 2000 film is more sensitive to exposure change than PagiSet film. The hypothesis 5 was then rejected.

Table 5. k-values of test elements on both film and t-test of differences

Test Element	k-value		F_{cal} for	$F_{critical}$
	PagiSet Film	Imageset 2000 Film	Slope Difference	
Checkerboard	8.19	11.17	80.85	5.59
Lines in Scan Direction	7.99	11.25	157.32	5.59
Cross-scan Lines	9.04	13.30	734.25	5.59

Summary

It was found in this study, that matching the density of checkerboard patterns to 50% reference halftone tints provides an accurate means to determine practical exposure. However, different calibration strategies are required for hybrid and rapid access film.

As far as resolution is concerned, matching the density of 1x1 checkerboard with that of the 50% reference tint is a valid calibration means for PagiSet film for the conventional screen rulings of up to 300 lpi. The smaller dot sizes show a non-linearity due to the low contrast of the film. However, if the exposure is adjusted for this resolution, the density of "solid" is only 2.08. Overexposure is needed in order to reproduce an aesthetically acceptable solid density of 3.0. This increase of exposure makes tone reproduction non-linear; therefore, a linearizing program is required. First matching the density of the 1x1 checkerboard to that of 50% reference tint and the increasing exposure to solid density of 3.0 assures that the least amount of linearization is used.

For Imageset 2000 film, using the 2x2 checkerboard (21 microns) instead of the 1x1 checkerboard (10.5 microns) gives accurate dot areas within ±1%. The density of 1x1 checkerboard reproduced lighter than that of the 50% reference tint at the practical exposure due to the low MTF and because very small areas are less affected by chemical spread than the larger ones. At this exposure, Imageset 2000 film is also more linear over the range of screen rulings up to 400 lpi, and has adequate solid density. However, the conclusion from these two films may not be true for other rapid access or hybrid films, and for other system conditions (imagesetters).

In terms of exposure latitude, dot area change on Imageset 2000 is more sensitive to exposure change than that on PagiSet film. The smaller the dot size, the bigger the difference of dot area change between the two films is. However, within an acceptable tolerance of ±1% dot area variation, the exposure latitude in terms of laser intensity units is small.

In addition, the results in this study showed differences between the two films in terms of contrast, modulation transfer function, and chemical spread. Imageset 2000 film has significantly higher contrast and slightly poorer MTF than PagiSet film. Imageset 2000 film also showed two microns of chemical spread while PagiSet film did not. These factors determine the response of films to exposure, and, therefore, the calibration strategy. At very small spot sizes, both MTF and chemical spread contribute to the spot size. However, above a certain dot size, the film contrast is the dominant factor. Combining all three factors: contrast, MTF and chemical spread, Imageset 2000 film clearly gave better results in terms of maximum density, hard dots, and linearity over the range of halftone dot sizes.

Recommendation for Further Study

Recently, computer-to-plate technology was introduced to printing industry. The pages in digital form can be used to output directly to a platesetter to make plates. Like an imagesetter, a platesetter has to be calibrated and linearized in order to obtain accurate results. Measuring dot areas on the processed plate is not easy. Maybe the calibration and linearization method used in this study can be adapted for computer-to-plate technology.

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Appendices

Appendix A

A(1) Data of Continuous-Tone Exposure Series and DLogE Curves

A(2) Regression Analysis of Straight Line Portions of D-LogE Curves

Appendix A (1)

Data of Continuous-Tone Exposure Series and DLogE Curves

Table A(1)-1. Raw data of densities on original continuous-tone stepwedge

Step	Density Reading on Orig. Stepwedge 1			Ave.	Density Reading on Orig. Stepwedge 2			Ave.	Density Reading on Orig. Stepwedge3			Ave.
	#1	#2	#3		#1	#2	#3		#1	#2	#3	
1	0.06	0.06	0.07	0.06	0.06	0.06	0.06	0.06	0.06	0.07	0.07	0.07
2	0.11	0.10	0.10	0.10	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11
3	0.14	0.13	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14
4	0.18	0.17	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18
5	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.23	0.23	0.23
6	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.28	0.28	0.28
7	0.32	0.32	0.32	0.32	0.33	0.33	0.33	0.33	0.32	0.33	0.33	0.33
8	0.37	0.37	0.37	0.37	0.38	0.38	0.38	0.38	0.37	0.38	0.38	0.38
9	0.42	0.42	0.42	0.42	0.43	0.43	0.43	0.43	0.42	0.42	0.43	0.42
10	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.48	0.47
11	0.52	0.51	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.52
12	0.57	0.57	0.57	0.57	0.58	0.58	0.58	0.58	0.57	0.58	0.58	0.58
13	0.63	0.62	0.62	0.62	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63
14	0.68	0.67	0.68	0.68	0.68	0.68	0.68	0.68	0.68	0.68	0.68	0.68
15	0.73	0.72	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.74	0.73	0.73
16	0.78	0.78	0.79	0.78	0.78	0.78	0.78	0.78	0.78	0.79	0.78	0.78
17	0.83	0.82	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83
18	0.88	0.88	0.88	0.88	0.89	0.89	0.89	0.89	0.88	0.89	0.89	0.89
19	0.93	0.93	0.93	0.93	0.94	0.94	0.93	0.94	0.93	0.93	0.93	0.93
20	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	1.00	0.99	0.99
21	1.04	1.04	1.04	1.04	1.05	1.05	1.05	1.05	1.04	1.04	1.04	1.04
22	1.10	1.09	1.10	1.10	1.11	1.11	1.10	1.11	1.10	1.10	1.10	1.10
23	1.16	1.15	1.15	1.15	1.16	1.16	1.15	1.16	1.16	1.15	1.15	1.15
24	1.20	1.20	1.20	1.20	1.21	1.21	1.21	1.21	1.20	1.21	1.21	1.21
25	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27
26	1.33	1.32	1.33	1.33	1.33	1.33	1.33	1.33	1.33	1.32	1.32	1.32
27	1.39	1.38	1.38	1.38	1.39	1.39	1.38	1.39	1.39	1.38	1.38	1.38
28	1.45	1.44	1.45	1.45	1.45	1.45	1.46	1.45	1.45	1.45	1.44	1.45

Table A(1)-2. Reproduced density readings of continuous-tone stepwedge on PagiSet film

Step	Reproduced Density on Film Output at 220 units			Average	Reproduced Density on Film Output at 260 units			Average
	#1	#2	#3		#1	#2	#3	
1	0.30	0.31	0.30	0.30	1.01	1.01	1.01	1.01
2	0.25	0.25	0.25	0.25	0.84	0.84	0.84	0.84
3	0.22	0.22	0.22	0.22	0.73	0.73	0.73	0.73
4	0.18	0.18	0.18	0.18	0.60	0.59	0.60	0.60
5	0.14	0.14	0.14	0.14	0.48	0.48	0.48	0.48
6	0.11	0.11	0.11	0.11	0.36	0.37	0.37	0.37
7	0.09	0.09	0.09	0.09	0.28	0.28	0.28	0.28
8	0.07	0.08	0.08	0.08	0.22	0.22	0.22	0.22
9	0.06	0.07	0.07	0.07	0.17	0.17	0.17	0.17
10	0.05	0.06	0.06	0.06	0.13	0.13	0.13	0.13
11	0.04	0.05	0.05	0.05	0.10	0.10	0.10	0.10
12	0.04	0.04	0.04	0.04	0.08	0.08	0.08	0.08
13	0.04	0.04	0.04	0.04	0.07	0.07	0.07	0.07
14	0.03	0.04	0.04	0.04	0.06	0.06	0.06	0.06
15	0.03	0.03	0.03	0.03	0.05	0.05	0.05	0.05
16	0.03	0.03	0.03	0.03	0.04	0.04	0.04	0.04
17	0.03	0.03	0.03	0.03	0.04	0.04	0.01	0.03
18	0.03	0.03	0.03	0.03	0.04	0.04	0.04	0.04
19	0.03	0.03	0.03	0.03	0.04	0.04	0.04	0.04
20	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
21	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
22	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
23	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
24	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
25	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
26	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
27	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
28	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03

Table A(1)-2 (continued). Reproduced density readings of continuous-tone stepwedge on PagiSet film

Step	Reproduced Density on Film Output at 307 units			Average	Reproduced Density on Film Output at 362 units			Average
	#1	#2	#3		#1	#2	#3	
1	2.62	2.60	2.60	2.61	4.71	4.71	4.70	4.71
2	2.24	2.24	2.24	2.24	4.47	4.46	4.46	4.46
3	1.94	1.93	1.94	1.94	4.11	4.11	4.10	4.11
4	1.63	1.63	1.63	1.63	3.88	3.87	3.86	3.87
5	1.37	1.37	1.37	1.37	3.42	3.39	3.40	3.40
6	1.20	1.22	1.22	1.21	2.82	2.84	2.88	2.85
7	1.01	1.01	1.01	1.01	2.39	2.39	2.40	2.39
8	0.82	0.81	0.82	0.82	1.98	1.99	2.00	1.99
9	0.66	0.65	0.65	0.65	1.76	1.72	1.75	1.74
10	0.51	0.51	0.51	0.51	1.63	1.62	1.62	1.62
11	0.40	0.39	0.40	0.40	1.40	1.39	1.41	1.40
12	0.30	0.29	0.29	0.29	1.11	1.10	1.10	1.10
13	0.22	0.22	0.22	0.22	0.76	0.72	0.74	0.74
14	0.16	0.15	0.16	0.16	0.63	0.64	0.64	0.64
15	0.12	0.11	0.12	0.12	0.43	0.43	0.42	0.43
16	0.09	0.09	0.09	0.09	0.37	0.38	0.38	0.38
17	0.08	0.07	0.08	0.08	0.28	0.28	0.28	0.28
18	0.06	0.06	0.06	0.06	0.22	0.22	0.22	0.22
19	0.05	0.05	0.05	0.05	0.17	0.17	0.17	0.17
20	0.05	0.05	0.05	0.05	0.12	0.12	0.12	0.12
21	0.04	0.04	0.04	0.04	0.09	0.09	0.09	0.09
22	0.04	0.04	0.04	0.04	0.07	0.07	0.07	0.07
23	0.03	0.03	0.03	0.03	0.06	0.06	0.06	0.06
24	0.03	0.03	0.03	0.03	0.05	0.05	0.05	0.05
25	0.03	0.03	0.03	0.03	0.05	0.04	0.04	0.04
26	0.03	0.03	0.03	0.03	0.04	0.04	0.04	0.04
27	0.03	0.03	0.03	0.03	0.04	0.04	0.04	0.04
28	0.03	0.03	0.03	0.03	0.04	0.04	0.04	0.04

Table A(1)-2 (continued). Reproduced density readings of continuous-tone stepwedge on PagiSet film

Step	Reproduced Density on Film Output at 427 units			Average	Reproduced Density on Film Output at 504 units			Average
	#1	#2	#3		#1	#2	#3	
1	5.59	5.55	5.57	5.57	5.73	5.73	5.74	5.73
2	5.59	5.55	5.56	5.57	5.72	5.73	5.74	5.73
3	5.53	5.52	5.52	5.52	5.73	5.73	5.74	5.73
4	5.45	5.44	5.44	5.44	5.73	5.74	5.73	5.73
5	5.26	5.27	5.25	5.26	5.69	5.71	5.71	5.70
6	5.05	5.06	5.02	5.04	5.67	5.68	5.70	5.68
7	4.70	4.74	4.72	4.72	5.65	5.65	5.65	5.65
8	4.44	4.45	4.45	4.45	5.62	5.60	5.60	5.61
9	3.95	3.98	3.97	3.97	5.60	5.58	5.58	5.59
10	3.66	3.69	3.69	3.68	5.58	5.54	5.53	5.55
11	3.57	3.56	3.57	3.57	5.46	5.44	5.44	5.45
12	2.97	3.00	2.99	2.99	5.38	5.33	5.35	5.35
13	2.41	2.42	2.43	2.42	5.10	5.07	5.08	5.08
14	2.10	2.05	2.05	2.07	4.75	4.75	4.75	4.75
15	1.56	1.56	1.56	1.56	4.34	4.33	4.33	4.33
16	1.37	1.37	1.37	1.37	3.90	3.92	3.92	3.91
17	1.25	1.23	1.23	1.24	3.57	3.55	3.54	3.55
18	1.12	1.11	1.12	1.12	3.20	3.22	3.22	3.21
19	0.82	0.85	0.84	0.84	2.88	2.91	2.89	2.89
20	0.56	0.56	0.56	0.56	2.50	2.50	2.50	2.50
21	0.40	0.39	0.39	0.39	1.90	1.90	1.90	1.90
22	0.30	0.29	0.29	0.29	1.44	1.44	1.44	1.44
23	0.21	0.21	0.21	0.21	1.08	1.08	1.07	1.08
24	0.16	0.15	0.15	0.15	0.82	0.81	0.81	0.81
25	0.12	0.11	0.11	0.11	0.62	0.60	0.60	0.61
26	0.09	0.08	0.08	0.08	0.55	0.53	0.53	0.54
27	0.07	0.06	0.06	0.06	0.36	0.36	0.36	0.36
28	0.05	0.05	0.05	0.05	0.25	0.23	0.24	0.24

Table A(1)-2 (continued). Reproduced density readings of continuous-tone stepwedge on PagiSet film

Step	Reproduced Density on Film Output at 595 units			Average
	#1	#2	#3	
1	5.73	5.73	5.75	5.74
2	5.73	5.74	5.74	5.74
3	5.73	5.73	5.75	5.74
4	5.73	5.75	5.74	5.74
5	5.73	5.74	5.73	5.73
6	5.73	5.73	5.73	5.73
7	5.72	5.72	5.72	5.72
8	5.72	5.72	5.73	5.72
9	5.70	5.70	5.70	5.70
10	5.70	5.69	5.69	5.69
11	5.65	5.65	5.65	5.65
12	5.62	5.63	5.63	5.63
13	5.57	5.57	5.58	5.57
14	5.45	5.45	5.45	5.45
15	5.26	5.27	5.26	5.26
16	5.17	5.17	5.17	5.17
17	4.80	4.81	4.81	4.81
18	4.55	4.55	4.55	4.55
19	4.04	4.04	4.04	4.04
20	3.54	3.54	3.54	3.54
21	3.05	3.05	3.05	3.05
22	2.60	2.60	2.60	2.60
23	2.21	2.21	2.21	2.21
24	1.89	1.89	1.89	1.89
25	1.43	1.44	1.44	1.44
26	1.19	1.20	1.20	1.20
27	0.94	0.94	0.94	0.94
28	0.70	0.70	0.70	0.70

Table A(1)-3. Reproduced density readings of continuous-tone stepwedge on Imageset 2000 film

Step	Reproduced Density on Film Output at 260 units			Average	Reproduced Density on Film Output at 300 units			Average
	#1	#2	#3		#1	#2	#3	
1	0.26	0.25	0.25	0.25	1.88	1.91	1.90	1.90
2	0.12	0.12	0.11	0.12	1.41	1.42	1.42	1.42
3	0.07	0.07	0.06	0.07	1.07	1.08	1.08	1.08
4	0.05	0.05	0.04	0.05	0.64	0.64	0.64	0.64
5	0.04	0.04	0.04	0.04	0.33	0.35	0.35	0.34
6	0.03	0.04	0.03	0.03	0.15	0.16	0.16	0.16
7	0.03	0.03	0.03	0.03	0.06	0.07	0.07	0.07
8	0.03	0.03	0.03	0.03	0.04	0.05	0.05	0.05
9	0.03	0.03	0.03	0.03	0.03	0.04	0.04	0.04
10	0.03	0.03	0.03	0.03	0.03	0.03	0.04	0.03
11	0.02	0.02	0.02	0.02	0.03	0.03	0.03	0.03
12	0.02	0.02	0.02	0.02	0.03	0.03	0.03	0.03
13	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
14	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
15	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
16	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
17	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
18	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
19	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
20	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
21	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
22	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
23	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
24	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
25	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
26	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
27	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
28	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02

Table A(1)-3 (continued). Reproduced density readings of continuous-tone stepwedge on Imageset 2000 film

Step	Reproduced Density on Film Output at 340 units			Average	Reproduced Density on Film Output at 380 units			Average
	#1	#2	#3		#1	#2	#3	
1	4.70	4.55	4.58	4.61	5.60	5.64	5.60	5.61
2	4.13	4.00	4.09	4.07	5.56	5.60	5.57	5.58
3	3.53	3.69	3.70	3.64	5.53	5.55	5.48	5.52
4	2.96	2.96	2.94	2.95	5.33	5.35	5.32	5.33
5	2.34	2.32	2.32	2.33	5.21	5.17	5.00	5.13
6	1.54	1.55	1.55	1.55	4.71	4.85	4.71	4.76
7	0.91	0.91	0.91	0.91	3.65	3.66	3.55	3.62
8	0.53	0.52	0.53	0.53	2.76	2.76	2.77	2.76
9	0.25	0.26	0.26	0.26	1.95	1.94	1.53	1.81
10	0.10	0.11	0.11	0.11	1.28	1.28	1.27	1.28
11	0.04	0.06	0.06	0.05	0.76	0.76	0.75	0.76
12	0.04	0.05	0.05	0.05	0.35	0.36	0.35	0.35
13	0.03	0.04	0.04	0.04	0.12	0.13	0.12	0.12
14	0.03	0.04	0.04	0.04	0.06	0.06	0.06	0.06
15	0.03	0.04	0.04	0.04	0.04	0.05	0.05	0.05
16	0.02	0.04	0.04	0.03	0.04	0.04	0.04	0.04
17	0.02	0.04	0.04	0.03	0.03	0.04	0.04	0.04
18	0.02	0.04	0.04	0.03	0.03	0.03	0.03	0.03
19	0.02	0.04	0.04	0.03	0.03	0.03	0.03	0.03
20	0.02	0.04	0.04	0.03	0.03	0.03	0.03	0.03
21	0.02	0.04	0.04	0.03	0.03	0.03	0.03	0.03
22	0.02	0.04	0.04	0.03	0.03	0.03	0.03	0.03
23	0.02	0.03	0.03	0.03	0.03	0.03	0.03	0.03
24	0.02	0.03	0.03	0.03	0.03	0.03	0.03	0.03
25	0.02	0.03	0.03	0.03	0.03	0.03	0.03	0.03
26	0.02	0.03	0.03	0.03	0.03	0.03	0.03	0.03
27	0.02	0.03	0.03	0.03	0.03	0.03	0.03	0.03
28	0.02	0.03	0.03	0.03	0.03	0.03	0.03	0.03

Table A(1)-3 (continued). Reproduced density readings of continuous-tone stepwedge on Imageset 2000 film

Step	Reproduced Density on Film Output at 420 units			Average	Reproduced Density on Film Output at 460 units			Average
	#1	#2	#3		#1	#2	#3	
1	5.58	5.64	5.64	5.62	5.56	5.59	5.59	5.58
2	5.57	5.63	5.63	5.61	5.55	5.57	5.57	5.56
3	5.57	5.64	5.63	5.61	5.54	5.56	5.57	5.56
4	5.58	5.63	5.62	5.61	5.55	5.55	5.56	5.55
5	5.59	5.63	5.63	5.62	5.55	5.55	5.57	5.56
6	5.57	5.63	5.62	5.61	5.55	5.55	5.57	5.56
7	5.55	5.62	5.62	5.60	5.54	5.55	5.57	5.55
8	5.50	5.47	5.46	5.48	5.54	5.57	5.58	5.56
9	4.90	4.19	4.24	4.44	5.53	5.58	5.57	5.56
10	4.23	3.22	3.24	3.56	5.55	5.57	5.52	5.55
11	3.19	1.96	1.97	2.37	5.48	5.44	5.42	5.45
12	2.01	1.15	1.11	1.42	5.05	5.30	5.25	5.20
13	1.15	0.59	0.59	0.78	4.34	4.40	4.32	4.35
14	0.59	0.24	0.24	0.36	3.24	3.22	3.31	3.26
15	0.25	0.09	0.09	0.14	1.97	2.06	2.01	2.01
16	0.09	0.05	0.05	0.06	1.18	1.20	1.16	1.18
17	0.05	0.04	0.04	0.04	0.73	0.72	0.73	0.73
18	0.04	0.04	0.04	0.04	0.44	0.45	0.44	0.44
19	0.04	0.04	0.04	0.04	0.09	0.08	0.06	0.08
20	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
21	0.04	0.03	0.04	0.04	0.04	0.04	0.04	0.04
22	0.03	0.03	0.04	0.03	0.04	0.04	0.04	0.04
23	0.03	0.03	0.03	0.03	0.03	0.04	0.04	0.04
24	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
25	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
26	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
27	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
28	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03

Table A(1)-3 (continued). Reproduced density readings of continuous-tone stepwedge on Imageset 2000 film

Step	Reproduced Density on Film Output at 500 units			Average
	#1	#2	#3	
1	5.66	5.65	5.64	5.65
2	5.66	5.63	5.64	5.64
3	5.64	5.64	5.64	5.64
4	5.65	5.65	5.65	5.65
5	5.65	5.65	5.65	5.65
6	5.66	5.65	5.65	5.65
7	5.66	5.66	5.66	5.66
8	5.66	5.66	5.66	5.66
9	5.65	5.65	5.65	5.65
10	5.65	5.64	5.65	5.65
11	5.65	5.63	5.63	5.64
12	5.65	5.63	5.63	5.64
13	5.63	5.60	5.61	5.61
14	5.58	5.55	5.56	5.56
15	4.96	5.00	4.98	4.98
16	3.79	3.82	3.81	3.81
17	3.03	2.94	2.96	2.98
18	1.88	1.86	1.88	1.87
19	1.14	1.14	1.17	1.15
20	0.56	0.54	0.52	0.54
21	0.18	0.22	0.20	0.20
22	0.09	0.08	0.07	0.08
23	0.05	0.05	0.05	0.05
24	0.04	0.04	0.04	0.04
25	0.04	0.04	0.04	0.04
26	0.03	0.03	0.03	0.03
27	0.03	0.03	0.03	0.03
28	0.03	0.03	0.03	0.03

Table A(1)-4. Average original and reproduced densities for exposure series of continuous-tone stepwedge on PagiSet film

Step	Density on films at the laser intensity unit of									
	Gray scale #1				Gray scale #2			Gray scale #3		
	D orig.	220	260	595	D orig.	362	427	D orig.	504	307
1	0.06	0.30	1.01	5.74	0.06	4.71	5.57	0.07	5.73	2.61
2	0.10	0.25	0.84	5.74	0.11	4.46	5.57	0.11	5.73	2.24
3	0.14	0.22	0.73	5.74	0.14	4.11	5.52	0.14	5.73	1.94
4	0.18	0.18	0.60	5.74	0.18	3.87	5.44	0.18	5.73	1.63
5	0.22	0.14	0.48	5.73	0.22	3.40	5.26	0.23	5.70	1.37
6	0.27	0.11	0.37	5.73	0.27	2.85	5.04	0.28	5.68	1.21
7	0.32	0.09	0.28	5.72	0.33	2.39	4.72	0.33	5.65	1.01
8	0.37	0.08	0.22	5.72	0.38	1.99	4.45	0.38	5.61	0.82
9	0.42	0.07	0.17	5.70	0.43	1.74	3.97	0.42	5.59	0.65
10	0.47	0.06	0.13	5.69	0.47	1.62	3.68	0.47	5.55	0.51
11	0.52	0.05	0.10	5.65	0.52	1.40	3.57	0.52	5.45	0.40
12	0.57	0.04	0.08	5.63	0.58	1.10	2.99	0.58	5.35	0.29
13	0.62	0.04	0.07	5.57	0.63	0.74	2.42	0.63	5.08	0.22
14	0.68	0.04	0.06	5.45	0.68	0.64	2.07	0.68	4.75	0.16
15	0.73	0.03	0.05	5.26	0.73	0.43	1.56	0.73	4.33	0.12
16	0.78	0.03	0.04	5.17	0.78	0.38	1.37	0.78	3.91	0.09
17	0.83	0.03	0.03	4.81	0.83	0.28	1.24	0.83	3.55	0.08
18	0.88	0.03	0.04	4.55	0.89	0.22	1.12	0.89	3.21	0.06
19	0.93	0.03	0.04	4.04	0.94	0.17	0.84	0.93	2.89	0.05
20	0.99	0.03	0.03	3.54	0.99	0.12	0.56	0.99	2.50	0.05
21	1.04	0.03	0.03	3.05	1.05	0.09	0.39	1.04	1.90	0.04
22	1.10	0.03	0.03	2.60	1.11	0.07	0.29	1.10	1.44	0.04
23	1.15	0.03	0.03	2.21	1.16	0.06	0.21	1.15	1.08	0.03
24	1.20	0.03	0.03	1.89	1.21	0.05	0.15	1.21	0.81	0.03
25	1.27	0.03	0.03	1.44	1.27	0.04	0.11	1.27	0.61	0.03
26	1.33	0.03	0.03	1.20	1.33	0.04	0.08	1.32	0.54	0.03
27	1.38	0.03	0.03	0.94	1.39	0.04	0.06	1.38	0.36	0.03
28	1.45	0.03	0.03	0.70	1.45	0.04	0.05	1.45	0.24	0.03

Table A(1)-5. Average original and reproduced densities for exposure series of continuous-tone stepwedge on Imageset 2000 film

Step	Density on films at the laser intensity unit of									
	Gray scale #1			Gray scale #2				Gray scale #3		
	D orig.	420	460	D orig	260	380	500	D orig	300	340
1	0.06	5.62	5.58	0.06	0.25	5.61	5.65	0.07	1.90	4.61
2	0.10	5.61	5.56	0.11	0.12	5.58	5.64	0.11	1.42	4.07
3	0.14	5.61	5.56	0.14	0.07	5.52	5.64	0.14	1.08	3.64
4	0.18	5.61	5.55	0.18	0.05	5.33	5.65	0.18	0.64	2.95
5	0.22	5.62	5.56	0.22	0.04	5.13	5.65	0.23	0.34	2.33
6	0.27	5.61	5.56	0.27	0.03	4.76	5.65	0.28	0.16	1.55
7	0.32	5.60	5.55	0.33	0.03	3.62	5.66	0.33	0.07	0.91
8	0.37	5.48	5.56	0.38	0.03	2.76	5.66	0.38	0.05	0.53
9	0.42	4.44	5.56	0.43	0.03	1.81	5.65	0.42	0.04	0.26
10	0.47	3.56	5.55	0.47	0.03	1.28	5.65	0.47	0.03	0.11
11	0.52	2.37	5.45	0.52	0.02	0.76	5.64	0.52	0.03	0.05
12	0.57	1.42	5.20	0.58	0.02	0.35	5.64	0.58	0.03	0.05
13	0.62	0.78	4.35	0.63	0.02	0.12	5.61	0.63	0.02	0.04
14	0.68	0.36	3.26	0.68	0.02	0.06	5.56	0.68	0.02	0.04
15	0.73	0.14	2.01	0.73	0.02	0.05	4.98	0.73	0.02	0.04
16	0.78	0.06	1.18	0.78	0.02	0.04	3.81	0.78	0.02	0.03
17	0.83	0.04	0.73	0.83	0.02	0.04	2.98	0.83	0.02	0.03
18	0.88	0.04	0.44	0.89	0.02	0.03	1.87	0.89	0.02	0.03
19	0.93	0.04	0.08	0.94	0.02	0.03	1.15	0.93	0.02	0.03
20	0.99	0.04	0.04	0.99	0.02	0.03	0.54	0.99	0.02	0.03
21	1.04	0.04	0.04	1.05	0.02	0.03	0.20	1.04	0.02	0.03
22	1.10	0.03	0.04	1.11	0.02	0.03	0.08	1.10	0.02	0.03
23	1.15	0.03	0.04	1.16	0.02	0.03	0.05	1.15	0.02	0.03
24	1.20	0.03	0.03	1.21	0.02	0.03	0.04	1.21	0.02	0.03
25	1.27	0.03	0.03	1.27	0.02	0.03	0.04	1.27	0.02	0.03
26	1.33	0.03	0.03	1.33	0.02	0.03	0.03	1.32	0.02	0.03
27	1.38	0.03	0.03	1.39	0.02	0.03	0.03	1.38	0.02	0.03
28	1.45	0.03	0.03	1.45	0.02	0.03	0.03	1.45	0.02	0.03

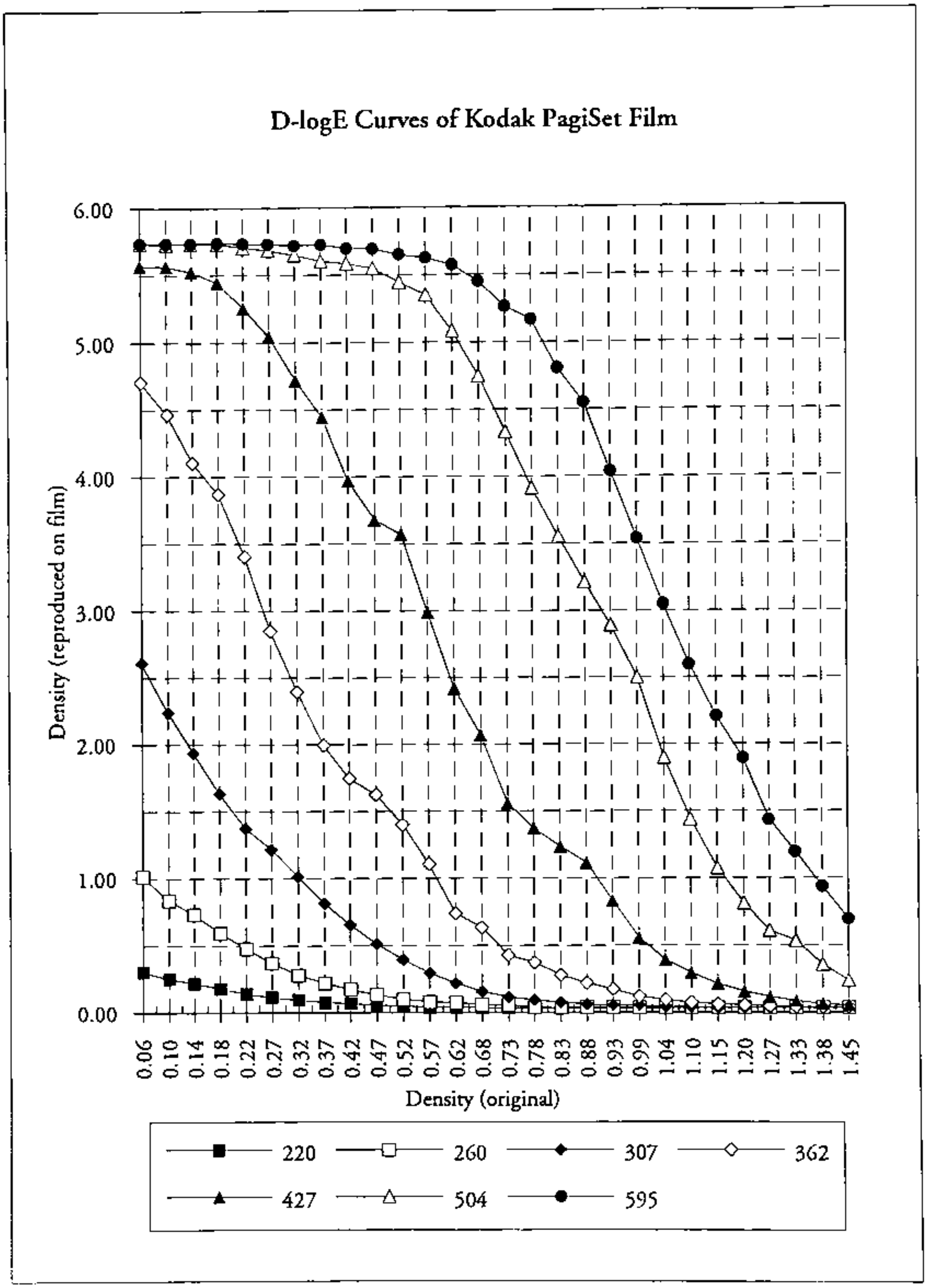


Figure A(1)-1. D logE curves of Kodak PagiSet film

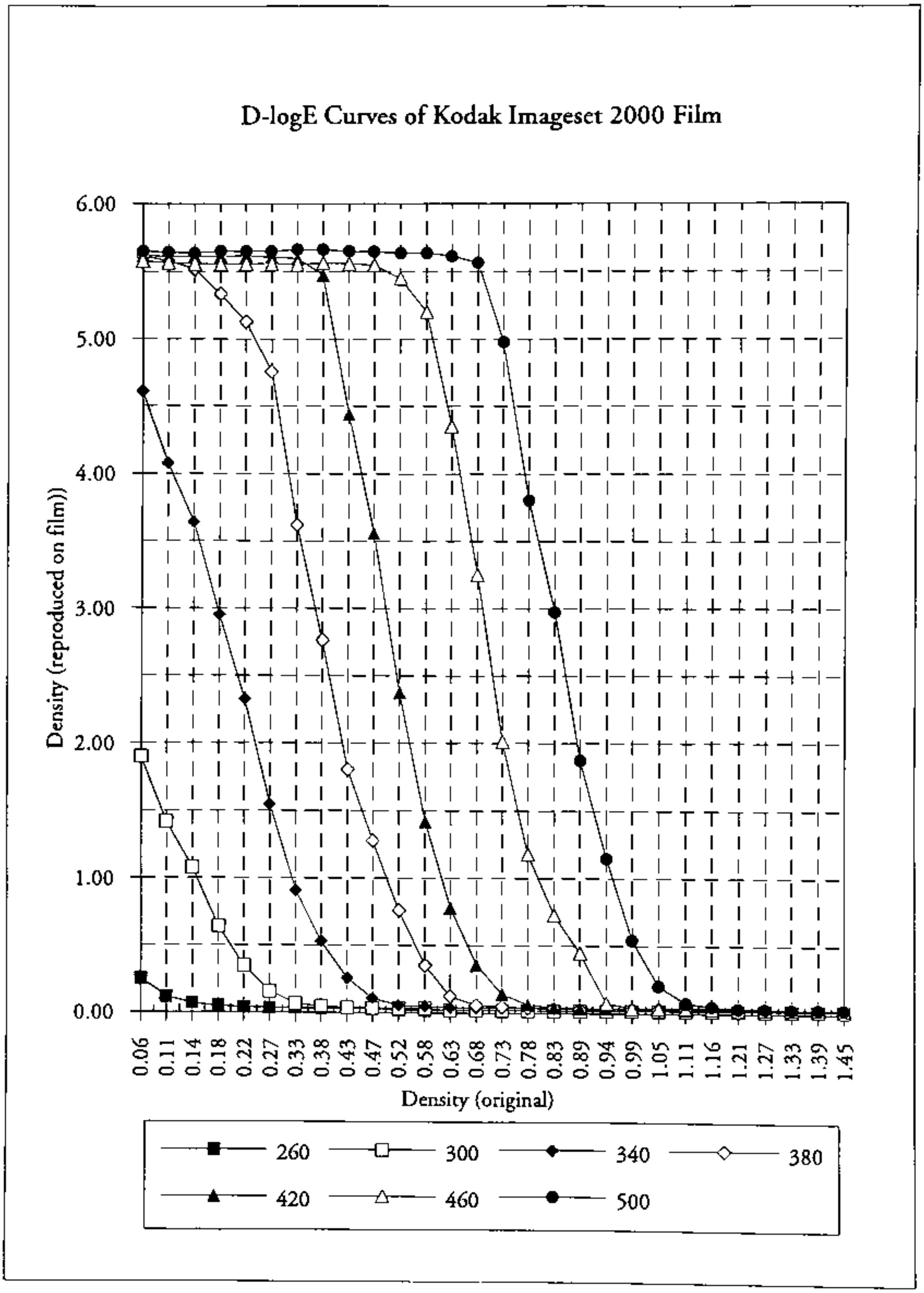


Figure A(1)-2. D logE curves of Kodak Imageset 2000 film

Table A(1)-6. Data of PagiSet film's D LogE curves used to perform regression analysis

Laser Intensity: 362			Laser Intensity: 427			Laser Intensity: 504			Laser Intensity: 559		
Step No.	x (Dorig)	y (D rep)	Step No.	x (Dorig)	y (D rep)	Step No.	x (Dorig)	y (D rep)	Step No.	x (Dorig)	y (D rep)
4	0.18	3.87	8	0.38	4.45	16	0.78	3.91	19	0.93	4.04
5	0.22	3.40	9	0.43	3.97	17	0.83	3.55	20	0.99	3.54
6	0.27	2.85	10	0.47	3.68	18	0.89	3.21	21	1.04	3.05
7	0.33	2.39	11	0.52	3.57	19	0.93	2.89	22	1.10	2.60
8	0.38	1.99	12	0.58	2.99	20	0.99	2.50	23	1.15	2.21
9	0.43	1.74	13	0.63	2.42	21	1.04	1.90	24	1.20	1.89
10	0.47	1.62	14	0.68	2.07	22	1.10	1.44	25	1.27	1.44

Table A(1)-7 Data of Imageset 2000 film's D LogE curves used to perform regression analysis

Laser Intensity: 380			Laser Intensity: 420			Laser Intensity: 460			Laser Intensity: 500		
Step No.	x (Dorig)	y (D rep)	Step No.	x (Dorig)	y (D rep)	Step No.	x (Dorig)	y (D rep)	Step No.	x (Dorig)	y (D rep)
6	0.27	4.76	9	0.42	4.44	12	0.62	4.35	14	0.73	4.98
7	0.33	3.62	10	0.47	3.56	13	0.68	3.26	15	0.78	3.81
8	0.38	2.76	11	0.52	2.37	14	0.73	2.01	16	0.83	2.98
9	0.43	1.81	12	0.57	1.42	15	0.78	1.18	17	0.89	1.87
10	0.47	1.28	13	0.62	0.78	16	0.83	0.73	18	0.94	1.15

Summary of Regression Statistics and Analysis of Varaince of PagiSet Film's DLogE curves

Laser Intensity: 362

Regression Statistics	
Multiple R	0.9855
R Square	0.97122
Adjusted R Square	0.96546
Standard Error	0.15926
Observations	7

Analysis of Variance	*df*	*Sum of Squares*	*Mean Square*	*F*	*Significance F*
Regression	1	4.27927905	4.27927905	168.716	4.82197E-05
Residual	5	0.126819363	0.025363873		
Total	6	4.406098413			

	Coefficients	*Standard Error*	*t Statistic*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	5.09642	0.204866265	24.87679919	2.8E-07	4.569792299	5.62304158
x1	-7.80917	0.601211975	-12.989054	1.3E-05	-9.354636868	-6.26371275

Laser Intensity: 427

Regression Statistics	
Multiple R	0.99145
R Square	0.98297
Adjusted R Square	0.97956
Standard Error	0.12198
Observations	7

Analysis of Variance	*df*	*Sum of Squares*	*Mean Square*	*F*	*Significance F*
Regression	1	4.29393148	4.29393148	288.576	1.29319E-05
Residual	5	0.074398679	0.014879736		
Total	6	4.368330159			

	Coefficients	*Standard Error*	*t Statistic*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	7.4001	0.245448575	30.14930697	8.8E-08	6.769159801	8.03104903
x1	-7.76894	0.457332388	-16.98751857	2.7E-06	-8.944550845	-6.59333403

Summary of Regression Statistics and Analysis of Varaince of PagiSet Film's DLogE curves (continued)

Laser Intensity: 504

Regression Statistics	
Multiple R	0.99482
R Square	0.98967
Adjusted R Square	0.9876
Standard Error	0.09886
Observations	7

Analysis of Variance	*df*	*Sum of Squares*	*Mean Square*	*F*	*Significance F*
Regression	1	4.682328822	4.682328822	479.0480785	3.69566E-06
Residual	5	0.048871178	0.009774236		
Total	6	4.7312			

	Coefficients	*Standard Error*	*t Statistic*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	10.0382	0.334020404	30.05266031	9.00445E-08	9.179576347	10.89682711
xI	-7.74821	0.354006942	-21.88716698	5.94257E-07	-8.65821138	-6.838206725

Laser Intensity: 559

Regression Statistics	
Multiple R	0.99731
R Square	0.99463
Adjusted R Square	0.99356
Standard Error	0.07418
Observations	7

Analysis of Variance	*df*	*Sum of Squares*	*Mean Square*	*F*	*Significance F*
Regression	1	5.095861568	5.095861568	926.188185	7.18695E-07
Residual	5	0.027509861	0.005501972		
Total	6	5.123371429			

	Coefficients	*Standard Error*	*t Statistic*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	11.1118	0.278441296	39.90710964	1.65468E-08	10.39603236	11.82754229
x1	-7.68435	0.252497911	-30.43334002	8.35303E-08	-8.333420249	-7.035289286

Summary of Regression Statistics and Analysis of Varaince of Imageset 2000 Film's DLogE curves

Laser Intensity: 380

Regression Statistics	
Multiple R	0.99881
R Square	0.99762
Adjusted R Square	0.99682
Standard Error	0.07871
Observations	5

Analysis of Variance	*df*	*Sum of Squares*	*Mean Square*	*F*	*Significance F*
Regression	1	7.780983468	7.780983468	1255.98	4.94029E-05
Residual	3	0.018585421	0.00619514		
Total	4	7.799568889			

	Coefficients	*Standard Error*	*t Statistic*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	9.46219	0.190014304	49.7972343	9.7E-07	8.857475948	10.0668977
x1	-17.5998	0.49661034	-35.43983335	3.8E-06	-19.18022491	-16.0193505

Laser Intensity: 420

Regression Statistics	
Multiple R	0.99335
R Square	0.98675
Adjusted R Square	0.98233
Standard Error	0.19997
Observations	5

Analysis of Variance	*df*	*Sum of Squares*	*Mean Square*	*F*	*Significance F*
Regression	1	8.931112462	8.931112462	223.347	0.000650198
Residual	3	0.119963094	0.039987698		
Total	4	9.051075556			

	Coefficients	*Standard Error*	*t Statistic*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	12.2118	0.654909239	18.6465469	4.9E-05	10.1275804	14.2960113
x1	-18.6458	1.247643596	-14.94478176	0.00012	-22.61632372	-14.6751988

Summary of Regression Statistics and Analysis of Varaince of Imageset 2000 Film's DLogE curves (continued)

Laser Intensity: 460

Regression Statistics	
Multiple R	0.98982
R Square	0.97974
Adjusted R Square	0.97298
Standard Error	0.24578
Observations	5

Analysis of Variance	*df*	*Sum of Squares*	*Mean Square*	*F*	*Significance F*
Regression	1	8.76194634	8.76194634	145.0508437	0.00123173
Residual	3	0.181218105	0.060406035		
Total	4	8.943164444			

	Coefficients	*Standard Error*	*t Statistic*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	15.5598	1.105953517	14.06915713	0.000148112	12.04019283	19.0794748
x1	-18.2225	1.513031255	-12.04370557	0.000272527	-23.03764819	-13.4073577

Laser Intensity: 500

Regression Statistics	
Multiple R	0.9976
R Square	0.99521
Adjusted R Square	0.99362
Standard Error	0.12153
Observations	5

Analysis of Variance	*df*	*Sum of Squares*	*Mean Square*	*F*	*Significance F*
Regression	1	9.210124707	9.210124707	623.6203299	0.000140796
Residual	3	0.044306404	0.014768801		
Total	4	9.254431111			

	Coefficients	*Standard Error*	*t Statistic*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	18.2295	0.613971567	29.6910875	7.66249E-06	16.27555014	20.1834169
x1	-18.3266	0.733873659	-24.97239135	1.52645E-05	-20.66209593	-15.99106452

Appendix A (2)

Regression Analysis of Straight Line Portions of D-LogE Curves

Table A(2)-1. Relationship between relative log E and log laser intensity unit of PagiSet Film

Laser Intensity	Log Laser Intensity	Dorig. required for Drepro of 0.3	Dorig. required for Drepro of 1.0	Dorig. required for Drepro of 2.0
220	2.34	0.07		
260	2.41	0.32	0.06	
307	2.49	0.59	0.32	0.14
362	2.56	0.85	0.61	0.42
427	2.63	1.15	0.92	0.74
504	2.70	1.40	1.18	1.05
559	2.75	0.00	1.37	1.19

Table A(2)-2. Relationship between relative log E and log laser intensity unit of Imageset 2000 Film

Laser Intensity	Log Laser Intensity	Dorig. required for Drepro of 0.3	Dorig. required for Drepro of 1.0	Dorig. required for Drepro of 2.0
260	2.41	0.06		-
300	2.48	0.23	0.15	0.05
340	2.53	0.42	0.31	0.24
380	2.58	0.62	0.52	0.45
420	2.62	0.72	0.63	0.57
460	2.66	0.89	0.8	0.73
500	2.70	1.07	0.98	0.92

Summary of regression statistics of the plots of rel. log E vs log laser intensity on PagiSet film

The plot of original densiies required to reproduce reproduced density of 0.3

Regression Statistics					
Multiple R	0.999679	Adjusted R Square	0.999198	Observations	6
R Square	0.999359	Standard Error	0.014231		

Analysis of Variance	*df*	*Sum of Squares*	*Mean Square*	*F*	*Significance F*	
Regression	1	1.262189906	1.262189906	6232.311	1.54308E-07	
Residual	4	0.000810094	0.000202524			
Total	5	1.263				
	Coefficients	*Standard Error*	*t Statistic*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	-8.68721	0.119429599	-72.73913157	9.3E-09	-9.018795733	-8.35561491
x1	3.733011	0.047286233	78.94498484	6.18E-09	3.601723029	3.864298832

The plot of original densiies required to reproduce reproduced density of 1.0

Regression Statistics					
Multiple R	0.99969	Adjusted R Square	0.999224	Observations	6
R Square	0.999379	Standard Error	0.014084		

Analysis of Variance	*df*	*Sum of Squares*	*Mean Square*	*F*	*Significance F*	
Regression	1	1.277739915	1.277739915	6441.695	1.44445E-07	
Residual	4	0.000793418	0.000198355			
Total	5	1.278533333				
	Coefficients	*Standard Error*	*t Statistic*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	-9.52848	0.1281105	-74.37701326	8.32E-09	-9.884168862	-9.17278385
x1	3.965671	0.049410204	80.26017022	5.69E-09	3.828486393	4.102856401

The plot of original densiies required to reproduce reproduced density of 2.0

Regression Statistics					
Multiple R	0.999115	Adjusted R Square	0.997641	Observations	5
R Square	0.998231	Standard Error	0.021112		

Analysis of Variance	*df*	*Sum of Squares*	*Mean Square*	*F*	*Significance F*	
Regression	1	0.754542847	0.75	1692.87	0.00	
Residual	3	0.001337153	0.000445718			
Total	4	0.75588				
	Coefficients	*Standard Error*	*t Statistic*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	-10.113	0.263170289	-38.42775604	2.74E-06	-10.95056975	-9.27551755
x1	4.121951	0.10018228	41.14451666	2.09E-06	3.803126467	4.44077652

Summary of regression statistics of the plots of rel. log E vs log laser intensity on Imageset 2000 Film

The plot of original densiies required to reproduce reproduced density of 0.3

Regression Statistics					
Multiple R	0.996538	Adjusted R Square	0.991706	Observations	7
R Square	0.993089	Standard Error	0.032742		

Analysis of Variance	*df*	*Sum of Squares*	*Mean Square*	*F*	*Significance F*
Regression	1	0.770182814	0.770182814	718.4483	1.35164E-06
Residual	5	0.005360044	0.001072009		
Total	6	0.775542857			

	Coefficients	*Standard Error*	*t Statistic*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	-8.46166	0.337287182	-25.08741245	2.64E-07	-9.328685538	-7.59463976
x1	3.515703	0.131163928	26.80388532	1.78E-07	3.178535823	3.852869943

The plot of original densiies required to reproduce reproduced density of 1.0

Regression Statistics					
Multiple R	0.996095	Adjusted R Square	0.990258	Observation	6
R Square	0.992206	Standard Error	0.030292		

Analysis of Variance	*df*	*Sum of Squares*	*Mean Square*	*F*	*Significance F*
Regression	1	0.467279522	0.467279522	509.2301	2.2838E-05
Residual	4	0.003670478	0.00091762		
Total	5	0.47095			

	Coefficients	*Standard Error*	*t Statistic*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	-9.00694	0.424353086	-21.22510453	4.3E-06	-10.18513408	-7.82874311
x1	3.687812	0.163422469	22.56612759	3.18E-06	3.234077829	4.141546735

The plot of original densiies required to reproduce reproduced density of 2.0

Regression Statistics					
Multiple R	0.997342	Adjusted R Square	0.993364	Observations	6
R Square	0.994691	Standard Error	0.025928		

Analysis of Variance	*df*	*Sum of Squares*	*Mean Square*	*F*	*Significance F*
Regression	1	0.50384433	0.50384433	749.4887	1.05869E-05
Residual	4	0.002689003	0.000672251		
Total	5	0.506533333			

	Coefficients	*Standard Error*	*t Statistic*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	-9.44606	0.363213248	-26.00691575	1.57E-06	-10.45450008	-8.43761261
x1	3.829381	0.139876927	27.37679074	1.22E-06	3.441019954	4.217742783

Testing of differences of lines slopes and average slope for PagiSet Film

Ho: ß = 3.7196 (average slope)
Ha: ß ≠ 3.7196
Significant level: 0.05

	N	x	y1 0.3	y2 1.0	y3 2.0
	1	2.34	0.06	-0.20	-0.39
	2	2.41	0.33	0.07	-0.11
	3	2.49	0.60	0.34	0.16
	4	2.56	0.86	0.61	0.43
	5	2.63	1.13	0.88	0.71
	6	2.70	1.40	1.15	0.98
Σ	6	15.14	4.4	2.8	1.8
Ave		2.52268	0.73	0.47308	0.29784

	X^2	y1^2	y2^2	y3^2	x.y1	xy2	xy3
	5.49	0.00	0.04	0.15	0.13	-0.48	-0.91
	5.83	0.11	0.00	0.01	0.79	0.17	-0.27
	6.19	0.36	0.12	0.03	1.49	0.84	0.40
	6.55	0.75	0.37	0.19	2.21	1.56	1.11
	6.92	1.28	0.77	0.50	2.98	2.31	1.86
	7.30	1.96	1.32	0.96	3.79	3.10	2.65
Σ	38.27	4.46	2.62	1.84	11.39	7.50	4.85

Sxx	Sxy1	Sxy2	Sxy3
0.09	0.34	0.34	0.34
	Syy1	Syy2	Syy3
	1.26	1.28	1.31
	Sy1x	Sy2x	Sy3x
	0.48	0.56	0.57
	b1	b2	b3
	3.73	3.75	3.80

	y1	y2	y3
Cal t	0.00	0.01	0.01
t0.025,4	2.78	2.78	2.78

It call < t therefore, fail to reject Ho.

Slopes of lines of Do of 0.3, 1.0 and 2.0 were not different from the average slope at confident level of 95%.

Testing of differences of lines slopes and average slope for Imageset 2000 Film

Ho: ß = 3.7196 (average slope)

Ha: ß ≠ 3.7196

Significant level: 0.05

	N	X	y1 0.3	y2 1.0	y3 2.0
	1	2.41	0.03	-0.10	-0.20
	2	2.48	0.25	0.13	0.04
	3	2.53	0.44	0.33	0.25
	4	2.58	0.61	0.51	0.43
	5	2.62	0.76	0.67	0.60
	6	2.66	0.90	0.81	0.75
	7	2.70	1.03	0.95	0.89
Σ	7	17.99	4.01	3.29	2.76
Ave		2.56976	0.57286	0.46986	0.39454

	X^2	y1^2	y2^2	y3^2	x.y1	xy2	xy3
	5.83	0.00	0.01	0.04	0.07	-0.24	-0.48
	6.14	0.06	0.02	0.00	0.61	0.32	0.10
	6.41	0.19	0.11	0.06	1.11	0.83	0.63
	6.66	0.37	0.26	0.19	1.57	1.31	1.12
	6.88	0.58	0.45	0.36	2.00	1.75	1.57
	7.09	0.81	0.66	0.56	2.40	2.16	2.00
	7.28	1.05	0.90	0.79	2.77	2.55	2.40
Σ	46.29	3.07	2.39	2.00	10.52	8.68	7.34

Sxx	Sxy1	Sxy2	Sxy3
0.06	0.22	0.23	0.24
	Syy1	Syy2	Syy3
	0.77	0.85	0.91
	Sy1x	Sy2x	Sy3x
	0.33	0.09	0.12
	b1	b2	b3
	3.52	3.69	3.83

	y1	y2	y3
Cal t	0.04	0.02	0.06
t 0.025,4	2.78	2.78	2.78

It call < t therefore, fail to reject Ho.

Slopes of lines of Do of 0.3, 1.0 and 2.0 were not different from the average slope at confident level of 95%.

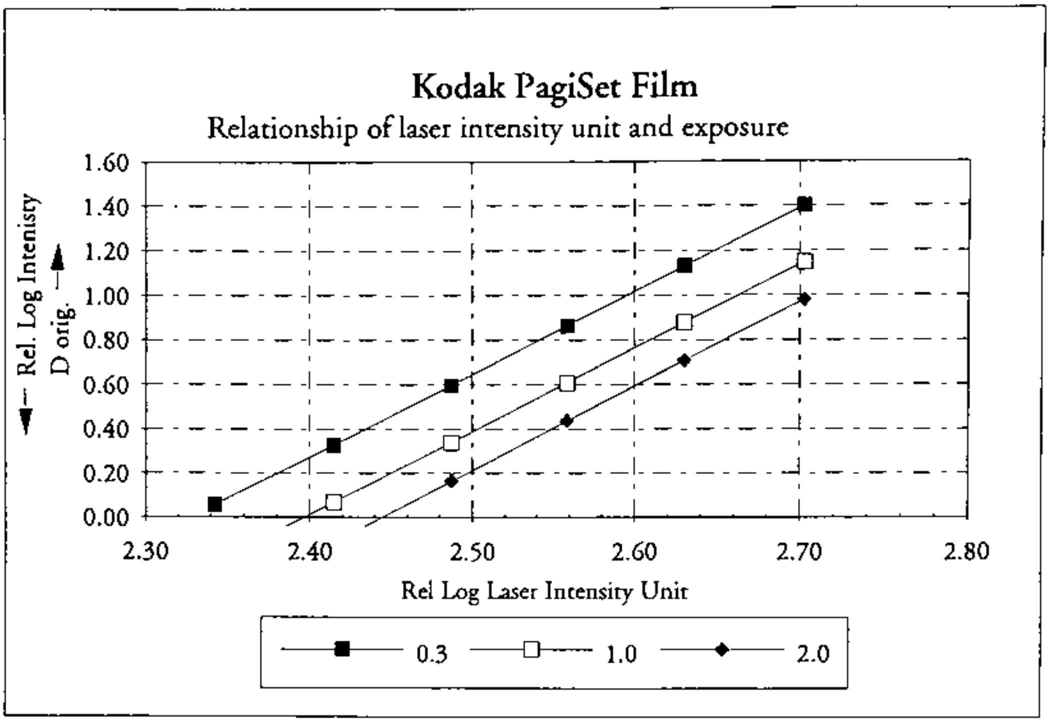


Figure A(2)-1 Relationship between relative log laser intensity and exposure for PagiSet film

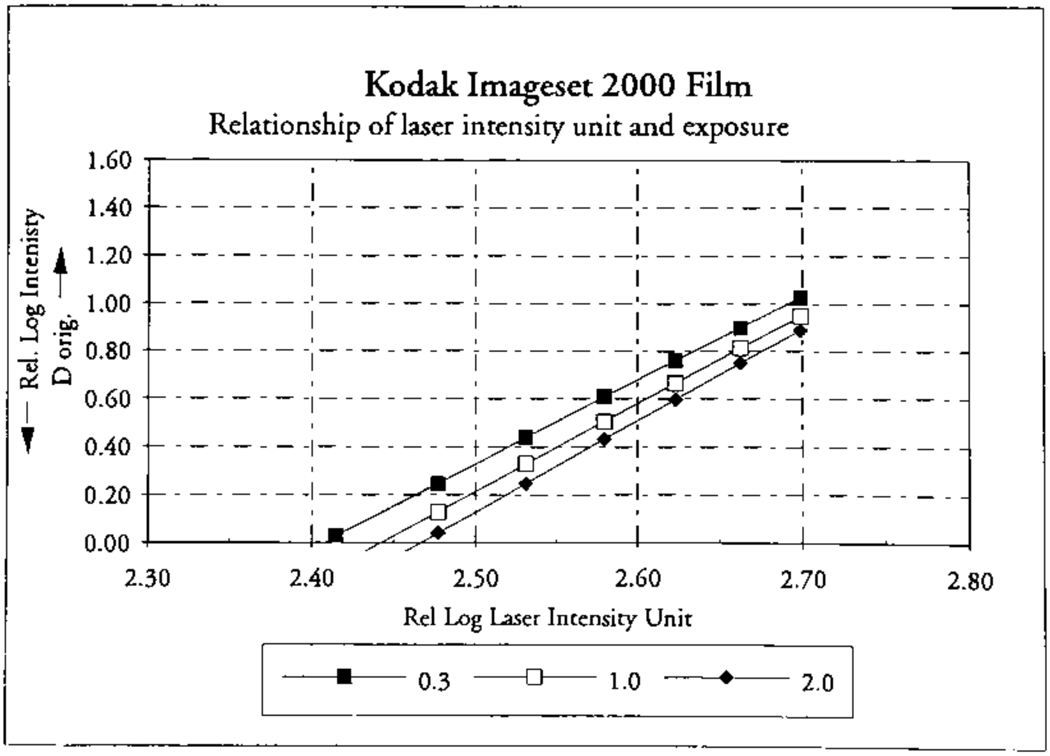


Figure A(2)-2 Relationship between relative log laser intensity and exposure for Imageset 2000 film

Appendix B

Halftone Scale Exposure Series

Table B1. Raw data of 100-lpi halftone scale exposure series on Kodak PagiSet film at different laser intensity units

Requested	1st Reading											2nd Reading										
dot area	233	244	255	266	278	290	303	316	330	345	360	233	244	255	266	278	290	303	316	330	345	360
0	78.6	90.4	98.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	78.7	90.6	98.3	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
2	76.7	88.6	96.1	98.0	98.2	98.5	98.6	98.7	98.8	99.0	99.1	76.9	88.6	96.3	98.3	98.3	98.5	98.6	98.7	98.8	99.0	99.1
5	74.0	85.3	92.7	94.7	95.0	95.4	95.6	95.8	96.1	96.3	96.5	74.2	85.5	93.0	95.0	95.1	95.5	95.7	95.8	96.1	96.4	96.6
10	69.8	80.2	87.3	89.4	89.8	90.4	90.7	91.0	91.1	91.6	92.0	70.0	80.5	87.6	89.7	89.9	90.3	90.7	91.1	91.1	91.6	92.0
30	52.7	61.3	66.9	69.0	69.6	70.3	70.7	71.3	71.6	72.4	72.9	52.6	61.2	67.1	69.2	69.7	70.4	70.6	71.2	71.6	72.4	72.9
50	36.4	42.5	46.9	49.4	50.1	50.8	51.2	51.9	52.2	53.2	53.7	36.3	42.7	47.2	49.1	50.1	50.8	51.2	51.9	52.2	53.5	53.7
70	21.4	24.8	28.0	29.5	29.7	30.7	31.0	31.3	31.5	32.2	32.6	21.5	24.8	28.0	29.1	29.6	30.3	30.8	31.3	31.5	32.5	32.8
90	6.8	7.8	8.9	9.9	10.0	10.5	10.9	10.7	11.2	11.1	11.6	6.6	7.6	8.9	9.4	9.9	10.3	10.7	10.7	11.1	11.5	11.7
95	3.2	3.6	4.3	4.9	5.2	5.4	5.8	5.6	5.8	6.0	6.1	3.5	3.6	4.2	4.6	4.9	5.1	5.6	5.8	5.8	6.1	6.2
98	1.3	1.3	1.6	2.0	1.9	2.3	2.3	2.3	2.3	2.3	2.3	1.2	1.5	1.5	1.6	1.7	2.0	2.2	2.3	2.3	2.5	2.5
100	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Requested	3rd Reading											Average dot area										
dot area	233	244	255	266	278	290	303	316	330	345	360	233	244	255	266	278	290	303	316	330	345	360
0	78.7	90.7	98.2	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	78.7	90.6	98.2	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
2	76.7	88.8	96.3	98.2	98.3	98.5	98.6	98.7	98.8	99.0	99.1	76.8	88.7	96.2	98.2	98.3	98.5	98.6	98.7	98.8	99.0	99.1
5	74.0	85.6	92.9	94.9	95.2	95.5	95.7	95.7	96.2	96.3	96.6	74.1	85.5	92.9	94.9	95.1	95.5	95.7	95.8	96.1	96.3	96.6
10	69.6	80.4	87.6	89.6	89.9	90.4	90.7	91.0	91.2	91.6	91.9	69.8	80.4	87.5	89.6	89.9	90.4	90.7	91.0	91.1	91.6	92.0
30	52.6	61.3	67.0	69.1	69.6	70.4	70.8	71.2	71.7	72.3	73.0	52.6	61.3	67.0	69.1	69.6	70.4	70.7	71.2	71.6	72.4	72.9
50	36.5	42.8	47.0	49.2	50.1	50.6	51.1	51.8	52.2	53.4	53.9	36.4	42.7	47.0	49.2	50.1	50.7	51.2	51.9	52.2	53.4	53.8
70	21.5	25.0	27.9	29.0	29.5	30.2	30.9	31.3	31.5	32.5	32.9	21.5	24.9	28.0	29.2	29.6	30.4	30.9	31.3	31.5	32.4	32.8
90	7.0	7.7	9.0	9.5	9.8	10.2	10.9	10.7	11.1	11.4	11.3	6.8	7.7	8.9	9.6	9.9	10.3	10.8	10.7	11.1	11.3	11.5
95	3.5	3.7	4.4	4.6	4.9	5.0	5.7	5.8	5.8	6.0	6.1	3.4	3.6	4.3	4.7	5.0	5.2	5.7	5.7	5.8	6.0	6.1
98	1.3	1.4	1.5	1.5	1.6	1.9	2.3	2.3	2.3	2.5	2.6	1.3	1.4	1.5	1.7	1.7	2.1	2.3	2.3	2.3	2.4	2.5
100	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table B2. Raw data of 150-lpi halftone scale exposure series on Kodak PagiSet film at different laser intensity units

Requested	1st Reading											2nd Reading										
dot area	233	244	255	266	278	290	303	316	330	345	360	233	244	255	266	278	290	303	316	330	345	360
0	78.4	90.3	98.3	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	78.7	90.6	98.3	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
2	76.5	88.5	95.9	98.0	98.3	98.6	98.8	99.0	99.2	99.4	99.6	76.7	88.7	96.3	98.3	98.4	98.6	98.7	98.9	99.1	99.4	99.5
5	73.4	85.1	92.5	94.7	95.1	95.5	95.9	96.2	96.5	97.0	97.3	73.7	85.3	92.8	94.9	95.3	95.6	95.8	96.0	96.4	97.0	97.2
10	68.7	79.6	86.9	89.2	89.8	90.4	90.9	91.3	91.8	92.4	92.8	69.0	79.8	87.2	89.5	89.9	90.5	90.9	91.1	91.6	92.4	92.8
30	51.2	60.1	66.1	68.3	69.5	70.4	71.2	71.8	72.7	73.7	74.5	51.5	60.3	66.5	68.6	69.7	70.4	71.3	72.0	72.6	73.9	74.5
50	34.7	41.1	45.9	48.2	49.6	50.7	51.7	52.5	53.5	54.6	55.5	34.9	41.3	46.2	48.5	49.5	50.7	51.7	52.7	53.3	54.7	55.6
70	19.8	23.9	26.8	28.4	29.4	30.1	31.0	31.6	32.3	33.3	33.9	20.0	23.8	26.8	28.5	29.3	30.0	30.8	31.3	32.3	33.5	33.8
90	5.8	7.0	8.2	9.0	9.7	10.1	10.6	10.9	11.5	11.9	12.2	5.9	7.0	8.3	9.2	10.0	9.9	10.4	10.7	11.5	12.2	12.3
95	2.6	3.0	4.0	4.5	4.6	5.0	5.5	5.5	5.8	6.2	6.5	2.8	2.9	3.8	4.2	4.6	4.8	5.3	5.8	5.9	6.5	6.5
98	0.8	0.9	1.2	1.6	1.9	2.0	2.4	2.2	2.4	2.7	2.8	0.8	1.1	1.1	1.6	1.6	1.9	2.2	2.3	2.4	3.0	2.8
100	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Requested	3rd Reading											Average dot area										
dot area	233	244	255	266	278	290	303	316	330	345	360	233	244	255	266	278	290	303	316	330	345	360
0	78.5	90.6	98.3	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	78.5	90.5	98.3	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
2	76.5	88.8	96.4	98.3	98.4	98.7	98.7	98.9	99.2	99.4	99.5	76.6	88.7	96.2	98.2	98.4	98.6	98.7	98.9	99.2	99.4	99.5
5	73.6	85.2	92.8	94.9	95.2	95.6	95.8	96.0	96.5	97.0	97.2	73.6	85.2	92.7	94.8	95.2	95.6	95.8	96.1	96.5	97.0	97.2
10	69.0	79.8	87.3	89.4	89.9	90.5	90.9	91.1	91.7	92.4	92.8	68.9	79.7	87.1	89.4	89.9	90.5	90.9	91.2	91.7	92.4	92.8
30	51.3	60.3	66.5	68.6	69.5	70.5	71.4	72.0	72.7	73.8	74.6	51.3	60.2	66.4	68.5	69.6	70.4	71.3	71.9	72.7	73.8	74.5
50	34.8	41.3	46.1	48.5	49.5	50.6	51.7	52.7	53.5	54.7	55.7	34.8	41.2	46.1	48.4	49.5	50.7	51.7	52.6	53.4	54.7	55.6
70	19.9	23.7	26.8	28.3	29.4	29.9	30.9	31.3	32.3	33.3	33.9	19.9	23.8	26.8	28.4	29.4	30.0	30.9	31.4	32.3	33.4	33.9
90	5.6	7.0	8.2	9.2	9.7	9.8	10.6	10.7	11.5	12.0	12.2	5.8	7.0	8.2	9.1	9.8	9.9	10.5	10.8	11.5	12.0	12.2
95	2.6	2.9	3.6	4.4	4.5	4.6	5.5	5.8	5.8	6.4	6.5	2.7	2.9	3.8	4.4	4.6	4.8	5.4	5.7	5.8	6.4	6.5
98	0.7	1.0	1.1	1.5	1.7	1.9	2.3	2.2	2.4	2.9	2.7	0.8	1.0	1.1	1.6	1.7	1.9	2.3	2.2	2.4	2.9	2.8
100	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table B3. Raw data of 200-lpi halftone scale exposure series on Kodak PagiSet film at different laser intensity units

Requested	1st Reading											2nd Reading										
dot area	233	244	255	266	278	290	303	316	330	345	360	233	244	255	266	278	290	303	316	330	345	360
0	78.6	90.2	97.7	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	78.7	90.4	97.8	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
2	76.5	88.0	95.5	97.8	98.2	98.7	98.9	99.1	99.4	99.7	99.8	76.6	88.2	95.7	98.1	98.4	98.7	99.0	99.2	99.4	99.7	99.8
5	73.2	84.6	92.0	94.4	95.0	95.5	95.9	96.3	96.7	97.2	97.5	73.4	84.8	92.4	94.7	95.1	95.5	96.0	96.3	96.8	97.2	97.5
10	68.5	79.3	86.6	89.1	89.9	90.7	91.2	91.8	92.4	93.1	93.6	68.7	79.4	86.9	89.3	90.1	90.6	91.3	91.7	92.5	93.1	93.6
30	50.7	59.1	65.5	68.4	69.5	70.6	71.6	72.4	73.4	74.5	75.5	50.8	59.3	65.8	68.5	69.3	70.6	71.7	72.5	73.5	74.6	75.5
50	33.7	40.1	45.1	47.6	49.2	50.8	51.8	52.9	54.1	55.6	57.0	33.8	40.2	45.4	47.8	49.5	50.7	51.9	53.0	54.0	55.8	57.2
70	19.1	22.9	26.0	27.7	28.9	30.2	31.0	31.6	32.5	33.7	34.6	19.2	22.8	26.0	27.8	29.1	30.2	31.0	31.6	32.5	33.9	34.6
90	5.7	6.9	8.3	9.0	9.5	10.4	10.8	11.0	11.4	12.1	12.5	5.7	7.0	8.1	9.1	9.6	10.1	10.8	11.0	11.5	12.4	12.4
95	2.3	2.8	3.7	4.0	4.4	5.1	5.5	5.6	5.8	6.2	6.3	2.3	2.7	3.4	4.0	4.4	4.9	5.4	5.6	5.8	6.4	6.5
98	0.9	0.9	1.2	1.5	1.6	2.1	2.2	2.2	2.2	2.7	2.5	1.0	0.8	1.0	1.7	1.6	2.0	2.0	2.2	2.3	2.9	2.6
100	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Requested	3rd Reading											Average dot area										
dot area	233	244	255	266	278	290	303	316	330	345	360	233	244	255	266	278	290	303	316	330	345	360
0	78.9	90.4	98.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	78.7	90.3	97.8	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
2	76.6	88.2	95.8	98.1	98.4	98.7	99.0	99.1	99.3	99.8	99.8	76.6	88.1	95.7	98.0	98.3	98.7	99.0	99.1	99.4	99.7	99.8
5	73.6	84.7	92.4	94.7	95.1	95.6	96.0	96.4	96.7	97.1	97.5	73.4	84.7	92.3	94.6	95.1	95.5	96.0	96.3	96.7	97.2	97.5
10	68.8	79.4	87.0	89.3	90.1	90.8	91.3	91.8	92.3	93.0	93.6	68.7	79.4	86.8	89.2	90.0	90.7	91.3	91.8	92.4	93.1	93.6
30	50.9	59.3	65.8	68.5	69.7	70.6	71.8	72.4	73.4	74.4	75.5	50.8	59.2	65.7	68.5	69.5	70.6	71.7	72.4	73.4	74.5	75.5
50	33.9	40.3	45.3	48.0	49.7	50.7	51.8	52.9	54.0	55.7	57.1	33.8	40.2	45.3	47.8	49.5	50.7	51.8	52.9	54.0	55.7	57.1
70	19.4	22.8	26.0	28.0	29.0	30.3	30.9	31.7	32.5	33.7	34.8	19.2	22.8	26.0	27.8	29.0	30.2	31.0	31.6	32.5	33.8	34.7
90	5.9	6.8	8.3	9.1	9.9	10.3	10.5	11.1	11.4	12.2	12.6	5.8	6.9	8.2	9.1	9.7	10.3	10.7	11.0	11.4	12.2	12.5
95	2.6	2.7	3.5	4.4	4.4	4.7	5.2	5.7	5.8	6.2	6.6	2.4	2.7	3.5	4.1	4.4	4.9	5.4	5.6	5.8	6.3	6.5
98	1.0	1.0	1.1	1.7	1.6	1.9	2.0	2.2	2.2	2.7	2.7	1.0	0.9	1.1	1.6	1.6	2.0	2.1	2.2	2.2	2.8	2.6
100	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table B4. Raw data of Velvet-screened scale exposu ̆ series on Kodak PagiSet film at different laser intensity units

Requested	1st Reading											2nd Reading										
dot area	233	244	255	266	278	290	303	316	330	345	360	233	244	255	266	278	290	303	316	330	345	360
0	78.2	89.9	97.9	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	78.4	90.0	97.9	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
2	75.7	87.5	95.5	97.4	97.8	98.2	98.4	98.7	98.9	99.2	99.4	75.9	87.6	95.4	97.7	97.9	98.3	98.5	98.7	99.0	99.2	99.4
5	72.0	83.6	91.4	94.1	94.9	95.8	96.3	96.8	97.5	98.1	98.6	72.2	83.8	91.7	94.4	95.1	95.8	96.4	96.8	97.5	98.0	98.6
10	66.1	77.5	85.8	88.7	90.3	91.7	92.8	93.8	95.0	96.2	97.2	66.1	77.8	85.6	89.0	90.4	91.7	92.9	93.8	95.1	96.2	97.2
30	44.8	54.3	61.8	66.6	69.8	72.9	75.3	77.5	80.4	83.3	85.9	45.0	54.4	61.9	66.7	69.9	72.9	75.3	77.5	80.5	83.4	85.9
50	26.7	33.3	39.5	44.3	48.1	52.0	55.0	57.7	61.4	64.8	67.9	26.7	33.3	39.7	44.4	48.2	51.8	54.9	57.6	61.3	64.8	68.1
70	13.3	16.9	20.8	24.1	26.7	29.6	31.9	33.7	36.5	39.1	41.5	13.2	16.9	20.6	23.8	26.8	29.4	31.8	33.7	36.5	39.2	41.6
90	3.9	4.5	5.9	7.0	7.9	9.1	10.0	10.5	11.7	12.7	13.5	3.9	4.5	5.7	6.6	7.9	8.8	10.1	10.5	11.9	12.9	13.5
95	2.1	2.1	3.1	3.5	3.9	4.6	5.0	5.1	5.8	6.2	6.6	2.2	2.1	3.0	3.2	3.7	4.4	5.0	5.1	5.9	6.5	6.5
98	0.9	0.7	1.2	1.4	1.5	1.8	2.0	1.9	2.2	2.1	2.3	0.8	0.7	1.1	1.1	1.5	1.4	2.0	1.8	2.1	2.5	2.4
100	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Requested	3rd Reading											Average dot area										
dot area	233	244	255	266	278	290	303	316	330	345	360	233	244	255	266	278	290	303	316	330	345	360
0	78.6	90.2	98.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	78.4	90.0	97.9	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
2	76.0	87.6	95.4	97.7	98.0	98.3	98.5	98.7	99.0	99.2	99.4	75.9	87.6	95.4	97.6	97.9	98.3	98.5	98.7	99.0	99.2	99.4
5	72.4	83.8	91.8	94.3	95.1	95.8	96.4	97.0	97.5	98.0	98.5	72.2	83.7	91.6	94.3	95.0	95.8	96.4	96.9	97.5	98.0	98.6
10	66.3	77.7	85.6	88.9	90.4	91.8	92.9	93.7	95.1	96.2	97.1	66.2	77.7	85.7	88.9	90.4	91.7	92.9	93.8	95.1	96.2	97.2
30	45.1	54.4	62.1	66.8	69.9	72.9	75.4	77.4	80.5	83.4	85.9	45.0	54.4	61.9	66.7	69.9	72.9	75.3	77.5	80.5	83.4	85.9
50	27.0	33.4	39.9	44.4	48.3	51.8	54.9	57.6	61.4	64.8	68.0	26.8	33.3	39.7	44.4	48.2	51.9	54.9	57.6	61.4	64.8	68.0
70	13.5	16.9	20.7	24.0	26.8	29.5	31.9	33.6	36.7	39.2	41.7	13.3	16.9	20.7	24.0	26.8	29.5	31.9	33.7	36.6	39.2	41.6
90	4.2	4.6	5.7	6.7	8.0	8.8	10.0	10.4	11.9	12.9	13.5	4.0	4.5	5.8	6.8	7.9	8.9	10.0	10.5	11.8	12.8	13.5
95	2.5	2.2	3.2	3.2	3.9	4.4	5.0	5.2	5.9	6.4	6.4	2.3	2.1	3.1	3.3	3.8	4.5	5.0	5.1	5.9	6.4	6.5
98	1.0	0.7	1.0	1.0	1.6	1.4	2.1	2.0	2.1	2.4	2.2	0.9	0.7	1.1	1.2	1.5	1.5	2.0	1.9	2.1	2.3	2.3
100	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table B5. Dot differences from requested dot areas of halftone scales at different exposures on Kodak PagiSet film

Requested	Dot differences from requested of 100-lpi halftone at the exposure of											Dot differences from requested of 150-lpi halftone at the exposure of										
dot area	233	244	255	266	278	290	303	316	330	345	360	233	244	255	266	278	290	303	316	330	345	360
0	-21.3	-9.4	-1.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-21.5	-9.5	-1.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	-21.2	-9.3	-1.8	0.2	0.3	0.5	0.6	0.7	0.8	1.0	1.1	-21.4	-9.3	-1.8	0.2	0.4	0.6	0.7	0.9	1.2	1.4	1.5
5	-20.9	-9.5	-2.1	-0.1	0.1	0.5	0.7	0.8	1.1	1.3	1.6	-21.4	-9.8	-2.3	-0.2	0.2	0.6	0.8	1.1	1.5	2.0	2.2
10	-20.2	-9.6	-2.5	-0.4	-0.1	0.4	0.7	1.0	1.1	1.6	2.0	-21.1	-10.3	-2.9	-0.6	-0.1	0.5	0.9	1.2	1.7	2.4	2.8
30	-17.4	-8.7	-3.0	-0.9	-0.4	0.4	0.7	1.2	1.6	2.4	2.9	-18.7	-9.8	-3.6	-1.5	-0.4	0.4	1.3	1.9	2.7	3.8	4.5
50	-13.6	-7.3	-3.0	-0.8	0.1	0.7	1.2	1.9	2.2	3.4	3.8	-15.2	-8.8	-3.9	-1.6	-0.5	0.7	1.7	2.6	3.4	4.7	5.6
70	-8.5	-5.1	-2.0	-0.8	-0.4	0.4	0.9	1.3	1.5	2.4	2.8	-10.1	-6.2	-3.2	-1.6	-0.6	0.0	0.9	1.4	2.3	3.4	3.9
90	-3.2	-2.3	-1.1	-0.4	-0.1	0.3	0.8	0.7	1.1	1.3	1.5	-4.2	-3.0	-1.8	-0.9	-0.2	-0.1	0.5	0.8	1.5	2.0	2.2
95	-1.6	-1.4	-0.7	-0.3	0.0	0.2	0.7	0.7	0.8	1.0	1.1	-2.3	-2.1	-1.2	-0.6	-0.4	-0.2	0.4	0.7	0.8	1.4	1.5
98	-0.7	-0.6	-0.5	-0.3	-0.3	0.1	0.3	0.3	0.3	0.4	0.5	-1.2	-1.0	-0.9	-0.4	-0.3	-0.1	0.3	0.2	0.4	0.9	0.8
100	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Requested	Dot differences from requested of 200-lpi halftone at the exposure of											Dot differences from requested of Velvet screen at the exposure of										
dot area	233	244	255	266	278	290	303	316	330	345	360	233	244	255	266	278	290	303	316	330	345	360
0	-21.3	-9.7	-2.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-21.6	-10.0	-2.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	-21.4	-9.9	-2.3	0.0	0.3	0.7	1.0	1.1	1.4	1.7	1.8	-22.1	-10.4	-2.6	-0.4	-0.1	0.3	0.5	0.7	1.0	1.2	1.4
5	-21.6	-10.3	-2.7	-0.4	0.1	0.5	1.0	1.3	1.7	2.2	2.5	-22.8	-11.3	-3.4	-0.7	0.0	0.8	1.4	1.9	2.5	3.0	3.6
10	-21.3	-10.6	-3.2	-0.8	0.0	0.7	1.3	1.8	2.4	3.1	3.6	-23.8	-12.3	-4.3	-1.1	0.4	1.7	2.9	3.8	5.1	6.2	7.2
30	-19.2	-10.8	-4.3	-1.5	-0.5	0.6	1.7	2.4	3.4	4.5	5.5	-25.0	-15.6	-8.1	-3.3	-0.1	2.9	5.3	7.5	10.5	13.4	15.9
50	-16.2	-9.8	-4.7	-2.2	-0.5	0.7	1.8	2.9	4.0	5.7	7.1	-23.2	-16.7	-10.3	-5.6	-1.8	1.9	4.9	7.6	11.4	14.8	18.0
70	-10.8	-7.2	-4.0	-2.2	-1.0	0.2	1.0	1.6	2.5	3.8	4.7	-16.7	-13.1	-9.3	-6.0	-3.2	-0.5	1.9	3.7	6.6	9.2	11.6
90	-4.2	-3.1	-1.8	-0.9	-0.3	0.3	0.7	1.0	1.4	2.2	2.5	-6.0	-5.5	-4.2	-3.2	-2.1	-1.1	0.0	0.5	1.8	2.8	3.5
95	-2.6	-2.3	-1.5	-0.9	-0.6	-0.1	0.4	0.6	0.8	1.3	1.5	-2.7	-2.9	-1.9	-1.7	-1.2	-0.5	0.0	0.1	0.9	1.4	1.5
98	-1.0	-1.1	-0.9	-0.4	-0.4	0.0	0.1	0.2	0.2	0.8	0.6	-1.1	-1.3	-0.9	-0.8	-0.5	-0.5	0.0	-0.1	0.1	0.3	0.3
100	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table B6. Raw data of 100-lpi halftone scale exposure series on Kodak Imageset 2000 film at different lase intensity units

Requested	1 st Reading											2nd Reading										
dot area	258	269	281	293	306	320	334	349	364	381	397	258	269	281	293	306	320	334	349	364	381	397
0	54.3	97.4	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	54.4	97.1	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
2	51.7	94.6	97.7	98.0	98.2	98.3	98.5	98.7	98.9	98.9	99.1	51.5	94.7	97.6	98.0	98.2	98.3	98.5	98.7	98.8	98.9	99.1
5	50.0	90.8	94.0	94.4	94.7	95.1	95.4	95.7	96.1	96.3	96.6	50.2	90.6	94.0	94.4	94.9	95.2	95.4	95.8	96.1	96.3	96.5
10	45.4	85.0	88.3	88.9	89.6	89.9	90.3	90.7	91.3	91.7	92.0	45.6	85.1	88.1	89.0	89.5	89.8	90.3	90.8	91.2	91.7	92.1
30	31.1	64.0	67.0	67.8	68.9	70.0	70.4	71.4	72.0	72.6	73.3	31.3	63.9	66.9	68.0	69.1	69.7	70.4	71.3	71.9	72.9	73.2
50	19.8	43.8	46.8	48.2	49.3	50.6	51.2	52.3	53.2	54.0	54.7	20.1	44.0	46.6	48.2	49.1	50.6	51.1	52.4	53.0	54.3	54.9
70	10.3	25.2	27.1	28.2	29.3	30.1	31.1	32.1	32.9	33.4	34.0	10.5	25.3	27.3	28.4	29.5	30.3	31.0	31.8	32.5	33.4	34.2
90	2.4	7.5	8.4	8.9	9.8	10.4	10.6	11.3	11.9	12.2	12.6	2.7	7.4	8.4	9.3	10.0	10.6	10.9	11.5	11.7	12.3	13.0
95	1.1	3.0	3.6	4.3	4.9	5.2	5.6	6.0	6.5	6.9	6.9	1.4	3.0	4.0	4.5	4.9	5.3	5.9	6.3	6.5	6.9	7.2
98	0.5	0.6	1.2	1.6	1.8	2.1	2.1	2.4	2.7	3.0	3.1	0.7	0.6	1.5	1.6	2.0	2.1	2.4	2.5	2.7	3.1	3.3
100	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Requested	3 rd Reading											Average dot area										
dot area	258	269	281	293	306	320	334	349	364	381	397	258	269	281	293	306	320	334	349	364	381	397
0	54.7	97.2	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	54.5	97.2	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
2	51.8	94.4	97.7	97.9	98.2	98.3	98.5	98.7	98.9	98.9	99.1	51.7	94.6	97.7	98.0	98.2	98.3	98.5	98.7	98.9	98.9	99.1
5	50.0	90.9	93.9	94.4	94.8	95.1	95.4	95.8	96.1	96.4	96.5	50.1	90.8	94.0	94.4	94.8	95.1	95.4	95.8	96.1	96.3	96.5
10	45.3	85.1	88.1	88.9	89.5	89.9	90.3	90.8	91.4	91.7	92.0	45.4	85.1	88.2	88.9	89.5	89.9	90.3	90.8	91.3	91.7	92.0
30	31.4	63.8	66.8	67.9	69.0	69.8	70.5	71.7	72.1	72.8	73.4	31.3	63.9	66.9	67.9	69.0	69.8	70.4	71.5	72.0	72.8	73.3
50	20.0	43.7	46.8	48.2	49.3	50.6	51.2	52.4	53.1	54.4	55.1	20.0	43.8	46.7	48.2	49.2	50.6	51.2	52.4	53.1	54.2	54.9
70	10.3	25.4	27.1	28.5	29.6	30.3	31.0	32.1	32.7	33.6	34.0	10.4	25.3	27.2	28.4	29.5	30.2	31.0	32.0	32.7	33.5	34.1
90	2.8	7.2	8.3	9.1	10.1	10.8	10.8	11.5	11.9	12.6	12.9	2.6	7.4	8.4	9.1	10.0	10.6	10.8	11.4	11.8	12.4	12.8
95	1.4	2.7	3.9	4.4	5.3	5.6	5.7	6.5	6.8	7.1	7.1	1.3	2.9	3.8	4.4	5.0	5.4	5.7	6.3	6.6	7.0	7.1
98	0.8	0.5	1.5	1.5	2.1	2.2	2.4	2.7	3.0	3.2	3.4	0.7	0.6	1.4	1.6	2.0	2.1	2.3	2.5	2.8	3.1	3.3
100	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table B7. Raw data of 150-lpi halftone scale exposure series on Kodak Imageset 2000 film at different laser intensity units

Requested	1 st Reading											2nd Reading										
dot area	258	269	281	293	306	320	334	349	364	381	397	258	269	281	293	306	320	334	349	364	381	397
0	53.6	97.1	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	53.9	97.1	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
2	50.2	93.9	97.4	97.8	98.1	98.4	98.7	98.9	99.2	99.3	99.5	50.4	93.8	97.4	97.8	98.1	98.4	98.7	98.9	99.2	99.3	99.5
5	48.6	89.7	93.5	94.2	94.8	95.2	95.7	96.1	96.6	96.9	97.3	48.4	89.6	93.4	94.2	94.8	95.2	95.7	96.2	96.5	96.9	97.3
10	43.2	83.4	87.4	88.3	89.2	89.9	90.5	91.2	91.9	92.4	93.0	43.4	83.4	87.3	88.3	89.2	89.8	90.5	91.3	91.8	92.4	93.0
30	28.9	61.5	65.2	67.1	68.6	69.9	71.0	72.2	73.2	74.4	75.3	28.8	61.3	65.2	67.1	68.6	69.8	70.9	72.3	73.2	74.4	75.2
50	16.9	40.9	44.6	46.9	49.0	50.8	52.0	53.6	55.0	56.4	57.5	16.8	40.9	44.7	47.0	48.9	50.6	52.0	53.6	54.9	56.3	57.4
70	8.5	23.0	25.6	27.6	29.1	30.5	31.6	33.0	34.1	35.1	36.0	8.4	23.1	25.7	27.5	29.0	30.6	31.9	33.0	34.1	35.1	36.0
90	1.3	6.1	7.4	8.7	9.7	10.7	11.1	12.2	12.7	13.5	14.1	1.1	6.1	7.8	8.8	10.1	10.7	11.3	12.1	12.6	13.7	14.2
95	0.0	2.1	3.1	4.0	5.0	5.5	5.6	6.6	7.0	7.7	7.9	0.0	2.2	3.4	4.1	4.9	5.4	6.0	6.7	7.3	7.8	8.1
98	0.0	0.2	0.9	1.4	1.9	2.4	2.3	2.9	3.3	3.6	3.9	0.0	0.3	1.2	1.5	2.0	2.5	2.4	2.8	3.6	3.8	4.1
100	0.0	0.0	0.0	0.0	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Requested	3 rd Reading											Average dot area										
dot area	258	269	281	293	306	320	334	349	364	381	397	258	269	281	293	306	320	334	349	364	381	397
0	53.9	97.1	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	53.8	97.1	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
2	50.3	93.7	97.4	97.8	98.1	98.4	98.6	98.9	99.2	99.3	99.6	50.3	93.8	97.4	97.8	98.1	98.4	98.7	98.9	99.2	99.3	99.5
5	48.5	89.6	93.4	94.1	94.8	95.2	95.6	96.2	96.5	96.9	97.3	48.5	89.6	93.4	94.2	94.8	95.2	95.7	96.2	96.5	96.9	97.3
10	43.5	83.3	87.3	88.3	89.2	89.9	90.5	91.3	91.9	92.4	93.0	43.4	83.4	87.3	88.3	89.2	89.9	90.5	91.3	91.9	92.4	93.0
30	29.0	61.3	65.2	67.0	68.6	69.8	70.9	72.2	73.4	74.4	75.1	28.9	61.4	65.2	67.1	68.6	69.8	70.9	72.2	73.3	74.4	75.2
50	16.9	40.9	44.7	46.9	49.1	50.6	52.1	53.6	55.0	56.2	57.5	16.9	40.9	44.7	46.9	49.0	50.7	52.0	53.6	55.0	56.3	57.5
70	8.5	22.9	25.6	27.8	29.1	30.4	31.6	32.9	34.2	35.0	36.0	8.5	23.0	25.6	27.6	29.1	30.5	31.7	33.0	34.1	35.1	36.0
90	1.2	6.0	7.5	8.8	10.1	10.6	11.2	12.3	12.9	13.8	14.3	1.2	6.1	7.6	8.8	10.0	10.7	11.2	12.2	12.7	13.7	14.2
95	0.0	2.0	3.3	4.0	5.1	5.5	6.0	6.7	7.4	8.0	8.2	0.0	2.1	3.3	4.0	5.0	5.5	5.9	6.7	7.2	7.8	8.1
98	0.0	0.0	1.0	1.4	2.1	2.5	2.4	3.2	3.6	4.0	4.2	0.0	0.2	1.0	1.4	2.0	2.5	2.4	3.0	3.5	3.8	4.1
100	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0

Table B8. Raw data of 200-lpi halftone scale exposure series on Kodak Imageset 2000 film at different laser intensity units

Requested	1 st Reading											2nd Reading										
dot area	258	269	281	293	306	320	334	349	364	381	397	258	269	281	293	306	320	334	349	364	381	397
0	54.2	97.4	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	54.3	97.4	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
2	51.0	93.8	96.9	97.5	98.0	98.4	98.7	99.1	99.4	99.6	99.9	50.8	93.6	96.9	97.5	98.0	98.5	98.7	99.1	99.4	99.6	99.9
5	48.1	89.4	92.8	93.8	94.5	95.1	95.6	96.2	96.7	97.2	97.6	48.1	89.5	92.8	93.8	94.5	95.1	95.6	96.2	96.7	97.1	97.6
10	43.6	82.9	86.6	88.0	89.0	90.0	90.8	91.6	92.4	93.2	93.7	43.8	82.9	86.6	87.9	89.0	90.0	90.7	91.6	92.4	93.1	93.7
30	28.6	60.4	64.4	66.7	68.6	70.0	71.4	73.0	74.2	75.4	76.6	28.7	60.4	64.4	66.7	68.5	70.0	71.4	72.9	74.2	75.4	76.5
50	16.3	39.3	43.3	46.3	48.6	50.7	52.3	54.4	56.4	57.8	59.0	16.5	39.3	43.3	46.3	48.5	50.7	52.4	54.4	56.2	57.7	59.0
70	8.1	21.2	24.4	26.9	28.9	30.6	32.1	33.6	35.0	36.5	37.5	8.1	21.2	24.5	26.9	28.7	30.6	32.0	33.5	35.1	36.4	37.8
90	1.5	5.3	7.2	8.8	10.1	11.1	11.6	12.8	13.5	14.3	15.2	1.6	5.6	7.3	8.8	9.8	11.1	11.9	12.8	13.6	14.5	15.4
95	0.6	1.5	2.8	4.0	4.9	5.8	6.1	7.0	7.7	8.3	8.8	0.6	1.8	2.7	4.2	4.9	5.9	6.2	7.1	7.8	8.5	9.1
98	0.3	0.3	0.5	1.1	1.8	2.4	2.5	3.1	3.6	3.9	4.4	0.4	0.3	0.5	1.2	1.7	2.5	2.4	3.3	3.7	4.0	4.7
100	0.0	0.0	0.0	0.4	0.2	0.1	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Requested	3 rd Reading											Average dot area										
dot area	258	269	281	293	306	320	334	349	364	381	397	258	269	281	293	306	320	334	349	364	381	397
0	54.4	97.3	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	54.3	97.4	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
2	51.2	93.6	96.9	97.5	97.9	98.3	98.7	99.1	99.4	99.6	99.9	51.0	93.7	96.9	97.5	98.0	98.4	98.7	99.1	99.4	99.6	99.9
5	48.1	89.3	92.8	93.8	94.5	95.1	95.6	96.2	96.7	97.2	97.6	48.1	89.4	92.8	93.8	94.5	95.1	95.6	96.2	96.7	97.2	97.6
10	43.6	82.9	86.6	87.9	89.0	90.0	90.7	91.6	92.4	93.1	93.8	43.7	82.9	86.6	87.9	89.0	90.0	90.7	91.6	92.4	93.1	93.7
30	28.8	60.3	64.4	66.6	68.4	70.0	71.4	73.0	74.2	75.4	76.6	28.7	60.4	64.4	66.7	68.5	70.0	71.4	73.0	74.2	75.4	76.6
50	16.5	39.1	43.2	46.3	48.6	50.6	52.4	54.6	56.3	57.9	59.0	16.4	39.2	43.3	46.3	48.6	50.7	52.4	54.5	56.3	57.8	59.0
70	8.4	21.1	24.5	27.1	28.9	30.6	32.0	33.8	34.8	36.7	37.8	8.2	21.2	24.5	27.0	28.8	30.6	32.0	33.6	35.0	36.5	37.7
90	1.5	5.3	7.4	9.0	10.0	11.2	11.9	13.1	13.7	14.6	15.3	1.5	5.4	7.3	8.9	10.0	11.1	11.8	12.9	13.6	14.5	15.3
95	0.8	1.4	2.8	4.1	5.0	6.0	6.1	7.3	8.0	8.6	8.9	0.7	1.6	2.8	4.1	4.9	5.9	6.1	7.1	7.8	8.5	8.9
98	0.4	0.0	0.5	1.4	2.0	2.3	2.7	3.5	4.0	4.2	4.5	0.4	0.2	0.5	1.2	1.8	2.4	2.5	3.3	3.8	4.0	4.5
100	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.1

Table B9. Raw data of Velvet-screened scale exposure series on Kodak Imageset 2000 film

Requested	1 st Reading											2nd Reading										
dot area	258	269	281	293	306	320	334	349	364	381	397	258	269	281	293	306	320	334	349	364	381	397
0	54.7	97.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	55.1	97.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
2	51.5	93.2	96.7	97.2	97.6	97.9	98.3	98.6	98.9	99.1	99.4	51.4	93.3	96.6	97.2	97.6	98.0	98.3	98.6	98.9	99.1	99.4
5	46.1	87.8	91.7	93.1	94.2	95.0	95.8	96.7	97.4	98.0	98.6	46.3	87.6	91.6	93.1	94.2	95.0	95.8	96.6	97.4	98.0	98.6
10	38.7	78.5	83.8	86.6	88.8	90.4	91.9	93.6	95.0	96.3	97.4	38.7	78.3	83.7	86.6	88.8	90.3	91.9	93.5	94.9	96.3	97.3
30	18.0	48.9	57.6	63.4	67.8	71.8	75.4	78.9	82.2	85.0	87.7	18.0	48.7	57.6	63.3	67.5	71.8	75.3	78.8	82.1	84.9	87.7
50	6.6	25.0	34.5	42.1	47.5	53.2	57.7	62.1	66.1	69.9	72.8	6.6	25.3	34.3	42.1	47.4	53.0	57.6	62.2	65.9	69.9	72.8
70	2.2	9.9	17.5	23.5	28.1	32.7	36.5	40.1	43.5	46.5	49.4	2.4	9.7	17.8	23.5	27.9	32.5	36.6	39.9	43.5	46.4	49.6
90	0.7	1.4	4.0	6.7	9.0	11.2	12.5	14.6	16.5	17.8	19.5	0.8	1.7	4.2	6.8	8.9	11.0	12.5	14.5	16.4	17.8	19.5
95	0.4	0.7	1.7	3.3	4.4	5.6	6.1	7.2	8.3	9.0	9.8	0.5	0.9	1.8	3.1	4.3	5.6	6.2	7.3	8.6	9.0	9.8
98	0.0	0.3	0.4	1.3	1.6	2.1	2.0	2.7	3.4	3.4	3.6	0.0	0.2	0.7	1.2	1.6	2.2	2.2	2.9	3.5	3.7	3.9
100	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Requested	3 rd Reading											Average dot area										
dot area	258	269	281	293	306	320	334	349	364	381	397	258	269	281	293	306	320	334	349	364	381	397
0	55.1	96.7	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	55.0	96.9	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
2	51.3	93.2	96.6	97.1	97.5	97.9	98.3	98.6	99.0	99.1	99.5	51.4	93.2	96.6	97.2	97.6	97.9	98.3	98.6	98.9	99.1	99.4
5	46.2	87.5	91.7	93.0	94.1	95.0	95.8	96.7	97.5	98.0	98.6	46.2	87.6	91.7	93.1	94.2	95.0	95.8	96.7	97.4	98.0	98.6
10	38.6	78.3	83.8	86.4	88.7	90.3	91.8	93.6	95.0	96.2	97.3	38.7	78.4	83.8	86.5	88.8	90.3	91.9	93.6	95.0	96.3	97.3
30	18.0	48.9	57.6	63.2	67.7	71.7	75.4	78.8	82.1	85.0	87.5	18.0	48.8	57.6	63.3	67.7	71.8	75.4	78.8	82.1	85.0	87.6
50	6.5	25.2	34.4	42.1	47.5	53.3	57.7	62.1	66.0	69.9	72.9	6.6	25.2	34.4	42.1	47.5	53.2	57.7	62.1	66.0	69.9	72.8
70	2.4	10.0	17.5	23.5	28.1	32.7	36.6	40.2	43.5	46.5	49.5	2.3	9.9	17.6	23.5	28.0	32.6	36.6	40.1	43.5	46.5	49.5
90	0.8	1.5	4.0	6.7	9.0	11.3	12.6	14.9	16.4	18.0	19.4	0.8	1.5	4.1	6.7	9.0	11.2	12.5	14.7	16.4	17.9	19.5
95	0.5	0.5	1.8	3.0	4.4	5.6	6.3	7.5	8.2	9.1	9.9	0.5	0.7	1.8	3.1	4.4	5.6	6.2	7.3	8.4	9.0	9.8
98	0.0	0.0	0.6	1.1	1.5	2.2	2.3	3.1	3.1	3.6	3.7	0.0	0.2	0.6	1.2	1.6	2.2	2.2	2.9	3.3	3.6	3.7
100	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table B10. Dot differences from requested dot areas of halftone scales at different exposures on Kodak Imagset 2000 film

Requested	Dot differences from requested of 100-lpi halftone at the exposure of											Dot differences from requested of 150-lpi halftone at the exposure of										
dot area	258	269	281	293	306	320	334	349	364	381	397	258	269	281	293	306	320	334	349	364	381	397
0	-45.5	-2.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-46.2	-2.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	-46.3	-3.4	-0.3	0.0	0.2	0.3	0.5	0.7	0.9	0.9	1.1	-47.7	-4.2	-0.6	-0.2	0.1	0.4	0.7	0.9	1.2	1.3	1.5
5	-44.9	-4.2	-1.0	-0.6	-0.2	0.1	0.4	0.8	1.1	1.3	1.5	-46.5	-5.4	-1.6	-0.8	-0.2	0.2	0.7	1.2	1.5	1.9	2.3
10	-44.6	-4.9	-1.8	-1.1	-0.5	-0.1	0.3	0.8	1.3	1.7	2.0	-46.6	-6.6	-2.7	-1.7	-0.8	-0.1	0.5	1.3	1.9	2.4	3.0
30	-38.7	-6.1	-3.1	-2.1	-1.0	-0.2	0.4	1.5	2.0	2.8	3.3	-41.1	-8.6	-4.8	-2.9	-1.4	-0.2	0.9	2.2	3.3	4.4	5.2
50	-30.0	-6.2	-3.3	-1.8	-0.8	0.6	1.2	2.4	3.1	4.2	4.9	-33.1	-9.1	-5.3	-3.1	-1.0	0.7	2.0	3.6	5.0	6.3	7.5
70	-19.6	-4.7	-2.8	-1.6	-0.5	0.2	1.0	2.0	2.7	3.5	4.1	-21.5	-7.0	-4.4	-2.4	-0.9	0.5	1.7	3.0	4.1	5.1	6.0
90	-7.4	-2.6	-1.6	-0.9	0.0	0.6	0.8	1.4	1.8	2.4	2.8	-8.8	-3.9	-2.4	-1.2	0.0	0.7	1.2	2.2	2.7	3.7	4.2
95	-3.7	-2.1	-1.2	-0.6	0.0	0.4	0.7	1.3	1.6	2.0	2.1	-5.0	-2.9	-1.7	-1.0	0.0	0.5	0.9	1.7	2.2	2.8	3.1
98	-1.3	-1.4	-0.6	-0.4	0.0	0.1	0.3	0.5	0.8	1.1	1.3	-2.0	-1.8	-1.0	-0.6	0.0	0.5	0.4	1.0	1.5	1.8	2.1
100	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0

Requested	Dot differences from requested of 200-lpi halftone at the exposure of											Dot differences from requested of Velvet screen at the exposure of										
dot area	258	269	281	293	306	320	334	349	364	381	397	258	269	281	293	306	320	334	349	364	381	397
0	-45.7	-2.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-45.0	-3.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	-47.0	-4.3	-1.1	-0.5	0.0	0.4	0.7	1.1	1.4	1.6	1.9	-46.6	-4.8	-1.4	-0.8	-0.4	-0.1	0.3	0.6	0.9	1.1	1.4
5	-46.9	-5.6	-2.2	-1.2	-0.5	0.1	0.6	1.2	1.7	2.2	2.6	-48.8	-7.4	-3.3	-1.9	-0.8	0.0	0.8	1.7	2.4	3.0	3.6
10	-46.3	-7.1	-3.4	-2.1	-1.0	0.0	0.7	1.6	2.4	3.1	3.7	-51.3	-11.6	-6.2	-3.5	-1.2	0.3	1.9	3.6	5.0	6.3	7.3
30	-41.3	-9.6	-5.6	-3.3	-1.5	0.0	1.4	3.0	4.2	5.4	6.6	-52.0	-21.2	-12.4	-6.7	-2.3	1.8	5.4	8.8	12.1	15.0	17.6
50	-33.6	-10.8	-6.7	-3.7	-1.4	0.7	2.4	4.5	6.3	7.8	9.0	-43.4	-24.8	-15.6	-7.9	-2.5	3.2	7.7	12.1	16.0	19.9	22.8
70	-21.8	-8.8	-5.5	-3.0	-1.2	0.6	2.0	3.6	5.0	6.5	7.7	-27.7	-20.1	-12.4	-6.5	-2.0	2.6	6.6	10.1	13.5	16.5	19.5
90	-8.5	-4.6	-2.7	-1.1	0.0	1.1	1.8	2.9	3.6	4.5	5.3	-9.2	-8.5	-5.9	-3.3	-1.0	1.2	2.5	4.7	6.4	7.9	9.5
95	-4.3	-3.4	-2.2	-0.9	-0.1	0.9	1.1	2.1	2.8	3.5	3.9	-4.5	-4.3	-3.2	-1.9	-0.6	0.6	1.2	2.3	3.4	4.0	4.8
98	-1.6	-1.8	-1.5	-0.8	-0.2	0.4	0.5	1.3	1.8	2.0	2.5	-2.0	-1.8	-1.4	-0.8	-0.4	0.2	0.2	0.9	1.3	1.6	1.7
100	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table B11. Dot areas on halftone scales at the exposure where 50% tints of all halftone scales reproduced as close 50% as possible on Kodak PagiSet film (Laser intensity of 285 units)

Requested	Reproduced dot area (100 lpi)				Reproduced dot area (150 lpi)				Reproduced dot area (200 lpi)				Reproduced dot area (Velvet)			
dot area	#1	#2	#3	Ave.	#1	#2	#3	Ave.	#1	#2	#3	Ave.	#1	#2	#3	Ave.
0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
2	98.4	98.4	98.4	98.4	98.5	98.5	98.5	98.5	98.5	98.5	98.5	98.5	98.1	98.1	98.1	98.1
5	95.3	95.3	95.4	95.3	95.4	95.5	95.5	95.5	95.3	95.4	95.3	95.3	95.4	95.5	95.5	95.5
10	90.2	90.2	90.2	90.2	90.3	90.2	90.2	90.2	90.4	90.5	90.4	90.4	91.1	91.1	91.1	91.1
30	70.1	70.1	70.2	70.1	70.1	70.1	70.1	70.1	70.2	70.0	70.0	70.1	71.7	71.4	71.5	71.5
50	50.3	50.3	50.1	50.2	50.4	50.6	50.4	50.5	50.0	49.9	50.0	50.0	50.1	50.1	50.1	50.1
70	30.2	30.2	30.1	30.2	30.1	30.0	30.0	30.0	29.6	29.6	29.6	29.6	28.4	28.3	28.4	28.4
90	10.0	10.0	10.2	10.1	10.5	10.2	10.4	10.4	10.0	9.6	10.0	9.9	8.6	8.6	8.6	8.6
95	5.0	5.0	5.0	5.0	5.2	5.0	5.1	5.1	4.7	4.7	4.7	4.7	4.2	4.4	4.4	4.3
98	2.2	2.2	2.2	2.2	1.8	1.8	1.8	1.8	1.4	1.7	1.6	1.6	1.7	1.5	1.6	1.6
100	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table B12. Dot areas on halftone scales at the exposure where 50% tints of all halftone scales reproduced as close 50% as possible on Kodak Imageset 2000 film (Laser intensity of 313 units)

Requested	Reproduced dot area (100 lpi)				Reproduced dot area (150 lpi)				Reproduced dot area (200 lpi)				Reproduced dot area (Velvet)			
dot area	#1	#2	#3	Ave.	#1	#2	#3	Ave.	#1	#2	#3	Ave.	#1	#2	#3	Ave.
0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
2	98.2	98.2	98.2	98.2	98.3	98.3	98.3	98.3	98.1	98.1	98.1	98.1	97.8	97.8	97.8	97.8
5	95.0	95.0	95.0	95.0	95.0	95.0	95.0	95.0	94.8	94.8	94.8	94.8	94.7	94.6	94.6	94.6
10	89.8	89.7	89.7	89.7	89.6	89.5	89.6	89.6	89.6	89.5	89.5	89.5	89.6	89.6	89.6	89.6
30	69.4	69.7	69.5	69.5	69.3	69.3	69.3	69.3	69.3	69.4	69.3	69.3	69.8	69.8	69.8	69.8
50	50.0	50.1	50.0	50.0	49.9	49.9	49.9	49.9	49.7	49.8	49.7	49.7	50.1	50.1	50.1	50.1
70	29.8	30.2	30.1	30.0	29.9	30.1	30.0	30.0	29.7	30.1	29.9	29.9	30.5	30.5	30.5	30.5
90	10.2	10.7	10.6	10.5	10.3	10.5	10.4	10.4	10.4	10.7	10.6	10.6	10.4	10.2	10.3	10.3
95	5.1	5.4	5.3	5.3	5.4	5.6	5.5	5.5	5.2	5.4	5.3	5.3	4.9	5.4	5.3	5.2
98	2.1	2.3	2.2	2.2	2.1	2.3	2.3	2.2	2.1	2.3	2.3	2.2	2.3	2.6	2.4	2.4
100	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

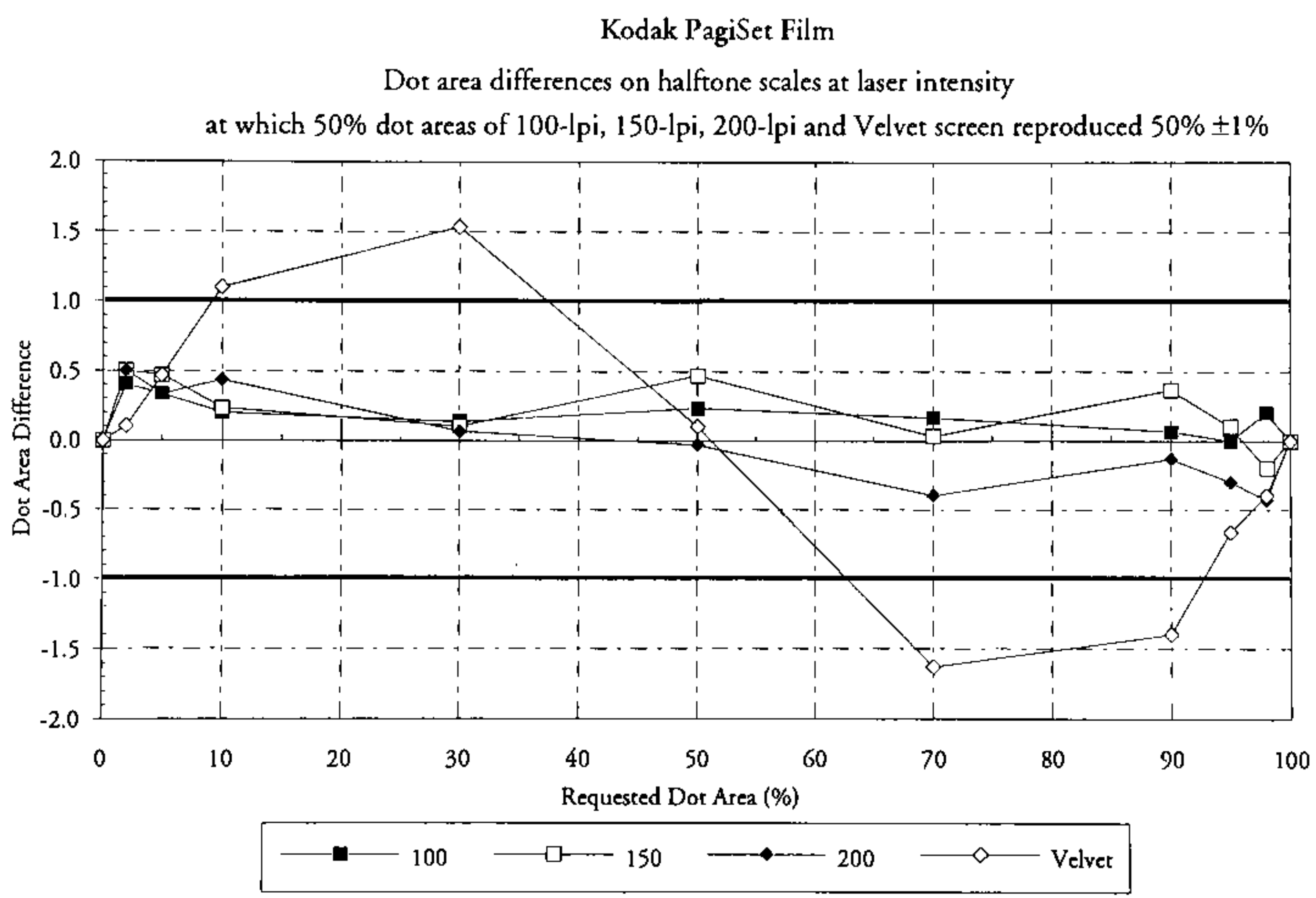


Figure B1. Dot area differences at the exposure where 50% tint reproduced as close 50% as possible on PagiSet film

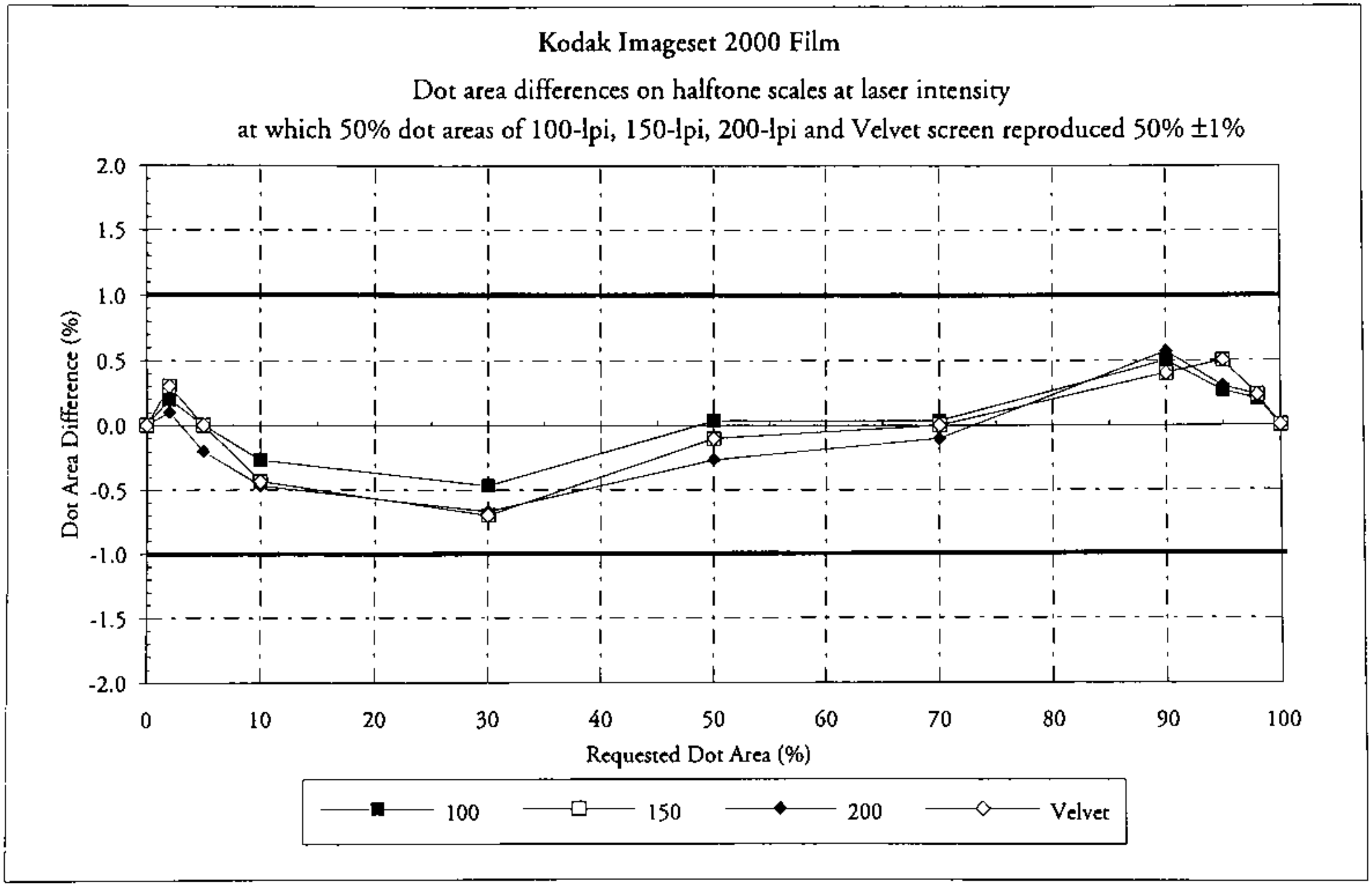


Figure B2. Dot area differences at the exposure where 50% tint reproduced as close 50% as possible on Imageset 2000 film

Table B13. Dot areas on halftone scales at the exposure where the density of 1x1 checkerboards matched that of 50% reference tints on Kodak PagiSet film (Laser intensity of 287 units)

Requested dot area	Reproduced dot area (100 lpi)				Reproduced dot area (150 lpi)				Reproduced dot area (200 lpi)				Reproduced dot area (Velvet)			
	#1	#2	#3	Ave.	#1	#2	#3	Ave.	#1	#2	#3	Ave.	#1	#2	#3	Ave.
0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
2	98.4	98.4	98.5	98.4	98.6	98.6	98.6	98.6	98.6	98.6	98.5	98.6	98.2	98.2	98.2	98.2
5	95.4	95.4	95.5	95.4	95.5	95.6	95.5	95.5	95.4	95.5	95.4	95.4	95.6	95.7	95.7	95.7
10	90.2	90.2	90.3	90.2	90.3	90.3	90.3	90.3	90.5	90.6	90.6	90.6	91.4	91.5	91.4	91.4
30	70.1	70.1	70.1	70.1	70.2	70.2	70.2	70.2	70.3	70.4	70.3	70.3	72.0	72.1	72.0	72.0
50	50.3	50.3	50.5	50.4	50.4	50.5	50.4	50.4	50.3	50.3	50.3	50.3	50.8	50.9	50.8	50.8
70	30.1	30.1	30.3	30.2	29.9	30.0	30.0	30.0	29.8	29.9	29.9	29.9	28.7	28.7	28.7	28.7
90	10.2	10.2	10.6	10.3	10.0	10.1	10.0	10.0	10.0	10.0	10.0	10.0	8.6	8.8	8.8	8.7
95	5.2	5.2	5.3	5.2	4.8	4.9	4.9	4.9	4.9	4.7	4.7	4.8	4.4	4.4	4.4	4.4
98	1.9	1.9	1.8	1.9	1.8	1.9	1.9	1.9	1.7	1.8	1.8	1.8	1.7	1.8	1.8	1.8
100	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table B14. Dot areas on halftone scales at the exposure where the density of 1x1 checkerboards matched that of 50% reference tints on Kodak Imagset 2000 film (Laser intensity of 320 units)

Requested dot area	Reproduced dot area (100 lpi)				Reproduced dot area (150 lpi)				Reproduced dot area (200 lpi)				Reproduced dot area (Velvet)			
	#1	#2	#3	Ave.	#1	#2	#3	Ave.	#1	#2	#3	Ave.	#1	#2	#3	Ave.
0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
2	98.3	98.3	98.3	98.3	98.4	98.4	98.4	98.4	98.4	98.5	98.3	98.4	97.9	98.0	97.9	97.9
5	95.1	95.2	95.1	95.1	95.2	95.2	95.2	95.2	95.1	95.1	95.1	95.1	95.0	95.0	95.0	95.0
10	89.9	89.8	89.9	89.9	89.9	89.8	89.9	89.9	90.0	90.0	90.0	90.0	90.4	90.3	90.3	90.3
30	70.0	69.7	69.8	69.8	69.9	69.8	69.8	69.8	70.0	70.0	70.0	70.0	71.8	71.8	71.7	71.8
50	50.6	50.6	50.6	50.6	50.8	50.6	50.6	50.7	50.7	50.7	50.6	50.7	53.2	53.0	53.3	53.2
70	30.1	30.3	30.3	30.2	30.5	30.6	30.4	30.5	30.6	30.6	30.6	30.6	32.7	32.5	32.7	32.6
90	10.4	10.6	10.8	10.6	10.7	10.7	10.6	10.7	11.1	11.1	11.2	11.1	11.2	11.0	11.3	11.2
95	5.2	5.3	5.6	5.4	5.5	5.4	5.5	5.5	5.8	5.9	6.0	5.9	5.6	5.6	5.6	5.6
98	2.1	2.1	2.2	2.1	2.4	2.5	2.5	2.5	2.4	2.5	2.3	2.4	2.1	2.2	2.2	2.2
100	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

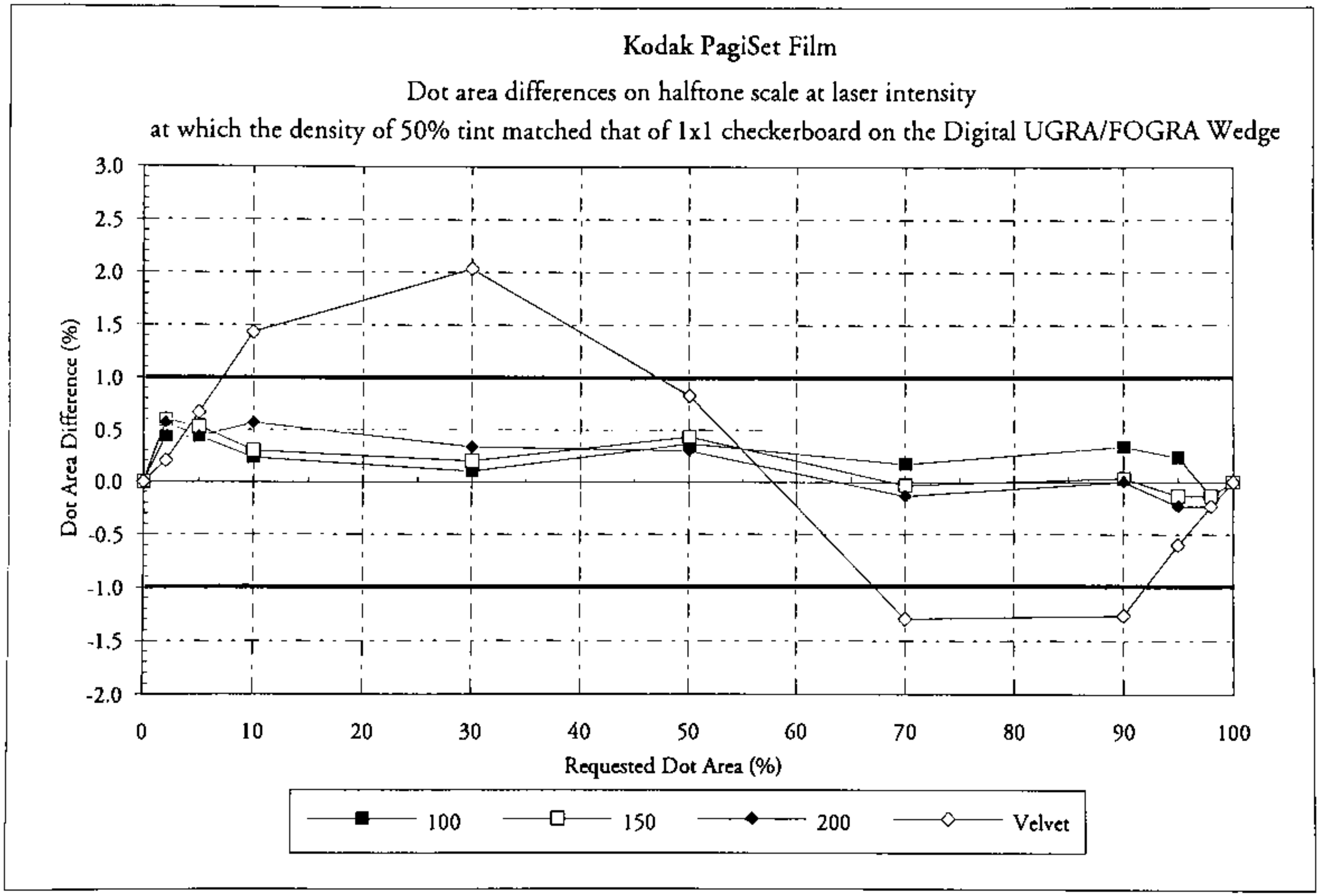


Figure B3. Dot area differences at the exposure where the density of 1x1 checkerboard matched that of 50% reference tint on PagiSet film

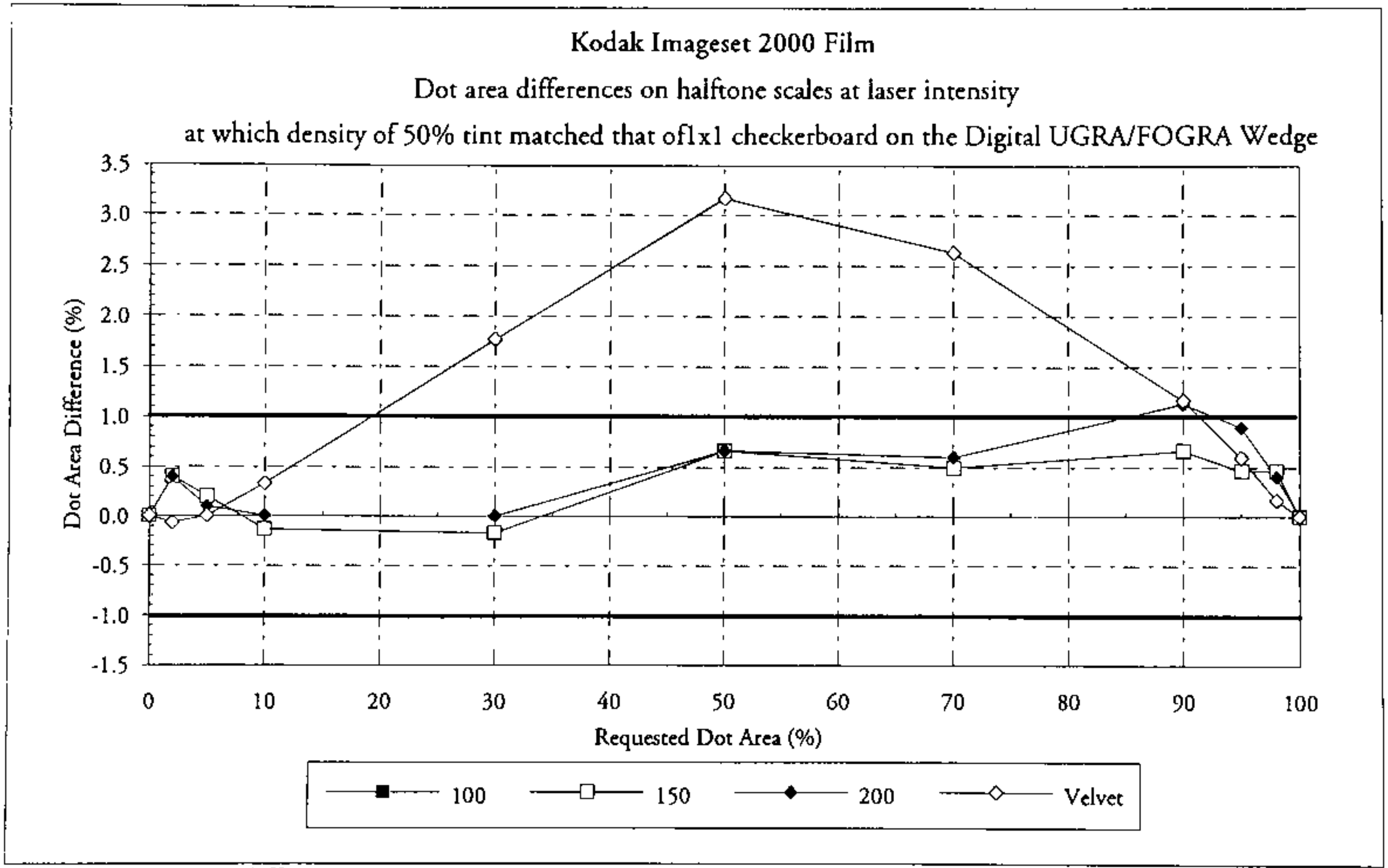


Figure B4. Dot area differences at the exposure where the density of 1x1 checkerboard matched that of 50% reference tint on Imageset 2000 film

Table B15. Dot area differences when the 50% tints on halftone scales reproduced as close 50% as possible

Requested	PagiSet (285 units)				Imageset 2000 (313 units)			
dot area	100 lpi	150 lpi	200 lpi	Velvet	100 lpi	150 lpi	200 lpi	Velvet
0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.4	0.5	0.5	0.1	0.2	0.3	0.1	0.3
5	0.3	0.5	0.3	0.5	0.0	0.0	-0.2	0.0
10	0.2	0.2	0.4	1.1	-0.3	-0.4	-0.5	-0.4
30	0.1	0.1	0.1	1.5	-0.5	-0.7	-0.7	-0.7
50	0.2	0.5	0.0	0.1	0.0	-0.1	-0.3	-0.1
70	0.2	0.0	-0.4	-1.6	0.0	0.0	-0.1	0.0
90	0.1	0.4	-0.1	-1.4	0.5	0.4	0.6	0.4
95	0.0	0.1	-0.3	-0.7	0.3	0.5	0.3	0.5
98	0.2	-0.2	-0.4	-0.4	0.2	0.2	0.2	0.2
100	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table B16. Dot area differences when the density of 1x1 checkerboard matched that of 50% reference tint

Requested	PagiSet (287 units)				Imageset 2000 (320 units)			
dot area	100 lpi	150 lpi	200 lpi	Velvet	100 lpi	150 lpi	200 lpi	Velvet
0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.4	0.6	0.6	0.2	0.4	0.4	0.4	-0.1
5	0.4	0.5	0.4	0.7	0.2	0.2	0.1	0.0
10	0.2	0.3	0.6	1.4	-0.1	-0.1	0.0	0.3
30	0.1	0.2	0.3	2.0	-0.2	-0.2	0.0	1.8
50	0.4	0.4	0.3	0.8	0.7	0.7	0.7	3.2
70	0.2	0.0	-0.1	-1.3	0.5	0.5	0.6	2.6
90	0.3	0.0	0.0	-1.3	0.7	0.7	1.1	1.2
95	0.2	-0.1	-0.2	-0.6	0.5	0.5	0.9	0.6
98	-0.1	-0.1	-0.2	-0.2	0.5	0.5	0.4	0.2
100	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table B17. Dot area differences of 50% tint at different laser intensity units

PagiSet Film

Laser unit	Rel. log E	Dot difference from 50%			
		100lpi	150 lpi	200 lpi	Velvet
233	-0.33	-13.6	-15.2	-16.2	-23.2
244	-0.25	-7.3	-8.8	-9.8	-16.7
255	-0.18	-3.0	-3.9	-4.7	-10.3
266	-0.11	-0.8	-1.6	-2.2	-5.6
278	-0.04	0.1	-0.5	-0.5	-1.8
285	0.00	0.2	0.5	0.0	0.1
290	0.03	0.7	0.7	0.7	1.9
303	0.10	1.2	1.7	1.8	4.9
316	0.17	1.9	2.6	2.9	7.6
330	0.24	2.2	3.4	4.0	11.4
345	0.31	3.4	4.7	5.7	14.8
360	0.38	3.8	5.6	7.1	18.0

Imageset 2000 Film

Laser unit	Rel. log E	Dot difference from 50%			
		100lpi	150 lpi	200 lpi	Velvet
258	-0.31	-30.0	-33.1	-33.6	-43.4
269	-0.24	-6.2	-9.1	-10.8	-24.8
281	-0.17	-3.3	-5.3	-6.7	-15.6
293	-0.11	-1.8	-3.1	-3.7	-7.9
306	-0.04	-0.8	-1.0	-1.4	-2.5
313	0.00	0.0	-0.1	-0.3	-0.1
320	0.04	0.6	0.7	0.7	3.2
334	0.10	1.2	2.0	2.4	7.7
349	0.18	2.4	3.6	4.5	12.1
364	0.24	3.1	5.0	6.3	16.0
381	0.32	4.2	6.3	7.8	19.9
397	0.38	4.9	7.5	9.0	22.8

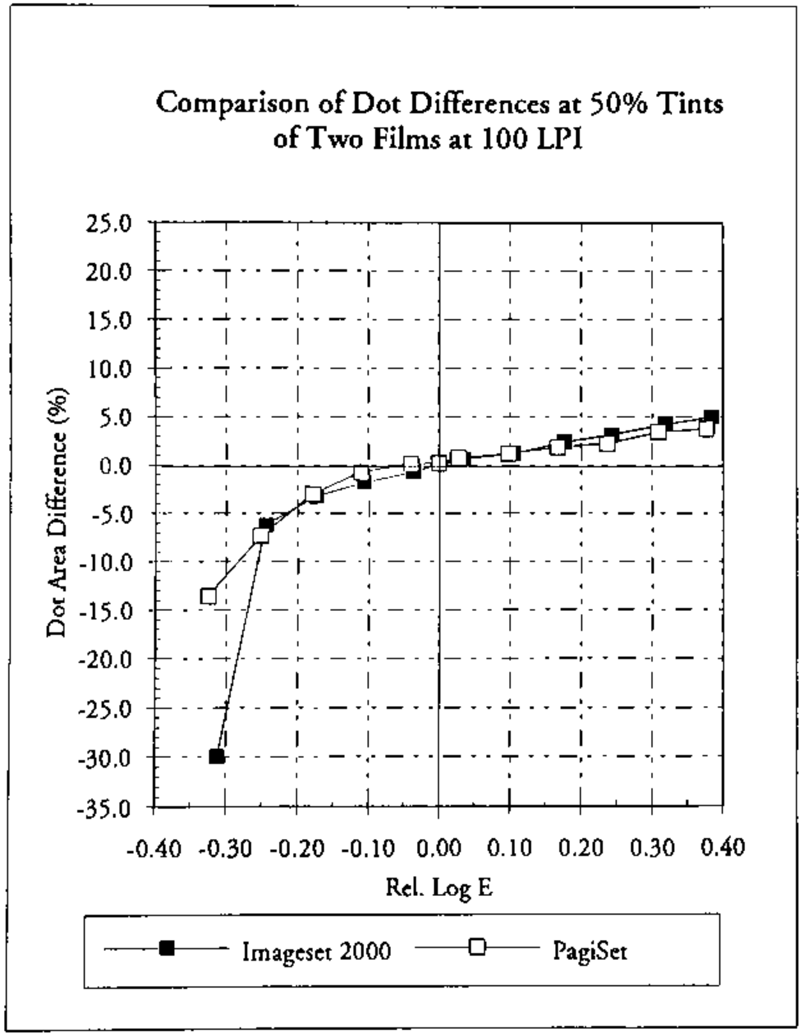


Figure B5. Dot area differences on 100-lpi, 50% tint as a function of exposure

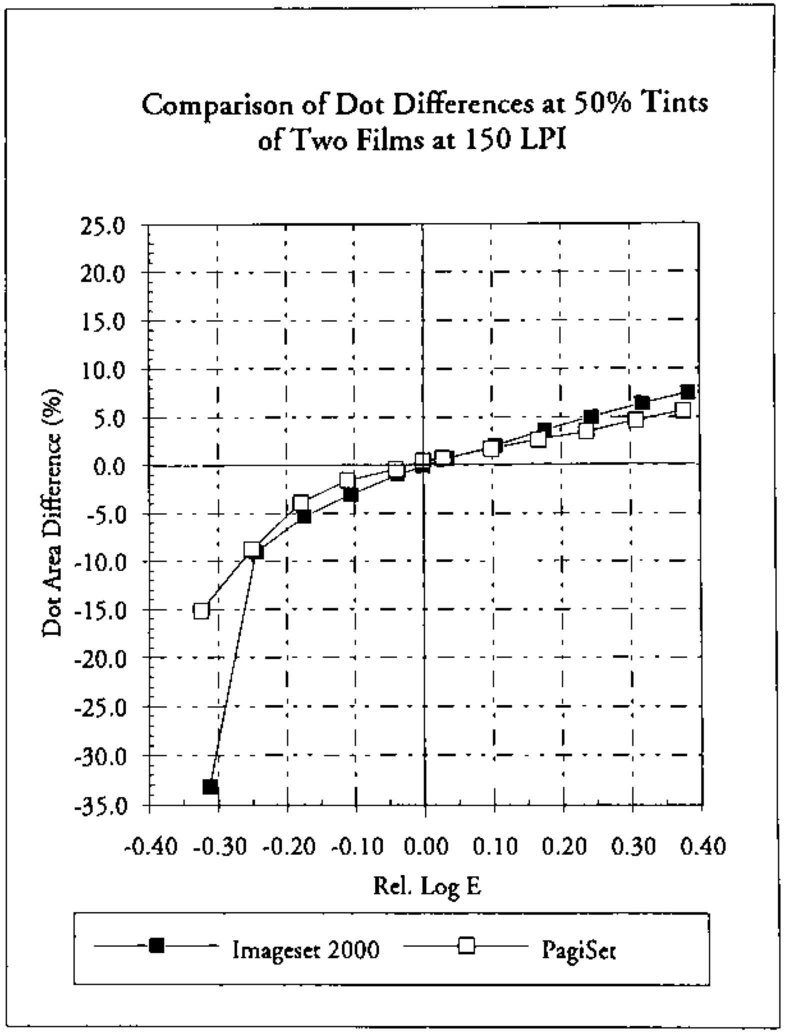


Figure B6. Dot area differences on 150-lpi, 50% tint as a function of exposure

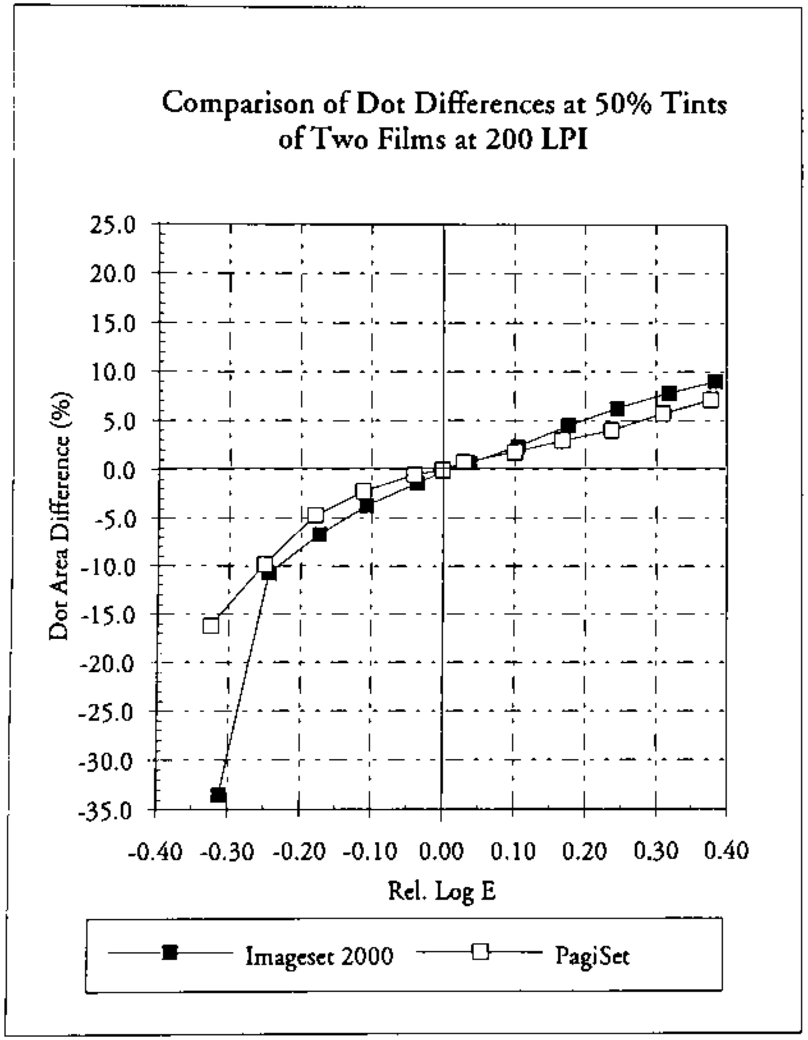


Figure B7. Dot area differences on 200-lpi, 50% tint as a function of exposure

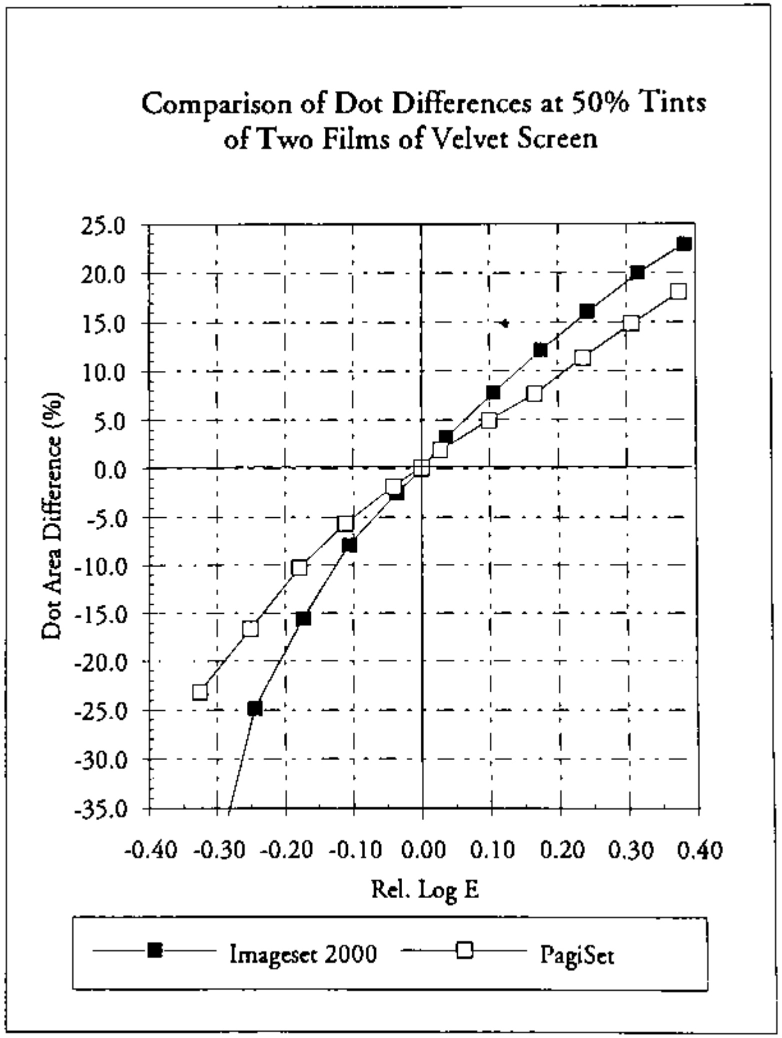
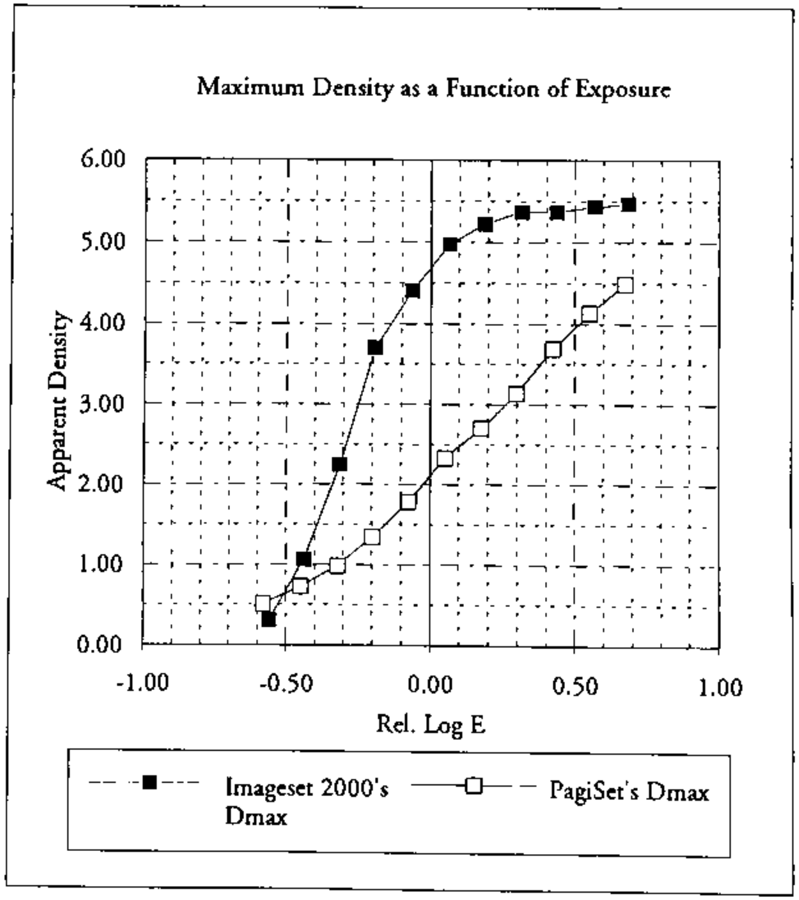


Figure B8. Dot area differences on 50% Velvet screen as a function of exposure

Table B18. Maximum and minimum densities of solid and clear ares at different exposures

Kodak Imageset 2000 FIlm				Kodak PagiSet FIlm			
Exp. unit	Rel. log exp.	Dmax	Dmin	Exp. unit	Rel. log exp.	Dmax	Dmin
258	-0.56	0.30	0.02	233	-0.58	0.51	0.02
269	-0.44	1.06	0.03	244	-0.45	0.72	0.02
281	-0.31	2.24	0.03	255	-0.32	0.98	0.02
293	-0.19	3.70	0.02	266	-0.20	1.34	0.02
306	-0.07	4.40	0.02	278	-0.07	1.78	0.02
320	0.06	4.97	0.03	290	0.05	2.33	0.02
334	0.19	5.22	0.02	303	0.18	2.70	0.02
349	0.31	5.37	0.02	316	0.30	3.14	0.02
364	0.44	5.37	0.03	330	0.42	3.69	0.02
381	0.57	5.43	0.03	345	0.55	4.13	0.02
397	0.69	5.46	0.03	360	0.67	4.49	0.02

Figure B9. Density of solid area as a function of exposure



Appendix C

C (1) The RIT Digital Output Resolution Tester Exposure Series Data

C (2) Edge Movement, the Frieser's Coefficient (k), and MTF Calculations

Appendix C (1)

The RIT Digital Output Resolution Tester Exposure Series Data

Table C(1)-1. Reproduced dot areas of test elements on the RIT Digital Output Resolution Tester on Kodak PagiSet film

Laser Intensity of : 233

Test	Test	Dot Area Reading				Test	Dot Area Reading				Test	Dot Area Reading			
Pattern	Elem.	#1	#2	#3	Ave.	Elem.	#1	#2	#3	Ave.	Elem.	#1	#2	#3	Ave.
Tint	25%	54.5	54.7	54.8	54.7	50%	33.4	33.7	33.8	33.6	75%	15.5	15.5	15.6	15.5
Checker-	1x3	43.3	43.6	43.7	43.5	1x1	13.0	13.2	13.4	13.2	3x1	3.6	3.8	3.8	3.7
boards	2x6	48.6	48.8	49.0	48.8	2x2	20.8	20.9	21.4	21.0	6x2	8.7	9.0	8.9	8.9
	3x9	51.2	51.4	51.5	51.4	3x3	25.3	25.6	26.0	25.6	9x3	11.5	11.7	11.7	11.6
	4x12	52.4	52.7	52.7	52.6	4x4	27.8	28.2	28.3	28.1	12x4	13.1	13.4	13.3	13.3
Cross-scan	1x3	46.6	46.8	47.1	46.8	1x1	16.3	16.4	16.6	16.4	3x1	6.9	7.4	7.3	7.2
Lines	2x6	51.2	51.5	51.6	51.4	2x2	25.4	25.8	25.9	25.7	6x2	12.1	12.5	12.4	12.3
	3x9	53.5	53.7	54.0	53.7	3x3	29.9	30.0	30.2	30.0	9x3	14.2	14.5	14.4	14.4
	4x12	54.4	54.7	54.9	54.7	4x4	31.4	31.7	31.9	31.7	12x4	15.5	15.7	15.7	15.6
Scan Lines	1x3	49.1	49.3	49.5	49.3	1x1	21.7	22.0	22.1	21.9	3x1	9.5	9.7	9.7	9.6
	2x6	52.6	52.9	53.2	52.9	2x2	28.2	28.5	28.8	28.5	6x2	13.9	14.1	14.0	14.0
	3x9	54.2	54.6	54.8	54.5	3x3	31.3	31.7	31.6	31.5	9x3	15.4	15.6	15.5	15.5
	4x12	54.9	55.2	55.4	55.2	4x4	33.0	33.1	33.4	33.2	12x4	16.1	16.3	16.3	16.2
UGRA/						50%	33.0	33.4	33.6	33.3					
FOGRA						1x1	12.7	13.0	13.1	12.9					
PS Control						2x2	20.6	20.6	21.4	20.9					
Strip						4x4	27.8	27.9	28.0	27.9					

Laser Intensity of : 244

Test	Test	Dot Area Reading				Test	Dot Area Reading				Test	Dot Area Reading			
Pattern	Elem.	#1	#2	#3	Ave.	Elem.	#1	#2	#3	Ave.	Elem.	#1	#2	#3	Ave.
Tint	25%	64.0	64.1	64.2	64.1	50%	39.6	39.9	39.9	39.8	75%	18.6	18.7	18.7	18.7
Checker-	1x3	55.7	55.8	55.8	55.8	1x1	19.1	19.2	19.2	19.2	3x1	5.2	5.4	5.4	5.3
boards	2x6	59.4	59.5	59.5	59.5	2x2	27.7	27.8	27.8	27.8	6x2	11.4	11.6	11.5	11.5
	3x9	61.3	61.5	61.4	61.4	3x3	32.0	32.3	32.3	32.2	9x3	14.5	14.6	14.5	14.5
	4x12	62.3	62.3	62.4	62.3	4x4	34.5	34.7	34.7	34.6	12x4	16.2	16.4	16.3	16.3
Cross-scan	1x3	56.7	56.9	56.8	56.8	1x1	23.2	23.2	23.2	23.2	3x1	9.6	9.6	9.6	9.6
Lines	2x6	61.2	61.1	61.2	61.2	2x2	32.2	32.5	32.5	32.4	6x2	15.3	15.6	15.6	15.5
	3x9	63.1	63.2	63.2	63.2	3x3	36.2	36.5	36.5	36.4	9x3	17.5	17.7	17.6	17.6
	4x12	64.0	64.0	64.0	64.0	4x4	37.8	38.1	38.1	38.0	12x4	18.6	18.8	18.7	18.7
Scan Lines	1x3	59.6	59.9	59.9	59.8	1x1	29.0	29.2	29.2	29.1	3x1	13.1	13.2	13.2	13.2
	2x6	62.5	62.7	62.7	62.6	2x2	35.6	35.8	35.8	35.7	6x2	17.3	17.4	17.5	17.4
	3x9	63.8	63.8	63.9	63.8	3x3	38.0	38.3	38.3	38.2	9x3	18.7	18.8	18.7	18.7
	4x12	64.7	64.6	64.7	64.7	4x4	39.4	39.6	39.6	39.5	12x4	19.5	19.7	19.8	19.7
UGRA/						50%	39.7	40.0	40.0	39.9					
FOGRA						1x1	18.6	19.0	19.0	18.9					
PS Control						2x2	27.9	28.1	28.1	28.0					
Strip						4x4	34.4	34.7	34.7	34.6					

Table C(1)-1 (continued). Reproduced dot areas of test elements on the RIT Digital Output Resolution Tester on Kodak PagiSet film

Laser Intensity of : 255

Test Pattern	Test Elem.	Dot Area Reading #1	#2	#3	Ave.	Test Elem.	Dot Area Reading #1	#2	#3	Ave.	Test Elem.	Dot Area Reading #1	#2	#3	Ave.
Tint	25%	70.4	70.8	70.8	70.7	50%	44.6	44.7	44.8	44.7	75%	21.7	21.8	21.8	21.8
Checker-boards	1x3	66.4	66.6	66.7	66.6	1x1	26.2	26.3	26.4	26.3	3x1	7.6	7.9	7.8	7.8
	2x6	67.3	67.6	67.6	67.5	2x2	34.2	34.5	34.5	34.4	6x2	14.6	14.8	14.8	14.7
	3x9	68.5	68.8	68.7	68.7	3x3	38.0	38.3	38.3	38.2	9x3	17.6	17.8	17.7	17.7
	4x12	69.1	69.3	69.2	69.2	4x4	40.1	40.4	40.3	40.3	12x4	19.1	19.3	19.3	19.2
Cross-scan Lines	1x3	65.0	65.4	65.3	65.2	1x1	30.1	30.2	30.2	30.2	3x1	13.2	13.6	13.4	13.4
	2x6	68.0	68.2	68.2	68.1	2x2	38.4	38.5	38.5	38.5	6x2	18.8	19.0	19.0	18.9
	3x9	69.7	69.9	69.8	69.8	3x3	41.7	42.1	42.0	41.9	9x3	20.3	20.6	20.5	20.5
	4x12	70.2	70.6	70.4	70.4	4x4	43.2	43.4	43.4	43.3	12x4	21.1	21.4	21.3	21.3
Scan Lines	1x3	67.7	68.0	67.9	67.9	1x1	36.8	36.7	36.8	36.8	3x1	16.4	16.5	16.5	16.5
	2x6	69.2	69.6	69.5	69.4	2x2	41.2	41.4	41.4	41.3	6x2	20.4	20.6	20.6	20.5
	3x9	70.4	70.8	70.6	70.6	3x3	43.5	43.9	43.7	43.7	9x3	21.6	21.7	21.6	21.6
	4x12	71.0	71.3	71.3	71.2	4x4	44.9	45.2	45.0	45.0	12x4	22.4	22.5	22.5	22.5
UGRA/ FOGRA PS Control Strip						50%	44.4	44.6	44.6	44.5					
						1x1	25.4	25.4	25.4	25.4					
						2x2	33.9	34.1	34.0	34.0					
						4x4	40.0	40.3	40.1	40.1					

Laser Intensity of : 266

Test Pattern	Test Elem.	Dot Area Reading #1	#2	#3	Ave.	Test Elem.	Dot Area Reading #1	#2	#3	Ave.	Test Elem.	Dot Area Reading #1	#2	#3	Ave.
Tint	25%	73.1	73.2	73.4	73.2	50%	47.5	47.2	47.1	47.3	75%	22.8	22.7	22.6	22.7
Checker-boards	1x3	75.4	75.5	75.6	75.5	1x1	35.1	35.1	35.1	35.1	3x1	10.2	10.3	10.4	10.3
	2x6	72.5	72.6	72.7	72.6	2x2	40.5	40.6	40.6	40.6	6x2	17.2	17.6	17.8	17.5
	3x9	72.4	72.6	72.6	72.5	3x3	42.9	42.9	42.8	42.9	9x3	19.7	20.0	20.1	19.9
	4x12	72.4	72.5	72.6	72.5	4x4	44.2	44.1	44.2	44.2	12x4	21.1	21.2	21.3	21.2
Cross-scan Lines	1x3	70.4	70.5	70.6	70.5	1x1	37.9	38.0	38.1	38.0	3x1	16.6	16.8	16.8	16.7
	2x6	71.3	71.4	71.5	71.4	2x2	42.9	43.1	43.1	43.0	6x2	20.9	21.1	21.2	21.1
	3x9	72.4	72.5	72.6	72.5	3x3	45.1	45.2	45.2	45.2	9x3	22.0	21.9	22.1	22.0
	4x12	72.7	72.9	73.0	72.9	4x4	45.9	46.1	46.1	46.0	12x4	22.6	22.9	22.7	22.7
Scan Lines	1x3	72.4	72.5	72.6	72.5	1x1	43.1	43.1	43.2	43.1	3x1	19.3	19.3	19.3	19.3
	2x6	72.4	72.4	72.4	72.4	2x2	45.3	45.4	45.4	45.4	6x2	22.0	22.2	22.2	22.1
	3x9	72.9	73.1	73.1	73.0	3x3	46.4	46.6	46.5	46.5	9x3	23.0	23.0	23.2	23.1
	4x12	73.2	73.3	73.4	73.3	4x4	47.1	47.3	47.3	47.2	12x4	23.3	23.4	23.5	23.4
UGRA/ FOGRA PS Control Strip						50%	47.0	47.2	47.3	47.2					
						1x1	34.0	34.2	34.1	34.1					
						2x2	40.3	40.6	40.5	40.5					
						4x4	44.2	44.2	44.3	44.2					

Table C(1)-1 (continued). Reproduced dot areas of test elements on the RIT Digital Output Resolution Tester on Kodak PagiSet film

Laser Intensity of : 278

Test Pattern	Test Elem.	Dot Area Reading #1	#2	#3	Ave.	Test Elem.	Dot Area Reading #1	#2	#3	Ave.	Test Elem.	Dot Area Reading #1	#2	#3	Ave.
Tint	25%	74.4	74.4	74.5	74.4	50%	48.3	48.5	48.6	48.5	75%	23.7	23.7	23.8	23.7
Checker- boards	1x3	82.6	82.6	82.7	82.6	1x1	45.1	45.3	45.4	45.3	3x1	13.9	14.0	14.0	14.0
	2x6	76.2	76.3	76.3	76.3	2x2	46.6	46.9	47.0	46.8	6x2	19.9	19.8	19.8	19.8
	3x9	74.7	74.9	74.9	74.8	3x3	47.1	47.2	47.3	47.2	9x3	21.7	21.6	21.6	21.6
	4x12	74.2	74.4	74.4	74.3	4x4	47.3	47.5	47.5	47.4	12x4	22.6	22.6	22.6	22.6
Cross-scan Lines	1x3	74.4	74.7	74.7	74.6	1x1	45.9	46.1	46.1	46.0	3x1	20.5	20.5	20.5	20.5
	2x6	73.2	73.4	73.5	73.4	2x2	46.6	46.8	46.9	46.8	6x2	22.9	22.9	23.0	22.9
	3x9	73.7	73.9	74.0	73.9	3x3	47.6	47.8	47.8	47.7	9x3	23.4	23.3	23.3	23.3
	4x12	73.8	74.0	74.0	73.9	4x4	47.7	47.9	47.9	47.8	12x4	23.7	23.7	23.7	23.7
Scan Lines	1x3	75.5	75.9	75.9	75.8	1x1	49.2	49.4	49.4	49.3	3x1	22.2	22.2	22.2	22.2
	2x6	73.9	74.1	74.1	74.0	2x2	48.1	48.4	48.4	48.3	6x2	23.7	23.8	23.8	23.8
	3x9	74.0	74.3	74.5	74.3	3x3	48.3	48.5	48.5	48.4	9x3	24.1	24.0	24.0	24.0
	4x12	74.1	74.3	74.4	74.3	4x4	48.5	48.7	48.9	48.7	12x4	24.4	24.5	24.4	24.4
UGRA/ FOGRA PS Control Strip						50%	48.6	48.7	48.7	48.7					
						1x1	43.5	43.7	43.6	43.6					
						2x2	45.9	46.2	46.2	46.1					
						4x4	47.1	47.3	47.4	47.3					

Laser Intensity of : 285

Test Pattern	Test Elem.	Dot Area Reading #1	#2	#3	Ave.	Test Elem.	Dot Area Reading #1	#2	#3	Ave.	Test Elem.	Dot Area Reading #1	#2	#3	Ave.
Tint	25%	74.9	75.1	75.0	75.0	50%	49.3	49.4	49.4	49.4	75%	24.2	24.1	24.1	24.1
Checker- boards	1x3	85.9	85.9	86.0	85.9	1x1	51.0	51.3	51.1	51.1	3x1	15.5	15.6	15.5	15.5
	2x6	78.0	78.1	78.0	78.0	2x2	50.0	50.2	50.0	50.1	6x2	21.3	21.4	21.4	21.4
	3x9	76.0	76.2	76.2	76.1	3x3	49.3	49.4	49.3	49.3	9x3	22.6	22.6	22.6	22.6
	4x12	75.2	75.3	75.2	75.2	4x4	49.0	49.1	49.0	49.0	12x4	23.4	23.3	23.3	23.3
Cross-scan Lines	1x3	76.9	77.0	77.0	77.0	1x1	50.7	50.8	50.7	50.7	3x1	22.5	22.5	22.5	22.5
	2x6	74.4	74.4	74.4	74.4	2x2	48.8	48.6	48.6	48.7	6x2	23.6	23.9	23.8	23.8
	3x9	74.4	74.6	74.6	74.5	3x3	49.0	49.2	49.1	49.1	9x3	23.8	23.9	23.8	23.8
	4x12	74.5	74.6	74.6	74.6	4x4	48.9	49.0	49.0	49.0	12x4	24.0	24.2	24.2	24.1
Scan Lines	1x3	77.6	77.7	77.6	77.6	1x1	52.9	53.4	53.0	53.1	3x1	23.6	23.8	23.8	23.7
	2x6	74.7	74.9	74.7	74.8	2x2	49.7	50.2	50.1	50.0	6x2	24.4	24.6	24.6	24.5
	3x9	74.6	74.8	74.7	74.7	3x3	49.4	49.6	49.6	49.5	9x3	24.4	24.5	24.4	24.4
	4x12	74.6	74.9	74.8	74.8	4x4	49.4	49.6	49.6	49.5	12x4	24.6	24.5	24.5	24.5
UGRA/ FOGRA PS Control Strip						50%	49.7	49.8	49.7	49.7					
						1x1	49.6	49.8	49.6	49.7					
						2x2	49.4	49.5	49.4	49.4					
						4x4	49.0	49.2	49.1	49.1					

Table C(1)-1 (continued). Reproduced dot areas of test elements on the RIT Digital Output Resolution Tester on Kodak PagiSet film

Laser Intensity of : 287

Test Pattern	Test Elem.	Dot Area Reading #1	#2	#3	Ave.	Test Elem.	Dot Area Reading #1	#2	#3	Ave.	Test Elem.	Dot Area Reading #1	#2	#3	Ave.
Tint	25%	75.1	75.2	75.2	75.2	50%	49.3	49.7	49.5	49.5	75%	24.3	25.0	24.9	24.7
Checker-boards	1x3	86.8	86.4	86.6	86.6	1x1	52.4	52.7	52.6	52.6	3x1	16.1	16.6	16.4	16.4
	2x6	78.6	78.7	78.7	78.7	2x2	50.7	51.0	50.8	50.8	6x2	21.5	22.0	21.8	21.8
	3x9	76.4	76.5	76.5	76.5	3x3	49.8	50.1	49.9	49.9	9x3	22.8	23.0	22.8	22.9
	4x12	75.4	75.6	75.5	75.5	4x4	49.4	49.8	49.6	49.6	12x4	23.4	23.8	23.3	23.5
Cross-scan Lines	1x3	77.3	77.4	77.3	77.3	1x1	51.5	51.9	51.6	51.7	3x1	22.7	23.2	23.0	23.0
	2x6	74.5	74.6	74.4	74.5	2x2	48.9	49.3	49.0	49.1	6x2	23.7	24.2	24.0	24.0
	3x9	74.6	74.8	74.6	74.7	3x3	49.1	49.6	49.4	49.4	9x3	23.8	24.3	24.0	24.0
	4x12	74.6	74.7	74.6	74.6	4x4	48.9	49.2	49.1	49.1	12x4	24.0	24.4	24.2	24.2
Scan Lines	1x3	78.1	78.3	78.2	78.2	1x1	53.7	54.0	53.8	53.8	3x1	23.9	24.2	24.1	24.1
	2x6	75.0	75.2	75.1	75.1	2x2	49.9	50.3	50.1	50.1	6x2	24.4	24.9	24.7	24.7
	3x9	74.7	74.9	74.8	74.8	3x3	49.5	50.0	49.8	49.8	9x3	24.4	24.8	24.7	24.6
	4x12	74.7	74.9	74.8	74.8	4x4	49.4	49.8	49.5	49.6	12x4	24.6	24.9	24.8	24.8
UGRA/ FOGRA PS Control Strip						50%	49.7	49.8	49.7	49.7					
						1x1	51.2	51.4	51.4	51.3					
						2x2	50.2	50.4	50.3	50.3					
						4x4	49.4	49.5	49.4	49.4					

Laser Intensity of : 290

Test Pattern	Test Elem.	Dot Area Reading #1	#2	#3	Ave.	Test Elem.	Dot Area Reading #1	#2	#3	Ave.	Test Elem.	Dot Area Reading #1	#2	#3	Ave.
Tint	25%	75.4	75.5	75.5	75.5	50%	49.7	49.9	49.8	49.8	75%	24.5	24.7	24.7	24.6
Checker-boards	1x3	88.6	88.7	88.7	88.7	1x1	56.0	56.1	56.1	56.1	3x1	17.5	17.7	17.7	17.6
	2x6	79.5	79.6	79.6	79.6	2x2	52.7	52.9	52.8	52.8	6x2	22.4	22.6	22.5	22.5
	3x9	77.0	77.1	77.0	77.0	3x3	51.0	51.3	51.2	51.2	9x3	23.4	23.4	23.4	23.4
	4x12	75.9	76.1	76.0	76.0	4x4	50.2	50.4	50.2	50.3	12x4	23.9	23.9	23.9	23.9
Cross-scan Lines	1x3	78.6	78.7	78.7	78.7	1x1	53.9	54.1	54.0	54.0	3x1	23.9	24.1	24.0	24.0
	2x6	75.1	75.2	75.0	75.1	2x2	50.1	50.4	50.2	50.2	6x2	24.3	24.6	24.5	24.5
	3x9	75.1	75.1	75.1	75.1	3x3	49.8	50.0	49.9	49.9	9x3	24.3	24.1	24.2	24.2
	4x12	74.9	74.9	75.0	74.9	4x4	49.5	49.7	49.6	49.6	12x4	24.4	24.7	24.6	24.6
Scan Lines	1x3	79.2	79.3	79.2	79.2	1x1	55.4	55.5	55.4	55.4	3x1	24.7	24.8	24.8	24.8
	2x6	75.4	75.6	75.5	75.5	2x2	50.6	50.9	50.8	50.8	6x2	24.9	25.2	25.1	25.1
	3x9	75.0	75.1	75.0	75.0	3x3	50.0	50.3	50.2	50.2	9x3	24.7	24.9	24.8	24.8
	4x12	74.9	75.0	74.9	74.9	4x4	49.7	49.9	49.9	49.8	12x4	24.8	25.0	24.9	24.9
UGRA/ FOGRA PS Control Strip						50%	50.0	50.0	50.0	50.0					
						1x1	54.5	54.6	54.5	54.5					
						2x2	52.0	52.1	52.0	52.0					
						4x4	50.1	50.2	50.0	50.1					

Table C(1)-1. (continued). Reproduced dot areas of test elements on the RIT Digital Output Resolution Tester on Kodak PagiSet film

Laser Intensity of : 303

Test Pattern	Test Elem.	Dot Area Reading #1	#2	#3	Ave.	Test Elem.	Dot Area Reading #1	#2	#3	Ave.	Test Elem.	Dot Area Reading #1	#2	#3	Ave.
Tint	25%	76.2	76.2	76.3	76.2	50%	50.9	50.8	50.9	50.9	75%	25.3	25.2	25.2	25.3
Checker-	1x3	92.2	92.4	92.4	92.3	1x1	65.8	66.0	66.1	65.9	3x1	21.4	21.4	21.4	21.4
boards	2x6	82.0	82.1	82.1	82.1	2x2	58.2	58.2	58.3	58.2	6x2	24.6	24.5	24.6	24.6
	3x9	78.6	78.6	78.6	78.6	3x3	54.6	54.7	54.7	54.7	9x3	24.8	24.7	24.8	24.8
	4x12	77.1	77.1	77.2	77.1	4x4	53.0	53.0	53.2	53.0	12x4	24.8	24.8	24.8	24.8
Cross-scan	1x3	82.0	82.0	82.1	82.0	1x1	60.9	60.9	61.0	60.9	3x1	27.0	27.0	27.1	27.0
Lines	2x6	76.6	76.6	76.7	76.6	2x2	53.0	53.0	53.1	53.0	6x2	25.9	25.8	25.9	25.9
	3x9	76.0	76.0	76.1	76.0	3x3	51.7	51.7	51.9	51.7	9x3	25.4	25.3	25.4	25.4
	4x12	75.6	75.7	75.7	75.7	4x4	50.9	50.9	51.0	50.9	12x4	25.2	25.1	25.3	25.2
Scan Lines	1x3	82.0	82.1	82.1	82.1	1x1	61.4	61.5	61.5	61.5	3x1	27.1	27.0	27.1	27.1
	2x6	76.6	76.6	76.7	76.6	2x2	53.0	53.0	53.2	53.0	6x2	26.1	26.1	26.1	26.1
	3x9	75.8	75.9	75.9	75.9	3x3	51.6	51.6	51.7	51.6	9x3	25.7	25.6	25.7	25.7
	4x12	75.5	75.6	75.6	75.6	4x4	51.1	51.1	51.2	51.1	12x4	25.5	25.4	25.5	25.5
UGRA/						50%	51.4	51.4	51.4	51.4					
FOGRA						1x1	64.1	63.9	64.0	64.0					
PS Control						2x2	57.2	57.4	57.4	57.3					
Strip						4x4	52.8	53.0	53.0	52.9					

Laser Intensity of : 316

Test Pattern	Test Elem.	Dot Area Reading #1	#2	#3	Ave.	Test Elem.	Dot Area Reading #1	#2	#3	Ave.	Test Elem.	Dot Area Reading #1	#2	#3	Ave.
Tint	25%	76.9	77.0	77.1	77.0	50%	51.7	51.8	51.8	51.8	75%	25.8	26.1	2.6	18.2
Checker-	1x3	95.3	95.3	95.4	95.3	1x1	74.5	74.6	63.2	70.8	3x1	25.2	25.5	25.5	25.4
boards	2x6	84.4	84.6	84.6	84.5	2x2	63.1	63.2	63.2	63.2	6x2	26.3	26.6	26.6	26.5
	3x9	80.2	80.4	80.4	80.3	3x3	57.7	57.9	57.9	57.8	9x3	25.9	26.2	26.2	26.1
	4x12	78.3	78.4	78.5	78.4	4x4	55.2	55.4	55.4	55.3	12x4	25.8	26.0	26.0	25.9
Cross-scan	1x3	85.1	85.2	85.2	85.2	1x1	67.2	67.4	67.3	67.3	3x1	29.5	29.7	29.8	29.7
Lines	2x6	77.8	77.9	77.9	77.9	2x2	55.5	55.7	55.7	55.6	6x2	26.9	27.2	27.2	27.1
	3x9	76.8	76.8	76.8	76.8	3x3	53.2	53.4	53.4	53.3	9x3	25.9	26.2	26.3	26.1
	4x12	76.2	76.3	76.3	76.3	4x4	52.0	52.2	52.2	52.1	12x4	25.6	25.9	26.0	25.8
Scan Lines	1x3	85.1	85.3	85.3	85.2	1x1	67.0	67.2	67.2	67.1	3x1	28.9	29.1	29.1	29.0
	2x6	77.8	77.8	77.8	77.8	2x2	55.3	55.5	55.4	55.4	6x2	26.9	27.2	27.2	27.1
	3x9	76.5	76.5	76.6	76.5	3x3	52.9	53.1	53.1	53.0	9x3	26.1	26.5	26.4	26.3
	4x12	76.1	76.2	76.3	76.2	4x4	52.0	52.2	52.2	52.1	12x4	25.8	26.0	26.0	25.9
UGRA/						50%	52.1	52.3	52.3	52.2					
FOGRA						1x1	72.3	72.4	72.5	72.4					
PS Control						2x2	62.0	62.2	62.2	62.1					
Strip						4x4	54.9	55.0	55.0	55.0					

Table C(1)-1 (continued). Reproduced dot areas of test elements on the RIT Digital Output Resolution Tester on Kodak PagiSet film

Laser Intensity of : 330

Test Pattern	Test Elem.	Dot Area Reading #1	#2	#3	Ave.	Test Elem.	Dot Area Reading #1	#2	#3	Ave.	Test Elem.	Dot Area Reading #1	#2	#3	Ave.
Tint	25%	77.7	77.8	77.9	77.8	50%	53.2	53.1	53.2	53.2	75%	26.7	26.7	26.8	26.7
Checker-boards	1x3	97.4	97.6	97.7	97.6	1x1	83.4	83.4	83.5	83.4	3x1	30.6	30.8	30.8	30.7
	2x6	87.3	87.3	87.4	87.3	2x2	68.9	68.9	69.0	68.9	6x2	28.8	29.0	29.0	28.9
	3x9	82.1	82.2	82.3	82.2	3x3	61.6	61.6	61.7	61.6	9x3	27.6	27.8	27.9	27.8
	4x12	79.8	79.8	79.9	79.8	4x4	58.0	58.1	58.1	58.1	12x4	27.0	27.3	27.3	27.2
Cross-scan Lines	1x3	89.1	89.2	89.2	89.2	1x1	74.8	74.9	75.0	74.9	3x1	32.6	32.9	33.0	32.8
	2x6	79.6	79.6	79.7	79.6	2x2	58.9	58.9	59.0	58.9	6x2	28.4	28.7	28.7	28.6
	3x9	77.9	77.9	78.0	77.9	3x3	55.3	55.4	55.4	55.4	9x3	27.0	27.1	27.2	27.1
	4x12	76.9	77.0	77.1	77.0	4x4	53.6	53.6	53.7	53.6	12x4	26.5	26.7	26.7	26.6
Scan Lines	1x3	88.8	88.8	88.9	88.8	1x1	74.1	74.0	74.1	74.1	3x1	31.5	31.8	31.8	31.7
	2x6	79.2	79.2	79.3	79.2	2x2	58.2	58.2	58.3	58.2	6x2	28.4	28.7	28.7	28.6
	3x9	77.5	77.5	77.6	77.5	3x3	54.8	54.9	55.0	54.9	9x3	27.1	27.5	27.5	27.4
	4x12	76.7	76.8	76.8	76.8	4x4	53.4	53.5	53.6	53.5	12x4	26.4	26.7	26.7	26.6
UGRA/ FOGRA PS Control Strip						50%	53.4	53.6	53.6	53.5					
						1x1	82.0	82.1	82.1	82.1					
						2x2	67.7	67.8	67.9	67.8					
						4x4	57.7	57.7	57.8	57.7					

Laser Intensity of : 345

Test Pattern	Test Elem.	Dot Area Reading #1	#2	#3	Ave.	Test Elem.	Dot Area Reading #1	#2	#3	Ave.	Test Elem.	Dot Area Reading #1	#2	#3	Ave.
Tint	25%	78.7	78.7	78.7	78.7	50%	54.1	54.3	54.2	54.2	75%	27.4	27.7	27.7	27.6
Checker-boards	1x3	99.0	99.0	99.0	99.0	1x1	90.4	90.7	90.5	90.5	3x1	36.4	36.8	36.7	36.6
	2x6	90.1	90.0	90.1	90.1	2x2	74.5	74.6	74.5	74.5	6x2	31.4	31.7	31.6	31.6
	3x9	84.0	84.1	84.1	84.1	3x3	65.5	65.7	65.6	65.6	9x3	29.3	29.5	29.5	29.4
	4x12	81.2	81.2	81.3	81.2	4x4	61.1	61.3	61.1	61.2	12x4	28.3	28.5	28.5	28.4
Cross-scan Lines	1x3	92.5	92.6	92.5	92.5	1x1	81.8	82.0	81.9	81.9	3x1	35.2	35.7	35.5	35.5
	2x6	81.3	81.5	81.5	81.4	2x2	62.2	62.3	62.3	62.3	6x2	29.8	30.0	30.0	29.9
	3x9	78.9	79.0	79.0	79.0	3x3	57.4	57.5	57.5	57.5	9x3	27.8	28.1	28.0	28.0
	4x12	77.7	77.9	77.9	77.8	4x4	54.9	55.1	55.0	55.0	12x4	27.0	27.3	27.3	27.2
Scan Lines	1x3	92.3	92.4	92.4	92.4	1x1	80.6	80.8	80.7	80.7	3x1	34.0	34.4	34.3	34.2
	2x6	80.8	81.0	81.0	80.9	2x2	61.2	61.4	61.4	61.3	6x2	29.6	29.8	29.8	29.7
	3x9	78.4	78.6	78.6	78.5	3x3	56.6	56.8	56.7	56.7	9x3	28.0	28.3	28.2	28.2
	4x12	77.4	77.6	77.6	77.5	4x4	54.8	54.9	54.9	54.9	12x4	27.1	27.4	27.4	27.3
UGRA/ FOGRA PS Control Strip						50%	54.7	54.8	54.8	54.8					
						1x1	88.9	88.9	88.8	88.9					
						2x2	73.4	73.4	73.4	73.4					
						4x4	60.4	60.5	60.4	60.4					

Table C(1)-1 (continued). Reproduced dot areas of test elements on the RIT Digital Output Resolution Tester on Kodak PagiSet film

Laser Intensity of : 360

Test	Test	Dot Area Reading				Test	Dot Area Reading				Test	Dot Area Reading			
Pattern	Elem.	#1	#2	#3	Ave.	Elem.	#1	#2	#3	Ave.	Elem.	#1	#2	#3	Ave.
Tint	25%	79.6	79.6	79.6	79.6	50%	55.2	55.3	55.3	55.3	75%	28.4	28.4	28.4	28.4
Checker-	1x3	99.6	99.6	99.6	99.6	1x1	94.7	94.7	94.7	94.7	3x1	42.2	42.7	42.5	42.5
boards	2x6	92.4	92.4	92.4	92.4	2x2	79.2	79.3	79.3	79.3	6x2	34.1	34.2	34.2	34.2
	3x9	85.9	86.0	86.0	86.0	3x3	68.9	68.9	69.0	68.9	9x3	30.9	31.1	31.1	31.0
	4x12	82.7	82.8	82.7	82.7	4x4	63.5	63.7	63.8	63.7	12x4	29.6	30.0	29.9	29.8
Cross-scan	1x3	95.4	95.3	95.4	95.4	1x1	87.6	87.7	87.7	87.7	3x1	38.1	38.5	38.4	38.3
Lines	2x6	83.1	83.1	83.2	83.1	2x2	65.2	65.6	65.5	65.4	6x2	31.2	31.6	31.5	31.4
	3x9	80.0	80.0	80.0	80.0	3x3	59.5	59.5	59.5	59.5	9x3	28.8	29.1	29.0	29.0
	4x12	78.6	78.6	78.6	78.6	4x4	56.5	56.7	56.7	56.6	12x4	27.8	28.2	28.1	28.0
Scan Lines	1x3	95.1	95.1	95.1	95.1	1x1	86.3	86.4	86.4	86.4	3x1	36.2	36.5	36.5	36.4
	2x6	82.7	82.8	82.8	82.8	2x2	64.3	64.5	64.5	64.4	6x2	30.6	31.1	31.0	30.9
	3x9	79.7	79.7	79.8	79.7	3x3	58.5	58.7	58.7	58.6	9x3	28.6	29.0	28.8	28.8
	4x12	78.4	78.3	78.4	78.4	4x4	55.9	56.1	56.0	56.0	12x4	27.6	28.0	27.9	27.8
UGRA/						50%	55.8	56.1	56.1	56.0					
FOGRA						1x1	93.8	93.7	93.8	93.8					
PS Control						2x2	78.2	78.3	78.4	78.3					
Strip						4x4	63.1	63.3	63.3	63.2					

Table C(1)-2. Reproduced dot areas of test elements on the RIT Digital output Resolution Teseter on Kodak Imageset 2000 film

Laser Intensity of : 258

Test	Test	Dot Area Reading				Test	Dot Area Reading				Test	Dot Area Reading			
Pattern	Elem.	#1	#2	#3	Ave.	Elem.	#1	#2	#3	Ave.	Elem.	#1	#2	#3	Ave.
Tint	25%	31.7	32.0	32.2	32.0	50%	16.5	17.0	16.6	16.7	75%	6.0	6.4	6.1	6.2
Checker-	1x3	8.2	8.6	8.5	8.4	1x1	0.2	0.5	0.5	0.4	3x1	0.0	0.3	0.2	0.2
boards	2x6	18.0	18.4	18.1	18.2	2x2	2.4	2.8	2.6	2.6	6x2	0.7	1.4	1.1	1.1
	3x9	24.1	24.6	24.4	24.4	3x3	5.6	5.7	5.7	5.7	9x3	2.0	2.6	2.7	2.4
	4x12	27.5	28.3	28.0	27.9	4x4	8.9	9.1	9.1	9.0	12x4	3.5	3.9	4.0	3.8
Cross-scan	1x3	18.2	18.7	18.7	18.5	1x1	0.8	1.1	1.1	1.0	3x1	0.0	0.4	1.0	0.5
Lines	2x6	26.8	27.2	27.2	27.1	2x2	4.7	4.9	4.9	4.8	6x2	1.8	2.4	2.7	2.3
	3x9	30.6	31.1	30.7	30.8	3x3	9.8	10.3	10.3	10.1	9x3	4.3	4.8	4.9	4.7
	4x12	32.0	32.4	32.3	32.2	4x4	12.8	13.2	13.2	13.1	12x4	6.1	6.3	6.5	6.3
Scan Lines	1x3	21.2	21.5	21.5	21.4	1x1	3.3	3.5	3.5	3.4	3x1	1.0	1.3	1.4	1.2
	2x6	28.8	29.2	29.1	29.0	2x2	7.4	7.8	7.7	7.6	6x2	2.9	3.2	3.3	3.1
	3x9	32.3	32.5	32.3	32.4	3x3	12.3	12.6	12.6	12.5	9x3	5.2	5.5	5.6	5.4
	4x12	33.8	34.3	34.3	34.1	4x4	15.2	15.4	15.4	15.3	12x4	6.7	7.0	6.9	6.9
UGRA/						50%	16.5	16.9	17.0	16.8					
FOGRA						1x1	0.8	1.2	1.0	1.0					
PS Control						2x2	2.8	3.2	3.3	3.1					
Strip						4x4	8.4	8.7	8.9	8.7					

Laser Intensity of : 269

Test	Test	Dot Area Reading				Test	Dot Area Reading				Test	Dot Area Reading			
Pattern	Elem.	#1	#2	#3	Ave.	Elem.	#1	#2	#3	Ave.	Elem.	#1	#2	#3	Ave.
Tint	25%	65.5	65.3	65.6	65.5	50%	39.4	39.4	39.2	39.3	75%	17.5	17.5	17.5	17.5
Checker-	1x3	32.3	32.4	32.1	32.3	1x1	1.3	1.5	1.0	1.3	3x1	0.5	0.5	0.5	0.5
boards	2x6	52.3	52.1	52.0	52.1	2x2	10.9	11.0	10.6	10.8	6x2	4.6	4.8	4.8	4.7
	3x9	58.5	58.3	58.3	58.4	3x3	21.9	22.0	21.7	21.9	9x3	10.2	10.5	10.4	10.4
	4x12	61.4	61.4	61.3	61.4	4x4	27.3	27.5	27.0	27.3	12x4	13.3	13.6	13.5	13.5
Cross-scan	1x3	46.4	46.4	46.4	46.4	1x1	2.0	2.3	2.0	2.1	3x1	0.9	0.9	0.7	0.8
Lines	2x6	58.1	58.0	57.9	58.0	2x2	20.4	20.4	20.1	20.3	6x2	9.8	9.6	9.5	9.6
	3x9	62.6	62.6	62.5	62.6	3x3	29.7	29.8	29.6	29.7	9x3	14.4	14.5	14.4	14.4
	4x12	65.0	64.9	64.6	64.8	4x4	33.5	33.4	33.3	33.4	12x4	16.7	16.7	16.5	16.6
Scan Lines	1x3	58.6	58.6	58.6	58.6	1x1	13.5	13.8	13.6	13.6	3x1	5.0	5.0	4.7	4.9
	2x6	64.7	64.6	64.4	64.6	2x2	31.4	31.6	31.4	31.5	6x2	15.6	15.5	15.3	15.5
	3x9	66.7	66.8	66.7	66.7	3x3	37.2	37.4	36.9	37.2	9x3	18.3	18.2	18.0	18.2
	4x12	67.6	67.5	67.6	67.6	4x4	39.4	39.3	39.0	39.2	12x4	19.7	19.8	19.6	19.7
UGRA/						50%	38.7	38.8	38.4	38.6					
FOGRA						1x1	1.6	1.7	1.6	1.6					
PS Control						2x2	11.8	12.0	11.5	11.8					
Strip						4x4	27.7	27.8	27.5	27.7					

Table C(1)-2. (continued). Reproduced dot areas of test elements on the RIT Digital Output Resolution Tester on Kodak Imageset 2000 film

Laser Intensity of : 281

Test	Test	Dot Area Reading				Test	Dot Area Reading				Test	Dot Area Reading			
Pattern	Elem.	#1	#2	#3	Ave.	Elem.	#1	#2	#3	Ave.	Elem.	#1	#2	#3	Ave.
Tint	25%	70.3	70.2	70.1	70.2	50%	43.9	43.8	43.9	43.9	75%	20.6	20.4	20.4	20.5
Checker-	1x3	53.2	53.0	52.8	53.0	1x1	2.5	2.6	2.4	2.5	3x1	0.7	0.6	0.5	0.6
boards	2x6	63.7	63.5	63.4	63.5	2x2	25.5	25.5	25.4	25.5	6x2	12.0	11.6	11.5	11.7
	3x9	66.4	66.2	66.2	66.3	3x3	32.9	32.9	32.6	32.8	9x3	16.0	15.7	15.5	15.7
	4x12	67.8	67.7	67.7	67.7	4x4	36.1	36.3	36.1	36.2	12x4	18.0	17.6	17.4	17.7
Cross-scan	1x3	56.8	56.6	56.6	56.7	1x1	4.9	4.9	4.8	4.9	3x1	2.0	1.5	1.5	1.7
Lines	2x6	64.5	64.3	64.3	64.4	2x2	32.2	32.1	32.1	32.1	6x2	16.4	16.1	16.0	16.2
	3x9	68.0	67.9	68.0	68.0	3x3	37.1	37.0	36.9	37.0	9x3	18.7	18.3	18.0	18.3
	4x12	69.6	69.6	69.5	69.6	4x4	39.5	39.6	39.5	39.5	12x4	20.1	19.7	19.5	19.8
Scan Lines	1x3	66.9	66.7	66.7	66.8	1x1	34.0	33.8	33.9	33.9	3x1	16.3	15.9	15.8	16.0
	2x6	70.0	69.9	69.8	69.9	2x2	42.1	42.0	41.9	42.0	6x2	21.4	20.8	20.7	21.0
	3x9	71.6	71.5	71.4	71.5	3x3	44.0	44.0	43.8	43.9	9x3	22.1	21.8	21.7	21.9
	4x12	72.4	72.4	72.2	72.3	4x4	45.1	45.0	44.9	45.0	12x4	22.6	22.1	22.1	22.3
UGRA/						50%	43.7	43.5	43.4	43.5					
FOGRA						1x1	3.1	3.1	3.0	3.1					
PS Control						2x2	26.4	26.4	26.4	26.4					
Strip						4x4	36.7	36.7	36.6	36.7					

Laser Intensity of : 293

Test	Test	Dot Area Reading				Test	Dot Area Reading				Test	Dot Area Reading			
Pattern	Elem.	#1	#2	#3	Ave.	Elem.	#1	#2	#3	Ave.	Elem.	#1	#2	#3	Ave.
Tint	25%	72.0	72.0	72.1	72.0	50%	46.2	46.3	46.4	46.3	75%	22.3	22.3	22.3	22.3
Checker-	1x3	72.3	72.2	72.3	72.3	1x1	11.4	11.4	11.3	11.4	3x1	2.2	2.5	2.5	2.4
boards	2x6	70.4	70.3	70.3	70.3	2x2	37.5	37.7	37.5	37.6	6x2	17.9	17.9	17.9	17.9
	3x9	70.6	70.6	70.6	70.6	3x3	40.9	41.0	40.8	40.9	9x3	20.0	20.0	20.1	20.0
	4x12	70.8	70.8	70.9	70.8	4x4	41.9	42.0	42.1	42.0	12x4	20.7	20.7	20.7	20.7
Cross-scan	1x3	64.3	64.2	64.1	64.2	1x1	22.1	22.2	22.3	22.2	3x1	9.4	9.3	9.4	9.4
Lines	2x6	68.1	68.1	68.0	68.1	2x2	39.9	39.9	40.0	39.9	6x2	20.3	20.2	20.2	20.2
	3x9	70.3	70.3	70.0	70.2	3x3	42.3	42.3	42.3	42.3	9x3	21.1	21.1	21.1	21.1
	4x12	71.3	71.3	71.3	71.3	4x4	43.2	43.3	43.2	43.2	12x4	21.6	21.6	21.6	21.6
Scan Lines	1x3	71.6	71.6	71.6	71.6	1x1	47.7	47.8	47.7	47.7	3x1	23.8	23.7	23.6	23.7
	2x6	72.1	72.0	72.1	72.1	2x2	47.2	47.3	47.3	47.3	6x2	23.9	23.9	23.8	23.9
	3x9	73.0	73.0	72.9	73.0	3x3	47.2	47.2	47.3	47.2	9x3	23.6	23.6	23.6	23.6
	4x12	73.4	73.3	73.3	73.3	4x4	47.5	47.5	47.6	47.5	12x4	23.5	23.5	23.4	23.5
UGRA/						50%	46.6	46.4	46.5	46.5					
FOGRA						1x1	13.5	13.6	13.5	13.5					
PS Control						2x2	38.1	37.9	37.9	38.0					
Strip						4x4	42.4	42.4	42.4	42.4					

Table C(1)-2. (continued). Reproduced dot areas of test elements on the RIT Digital Output Resolution Tester on Kodak Imageset 2000 film

Laser Intensity of : 306

Test	Test	Dot Area Reading				Test	Dot Area Reading				Test	Dot Area Reading			
Pattern	Elem.	#1	#2	#3	Ave.	Elem.	#1	#2	#3	Ave.	Elem.	#1	#2	#3	Ave.
Tint	25%	73.4	73.3	73.5	73.4	50%	48.2	48.1	48.2	48.2	75%	23.7	23.8	23.9	23.8
Checker-boards	1x3	80.7	80.7	80.8	80.7	1x1	30.6	31.0	31.1	30.9	3x1	9.5	9.7	9.7	9.6
	2x6	74.4	74.3	74.4	74.4	2x2	46.1	46.2	46.2	46.2	6x2	22.7	22.4	22.6	22.6
	3x9	73.5	73.3	73.4	73.4	3x3	46.5	46.4	46.5	46.5	9x3	23.4	23.1	23.3	23.3
	4x12	73.1	73.0	73.2	73.1	4x4	46.6	46.4	46.4	46.5	12x4	23.3	23.1	23.3	23.2
Cross-scan Lines	1x3	69.3	69.2	69.3	69.3	1x1	41.3	41.2	41.1	41.2	3x1	20.5	20.2	20.5	20.4
	2x6	70.7	70.5	70.6	70.6	2x2	45.1	44.9	45.0	45.0	6x2	23.3	23.2	23.4	23.3
	3x9	72.0	71.9	71.9	71.9	3x3	45.8	45.8	45.8	45.8	9x3	23.2	23.1	23.1	23.1
	4x12	72.6	72.4	72.5	72.5	4x4	45.8	45.9	46.0	45.9	12x4	23.1	23.1	23.2	23.1
Scan Lines	1x3	74.9	74.9	75.0	74.9	1x1	55.9	55.7	55.8	55.8	3x1	28.6	28.4	28.5	28.5
	2x6	74.0	74.0	74.0	74.0	2x2	51.0	50.9	50.9	50.9	6x2	26.2	26.0	26.2	26.1
	3x9	74.1	74.0	74.1	74.1	3x3	49.9	49.7	49.8	49.8	9x3	25.2	25.1	25.4	25.2
	4x12	74.2	74.1	74.3	74.2	4x4	49.2	49.1	49.1	49.1	12x4	24.8	24.9	24.8	24.8
UGRA/						50%	48.6	48.6	48.5	48.6					
FOGRA						1x1	33.2	33.2	33.2	33.2					
PS Control						2x2	46.5	46.3	46.5	46.4					
Strip						4x4	47.1	47.0	47.0	47.0					

Laser Intensity of : 313

Test	Test	Dot Area Reading				Test	Dot Area Reading				Test	Dot Area Reading			
Pattern	Elem.	#1	#2	#3	Ave.	Elem.	#1	#2	#3	Ave.	Elem.	#1	#2	#3	Ave.
Tint	25%	74.0	74.1	74.1	74.1	50%	49.1	49.3	49.3	49.2	75%	24.5	24.6	24.5	24.5
Checker-boards	1x3	85.9	85.8	85.9	85.9	1x1	41.7	42.0	41.9	41.9	3x1	15.9	15.4	15.7	15.7
	2x6	76.5	76.7	76.7	76.6	2x2	50.7	50.8	50.7	50.7	6x2	25.2	24.7	24.9	24.9
	3x9	74.8	74.8	74.9	74.8	3x3	49.4	49.5	49.4	49.4	9x3	25.1	25.0	25.1	25.1
	4x12	74.0	74.2	74.3	74.2	4x4	48.4	48.5	48.3	48.4	12x4	24.3	24.6	24.5	24.5
Cross-scan Lines	1x3	72.0	71.9	72.0	72.0	1x1	48.0	48.2	48.1	48.1	3x1	24.3	24.5	24.5	24.4
	2x6	72.0	71.9	72.0	72.0	2x2	47.7	47.7	47.6	47.7	6x2	24.6	24.8	24.8	24.7
	3x9	72.8	72.9	72.9	72.9	3x3	47.6	47.6	47.5	47.6	9x3	24.1	24.3	24.2	24.2
	4x12	73.1	73.5	73.4	73.3	4x4	47.1	47.2	47.1	47.1	12x4	23.7	24.0	23.9	23.9
Scan Lines	1x3	77.2	76.9	77.0	77.0	1x1	59.6	59.7	59.6	59.6	3x1	30.7	30.6	30.6	30.6
	2x6	74.9	74.9	74.9	74.9	2x2	52.8	52.8	52.8	52.8	6x2	27.1	27.1	27.0	27.1
	3x9	74.7	74.9	74.8	74.8	3x3	51.1	51.2	51.1	51.1	9x3	25.8	25.9	25.8	25.8
	4x12	74.5	74.7	74.7	74.6	4x4	50.2	50.3	50.1	50.2	12x4	25.1	25.2	25.2	25.2
UGRA/						50%	49.4	49.8	49.6	49.6					
FOGRA						1x1	42.4	42.9	42.8	42.7					
PS Control						2x2	50.1	50.4	50.3	50.3					
Strip						4x4	48.9	49.2	49.0	49.0					

Table C(1)-2. (continued). Reproduced dot areas of test elements on the RIT Digital Output Resolution Tester on Kodak Imageset 2000 film

Laser Intensity of : 320

Test	Test	Dot Area Reading				Test	Dot Area Reading				Test	Dot Area Reading			
Pattern	Elem.	#1	#2	#3	Ave.	Elem.	#1	#2	#3	Ave.	Elem.	#1	#2	#3	Ave.
Tint	25%	74.9	74.8	74.8	74.8	50%	50.1	49.9	49.8	49.9	75%	25.5	25.6	25.6	25.6
Checker-	1x3	88.6	88.7	88.3	88.5	1x1	53.8	53.6	53.8	53.7	3x1	20.6	20.8	20.9	20.8
boards	2x6	78.2	78.6	78.2	78.3	2x2	55.6	55.4	55.5	55.5	6x2	26.9	26.8	27.1	26.9
	3x9	76.3	76.5	76.5	76.4	3x3	52.9	52.7	52.7	52.8	9x3	26.5	26.4	26.4	26.4
	4x12	75.3	75.2	75.2	75.2	4x4	51.1	51.3	51.3	51.2	12x4	25.5	25.3	25.6	25.5
Cross-scan	1x3	74.4	74.2	74.2	74.3	1x1	53.7	53.5	53.5	53.6	3x1	27.4	27.2	27.2	27.3
Lines	2x6	73.2	73.0	73.1	73.1	2x2	50.1	50.0	49.9	50.0	6x2	26.1	26.0	26.0	26.0
	3x9	73.7	73.5	73.5	73.6	3x3	49.4	49.2	49.2	49.3	9x3	25.2	25.0	25.1	25.1
	4x12	73.9	73.8	73.7	73.8	4x4	48.6	48.4	48.4	48.5	12x4	24.8	24.8	24.8	24.8
Scan Lines	1x3	78.9	78.8	78.8	78.8	1x1	63.5	63.3	63.3	63.4	3x1	32.4	32.4	32.3	32.4
	2x6	75.8	75.7	75.7	75.7	2x2	54.7	54.6	54.6	54.6	6x2	28.4	28.2	28.2	28.3
	3x9	75.4	75.3	75.2	75.3	3x3	52.6	52.3	52.3	52.4	9x3	27.0	26.8	26.9	26.9
	4x12	75.2	75.2	75.3	75.2	4x4	51.4	51.2	51.1	51.2	12x4	26.0	25.9	25.9	25.9
UGRA/						50%	50.6	50.5	50.5	50.5					
FOGRA						1x1	54.3	54.1	54.3	54.2					
PS Control						2x2	55.2	55.1	55.2	55.2					
Strip						4x4	51.8	51.6	51.9	51.8					

Laser Intensity of : 334

Test	Test	Dot Area Reading				Test	Dot Area Reading				Test	Dot Area Reading			
Pattern	Elem.	#1	#2	#3	Ave.	Elem.	#1	#2	#3	Ave.	Elem.	#1	#2	#3	Ave.
Tint	25%	76.2	76.1	76.1	76.1	50%	51.5	51.6	52.4	51.8	75%	26.3	26.5	26.5	26.4
Checker-	1x3	94.8	94.9	94.9	94.9	1x1	73.2	73.3	73.4	73.3	3x1	30.3	30.6	30.5	30.5
boards	2x6	82.4	82.3	82.3	82.3	2x2	64.0	64.0	64.5	64.2	6x2	30.8	31.0	31.0	30.9
	3x9	78.8	78.7	78.8	78.8	3x3	58.7	58.6	58.7	58.7	9x3	28.8	28.9	28.9	28.9
	4x12	77.0	77.0	77.1	77.0	4x4	55.1	55.1	55.1	55.1	12x4	27.1	27.3	27.3	27.2
Cross-scan	1x3	79.6	79.7	79.7	79.7	1x1	63.4	63.4	63.4	63.4	3x1	32.5	32.6	32.6	32.6
Lines	2x6	75.6	75.6	75.6	75.6	2x2	54.6	54.8	54.8	54.7	6x2	28.1	28.3	28.3	28.2
	3x9	75.3	75.3	75.4	75.3	3x3	52.3	52.4	52.4	52.4	9x3	26.3	26.4	26.6	26.4
	4x12	74.8	74.9	74.9	74.9	4x4	50.8	50.9	50.8	50.8	12x4	25.3	25.5	25.7	25.5
Scan Lines	1x3	83.6	83.6	83.5	83.6	1x1	71.6	71.6	71.7	71.6	3x1	36.2	36.2	36.4	36.3
	2x6	77.6	77.6	77.6	77.6	2x2	58.4	58.4	58.5	58.4	6x2	29.9	29.8	30.1	29.9
	3x9	76.5	76.5	76.5	76.5	3x3	54.8	54.9	54.9	54.9	9x3	27.5	27.6	27.7	27.6
	4x12	76.0	76.1	76.1	76.1	4x4	53.0	53.1	53.2	53.1	12x4	26.4	26.5	26.7	26.5
UGRA/						50%	52.1	52.2	52.3	52.2					
FOGRA						1x1	73.7	73.6	73.4	73.6					
PS Control						2x2	63.4	63.5	63.5	63.5					
Strip						4x4	55.6	55.5	55.8	55.6					

Table C(1)-2. (continued). Reproduced dot areas of test elements on the RIT Digital Output Resolution Tester on Kodak Imageset 2000 film

Laser Intensity of : 349

Test Pattern	Test Elem.	Dot Area Reading #1	#2	#3	Ave.	Test Elem.	Dot Area Reading #1	#2	#3	Ave.	Test Elem.	Dot Area Reading #1	#2	#3	Ave.
Tint	25%	77.4	77.2	77.4	77.3	50%	53.3	53.3	53.5	53.4	75%	28.1	27.8	27.9	27.9
Checker-boards	1x3	98.2	98.3	98.3	98.3	1x1	87.2	87.2	87.3	87.2	3x1	39.4	39.3	39.4	39.4
	2x6	85.2	85.2	85.3	85.2	2x2	71.1	70.9	71.1	71.0	6x2	35.1	35.0	35.1	35.1
	3x9	81.2	81.0	81.1	81.1	3x3	63.8	63.6	63.8	63.7	9x3	31.7	31.6	31.8	31.7
	4x12	79.0	78.9	79.0	79.0	4x4	59.8	59.6	59.9	59.8	12x4	29.4	29.3	29.5	29.4
Cross-scan Lines	1x3	84.4	84.2	84.3	84.3	1x1	71.9	71.7	71.8	71.8	3x1	36.8	36.6	36.9	36.8
	2x6	77.9	77.7	77.8	77.8	2x2	58.3	58.3	58.4	58.3	6x2	30.6	30.4	30.7	30.6
	3x9	76.7	76.7	76.8	76.7	3x3	55.0	54.8	55.0	54.9	9x3	28.1	27.9	28.5	28.2
	4x12	76.0	76.0	76.1	76.0	4x4	53.1	52.9	53.1	53.0	12x4	26.7	26.6	27.1	26.8
Scan Lines	1x3	87.4	87.3	87.4	87.4	1x1	79.1	79.0	79.1	79.1	3x1	40.1	39.9	40.1	40.0
	2x6	79.4	79.2	79.3	79.3	2x2	61.8	61.5	61.9	61.7	6x2	32.0	31.7	32.0	31.9
	3x9	77.6	77.7	77.6	77.6	3x3	57.2	57.0	57.3	57.2	9x3	29.1	29.2	29.4	29.2
	4x12	77.2	76.9	77.0	77.0	4x4	54.8	54.8	55.0	54.9	12x4	27.6	27.5	27.7	27.6
UGRA/ FOGRA PS Control Strip						50%	54.1	54.1	54.2	54.1					
						1x1	87.5	87.5	87.7	87.6					
						2x2	70.8	70.8	70.9	70.8					
						4x4	59.5	59.6	59.8	59.6					

Laser Intensity of : 364

Test Pattern	Test Elem.	Dot Area Reading #1	#2	#3	Ave.	Test Elem.	Dot Area Reading #1	#2	#3	Ave.	Test Elem.	Dot Area Reading #1	#2	#3	Ave.
Tint	25%	78.5	78.4	78.4	78.4	50%	54.8	54.6	54.8	54.7	75%	29.0	28.7	28.9	28.9
Checker-boards	1x3	99.8	99.8	99.8	99.8	1x1	95.9	95.9	96.0	95.9	3x1	48.7	48.5	48.6	48.6
	2x6	88.1	88.0	88.0	88.0	2x2	76.2	76.1	76.2	76.2	6x2	38.4	38.2	38.1	38.2
	3x9	83.1	82.9	83.0	83.0	3x3	67.6	67.4	67.5	67.5	9x3	33.8	33.5	33.6	33.6
	4x12	80.7	80.6	80.7	80.7	4x4	62.6	62.7	62.5	62.6	12x4	31.3	31.1	31.0	31.1
Cross-scan Lines	1x3	89.6	89.5	89.6	89.6	1x1	80.7	80.6	80.7	80.7	3x1	40.5	40.4	43.4	41.4
	2x6	79.7	79.7	79.6	79.7	2x2	62.2	61.9	62.1	62.1	6x2	32.4	32.2	32.3	32.3
	3x9	78.0	77.9	77.9	77.9	3x3	57.6	57.4	57.5	57.5	9x3	29.4	29.2	29.3	29.3
	4x12	77.0	76.9	77.0	77.0	4x4	54.6	54.7	54.7	54.7	12x4	27.8	27.6	27.6	27.7
Scan Lines	1x3	92.3	92.5	92.7	92.5	1x1	86.6	86.6	86.6	86.6	3x1	43.0	42.9	43.1	43.0
	2x6	81.1	81.0	81.0	81.0	2x2	65.1	64.9	65.5	65.2	6x2	33.6	33.4	33.5	33.5
	3x9	78.8	78.7	78.8	78.8	3x3	59.2	59.0	59.1	59.1	9x3	30.4	30.3	30.3	30.3
	4x12	77.8	77.7	77.7	77.7	4x4	56.4	56.2	56.3	56.3	12x4	28.6	28.4	28.3	28.4
UGRA/ FOGRA PS Control Strip						50%	55.8	55.6	55.7	55.7					
						1x1	94.9	95.1	94.8	94.9					
						2x2	75.8	75.7	75.5	75.7					
						4x4	63.4	63.2	63.1	63.2					

Table C(1)-2. (continued). Reproduced dot areas of test elements on the RIT Digital Output Resolution Tester on Kodak Imageset 2000 film

Laser Intensity of : 381

Test Pattern	Test Elem.	Dot Area Reading #1	#2	#3	Ave.	Test Elem.	Dot Area Reading #1	#2	#3	Ave.	Test Elem.	Dot Area Reading #1	#2	#3	Ave.
Tint	25%	79.5	79.4	79.6	79.5	50%	56.3	56.4	56.8	56.5	75%	30.1	30.3	30.6	30.3
Checker-boards	1x3	99.9	99.9	99.9	99.9	1x1	99.2	99.2	99.0	99.1	3x1	57.8	57.8	58.1	57.9
	2x6	90.9	91.0	90.9	90.9	2x2	80.9	81.0	81.2	81.0	6x2	42.1	42.1	42.3	42.2
	3x9	85.4	85.5	85.5	85.5	3x3	71.7	71.7	72.0	71.8	9x3	36.5	36.4	36.8	36.6
	4x12	82.5	82.4	82.4	82.4	4x4	65.9	66.0	66.1	66.0	12x4	33.3	33.2	33.6	33.4
Cross-scan Lines	1x3	95.4	95.4	95.4	95.4	1x1	90.2	90.0	90.0	90.1	3x1	44.2	44.1	44.5	44.3
	2x6	82.0	81.9	82.0	82.0	2x2	65.9	65.9	66.2	66.0	6x2	34.4	34.2	34.1	34.2
	3x9	79.5	79.4	79.6	79.5	3x3	60.6	60.5	60.7	60.6	9x3	30.7	30.6	31.0	30.8
	4x12	78.2	78.2	78.2	78.2	4x4	57.2	57.2	57.3	57.2	12x4	28.8	28.7	29.0	28.8
Scan Lines	1x3	97.6	97.6	97.7	97.6	1x1	95.1	95.1	95.1	95.1	3x1	46.3	46.0	46.4	46.2
	2x6	83.1	83.1	83.2	83.1	2x2	68.3	68.3	68.4	68.3	6x2	35.5	35.3	35.7	35.5
	3x9	80.2	80.2	80.3	80.2	3x3	61.7	61.6	61.8	61.7	9x3	31.6	31.7	32.0	31.8
	4x12	78.8	78.8	78.9	78.8	4x4	58.4	58.3	58.6	58.4	12x4	29.7	29.8	30.0	29.8
UGRA/ FOGRA PS Control Strip						50%	57.2	57.7	57.4	57.4					
						1x1	98.9	98.9	98.9	98.9					
						2x2	80.0	79.8	79.9	79.9					
						4x4	65.7	65.9	66.1	65.9					

Laser Intensity of : 397

Test Pattern	Test Elem.	Dot Area Reading #1	#2	#3	Ave.	Test Elem.	Dot Area Reading #1	#2	#3	Ave.	Test Elem.	Dot Area Reading #1	#2	#3	Ave.
Tint	25%	80.4	80.4	80.5	80.4	50%	57.9	57.9	57.8	57.9	75%	31.2	31.4	31.5	31.4
Checker-boards	1x3	99.9	100.0	100.0	100.0	1x1	99.8	99.9	99.9	99.9	3x1	66.5	66.5	66.8	66.6
	2x6	93.5	93.6	93.6	93.6	2x2	84.8	84.8	84.9	84.8	6x2	46.1	46.1	46.1	46.1
	3x9	87.2	87.3	87.3	87.3	3x3	74.3	74.3	74.2	74.3	9x3	39.2	39.2	39.2	39.2
	4x12	84.1	84.1	84.1	84.1	4x4	68.2	68.2	68.3	68.2	12x4	35.3	35.3	35.3	35.3
Cross-scan Lines	1x3	99.1	99.2	99.3	99.2	1x1	97.3	97.2	97.4	97.3	3x1	47.4	47.3	47.5	47.4
	2x6	84.1	84.0	84.1	84.1	2x2	69.9	69.8	69.8	69.8	6x2	36.1	36.3	36.3	36.2
	3x9	80.9	81.0	81.0	81.0	3x3	63.0	62.9	63.0	63.0	9x3	32.5	32.6	32.3	32.5
	4x12	79.3	79.3	79.3	79.3	4x4	59.0	59.1	59.2	59.1	12x4	29.9	30.0	29.9	29.9
Scan Lines	1x3	99.7	99.8	99.8	99.8	1x1	98.9	99.1	99.1	99.0	3x1	49.1	49.0	49.0	49.0
	2x6	85.0	84.9	85.1	85.0	2x2	71.7	71.7	71.8	71.7	6x2	36.9	36.8	36.7	36.8
	3x9	81.2	81.2	81.2	81.2	3x3	64.0	64.0	64.0	64.0	9x3	32.7	32.9	32.8	32.8
	4x12	79.5	79.6	79.7	79.6	4x4	59.9	60.0	60.0	60.0	12x4	30.6	30.7	30.5	30.6
UGRA/ FOGRA PS Control Strip						50%	58.9	59.1	59.1	59.0					
						1x1	99.8	99.9	99.9	99.9					
						2x2	84.8	84.6	85.0	84.8					
						4x4	68.8	68.9	68.6	68.8					

Appendix C (2)

Edge Movement, the Frieser's Coefficient (k), and MTF Calculations

Dot Width and Line Width Calculation of
25%- and 75%- Checkerboards and Parallel Line Patterns

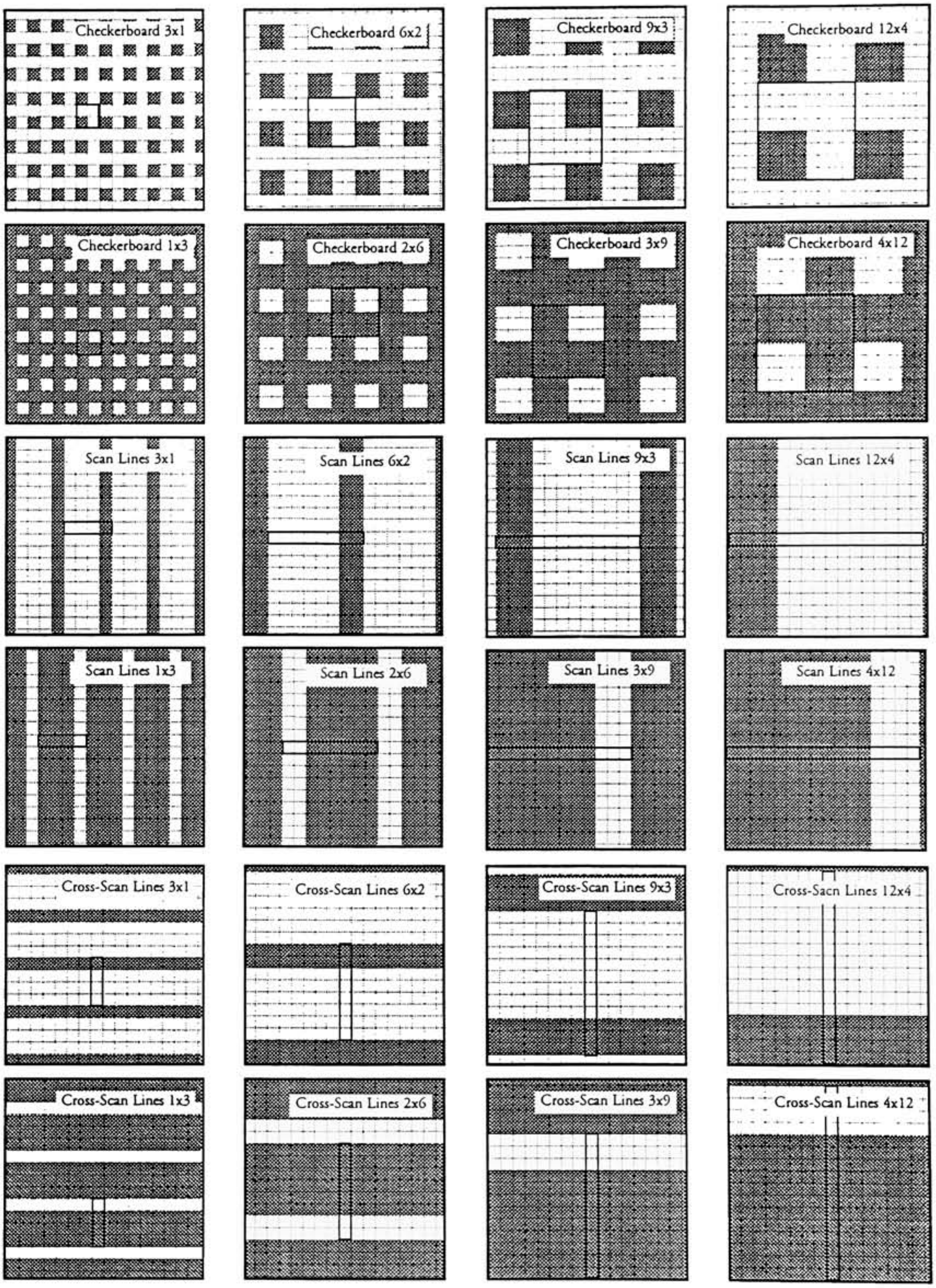
Dot width and line width were calculated based on dot area readings from 25% and 75% checkerboards, scan line patterns, and cross-scan line patterns of the RIT Resolution Target. Prior to the calculation of dot and line widths, the following simplifying assumptions were made.

1. Dot shape is square for all percent dot areas of checkerboards.
2. Edges of both horizontal and vertical lines are smooth.
3. Densities of dot and Dmax are identical.

Dot Width Calculation

Checkerboards of the RIT Resolution Target were made up by alternately drawing horizontal and vertical lines. At the addressibility of 2400 dpi, the smallest pixel grid is 10.58 microns wide. In order to create 25% and 75% checkerboards, the smallest, repeated unit or 100% unit area is an alternately black and clear lines in both horizontal and vertical directions. Therefore, the unit contains four pixels: 2 pixels x 2 pixels. The smallest 25% and 75% checkerboards are called 1x3 and 3x1 checkerboard respectively. The 25% and 75% checkerboards can be made by alternately drawing two, three, or four black and clear lines horizontally and vertically: the units contain 16 pixels (4 pixels x 4 pixels), 36 (6 pixels x 6 pixels, and 64 pixels (8 pixels x 8 pixels) respectively.

Figure C(2)-1. Dot and line patterns of 25% and 75% test elements on processed film



Note: Solid-line square or rectangle in each block is a unit used for calculating dot or line width

Table C(2)-1. Number of pixels in a unit of 25% and 75% checkerboards

25%	75%	number of pixels in a unit
1x3	3x1	4
2x6	6x2	16
3x9	9x3	36
4x12	12x4	64

Calculation:

Pixel width(microns): 10.5833

Area of a pixel ($micron^2$): 112.00623

Total number of pixels in a unit (pixels): $No._{total}$

Area of a unit ($micron^2$): 112.00623 * $No._{total}$

Dot area reading on solid area (%): DA_{solid}

No. of black pixels in a unit (pixels): $No._{black}$

Dot area reading on test element(%): $DA_{element}$

Area of actual dots in a unit on processed film ($micron^2$): $AREA_{element}$

Dot width (microns): DW

$$AREA_{element} = 112.00623 \cdot No._{total} \cdot DA_{element} / DA_{solid}$$

$$(DW)^2 = 112.00623 \cdot No._{total} \cdot DA_{element} / DA_{solid}$$

$$DW = \sqrt{112.00623 \cdot No._{total} \cdot DA_{element} / DA_{solid}} \qquad (C1)$$

$$DW = \sqrt{112.00623 \cdot No._{total} \cdot (DA_{solid} - DA_{element}) / DA_{solid}} \qquad (C2)$$

Equation C1 was used to calculate dot widths for 75% checkerboards and equation C2 was used to calculate dot widths for 25% checkerboards.

Line Width Calculation

Scan line patterns were made up of alternately black and clear lines in scan direction (in this case, vertical direction). Likewise, cross-scan line patterns were made up of alternately black and clear lines in cross-scan direction or, in this experiment, horizontal direction. The ratio of black to clear lines of 25% test elements on processed film is 3 to 1. On the other hand, the ratio of black and clear lines of 75% test elements on processed film is 1 to 3. The following table shows the number of black and clear pixels for both scan line and cross-scan line patterns in a unit area (see figure C(2)-1).

Table C(2)-2. Number of pixels ina unit of 25% and 75% of scan or cross scan line patterns

25% test element	No. of pixels/ unit area		75% test element	No. of pixels/ unit area	
	Black	Clear		Black	Clear
3x1	3	1	1x3	1	3
2x6	6	2	6x2	2	6
3x9	9	3	9x3	3	9
4x12	12	4	12x4	4	12

Calculation:

Pixel width(microns): 10.5833

Area of a pixel (micron^2): 112.00623

Total number of pixels in a unit (pixels): $No._{total}$

Area of a unit (micron^2): 112.00623 · $No._{total}$

Dot area reading on solid area (%): DA_{solid}

No. of black pixels in a unit (pixels): $No._{black}$

Dot area reading on test element(%): $DA_{element}$

Area of actual line in a unit on processed film ($micron^2$): $AREA_{element}$

Line width (microns): LW

$$AREA_{element} = 112.00623 \cdot No._{total} \cdot DA_{element} / DA_{solid}$$

$$LW \cdot 10.5833 = 112.00623 \cdot No._{total} \cdot DA_{element} / DA_{solid}$$

$$LW = 10.5833 \cdot No._{total} \cdot DA_{element} / DA_{solid} \quad (C3)$$

$$LW = 10.5833 \cdot No._{total} \cdot (DA_{solid} - DA_{element}) / DA_{solid} \quad (C4)$$

Equation C2 then was used to calculate line widths for both 75% scan line and cross-scan line patterns; and equation C4 was used to calculate line widths for both 25% scan line and cross-scan line patterns.

Table C(2)-3. Dot Areas and relative edge movement of 25% checkerboards on PagiSet film

Exp. unit	Rel. log exp.	% Dot of Dmax	Reproduced Dot Area (%)				Rel. Edge Movement (μ)			
			1x3	2x6	3x9	4x12	1x3	2x6	3x9	4x12
233	-0.33	78.6	43.5	48.8	51.4	52.6	-6.2	-6.2	-6.4	-6.6
244	-0.25	90.4	55.8	59.5	61.4	62.3	-5.2	-4.9	-4.9	-5.0
255	-0.18	98.0	66.6	67.5	68.7	69.2	-4.0	-3.8	-3.7	-3.8
266	-0.11	100.0	75.5	72.6	72.5	72.5	-2.5	-2.3	-2.3	-2.3
278	-0.04	100.0	82.6	76.3	74.8	74.3	-0.9	-0.8	-0.8	-0.8
285	0.00	100.0	85.9	78.0	76.1	75.2	0.0	0.0	0.0	0.0
290	0.03	100.0	88.7	79.6	77.0	76.0	0.8	0.7	0.6	0.7
303	0.10	100.0	92.3	82.1	78.6	77.1	2.1	1.9	1.6	1.6
316	0.17	100.0	95.3	84.5	80.3	78.4	3.4	3.2	2.9	2.8
330	0.24	100.0	97.6	87.3	82.2	79.8	4.6	4.8	4.2	4.1
345	0.31	100.0	99.0	90.1	84.1	81.2	5.8	6.5	5.7	5.5
360	0.38	100.0	99.6	92.4	86.0	82.7	6.6	8.2	7.2	7.0

Table C(2)-4. Dot Areas and relative edge movement of 75% checkerboards on PagiSet film

Exp. unit	Rel. log exp.	% Dot of Dmax	Reproduced Dot Area (%)				Rel. Edge Movement (μ)			
			1x3	2x6	3x9	4x12	1x3	2x6	3x9	4x12
233	-0.33	78.6	3.7	8.9	11.6	13.3	-3.7	-5.3	-5.8	-6.1
244	-0.25	90.4	5.3	11.5	14.5	16.3	-3.2	-4.5	-4.7	-4.9
255	-0.18	98.0	7.8	14.7	17.7	19.2	-2.4	-3.2	-3.2	-3.4
266	-0.11	100.0	10.3	17.5	19.9	21.2	-1.5	-1.8	-1.8	-1.9
278	-0.04	100.0	14.0	19.8	21.6	22.6	-0.4	-0.7	-0.7	-0.6
285	0.00	100.0	15.5	21.4	22.6	23.3	0.0	0.0	0.0	0.0
290	0.03	100.0	17.6	22.5	23.4	23.9	0.5	0.5	0.5	0.5
303	0.10	100.0	21.4	24.6	24.8	24.8	1.4	1.4	1.4	1.3
316	0.17	100.0	25.4	26.5	26.1	25.9	2.3	2.2	2.3	2.2
330	0.24	100.0	30.7	28.9	27.8	27.2	3.4	3.2	3.3	3.3
345	0.31	100.0	36.6	31.6	29.4	28.4	4.5	4.2	4.3	4.2
360	0.38	100.0	42.5	34.2	31.0	29.8	5.5	5.2	5.2	5.3

Table C(2)-5. Dot widths at practical exposure on PagiSet film

% Dot Area	Exp. unit	% Dot of Dmax	Reproduced Dot Area (%)				Dot Width (μ)			
			1x3, 3x1	2x6, 6x2	3x9, 9x3	4x12, 12x4	1x3, 3x1	2x6, 6x2	3x9, 9x3	4x12, 12x4
25%	285	100.0	85.9	78.0	76.1	75.2	7.9	19.8	31.0	42.1
75%	285	100.0	15.533	21.367	22.6	23.333	8.3	19.6	30.2	40.9

Table C(2)-6. Relative edge movement of checkerboards on PagiSet film

Exp. unit	Rel. log exp.	Dmax	Rel. Edge Movement (microns) 1x3	2x6	3x9	4x12	3x1	6x2	9x3	12x4	Cal.*
233	-0.33	0.51	-3.1	-3.1	-3.2	-3.3	-1.9	-2.7	-2.9	-3.1	
244	-0.25	0.72	-2.6	-2.5	-2.5	-2.5	-1.6	-2.2	-2.4	-2.5	-5.50
255	-0.18	0.98	-2.0	-1.9	-1.9	-1.9	-1.2	-1.6	-1.6	-1.7	-2.59
266	-0.11	1.34	-1.3	-1.2	-1.1	-1.1	-0.8	-0.9	-0.9	-1.0	-1.26
278	-0.04	1.78	-0.4	-0.4	-0.4	-0.4	-0.2	-0.4	-0.3	-0.3	-0.38
285	0.00	2.08	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00
290	0.03	2.33	0.4	0.4	0.3	0.3	0.3	0.3	0.3	0.2	0.23
303	0.10	2.70	1.0	1.0	0.8	0.8	0.7	0.7	0.7	0.6	0.81
316	0.17	3.14	1.7	1.6	1.4	1.4	1.2	1.1	1.1	1.1	1.37
330	0.24	3.69	2.3	2.4	2.1	2.1	1.7	1.6	1.6	1.6	1.94
345	0.31	4.13	2.9	3.2	2.8	2.7	2.2	2.1	2.1	2.1	2.53
360	0.38	4.49	3.3	4.1	3.6	3.5	2.7	2.6	2.6	2.7	3.09

* Note: Relative dot width differences from Frieser's equation of k = 8.19

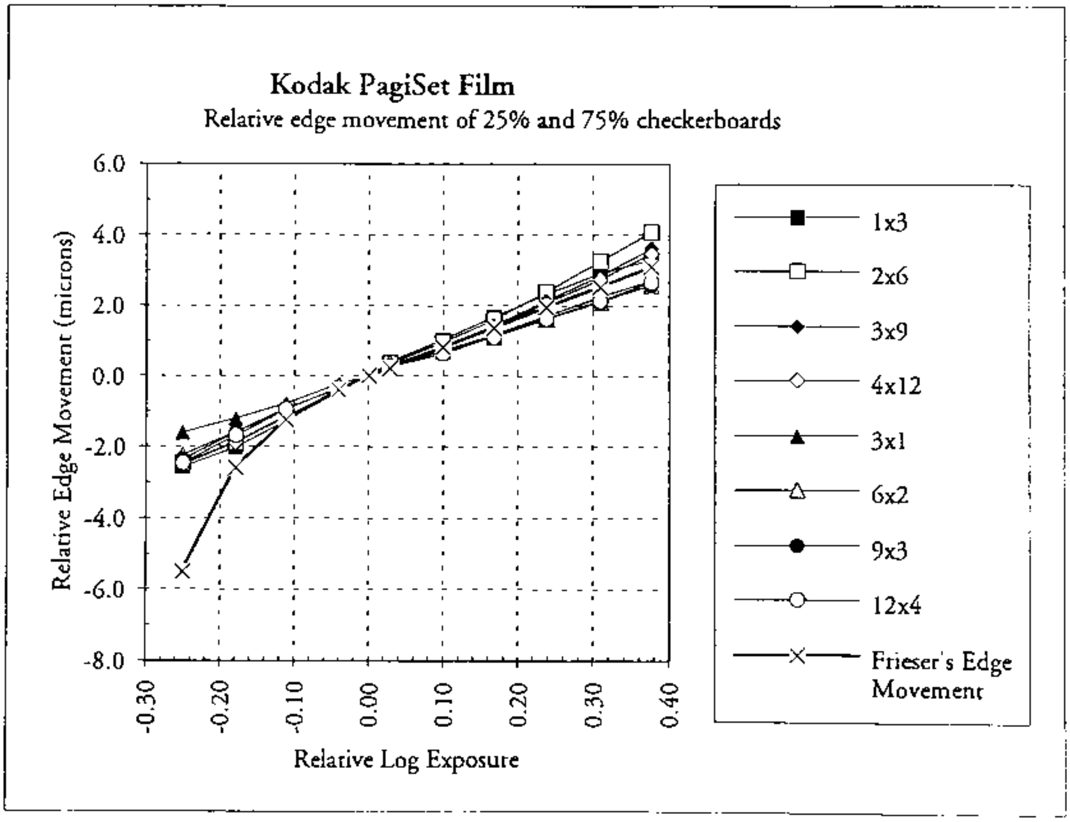


Figure C(2)-2. Relative edge movement of checkerboards on PagiSet film

Table C(2)-7. Dot Areas and relative edge movement of 25% scan line patterns on PagiSet film

Exp.	Rel.	% Dot	Reproduced Dot Area (%)				Rel. Edge Movement (μ)			
unit	log exp.	of Dmax	1x3	2x6	3x9	4x12	1x3	2x6	3x9	4x12
233	-0.33	78.6	49.3	52.9	54.5	55.2	-6.3	-6.3	-6.8	-7.8
244	-0.25	90.4	59.8	62.6	63.8	64.7	-4.9	-4.6	-5.2	-5.5
255	-0.18	98.0	67.9	69.4	70.6	71.2	-3.5	-3.3	-3.4	-3.6
266	-0.11	100.0	72.5	72.4	73.0	73.3	-2.2	-2.0	-2.1	-2.5
278	-0.04	100.0	75.8	74.0	74.3	74.3	-0.8	-0.6	-0.6	-0.8
285	0.00	100.0	77.6	74.8	74.7	74.8	0.0	0.0	0.0	0.0
290	0.03	100.0	79.2	75.5	75.0	74.9	0.7	0.6	0.4	0.3
303	0.10	100.0	82.1	76.6	75.9	75.6	1.9	1.6	1.5	1.3
316	0.17	100.0	85.2	77.8	76.5	76.2	3.2	2.6	2.3	2.4
330	0.24	100.0	88.8	79.2	77.5	76.8	4.7	3.8	3.6	3.4
345	0.31	100.0	92.4	80.9	78.5	77.5	6.2	5.2	4.9	4.7
360	0.38	100.0	95.1	82.8	79.7	78.4	7.4	6.8	6.4	6.1

Table C(2)-8. Dot Areas and relative edge movement of 75% scan line patterns on PagiSet film

Exp.	Rel.	% Dot	Reproduced Dot Area (%)				Rel. Edge Movement (μ)			
unit	log exp.	of Dmax	1x3	2x6	3x9	4x12	1x3	2x6	3x9	4x12
233	-0.33	78.6	9.6	14.0	15.5	16.2	-4.9	-5.7	-6.0	-6.6
244	-0.25	90.4	13.2	17.4	18.7	19.7	-3.9	-4.5	-4.7	-4.7
255	-0.18	98.0	16.5	20.5	21.6	22.5	-2.9	-3.0	-3.0	-2.7
266	-0.11	100.0	19.3	22.1	23.1	23.4	-1.9	-2.0	-1.7	-1.9
278	-0.04	100.0	22.2	23.8	24.0	24.4	-0.6	-0.6	-0.5	-0.2
285	0.00	100.0	23.7	24.5	24.4	24.5	0.0	0.0	0.0	0.0
290	0.03	100.0	24.8	25.1	24.8	24.9	0.4	0.5	0.5	0.6
303	0.10	100.0	27.1	26.1	25.7	25.5	1.4	1.3	1.5	1.6
316	0.17	100.0	29.0	27.1	26.3	25.9	2.2	2.2	2.4	2.4
330	0.24	100.0	31.7	28.6	27.4	26.6	3.4	3.4	3.7	3.5
345	0.31	100.0	34.2	29.7	28.2	27.3	4.4	4.4	4.7	4.7
360	0.38	100.0	36.4	30.9	28.8	27.8	5.4	5.4	5.5	5.6

Table C(2)-9. Scan line widths at practical exposure on PagiSet film

% Dot	Exp.	% Dot	Reproduced Dot Area (%)				Line Width (μ)			
Area	unit	of Dmax	1x3, 3x1	2x6, 6x2	3x9, 9x3	4x12, 12x4	1x3, 3x1	2x6, 6x2	3x9, 9x3	4x12, 12x4
25%	285	100.0	77.6	74.8	74.7	74.8	9.5	21.4	32.1	42.7
75%	285	100.0	23.7	24.5	24.4	24.5	10.0	20.8	31.0	41.5

Table C(2)-10. Relative edge movement of scan line patterns on PagiSet film

Exp. unit	Rel. log exp.	Rel. Edge Movement (microns)								
		1x3	2x6	3x9	4x12	3x1	6x2	9x3	12x4	Cal.*
233	-0.33	-3.2	-3.2	-3.4	-3.9	-2.4	-2.8	-3.0	-3.3	
244	-0.25	-2.4	-2.3	-2.6	-2.7	-1.9	-2.2	-2.4	-2.4	-5.36
255	-0.18	-1.8	-1.7	-1.7	-1.8	-1.5	-1.5	-1.5	-1.4	-2.53
266	-0.11	-1.1	-1.0	-1.1	-1.2	-0.9	-1.0	-0.9	-1.0	-1.22
278	-0.04	-0.4	-0.3	-0.3	-0.4	-0.3	-0.3	-0.3	-0.1	-0.37
285	0.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00
290	0.03	0.3	0.3	0.2	0.1	0.2	0.2	0.2	0.3	0.22
303	0.10	0.9	0.8	0.7	0.7	0.7	0.7	0.8	0.8	0.79
316	0.17	1.6	1.3	1.2	1.2	1.1	1.1	1.2	1.2	1.33
330	0.24	2.4	1.9	1.8	1.7	1.7	1.7	1.9	1.7	1.89
345	0.31	3.1	2.6	2.4	2.3	2.2	2.2	2.4	2.3	2.46
360	0.38	3.7	3.4	3.2	3.0	2.7	2.7	2.8	2.8	3.01

* Note: Relative line width differences from Frieser's equation of k = 7.99

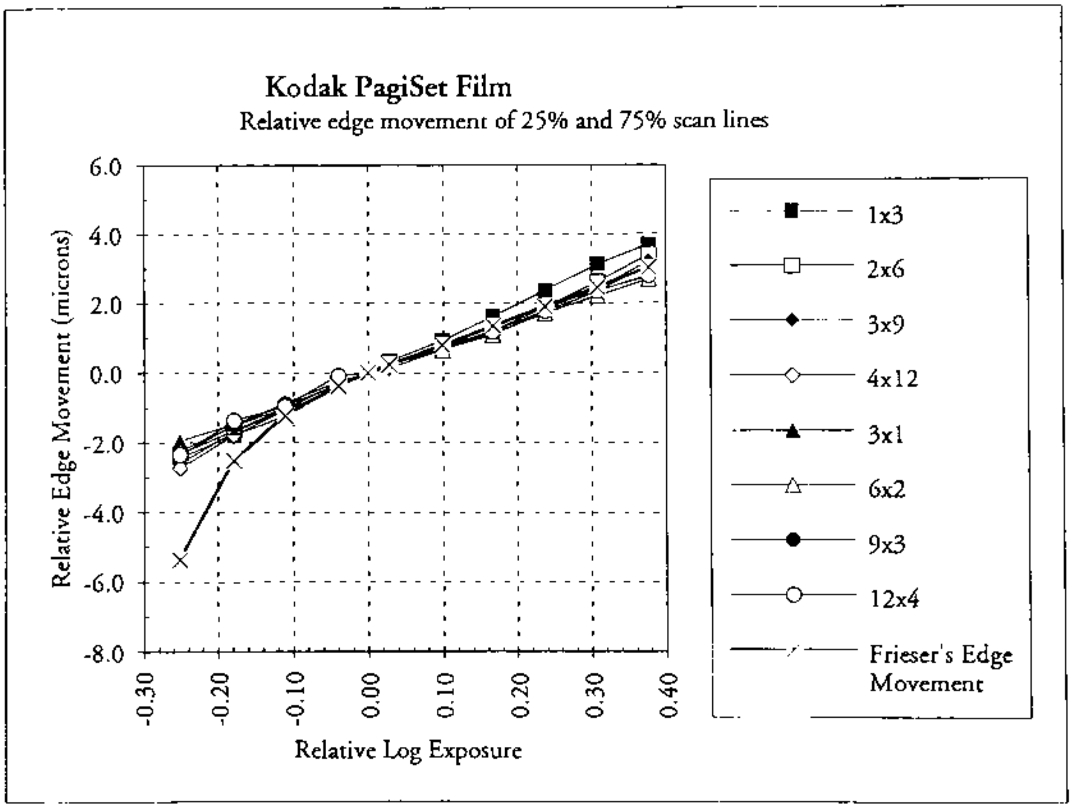


Figure C(2)-3. Relative edge movement of scan line patterns on PagiSet film

Table C(2)-11. Dot Areas and relative edge movement of 25% cross-scan line patterns on PagiSet film

Exp.	Rel.	% Dot	Reproduced Dot Area (%)				Rel. Edge Movement (μ)			
unit	log exp.	of Dmax	1x3	2x6	3x9	4x12	1x3	2x6	3x9	4x12
233	-0.33	78.6	46.8	51.4	53.7	54.7	-7.4	-7.6	-7.8	-8.5
244	-0.25	90.4	56.8	61.2	63.2	64.0	-6.0	-5.7	-5.9	-6.4
255	-0.18	98.0	65.2	68.1	69.8	70.4	-4.4	-4.1	-4.2	-4.6
266	-0.11	100.0	70.5	71.4	72.5	72.9	-2.7	-2.5	-2.6	-2.9
278	-0.04	100.0	74.6	73.4	73.9	73.9	-1.0	-0.9	-0.8	-1.1
285	0.00	100.0	77.0	74.4	74.5	74.6	0.0	0.0	0.0	0.0
290	0.03	100.0	78.7	75.1	75.1	74.9	0.7	0.6	0.7	0.6
303	0.10	100.0	82.0	76.6	76.0	75.7	2.1	1.9	1.9	1.8
316	0.17	100.0	85.2	77.9	76.8	76.3	3.5	2.9	2.9	2.9
330	0.24	100.0	89.2	79.6	77.9	77.0	5.2	4.4	4.3	4.1
345	0.31	100.0	92.5	81.4	79.0	77.8	6.6	6.0	5.6	5.5
360	0.38	100.0	95.4	83.1	80.0	78.6	7.8	7.4	6.9	6.8

Table C(2)-12. Dot Areas and relative edge movement of 75% cross-scan line patterns on PagiSet film

Exp.	Rel.	% Dot	Reproduced Dot Area (%)				Rel. Edge Movement (μ)			
unit	log exp.	of Dmax	1x3	2x6	3x9	4x12	1x3	2x6	3x9	4x12
233	-0.33	78.6	7.2	12.3	14.4	15.6	-5.6	-6.8	-7.1	-7.2
244	-0.25	90.4	9.6	15.5	17.6	18.6	-5.0	-5.6	-5.5	-6.0
255	-0.18	98.0	13.4	18.9	20.5	21.3	-3.7	-3.8	-3.7	-4.1
266	-0.11	100.0	16.7	21.1	22.0	22.7	-2.4	-2.3	-2.3	-2.4
278	-0.04	100.0	20.5	22.9	23.3	23.7	-0.8	-0.7	-0.6	-0.7
285	0.00	100.0	22.5	23.8	23.8	24.1	0.0	0.0	0.0	0.0
290	0.03	100.0	24.0	24.5	24.2	24.6	0.6	0.6	0.5	0.7
303	0.10	100.0	27.0	25.9	25.4	25.2	1.9	1.8	1.9	1.7
316	0.17	100.0	29.7	27.1	26.1	25.8	3.0	2.8	2.9	2.9
330	0.24	100.0	32.8	28.6	27.1	26.6	4.4	4.1	4.1	4.2
345	0.31	100.0	35.5	29.9	28.0	27.2	5.5	5.2	5.2	5.2
360	0.38	100.0	38.3	31.4	29.0	28.0	6.7	6.5	6.5	6.6

Table C(2)-13. Cross-scan line widths at practical exposure on PagiSet film

% Dot	Exp.	% Dot	Reproduced Dot Area (%)				Line Width (μ)			
Area	unit	of Dmax	1x3, 3x1	2x6, 6x2	3x9, 9x3	4x12, 12x4	1x3, 3x1	2x6, 6x2	3x9, 9x3	4x12, 12x4
25%	285	100.0	77.0	74.4	74.5	74.6	9.8	21.7	32.3	43.1
75%	285	100.0	22.5	23.8	23.8	24.1	9.5	20.1	30.3	40.9

Table C(2)-14. Relative edge movement of cross-scan line patterns on PagiSet film

Exp. unit	Rel. log exp.	Dmax	Rel. Edge Movement (microns)								
			1x3	2x6	3x9	4x12	3x1	6x2	9x3	12x4	Cal.*
233	-0.33	0.51	-3.7	-3.8	-3.9	-4.2	-2.8	-3.4	-3.5	-3.6	
244	-0.25	0.72	-3.0	-2.9	-3.0	-3.2	-2.5	-2.8	-2.8	-3.0	-6.07
255	-0.18	0.98	-2.2	-2.1	-2.1	-2.3	-1.9	-1.9	-1.9	-2.1	-2.86
266	-0.11	1.34	-1.4	-1.3	-1.3	-1.4	-1.2	-1.1	-1.2	-1.2	-1.39
278	-0.04	1.78	-0.5	-0.4	-0.4	-0.5	-0.4	-0.4	-0.3	-0.4	-0.42
285	0.00	2.08	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00
290	0.03	2.33	0.4	0.3	0.4	0.3	0.3	0.3	0.2	0.4	0.25
303	0.10	2.70	1.1	0.9	0.9	0.9	1.0	0.9	1.0	0.9	0.89
316	0.17	3.14	1.7	1.5	1.4	1.4	1.5	1.4	1.5	1.4	1.51
330	0.24	3.69	2.6	2.2	2.2	2.1	2.2	2.0	2.1	2.1	2.14
345	0.31	4.13	3.3	3.0	2.8	2.8	2.7	2.6	2.6	2.6	2.79
360	0.38	4.49	3.9	3.7	3.5	3.4	3.4	3.2	3.3	3.3	3.41

* Note: Relative line width differences from Frieser's equation of k = 9.04

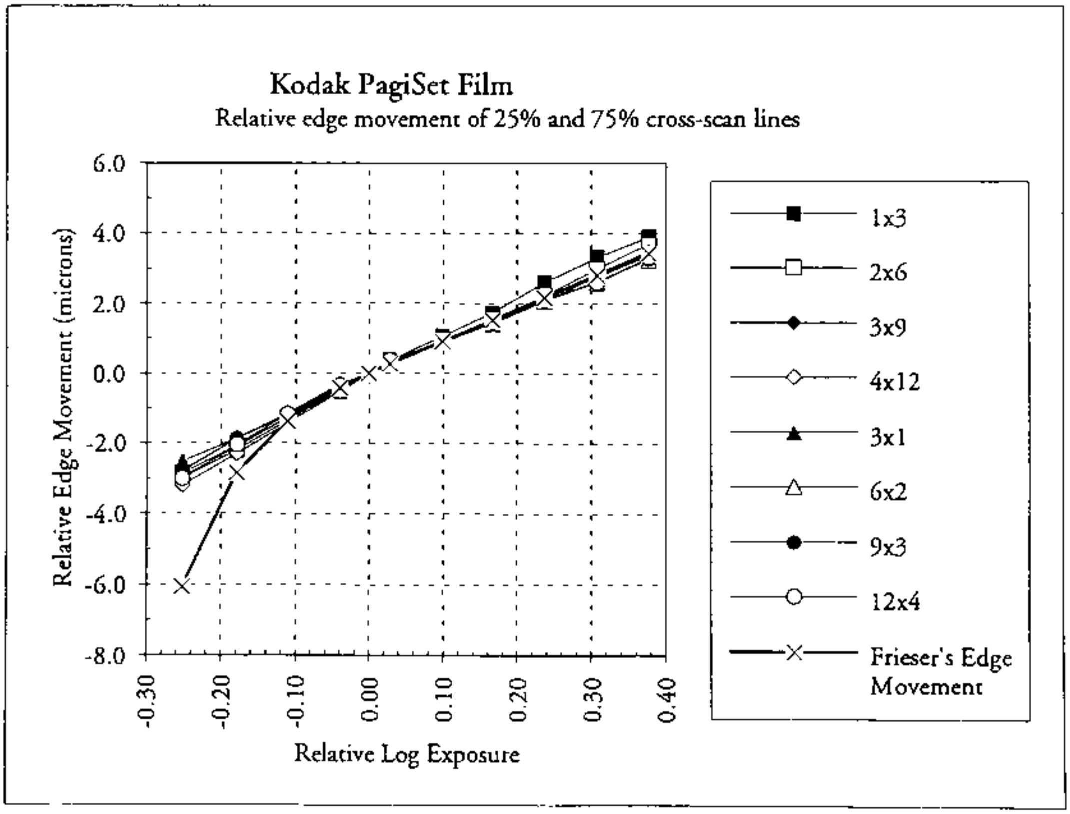


Figure C(2)-4. Relative edge movement of cross-scan line patterns on PagiSet film

Table C(2)-15. Dot Areas and relative edge movement of 25% checkerboards on Imageset 2000 film

Exp.	Rel.	% Dot	Reproduced Dot Area (%)				Rel. Edge Movement (μ)			
unit	log exp.	of Dmax	1x3	2x6	3x9	4x12	1x3	2x6	3x9	4x12
258	-0.31	54.3	8.4	18.2	24.4	27.9	-11.5	-14.1	-15.3	-16.0
269	-0.24	97.4	32.3	52.1	58.4	61.4	-9.4	-8.4	-8.3	-8.5
281	-0.17	100.0	53.0	63.5	66.3	67.7	-6.6	-5.1	-5.0	-5.1
293	-0.11	100.0	72.3	70.3	70.6	70.8	-3.2	-2.6	-2.6	-2.7
306	-0.04	100.0	80.7	74.4	73.4	73.1	-1.3	-1.0	-0.9	-0.9
313	0.00	100.0	85.9	76.6	74.8	74.2	0.0	0.0	0.0	0.0
320	0.04	100.0	88.5	78.3	76.4	75.2	0.8	0.8	1.0	0.9
334	0.10	100.0	94.9	82.3	78.8	77.0	3.2	2.7	2.6	2.5
349	0.18	100.0	98.3	85.2	81.1	79.0	5.2	4.2	4.2	4.2
364	0.24	100.0	99.8	88.0	83.0	80.7	7.0	5.8	5.7	5.8
381	0.32	100.0	99.9	90.9	85.5	82.4	7.3	7.7	7.6	7.5
397	0.38	100.0	100.0	93.6	87.3	84.1	7.6	9.7	9.2	9.3

Table C(2)-16. Dot Areas and relative edge movement of 75% checkerboards on Imageset 2000 film

Exp.	Rel.	% Dot	Reproduced Dot Area (%)				Rel. Edge Movement (μ)			
unit	log exp.	of Dmax	1x3	2x6	3x9	4x12	1x3	2x6	3x9	4x12
258	-0.31	54.3	0.2	1.1	2.4	3.8	-7.2	-15.2	-18.3	-19.5
269	-0.24	97.4	0.5	4.7	10.4	13.5	-6.9	-11.8	-11.1	-10.4
281	-0.17	100.0	0.6	11.7	15.7	17.7	-6.7	-6.7	-6.6	-6.3
293	-0.11	100.0	2.4	17.9	20.0	20.7	-5.1	-3.2	-3.4	-3.4
306	-0.04	100.0	9.6	22.6	23.3	23.2	-1.8	-1.0	-1.2	-1.1
313	0.00	100.0	15.7	24.9	25.1	24.5	0.0	0.0	0.0	0.0
320	0.04	100.0	20.8	26.9	26.4	25.5	1.3	0.8	0.9	0.8
334	0.10	100.0	30.5	30.9	28.9	27.2	3.3	2.4	2.3	2.3
349	0.18	100.0	39.4	35.1	31.7	29.4	4.9	3.9	4.0	4.0
364	0.24	100.0	48.6	38.2	33.6	31.1	6.4	5.0	5.0	5.4
381	0.32	100.0	57.9	42.2	36.6	33.4	7.7	6.4	6.6	7.0
397	0.38	100.0	66.6	46.1	39.2	35.3	8.9	7.6	8.0	8.4

Table C(2)-17. Dot widths at practical exposure on Imageset 2000 film

% Dot	Exp.	% Dot	Reproduced Dot Area (%)				Dot Width (μ)			
Area	unit	of Dmax	1x3, 3x1	2x6, 6x2	3x9, 9x3	4x12, 12x4	1x3, 3x1	2x6, 6x2	3x9, 9x3	4x12, 12x4
25%	313	100.0	85.9	76.6	74.8	74.2	8.0	20.5	31.9	43.0
75%	313	100.0	15.7	24.9	25.1	24.5	8.4	21.1	31.8	41.9

Table C(2)-18. Relative edge movement of checkerboards on Imageset 2000 film

Exp. unit	Rel. log exp.	Dmax	Reproduced Dot Area (%)				Rel. Dot Width Differences (μ)				
			1x3	2x6	3x9	4x12	3x1	6x2	9x3	12x4	Cal.*
258	-0.31	0.30	-5.7	-7.0	-7.6	-8.0	-3.6	-7.6	-9.2	-9.7	
269	-0.24	1.06	-4.7	-4.2	-4.2	-4.2	-3.4	-5.9	-5.5	-5.2	-6.95
281	-0.17	2.24	-3.3	-2.6	-2.5	-2.5	-3.4	-3.3	-3.3	-3.1	-3.35
293	-0.11	3.70	-1.6	-1.3	-1.3	-1.3	-2.5	-1.6	-1.7	-1.7	-1.61
306	-0.04	4.40	-0.7	-0.5	-0.4	-0.4	-0.9	-0.5	-0.6	-0.5	-0.47
313	0.00	4.73	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00
320	0.04	4.97	0.4	0.4	0.5	0.4	0.6	0.4	0.4	0.4	0.40
334	0.10	5.22	1.6	1.3	1.3	1.2	1.7	1.2	1.2	1.2	1.17
349	0.18	5.37	2.6	2.1	2.1	2.1	2.5	2.0	2.0	2.0	1.96
364	0.24	5.37	3.5	2.9	2.8	2.9	3.2	2.5	2.5	2.7	2.72
381	0.32	5.43	3.6	3.9	3.8	3.8	3.9	3.2	3.3	3.5	3.55
397	0.38	5.46	3.8	4.9	4.6	4.6	4.4	3.8	4.0	4.2	4.29

* Note: Relative dot width differences from Frieser's equation of k = 11.17

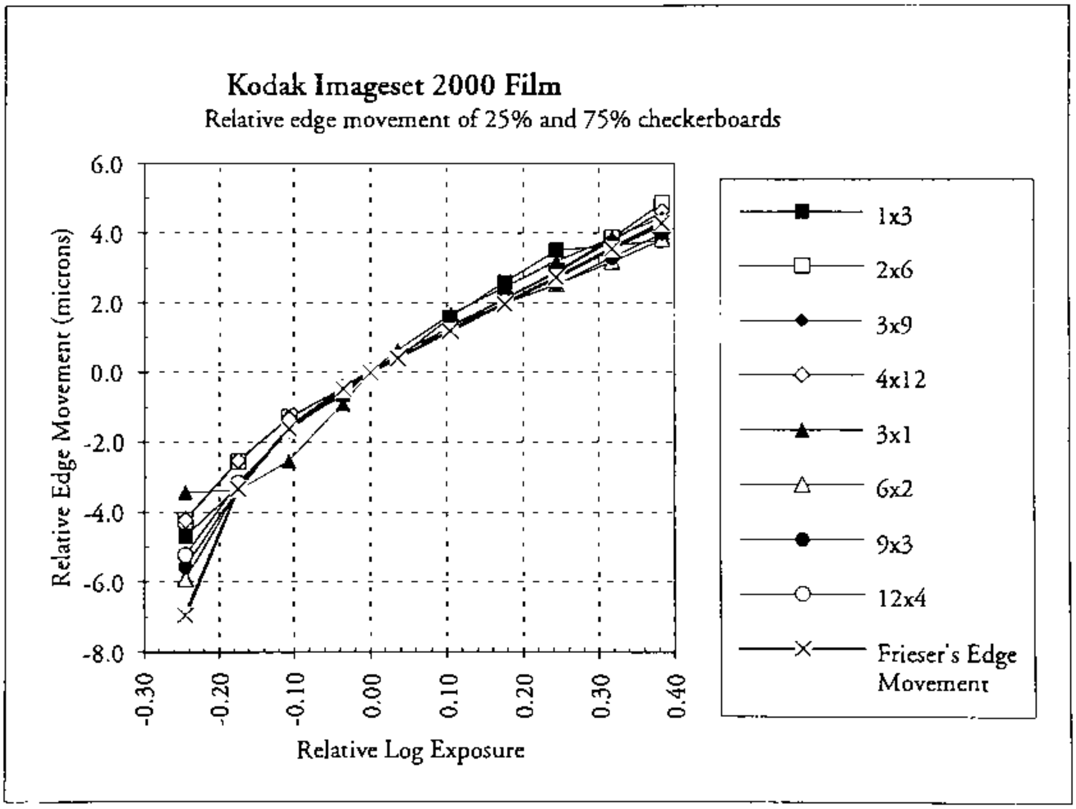


Figure C(2)-5. Relative edge movement of checkerboards on Imageset 2000 film

Table C(2)-19. Dot Areas and relative edge movement of 25% scan line patterns on Imageset 2000 film

Exp.	Rel.	% Dot	Reproduced Dot Area (%)				Rel. Edge Movement (μ)			
unit	log exp.	of Dmax	1x3	2x6	3x9	4x12	1x3	2x6	3x9	4x12
258	-0.31	54.3	21.4	29.0	32.4	34.1	-15.9	-18.1	-19.3	-19.9
269	-0.24	97.4	58.6	64.6	66.7	67.6	-7.1	-7.3	-8.0	-8.9
281	-0.17	100.0	66.8	69.9	71.5	72.3	-4.3	-4.2	-4.2	-3.9
293	-0.11	100.0	71.6	72.1	73.0	73.3	-2.3	-2.4	-2.3	-2.2
306	-0.04	100.0	74.9	74.0	74.1	74.2	-0.9	-0.8	-0.9	-0.7
313	0.00	100.0	77.0	74.9	74.8	74.6	0.0	0.0	0.0	0.0
320	0.04	100.0	78.8	75.7	75.3	75.2	0.8	0.7	0.6	1.0
334	0.10	100.0	83.6	77.6	76.5	76.1	2.8	2.3	2.2	2.4
349	0.18	100.0	87.4	79.3	77.6	77.0	4.4	3.7	3.6	4.1
364	0.24	100.0	92.5	81.0	78.8	77.7	6.5	5.2	5.0	5.2
381	0.32	100.0	97.6	83.1	80.2	78.8	8.7	7.0	6.9	7.1
397	0.38	100.0	99.8	85.0	81.2	79.6	9.6	8.6	8.1	8.4

Table C(2)-20. Dot Areas and relative edge movement of 75% scan line patterns on Imageset 2000 film

Exp.	Rel.	% Dot	Reproduced Dot Area (%)				Rel. Edge Movement (μ)			
unit	log exp.	of Dmax	1x3	2x6	3x9	4x12	1x3	2x6	3x9	4x12
258	-0.31	54.3	1.2	3.1	5.4	6.9	-12.0	-18.0	-20.1	-21.2
269	-0.24	97.4	4.9	15.5	18.2	19.7	-10.8	-9.5	-9.1	-8.4
281	-0.17	100.0	16.0	21.0	21.9	22.3	-6.2	-5.2	-5.0	-4.9
293	-0.11	100.0	23.7	23.9	23.6	23.5	-2.9	-2.7	-2.8	-2.9
306	-0.04	100.0	28.5	26.1	25.2	24.8	-0.9	-0.8	-0.8	-0.6
313	0.00	100.0	30.6	27.1	25.8	25.2	0.0	0.0	0.0	0.0
320	0.04	100.0	32.4	28.3	26.9	25.9	0.7	1.0	1.4	1.3
334	0.10	100.0	36.3	29.9	27.6	26.5	2.4	2.4	2.2	2.3
349	0.18	100.0	40.0	31.9	29.2	27.6	4.0	4.1	4.3	4.1
364	0.24	100.0	43.0	33.5	30.3	28.4	5.2	5.4	5.7	5.5
381	0.32	100.0	46.2	35.5	31.8	29.8	6.6	7.1	7.5	7.9
397	0.38	100.0	49.0	36.8	32.8	30.6	7.8	8.2	8.8	9.2

Table C(2)-21. Scan line widths at practical exposure on Imageset 2000 film

% Dot	Exp.	% Dot	Reproduced Dot Area (%)				Line Width (μ)			
Area	unit	of Dmax	1x3, 3x1	2x6, 6x2	3x9, 9x3	4x12, 12x4	1x3, 3x1	2x6, 6x2	3x9, 9x3	4x12, 12x4
25%	313	100.0	77.0	74.9	74.8	74.6	9.7	21.3	32.0	43.0
75%	313	100.0	30.6	27.1	25.8	25.2	13.0	22.9	32.8	42.6

Table C(2)-22. Relative edge movement of scan line patterns on Imageset 2000 film

Exp. unit	Rel. log exp.	Dmax	Reproduced Dot Area (%)				Rel. Line Width Differences (μ)				
			1x3	2x6	3x9	4x12	3x1	6x2	9x3	12x4	Cal.*
258	-0.31	0.30	-8.0	-9.1	-9.6	-10.0	-6.0	-9.0	-10.1	-10.6	-
269	-0.24	1.06	-3.6	-3.6	-4.0	-4.5	-5.4	-4.7	-4.6	-4.2	-7.01
281	-0.17	2.24	-2.2	-2.1	-2.1	-1.9	-3.1	-2.6	-2.5	-2.5	-3.37
293	-0.11	3.70	-1.2	-1.2	-1.2	-1.1	-1.5	-1.4	-1.4	-1.4	-1.63
306	-0.04	4.40	-0.4	-0.4	-0.5	-0.4	-0.5	-0.4	-0.4	-0.3	-0.47
313	0.00	4.73	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00
320	0.04	4.97	0.4	0.4	0.3	0.5	0.4	0.5	0.7	0.6	0.40
334	0.10	5.22	1.4	1.1	1.1	1.2	1.2	1.2	1.1	1.2	1.18
349	0.18	5.37	2.2	1.9	1.8	2.0	2.0	2.0	2.2	2.1	1.98
364	0.24	5.37	3.3	2.6	2.5	2.6	2.6	2.7	2.9	2.8	2.74
381	0.32	5.43	4.4	3.5	3.5	3.6	3.3	3.6	3.8	4.0	3.57
397	0.38	5.46	4.8	4.3	4.1	4.2	3.9	4.1	4.4	4.6	4.32

* Note: Relative dot width differences from Frieser's equation of k = 11.25

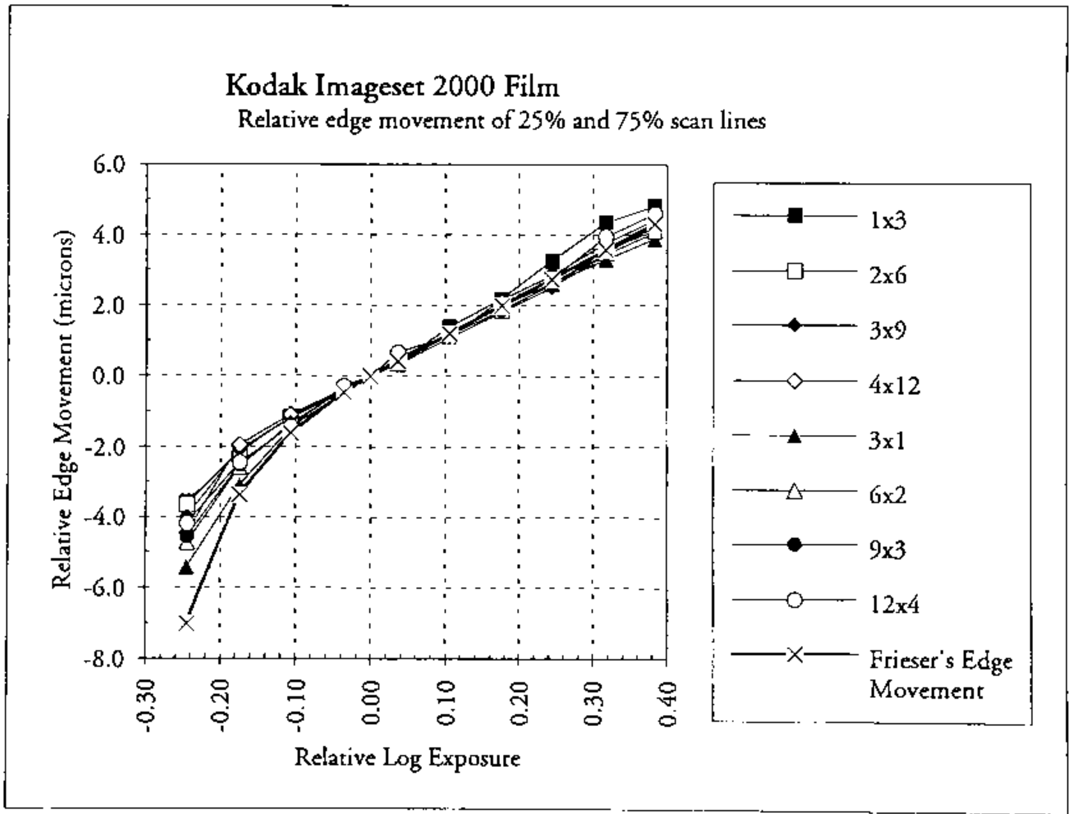


Figure C(2)-6. Relative edge movement of scan line patterns on Imageset 2000 film

Table C(2)-23. Dot Areas and relative edge movement of 25% cross-scan line patterns on Imageset 2000 film

Exp.	Rel.	% Dot	Reproduced Dot Area (%)				Rel. Edge Movement (μ)			
unit	log exp.	of Dmax	1x3	2x6	3x9	4x12	1x3	2x6	3x9	4x12
258	-0.31	54.3	18.5	27.1	30.8	32.2	-16.0	-18.7	-20.5	-23.7
269	-0.24	97.4	46.4	58.0	62.6	64.8	-10.3	-10.5	-11.0	-11.5
281	-0.17	100.0	56.7	64.4	68.0	69.6	-6.5	-6.4	-6.2	-6.4
293	-0.11	100.0	64.2	68.1	70.2	71.3	-3.3	-3.3	-3.4	-3.4
306	-0.04	100.0	69.3	70.6	71.9	72.5	-1.1	-1.2	-1.2	-1.4
313	0.00	100.0	72.0	72.0	72.9	73.3	0.0	0.0	0.0	0.0
320	0.04	100.0	74.3	73.1	73.6	73.8	1.0	1.0	0.9	0.8
334	0.10	100.0	79.7	75.6	75.3	74.9	3.3	3.1	3.1	2.6
349	0.18	100.0	84.3	77.8	76.7	76.0	5.2	4.9	4.9	4.6
364	0.24	100.0	89.6	79.7	77.9	77.0	7.5	6.5	6.4	6.2
381	0.32	100.0	95.4	82.0	79.5	78.2	9.9	8.5	8.4	8.2
397	0.38	100.0	99.2	84.1	81.0	79.3	11.5	10.2	10.3	10.1

Table C(2)-24. Dot Areas and relative edge movement of 75% cross-scan line patterns on Imageset 2000 film

Exp.	Rel.	% Dot	Reproduced Dot Area (%)				Rel. Edge Movement (μ)			
unit	log exp.	of Dmax	1x3	2x6	3x9	4x12	1x3	2x6	3x9	4x12
258	-0.31	54.3	0.5	2.3	4.7	6.3	-10.0	-17.4	-19.8	-20.8
269	-0.24	97.4	0.8	9.6	14.4	16.6	-10.0	-12.6	-11.9	-11.5
281	-0.17	100.0	1.7	16.2	18.3	19.8	-9.6	-7.3	-7.5	-6.9
293	-0.11	100.0	9.4	20.2	21.1	21.6	-6.4	-3.8	-3.9	-3.8
306	-0.04	100.0	20.4	23.3	23.1	23.1	-1.7	-1.2	-1.4	-1.2
313	0.00	100.0	24.4	24.7	24.2	23.9	0.0	0.0	0.0	0.0
320	0.04	100.0	27.3	26.0	25.1	24.8	1.2	1.1	1.1	1.6
334	0.10	100.0	32.6	28.2	26.4	25.5	3.4	3.0	2.8	2.8
349	0.18	100.0	36.8	30.6	28.2	26.8	5.2	4.9	5.0	5.0
364	0.24	100.0	41.4	32.3	29.3	27.7	7.2	6.4	6.5	6.4
381	0.32	100.0	44.3	34.2	30.8	28.8	8.4	8.0	8.3	8.4
397	0.38	100.0	47.4	36.2	32.5	29.9	9.7	9.7	10.5	10.3

Table C(2)-25. Cross-scan line widths at practical exposure on Imageset 2000 film

% Dot	Exp.	% Dot	Reproduced Dot Area (%)				Line Width (μ)			
Area	unit	of Dmax	1x3, 3x1	2x6, 6x2	3x9, 9x3	4x12, 12x4	1x3, 3x1	2x6, 6x2	3x9, 9x3	4x12, 12x4
25%	313	100.0	72.0	72.0	72.9	73.3	11.9	23.7	34.5	45.2
75%	313	100.0	24.433	24.733	24.2	23.867	10.3	20.9	30.7	40.4

Table C(2)-26. Relative edge movement of cross-scan line patterns on Imageset 2000 film

Exp. unit	Rel. log exp.	Dmax	Reproduced Dot Area (%) 1x3	2x6	3x9	4x12	Rel. Line Width Differences (μ) 3x1	6x2	9x3	12x4	Cal.*
258	-0.31	0.30	-8.0	-9.4	-10.3	-11.8	-5.0	-8.7	-9.9	-10.4	
269	-0.24	1.06	-5.1	-5.3	-5.5	-5.7	-5.0	-6.3	-6.0	-5.7	-8.29
281	-0.17	2.24	-3.2	-3.2	-3.1	-3.2	-4.8	-3.6	-3.7	-3.5	-3.99
293	-0.11	3.70	-1.6	-1.7	-1.7	-1.7	-3.2	-1.9	-2.0	-1.9	-1.92
306	-0.04	4.40	-0.6	-0.6	-0.6	-0.7	-0.9	-0.6	-0.7	-0.6	-0.56
313	0.00	4.73	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00
320	0.04	4.97	0.5	0.5	0.4	0.4	0.6	0.6	0.6	0.8	0.48
334	0.10	5.22	1.6	1.5	1.6	1.3	1.7	1.5	1.4	1.4	1.40
349	0.18	5.37	2.6	2.5	2.5	2.3	2.6	2.5	2.5	2.5	2.34
364	0.24	5.37	3.7	3.3	3.2	3.1	3.6	3.2	3.2	3.2	3.24
381	0.32	5.43	5.0	4.2	4.2	4.1	4.2	4.0	4.2	4.2	4.23
397	0.38	5.46	5.8	5.1	5.1	5.1	4.9	4.9	5.2	5.1	5.11

* Note: Relative dot width differences from Frieser's equation of k = 13.30

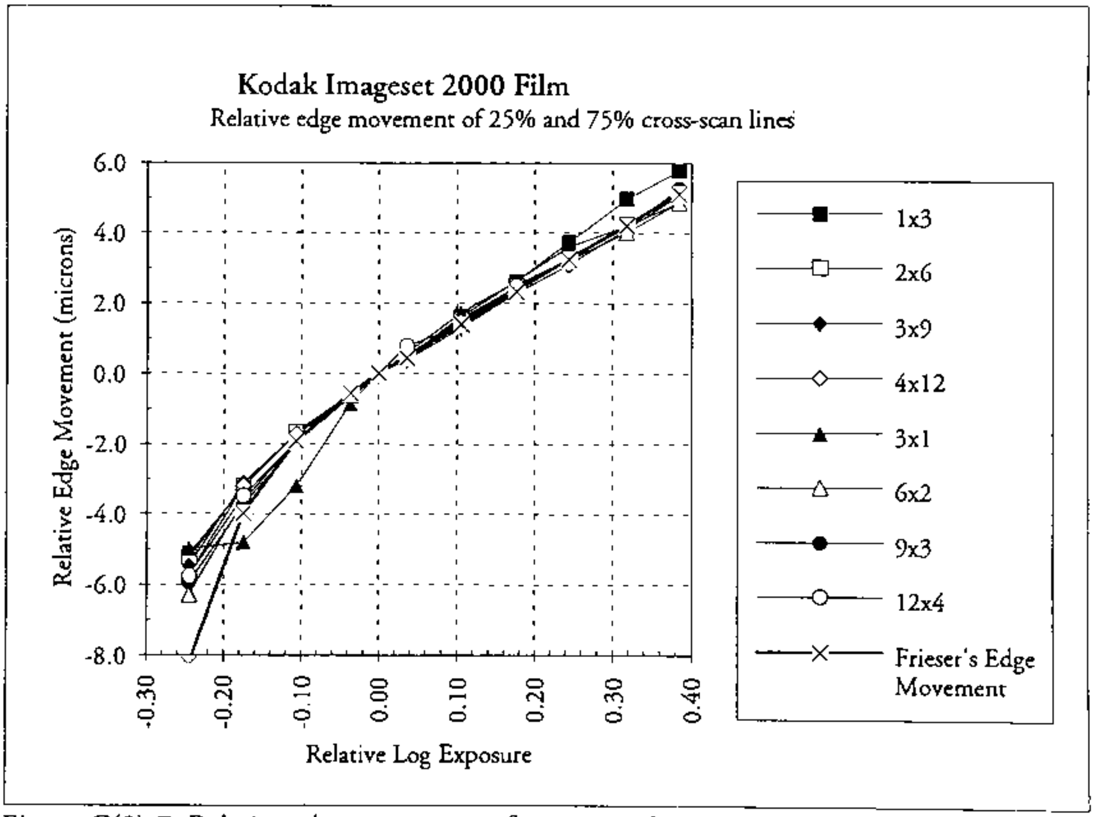


Figure C(2)-7. Relative edge movement of cross-scan line patterns on Imageset 2000 film

Table C(2)-27. Spread functions of PagiSet and Imageset 2000 film

$$I(x) = (1/2) * 10^{\wedge}(x/k) \quad \text{for } x = -\infty \text{ to } 0$$
$$I(x) = 1-((1/2) * 10^{\wedge}(x/k)) \quad \text{for } x = 0 \text{ to } \infty$$

	I(x)	
	Imageset k=11.17	PagiSet k=8.19
-10	0.0033318	0.001016
-8	0.0076017	0.003127
-6	0.0173436	0.009625
-4	0.0395703	0.029629
-2	0.0902817	0.091212
0	0.2059823	0.280789
2	0.0902817	0.091212
4	0.0395703	0.029629
6	0.0173436	0.009625
8	0.0076017	0.003127
10	0.0033318	0.001016

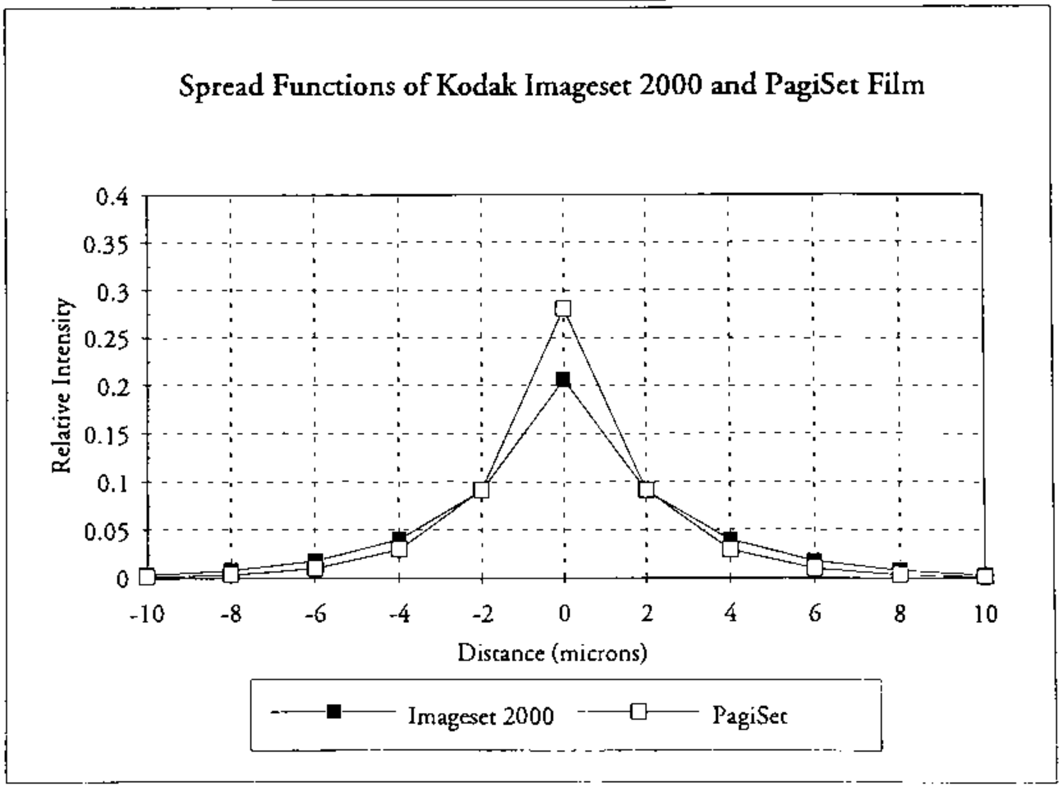


Figure C(2)-8. The plots of spread functions

Table C(2)-28. Modulation Transfer Functions (MTF) of PagiSet and Imageset 2000 film

m(v) = 1/(1+(¶kv/2.3)^2)

Imageset 2000 film: k = 11.17
PagiSet film: k = 8.19

v		0	0.05	0.1	0.15	0.2	0.25	0.3	0.35	0.4
m(v)	Imageset	1.000	0.632	0.300	0.160	0.097	0.064	0.046	0.034	0.026
	PagiSet	1.000	0.761	0.444	0.262	0.166	0.113	0.081	0.061	0.048

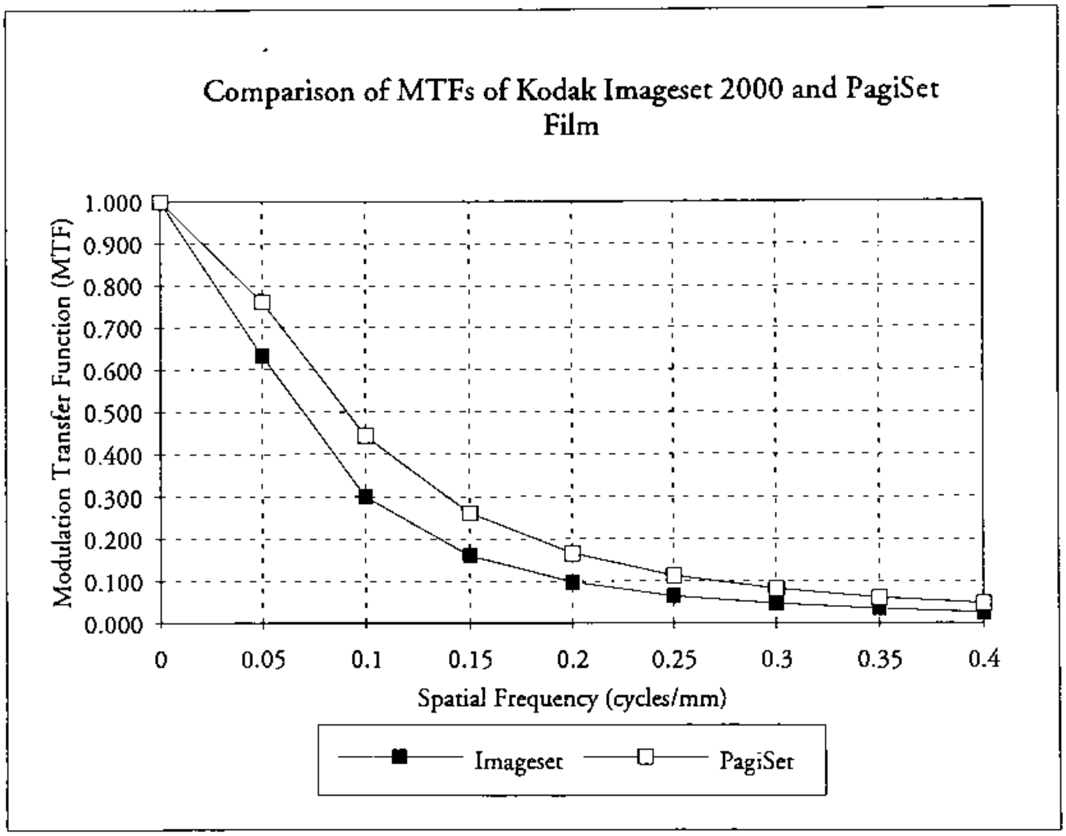


Figure C(2)-9. The plots of modulation transfer functions

Appendix D

The RIT Pixeldot Test Target Exposure Series

Table D1. Percent dot areas on the RIT Pixeldot Test Target on Pagiset film

Laser Intensity: 233

Checkerboard	Percent Dot Area				
Pattern	88.9	75	50	25	11.1
1x1	1.4	3.9	13.3	43.4	63.2
2x2	4.2	9.0	21.3	48.9	65.2
3x3	5.2	12.0	25.8	51.4	66.5
4x4	6.1	13.6	28.2	53.4	67.6
5x5	6.7	14.7	30.3	54.0	68.1
6x6	7.3	15.6	31.5	54.6	68.1
7x7	7.2	15.9	32.4	55.0	68.4
8x8	7.4	16.3	33.0	55.5	68.2
9x9	7.2	16.6	33.6	55.8	68.5
10x10	7.4	16.9	34.0	56.1	68.7
11x11	7.4	17.0	34.5	56.2	68.7
12x12	7.5	17.3	35.1	56.7	68.9
13x13	7.6	17.6	35.5	56.9	69.1
14x14	7.9	17.6	35.8	57.0	69.2
15x15	8.0	17.9	36.0	57.2	69.3

Laser Intensity: 244

Checkerboard	Percent Dot Area				
Pattern	88.9	75	50	25	11.1
1x1	1.6	5.1	18.8	55.6	75.6
2x2	4.8	11.6	27.6	59.4	76.5
3x3	6.3	15.0	32.0	61.1	77.3
4x4	7.0	16.5	34.8	62.5	78.0
5x5	7.6	17.7	36.6	63.3	78.3
6x6	8.0	18.3	37.8	64.1	78.7
7x7	8.3	19.1	38.7	64.4	78.9
8x8	8.4	19.3	39.4	65.0	79.2
9x9	8.4	19.6	40.2	65.3	79.3
10x10	8.5	19.8	40.9	65.5	79.5
11x11	8.7	20.0	41.3	65.6	79.6
12x12	8.7	20.1	41.8	65.7	79.7
13x13	8.8	20.4	41.6	65.9	79.8
14x14	8.9	20.5	41.8	66.1	79.8
15x15	9.1	20.9	42.3	66.1	80.3

Laser Intensity: 255

Checkerboard	Percent Dot Area				
Pattern	88.9	75	50	25	11.1
1x1	2.3	7.4	26.1	66.7	84.9
2x2	6.2	14.7	34.6	67.6	84.4
3x3	7.8	17.9	38.4	68.7	84.9
4x4	8.4	19.5	40.6	69.5	85.2
5x5	8.9	20.4	41.9	70.0	85.4
6x6	9.1	21.0	42.9	70.4	85.7
7x7	9.5	21.6	43.6	70.8	85.9
8x8	9.7	21.8	44.3	71.2	86.0
9x9	9.7	22.1	44.9	71.4	86.0
10x10	9.9	22.3	45.2	71.8	86.3
11x11	10.1	22.6	45.7	71.8	86.3
12x12	10.1	22.8	46.3	72.0	86.5
13x13	10.3	22.9	46.2	72.2	86.6
14x14	10.3	23.2	46.7	72.2	86.7
15x15	10.6	23.3	46.7	72.2	86.5

Laser Intensity: 266

Checkerboard	Percent Dot Area				
Pattern	88.9	75	50	25	11.1
1x1	3.4	10.4	34.6	75.2	89.8
2x2	7.5	17.7	41.0	72.7	87.8
3x3	8.7	20.3	43.3	72.5	87.6
4x4	9.4	21.4	44.6	72.7	87.7
5x5	9.6	22.5	45.5	73.1	87.9
6x6	10.1	23.0	46.4	73.4	87.9
7x7	10.1	23.4	46.6	73.4	88.0
8x8	10.4	23.3	47.0	73.6	88.1
9x9	10.3	23.6	47.4	73.6	88.2
10x10	10.3	23.6	47.6	73.8	88.2
11x11	10.6	23.8	47.8	73.9	88.1
12x12	10.8	23.7	48.3	73.8	88.2
13x13	10.7	24.0	48.4	73.7	88.4
14x14	10.7	24.2	48.5	74.0	88.3
15x15	10.9	24.4	48.6	74.2	88.4

Table D1 (continued). Percent dot areas on the RIT Pixeldot Test Target on PagiSet film

Laser Intensity: 278

Checkerboard	Percent Dot Area				
Pattern	88.9	75	50	25	11.1
1x1	4.7	13.3	44.9	82.7	93.1
2x2	8.6	20.0	47.1	76.5	89.5
3x3	9.6	22.0	47.5	74.8	88.8
4x4	10.0	22.8	47.8	74.6	88.6
5x5	10.3	23.4	48.2	74.4	88.6
6x6	10.3	23.7	48.4	74.4	88.6
7x7	10.5	24.1	48.7	74.5	88.6
8x8	10.4	24.2	48.7	74.5	88.6
9x9	10.6	24.3	48.9	74.5	88.6
10x10	10.6	24.4	49.0	74.6	88.5
11x11	10.8	24.4	49.0	74.5	88.7
12x12	10.8	24.5	49.5	74.6	88.6
13x13	10.7	24.7	49.4	74.5	88.6
14x14	10.9	24.7	49.6	74.5	88.6
15x15	10.8	24.8	49.7	74.5	88.6

Laser Intensity: 285

Chkboard	Percent Dot Area				
Pattern	88.9	75	50	25	11.1
1x1	5.3	15.3	50.8	86.2	94.6
2x2	9.1	21.3	50.5	78.4	90.4
3x3	10.0	23.1	49.8	75.9	89.4
4x4	10.2	23.6	49.6	75.3	89.1
5x5	10.5	24.0	49.5	75.1	89.0
6x6	10.6	24.2	49.5	75.1	88.9
7x7	10.7	24.5	49.5	74.9	88.9
8x8	10.8	24.5	49.5	74.9	88.9
9x9	10.6	24.6	49.5	74.9	88.9
10x10	10.8	24.6	49.6	74.9	88.9
11x11	10.8	24.7	49.8	74.9	88.8
12x12	10.9	24.9	50.0	74.9	88.7
13x13	10.9	24.6	50.1	74.8	88.8
14x14	10.8	24.7	49.9	75.1	88.7
15x15	10.8	24.7	50.2	74.8	88.8

Laser Intensity: 290

Checkerboard	Percent Dot Area				
Pattern	88.9	75	50	25	11.1
1x1	6.2	17.1	56.3	89.0	95.7
2x2	9.6	22.6	53.4	80.0	91.1
3x3	10.3	24.1	51.8	77.2	89.8
4x4	10.6	24.4	51.1	76.4	89.4
5x5	10.8	24.5	50.8	75.8	89.3
6x6	10.8	24.6	50.6	75.6	89.2
7x7	10.8	24.8	50.5	75.4	89.0
8x8	11.0	24.8	50.4	75.4	89.1
9x9	11.0	24.9	50.4	75.3	88.9
10x10	11.0	24.8	50.3	75.3	88.9
11x11	11.0	24.9	50.4	75.3	89.0
12x12	11.2	24.9	50.7	75.3	89.1
13x13	11.2	24.9	50.7	75.3	88.8
14x14	11.1	25.1	50.6	75.2	89.0
15x15	11.1	25.2	50.5	75.0	88.8

Laser Intensity:303

Checkerboard	Percent Dot Area				
Pattern	88.9	75	50	25	11.1
1x1	8.0	21.3	66.3	92.7	97.3
2x2	10.8	25.0	59.2	82.4	92.3
3x3	11.2	25.5	55.3	78.8	90.7
4x4	11.5	25.6	53.7	77.5	90.0
5x5	11.4	25.6	53.0	76.8	89.7
6x6	11.3	25.5	52.3	76.5	89.6
7x7	11.5	25.6	52.0	76.2	89.5
8x8	11.4	25.4	51.7	76.1	89.3
9x9	11.4	25.5	51.5	75.9	89.3
10x10	11.2	25.4	51.4	75.9	89.4
11x11	11.3	25.5	51.3	75.7	89.3
12x12	11.3	25.5	51.5	75.6	89.3
13x13	11.3	25.5	51.5	75.5	89.3
14x14	11.3	25.5	51.3	75.6	89.0
15x15	11.3	25.6	51.3	75.7	89.0

Table D1 (continued). Percent dot areas on the RIT Pixeldot Test Target on PagiSet film

Laser Intensity: 316

Checkerboard	Percent Dot Area				
Pattern	88.9	75	50	25	11.1
1x1	9.6	25.3	74.5	95.4	98.4
2x2	11.9	26.9	63.6	84.7	93.3
3x3	11.8	26.9	58.5	80.3	91.3
4x4	11.8	26.6	56.0	78.7	90.6
5x5	11.7	26.4	54.6	77.7	90.1
6x6	11.7	26.2	53.7	77.2	89.9
7x7	11.6	26.2	53.3	76.7	89.8
8x8	11.5	26.0	52.8	76.6	89.5
9x9	11.5	26.0	52.5	76.3	89.5
10x10	11.5	25.9	52.3	76.3	89.4
11x11	11.6	25.6	52.0	76.1	89.4
12x12	11.4	25.6	52.4	76.2	89.4
13x13	11.4	26.0	52.1	76.1	89.4
14x14	11.5	25.8	52.0	75.7	89.3
15x15	11.4	25.7	51.9	75.9	89.1

Laser Intensity: 330

Checkerboard	Percent Dot Area				
Pattern	88.9	75	50	25	11.1
1x1	11.5	30.7	83.7	97.7	99.2
2x2	12.8	29.4	69.8	87.5	94.6
3x3	12.6	28.6	62.3	82.3	92.2
4x4	12.4	27.9	58.9	80.1	91.2
5x5	12.1	27.4	57.0	78.8	90.7
6x6	12.1	27.2	55.7	78.2	90.4
7x7	11.8	26.9	54.9	77.6	90.1
8x8	11.8	26.6	54.2	77.4	89.9
9x9	11.7	26.4	53.8	77.0	89.8
10x10	11.6	26.4	53.3	76.8	89.7
11x11	11.7	26.3	53.1	76.6	89.6
12x12	11.6	26.0	53.2	76.4	89.5
13x13	11.6	26.0	53.1	76.5	89.4
14x14	11.6	26.0	52.6	76.4	89.5
15x15	11.7	26.0	52.5	76.3	89.7

Laser Intensity: 345

Checkerboard	Percent Dot Area				
Pattern	88.9	75	50	25	11.1
1x1	13.5	36.5	90.4	99.1	99.7
2x2	13.8	31.9	75.1	90.3	95.8
3x3	13.2	30.6	66.0	84.2	93.1
4x4	13.0	29.8	61.6	81.6	91.9
5x5	12.9	28.7	59.3	80.1	91.2
6x6	12.5	27.9	57.6	79.2	90.8
7x7	12.3	27.6	56.5	78.5	90.6
8x8	12.0	27.4	55.7	78.1	90.4
9x9	12.1	27.1	55.1	77.8	90.1
10x10	11.8	27.0	54.5	77.5	89.9
11x11	11.8	27.0	54.2	77.2	89.9
12x12	11.8	26.9	54.4	77.1	89.9
13x13	11.6	26.7	54.0	77.0	90.0
14x14	11.6	26.5	53.5	76.8	89.8
15x15	11.7	26.6	53.5	76.7	89.6

Laser Intensity: 360

Checkerboard	Percent Dot Area				
Pattern	88.9	75	50	25	11.1
1x1	15.2	42.2	95.0	99.6	99.9
2x2	14.7	34.2	80.1	92.6	96.9
3x3	13.9	31.8	69.6	86.0	94.0
4x4	13.2	30.2	64.4	83.0	92.5
5x5	12.9	29.5	61.4	81.3	91.6
6x6	12.7	28.8	59.5	80.1	91.3
7x7	12.4	28.3	58.1	79.3	90.9
8x8	12.3	27.8	57.0	78.8	90.6
9x9	12.1	27.6	56.3	78.4	90.5
10x10	12.0	27.4	55.7	78.1	90.4
11x11	11.9	27.3	55.1	77.9	90.2
12x12	11.8	27.2	55.2	77.6	90.0
13x13	12.0	27.1	54.6	77.2	90.1
14x14	11.8	27.1	54.4	77.2	90.0
15x15	11.8	26.6	54.3	77.1	90.0

Table D2. Percent dot differences from requested dot areas on RIT Pixeldot Test Target on PagiSet film

Laser Intensity: 233

Checkerboard	Percent Dot Difference				
Pattern	88.9	75	50	25	11.1
1x1	-9.7	-21.1	-36.7	-31.6	-25.7
2x2	-6.9	-16.0	-28.7	-26.1	-23.7
3x3	-5.9	-13.0	-24.2	-23.6	-22.4
4x4	-5.0	-11.4	-21.8	-21.6	-21.3
5x5	-4.4	-10.3	-19.7	-21.0	-20.8
6x6	-3.8	-9.4	-18.5	-20.4	-20.8
7x7	-3.9	-9.1	-17.6	-20.0	-20.5
8x8	-3.7	-8.7	-17.0	-19.5	-20.7
9x9	-3.9	-8.4	-16.4	-19.2	-20.4
10x10	-3.7	-8.1	-16.0	-18.9	-20.2
11x11	-3.7	-8.0	-15.5	-18.8	-20.2
12x12	-3.6	-7.7	-14.9	-18.3	-20.0
13x13	-3.5	-7.4	-14.5	-18.1	-19.8
14x14	-3.2	-7.4	-14.2	-18.0	-19.7
15x15	-3.1	-7.1	-14.0	-17.8	-19.6

Laser Intensity: 244

Checkerboard	Percent Dot Difference				
Pattern	88.9	75	50	25	11.1
1x1	-9.5	-19.9	-31.2	-19.4	-13.3
2x2	-6.3	-13.4	-22.4	-15.6	-12.4
3x3	-4.8	-10.0	-18.0	-13.9	-11.6
4x4	-4.1	-8.5	-15.2	-12.5	-10.9
5x5	-3.5	-7.3	-13.4	-11.7	-10.6
6x6	-3.1	-6.7	-12.2	-10.9	-10.2
7x7	-2.8	-5.9	-11.3	-10.6	-10.0
8x8	-2.7	-5.7	-10.6	-10.0	-9.7
9x9	-2.7	-5.4	-9.8	-9.7	-9.6
10x10	-2.6	-5.2	-9.1	-9.5	-9.4
11x11	-2.4	-5.0	-8.7	-9.4	-9.3
12x12	-2.4	-4.9	-8.2	-9.3	-9.2
13x13	-2.3	-4.6	-8.4	-9.1	-9.1
14x14	-2.2	-4.5	-8.2	-8.9	-9.1
15x15	-2.0	-4.1	-7.7	-8.9	-8.6

Laser Intensity: 255

Checkerboard	Percent Dot Difference				
Pattern	88.9	75	50	25	11.1
1x1	-8.8	-17.6	-23.9	-8.3	-4.0
2x2	-4.9	-10.3	-15.4	-7.4	-4.5
3x3	-3.3	-7.1	-11.6	-6.3	-4.0
4x4	-2.7	-5.5	-9.4	-5.5	-3.7
5x5	-2.2	-4.6	-8.1	-5.0	-3.5
6x6	-2.0	-4.0	-7.1	-4.6	-3.2
7x7	-1.6	-3.4	-6.4	-4.2	-3.0
8x8	-1.4	-3.2	-5.7	-3.8	-2.9
9x9	-1.4	-2.9	-5.1	-3.6	-2.9
10x10	-1.2	-2.7	-4.8	-3.2	-2.6
11x11	-1.0	-2.4	-4.3	-3.2	-2.6
12x12	-1.0	-2.2	-3.7	-3.0	-2.4
13x13	-0.8	-2.1	-3.8	-2.8	-2.3
14x14	-0.8	-1.8	-3.3	-2.8	-2.2
15x15	-0.5	-1.7	-3.3	-2.8	-2.4

Laser Intensity: 266

Checkerboard	Percent Dot Difference				
Pattern	88.9	75	50	25	11.1
1x1	-7.7	-14.6	-15.4	0.2	0.9
2x2	-3.6	-7.3	-9.0	-2.3	-1.1
3x3	-2.4	-4.7	-6.7	-2.5	-1.3
4x4	-1.7	-3.6	-5.4	-2.3	-1.2
5x5	-1.5	-2.5	-4.5	-1.9	-1.0
6x6	-1.0	-2.0	-3.6	-1.6	-1.0
7x7	-1.0	-1.6	-3.4	-1.6	-0.9
8x8	-0.7	-1.7	-3.0	-1.4	-0.8
9x9	-0.8	-1.4	-2.6	-1.4	-0.7
10x10	-0.8	-1.4	-2.4	-1.2	-0.7
11x11	-0.5	-1.2	-2.2	-1.1	-0.8
12x12	-0.3	-1.3	-1.7	-1.2	-0.7
13x13	-0.4	-1.0	-1.6	-1.3	-0.5
14x14	-0.4	-0.8	-1.5	-1.0	-0.6
15x15	-0.2	-0.6	-1.4	-0.8	-0.5

Table D2 (continued). Percent dot differences from requested dot areas on the RIT Pixeldot Test Target on PagiSet film

Laser Intensity: 278

Checkerboard	Percent Dot Difference				
Pattern	88.9	75	50	25	11.1
1x1	-6.4	-11.7	-5.1	7.7	4.2
2x2	-2.5	-5.0	-2.9	1.5	0.6
3x3	-1.5	-3.0	-2.5	-0.2	-0.1
4x4	-1.1	-2.2	-2.2	-0.4	-0.3
5x5	-0.8	-1.6	-1.8	-0.6	-0.3
6x6	-0.8	-1.3	-1.6	-0.6	-0.3
7x7	-0.6	-0.9	-1.3	-0.5	-0.3
8x8	-0.7	-0.8	-1.3	-0.5	-0.3
9x9	-0.5	-0.7	-1.1	-0.5	-0.3
10x10	-0.5	-0.6	-1.0	-0.4	-0.4
11x11	-0.3	-0.6	-1.0	-0.5	-0.2
12x12	-0.3	-0.5	-0.5	-0.4	-0.3
13x13	-0.4	-0.3	-0.6	-0.5	-0.3
14x14	-0.2	-0.3	-0.4	-0.5	-0.3
15x15	-0.3	-0.2	-0.3	-0.5	-0.3

Laser Intensity: 285

Checkerboard	Percent Dot Difference				
Pattern	88.9	75	50	25	11.1
1x1	-5.8	-9.7	0.8	11.2	5.7
2x2	-2.0	-3.7	0.5	3.4	1.5
3x3	-1.1	-1.9	-0.2	0.9	0.5
4x4	-0.9	-1.4	-0.4	0.3	0.2
5x5	-0.6	-1.0	-0.5	0.1	0.1
6x6	-0.5	-0.8	-0.5	0.1	0.0
7x7	-0.4	-0.5	-0.5	-0.1	0.0
8x8	-0.3	-0.5	-0.5	-0.1	0.0
9x9	-0.5	-0.4	-0.5	-0.1	0.0
10x10	-0.3	-0.4	-0.4	-0.1	0.0
11x11	-0.3	-0.3	-0.2	-0.1	-0.1
12x12	-0.2	-0.1	0.0	-0.1	-0.2
13x13	-0.2	-0.4	0.1	-0.2	-0.1
14x14	-0.3	-0.3	-0.1	0.1	-0.2
15x15	-0.3	-0.3	0.2	-0.2	-0.1

Laser Intensity: 290

Checkerboard	Percent Dot Difference				
Pattern	88.9	75	50	25	11.1
1x1	-4.9	-7.9	6.3	14.0	6.8
2x2	-1.5	-2.4	3.4	5.0	2.2
3x3	-0.8	-0.9	1.8	2.2	0.9
4x4	-0.5	-0.6	1.1	1.4	0.5
5x5	-0.3	-0.5	0.8	0.8	0.4
6x6	-0.3	-0.4	0.6	0.6	0.3
7x7	-0.3	-0.2	0.5	0.4	0.1
8x8	-0.1	-0.2	0.4	0.4	0.2
9x9	-0.1	-0.1	0.4	0.3	0.0
10x10	-0.1	-0.2	0.3	0.3	0.0
11x11	-0.1	-0.1	0.4	0.3	0.1
12x12	0.1	-0.1	0.7	0.3	0.2
13x13	0.1	-0.1	0.7	0.3	-0.1
14x14	0.0	0.1	0.6	0.2	0.1
15x15	0.0	0.2	0.5	0.0	-0.1

Laser Intensity: 303

Checkerboard	Percent Dot Difference				
Pattern	88.9	75	50	25	11.1
1x1	-3.1	-3.7	16.3	17.7	8.4
2x2	-0.3	0.0	9.2	7.4	3.4
3x3	0.1	0.5	5.3	3.8	1.8
4x4	0.4	0.6	3.7	2.5	1.1
5x5	0.3	0.6	3.0	1.8	0.8
6x6	0.2	0.5	2.3	1.5	0.7
7x7	0.4	0.6	2.0	1.2	0.6
8x8	0.3	0.4	1.7	1.1	0.4
9x9	0.3	0.5	1.5	0.9	0.4
10x10	0.1	0.4	1.4	0.9	0.5
11x11	0.2	0.5	1.3	0.7	0.4
12x12	0.2	0.5	1.5	0.6	0.4
13x13	0.2	0.5	1.5	0.5	0.4
14x14	0.2	0.5	1.3	0.6	0.1
15x15	0.2	0.6	1.3	0.7	0.1

Table D2 (continued). Percent dot differences from requested dot areas on the RIT Pixeldot Test Target on PagiSet film

Laser Intensity: 316

Checkerboard	Percent Dot Difference				
Pattern	88.9	75	50	25	11.1
1x1	-1.5	0.3	24.5	20.4	9.5
2x2	0.8	1.9	13.6	9.7	4.4
3x3	0.7	1.9	8.5	5.3	2.4
4x4	0.7	1.6	6.0	3.7	1.7
5x5	0.6	1.4	4.6	2.7	1.2
6x6	0.6	1.2	3.7	2.2	1.0
7x7	0.5	1.2	3.3	1.7	0.9
8x8	0.4	1.0	2.8	1.6	0.6
9x9	0.4	1.0	2.5	1.3	0.6
10x10	0.4	0.9	2.3	1.3	0.5
11x11	0.5	0.6	2.0	1.1	0.5
12x12	0.3	0.6	2.4	1.2	0.5
13x13	0.3	1.0	2.1	1.1	0.5
14x14	0.4	0.8	2.0	0.7	0.4
15x15	0.3	0.7	1.9	0.9	0.2

Laser Intensity: 330

Checkerboard	Percent Dot Difference				
Pattern	88.9	75	50	25	11.1
1x1	0.4	5.7	33.7	22.7	10.3
2x2	1.7	4.4	19.8	12.5	5.7
3x3	1.5	3.6	12.3	7.3	3.3
4x4	1.3	2.9	8.9	5.1	2.3
5x5	1.0	2.4	7.0	3.8	1.8
6x6	1.0	2.2	5.7	3.2	1.5
7x7	0.7	1.9	4.9	2.6	1.2
8x8	0.7	1.6	4.2	2.4	1.0
9x9	0.6	1.4	3.8	2.0	0.9
10x10	0.5	1.4	3.3	1.8	0.8
11x11	0.6	1.3	3.1	1.6	0.7
12x12	0.5	1.0	3.2	1.4	0.6
13x13	0.5	1.0	3.1	1.5	0.5
14x14	0.5	1.0	2.6	1.4	0.6
15x15	0.6	1.0	2.5	1.3	0.8

Laser Intensity: 345

Checkerboard	Percent Dot Difference				
Pattern	88.9	75	50	25	11.1
1x1	2.4	11.5	40.4	24.1	10.8
2x2	2.7	6.9	25.1	15.3	6.9
3x3	2.1	5.6	16.0	9.2	4.2
4x4	1.9	4.8	11.6	6.6	3.0
5x5	1.8	3.7	9.3	5.1	2.3
6x6	1.4	2.9	7.6	4.2	1.9
7x7	1.2	2.6	6.5	3.5	1.7
8x8	0.9	2.4	5.7	3.1	1.5
9x9	1.0	2.1	5.1	2.8	1.2
10x10	0.7	2.0	4.5	2.5	1.0
11x11	0.7	2.0	4.2	2.2	1.0
12x12	0.7	1.9	4.4	2.1	1.0
13x13	0.5	1.7	4.0	2.0	1.1
14x14	0.5	1.5	3.5	1.8	0.9
15x15	0.6	1.6	3.5	1.7	0.7

Laser Intensity: 360

Checkerboard	Percent Dot Difference				
Pattern	88.9	75	50	25	11.1
1x1	4.1	17.2	45.0	24.6	11.0
2x2	3.6	9.2	30.1	17.6	8.0
3x3	2.8	6.8	19.6	11.0	5.1
4x4	2.1	5.2	14.4	8.0	3.6
5x5	1.8	4.5	11.4	6.3	2.7
6x6	1.6	3.8	9.5	5.1	2.4
7x7	1.3	3.3	8.1	4.3	2.0
8x8	1.2	2.8	7.0	3.8	1.7
9x9	1.0	2.6	6.3	3.4	1.6
10x10	0.9	2.4	5.7	3.1	1.5
11x11	0.8	2.3	5.1	2.9	1.3
12x12	0.7	2.2	5.2	2.6	1.1
13x13	0.9	2.1	4.6	2.2	1.2
14x14	0.7	2.1	4.4	2.2	1.1
15x15	0.7	1.6	4.3	2.1	1.1

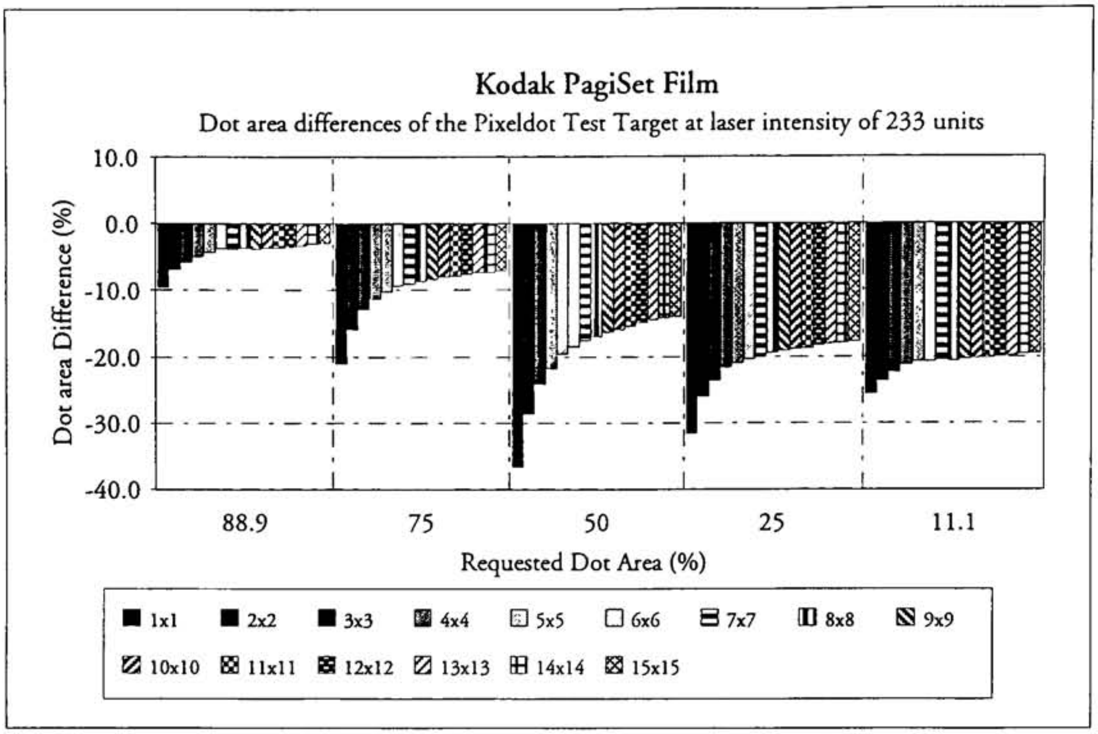


Figure D1. Dot Differences on the Pixeldot Test Target on PagiSet film at laser intensity of 233 units

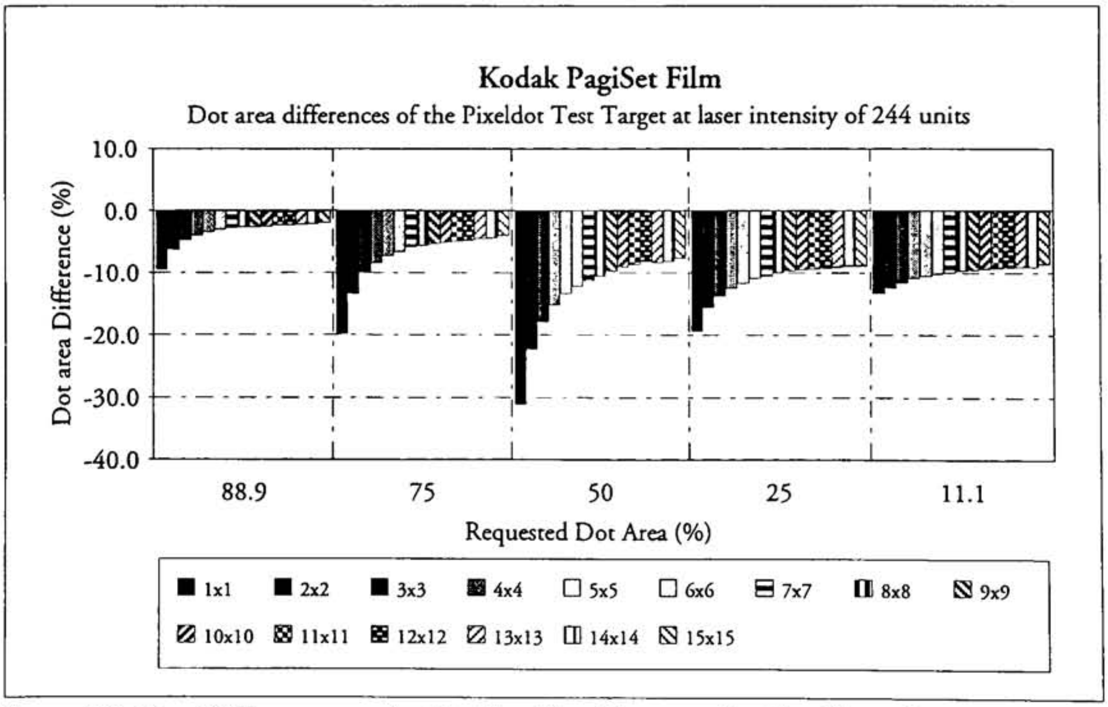


Figure D2. Dot Differences on the Pixeldot Test Target on PagiSet film at laser intensity of 244 units

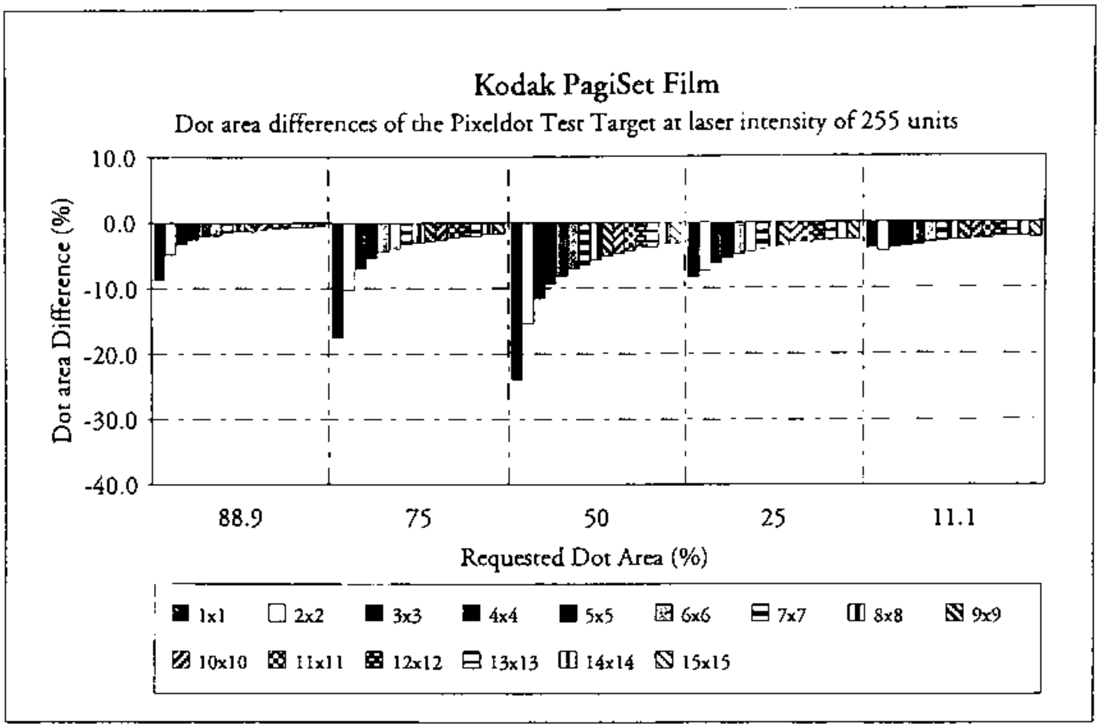


Figure D3. Dot Differences on the Pixeldot Test Target on PagiSet film at laser intensity of 255 units

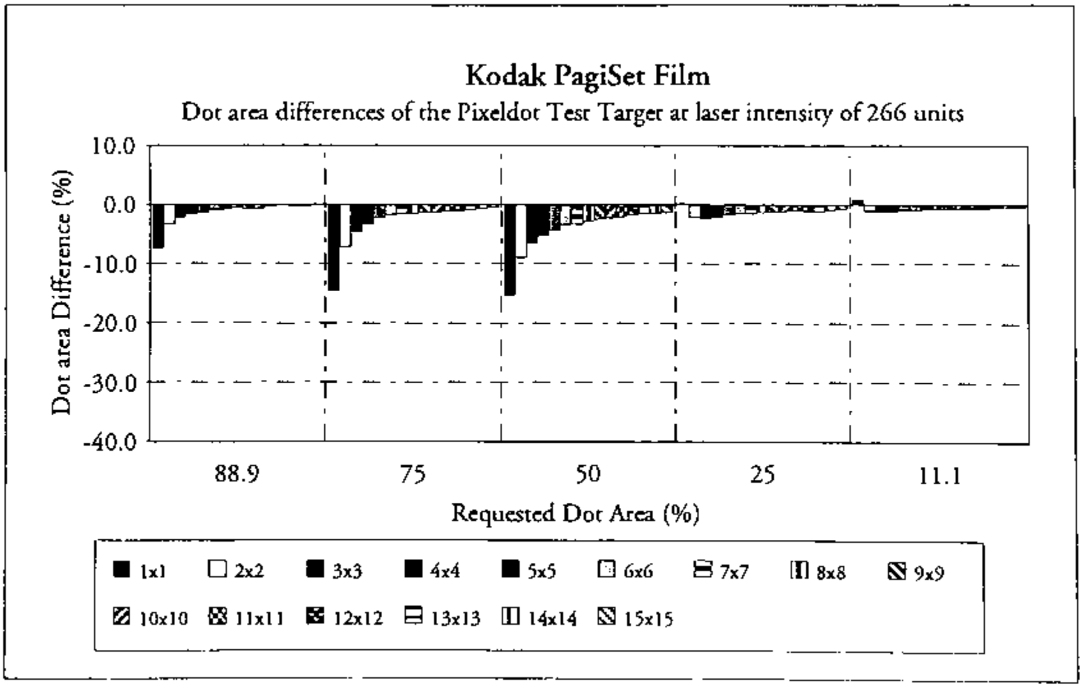


Figure D4. Dot Differences on the Pixeldot Test Target on PagiSet film at laser intensity of 266 units

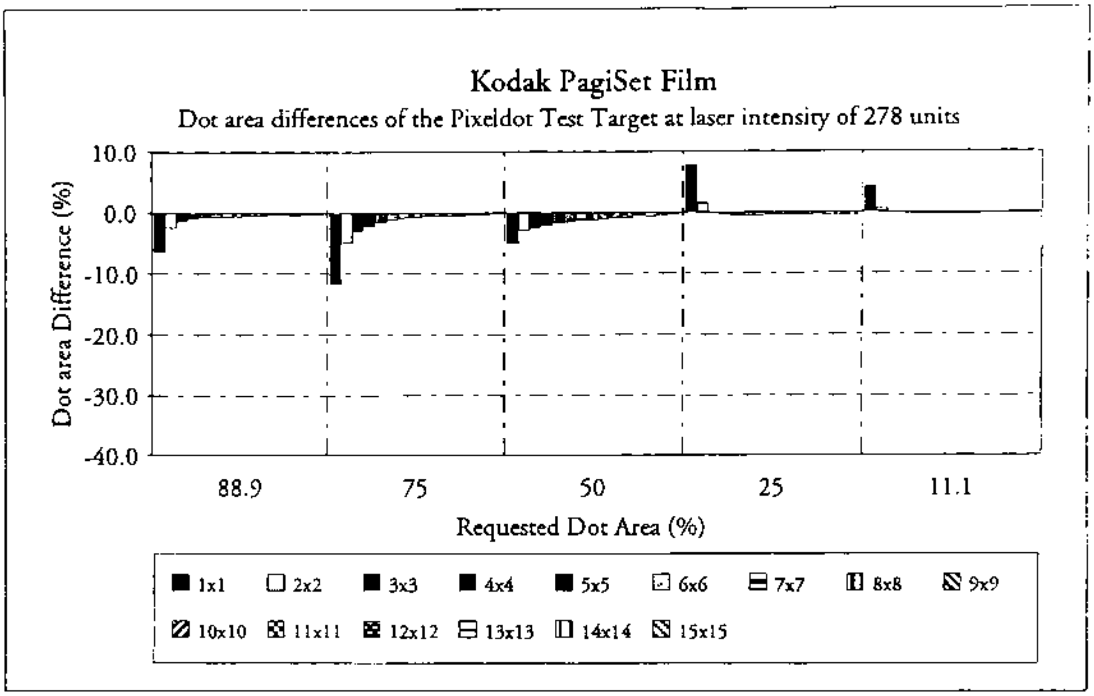


Figure D5. Dot Differences on the Pixeldot Test Target on PagiSet film at laser intensity of 278 units

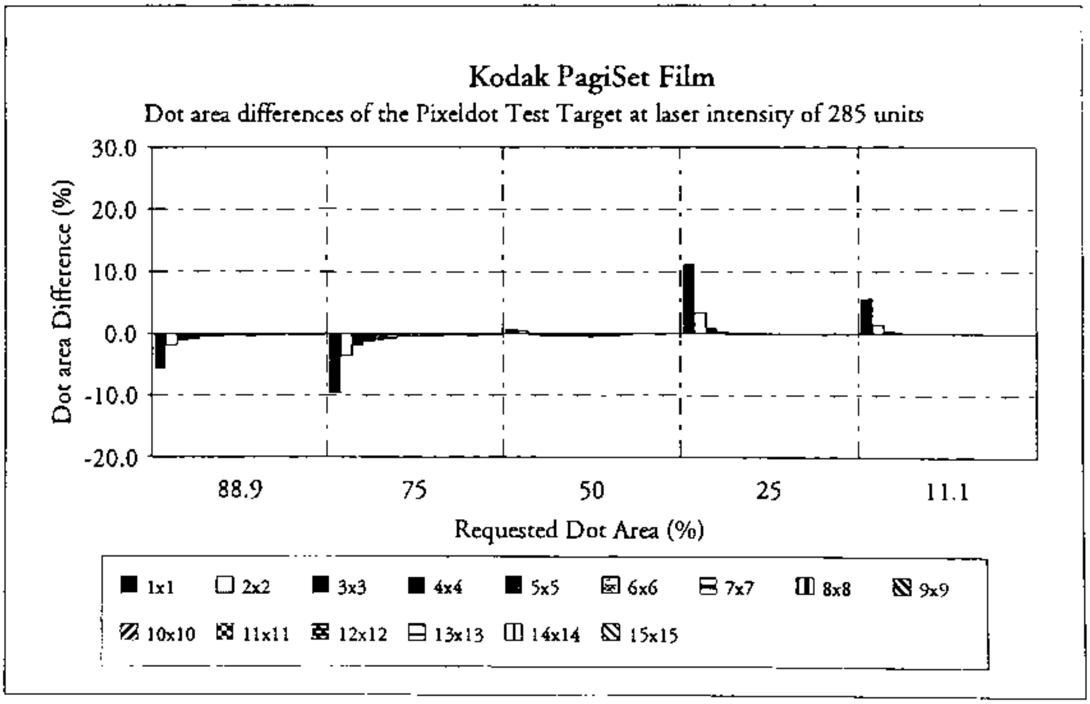


Figure D6. Dot Differences on the Pixeldot Test Target on PagiSet film at laser intensity of 285 units

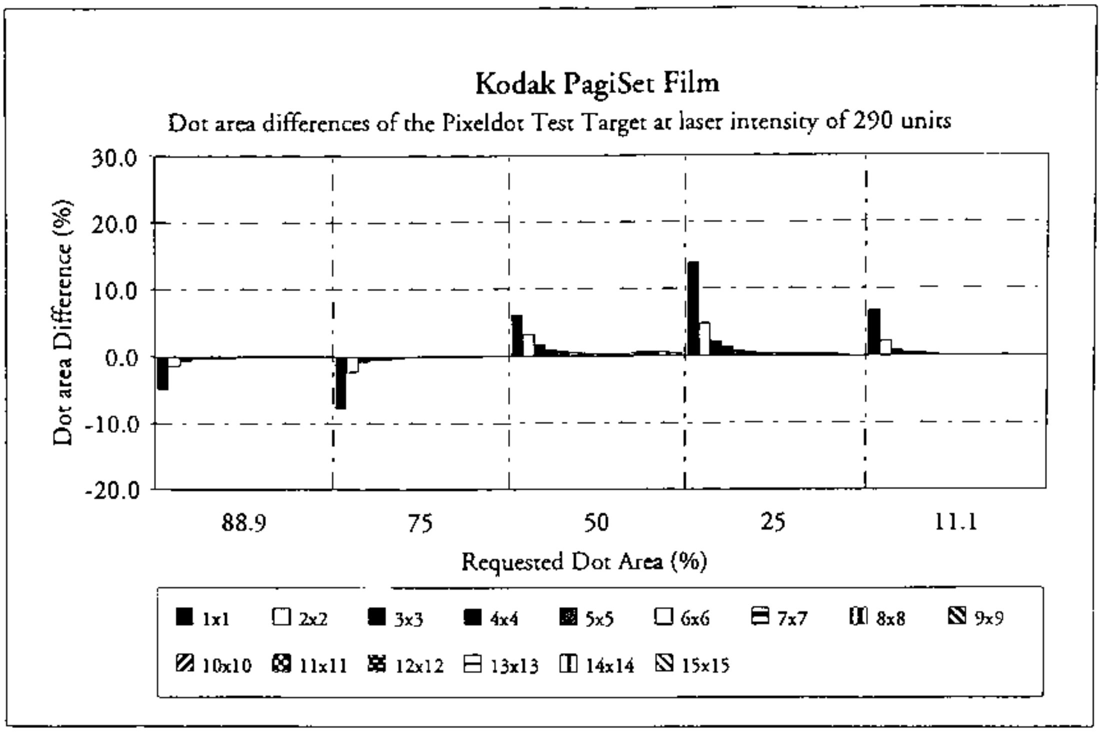


Figure D7. Dot Differences on the Pixeldot Test Target on PagiSet film at laser intensity of 290 units

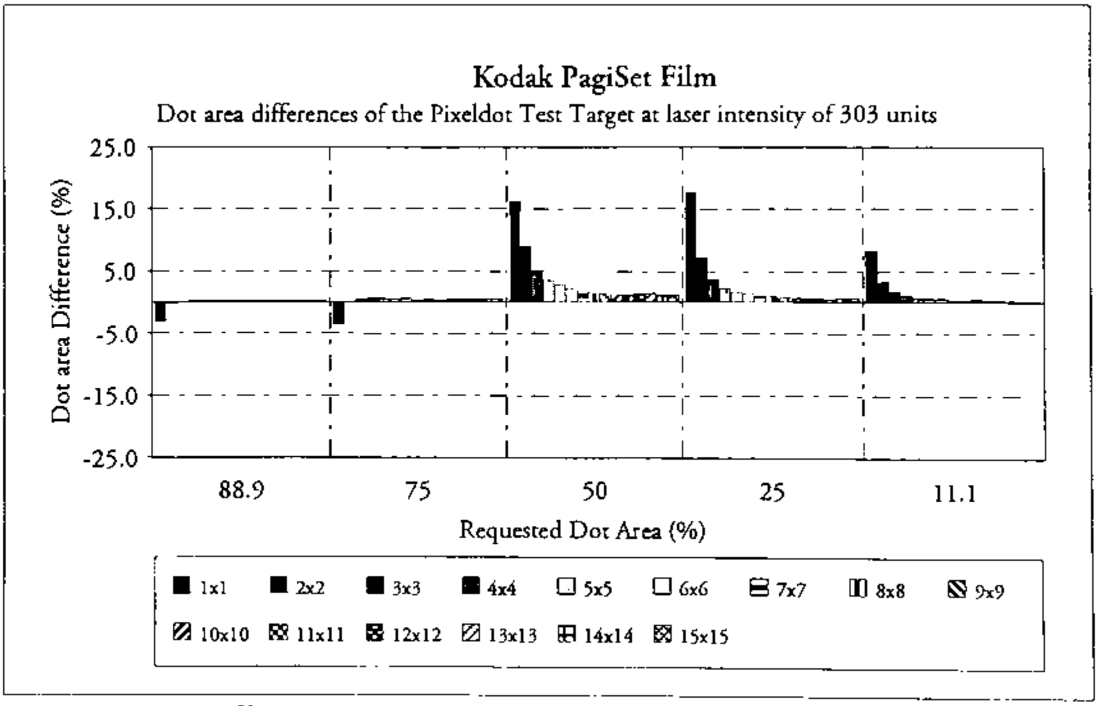


Figure D8. Dot Differences on the Pixeldot Test Target on PagiSet film at laser intensity of 303 units

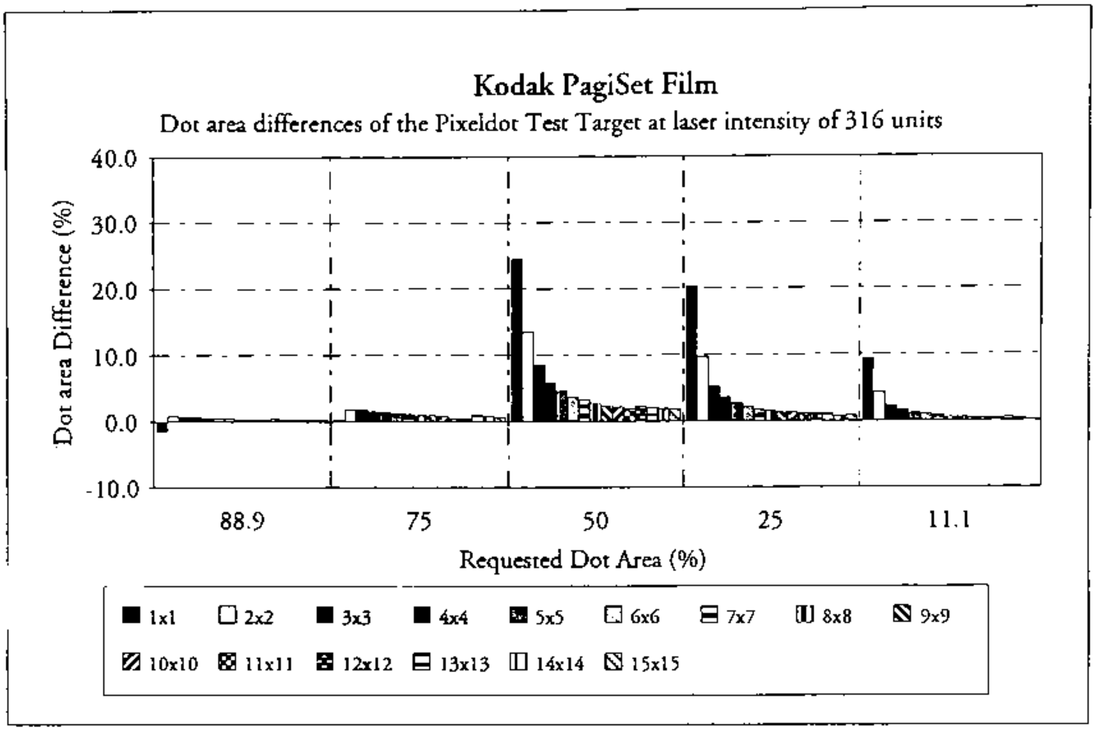


Figure D9. Dot Differences on the Pixeldot Test Target on PagiSet film at laser intensity of 316 units

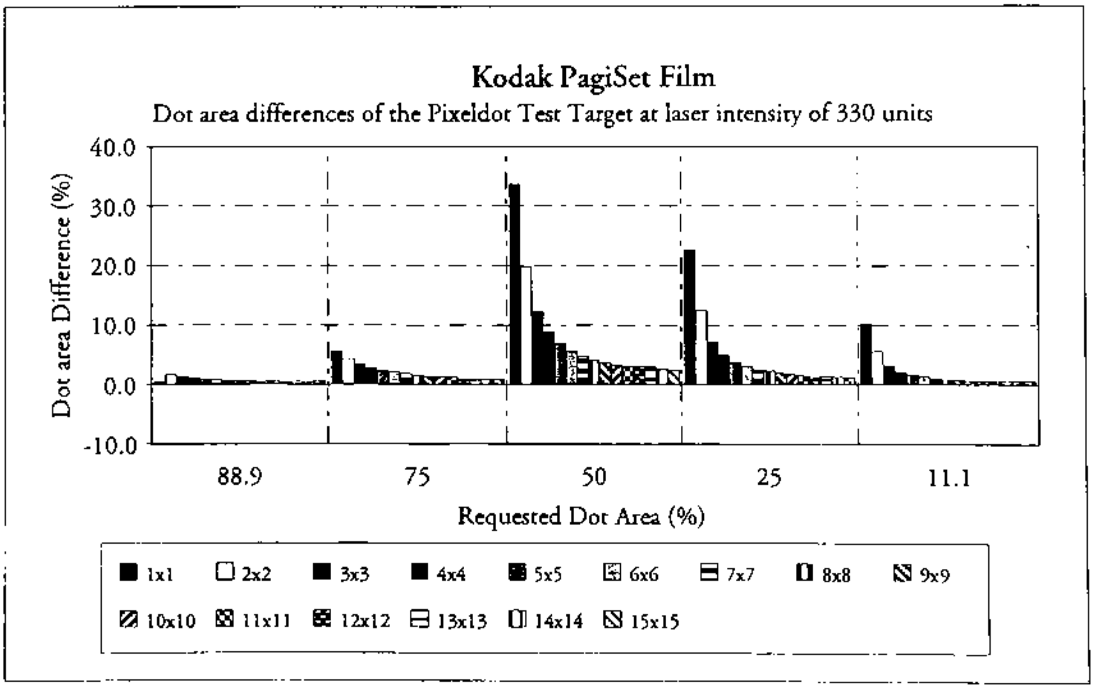


Figure D10. Dot Differences on the Pixeldot Test Target on PagiSet film at laser intensity of 330 units

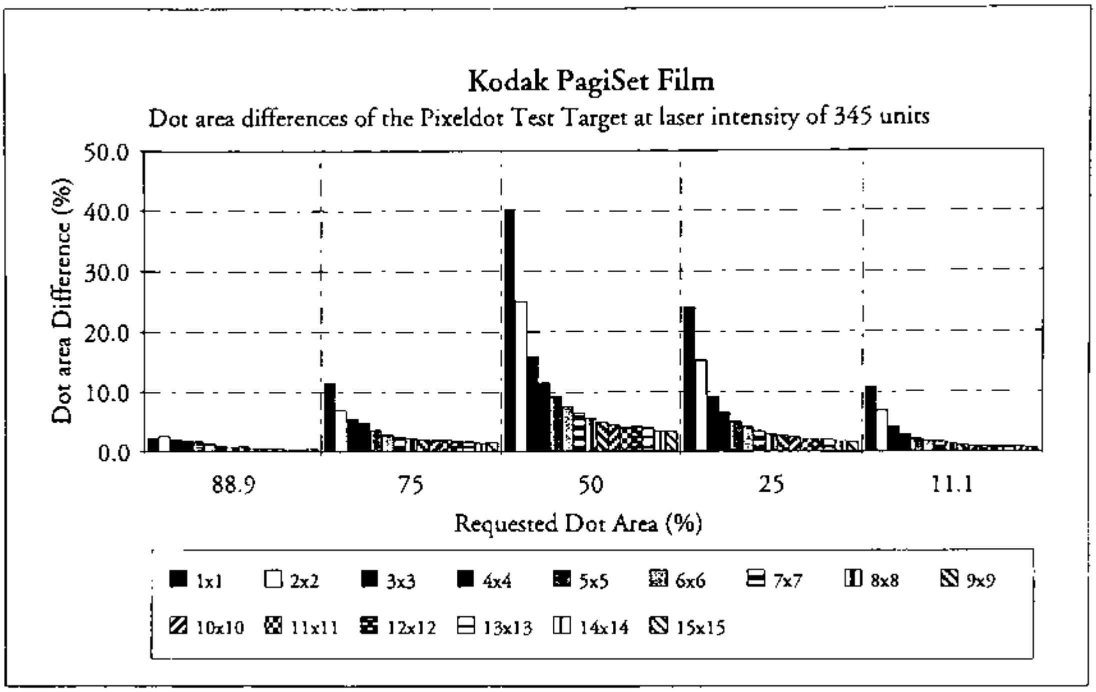


Figure D11. Dot Differences on the Pixeldot Test Target on PagiSet film at laser intensity of 345 units

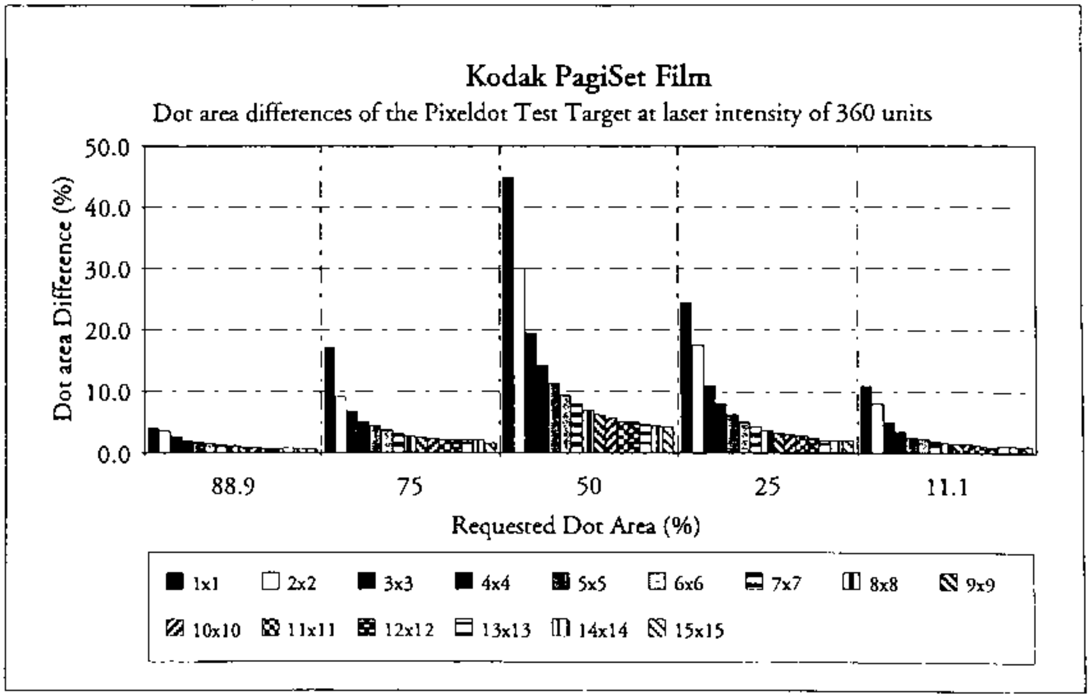


Figure D12. Dot Differences on the Pixeldot Test Target on PagiSet film at laser intensity of 360 units

Table D3. Percent dot areas on the RIT Pixeldot Test Target on Imageset 2000 film

Laser Intensity: 258

Checkerboard Pattern	Percent Dot Area 88.9	75	50	25	11.1
1x1	0.0	0.0	0.2	7.6	27.9
2x2	0.7	0.9	2.2	17.3	36.9
3x3	0.9	2.2	5.0	24.1	39.5
4x4	1.5	3.2	7.9	27.5	41.5
5x5	2.0	4.2	9.9	29.5	42.6
6x6	2.0	5.1	11.8	30.2	43.6
7x7	2.8	5.7	13.0	31.4	44.1
8x8	2.9	6.3	14.0	31.8	44.0
9x9	3.0	6.8	15.0	32.4	44.2
10x10	3.1	7.0	15.6	32.7	44.3
11x11	3.0	7.7	16.1	33.3	44.2
12x12	3.2	7.9	17.0	33.8	43.8
13x13	3.2	7.5	16.7	34.0	43.9
14x14	3.3	8.1	17.9	33.6	44.1
15x15	3.4	8.3	19.0	33.6	44.1

Laser Intensity: 269

Checkerboard Pattern	Percent Dot Area 88.9	75	50	25	11.1
1x1	0.4	0.4	1.3	31.1	69.2
2x2	2.1	3.7	10.3	51.9	77.2
3x3	4.3	9.9	21.4	58.3	79.8
4x4	6.2	13.1	26.9	61.9	81.9
5x5	7.0	15.1	30.9	63.8	82.8
6x6	7.3	16.6	33.5	65.5	83.8
7x7	7.8	17.7	35.5	66.4	83.9
8x8	8.2	18.5	37.1	67.5	84.6
9x9	8.7	19.1	38.4	68.3	84.9
10x10	9.0	19.7	39.7	69.1	85.1
11x11	9.0	20.1	40.3	69.2	85.5
12x12	9.5	20.4	41.2	70.1	85.3
13x13	9.3	20.8	41.9	70.1	85.6
14x14	9.6	21.3	42.2	70.3	85.6
15x15	9.7	21.5	43.0	71.0	85.9

Laser Intensity: 281

Checkerboard Pattern	Percent Dot Area 88.9	75	50	25	11.1
1x1	0.7	0.7	2.5	51.1	80.3
2x2	5.0	10.8	24.2	63.3	82.3
3x3	7.0	15.8	32.1	65.9	84.5
4x4	8.0	17.7	36.0	67.6	85.5
5x5	8.9	19.1	38.3	68.7	86.2
6x6	9.1	20.1	39.9	69.8	86.6
7x7	9.6	20.6	41.2	70.4	86.8
8x8	9.9	21.2	42.2	71.0	86.3
9x9	10.0	21.5	42.9	71.3	87.3
10x10	10.2	21.8	43.6	71.6	87.4
11x11	10.1	22.0	44.1	71.9	87.6
12x12	10.2	22.1	44.7	72.2	87.8
13x13	10.1	22.4	45.2	72.6	87.9
14x14	10.1	22.5	45.6	72.5	88.0
15x15	10.1	22.8	45.7	72.6	86.7

Laser Intensity: 293

Checkerboard Pattern	Percent Dot Area 88.9	75	50	25	11.1
1x1	0.5	1.5	8.5	70.9	86.9
2x2	7.9	17.3	36.9	70.3	85.8
3x3	9.2	20.0	40.5	70.3	86.4
4x4	9.6	20.9	42.2	70.9	86.9
5x5	9.8	21.6	43.3	71.4	87.2
6x6	9.9	21.9	44.2	71.8	87.5
7x7	10.0	22.3	44.9	72.2	87.5
8x8	10.2	22.5	45.3	72.5	87.7
9x9	10.2	22.7	45.8	72.7	87.9
10x10	10.4	23.0	46.1	73.0	87.9
11x11	10.2	23.3	46.6	73.1	88.0
12x12	10.7	23.9	47.2	73.1	88.0
13x13	10.7	23.9	47.5	73.3	88.0
14x14	10.8	23.9	47.7	73.5	88.2
15x15	10.7	23.7	47.9	73.8	88.5

Table D3 (continued). Percent dot areas on the RIT Pixeldot Test Target on Imageset 2000 film

Laser Intensity: 306

Checkerboard	Percent Dot Area				
Pattern	88.9	75	50	25	11.1
1x1	2.2	6.8	24.8	80.7	90.8
2x2	10.2	22.5	45.3	74.6	88.0
3x3	10.7	23.6	46.7	73.4	87.8
4x4	10.8	23.7	47.0	73.4	87.9
5x5	10.9	24.1	47.4	73.5	88.0
6x6	10.8	24.1	47.5	73.6	88.1
7x7	10.9	24.2	47.8	73.6	88.1
8x8	10.8	24.2	47.9	73.7	88.2
9x9	11.0	24.3	48.1	73.7	88.3
10x10	10.9	24.3	48.2	74.0	88.4
11x11	10.9	24.5	48.4	73.9	88.3
12x12	10.9	24.5	48.7	74.0	88.4
13x13	11.2	24.5	48.9	74.1	88.5
14x14	11.0	24.5	48.9	74.2	88.6
15x15	11.0	24.7	48.9	74.1	88.5

Laser Intensity: 313

Checkerboard	Percent Dot Area				
Pattern	88.9	75	50	25	11.1
1x1	4.0	11.5	36.9	85.3	92.8
2x2	11.1	24.9	50.6	76.8	88.9
3x3	11.3	25.2	49.9	74.9	88.4
4x4	11.3	24.8	49.2	74.4	88.3
5x5	11.2	24.8	49.1	74.2	88.3
6x6	11.1	24.7	49.2	74.2	88.3
7x7	11.0	24.7	49.2	74.1	88.3
8x8	11.0	24.7	49.2	74.4	88.5
9x9	11.1	24.6	49.2	74.4	88.4
10x10	11.1	24.7	49.2	74.3	88.5
11x11	10.9	24.7	49.4	74.3	88.6
12x12	11.0	24.7	49.6	74.5	88.6
13x13	10.9	24.8	49.7	74.5	88.5
14x14	11.1	24.6	49.6	74.4	88.5
15x15	10.9	24.5	49.6	74.3	88.4

Laser Intensity: 320

Checkerboard	Percent Dot Area				
Pattern	88.9	75	50	25	11.1
1x1	6.2	16.6	48.9	89.0	95.2
2x2	12.4	26.9	56.0	79.0	90.0
3x3	12.2	26.6	53.5	76.5	89.2
4x4	12.0	26.0	52.4	75.7	88.9
5x5	11.8	25.8	51.8	75.2	88.9
6x6	11.7	25.7	51.2	75.2	88.8
7x7	11.7	25.6	50.9	75.0	88.8
8x8	11.5	25.4	50.6	74.9	88.8
9x9	11.4	25.3	50.5	74.9	88.9
10x10	11.3	25.3	50.4	74.9	88.9
11x11	11.3	25.3	50.3	74.8	88.8
12x12	11.2	25.1	50.5	74.9	88.9
13x13	11.3	25.1	50.5	74.8	88.7
14x14	11.3	25.2	50.4	74.9	88.6
15x15	11.3	25.1	50.2	74.9	88.4

Laser Intensity:334

Checkerboard	Percent Dot Area				
Pattern	88.9	75	50	25	11.1
1x1	11.3	28.0	69.7	95.1	97.8
2x2	14.1	31.3	63.8	82.4	91.7
3x3	13.2	29.5	59.4	78.8	90.3
4x4	12.6	28.3	56.4	77.5	89.0
5x5	12.2	27.6	54.9	76.8	89.6
6x6	11.9	26.9	54.1	76.3	89.4
7x7	11.7	26.6	53.3	75.9	89.3
8x8	11.5	26.3	52.7	75.8	89.2
9x9	11.4	26.1	52.3	75.7	89.1
10x10	11.3	25.9	52.1	75.5	89.1
11x11	11.2	25.8	51.8	75.5	89.1
12x12	11.2	25.7	52.1	75.5	89.0
13x13	11.2	25.5	51.9	75.4	89.0
14x14	11.0	25.6	51.5	75.3	88.7
15x15	11.0	25.4	51.5	75.2	88.7

Table D3 (continued). Percent dot areas on the RIT Pixeldot Test Target on Imageset 2000 film

Laser Intensity: 349

Checkerboard	Percent Dot Area				
Pattern	88.9	75	50	25	11.1
1x1	15.9	37.0	86.0	98.6	99.5
2x2	16.3	35.4	71.1	85.7	93.2
3x3	14.7	32.4	64.5	81.5	91.4
4x4	13.7	30.5	60.9	79.5	90.6
5x5	13.2	29.5	58.4	78.4	90.3
6x6	12.8	28.7	57.1	77.9	89.9
7x7	12.6	28.3	55.9	77.4	89.8
8x8	12.5	27.8	55.0	77.0	89.7
9x9	12.2	27.3	54.7	76.7	89.5
10x10	12.1	27.1	53.9	76.5	89.4
11x11	12.0	26.9	53.5	76.3	89.3
12x12	12.0	26.6	53.5	76.4	89.3
13x13	11.9	26.7	53.3	75.4	89.3
14x14	11.7	26.3	52.9	75.9	89.3
15x15	11.5	26.4	52.8	76.1	88.7

Laser Intensity: 364

Checkerboard	Percent Dot Area				
Pattern	88.9	75	50	25	11.1
1x1	20.3	45.6	95.1	99.9	100.0
2x2	18.2	38.9	77.0	88.7	94.7
3x3	15.9	35.2	68.6	83.7	92.6
4x4	14.8	32.5	64.2	81.4	91.5
5x5	14.0	31.2	61.3	79.9	91.0
6x6	13.5	30.0	59.1	79.1	90.5
7x7	13.0	29.2	57.9	78.5	90.3
8x8	12.7	28.7	56.9	78.0	90.2
9x9	12.4	28.4	56.2	77.7	90.0
10x10	12.3	27.8	55.4	77.3	89.8
11x11	12.2	27.4	55.0	77.2	89.7
12x12	12.2	27.4	55.1	77.1	89.6
13x13	12.2	27.2	54.6	76.8	89.6
14x14	12.1	27.1	54.1	76.7	89.6
15x15	11.9	26.9	54.0	76.5	89.4

Laser Intensity: 381

Checkerboard	Percent Dot Area				
Pattern	88.9	75	50	25	11.1
1x1	24.1	54.3	99.0	99.9	99.9
2x2	20.0	42.4	81.1	91.5	95.9
3x3	17.2	37.3	72.0	85.5	93.4
4x4	15.6	34.2	66.8	82.3	92.3
5x5	14.7	32.6	63.8	81.3	91.5
6x6	14.0	31.2	61.7	80.3	91.1
7x7	13.5	30.4	60.0	79.5	90.8
8x8	13.3	29.7	58.8	79.0	90.5
9x9	12.9	29.3	57.8	78.5	90.4
10x10	12.8	28.8	56.9	78.2	90.3
11x11	12.5	28.3	56.3	77.9	90.1
12x12	12.6	28.1	56.3	77.4	90.0
13x13	12.6	28.2	55.8	77.5	89.9
14x14	12.6	27.6	55.3	77.1	89.9
15x15	12.4	27.4	55.1	77.1	89.6

Laser Intensity: 397

Checkerboard	Percent Dot Area				
Pattern	88.9	75	50	25	11.1
1x1	28.7	64.5	99.8	99.8	99.8
2x2	21.8	46.6	85.6	93.8	97.2
3x3	18.3	40.3	75.5	87.5	94.3
4x4	16.6	36.5	69.7	84.5	93.0
5x5	15.5	34.2	66.1	82.6	92.1
6x6	14.7	32.8	63.7	81.4	91.5
7x7	14.2	31.8	61.9	80.4	91.2
8x8	13.9	30.9	60.4	79.8	90.9
9x9	13.7	30.3	59.1	79.1	90.7
10x10	13.5	29.6	58.5	78.9	90.4
11x11	13.2	29.2	57.6	78.4	90.2
12x12	13.0	29.0	57.5	78.2	90.0
13x13	13.0	28.8	57.1	77.9	89.9
14x14	12.9	28.5	56.3	77.7	90.0
15x15	13.0	28.6	56.1	77.7	90.0

Table D4. Percent dot differences from requested dot areas on the RIT Pixeldot Test Target on Imageset 2000 film

Laser Intensity: 258

Checkerboard	Percent Dot Difference				
Pattern	88.9	75	50	25	11.1
1x1	-11.1	-25.0	-49.8	-67.4	-61.0
2x2	-10.4	-24.1	-47.8	-57.7	-52.0
3x3	-10.2	-22.8	-45.0	-50.9	-49.4
4x4	-9.6	-21.8	-42.1	-47.5	-47.4
5x5	-9.1	-20.8	-40.1	-45.5	-46.3
6x6	-9.1	-19.9	-38.2	-44.8	-45.3
7x7	-8.3	-19.3	-37.0	-43.6	-44.8
8x8	-8.2	-18.7	-36.0	-43.2	-44.9
9x9	-8.1	-18.2	-35.0	-42.6	-44.7
10x10	-8.0	-18.0	-34.4	-42.3	-44.6
11x11	-8.1	-17.3	-33.9	-41.7	-44.7
12x12	-7.9	-17.1	-33.0	-41.2	-45.1
13x13	-7.9	-17.5	-33.3	-41.0	-45.0
14x14	-7.8	-16.9	-32.1	-41.4	-44.8
15x15	-7.7	-16.7	-31.0	-41.4	-44.8

Laser Intensity: 269

Checkerboard	Percent Dot Difference				
Pattern	88.9	75	50	25	11.1
1x1	-10.7	-24.6	-48.7	-43.9	-19.7
2x2	-9.0	-21.3	-39.7	-23.1	-11.7
3x3	-6.8	-15.1	-28.6	-16.7	-9.1
4x4	-4.9	-11.9	-23.1	-13.1	-7.0
5x5	-4.1	-9.9	-19.1	-11.2	-6.1
6x6	-3.7	-8.4	-16.5	-9.5	-5.1
7x7	-3.3	-7.3	-14.5	-8.6	-5.0
8x8	-2.9	-6.5	-12.9	-7.5	-4.3
9x9	-2.4	-5.9	-11.6	-6.7	-4.0
10x10	-2.1	-5.3	-10.3	-5.9	-3.8
11x11	-2.1	-4.9	-9.7	-5.8	-3.4
12x12	-1.6	-4.6	-8.8	-4.9	-3.6
13x13	-1.8	-4.2	-8.1	-4.9	-3.3
14x14	-1.5	-3.7	-7.8	-4.7	-3.3
15x15	-1.4	-3.5	-7.0	-4.0	-3.0

Laser Intensity: 281

Checkerboard	Percent Dot Difference				
Pattern	88.9	75	50	25	11.1
1x1	-10.4	-24.3	-47.5	-23.9	-8.6
2x2	-6.1	-14.2	-25.8	-11.7	-6.6
3x3	-4.1	-9.2	-17.9	-9.1	-4.4
4x4	-3.1	-7.3	-14.0	-7.4	-3.4
5x5	-2.2	-5.9	-11.7	-6.3	-2.7
6x6	-2.0	-4.9	-10.1	-5.2	-2.3
7x7	-1.5	-4.4	-8.8	-4.6	-2.1
8x8	-1.2	-3.8	-7.8	-4.0	-2.6
9x9	-1.1	-3.5	-7.1	-3.7	-1.6
10x10	-0.9	-3.2	-6.4	-3.4	-1.5
11x11	-1.0	-3.0	-5.9	-3.1	-1.3
12x12	-0.9	-2.9	-5.3	-2.8	-1.1
13x13	-1.0	-2.6	-4.8	-2.4	-1.0
14x14	-1.0	-2.5	-4.4	-2.5	-0.9
15x15	-1.0	-2.2	-4.3	-2.4	-2.2

Laser Intensity: 293

Checkerboard	Percent Dot Difference				
Pattern	88.9	75	50	25	11.1
1x1	-10.6	-23.5	-41.5	-4.1	-2.0
2x2	-3.2	-7.7	-13.1	-4.7	-3.1
3x3	-1.9	-5.0	-9.5	-4.7	-2.5
4x4	-1.5	-4.1	-7.8	-4.1	-2.0
5x5	-1.3	-3.4	-6.7	-3.6	-1.7
6x6	-1.2	-3.1	-5.8	-3.2	-1.4
7x7	-1.1	-2.7	-5.1	-2.8	-1.4
8x8	-0.9	-2.5	-4.7	-2.5	-1.2
9x9	-0.9	-2.3	-4.2	-2.3	-1.0
10x10	-0.7	-2.0	-3.9	-2.0	-1.0
11x11	-0.9	-1.7	-3.4	-1.9	-0.9
12x12	-0.4	-1.1	-2.8	-1.9	-0.9
13x13	-0.4	-1.1	-2.5	-1.7	-0.9
14x14	-0.3	-1.1	-2.3	-1.5	-0.7
15x15	-0.4	-1.3	-2.1	-1.2	-0.4

Table D4 (continued). Percent dot differences from requested dot areas on the RIT Pixeldot Test Target on Imageset 2000 film

Laser Intensity: 306

Checkerboard	Percent Dot Difference				
Pattern	88.9	75	50	25	11.1
1x1	-8.9	-18.2	-25.2	5.7	1.9
2x2	-0.9	-2.5	-4.7	-0.4	-0.9
3x3	-0.4	-1.4	-3.3	-1.6	-1.1
4x4	-0.3	-1.3	-3.0	-1.6	-1.0
5x5	-0.2	-0.9	-2.6	-1.5	-0.9
6x6	-0.3	-0.9	-2.5	-1.4	-0.8
7x7	-0.2	-0.8	-2.2	-1.4	-0.8
8x8	-0.3	-0.8	-2.1	-1.3	-0.7
9x9	-0.1	-0.7	-1.9	-1.3	-0.6
10x10	-0.2	-0.7	-1.8	-1.0	-0.5
11x11	-0.2	-0.5	-1.6	-1.1	-0.6
12x12	-0.2	-0.5	-1.3	-1.0	-0.5
13x13	0.1	-0.5	-1.1	-0.9	-0.4
14x14	-0.1	-0.5	-1.1	-0.8	-0.3
15x15	-0.1	-0.3	-1.1	-0.9	-0.4

Checkerboard	Percent Dot Difference				
Pattern	88.9	75	50	25	11.1
1x1	-7.1	-13.5	-13.1	10.3	3.9
2x2	0.0	-0.1	0.6	1.8	0.0
3x3	0.2	0.2	-0.1	-0.1	-0.5
4x4	0.2	-0.2	-0.8	-0.6	-0.6
5x5	0.1	-0.2	-0.9	-0.8	-0.6
6x6	0.0	-0.3	-0.8	-0.8	-0.6
7x7	-0.1	-0.3	-0.8	-0.9	-0.6
8x8	-0.1	-0.3	-0.8	-0.6	-0.4
9x9	0.0	-0.4	-0.8	-0.6	-0.5
10x10	0.0	-0.3	-0.8	-0.7	-0.4
11x11	-0.2	-0.3	-0.6	-0.7	-0.3
12x12	-0.1	-0.3	-0.4	-0.5	-0.3
13x13	-0.2	-0.2	-0.3	-0.5	-0.4
14x14	0.0	-0.4	-0.4	-0.6	-0.4
15x15	-0.2	-0.5	-0.4	-0.7	-0.5

Laser Intensity: 320

Checkerboard	Percent Dot Difference				
Pattern	88.9	75	50	25	11.1
1x1	-4.9	-8.4	-1.1	14.0	6.3
2x2	1.3	1.9	6.0	4.0	1.1
3x3	1.1	1.6	3.5	1.5	0.3
4x4	0.9	1.0	2.4	0.7	0.0
5x5	0.7	0.8	1.8	0.2	0.0
6x6	0.6	0.7	1.2	0.2	-0.1
7x7	0.6	0.6	0.9	0.0	-0.1
8x8	0.4	0.4	0.6	-0.1	-0.1
9x9	0.3	0.3	0.5	-0.1	0.0
10x10	0.2	0.3	0.4	-0.1	0.0
11x11	0.2	0.3	0.3	-0.2	-0.1
12x12	0.1	0.1	0.5	-0.1	0.0
13x13	0.2	0.1	0.5	-0.2	-0.2
14x14	0.2	0.2	0.4	-0.1	-0.3
15x15	0.2	0.1	0.2	-0.1	-0.5

Laser Intensity:334

Checkerboard	Percent Dot Difference				
Pattern	88.9	75	50	25	11.1
1x1	0.2	3.0	19.7	20.1	8.9
2x2	3.0	6.3	13.8	7.4	2.8
3x3	2.1	4.5	9.4	3.8	1.4
4x4	1.5	3.3	6.4	2.5	0.1
5x5	1.1	2.6	4.9	1.8	0.7
6x6	0.8	1.9	4.1	1.3	0.5
7x7	0.6	1.6	3.3	0.9	0.4
8x8	0.4	1.3	2.7	0.8	0.3
9x9	0.3	1.1	2.3	0.7	0.2
10x10	0.2	0.9	2.1	0.5	0.2
11x11	0.1	0.8	1.8	0.5	0.2
12x12	0.1	0.7	2.1	0.5	0.1
13x13	0.1	0.5	1.9	0.4	0.1
14x14	-0.1	0.6	1.5	0.3	-0.2
15x15	-0.1	0.4	1.5	0.2	-0.2

Table D4 (continued). Percent dot differences from requested dot areas on the RIT Pixeldot Test Target on Imageset 2000 film

Laser Intensity: 349

Checkerboard	Percent Dot Difference				
Pattern	88.9	75	50	25	11.1
1x1	4.8	12.0	36.0	23.6	10.6
2x2	5.2	10.4	21.1	10.7	4.3
3x3	3.6	7.4	14.5	6.5	2.5
4x4	2.6	5.5	10.9	4.5	1.7
5x5	2.1	4.5	8.4	3.4	1.4
6x6	1.7	3.7	7.1	2.9	1.0
7x7	1.5	3.3	5.9	2.4	0.9
8x8	1.4	2.8	5.0	2.0	0.8
9x9	1.1	2.3	4.7	1.7	0.6
10x10	1.0	2.1	3.9	1.5	0.5
11x11	0.9	1.9	3.5	1.3	0.4
12x12	0.9	1.6	3.5	1.4	0.4
13x13	0.8	1.7	3.3	0.4	0.4
14x14	0.6	1.3	2.9	0.9	0.4
15x15	0.4	1.4	2.8	1.1	-0.2

Laser Intensity: 364

Checkerboard	Percent Dot Difference				
Pattern	88.9	75	50	25	11.1
1x1	9.2	20.6	45.1	24.9	11.1
2x2	7.1	13.9	27.0	13.7	5.8
3x3	4.8	10.2	18.6	8.7	3.7
4x4	3.7	7.5	14.2	6.4	2.6
5x5	2.9	6.2	11.3	4.9	2.1
6x6	2.4	5.0	9.1	4.1	1.6
7x7	1.9	4.2	7.9	3.5	1.4
8x8	1.6	3.7	6.9	3.0	1.3
9x9	1.3	3.4	6.2	2.7	1.1
10x10	1.2	2.8	5.4	2.3	0.9
11x11	1.1	2.4	5.0	2.2	0.8
12x12	1.1	2.4	5.1	2.1	0.7
13x13	1.1	2.2	4.6	1.8	0.7
14x14	1.0	2.1	4.1	1.7	0.7
15x15	0.8	1.9	4.0	1.5	0.5

Laser Intensity: 381

Checkerboard	Percent Dot Difference				
Pattern	88.9	75	50	25	11.1
1x1	13.0	29.3	49.0	24.9	11.0
2x2	8.9	17.4	31.1	16.5	7.0
3x3	6.1	12.3	22.0	10.5	4.5
4x4	4.5	9.2	16.8	7.3	3.4
5x5	3.6	7.6	13.8	6.3	2.6
6x6	2.9	6.2	11.7	5.3	2.2
7x7	2.4	5.4	10.0	4.5	1.9
8x8	2.2	4.7	8.8	4.0	1.6
9x9	1.8	4.3	7.8	3.5	1.5
10x10	1.7	3.8	6.9	3.2	1.4
11x11	1.4	3.3	6.3	2.9	1.2
12x12	1.5	3.1	6.3	2.4	1.1
13x13	1.5	3.2	5.8	2.5	1.0
14x14	1.5	2.6	5.3	2.1	1.0
15x15	1.3	2.4	5.1	2.1	0.7

Laser Intensity: 397

Checkerboard	Percent Dot Difference				
Pattern	88.9	75	50	25	11.1
1x1	17.6	39.5	49.8	24.8	10.9
2x2	10.7	21.6	35.6	18.8	8.3
3x3	7.2	15.3	25.5	12.5	5.4
4x4	5.5	11.5	19.7	9.5	4.1
5x5	4.4	9.2	16.1	7.6	3.2
6x6	3.6	7.8	13.7	6.4	2.6
7x7	3.1	6.8	11.9	5.4	2.3
8x8	2.8	5.9	10.4	4.8	2.0
9x9	2.6	5.3	9.1	4.1	1.8
10x10	2.4	4.6	8.5	3.9	1.5
11x11	2.1	4.2	7.6	3.4	1.3
12x12	1.9	4.0	7.5	3.2	1.1
13x13	1.9	3.8	7.1	2.9	1.0
14x14	1.8	3.5	6.3	2.7	1.1
15x15	1.9	3.6	6.1	2.7	1.1

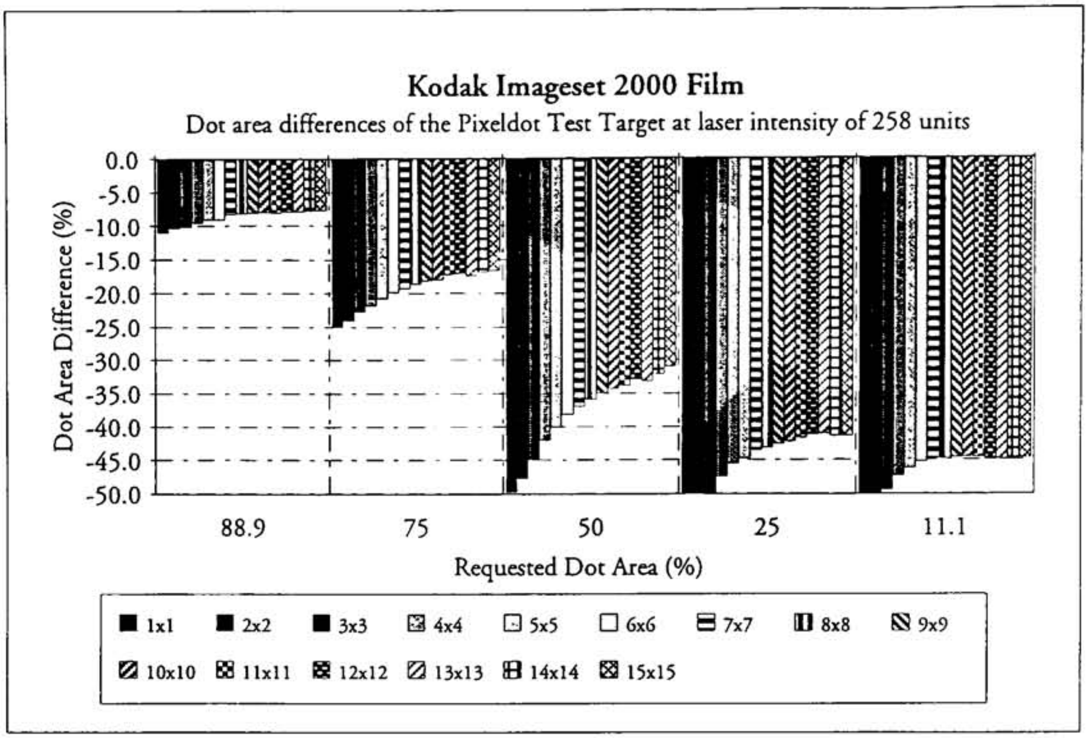


Figure D13. Dot Differences on the Pixeldot Test Target on Imageset 2000 film at laser intensity of 258 units

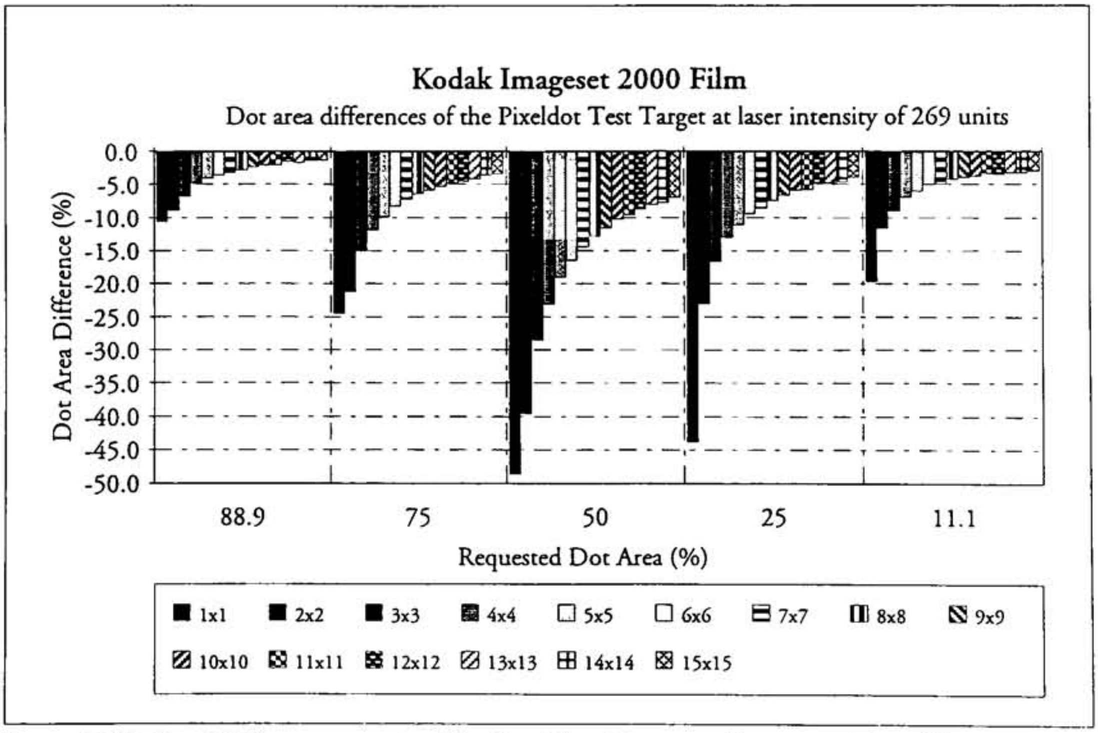


Figure D14. Dot Differences on the Pixeldot Test Target on Imageset 2000 film at laser intensity of 269 units

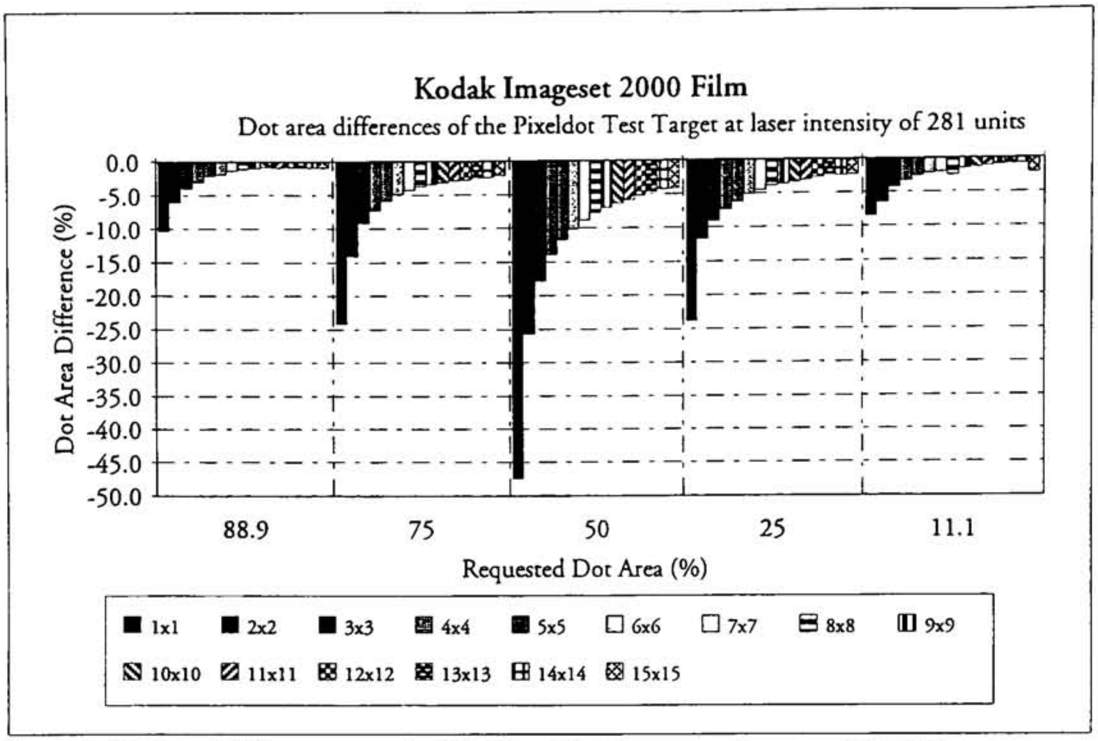


Figure D15. Dot Differences on the Pixeldot Test Target on Imageset 2000 film at laser intensity of 281 units

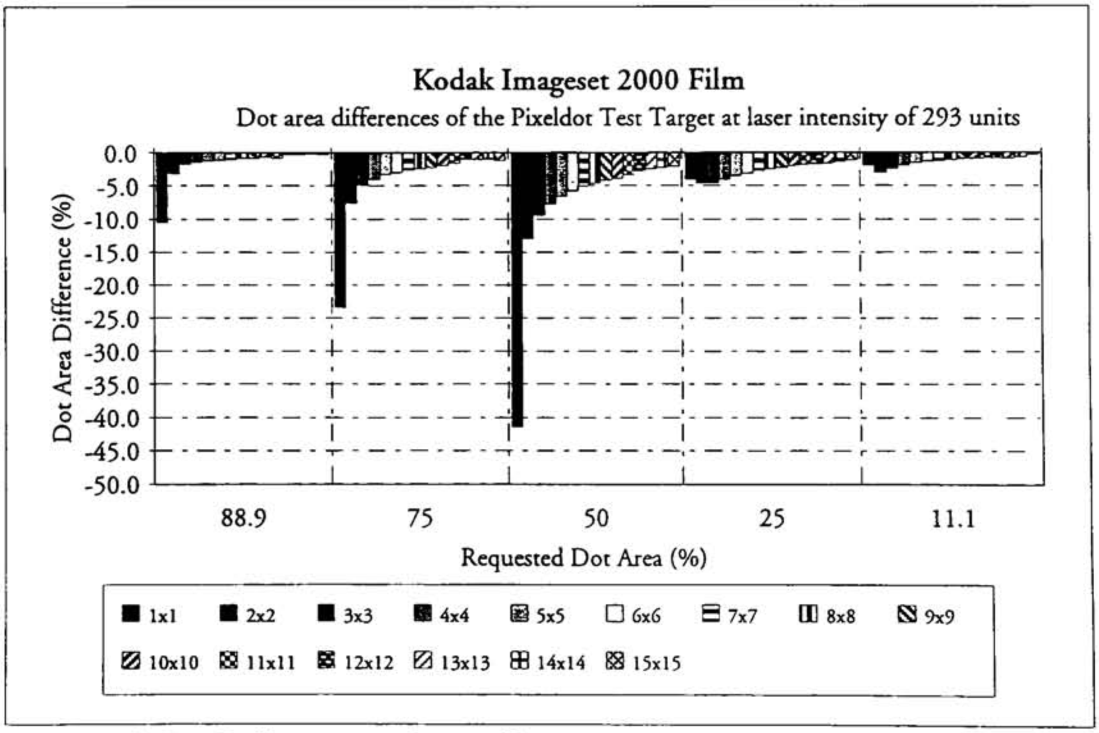


Figure D16. Dot Differences on the Pixeldot Test Target on Imageset 2000 film at laser intensity of 293 units

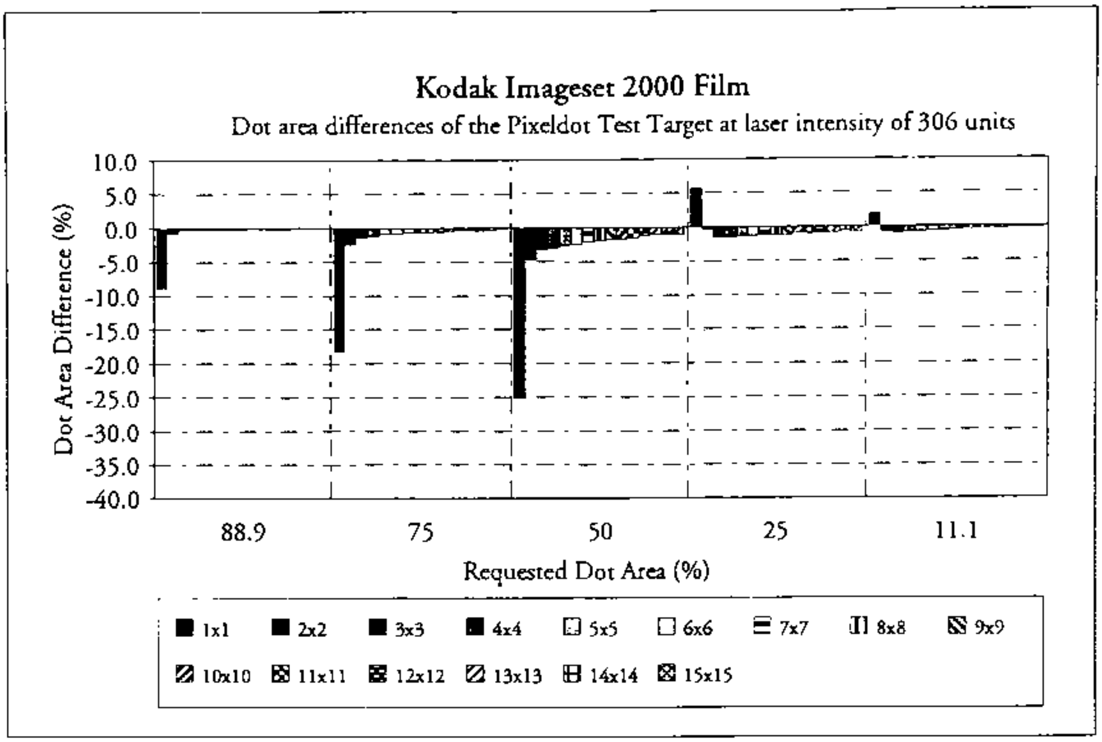


Figure D17. Dot Differences on the Pixeldot Test Target on Imageset 2000 film at laser intensity of 306 units

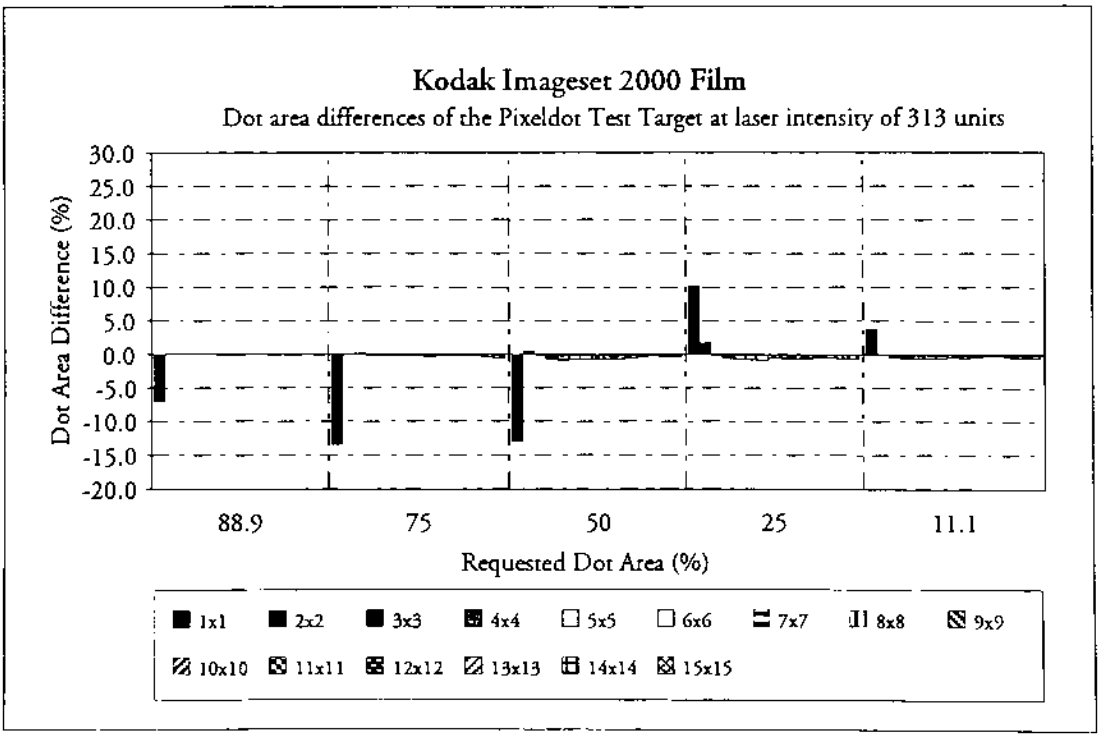


Figure D18. Dot Differences on the Pixeldot Test Target on Imageset 2000 film at laser intensity of 313 units

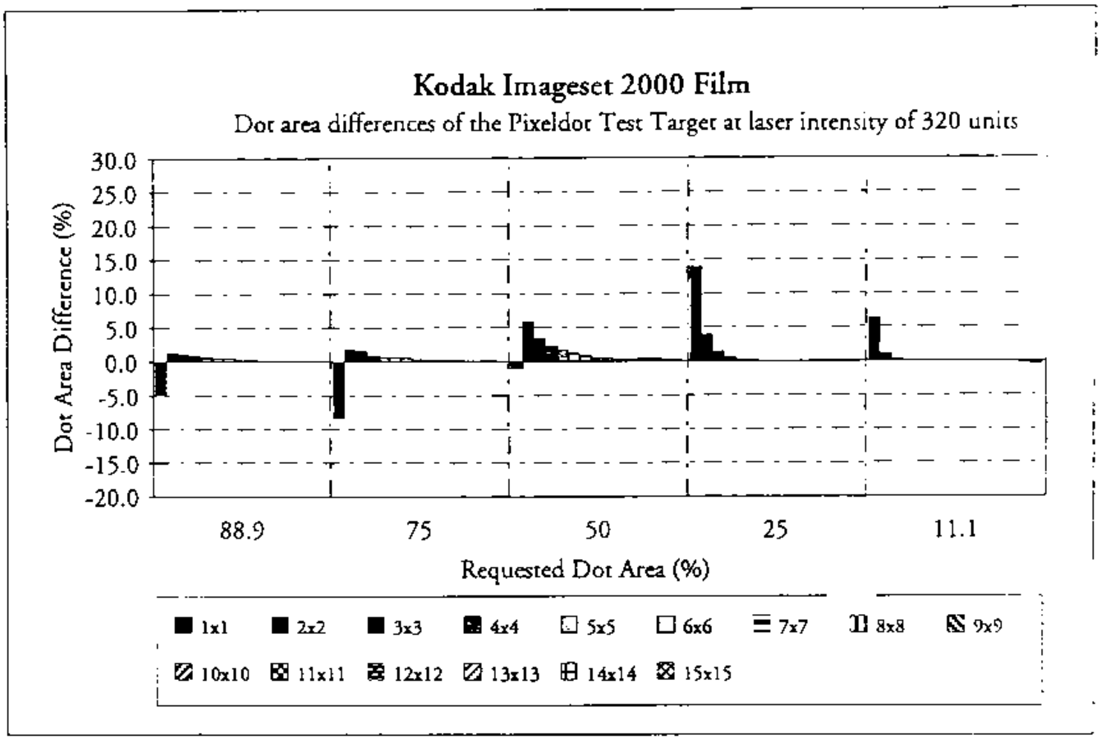


Figure D19. Dot Differences on the Pixeldot Test Target on Imageset 2000 film at laser intensity of 320 units

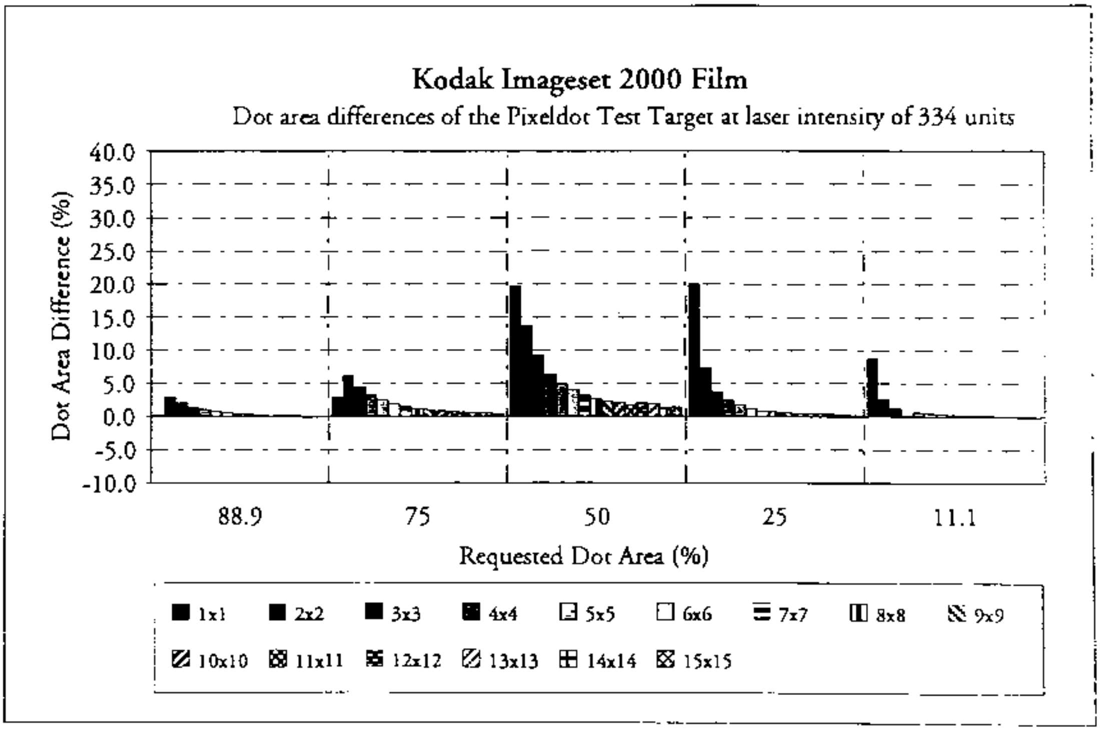


Figure D20. Dot Differences on the Pixeldot Test Target on Imageset 2000 film at laser intensity of 334 units

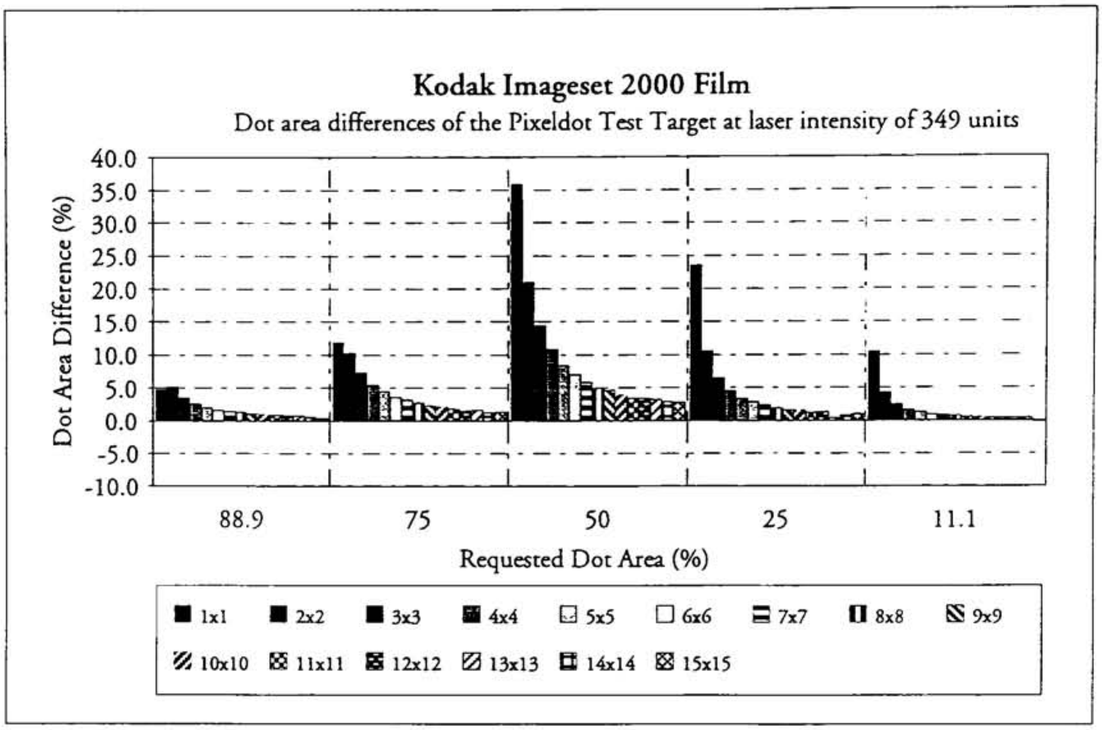


Figure D21. Dot Differences on the Pixeldot Test Target on Imageset 2000 film at laser intensity of 349 units

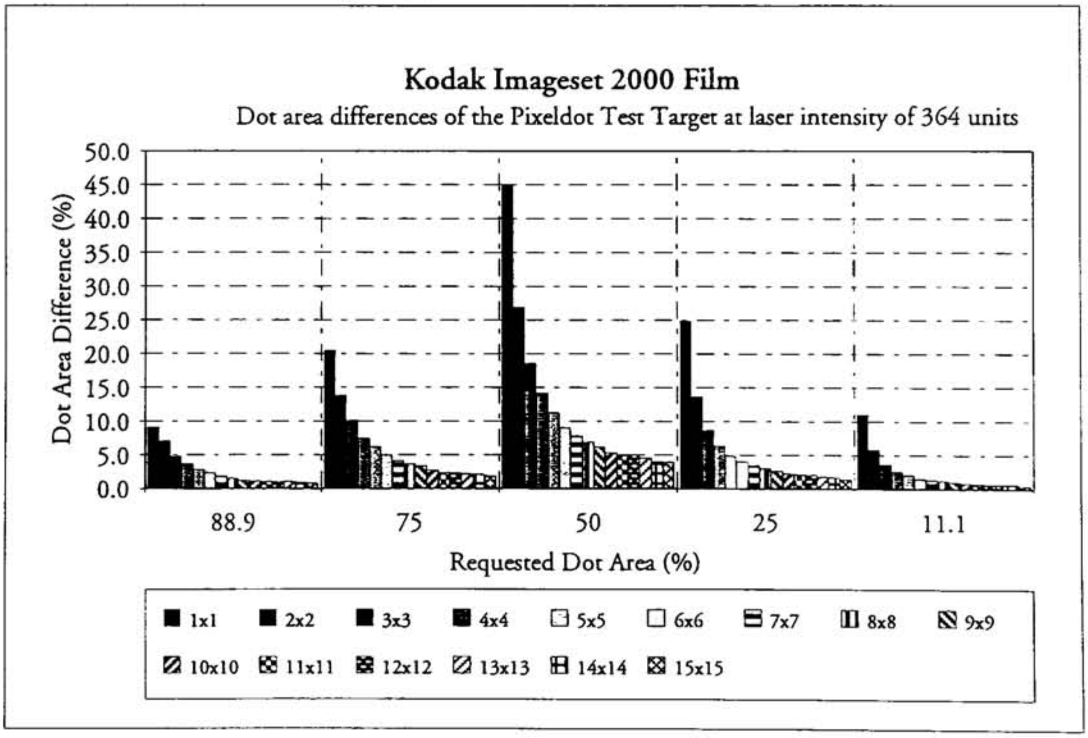


Figure D22. Dot Differences on the Pixeldot Test Target on Imageset 2000 film at laser intensity of 364 units

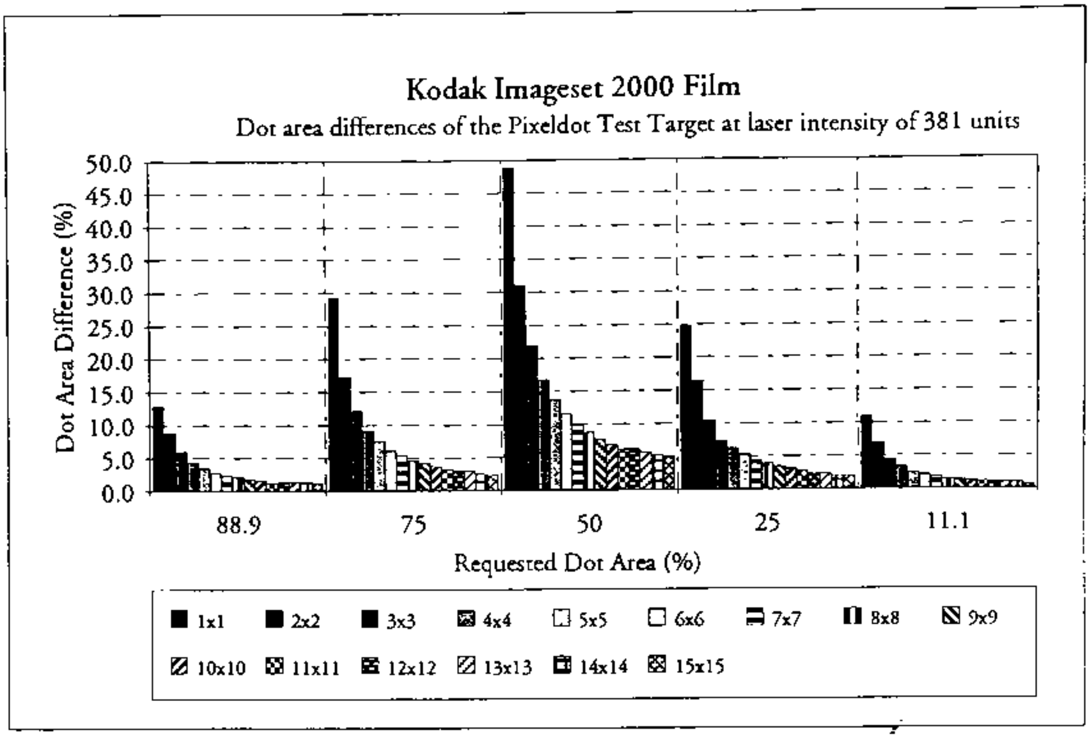


Figure D23. Dot Differences on the Pixeldot Test Target on Imageset 2000 film at laser intensity of 381 units

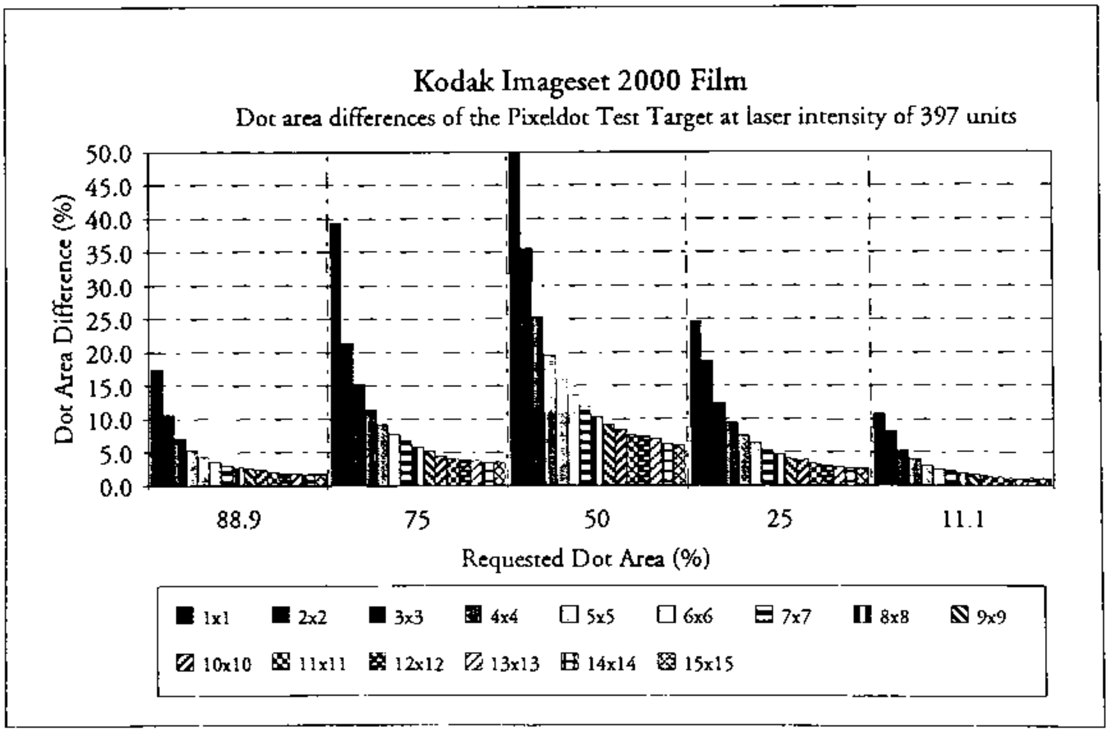


Figure D24. Dot Differences on the Pixeldot Test Target on Imageset 2000 film at laser intensity of 397 units

Appendix E

Verification of Applicability of 2x2 Checkerboard for Calibrating Imageset 2000 Film

Appendix E

Verification of Applicability of 2x2 Checkerboard for Calibrating Imageset 2000 Film

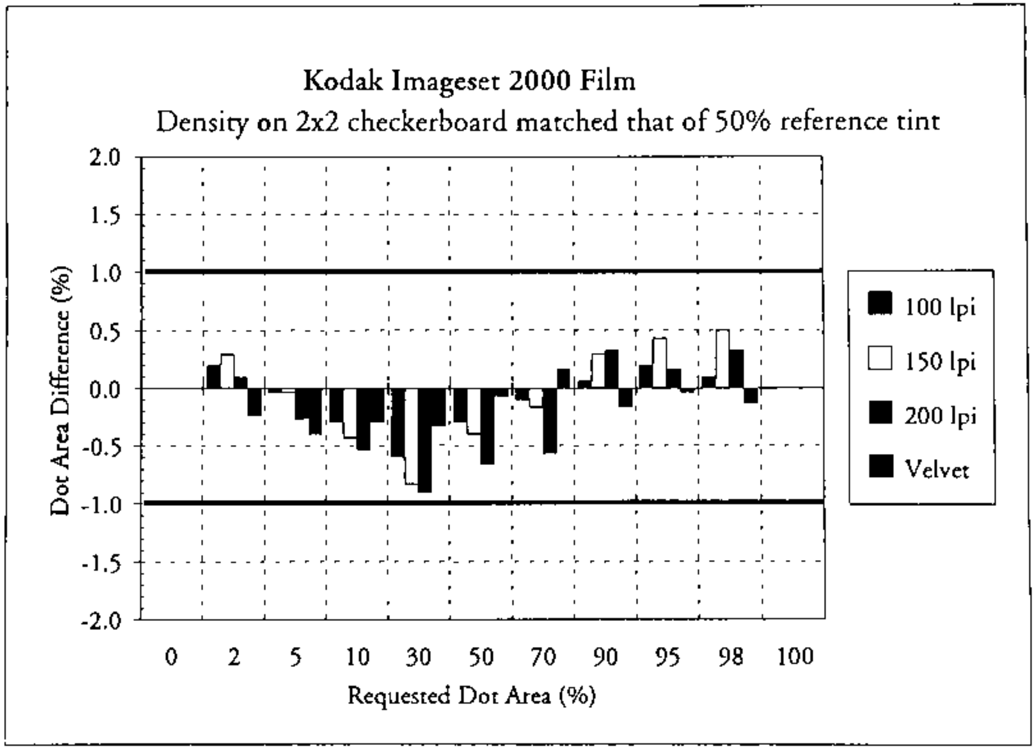
Table E1. Reproduced dot areas on halftone scales when the density of 2x2 checkerboard matched that of 50% reference tint on Kodak Imageset 2000 Film. (Laser Intensity of 329 units)

Requested	1st reading				2nd reading				3rd reading				Average			
dot area	100 lpi	150 lpi	200 lpi	Velvet	100 lpi	150 lpi	200 lpi	Velvet	100 lpi	150 lpi	200 lpi	Velvet	100 lpi	150 lpi	200 lpi	Velvet
0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
2	98.2	98.3	98.1	97.8	98.2	98.3	98.1	97.7	98.2	98.3	98.1	97.8	98.2	98.3	98.1	97.8
5	95.0	95.0	94.7	94.6	94.9	95.0	94.7	94.6	95.0	94.9	94.8	94.6	95.0	95.0	94.7	94.6
10	89.7	89.6	89.5	89.7	89.7	89.6	89.4	89.7	89.7	89.5	89.5	89.7	89.7	89.6	89.5	89.7
30	69.5	69.2	69.1	69.7	69.3	69.1	69.1	69.5	69.4	69.2	69.1	69.8	69.4	69.2	69.1	69.7
50	49.5	49.6	49.4	49.9	49.7	49.6	49.3	49.9	49.9	49.6	49.3	50.0	49.7	49.6	49.3	49.9
70	29.7	29.8	29.4	30.2	30.1	29.9	29.5	30.1	29.9	29.8	29.4	30.2	29.9	29.8	29.4	30.2
90	10.0	10.2	10.2	9.7	10.1	10.4	10.5	9.9	10.1	10.3	10.3	9.9	10.1	10.3	10.3	9.8
95	4.9	5.3	5.0	4.7	5.3	5.5	5.2	5.1	5.4	5.5	5.3	5.1	5.2	5.4	5.2	5.0
98	1.9	2.3	2.3	1.6	2.2	2.6	2.4	2.0	2.2	2.6	2.3	2.0	2.1	2.5	2.3	1.9
100	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table E2. Dot differences from requested dot areas

Requested dot area	Imageset 2000 Film			
	100 lpi	150 lpi	200 lpi	Velvet
0	0.0	0.0	0.0	0.0
2	0.2	0.3	0.1	-0.2
5	0.0	0.0	-0.3	-0.4
10	-0.3	-0.4	-0.5	-0.3
30	-0.6	-0.8	-0.9	-0.3
50	-0.3	-0.4	-0.7	-0.1
70	-0.1	-0.2	-0.6	0.2
90	0.1	0.3	0.3	-0.2
95	0.2	0.4	0.2	0.0
98	0.1	0.5	0.3	-0.1
100	0.0	0.0	0.0	0.0

Figure E1. The plots of dot differences from requested dot areas when using 2x2 checkerboard for calibration and linearization



Appendix F

Reliability of Dot Area Readings

Table F1. Dot differences between maximum and minimum dot areas of three readings on Kodak PagiSet film

Requested	Differences of max.-min. readings of 100-lpi halftone at the exposure of											Differences of max.-min. readings of 150-lpi halftone at the exposure of										
dot area	233	244	255	266	278	290	303	316	330	345	360	233	244	255	266	278	290	303	316	330	345	360
0	0.1	0.3	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.2	0.2	0.2	0.3	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.3	0.5	0.3	0.1	0.1	0.1	0.1	0.1	0.0	0.1
5	0.2	0.3	0.3	0.3	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.3	0.2	0.3	0.2	0.2	0.1	0.1	0.2	0.1	0.0	0.1
10	0.4	0.3	0.3	0.3	0.1	0.1	0.0	0.1	0.1	0.0	0.1	0.3	0.2	0.4	0.3	0.1	0.1	0.0	0.2	0.2	0.0	0.0
30	0.1	0.1	0.2	0.2	0.1	0.1	0.2	0.1	0.1	0.1	0.1	0.3	0.2	0.4	0.3	0.2	0.1	0.2	0.2	0.1	0.2	0.1
50	0.2	0.3	0.3	0.3	0.0	0.2	0.1	0.1	0.0	0.3	0.2	0.2	0.2	0.3	0.3	0.1	0.1	0.0	0.2	0.2	0.1	0.2
70	0.1	0.2	0.1	0.5	0.2	0.5	0.2	0.0	0.0	0.3	0.3	0.2	0.2	0.0	0.2	0.1	0.2	0.2	0.3	0.0	0.2	0.1
90	0.4	0.2	0.1	0.5	0.2	0.3	0.2	0.0	0.1	0.4	0.4	0.3	0.0	0.1	0.2	0.3	0.3	0.2	0.2	0.0	0.3	0.1
95	0.3	0.1	0.2	0.3	0.3	0.4	0.2	0.2	0.0	0.1	0.1	0.2	0.1	0.4	0.3	0.1	0.4	0.2	0.3	0.1	0.3	0.0
98	0.1	0.2	0.1	0.5	0.3	0.4	0.1	0.0	0.0	0.2	0.3	0.1	0.2	0.1	0.1	0.3	0.1	0.2	0.1	0.0	0.3	0.1
100	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Requested	Differences of max.-min. readings of 200-lpi halftone at the exposure of											Differences of max.-min. readings of Velvet screen at the exposure of										
dot area	233	244	255	266	278	290	303	316	330	345	360	233	244	255	266	278	290	303	316	330	345	360
0	0.3	0.2	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.3	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.1	0.2	0.3	0.3	0.2	0.0	0.1	0.1	0.1	0.1	0.0	0.3	0.1	0.1	0.3	0.2	0.1	0.1	0.0	0.1	0.0	0.0
5	0.4	0.2	0.4	0.3	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.4	0.2	0.4	0.3	0.2	0.0	0.1	0.2	0.0	0.1	0.1
10	0.3	0.1	0.4	0.2	0.2	0.2	0.1	0.1	0.2	0.1	0.0	0.2	0.3	0.2	0.3	0.1	0.1	0.1	0.1	0.1	0.0	0.1
30	0.2	0.2	0.3	0.1	0.4	0.0	0.2	0.1	0.1	0.2	0.0	0.3	0.1	0.3	0.2	0.1	0.0	0.1	0.1	0.1	0.1	0.0
50	0.2	0.2	0.3	0.4	0.5	0.1	0.1	0.1	0.1	0.2	0.2	0.3	0.1	0.4	0.1	0.2	0.2	0.1	0.1	0.1	0.0	0.2
70	0.3	0.1	0.0	0.3	0.2	0.1	0.1	0.1	0.0	0.2	0.2	0.3	0.0	0.2	0.3	0.1	0.2	0.1	0.1	0.2	0.1	0.2
90	0.2	0.2	0.2	0.1	0.4	0.3	0.3	0.1	0.1	0.3	0.2	0.3	0.1	0.2	0.4	0.1	0.3	0.1	0.1	0.2	0.2	0.0
95	0.3	0.1	0.3	0.4	0.0	0.4	0.3	0.1	0.0	0.2	0.3	0.4	0.1	0.2	0.3	0.2	0.2	0.0	0.1	0.1	0.3	0.2
98	0.1	0.2	0.2	0.2	0.0	0.2	0.2	0.0	0.1	0.2	0.2	0.2	0.0	0.2	0.4	0.1	0.4	0.1	0.2	0.1	0.4	0.2
100	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table F2. Dot differences between maximum and minimum dot areas of three readings on Kodak Imageset 2000 film

Requested	Differences of max,-min. readings of 100-lpi halftone at the exposure of											Differences of max.-min. readings of 150-lpi halftone at the exposure of										
dot area	258	269	281	293	306	320	334	349	364	381	397	258	269	281	293	306	320	334	349	364	381	397
0	0.4	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.3	0.3	0.1	0.1	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.2	0.2	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.1
5	0.2	0.3	0.1	0.0	0.2	0.1	0.0	0.1	0.0	0.1	0.1	0.2	0.1	0.1	0.1	0.0	0.0	0.1	0.1	0.1	0.0	0.0
10	0.3	0.1	0.2	0.1	0.1	0.1	0.0	0.1	0.2	0.0	0.1	0.3	0.1	0.1	0.0	0.0	0.1	0.0	0.1	0.1	0.0	0.0
30	0.3	0.2	0.2	0.2	0.2	0.3	0.1	0.4	0.2	0.3	0.2	0.2	0.2	0.0	0.1	0.0	0.1	0.1	0.1	0.2	0.0	0.2
50	0.3	0.3	0.2	0.0	0.2	0.0	0.1	0.1	0.2	0.4	0.4	0.1	0.0	0.1	0.1	0.2	0.2	0.1	0.0	0.1	0.2	0.1
70	0.2	0.2	0.2	0.3	0.3	0.2	0.1	0.3	0.4	0.2	0.2	0.1	0.2	0.1	0.3	0.1	0.2	0.3	0.1	0.1	0.1	0.0
90	0.4	0.3	0.1	0.4	0.3	0.4	0.3	0.2	0.2	0.4	0.4	0.2	0.1	0.4	0.1	0.4	0.1	0.2	0.2	0.3	0.3	0.2
95	0.3	0.3	0.4	0.2	0.4	0.4	0.3	0.5	0.3	0.2	0.3	0.0	0.2	0.3	0.1	0.2	0.1	0.4	0.1	0.4	0.3	0.3
98	0.3	0.1	0.3	0.1	0.3	0.1	0.3	0.3	0.3	0.2	0.3	0.0	0.3	0.3	0.1	0.2	0.1	0.1	0.4	0.3	0.4	0.3
100	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.1	0.0	0.0	0.0	0.0	0.0
Requested	Differences of max.-min. readings of 200-lpi halftone at the exposure of											Differences of max.-min. readings of Velvet screen at the exposure of										
dot area	258	269	281	293	306	320	334	349	364	381	397	258	269	281	293	306	320	334	349	364	381	397
0	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.4	0.2	0.0	0.0	0.1	0.2	0.0	0.0	0.0	0.0	0.0	0.2	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.1	0.0	0.1
5	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.2	0.3	0.1	0.1	0.1	0.0	0.0	0.1	0.1	0.0	0.0
10	0.2	0.0	0.0	0.1	0.0	0.0	0.1	0.0	0.0	0.1	0.1	0.1	0.2	0.1	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1
30	0.2	0.1	0.0	0.1	0.2	0.0	0.0	0.1	0.0	0.0	0.1	0.0	0.2	0.0	0.2	0.3	0.1	0.1	0.1	0.1	0.1	0.2
50	0.2	0.2	0.1	0.0	0.1	0.1	0.1	0.2	0.2	0.2	0.0	0.1	0.3	0.2	0.0	0.1	0.3	0.1	0.1	0.2	0.0	0.1
70	0.3	0.1	0.1	0.2	0.2	0.0	0.1	0.3	0.3	0.3	0.3	0.2	0.3	0.3	0.0	0.2	0.2	0.1	0.3	0.0	0.1	0.2
90	0.1	0.3	0.2	0.2	0.3	0.1	0.3	0.3	0.2	0.3	0.2	0.1	0.3	0.2	0.1	0.1	0.3	0.1	0.4	0.1	0.2	0.1
95	0.2	0.4	0.1	0.2	0.1	0.2	0.1	0.3	0.3	0.3	0.3	0.1	0.4	0.1	0.3	0.1	0.0	0.2	0.3	0.4	0.1	0.1
98	0.1	0.3	0.0	0.3	0.3	0.2	0.3	0.4	0.4	0.3	0.3	0.0	0.3	0.3	0.2	0.1	0.1	0.3	0.4	0.4	0.3	0.3
100	0.0	0.0	0.0	0.4	0.2	0.1	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Histrogram and Descriptive Statistics of the Variation of Dot Area Readings

Histrogram

Bin	*Frequency*	*Cumulative %*	*Bin*	*Frequency*	*Cumulative %*
0	136	17.17%	0.083333333	264	33.33%
0.083333333	264	50.51%	0.166666667	189	57.20%
0.166666667	189	74.37%	0.25	143	75.25%
0.25	143	92.42%	0	136	92.42%
0.333333333	53	99.12%	0.333333333	53	99.12%
0.416666667	7	100.00%	0.416666667	7	100.00%

Descriptive Statistics

Column 1	
Mean	0.166456229
Standard Error	0.004258939
Median	0.1
Mode	0
Standard Deviat	0.119857154
Variance	0.014365737
Kurtosis	-0.54506854
Skewness	0.425532262
Range	0.5
Minimum	0
Maximum	0.5
Sum	131.8333333
Count	792

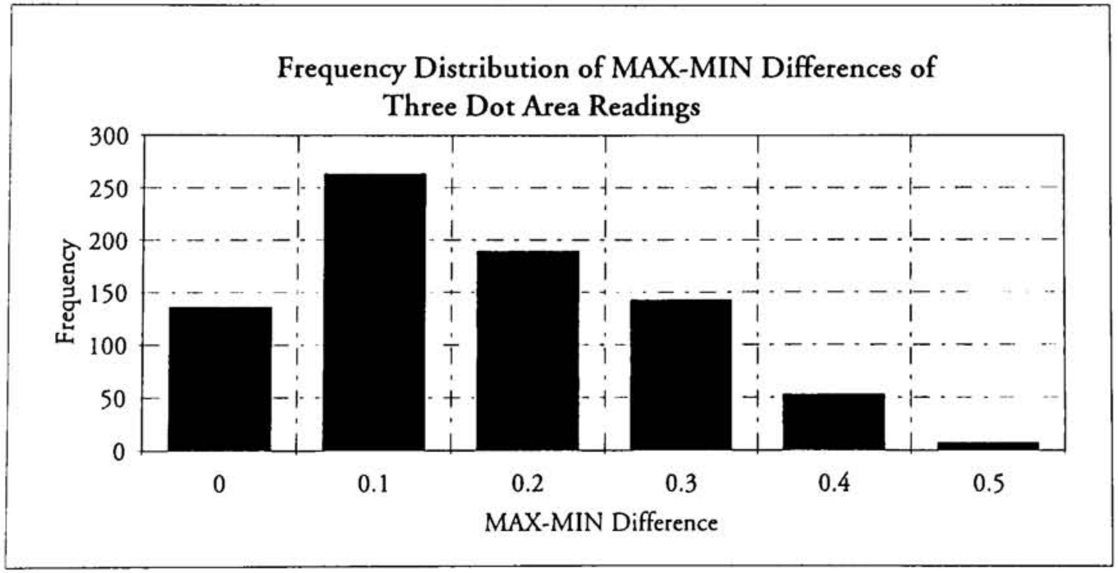


Figure F1. Frequency distribution of dot area reading variation

Appendix G

Effect of Adding Diffusing Sheet to near-Specular Illumination

Appendix G

Effect of adding diffusing sheet to near-specular illumination

Problem: From the plots of reproduced dot area on test elements of the RIT Digital Output Resolution Tester vs laser intensity unit of both Kodak Imageset 2000 and PagiSet film, curves of checkerboards and parallel-line patterns at different dot and line width crossed one another at reproduced dot area of less than 50% (see figure G1 to G3). It was expected that these lines will cross at 50%. Therefore, it was questioned whether the specular illumination of the dot area meter causes the below-50% cross.

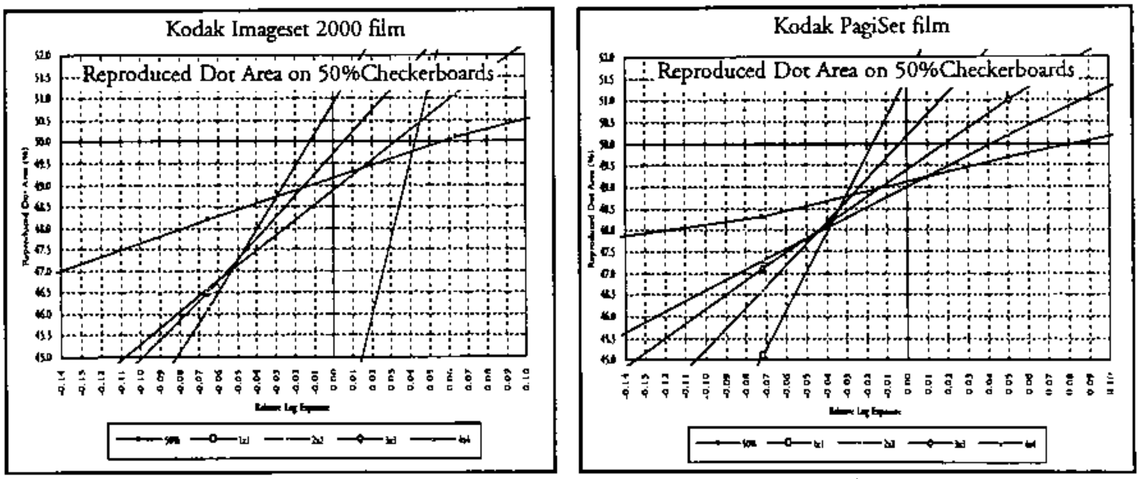


Figure G1 Reproduced dot areas of 50% checkerboards of both films

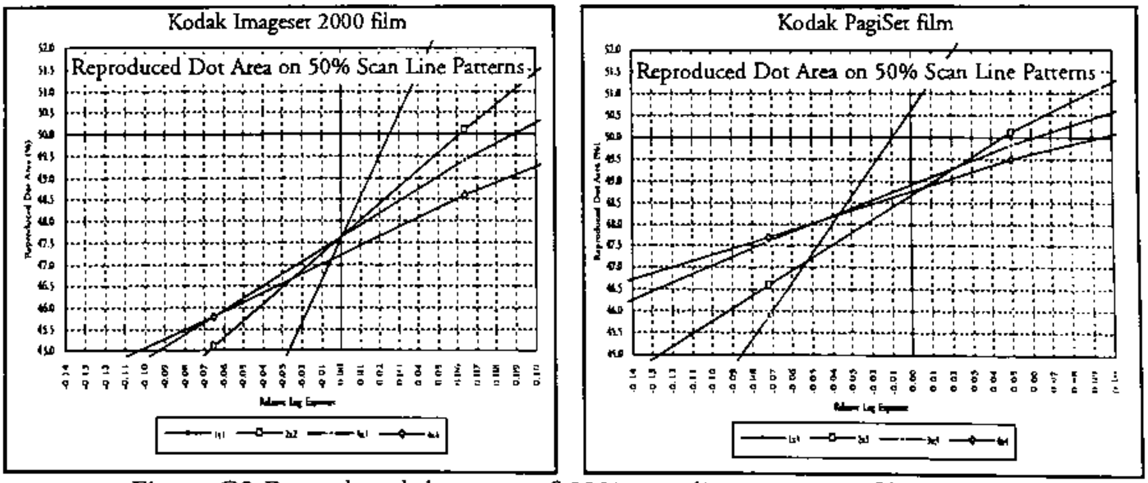


Figure G2 Reproduced dot areas of 50% scan line patterns of both films

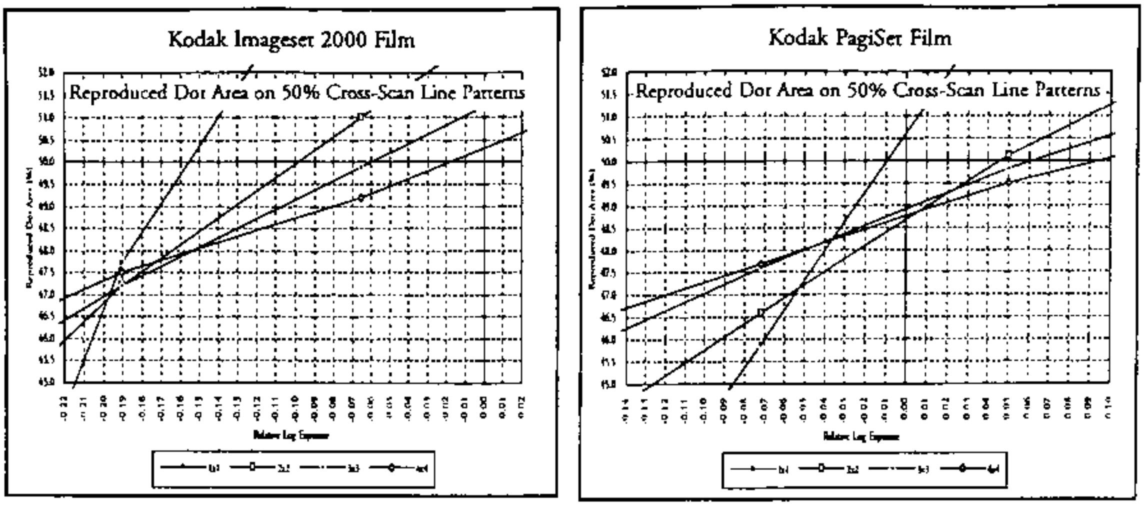


Figure G3 Reproduced dot areas of 50% cross-scan line patterns of both films

Theory: The dot area meter used is specular-specular (illumation-collection). Normally, near-specular illumination focuses light to the sample through a lens. The near-specular measurement is done by collecting light through a lens. By placing a diffusing sheet at the aperture, the illumination becomes diffused.

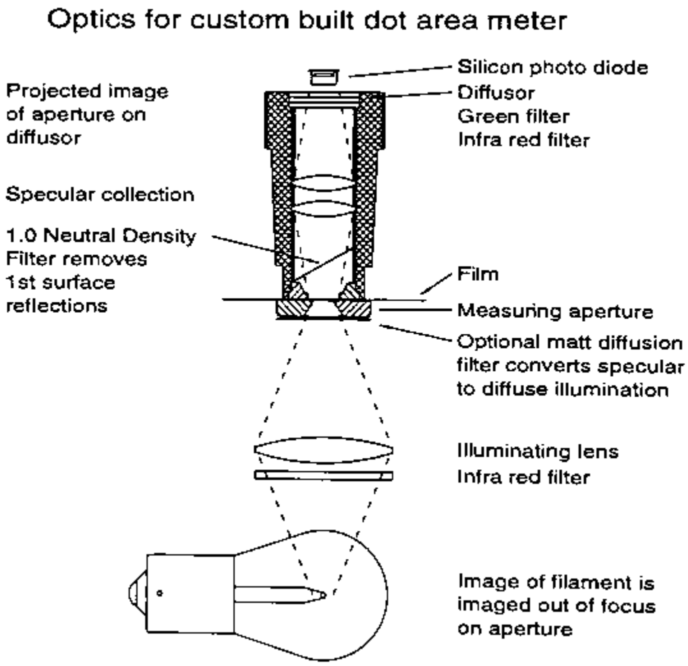


Figure G4 Dot area meter configuration

Test Procedure: In order to find out whether dot areas are different when diffuse illumination is used, a polyester matte-diffusing sheet was placed under the aperture (3 mm. under the film). Dot areas on test elements of the RIT Digital Output Resolution Tester at dot-for-dot exposure were measured with and without diffusing sheet. The differences between dot area measured with and without diffusing sheet (diffuse dot area - specular dot area) were calculated. Then the dot differences were plotted against measured specular dot areas.

Results:

Table G1 Dot area readings with and without diffuser and differences of PagiSet film

Pattern	Test Element	Dot Area (%) w/o diffuse				Dot Area (%) w/ diffuser				Difference
		1st	2nd	3rd	Ave.	1st	2nd	3rd	Ave.	
1x3	Checker-25%	85.9	85.9	85.9	85.9	85.3	85.3	85.3	85.3	0.6
1x1	Checker-50%	51.1	51.1	51.1	51.1	50.0	50.0	50.0	50.0	1.1
3x1	Checker-75%	15.7	15.8	15.7	15.7	15.2	15.3	15.2	15.2	0.5
1x3	Scan line-25%	77.6	77.6	77.6	77.6	77.3	77.3	77.3	77.3	0.3
1x1	Scan line-50%	53.4	53.5	53.4	53.4	52.7	52.7	52.7	52.7	0.7
3x1	Scan line-75%	23.7	23.7	23.7	23.7	23.5	23.5	23.5	23.5	0.2
1x3	Cross-scan-25%	76.9	76.9	76.9	76.9	76.5	76.4	76.5	76.5	0.4
1x1	Cross-scan-50%	50.8	50.8	50.8	50.8	50.0	50.0	50.0	50.0	0.8
3x1	Cross-scan-75%	22.4	22.4	22.4	22.4	22.1	22.1	22.1	22.1	0.3
4x12	Checker-25%	75.3	75.3	75.3	75.3	75.1	75.1	75.1	75.1	0.2
4x4	Checker-50%	49.1	49.1	49.1	49.1	48.7	48.6	48.7	48.7	0.4
12x4	Checker-75%	23.4	23.4	23.4	23.4	23.2	23.1	23.2	23.2	0.2
4x12	Scan line-25%	74.8	74.7	74.7	74.7	74.7	74.7	74.7	74.7	0.0
4x4	Scan line-50%	49.7	49.7	49.7	49.7	49.5	49.5	49.5	49.5	0.2
12x4	Scan line-75%	24.7	24.7	24.7	24.7	24.5	24.5	24.5	24.5	0.2
4x12	Cross-scan-25%	74.5	74.5	74.5	74.5	74.4	74.5	74.4	74.4	0.1
4x4	Cross-scan-50%	48.9	49.0	49.0	49.0	48.7	48.7	48.7	48.7	0.3
12x4	Cross-scan-75%	24.2	24.2	24.3	24.2	24.0	24.0	24.0	24.0	0.2
	Tint-25%	24.6	24.6	24.5	24.6	24.5	24.5	24.4	24.5	0.1
-	Tint-50%	49.4	49.3	49.4	49.4	49.1	49.2	49.0	49.1	0.3
-	TInt-75%	74.2	74.3	74.2	74.2	74.3	74.1	74.2	74.2	0.0

Table G2 Dot area readings with and without diffuser and differences of Imageset 2000 film

Pattern	Test Element	Dot Area (%) w/o diffuser				Dot Area (%) w/ diffuser				Difference
		1st	2nd	3rd	Ave.	1st	2nd	3rd	Ave.	
1x3	Checker-25%	85.8	85.7	85.8	85.8	85.5	85.5	85.5	85.5	0.3
1x1	Checker-50%	41.6	41.6	41.6	41.6	41.1	41.1	41.1	41.1	0.5
3x1	Checker-75%	14.8	14.7	14.8	14.8	14.4	14.5	14.5	14.5	0.3
1x3	Scan line-25%	76.7	76.7	76.7	76.7	76.5	76.5	76.5	76.5	0.2
1x1	Scan line-50%	59.5	59.5	59.6	59.5	59.1	59.1	59.1	59.1	0.4
3x1	Scan line-75%	30.6	30.6	30.6	30.6	30.2	30.3	30.3	30.3	0.3
1x3	Cross-scan-25%	71.8	71.8	71.8	71.8	71.4	71.4	71.4	71.4	0.4
1x1	Cross-scan-50%	48.0	47.9	47.9	47.9	47.3	47.4	47.4	47.4	0.6
3x1	Cross-scan-75%	24.3	24.3	24.3	24.3	23.9	23.8	23.8	23.8	0.5
4x12	Checker-25%	74.2	74.1	74.2	74.2	74.0	74.0	74.0	74.0	0.2
4x4	Checker-50%	48.7	48.7	48.6	48.7	48.2	48.2	48.2	48.2	0.5
12x4	Checker-75%	24.4	24.4	24.4	24.4	24.1	24.1	24.1	24.1	0.3
4x12	Scan line-25%	74.7	74.8	74.9	74.8	74.6	74.6	74.6	74.6	0.2
4x4	Scan line-50%	50.3	50.3	50.3	50.3	50.0	49.9	50.0	50.0	0.3
12x4	Scan line-75%	25.2	25.3	25.3	25.3	25.1	25.1	25.1	25.1	0.2
4x12	Cross-scan-25%	73.1	73.2	73.2	73.2	73.1	73.1	73.0	73.1	0.1
4x4	Cross-scan-50%	47.2	47.3	47.3	47.3	46.9	47.0	47.0	47.0	0.3
12x4	Cross-scan-75%	24.3	24.3	24.3	24.3	23.9	23.9	23.9	23.9	0.4
	Tint-25%	24.6	24.6	24.5	24.6	24.5	24.5	24.4	24.5	0.1
-	Tint-50%	49.4	49.3	49.4	49.4	49.1	49.2	49.0	49.1	0.3
-	TInt-75%	74.2	74.3	74.2	74.2	74.3	74.1	74.2	74.2	0.0

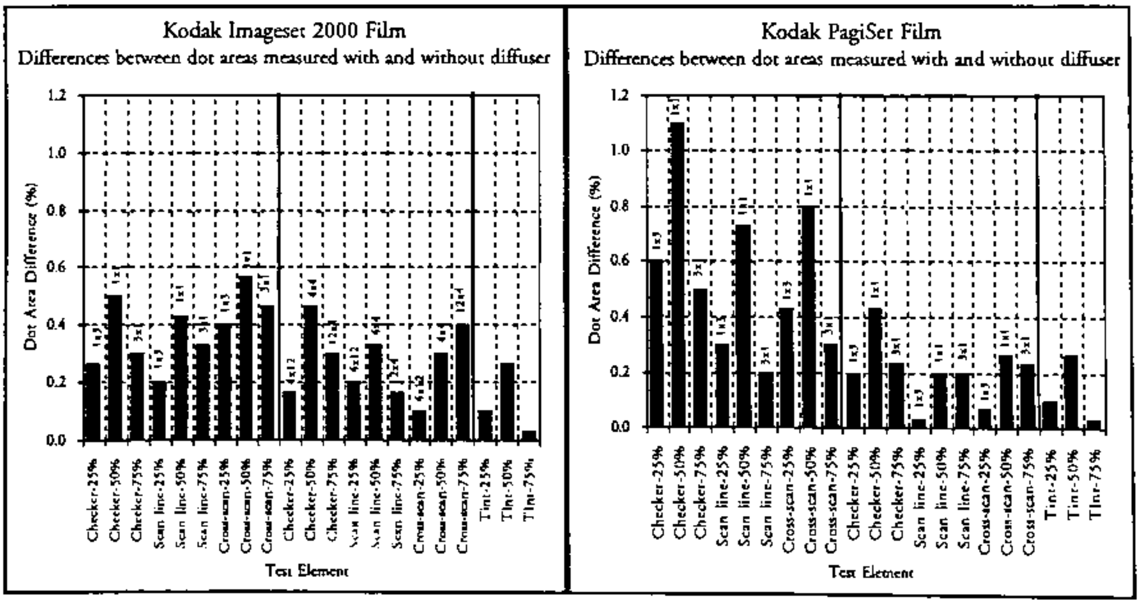


Figure G5 Differences between dot areas measured with and without diffuser of the two films

The use of a diffuser caused lower dot area readings in both films than readings without diffuser. Diffuse illumination has more effect on the reading of very fine halftone dots than that of large one. This is because of the greater border zone of the finer halftone dots. Comparing the two films, PagiSet film was more affected from the use of diffuser than Imageset 2000 Film. The differences between dot areas measured without and with diffuser of PagiSet film were within 1.1% while those of Imageset 2000 film were within only 0.6%. The larger of dot area reading difference of PagiSet film is probably due to more fringe.

Conclusion

Due to the lower readings when using diffuse illumination, the crossing points of tint and checkerboards are lower than when using specular illuminantion. Therefore, the illumination optics of the dot area meter can only be a partial explanation of the cause for this 50% offset.

Appendix H

Test Form Used to Perform Exposure Series

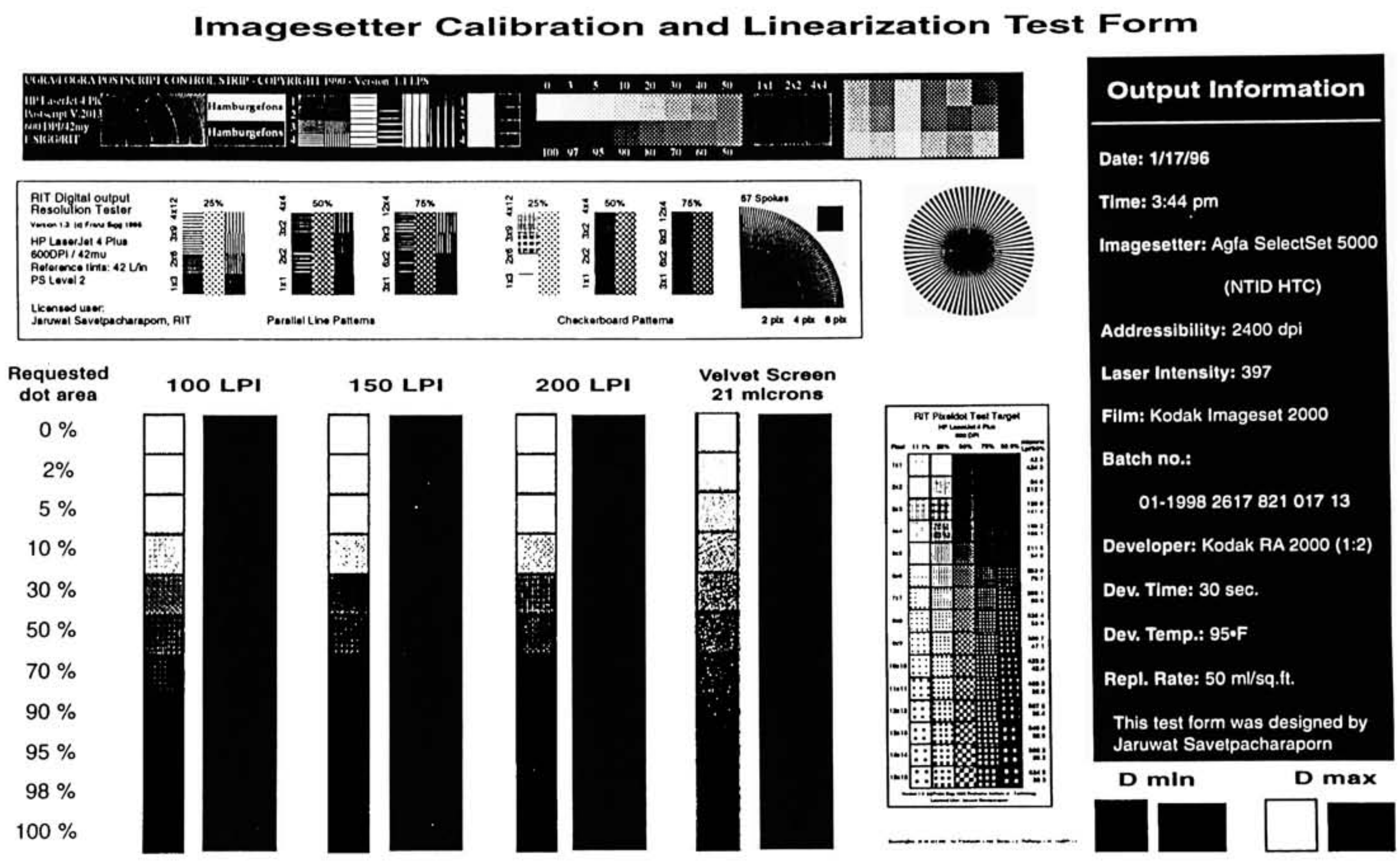


Figure H1: Test form used to perform exposure series

Appendix I

Microphotographs of Test Elements and Solid Areas

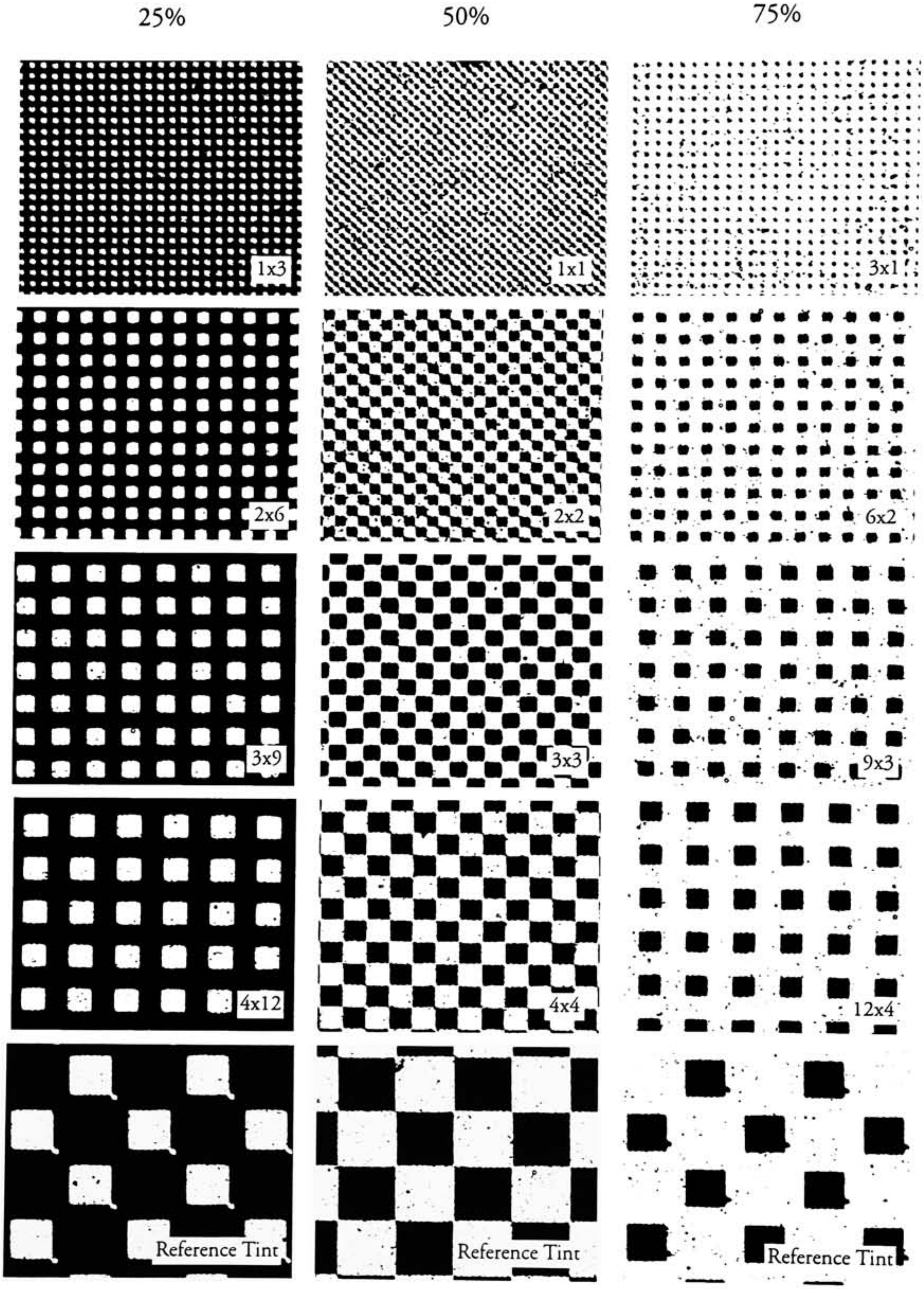


Figure I1. Checkerboard patterns on Kodak PagiSet film at practical exposure

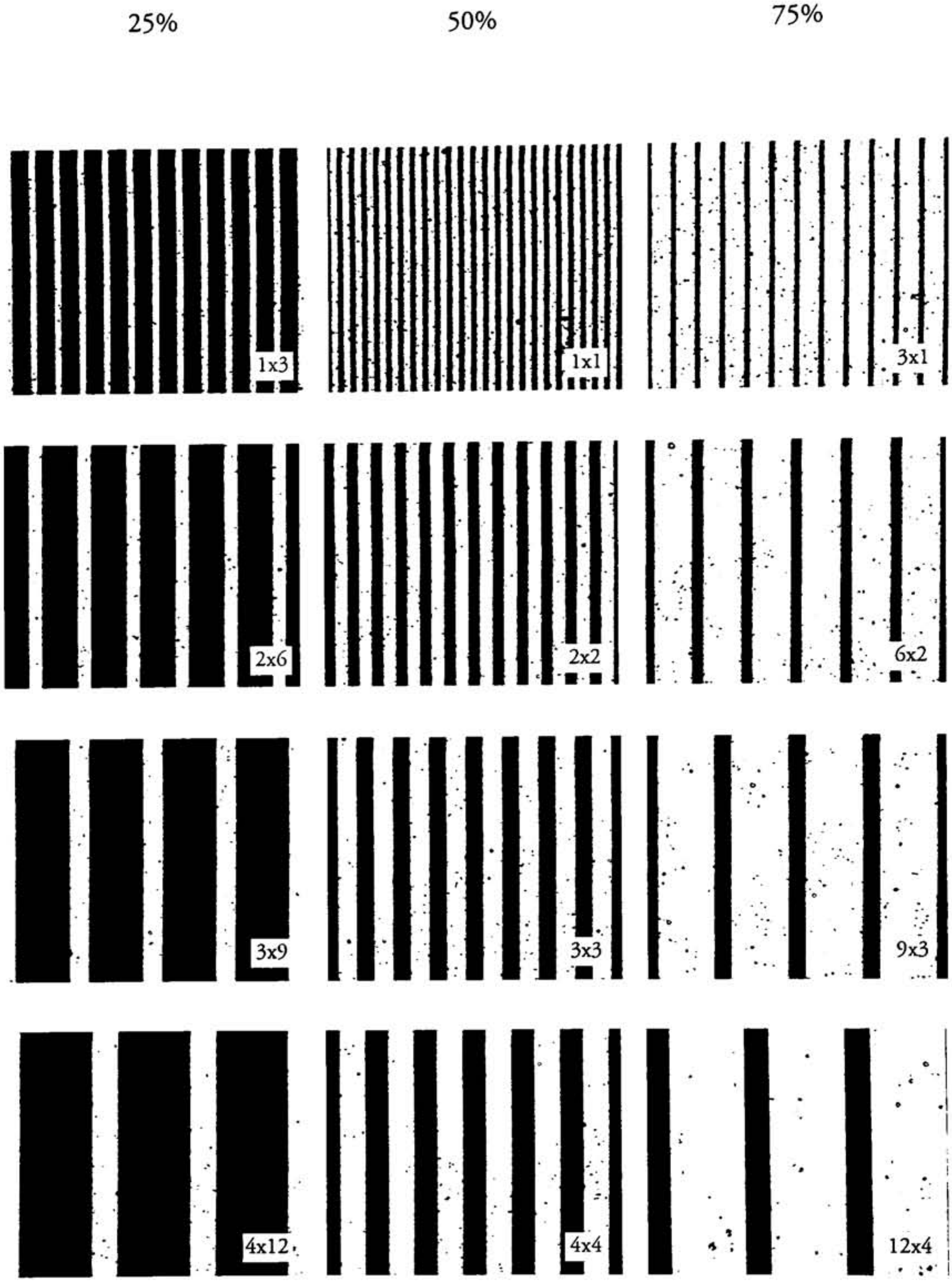


Figure 12. Scan line patterns on Kodak PagiSet film at practical exposure

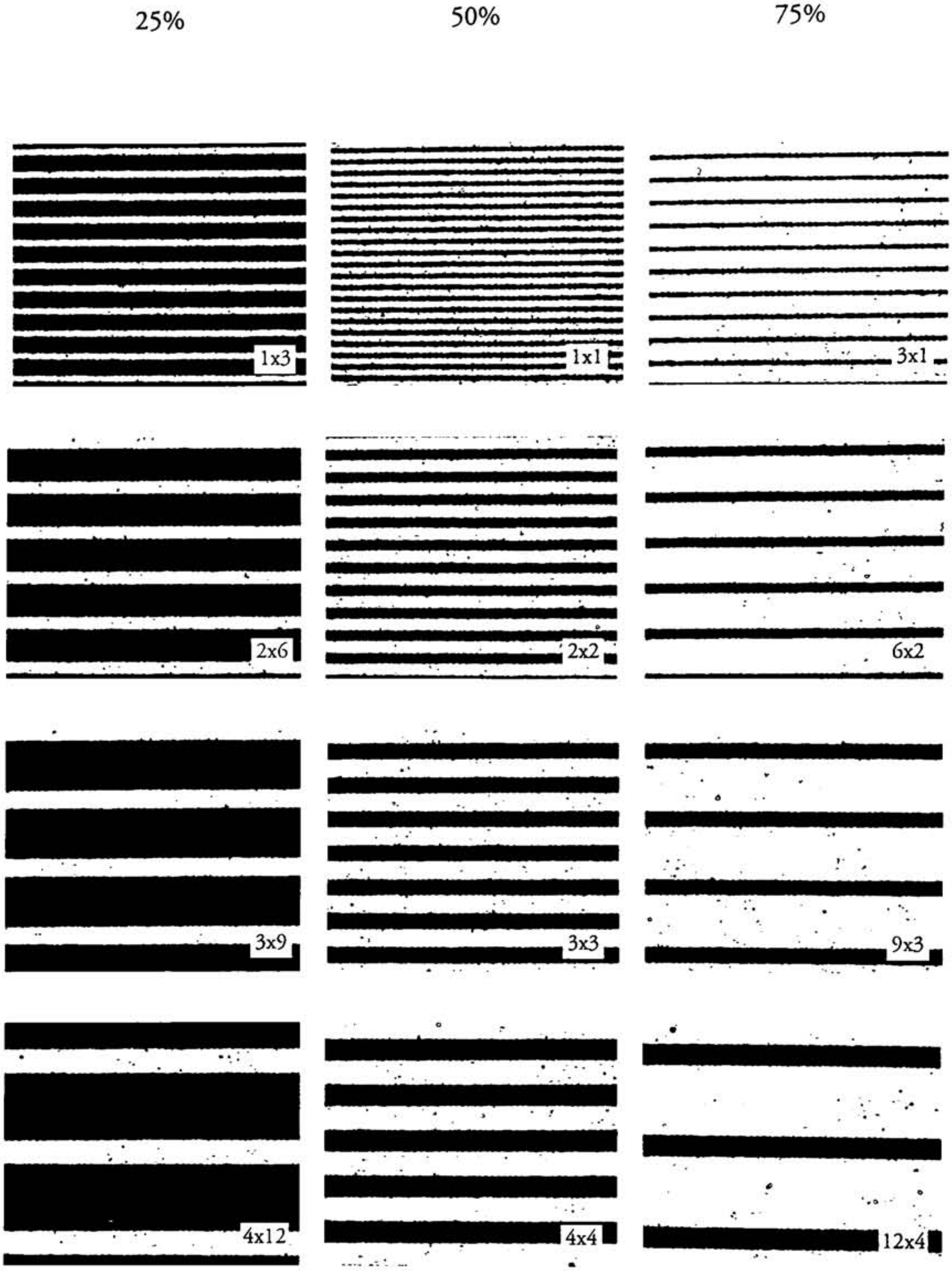


Figure I3. Cross scan line patterns on Kodak PagiSet film at practical exposure

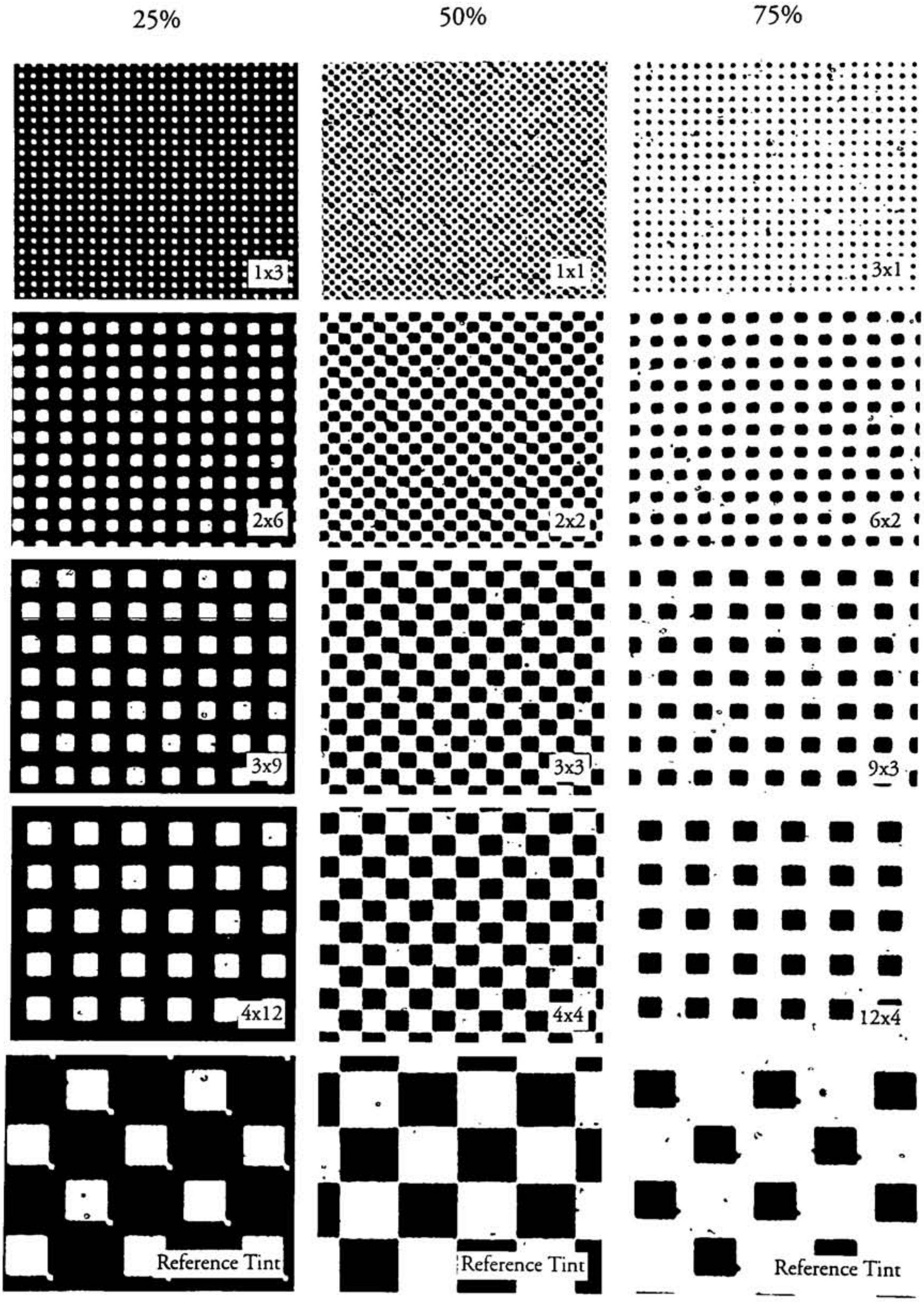


Figure I4. Checkerboard patterns on Kodak Imageset 2000 film at practical exposure

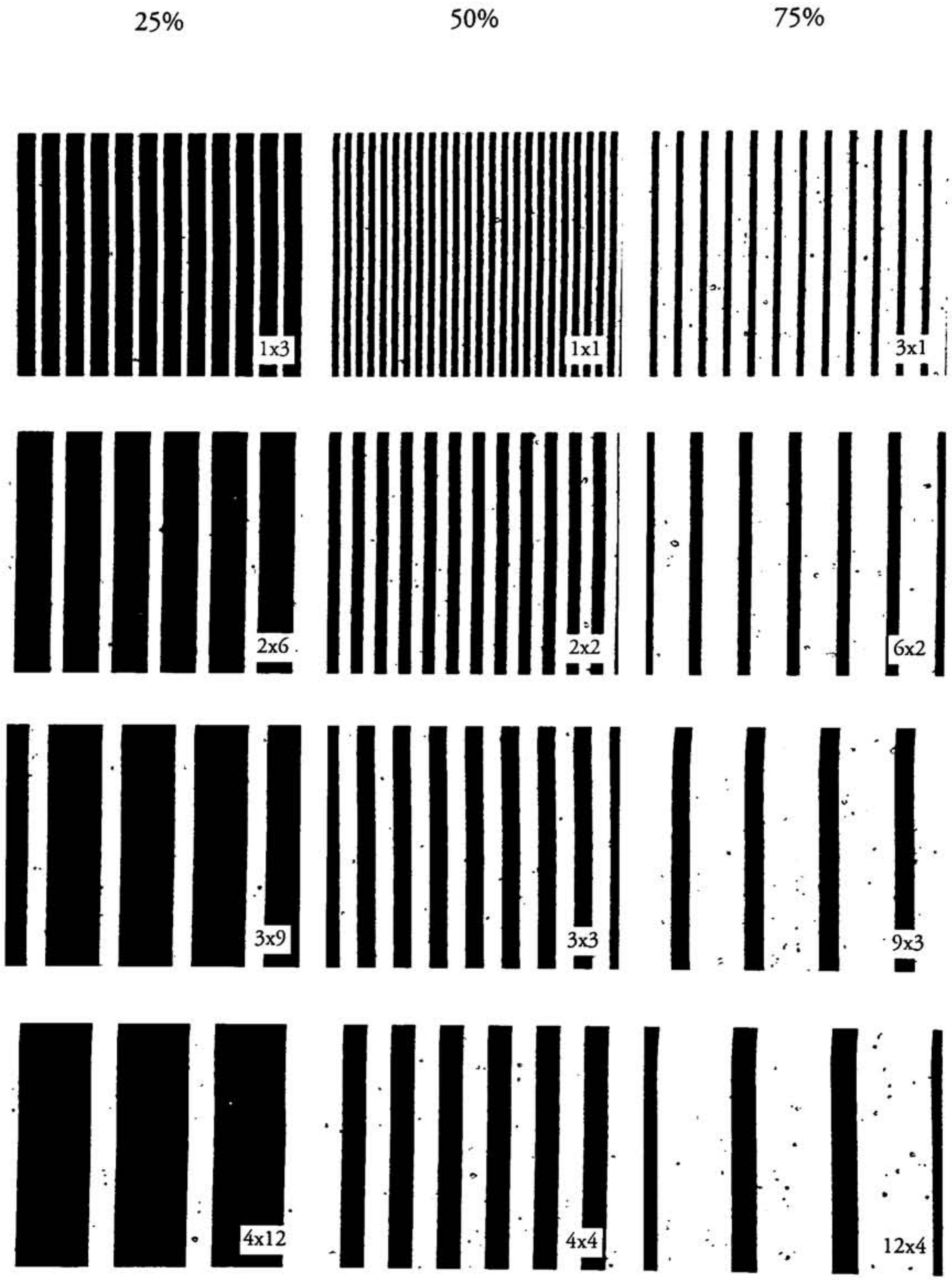


Figure I5. Scan line patterns on Kodak Imageset 2000 film at practical Exposure

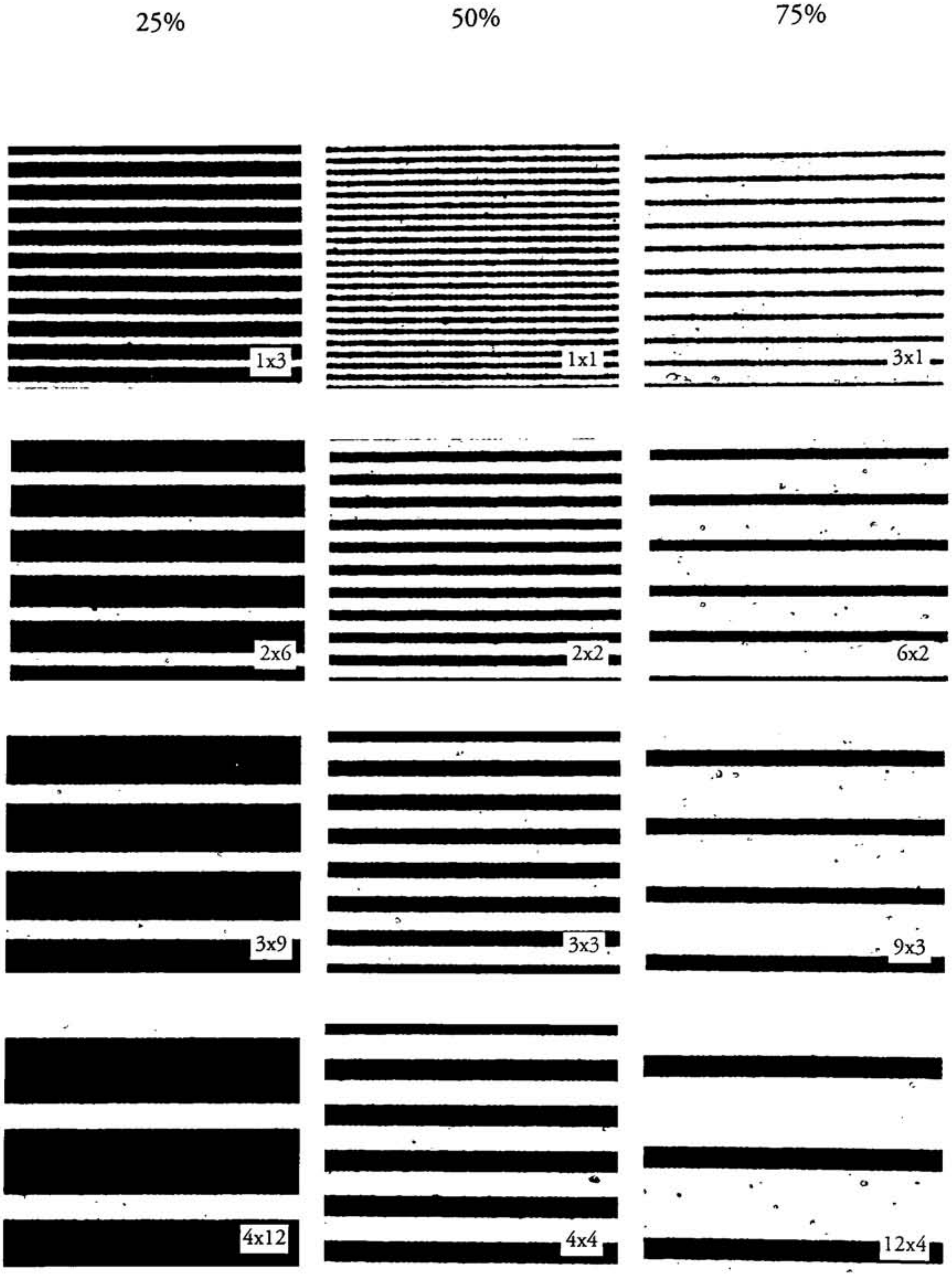
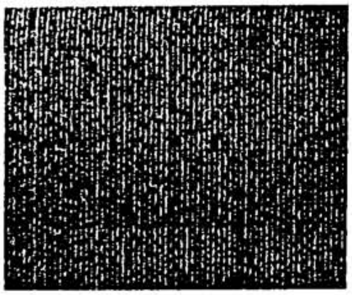


Figure I6. Cross scan line patterns on Kodak Imageset 2000 film at practical exposure

Figure I7. Comparison of solid density at about same relative log exposure of the two films

PagiSet Film | Imageset 2000 Film

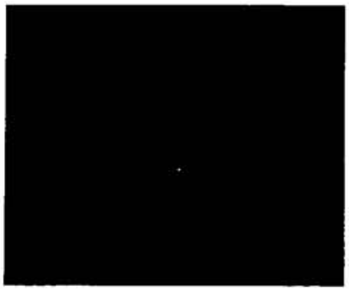
(233 units)



(258 units)

(244 units)

(269 units)



(255 units)

(281 units)