

Installation and Operation of an Inductively-Coupled Plasma (ICP) Etcher

Eve Arnold, Advisor Scott Blondell

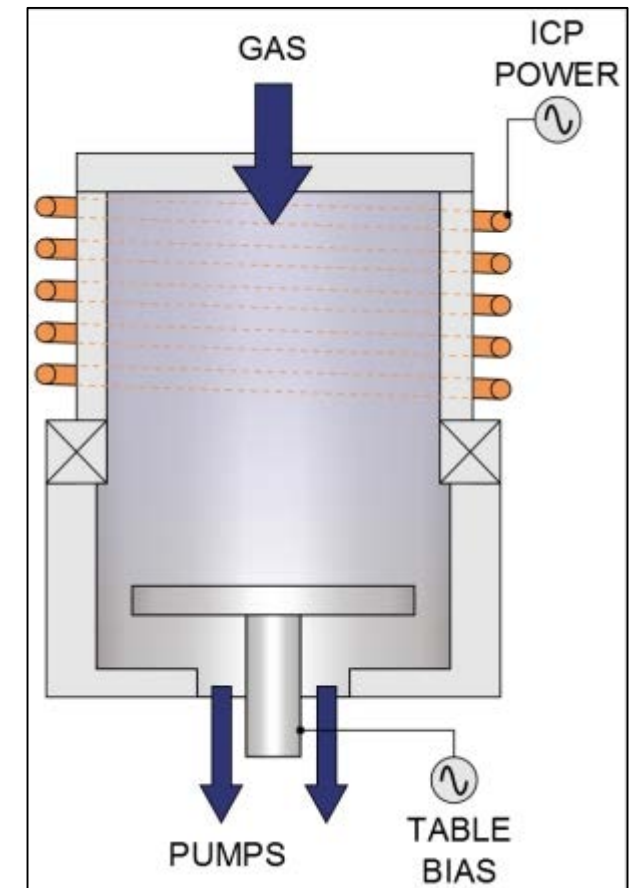
Project Goals

- Gain an understanding of the benefits of ICP etching and how it works
- Design a timeline of a tool installation in a cleanroom
- Decommission the PE 2400 Sputtering System
- Relocate and Reinstall CVC Thermal Evaporator
- Install ICP Etcher, Auxiliary Equipment

ICP Etching/Tool Operation

Recipe 1	Step1	Step2	Step3	Step4	Step5	Step6
Press (mT)	300	300	300	300	0	0
RF Top (W)	0	0	0	0	0	0
RF Bot (W)	0	350	275	275	0	0
Gap (cm)	3.000	3.000	3.000	3.000	5.300	5.300
SF ₆ (sccm)	0	0	0	0	0	0
N ₂ (sccm)	25	25	40	50	50	0
BCl ₃ (sccm)	100	100	50	50	0	0
Cl ₂ (sccm)	10	10	60	45	0	0
Ar (sccm)	0	0	0	0	0	0
CForm (sccm)	15	15	15	15	0	0
Completion	Stabl	Time	Endpt	Time	End	
Time	15 sec	8 sec	120 sec	25%	15 sec	

Sample etch recipe from LAM 4600 Reactive Ion Etch (RIE) dry etch tool. <https://wiki.rit.edu/display/smfl/Lam+4600+Process+Information>

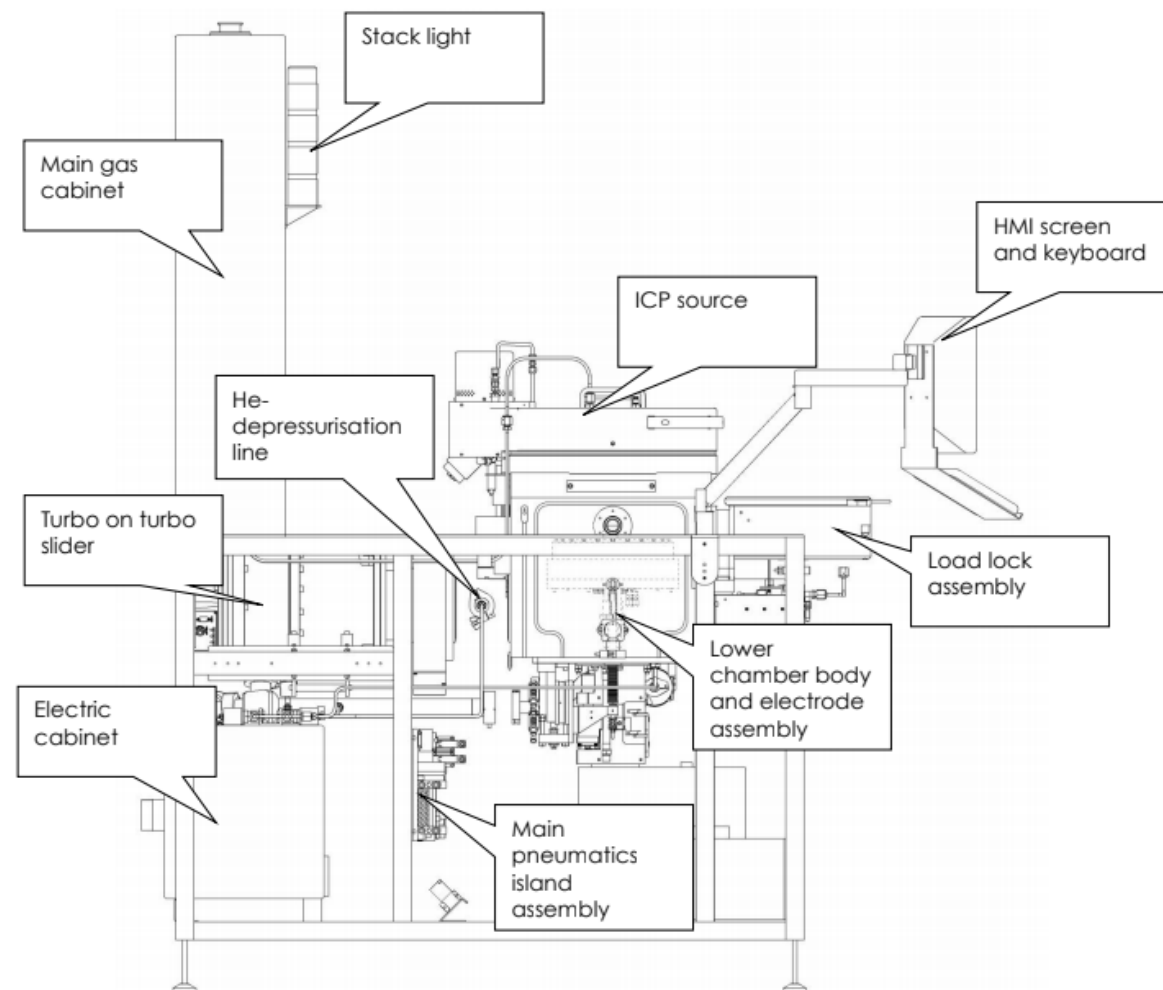


*“Inductively Coupled Plasma (ICP) Etching.”
Oxford Instruments, www.oxford-instruments.com/products/etching-deposition-and-growth/plasma-etch-deposition/icp-etch*

Tool Components



Advanced Vacuum PlasmaTherm
Apex SLR ICP Etcher



*Advanced Vacuum Apex SLR ICP Installation
Guide and Users Manual*

Auxiliary Equipment



Large Chiller



Small Chiller



Roughing Pump

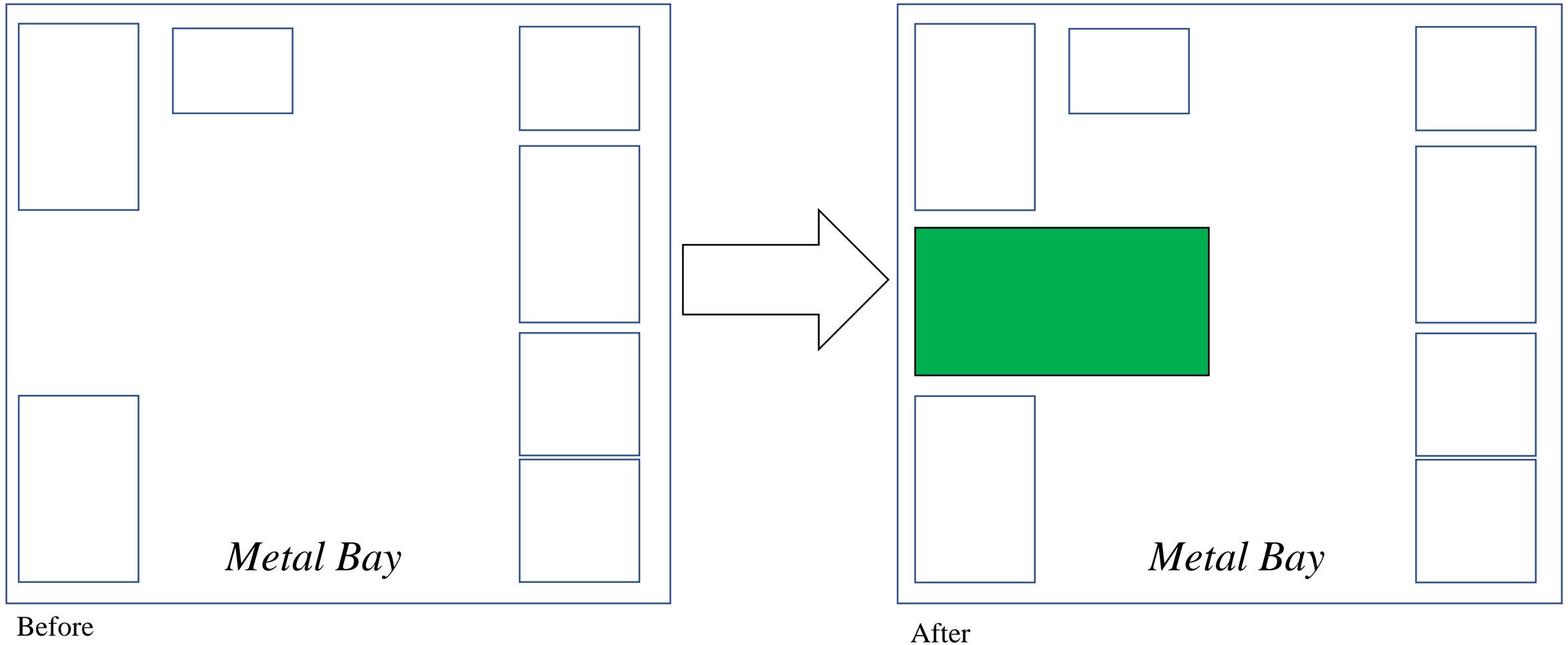


Gas Reactor
Cabinet (GRC)



Determining Tool Location

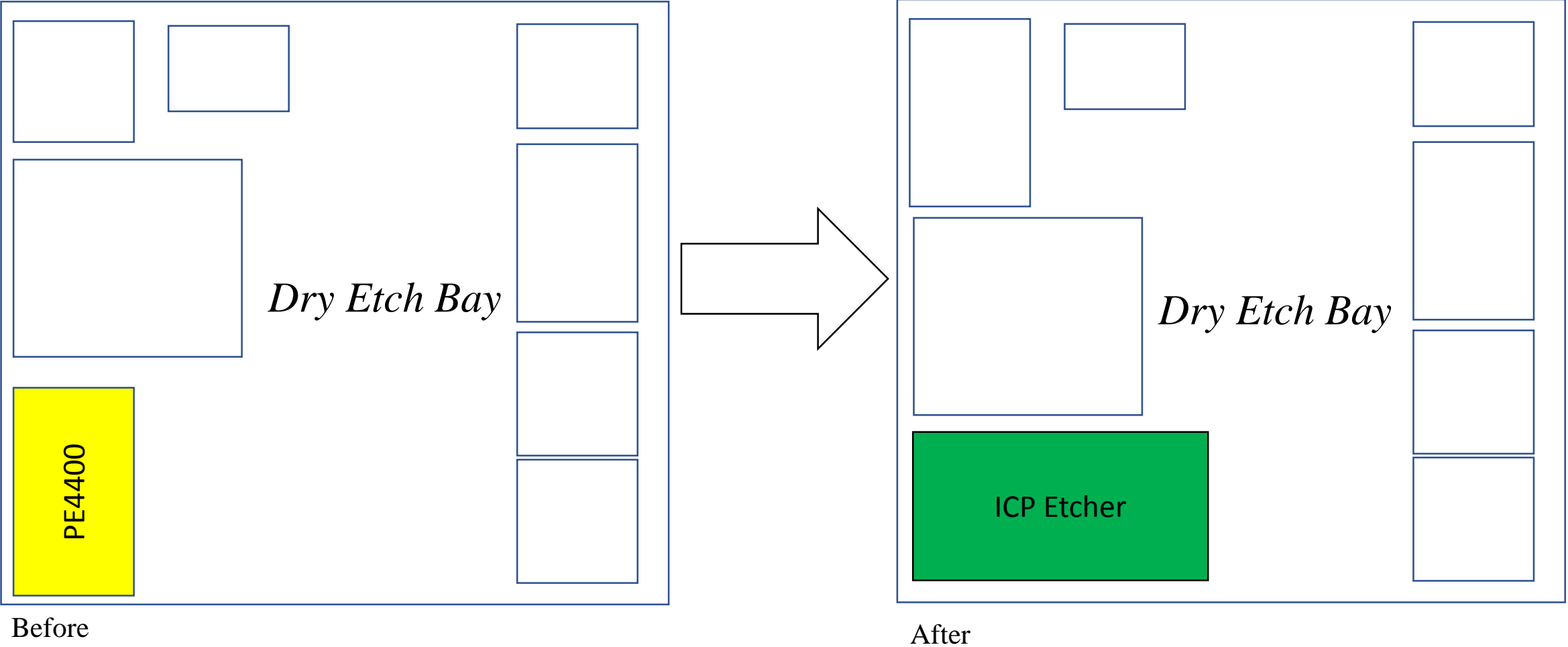
Option 1





Determining Tool Location

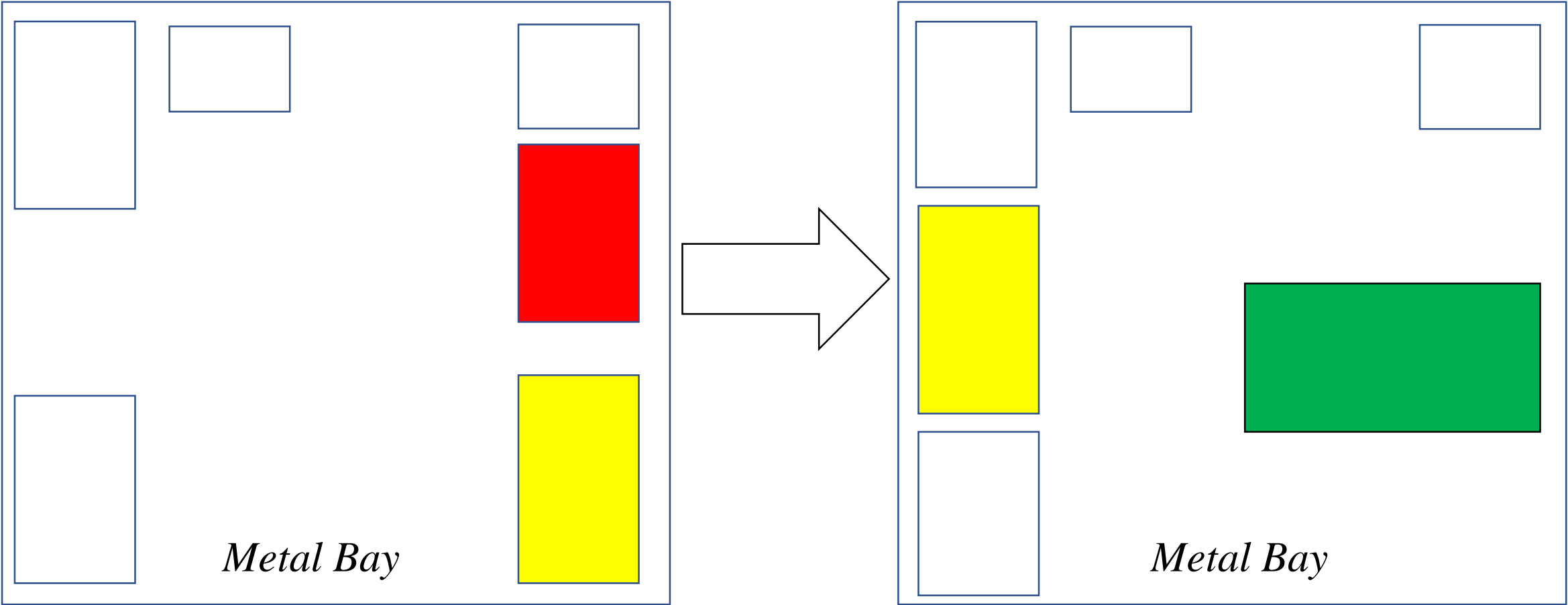
Option 2





Determining Tool Location

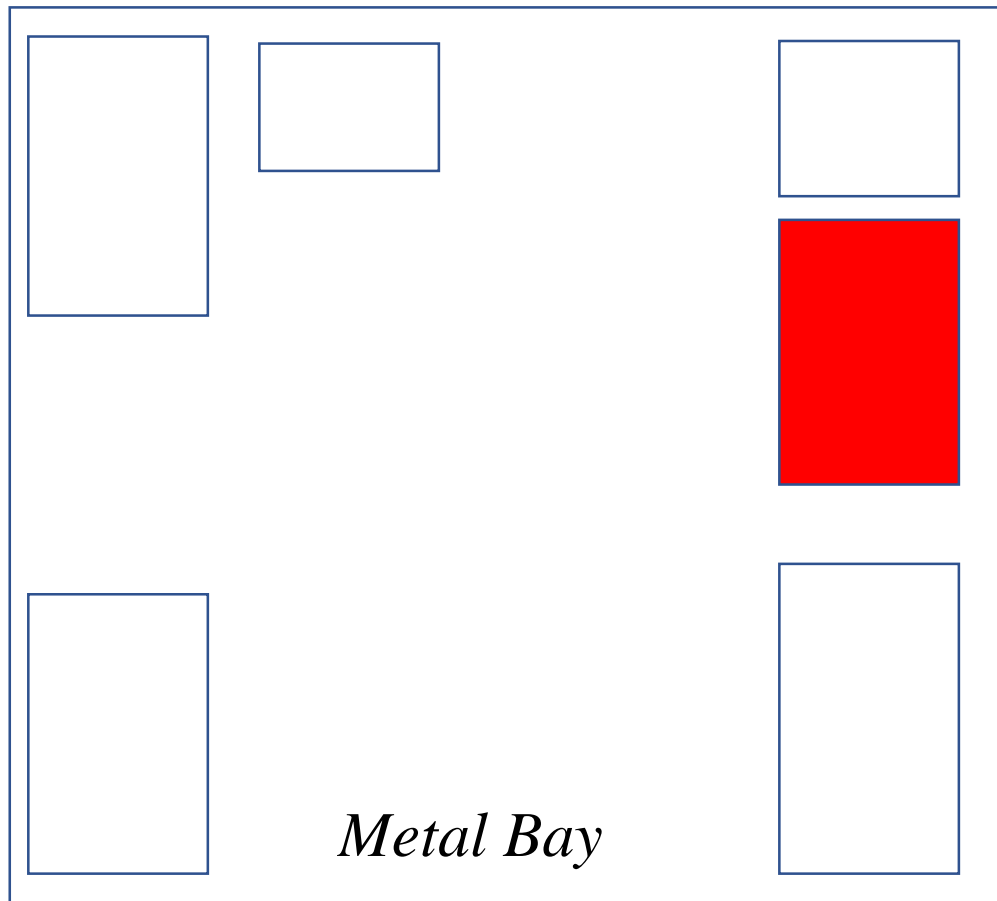
Option 3 (Final)



Before

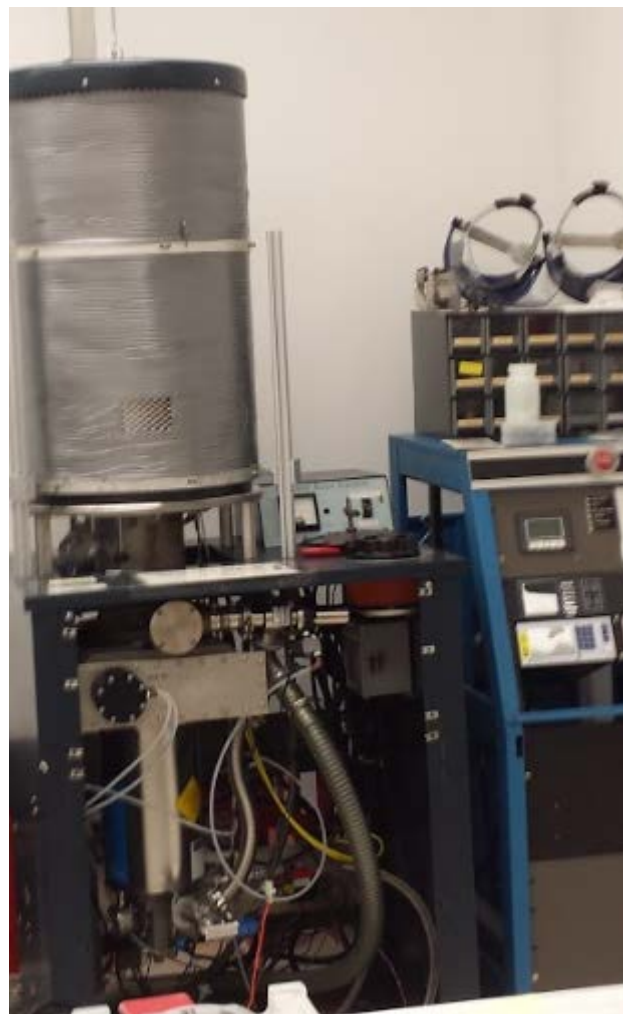
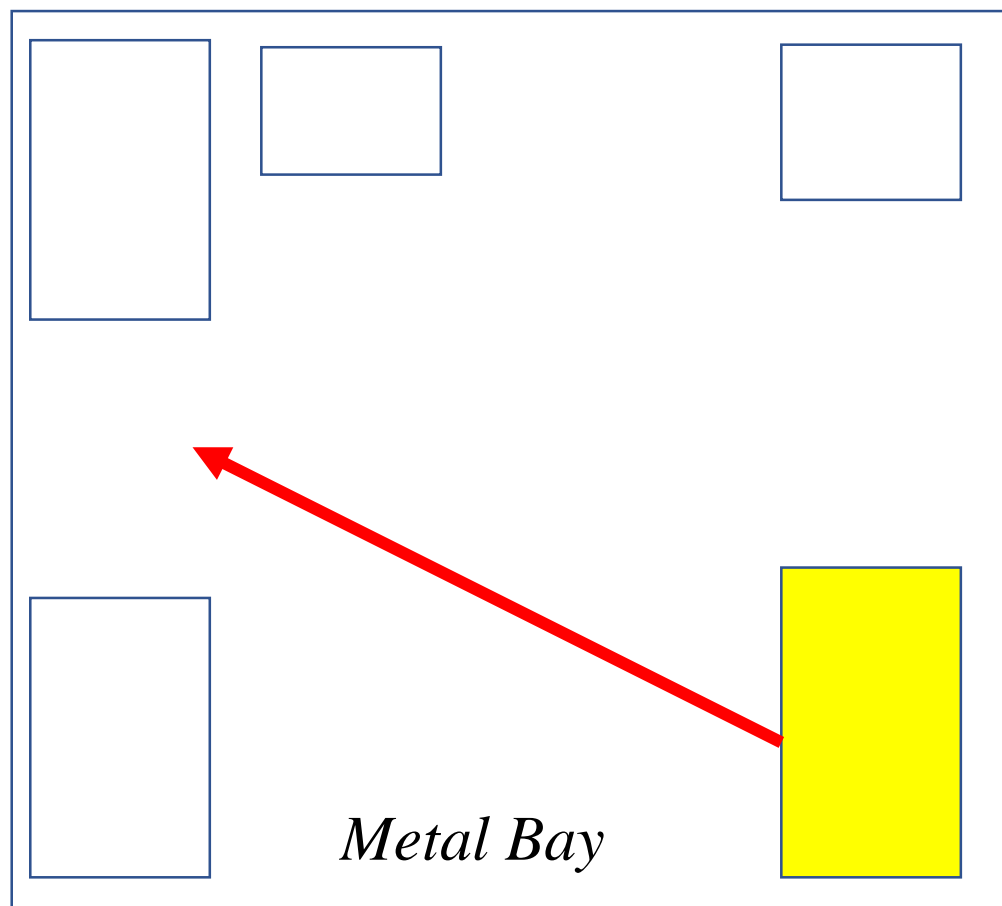
After

Decommissioning PE 2400

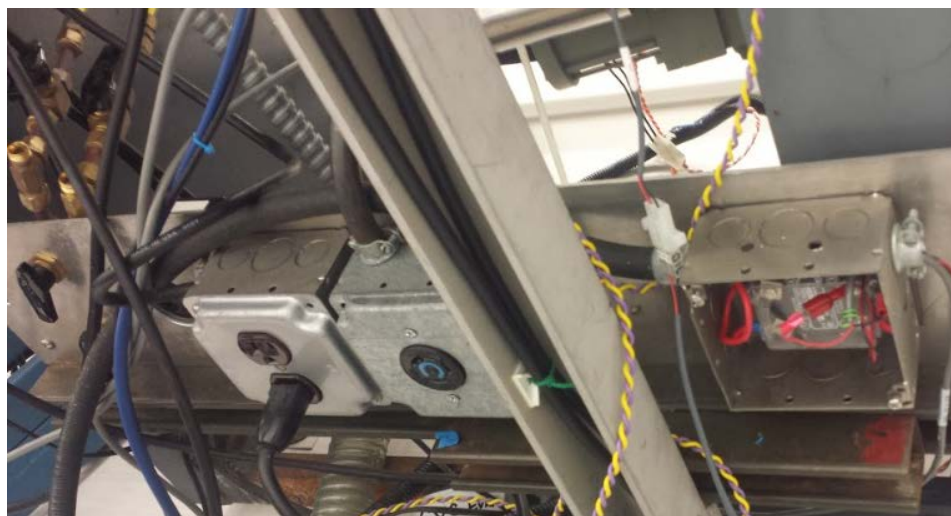


<http://www.semistarcorp.com/product/perkin-elmer-2400-sputtering-system/>

Moving CVC Evaporator



Refurbishing CVC Evaporator



Reinstalling CVC Evaporator



ICP Etcher Electrical Work

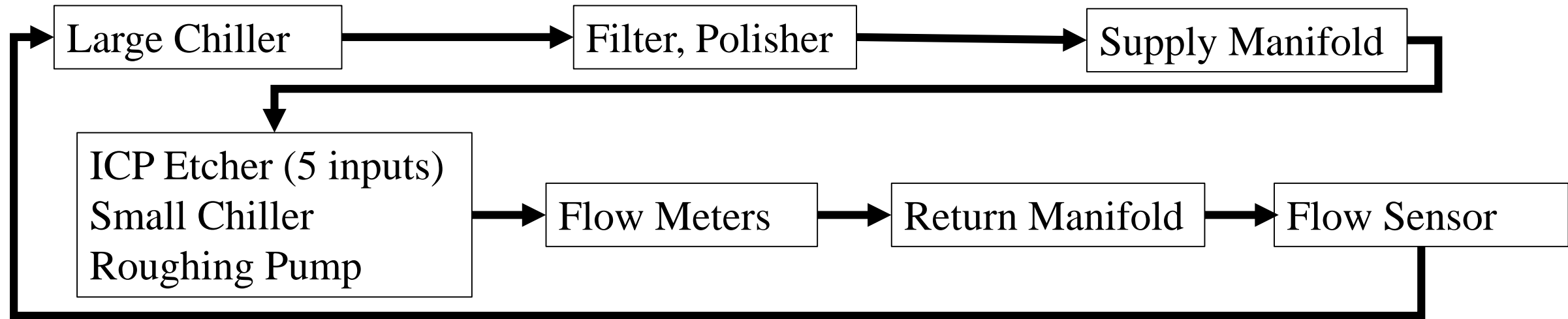


ICP Etcher Exhaust Work

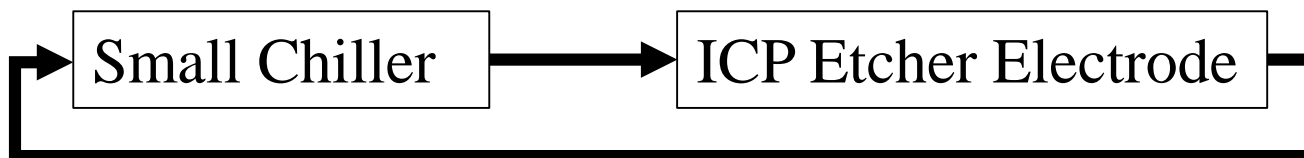


ICP Etcher Cooling Loops

Water Cooling Loop



Thermal Fluid Loop



ICP Etcher Gas Needs



FLAMMABLE GAS

- FLAMMABLE. CAN IGNITE IN PRESENCE OF HEAT OR ARC

After a processing run the process chamber must be subjected to at least one full purge cycle before any maintenance work can be carried out.

Ensure that the gas lines have been purged before removing or loosening components.

Wear personal protective equipment as necessary.



TOXIC GAS

- CONTACT CAN CAUSE DEATH OR SERIOUS INJURY

After a processing run the process chamber must be subjected to at least one full purge cycle before any maintenance work can be carried out.

Ensure that the gas lines have been purged before removing or loosening components.

Wear personal protective equipment as necessary.



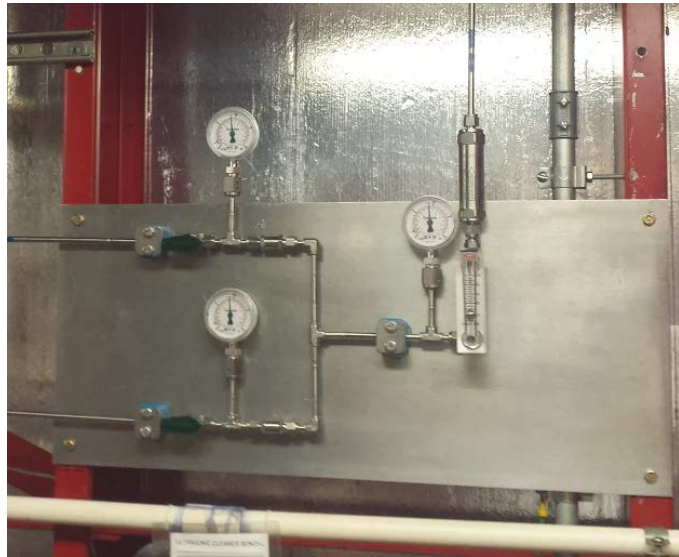
CORROSIVE GAS

- CONTACT CAN CAUSE DEATH OR SERIOUS INJURY

After a processing run the process chamber must be subjected to at least one full purge cycle before any maintenance work can be carried out.

Ensure that the gas lines have been purged before removing or loosening components.

Wear personal protective equipment as necessary.





Future work

- Finish cooling water
- Finish exhaust
- Finish gas lines
- Bring in Advanced Vacuum for installation review, recipe loading



Conclusions/Lessons Learned

- Try to finish on time, but don't expect to
- Anything worth doing is worth doing right
- Preventative measures are better than firefighting
- General installation/cleanroom knowledge



Acknowledgements

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References

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- <https://wiki.rit.edu/display/smfl/Lam+4600+Process+Information>
- “Inductively Coupled Plasma (ICP) Etching.” Oxford Instruments, www.oxford-instruments.com/products/etching-deposition-and-growth/plasma-etch-deposition/icp-etch
- <http://www.semistarcorp.com/product/perkin-elmer-2400-sputtering-system/>