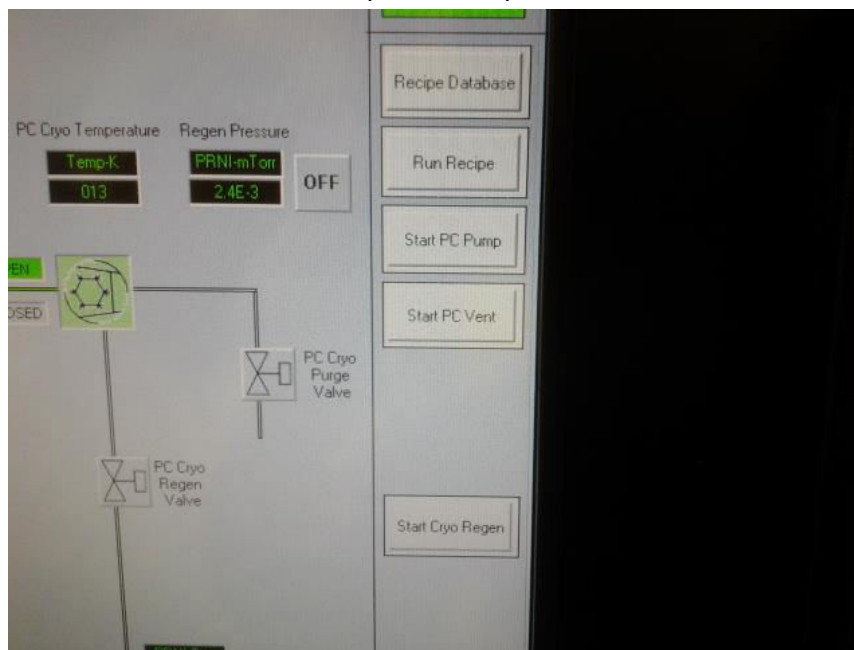
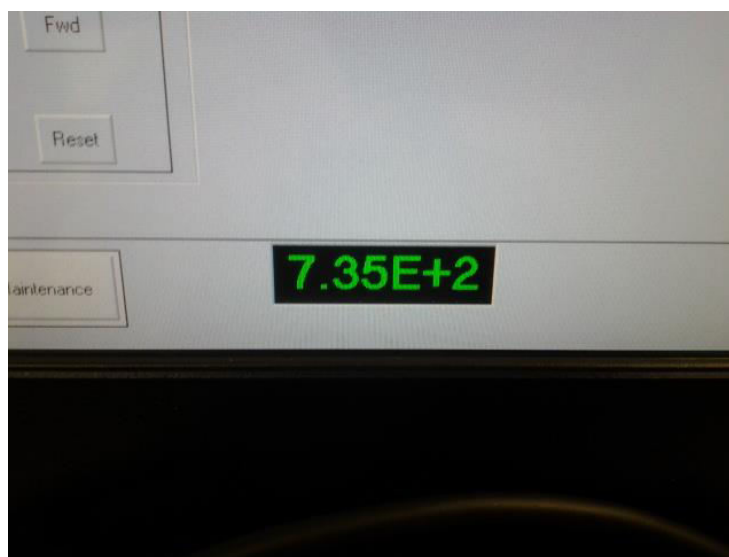


- 1.2 "Start PC Vent". This will automatically open and close valves, and vent the chamber with dry nitrogen (up to atmospheric pressure), in preparation to open the main chamber door to add samples for deposition.



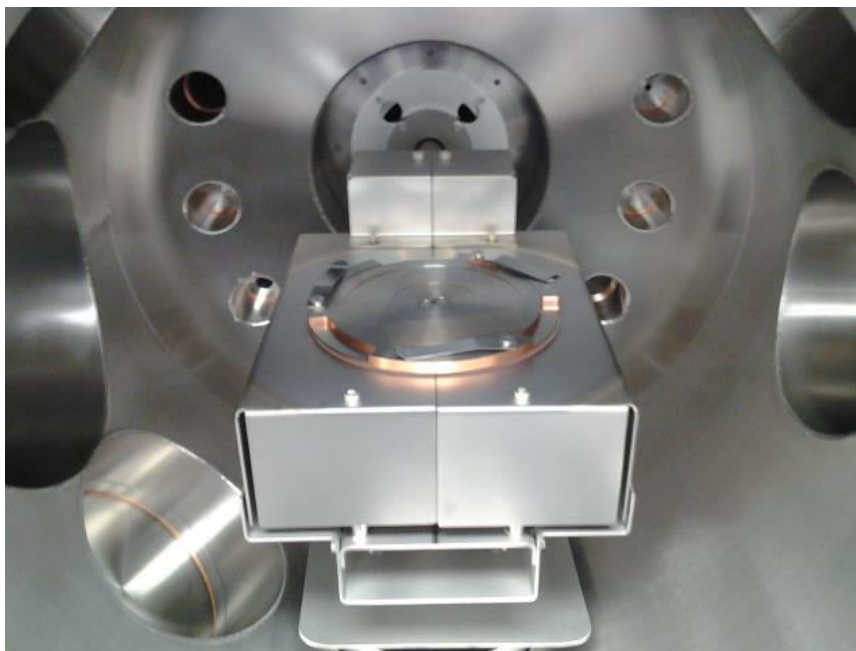
- 1.3 The door cannot be opened until atmospheric pressure has been achieved. The dry nitrogen backfill pressure is intentionally slow. Please be patient. This may take several minutes.



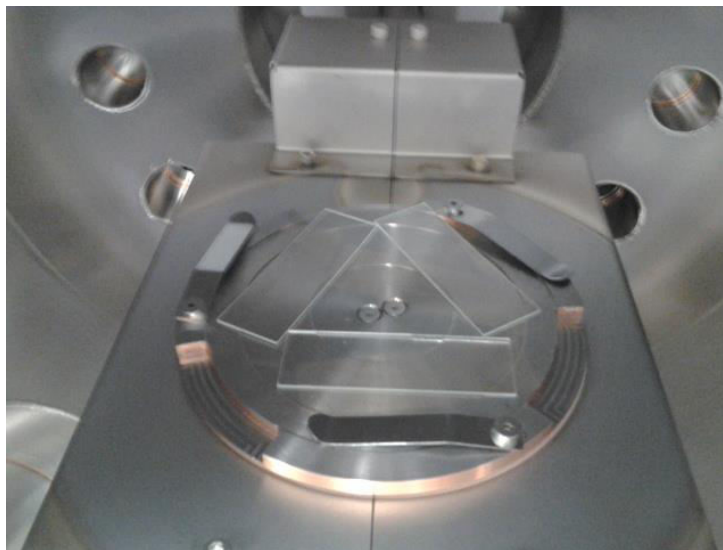
- 1.4 Open upper door. It is heavy and can swing in a wide arc. Open it cautiously!



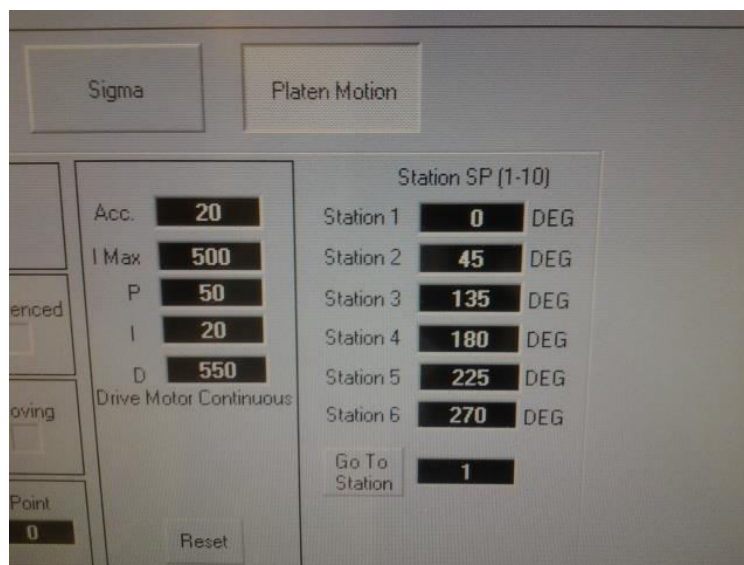
- 1.5 When you open the door, you should see the internal arm of the machine (the platen arm) in an upward facing position (Station 4) for the insertion of multiple or single samples. Your substrate(s) are to be secured under the provided metal clips. No other clips or tape or adhesives are to be used without specific permission of cleanroom staff. Use the hex head tool to tighten the clips.



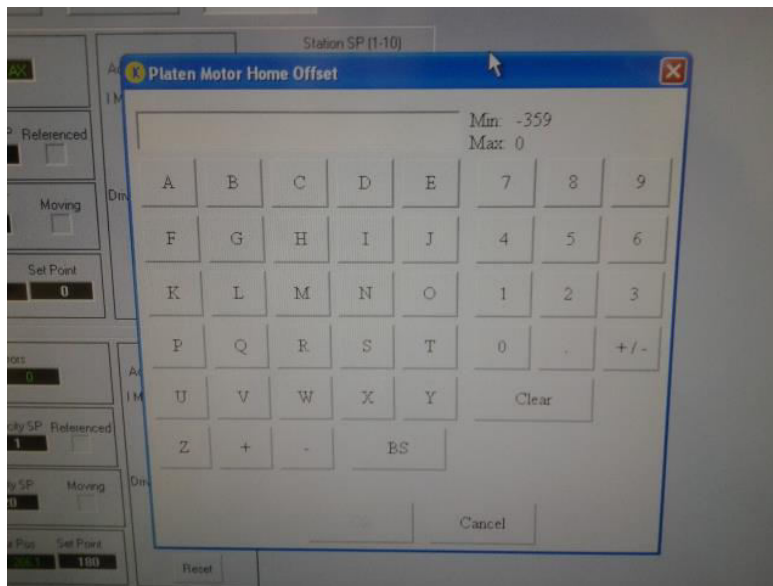
- 1.6 If, for example, you are using microscope slides as your substrate, use the metal clips to add up to three of them in whatever pattern or configuration that you choose. Please make sure that your samples are extremely clean and dry before you begin pumping, as this will reduce pumping times and general contamination of the machine.



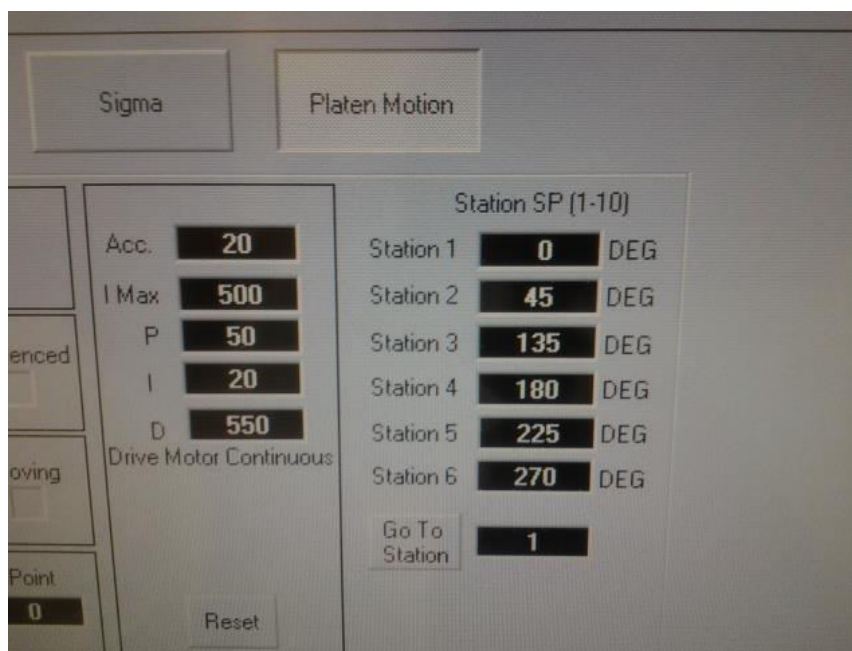
- 1.7 Back on the main touchscreen, you want to click on the “platen motion” tab. The purpose is to set the position of the platen arm to face down (Station 1). This is to ensure that your samples stay in place during deposition. Click in the black area next to the “Go To station” button. A small screen should pop-up.



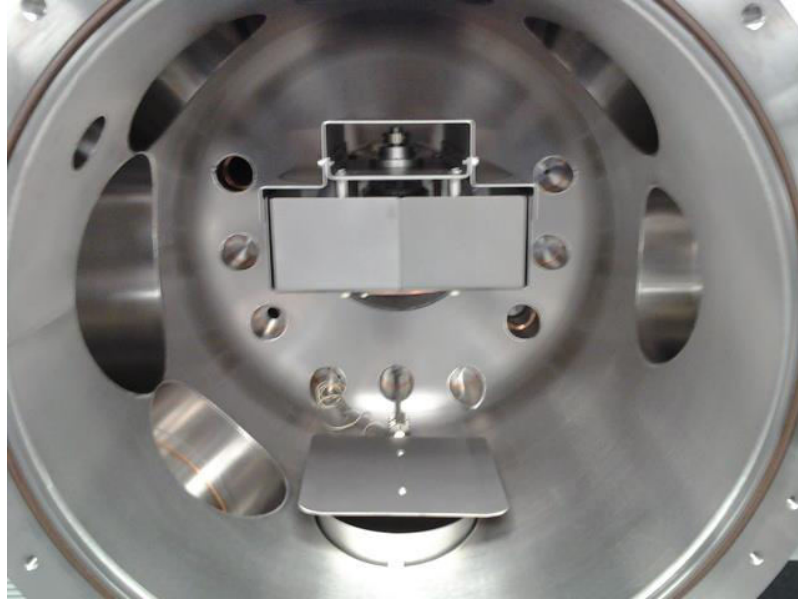
- 1.8 On this pop-up screen you want to select the position. Station setting is 1 for down and 4 for up. Set it to 1 and click “ok”.



- 1.9 Click the “Go To Station” button. The arm will slowly rotate downward for you to see if your samples remain secure or not. **DO NOT TOUCH THE ARM WHEN IT IS IN MOTION!!** If your samples fall off, or shift position, rotate back up to position 4 and re-attach or adjust. If they stay in place, move to the next page.



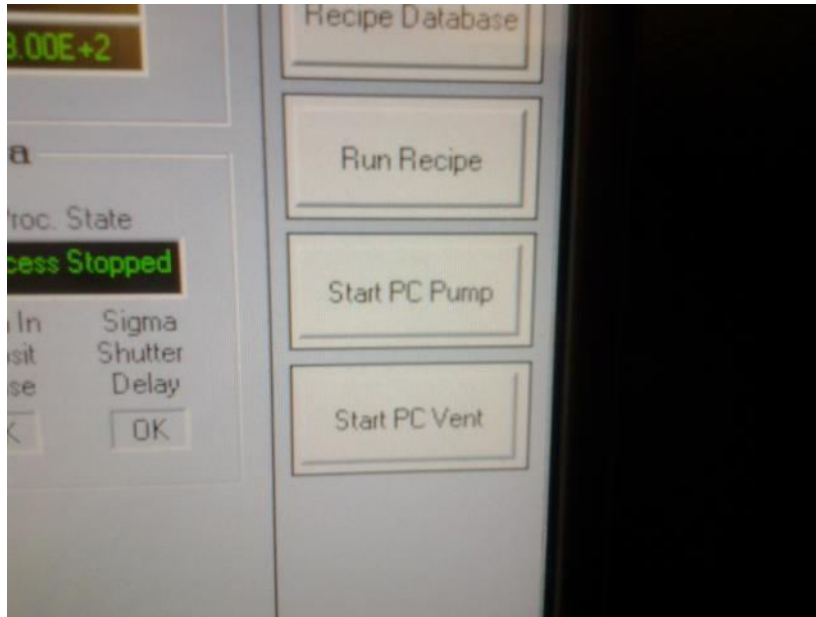
- 1.10 Platen arm facing down, with samples inserted and secured, ready for pumping and deposition.



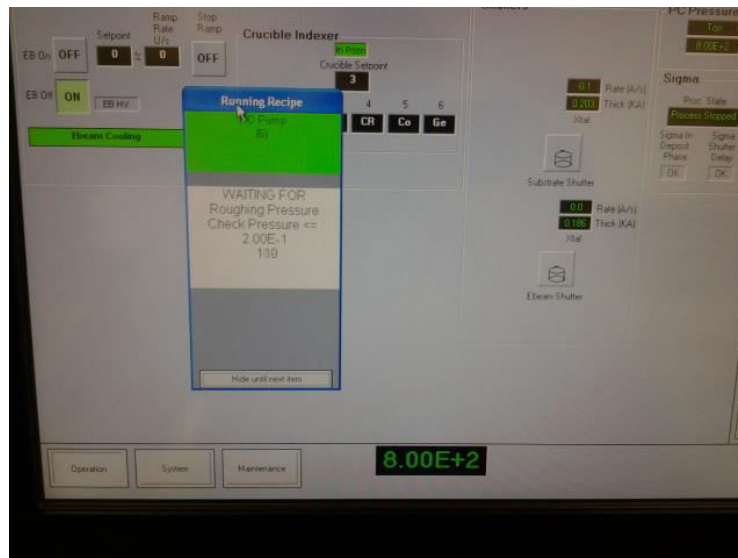
- 1.11 Gently seal and lock the main chamber door. Do not touch the gasket or sealing-surfaces of the chamber. This is a good time to visually inspect for dirt or contaminants, obvious fingerprints on any of the inner surfaces, cracks in the gasket, etc.



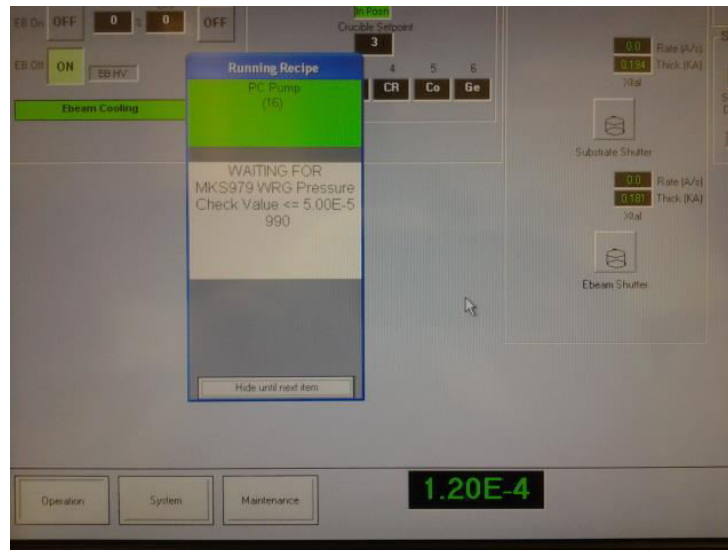
1.12 Click 'Start PC Pump' to begin the pump-down process.



1.13 Pumping is entirely automated. This pop-up screen will remain until the automated procedure has completed.

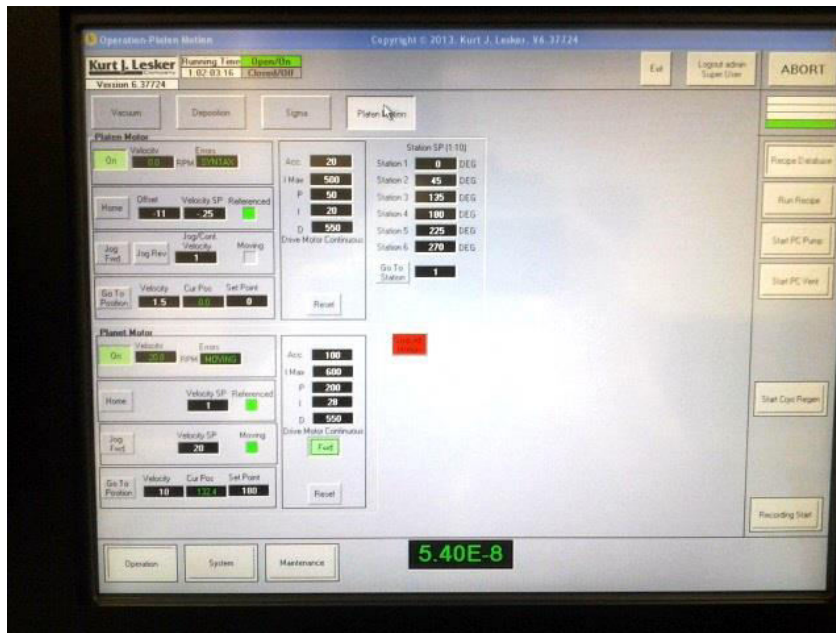


- 1.14 After 1×10^{-2} rough pressure is achieved, it will open the cryopump and complete its automated process. Once the main valve opens, the pressure will drop very quickly down to 10^{-5} pressures and then on to 10^{-6} . It will slow down as it gets towards low 10^{-6} into 10^{-7} levels.



- 1.15 When the recipe has been completed, you can click on “OK” to close that pop up window. You now wait until something close to 5×10^{-7} Torr pressure has been achieved before you continue. This generally takes 20-30 minutes in total. For best deposition results, operational pressures can be as low as 1×10^{-7} or 9×10^{-8} Torr.

- 1.16 On the “Platen Motion’ tab, click FWD, it will turn green. You should hear the platen begin to rotate up to a speed of roughly 20 RPM. This motion may be stopped or started at will and at any time during the process. Its purpose is to ensure even and full coverage of metal, especially over uneven surfaces and substates.



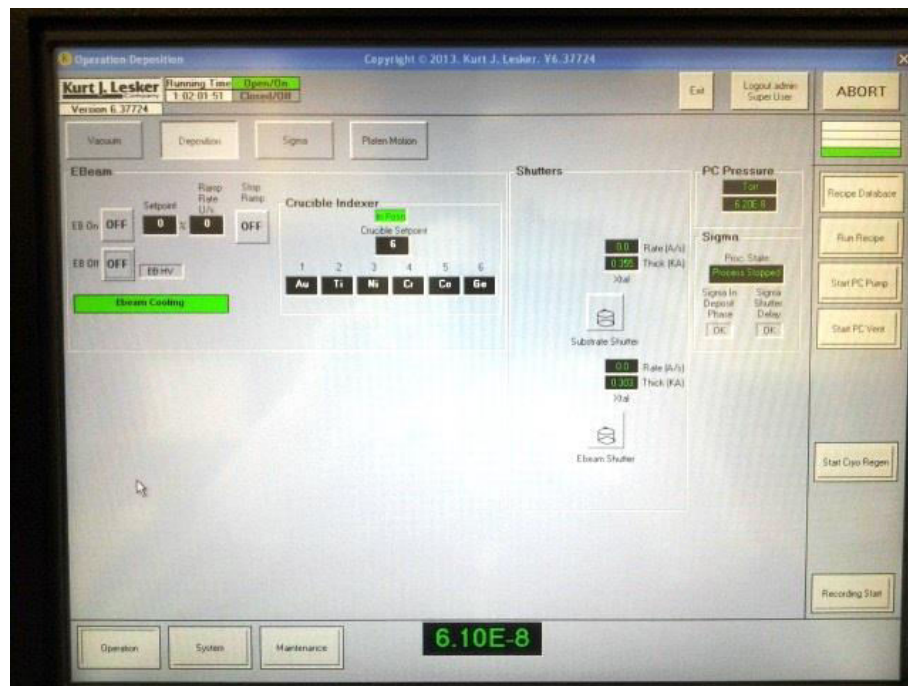
- 1.17 Make sure that the manual controller is plugged in. After plugging it in, click the lit yellow button under (MENU/QUIT). This will unlock the controller. It is necessary for semi-automatic use of the E-beam, but, as a user, you will not have to do anything else with it until you have completed all other steps and are ready to shut down again.



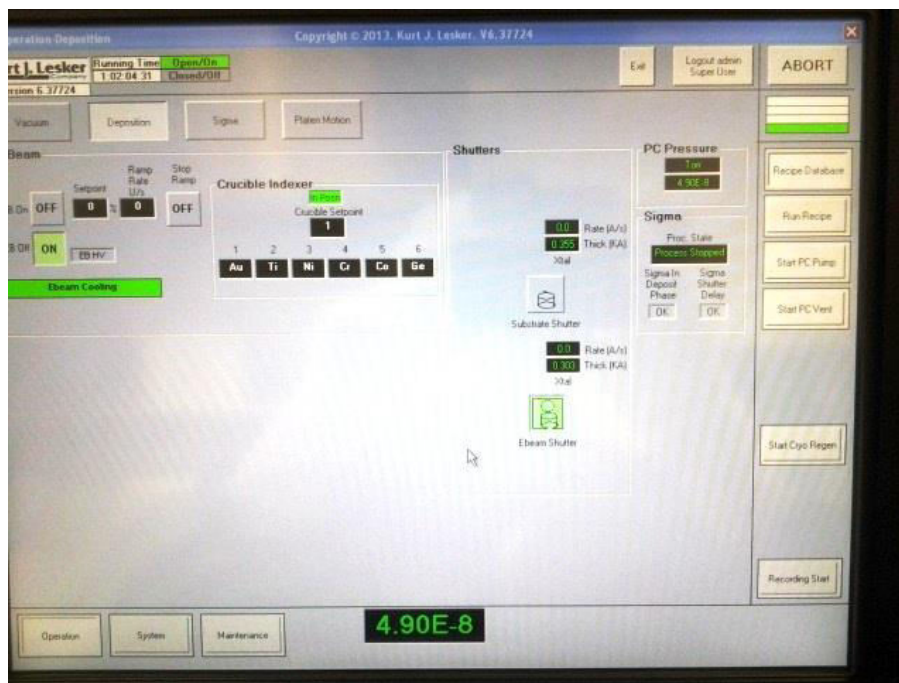
- 1.18 Make sure that the power supply is in the on position. The main switch will light up green.



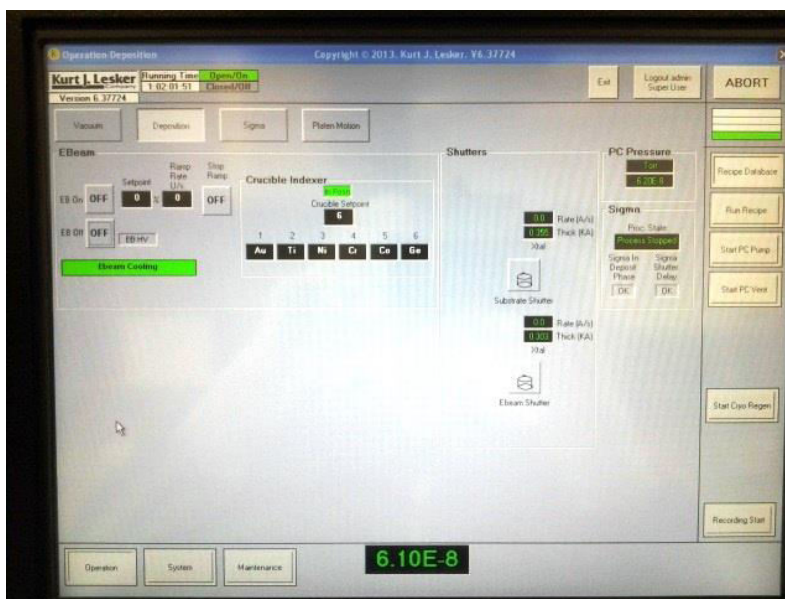
- 1.19 On the “Deposition” tab, click on the little black text box under the words ‘Crucible Setpoint’. A pop-up screen will open that allows you to enter a crucible number for deposition. All of the metals available for deposition have been predetermined and premelted.



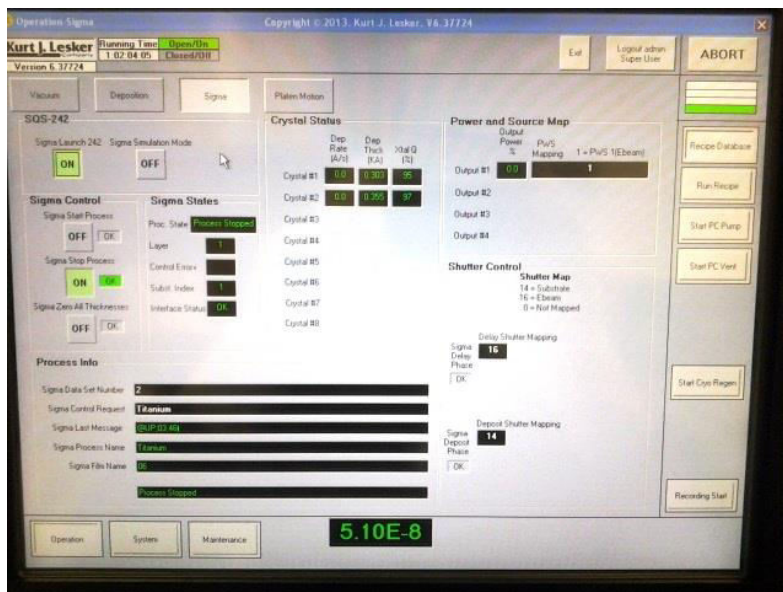
- 1.20 When you have entered a value and clicked ok, the green “In Posn” box will shift to grey, and then after several seconds, back to green, as the crucible holder rotates to your chosen metal.



- 1.21 Still on the “deposition” tab, click ‘Ebeam off’ to grey and click “Ebeam on” to green. This unlocks the power supply, and then turns it on and prepares the high voltage for use.



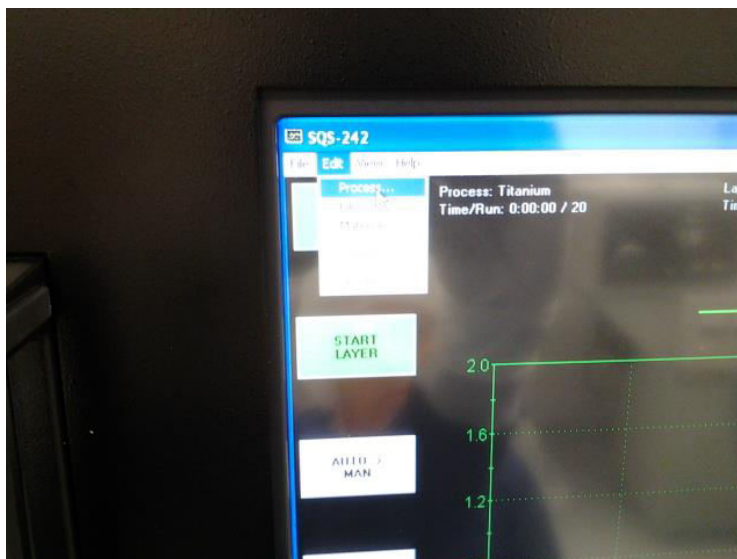
- 1.22 Click the “Sigma” tab. Then click the “Sigma Launch 242” button to Grey. What a second and click the “Sigma Launch 242” buton to Gree. It is towards the upper left hand corner of the screen. The button should be green when you start, then grey when you click it once, then green when you click it the second time. When you do this, it may open a new window and ask for a password, there currently isn’t one. Simply click “ok”.



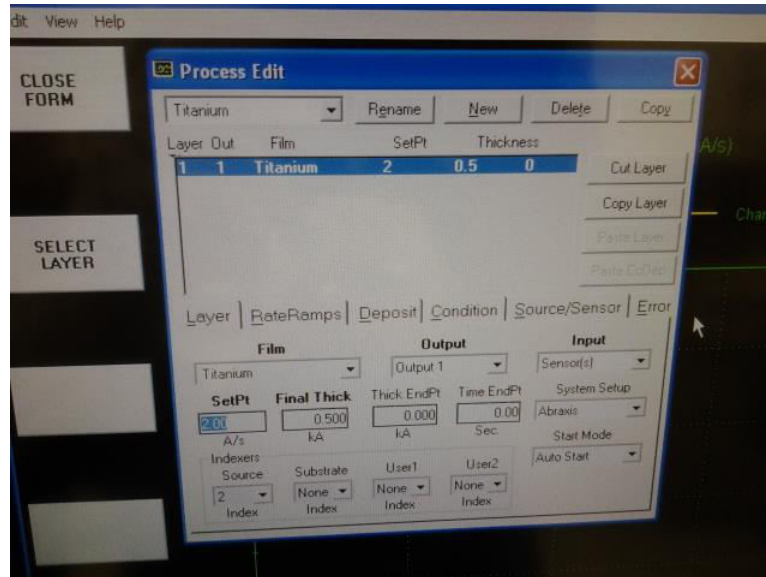
- 1.23 To get to the “Sigma Screen”, click on the keyboard, holding the ‘Alt’ and ‘Tab’ keys together. Do this twice. It should take you to the Sigma software that is now running in the background. “Sigma 242” automatically controls parameters such as thickness, ramp rates, and power. You must manually select your process/metal. You will enter your values for rate “Setpt” (Å/S) and thickness “Final Thick” (in kÅ).



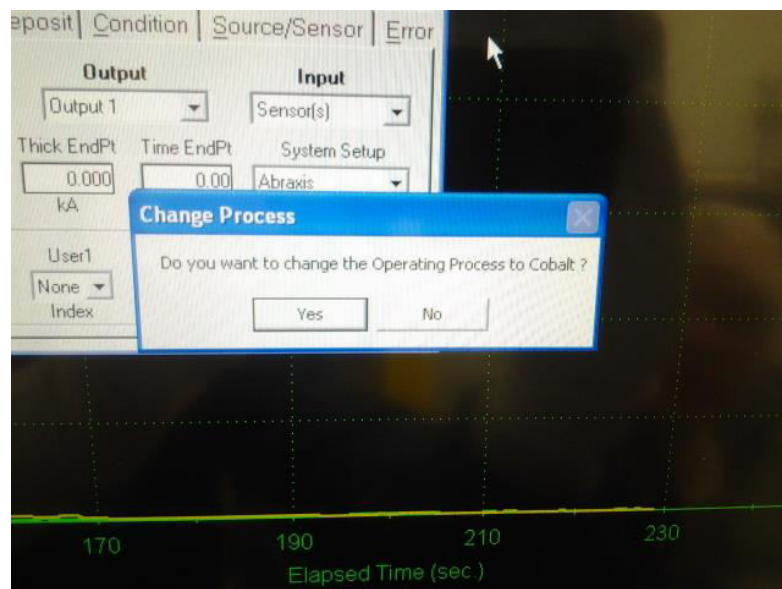
- 1.24 Edit → Process.



- 1.25 On the pop-up window you will first choose your metal from the dropdown process list in the top left hand corner of the window. On the “Layer” tab, adjust ONLY “SetPt” and “Final Thick”. Those are your deposition rate and overall desired thickness of that layer of metal. You may set your rate as high as **3-5 Å/S**, and your overall thickness to whatever level is required for your layer/research. After choosing your metal, rate, and thickness, click the RED X to close the window.



- 1.26 If a pop-up box asks you to change “Operating Process to ‘XXXXXX’” (i.e. Cobalt), click “Yes”. This pop-up is based entirely upon the last metal that was used. It is simply confirming whether or not you want to use the same metal or different one.



- 1.27 Press and hold the Alt key again and then press the Tab key once to return to the main Kurt J Lesker software. Click the Sigma Stop Process button. It will turn from green to grey. Then click the Sigma Start Process. It will turn from grey to green. You are now starting your deposition. In order to watch the deposition rate graphs, Live, press and hold the Alt key again and then press the Tab key twice, returning you to the Sigma software screen.



- 1.28 The Sigma 242 software will track and graph the rates and progress of the deposition. It will start and stop automatically. The startup is slow as it ramps up the current to the full rate. When complete the text in the upper right corner will say "Phase: Stopped". You may notice the "Progress %" bar, this tells you roughly how long until it completes deposition.

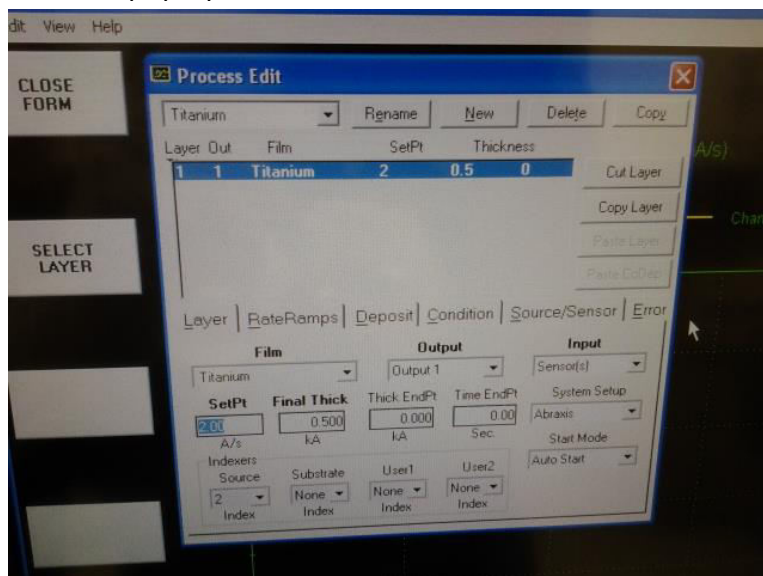


- 1.29 When it has completed its layer, the click-boxes in the upper left hand corner ('Start Process' and 'Start Layer') will change from red to green. It is at this point that the process has ended and power to the beam has automatically shut down. At this point you may select another metal or you may continue on to the latter series of instructions to retrieve your samples and shut down.



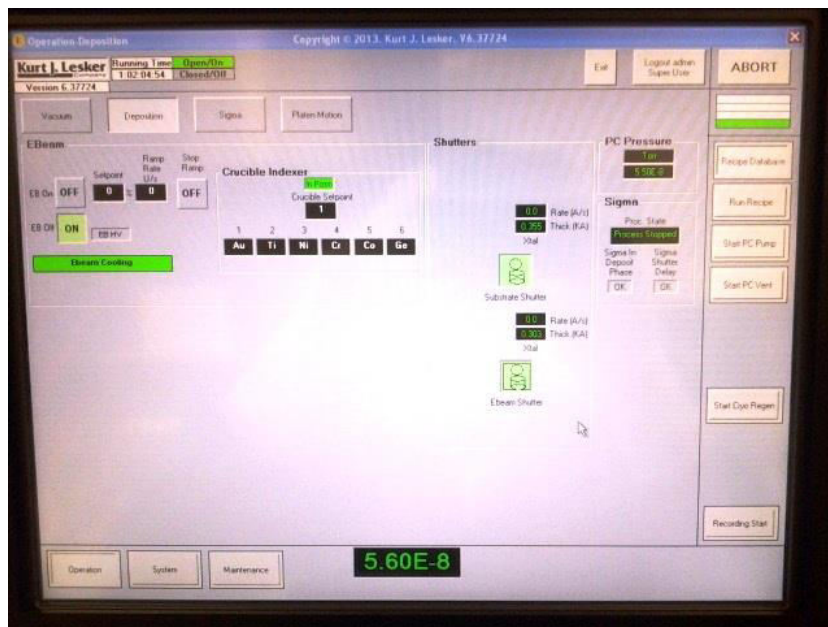
- 1.30 To add another layer:

- 1.30.1 go back to Edit → Process
- 1.30.2 change the metal type, check/change your rate and thickness
- 1.30.3 close the pop-up window



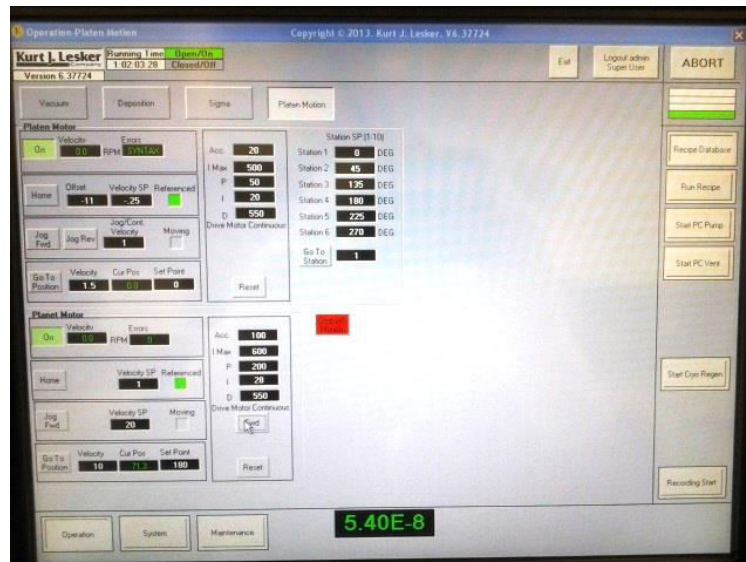
- 1.30.4 Alt + Tab again to go back to the Kurt Lesker software, select the 'Deposition' tab

- 1.30.5 Click “EB Off” to green, locking the power supply
- 1.30.6 Click the black box under “Crucible Setpoint” and select and change to your new metal
- 1.30.7 Click “EB Off” to grey and “EB On” to green.



- 1.30.8 Go to the “Sigma” tab
- 1.30.9 Click “Sigma Start Process” to green
- 1.30.10 Alt + Tab to go back to “Sigma 242 software”
- 1.31 It should have begun running your new layer automatically.
- 1.32 Additional multiple layers may be added via this same method 2.30.
 - 1.33 **--SHUT DOWN PROCESS/EXPLANATION BEGINS HERE--**
 - 1.34 Press and hold “Alt” + press the “Tab” key to return to Kurt Lesker software screen. Click the “Deposition” tab, click “EB Off” to green. This will turn off the power supply and safely lock it out.

- 1.35 Click the “Platen Motion” tab. Rotate the main arm back to its upward facing position (station 4), by once again clicking in the small back text box next to “Go To Station”, selecting 4, clicking ok on the pop-up, and then clicking “Go To Station” to make it so. You should also use this opportunity to stop rotation of the platen (click ‘FWD’ to grey). The platen arm will be facing up and all motion will have ceased.



- 1.36 Click “Start PC Vent”. This will automatically open and close valves, backfill with dry nitrogen, and raise the chamber pressure back to atmosphere so that you may safely open the chamber door. It will take a few minutes.
- 1.37 At atmospheric pressure the main door may be opened and your samples may be removed. There will be a pop-up window to tell you that the receipe for venting has been completed, you may click “ok” to acknowledge and close it.
- 1.38 Once you have removed your samples and have resealed the main chamber door, please click on “Start PC Pump” to automatically start the machine back towards ultra high vacuum levels for the next user. Log out of the machine once you are sure that the system is pumping and that you are finished.

1.39 Unplug the manual controller. This saves screen-life for the device.



Manually shut off the main ebeam power supply. The power button should no longer be lit up.



2.0 Specifications / Features

- 6 pocket e-beam evaporator head
- Materials include: Au, Cr, Pt, Ti, Ni, Ge (for use of SiO₂, Ge, Ag, Ni, please see the BOC Edwards Auto 500 Electron Beam Evaporator)
- 6000V power supply, 500 mA, beam sweep, substrate rotation
- GLAD (glancing angle deposition with multi-position sample mount arm)
- 2 quartz thickness monitors
- Computer controlled deposition
- Dry rough pump, Cryopumped chamber with ultimate vacuum of 1 x 10⁻⁹ Torr, Typical vacuum during deposition 1 x 10⁻⁷ Torr
- Fast cycle times

3.0 User Requirements

The E-Beam Evaporator with Glancing Angle Deposition (GLAD) - Kurt J. Lesker Company AXXIS must be used by authorized personnel only. All authorized users are expected to read and understand this SOP and follow the operation instructions carefully. No unauthorized personnel may use this equipment. All users must wear appropriate personal protective equipment. To become an authorized user, one must:

1. Complete Environment, Health & Safety (EH&S) training
2. Complete initial orientation and training for the Davis Hall EE Cleanroom
3. Receive training on this piece of equipment from lab personnel
4. Schedule equipment time using the calendar
5. Read and fully understand this SOP

4.0 General Safety

4.1 Required Personal Protective Equipment

Users must wear coveralls, bouffant caps, shoe covers, safety glasses, and gloves. Shorts, open-toed shoes, high heels, and skirts, are forbidden.

4.2 Emergency Procedures and Contacts

For non-life threatening emergencies: use the main cleanroom phone and call the emergency contact #'s listed on the wall or for police / ambulance, call 645-2222

In case of fire or other life threatening emergency: Exit the cleanroom through an emergency exit door. Pull one of the fire alarms located in the main hallway outside of the cleanroom. Dial campus police / ambulance at 645-2222.

4.3 University after hours laboratory use policy

No working alone, use the buddy system!

#	Revised by	Date	Modification
1	David Eason	12/28/2015	Added Safety + format to #.#
2			
3			
4			
5			