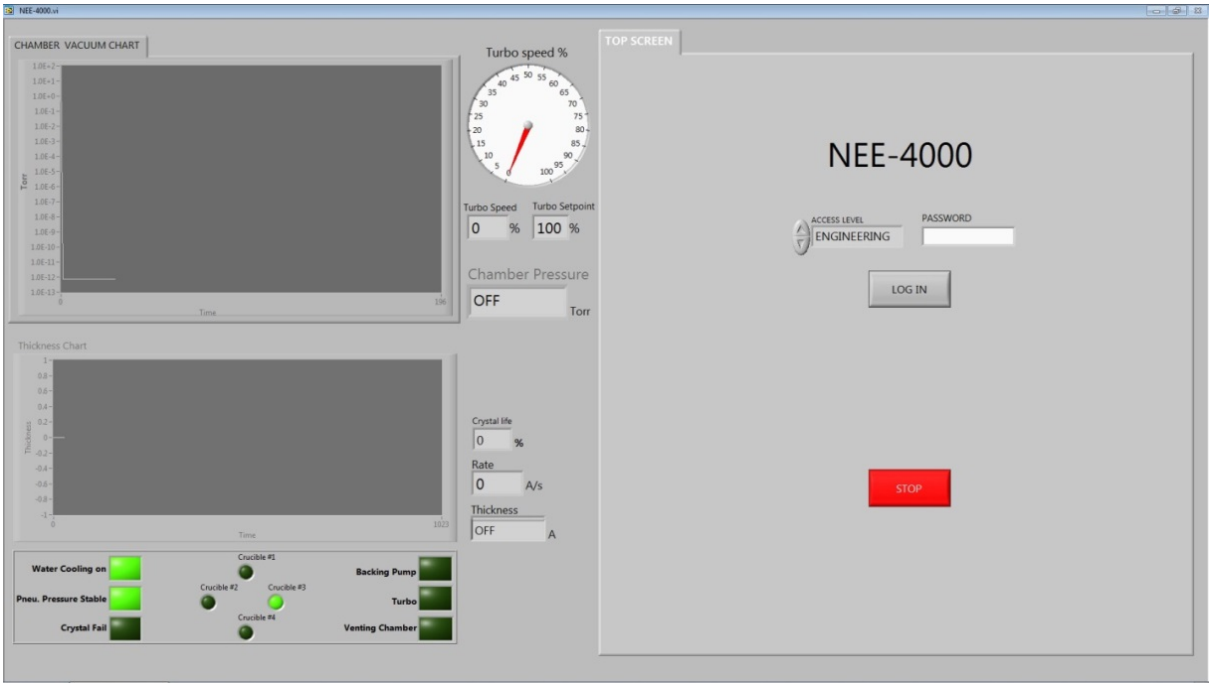
NEE-400 Dual Ebeam Evaporator SOP

06.20.2018

Operation Preparation:

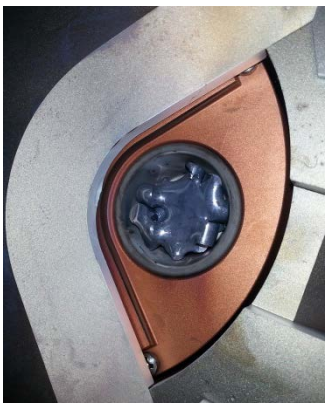
1. Click “NEE-400” icon and log in the home page. Access Level: engineering, Password: drive

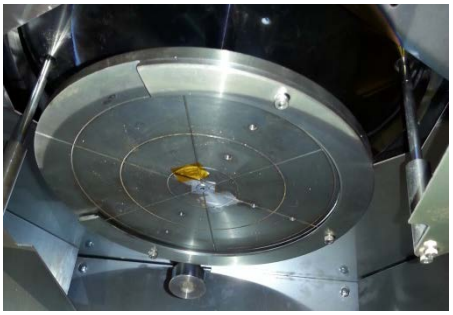


2. The chamber will be under vacuum when not used. To vent the chamber, go to “ VACUUM” tab. Click“Vent”.

3. Once the door is open.

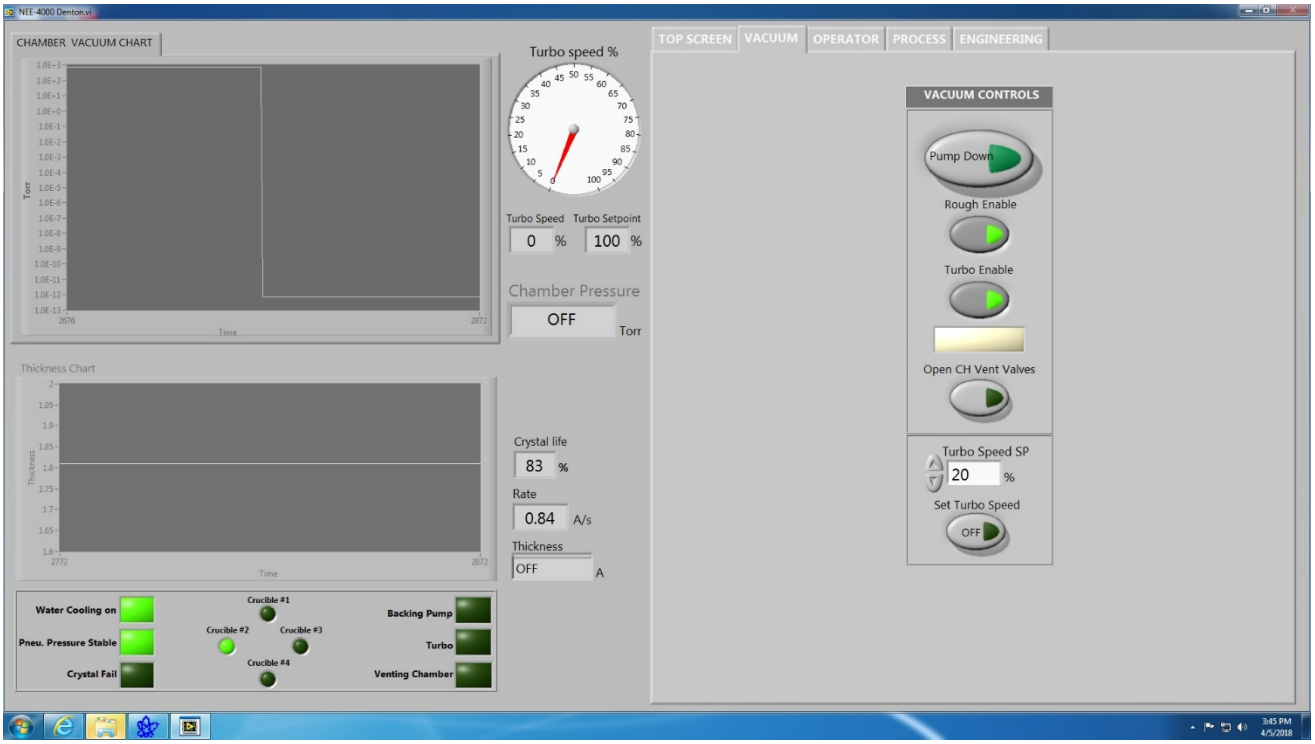
4. Load your sample: Make sure the crucible has enough material (choose right crucible through “engineering” tab). For small samples, use Kapton tape.





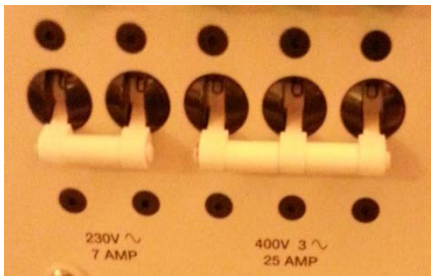
6. Turn on the chiller. “Water cooling on” should be green.

5. Go to “Vacuum” tab. Make sure “Turbo Enable” and “Rough Enable” are green. Press “Pump Down” to rough the chamber. The pressure should reach high E-6 torr . Make sure lift the door up a little to close it completely and after few seconds, pull back to see whether it’s fully sucked in.



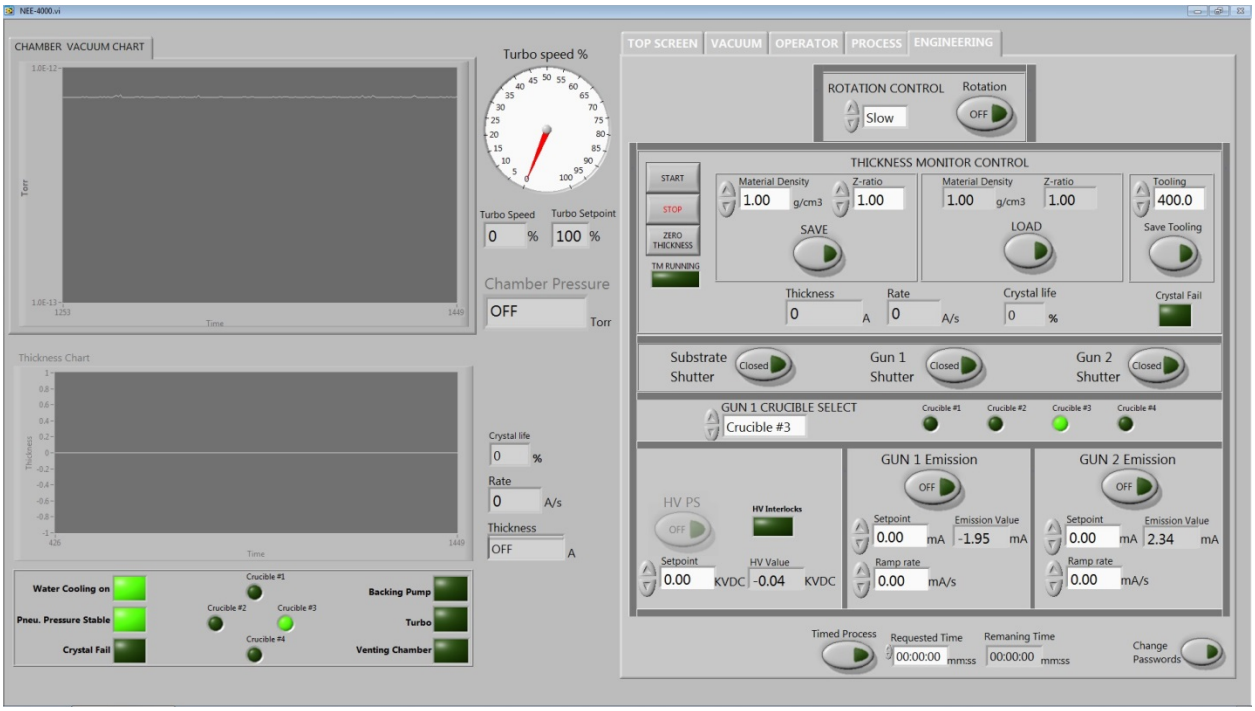
Manual operation based on thickness:

1. Turn on the High Voltage power switches and the Gun sweep control power from bottom to top.



2. Under the engineering page, “LOAD” your material file and input correct “Tooling” factor.

3. Set HVPS “Setpoint” at 10KVDC and choose GUN 1 or 2 and set starting “Set point” at 15 mA and “Ramp rate” at 1 mA/s.



4. **Open** the GUN 1 or 2 Shutter. Turn on HVPS and emission “GUN1/2 Emission”.

To warm up the material, gradually increase “Emission current” by 3 mA through few seconds each time. Adjust the beam location and pattern if needed through the remote pattern sweep. Increase the GUN emission current “Setpoint” to have a satisfied thickness rate “Rate” A/s. eg. “Rate” is around 1A/s.

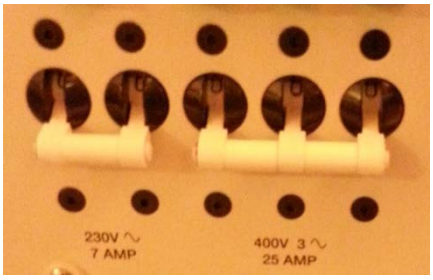
5. **Turn on the thickness monitor** by clicking “START”. During the adjustment, the substrate shutter remains close.

6. Once the deposition rate reaches desired value, click “Zero Thickness” and **Open the “Substrate Shutter”** and **Turn on “Rotation”** if needed to start the deposition process. If certain thickness is the target, eg. 100A. wait the thickness is close to 100A and close the “Substrate Shutter” to stop the deposition on your sample.

7. Gradually **decrease** the “Emission Current” by 5mA to 0mA through few minutes to cool down the material. Turn off the GUN 1 or 2 Emission. Turn off the HVPS and close the GUN 1 or 2 shutter and “STOP” the thickness crystal monitor.

8. **Turn off** the High Voltage power switches and the Gun sweep control power from top to bottom.

9. **Turn off** the rotation. Make sure wait for at least **3 mins** for the GUN to cool down before venting.



Shut down steps:

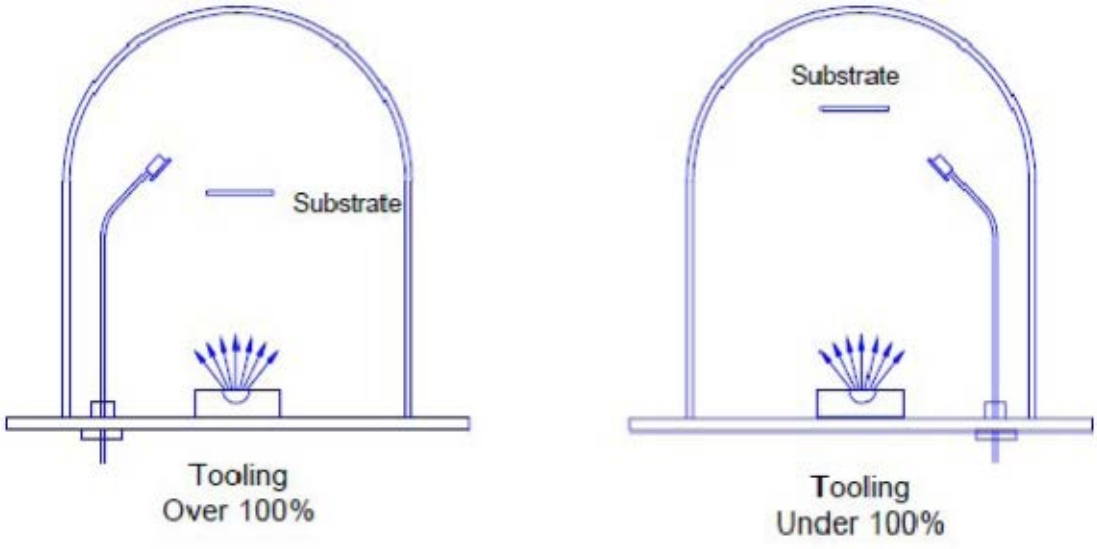
1. Click “Vent” to vent the chamber.
2. Take sample out. Vacuum clean if flakes found.
3. Roughing the chamber: Uncheck “Turbo Enable” and it turns gray.
4. Click “Pump down” so that only mechanic pump pumps the chamber. Make sure the vacuum reach E0 level.
5. Uncheck “Rough enable” to shut off roughing pump. Log out the software.
6. Turn off the chiller.
7. Log off the FOM to end the usage time.

Common Material Density and Z- Ratio

Film Number	Deposition Material	Density	Z-Ratio
Film 1	Aluminum	2.70	1.08
Film 2	Titanium	4.50	0.628
Film 3	Copper	8.93	0.437
Film 4	Gold	19.3	0.381
Film 5	Silicon	2.32	0.712
Film 6	Nickel	8.91	0.331
Film 7	Platinum	21.4	0.245
Film 8	Silicon Dioxide	2.648	1.00
Film 9	Al2O3	3.97	0.33

Appendix B: Tooling Factor

How do I determine Tooling Factor?
Tooling Factor adjusts for the difference in material deposited on the quartz sensor versus the substrate. This is an inherent problem. We don't want to cover your sample with the detector! Tooling may be less
than or greater than 100% as shown below.



1. Place your substrate and a new quartz sensor in their normal position.
2. Set Tooling to an approximate value; Set Density and Z-Factor for your material.
3. Deposit approximately 1000 to 2500 Å of material.
4. Use a profilometer to measure the substrate's film thickness.
5. The correct Tooling Factor is calculated by:

$$\text{Tooling}_{\text{ACTUAL}} = \text{Tooling}_{\text{APPROX}} \times \frac{\text{Thickness}_{\text{ACTUAL}}}{\text{Thickness}_{\text{QCM}}}$$

Why do I determine Tooling Factor?
It is necessary for very accurate deposition.