

# NEE-400 Dual Ebeam Evaporator SOP



## Utility checklist:

Chiller is on (in the chase)

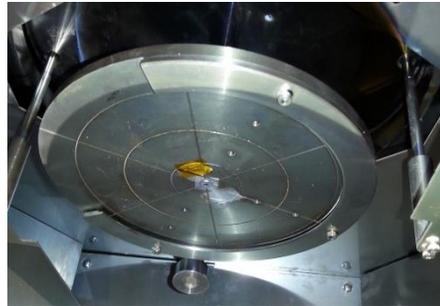
Breaker is on (lower back of the tool)

CDA and N2 are on

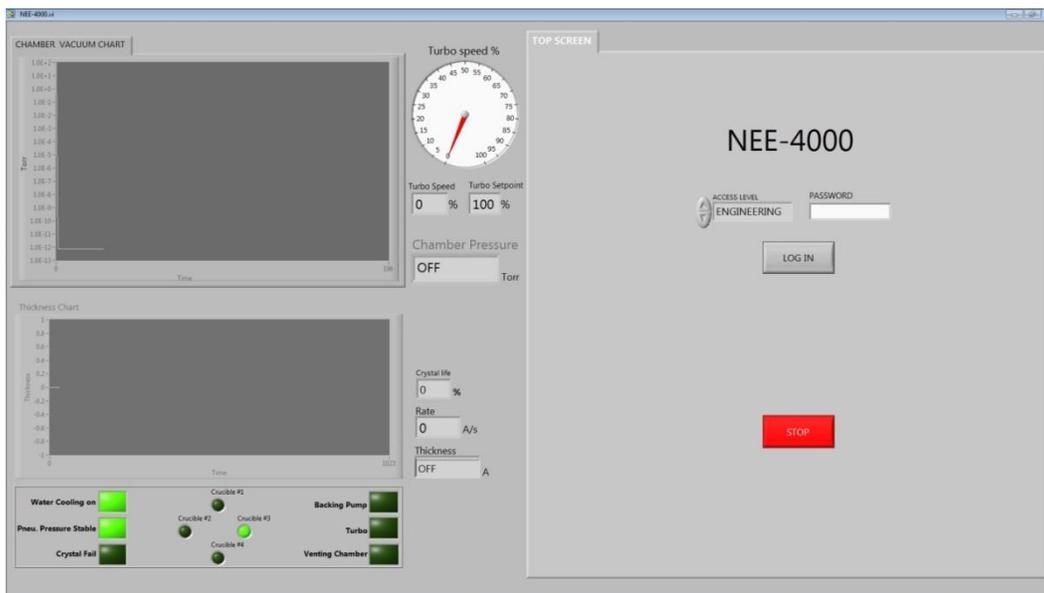


## Operation Preparation:

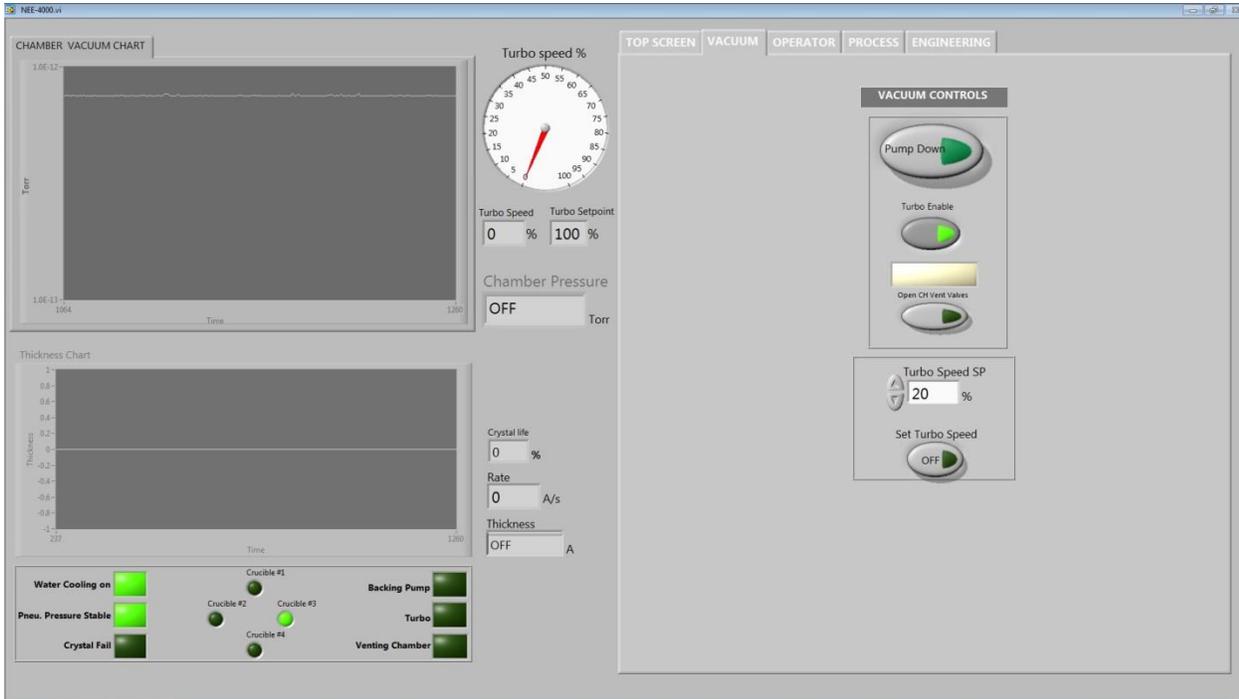
1. Turn on the breaker at the lower back of the system. Turn on the PC at the bottom of the right front panel. Make sure the crucible has enough material (choose right crucible through “engineering” tab) and load your wafer by using the half ring holder. For small samples, use Kapton tape.



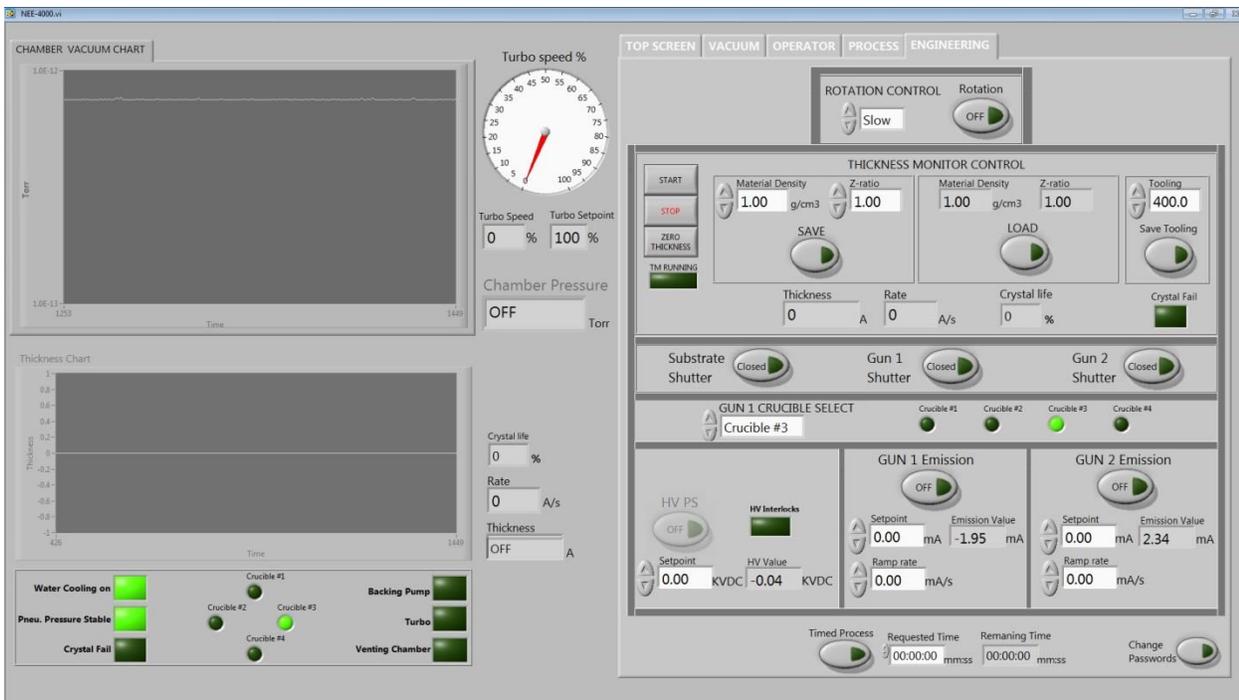
2. Click “NEE-400” icon and log in the home page. Access Level: engineering, Password: drive



3. Go to Vacuum tab. Press “Pump Down” to rough the chamber. When pressure is < 10 torr, Turbo will be on. The pressure should reach mid E-6 torr or below. **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.**



4. Go to engineering tab to setup the process parameters. HV Power Supply set point: 10KVDC  
 “START” “STOP” AND “ZERO THICKNESS” are for the crystal thickness monitor. It is useful when doing a manual deposition based on the thickness.



## Manual operation based on thickness:

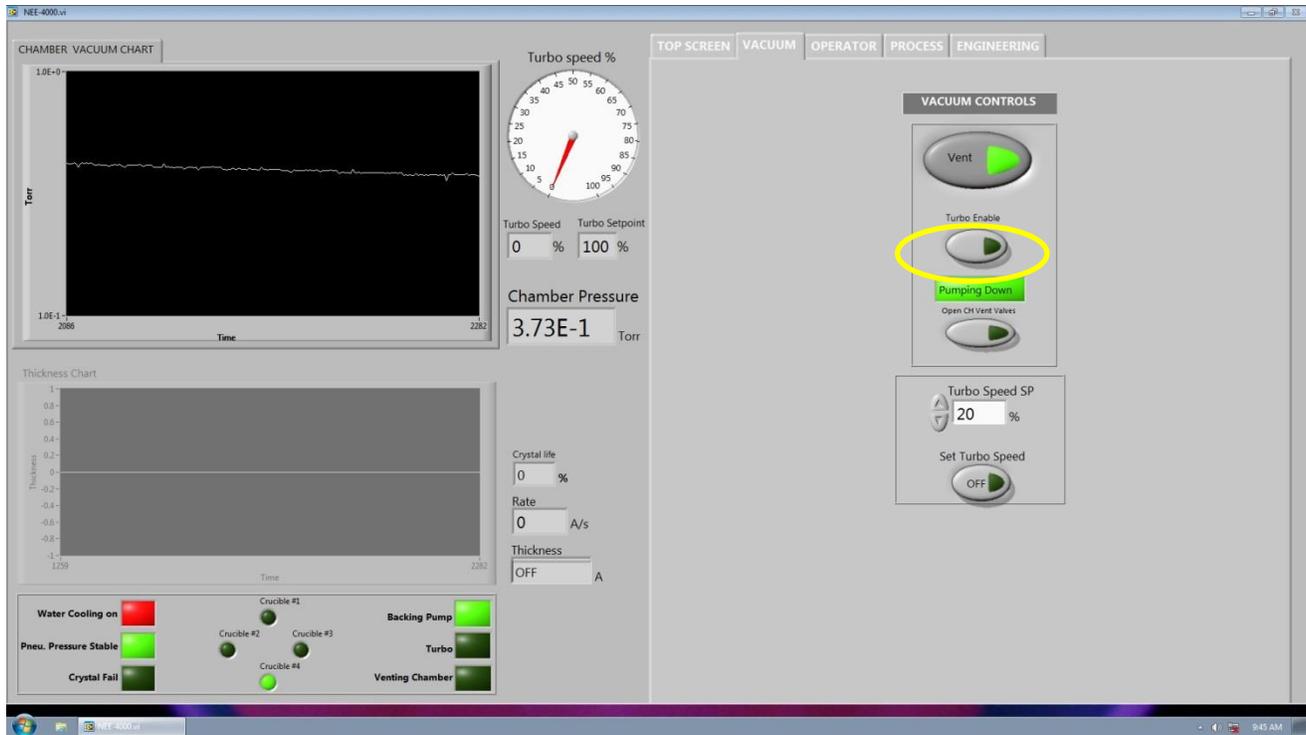
1. Turn on the High Voltage power switches and the Gun sweep control power.



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 “Setpoint” at 20 mA and “Ramp rate” at 1 mA/s.
4. Open the GUN 1 or 2 Shutter. Turn on HVPS. **To warm up the material, gradually increase “Emission current” by 5 mA through few minutes 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. click “START” to run the thickness crystal monitor. During the adjustment, the substrate shutter remains close.
5. 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. **Plug in the USB and Turn on the temperature(< 30 C) to avoid overheating and system shut**  **webcam to check on the chiller down.**

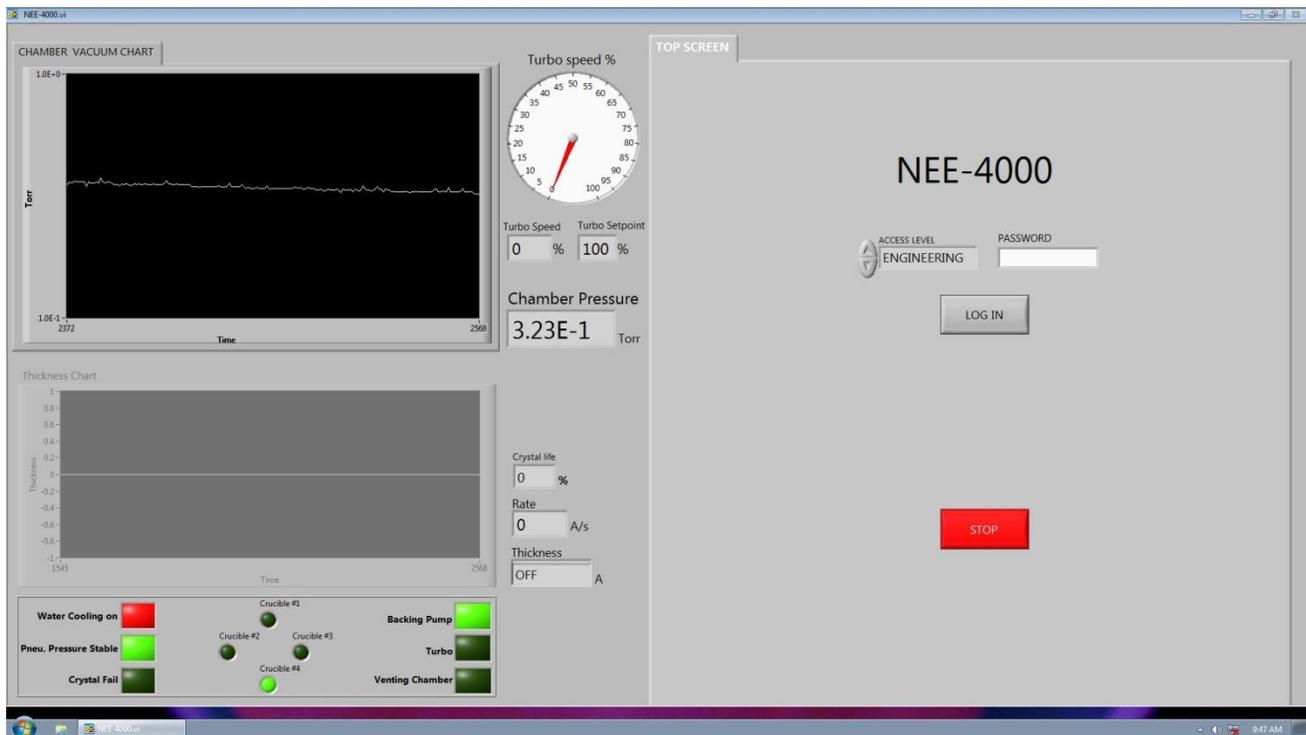


6. **Gradually** decrease the “Emission Current” by 5mA to 0mA through few minutes to cool down the material. Turn off the GUN 1 or 2 Emission. Turn off the HVPS and close the GUN 1 or 2 shutter and “STOP” the thickness crystal monitor.
7. **Make sure wait for at least 3 mins for the GUN to cool down before venting.** Go back to “VACUUM” page for venting. **Use the small vacuum cleaner to clean the debris near the GUNS!!**



8. Once samples being taken out, close the door and disable the Turbo by click “Turbo Enable”.

Then click “Pump down” so that only mechanic pump pumps the chamber. Make sure the vacuum reach E-1 level. Then **close the software and re-open** the software to shut off the mechanic pump and leave the chamber in vacuum.



Common Material Density and Z- Ratio

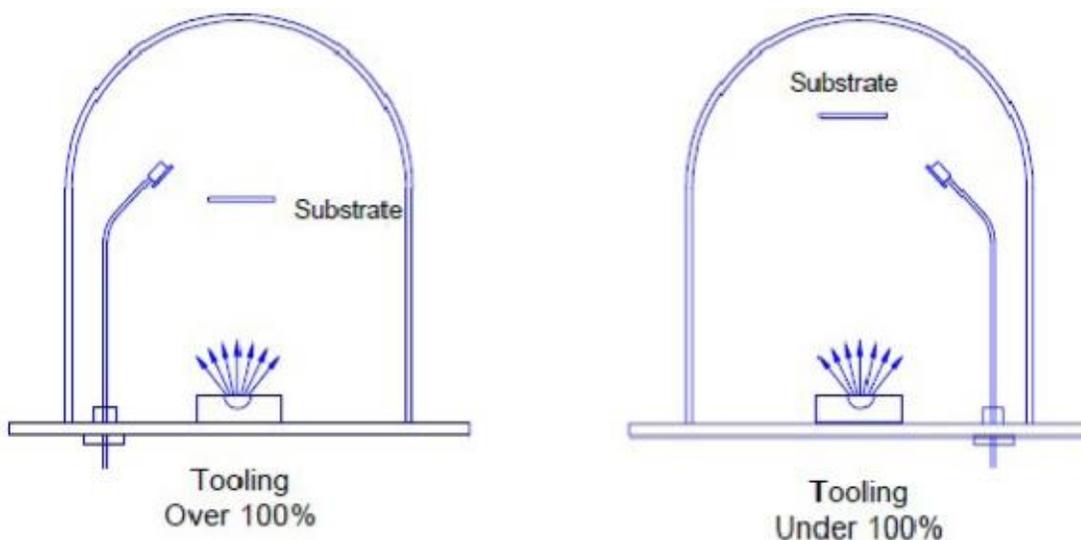
Film Number	Deposition Material	Density	Z-Ratio
<b>Film 1</b>	Aluminum	2.70	1.08
<b>Film 2</b>	Titanium	4.50	0.628
<b>Film 3</b>	Copper	8.93	0.437
<b>Film 4</b>	Gold	19.3	0.381
<b>Film 5</b>	Silicon	2.32	0.712
<b>Film 6</b>	Nickel	8.91	0.331
<b>Film 7</b>	Platinum	21.4	0.245
<b>Film 8</b>	Silicon Dioxide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

# Appendix B: Tooling Factor

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## 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.