Tri-Axial 6-Target E-Beam Evaporator Standard Operating Procedure

Outside MBE-lab:

1) Switching on the system: a) Turn on the Main power supply from the service corridor. b) Then press the green button.

2) Switch on the cooling water valves(first inlet then outlet) for the Turbo and close both the bypass valves
(Flow: 6-8 lit/min)

Inside MBE-lab:

1) Press the UPS button to start the computer. Then it will take some time to load the Application. After that Software page will display automatically.
2) "Login" : Select the user name from the dropdown box, enter the password and click "ok".

Loading the Sample:

1) Click on "Manual Key" and then click on "VENT CHAMBER" to vent the chamber to ATM(7.8×10^2 torr).
2) Now, **"Enable"** the Pocket Indexer and Click **HOME**, also check the crystal life(after switching to Sigma window, we can check the crystal life)
3) Click the "shutter key" and put the materials to be deposited (III-V compounds only) in the appropriate pockets.
4) Remove the sample holder and load the sample.
5) Now, Click on "PUMP DOWN CHAMBER" and check all the interlocks.
6) This will starts the Mechanical pump and after that Turbo will start automatically. Wait till you find Turbo reaches a final speed from 0% to 100% (as visible from the turbo panel).
7) During this period SP2 starts decreasing and Foreline SP1 reaches to 60(see behind the chamber).
8) Wait until the Chamber base pressure reaches atleast 6×10^{-6} torr(or 4×10^{-6}).

Deposition Process:

Before you create a process, you will have to create some films.

1) Go to "Sigma Software".
2) Create Films:
   You can edit/create films from the **Edit** menu, **Films** item. There are four tabs available when editing films. The following tabs are available:
   a) Deposit (PID): If you are not aware of how PID controllers work, it would be best to use default values. P=25, I=1, D=0. Be Sure Shutter Delay Enabled is **not** selected. Select Continuous for Rate Sampling.
   b) Condition (Ramp/Soaks): In this tab, you can define the ramp and soak values for time and power (Pre-Condition). There are a total of two ramps and two soaks. The Post Condition consists of feed power , idle time, ramp time etc. These values can be edited for the post deposition (cool down) of the deposition material before moving to the next index position.
   c) Source/Sensor: This is the tab where you select the material for deposition. It will also allow you to set max. power, slew rate and tooling factors. Be sure to set the Slew Rate to a low percentage (<10) for materials that evaporate at a fast rate & with lower power.
   d) Errors: In this tab, Crystal Fail should be Enabled and Timed Power should be ticked.

3) Create Process:
   You can edit/create films from the **Edit** menu, **Process** item. To create a new process, click the "New" button. There are several tabs when editing films. The following tabs are available:
   a) Layer: This is where you set the following: Film, SetPt(rate), Final Thickness, System Setup - Source 1 (for E-gun) and (in case Boat) Source 2, Source/Pocket, Input-Sensors, Start Mode-Autostart. There are a few really critical items that must be selected properly or disastrous results could occur. The **Source/Pocket Index** must match the correct pocket. In the main page, you can name each pocket material. In the sigma software you must set the **Source Index** number. This will dictate which pocket will be selected prior to starting the power supply.
   b) Rate Ramps:
   c) Deposit: This will provide a second opportunity to edit the PID values as configured when developing the film.
   d) Condition: This will provide a second opportunity to edit the error data as configured when developing the film.
   e) Source/Sensor: This will provide a second opportunity to edit the error data as configured when developing the film.

f) Errors: This will provide a second opportunity to edit the error data as configured when developing the film.
Note: If you are running the process from the **Sigma software** the layer switching must be set to **Auto**. If you are running the process from the **SC3000 software** the layer switching must be set to **Manual**. The reasoning behind these selections is that when running the process from Sigma, the layer switching should be automatic. Therefore you will not have to manually click on start layer between each deposition. When operating from the SC3000 software, the process must be in the manual mode.

4) Create Recipe:

Once you have created your films & processes in the Sigma software you must then create a recipe in Excel for the SC3000 software.
Click on " Autostart". Go to Edit.

There are several critical issues when developing a recipe.

a) The Sigma Process Name entered in the spreadsheet must match the name in Sigma sotware.
b) Auto start Requirements: The SC3000 software will have many items that need to be checked before you can start an auto process (interfacing with the Sigma software). The following screen is presented to the operator before you can start process.

Shutting down the system

1)After deposition, vent the chamber.

2)Unload the sample properly, then pump down the chamber.

3)Logout from the GUI.

4)Shut Down the PC.

5)Turn of the UPS button

6)Close the Inlet/Outlet valves and open the bypass valves in the service corridor.

7)Switch off the main power supply.