

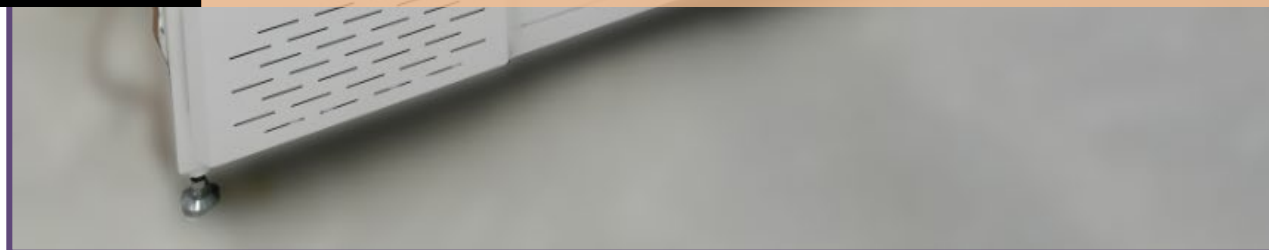


**Nano
Fabrication
Center**

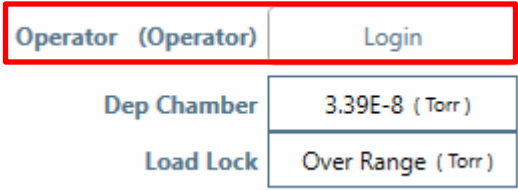
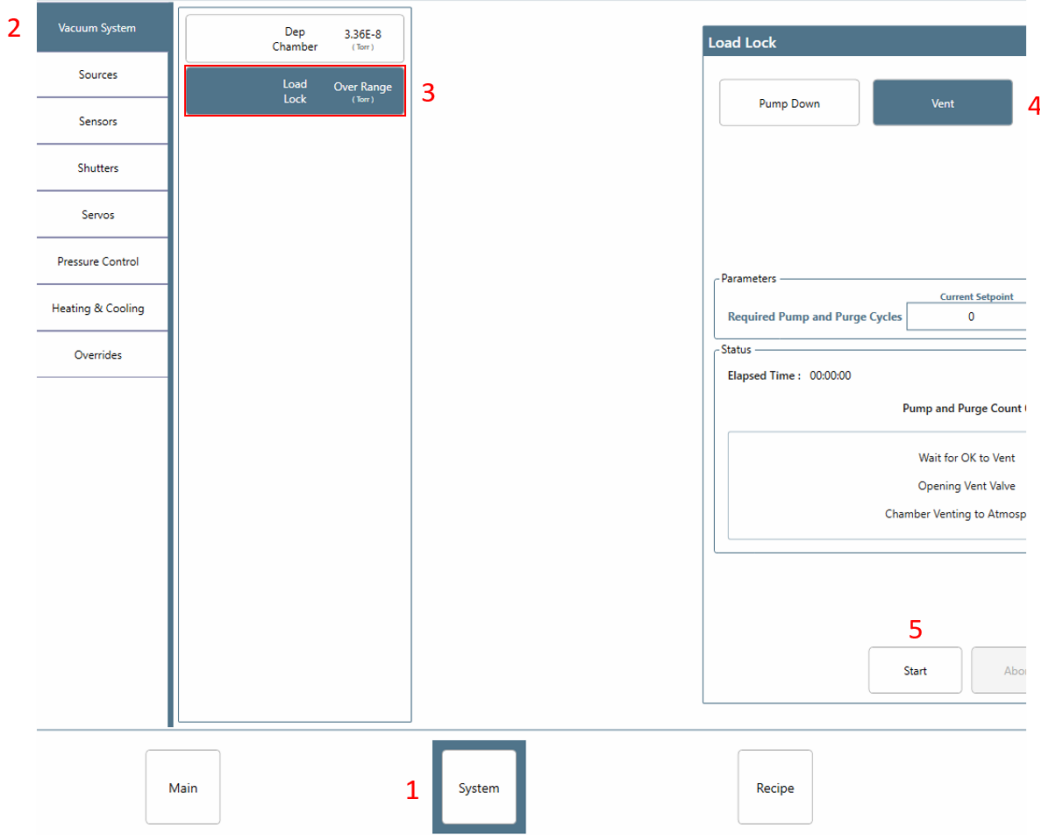
Angstrom Evaporator




Standard Operating Procedure



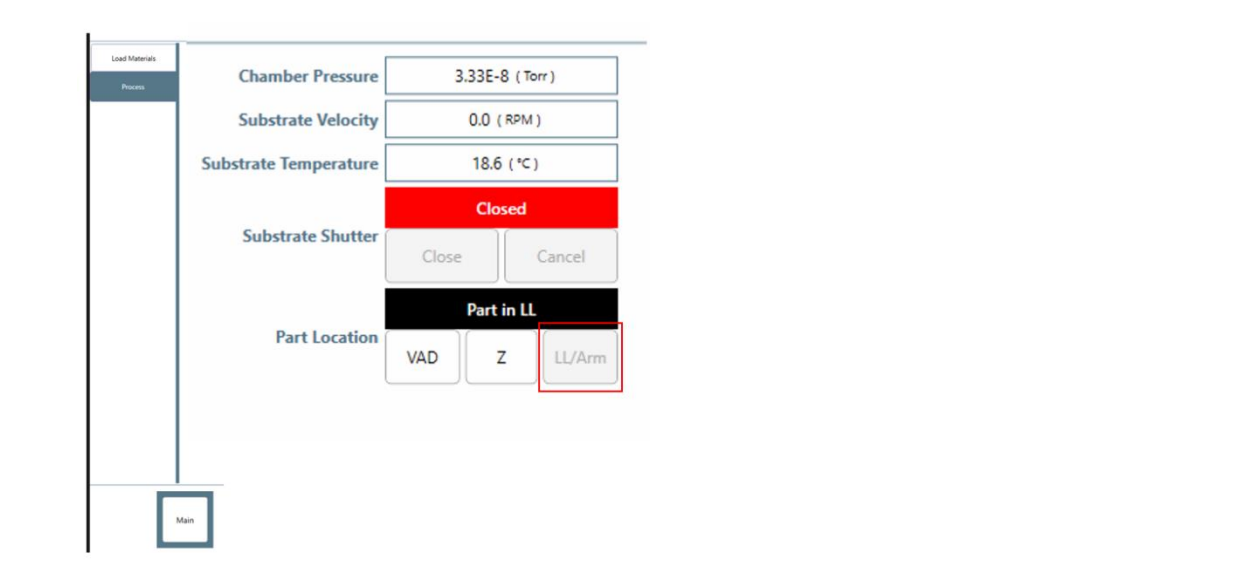
Written by Sigal Keshet



Standard Operation

<p>1</p>	<p>Log in to system by pressing the logged user on the upper right corner. Username/ Password: Operator.</p>	
<p>*</p>	<p>Overview</p>	<ol style="list-style-type: none"> 1. LL vent and insert the sample (system→vacuum tab) 2. Loading (main→process→load recipe option) 3. Process (main→process→load recipe option) 4. Unloading (main→process→load recipe option) 5. LL vent and taking out the sample (system→vacuum tab) 6. LL vacuum (system→vacuum tab)
<p>2</p>	<p>LL vent: go to 1. system (bottom bar) 2. vacuum system 3. load lock 4. vent 5. Start</p> <p>wait till completed.</p>	

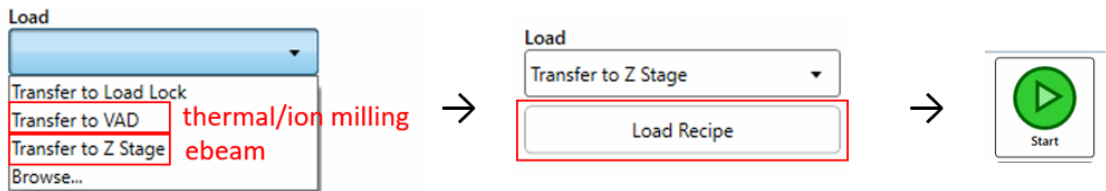
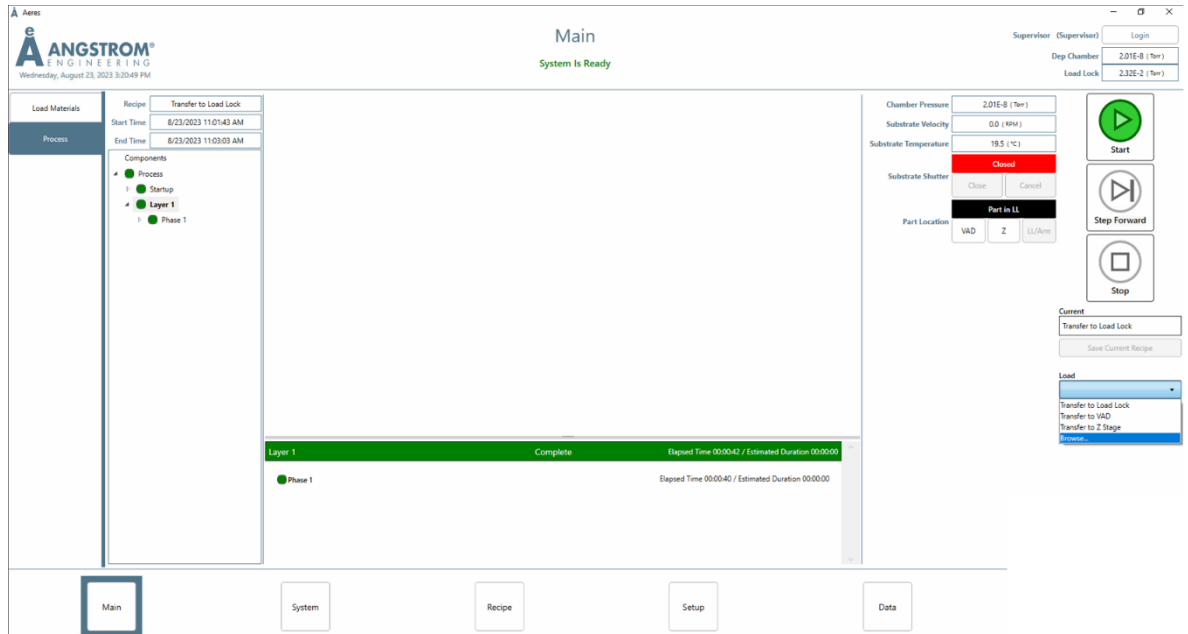
<p>3</p>	<p>Open the load lock chamber door. take out the sample holder (touching edges only).</p>	
<p>4</p>	<p>Attach your samples to the sample holder.</p>	
<p>5</p>	<p>Place sample holder in the load lock and <u>make sure it seats in the right orientation: tape to tape!</u></p>	

<p>6</p>	<p>Make sure pins sits correctly in place.</p>	
<p>7</p>	<p>Close load lock chamber door.</p>	
<p>8</p>	<p>Most important step! In part location, make sure the part in LL (sample holder). If not, arm will be crushed by z stage.</p>	

9

Load recipe

In main-process-choose load option (on the right). You have 3 mechanical options. For **ebeam** process: choose 'Transfer to Z stage'. For **thermal/ion milling** process: choose 'Transfer to VAD'. Then load recipe (recipe will appear on the left). Click sub arrows, then press start . **Make sure process is completed.**



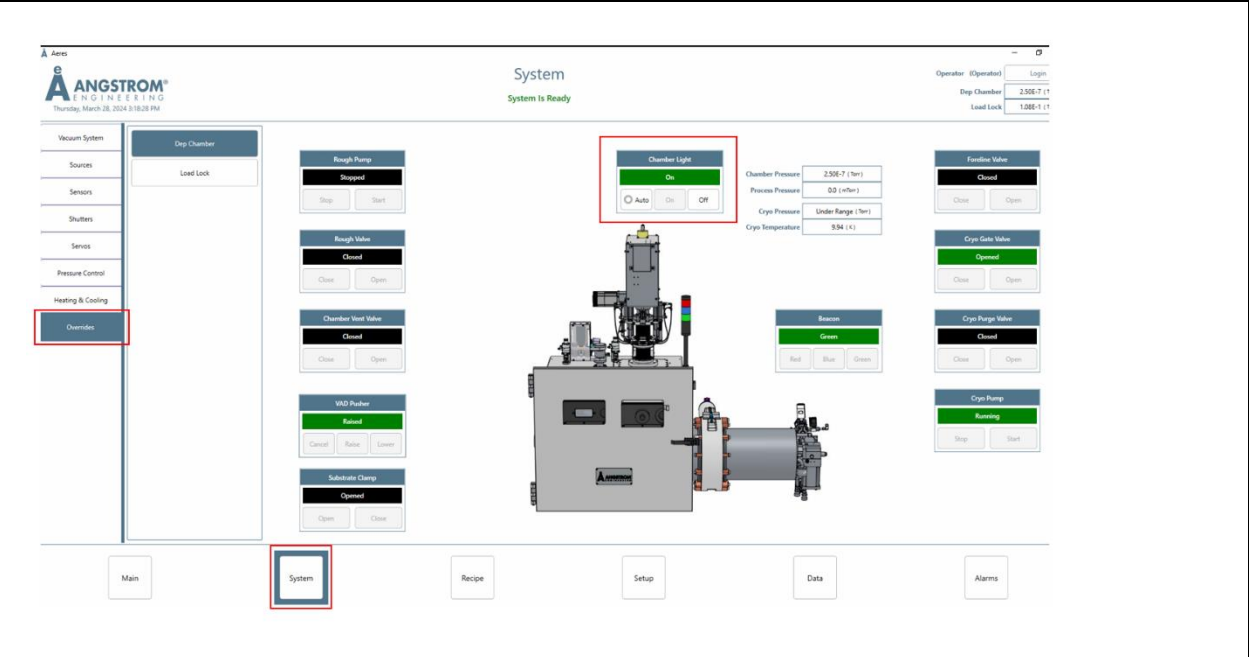
Sample holder in VAD stage



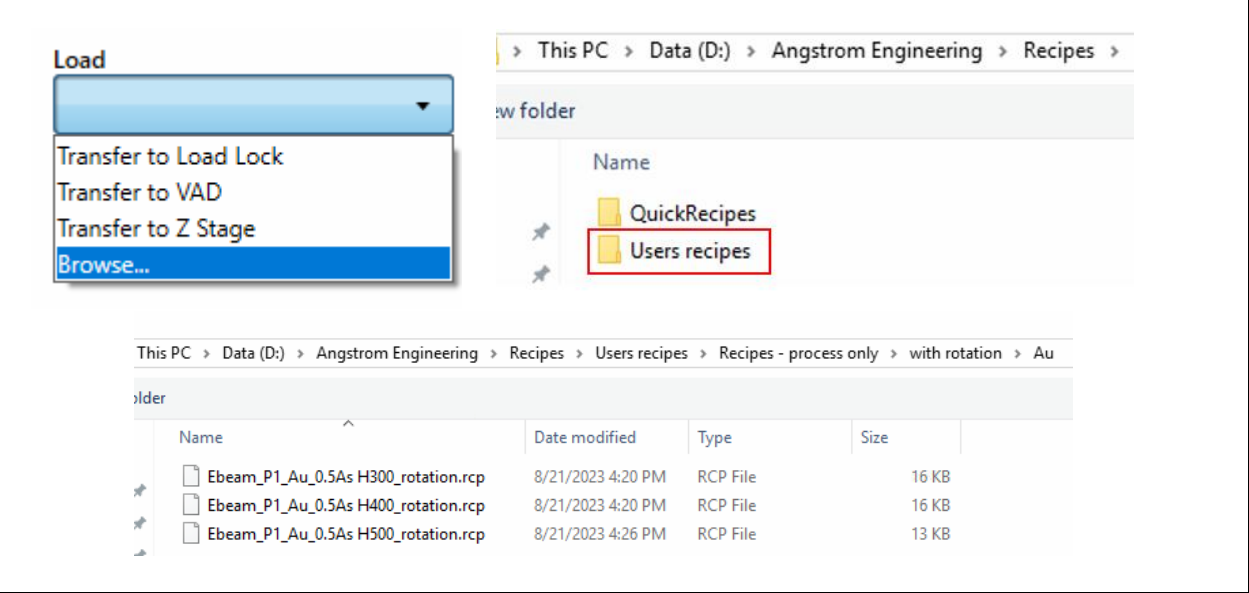
Sample holder in Z stage



* Turn on/off chamber light



10 Process: from main-process option-choose 1. load 2. browse 3. choose your desired recipe. 4. load recipe.



11 Define rate & thickness
 press load recipe button, then define both rate and thickness.
 Click update. Load recipe opens your recipe on the left. Click the sub arrows to view the recipe and edit each step per your demand. You can edit during process as well.

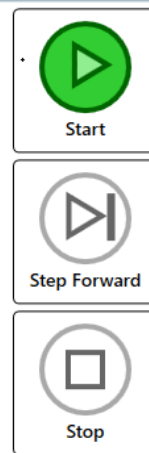
Update the Recipe Template

rate (A / s)

thickness (A)

The screenshot shows the 'Main' interface of the Angstrom Engineering software. The top status bar indicates 'System Is Ready'. The left sidebar contains a recipe tree for 'Ebeam_P3_Ti_H500_0'. The central area features three graphs: 'Rate', 'Output', and '% Rate Dev.', each with an 'Auto Scale' checkbox and a 'Current Value' display. The right sidebar contains a control panel with fields for Chamber Pressure (2.50E-7 Torr), Substrate Velocity (0.0 RPM), Substrate Temperature (20.5 °C), and Substrate Shutter (Closed). Below these are buttons for 'Start', 'Step Forward', and 'Stop'. A 'Part in LL' indicator is also present.

12 Start recipe:
 press start (or stop to stop recipe, if you wish to stop any action of the instrument).



13 Click the marked arrow to open QCM data.

The screenshot shows the control interface for the Ti_P3_H400 eBeam Pocket 3 (Titanium). It displays the following parameters:

- Thickness: 4.32 A (0.00 A)
- Rate: 0.00 A/s (0.50 A/s)
- Output: 0.00 %
- High Voltage: 0.00 kV
- Beam Current: 0 mA

Below the parameters are control buttons for Manual (unchecked) and Automatic (checked). There is an "Output (%)" field set to 0.00 with an "Update" button. A "Zero Thickness" button is also present. The "Source Shutter" is currently "Closed", with "Close" and "Open" buttons. At the bottom, a table shows QCM sensor data:

Sensor	Rate	Thicknes	TF
Physical Sensor 1A	0.00 A/s	0.00 A	0.00
Physical Sensor 1B	0.00 A/s	0.00 A	0.00

14 Process is built from 2 sections:
*Startup
*Layers

The screenshot shows the process configuration menu. On the left, there are two main options: "Load Materials" and "Process", with "Process" selected. On the right, the "Recipe" is set to "Ebeam_P3_Ti_H400_R0". There are fields for "Start Time" and "End Time". Below these, a "Components" list is shown with "Process" selected, and sub-options for "Startup" and "Layer 1".

15 Startup consist of chamber pump; chamber vacuum ($2e^{-7}$); substrate rotation (in case you choose rotation option).

The screenshot shows the startup configuration menu. The "Components" list is expanded to show "Startup" selected. Under "Startup", there are two sub-steps:

- Step 1: Pump Down Dep Chamber
- Step 2: Wait For Dep Chamber Chamber Pressure, Enable Substrate Rotation

Below this, "Layer 1" is also listed as a component.

16

Layer 1

contain all process steps. Open the sub arrows and click on each step while working.

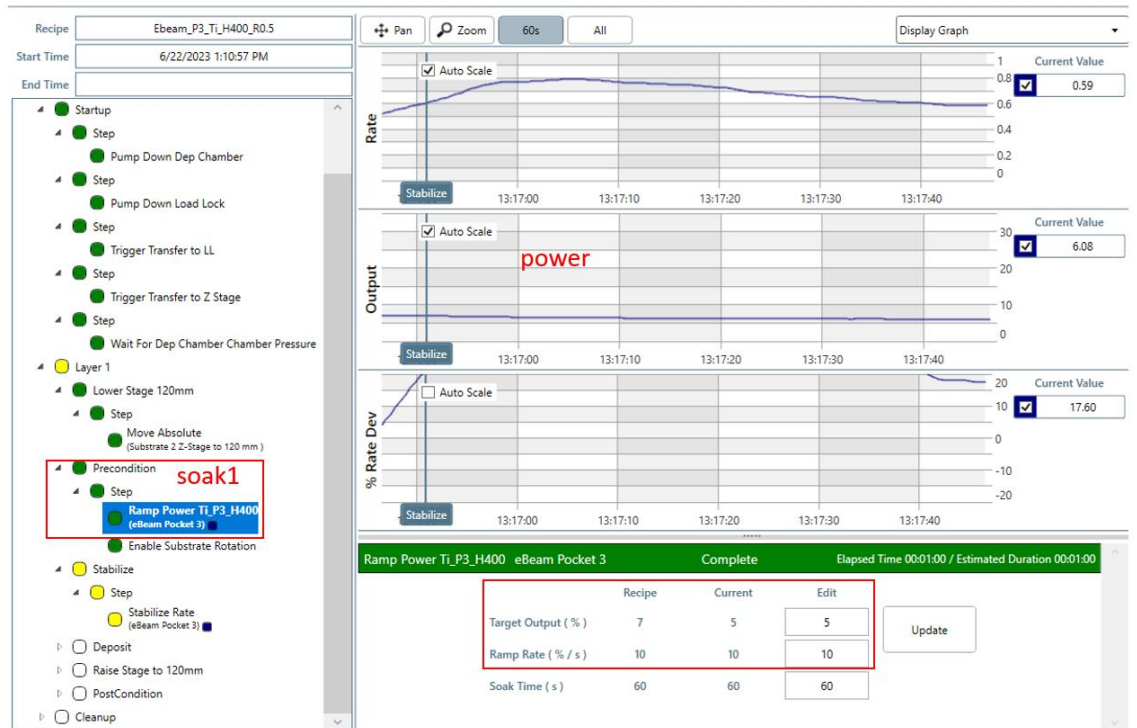
- ▲ Components
 - Ti P3 H500 eBeam Pocket 3 (Titanium)
- ▲ Process
 - ▶ Startup
 - ▲ Layer 1
 - ▶ Precondition
 - ▶ Stabilize
 - ▶ Deposit
 - ▶ PostCondition

17

Layer section:

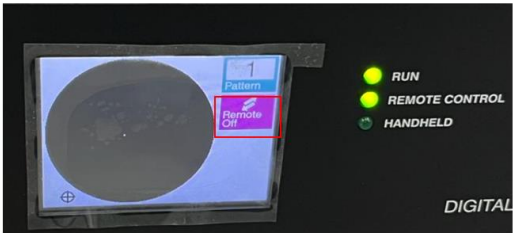
In precondition step (soak1), go to ramp power and adjust the target output (power) and ramp rate. recipe values are calibrated for rate 0.5Å/s. press update. rate and power (output) values appear on charts. rate should reach ~70% of final rate.

The only step where you can control the power:

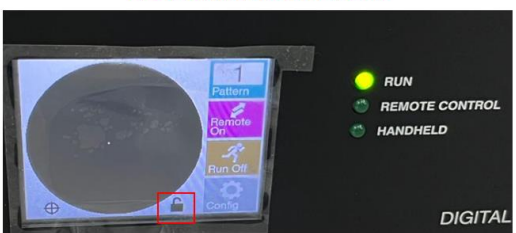


18 Beam alignment
 when beam is observed, start the alignment.
1. click the Remote off option (make sure in unlock position, If in lock position- click the icon- then password 1234- then ok.).
2. connect the joystick.
3. click the target icon.
4. align the beam.


Initial view



Post Remote off view




If in lock position, open with password:




1

Connect joystick



2

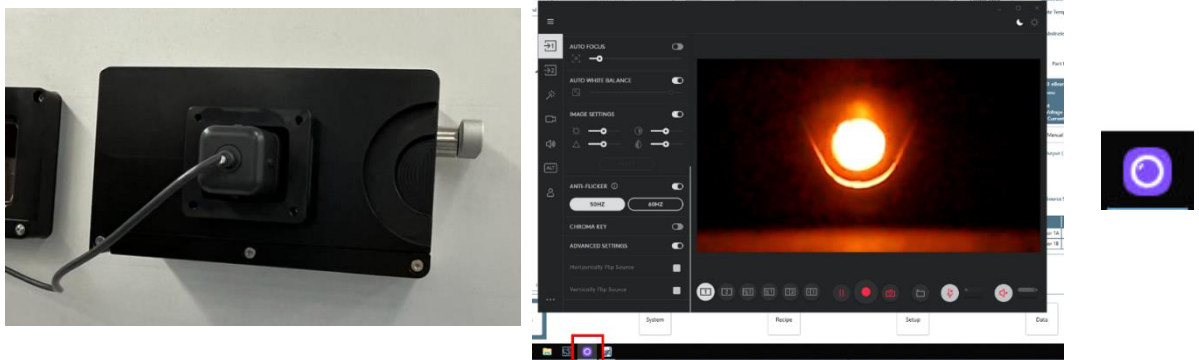

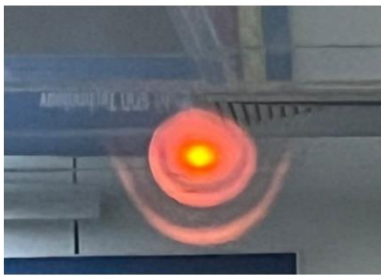

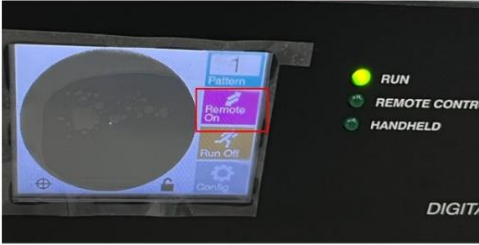
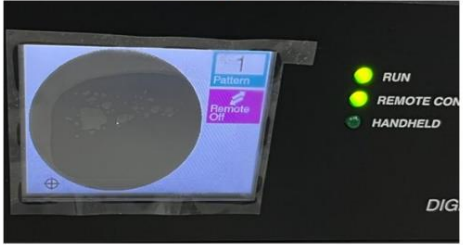
Click target icon:



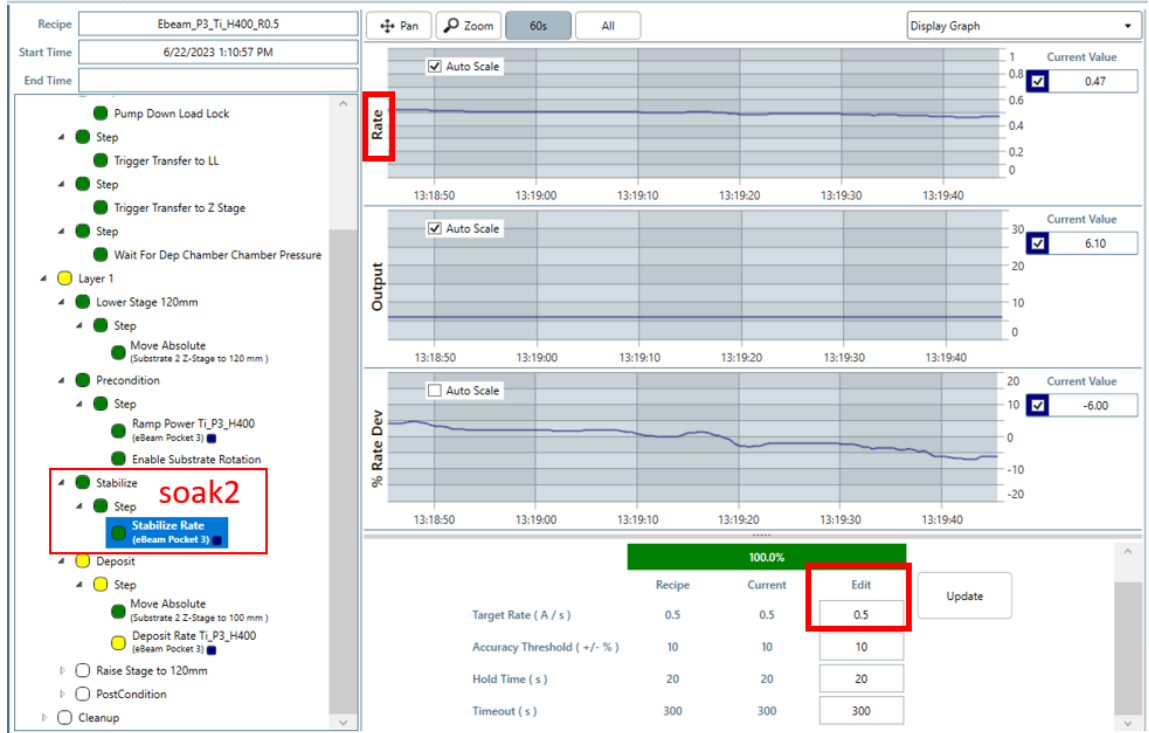
3

19 Cover the viewing window using the intensity reducer window.

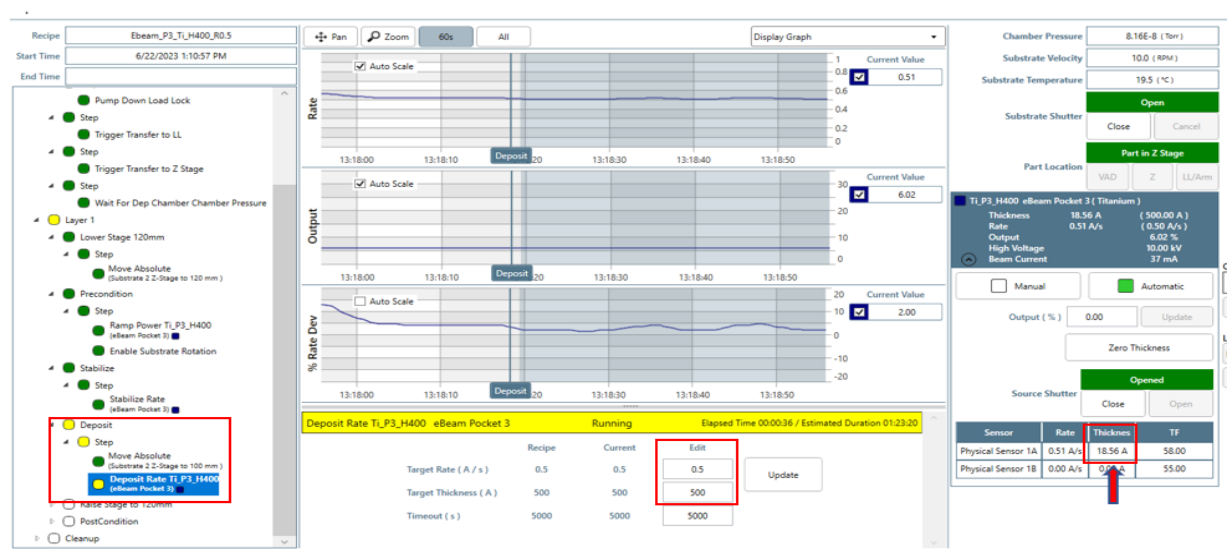


<p>20</p>	<p>If you wish to see the beam in camera, use the camera shield as well.</p>	
<p>21</p>	<p>Make sure the correct pattern appears (sweep1 for spot, sweep2 for circle).</p>	<div style="display: flex; justify-content: space-around;"> <div style="text-align: center;"> <p>Cr/Co/oxides (sweep2)</p>  </div> <div style="text-align: center;"> <p>Rest of metals (sweep1)</p>  </div> </div>
<p>22</p>	<p>When alignment is finished:</p> <ol style="list-style-type: none"> 1. click the ok button. 2. disconnect joystick 3. click the Remote on 4. close the door. 	<div style="text-align: center;">  </div> <div style="display: flex; justify-content: space-around; margin-top: 10px;"> <div style="text-align: center;"> <p style="color: red;">After disconnecting</p>  </div> <div style="text-align: center;"> <p style="color: red;">After clicking Remote on</p>  </div> </div>

23 In stabilize step (soak2), make sure your desired rate is stable in charts. Power cannot be changed in this step.



24 Deposition
In deposition step, you can view the actual thickness on the right side.



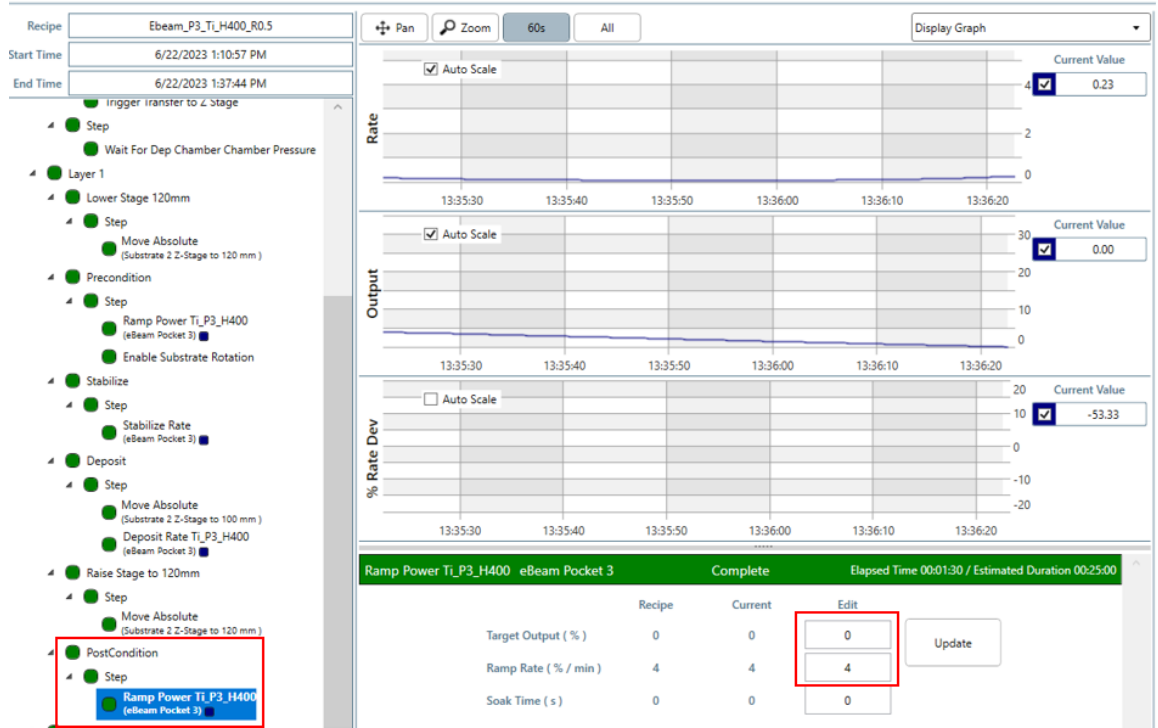
***** Logbook

Please fill deposition details in the log book:

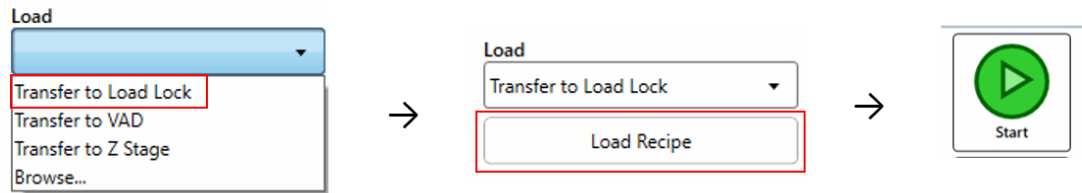
Angstrom Evaporator Users logbook

Date	Start Time	End Time	Username	Materials	Layer Thickness	Rate	Power	Remarks

25 Post condition ramp down step. ramp down time should be at list 2 minutes. If your power was 18%, ramp rate should be 9%/min or lower value. For over 20%- make it 3 minutes. Wait till process is complete and all steps are green.

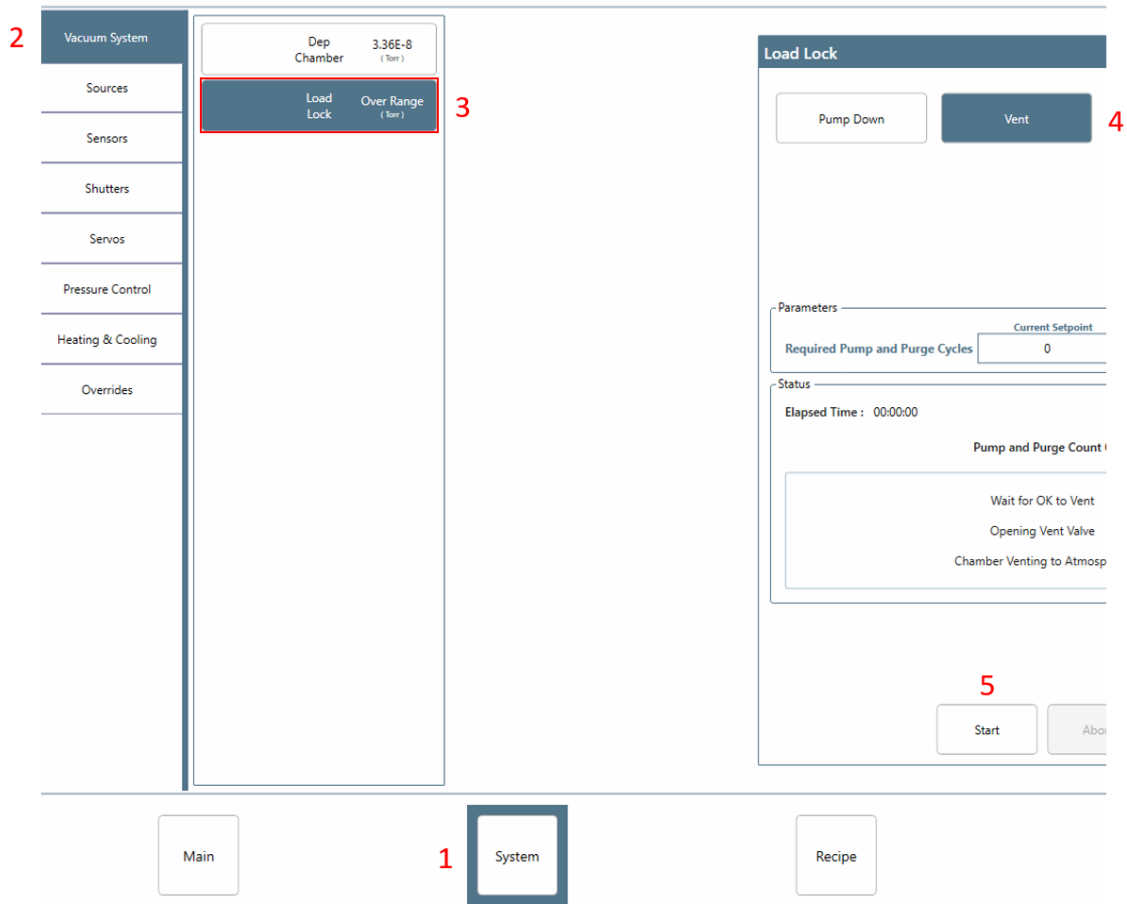


26 Unloading from Load section, choose the transfer to load lock option. Then load recipe. Then start. wait till step is completed.

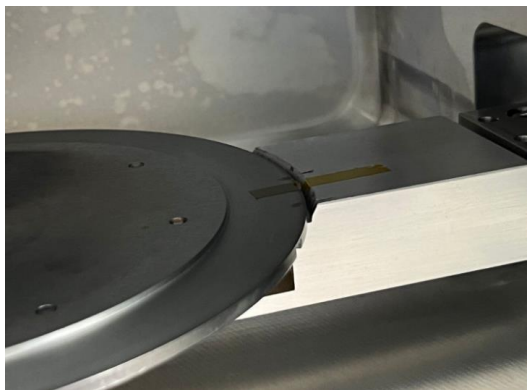


27 Vent load lock
 go to
 1. system
 (bottom bar)
 2. vacuum
 system
 3. load lock
 4. vent
 5. Start

wait till
 completed.



28 Take out the sample holder,
 remove your
 sample,
 bring back
 the sample
 holder (tape
 to tape),
 close the
 door.



<p>29</p>	<p>Load lock vacuum go to 1. system (bottom bar) 2. vacuum system 3. load lock 4. pump down 5. Start</p>	
<p>*</p>	<p>Errors</p>	<p>If you have errors from any kind, please take a screen shot and save it here, and send an email to Sigal/Assaf/Sharon on call.</p>