

Title <i>(Of equipment, plant, experiment, activity, etc.)</i>	Operating procedure for EBL 1		Date 01/09/2026		
			Version 1.2		
Activity Details <i>(of equipment, plant, experiment, activity, etc.)</i>	Description	Step-wise procedure to operate the EBL 1 tool			
	Location	#160_P3.51H (EBL1)			
	After-Hours Work	☐	YES	☒	NO
Photo/s <i>(of equipment, plant, experiment, activity, etc., used as part of this procedure)</i>	EBL1 				
Operational requirements	Equipment / Process / Plant / etc.		Instruction Manual (IM)		
	Cleanroom Laboratory Dress Code		IM_160-P3.51_Gowning_Cleanroom_V1.2		
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Describe, in detail and in sequence, the steps involved in this activity

PRE-OPERATIONAL CHECK

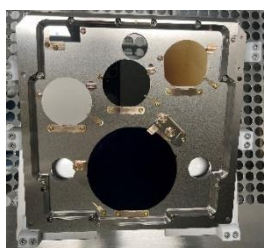
Before starting, please verify that you possess the following items:

1. A clean, spin-coated sample.
2. A finalised mask design file in a . CAR format

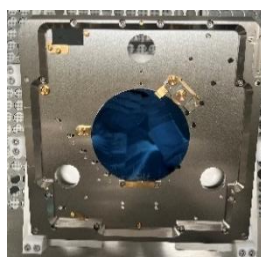
OPERATION – LIST STEPS TO COMPLETE THE ACTIVITY FROM START TO FINISH

Sample Loading & Mounting

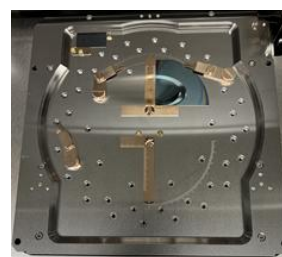
3. **Required Tools:** Tweezers, sample holder stand, appropriate sample holder, and your resist-coated sample
4. Choose the specific holder dedicated to your sample size from the following system configurations:



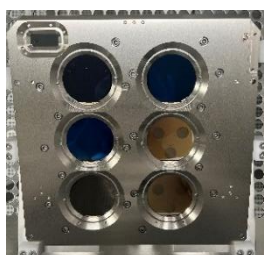
1 x 4", 3 x 2"
combination



Single 2" ~ 6" Wafer



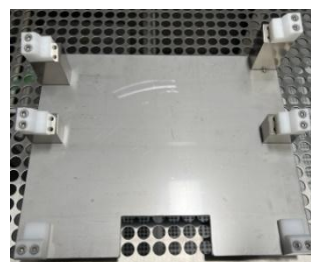
Wafer Piece



2" wafer x 6 slots



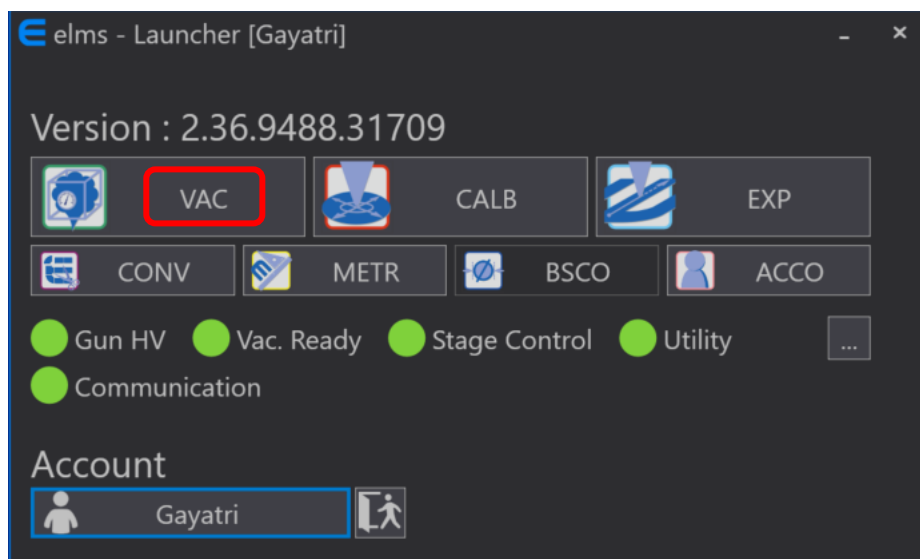
Small Pieces
5mm – 1 cm



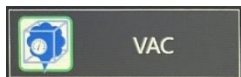
Holder Stand

5. Place the selected sample holder securely onto the designated **Holder Stand**.
6. If required, clean the holder by spraying it with Isopropanol (IPA) from a squirt bottle and wiping it thoroughly down with a lint-free cleanroom cloth.
7. Position your sample onto the holder carefully and engage the manual clamps to lock it into place.
8. Use the Nitrogen gun to blow over the sample surface, completely clearing away particles or loose contamination.

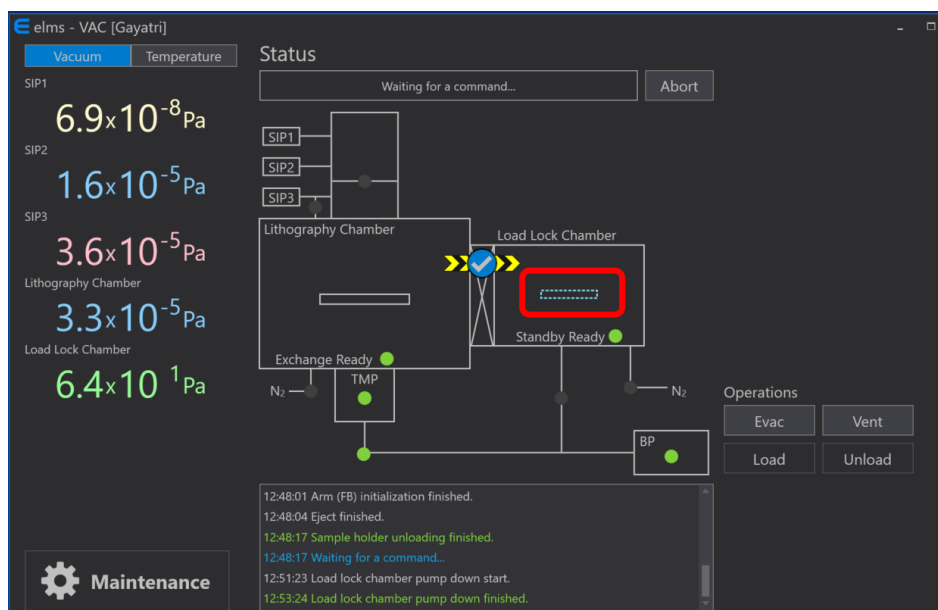
9. Check the computer monitor UI and confirm that the **elms Launcher** window is active.



10. Click on the **VAC** interface button



11. A secondary configuration window will pop up. Verify whether the blue plate is inside the Load Lock (LL) chamber interface graphic.



12. Walk over to the physical instrument panel on the Load Lock chamber and press the **Vent** button.
13. Wait for the venting cycle to complete. The Vent button will stop glowing once the atmosphere inside is fully equalised.



14. Open the Load Lock lid

15. Insert the mechanical restraint knob located at the right corner of the LL chamber into the hole parallel to the side of the lid.



16. Secure the sample holder in its place



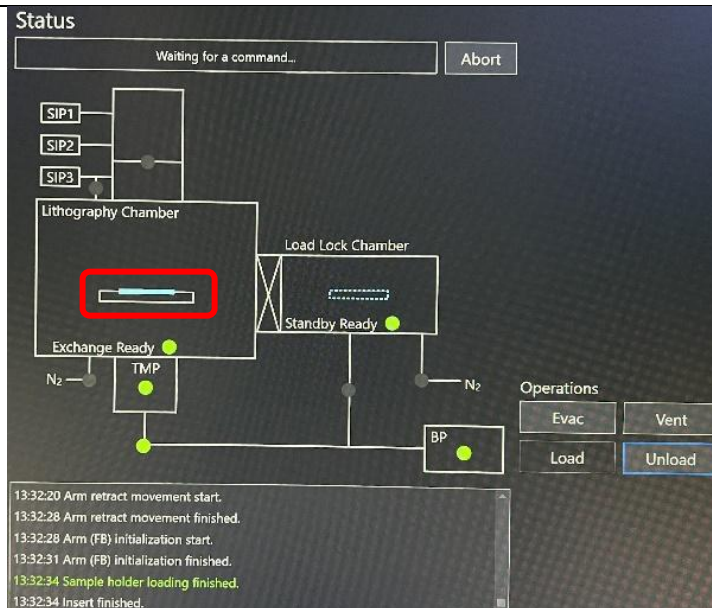
17. Press the small square button to release the knob and the lid and close the LL chamber



18. Press the **Start button**. The loading procedure starts.



19. Ensure that the sample loading sequence is fully complete, the blue plate has finished navigating to the Lithography Chamber on your graphic interface, and the status log prints "Sample holder loading finished"

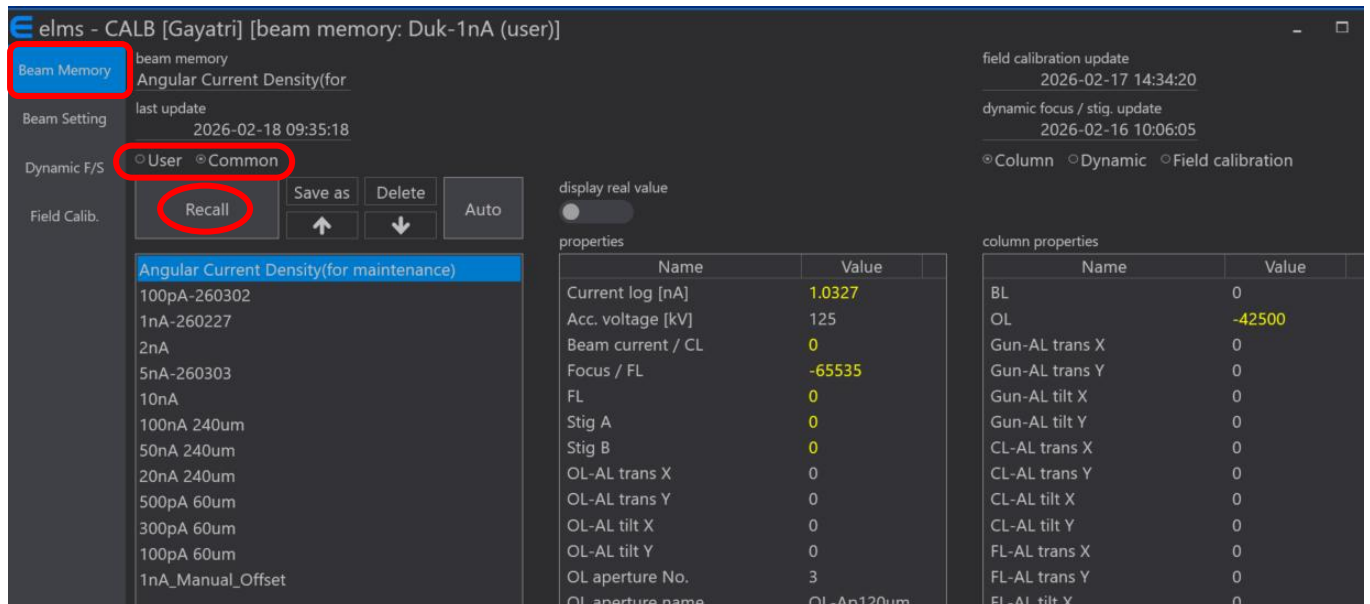


Beam Conditions Setup

20. From the main screen of the **ELMS Launcher** interface, select the **CALB** (Calibration) dashboard option



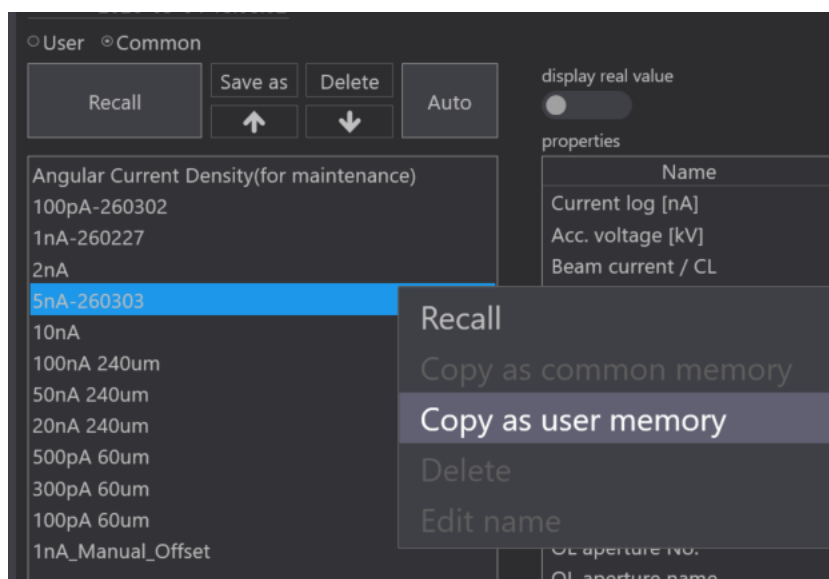
21. Click on the **Beam Memory** function tab



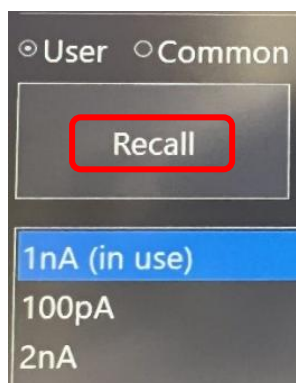
Name	Value
Current log [nA]	1.0327
Acc. voltage [kV]	125
Beam current / CL	0
Focus / FL	-65535
FL	0
Stig A	0
Stig B	0
OL-AL trans X	0
OL-AL trans Y	0
OL-AL tilt X	0
OL-AL tilt Y	0
OL aperture No.	3
OL aperture name	OL-Ap120um

22. In the active window, verify whether the system is set to the **USER** or **Common** beam profile directory.

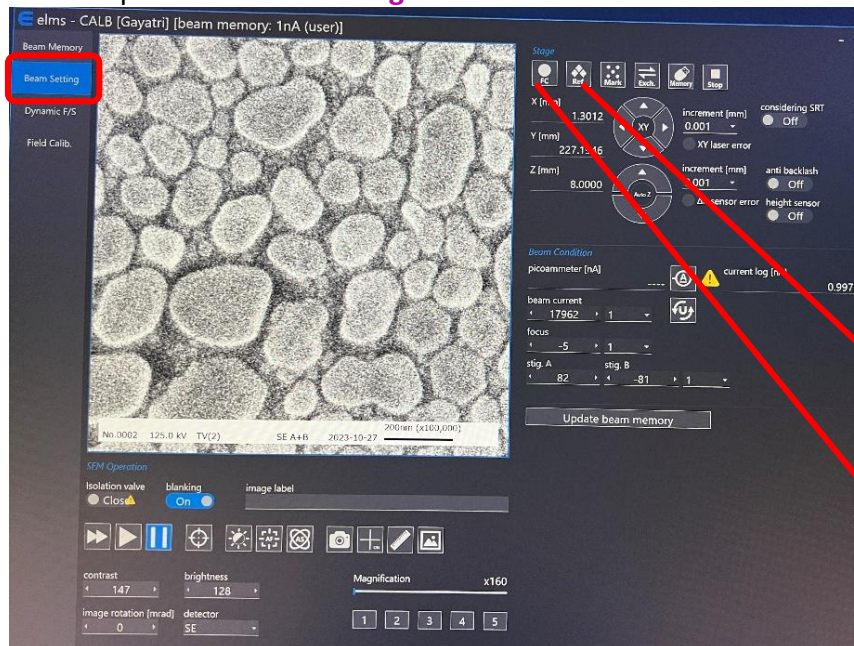
23. *If generating a new system current profile:* Navigate to the **Common** column, select your target beam current, right-click, and choose **Save as User Memory** to rename and save it to your local directory.



24. Locate your intended operational current under the **USER** configuration column and click **Recall**
Example: Recalling a 1 nA setting automatically loads all pre-configured parameters required for calibration and subsequent exposure



25. Open the **Beam Setting** control window



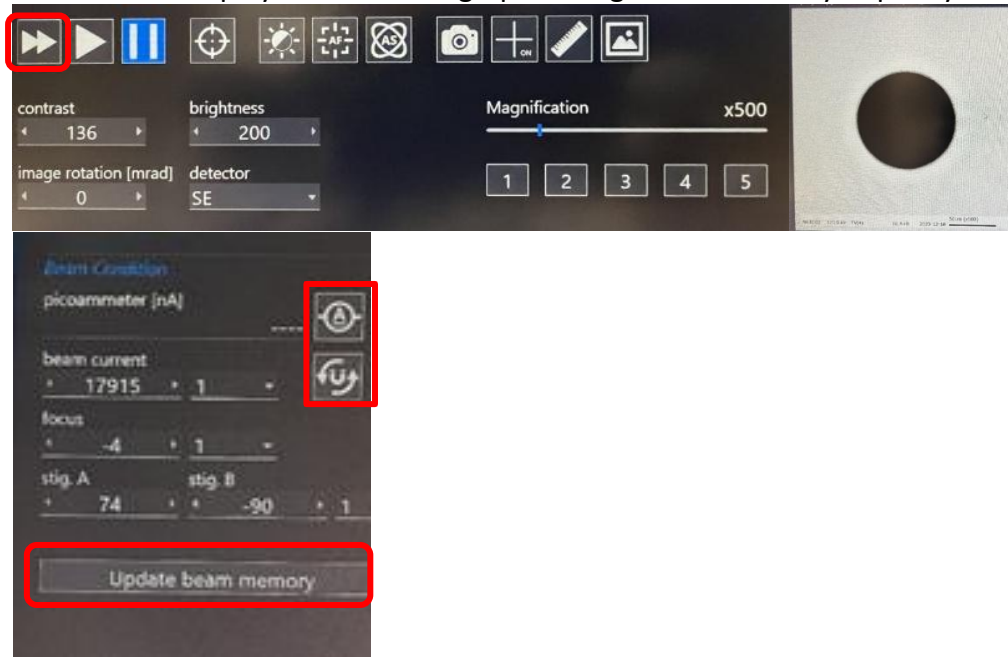
Faraday Cup (FC) Current Measurement

26. Within the Beam Setting interface, click the **FC** button



The internal physical stage will automatically drive to the Faraday Cup location for precise current validation.

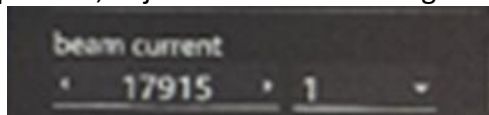
27. Click **Scan** to display the real-time graphic image of the Faraday Cup on your workspace monitor



28. Click the **Measure** button to capture the active electron beam current



29. Evaluate the measured value against your desired target setting. If a significant deviation is present, adjust the current tuning controls until the reading balances with the set value



30. Once balanced, click the measurement action button a second time to stop the active current tracking sequence.

Navigating to the Reference Sample

31. From the navigation menu, select **Move to Reference Sample** to reposition the stage



32. Set the system magnification to **Mag 2** and click **Scan** to inspect the target reference sample surface visually.

33. *Stage Adjustments*: If the displayed area appears completely dark or lacks recognisable features, right-click directly on the live image stream and select **Stage Moving** from the contextual drop-down menu.

34. Click anywhere on the live image to instantly centre the mechanical stage to that specific feature coordinate.

35. Select **Mag 4/5** to do the beam focusing.

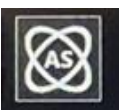
36. In case you need to adjust the contrast brightness, please click



37. Click Auto focus (AF)



38. Click Auto Stig (AS)



39. Click hysteresis correction to adjust the lag between the previous and current beam parameters



40. Measure the current



41. If any adjustments are required, please repeat the AF, AS, current measurement and Hysteresis correction steps till the current is stable and the image is in focus.

Update beam memory

42. Update the Beam memory

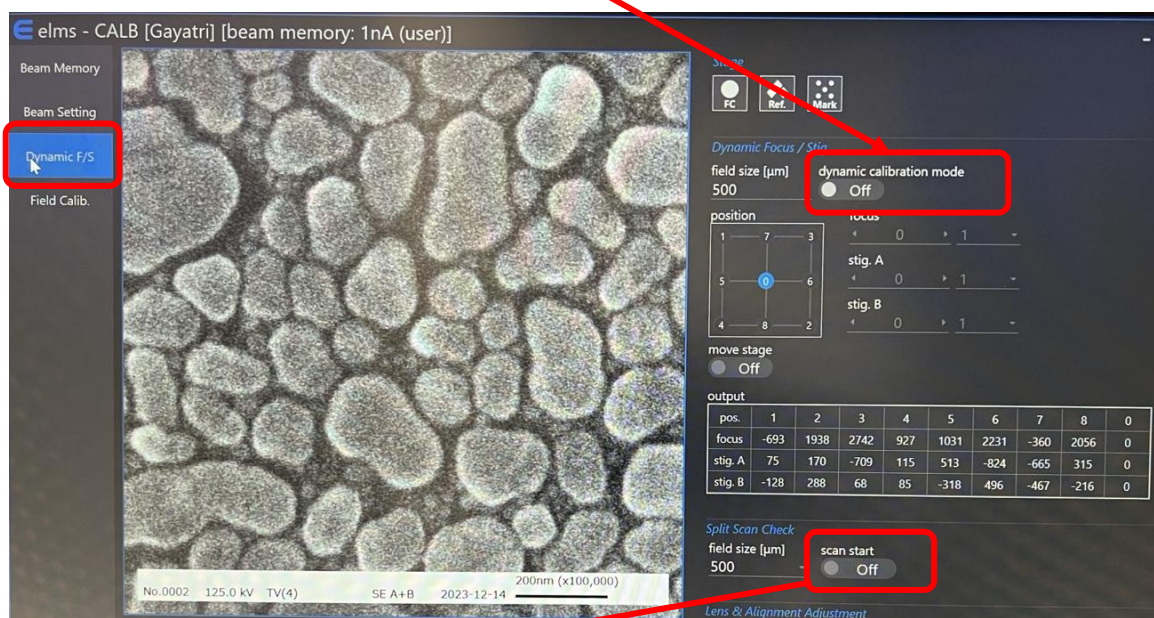
After completing the beam calibration

43. You can also use the AUTO option to adjust the beam parameters once you are more familiar with the operations.

Dynamic Focus and Astigmatism Calibration

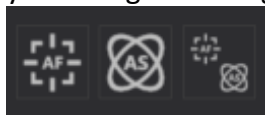
44. Activate the dynamic calibration tool palette

45. Click on the **Dynamic Calibration Mode**



46. Click on **Scan Start**

47. This will check the **DyFocus (AF)** and **DyStig (AS)** sequentially across all peripheral corners of your designated target field that require focus or astigmatism corrections.



48. Review the visual results:

49. Stop the Scan

50. If the focus profile satisfies your target exposure parameters, proceed to the next step.

51. If aberrations or blur remain, **repeat the AF and AS** routine on the problematic quadrants.

52. Click on **SCAN Start** again to check the results.

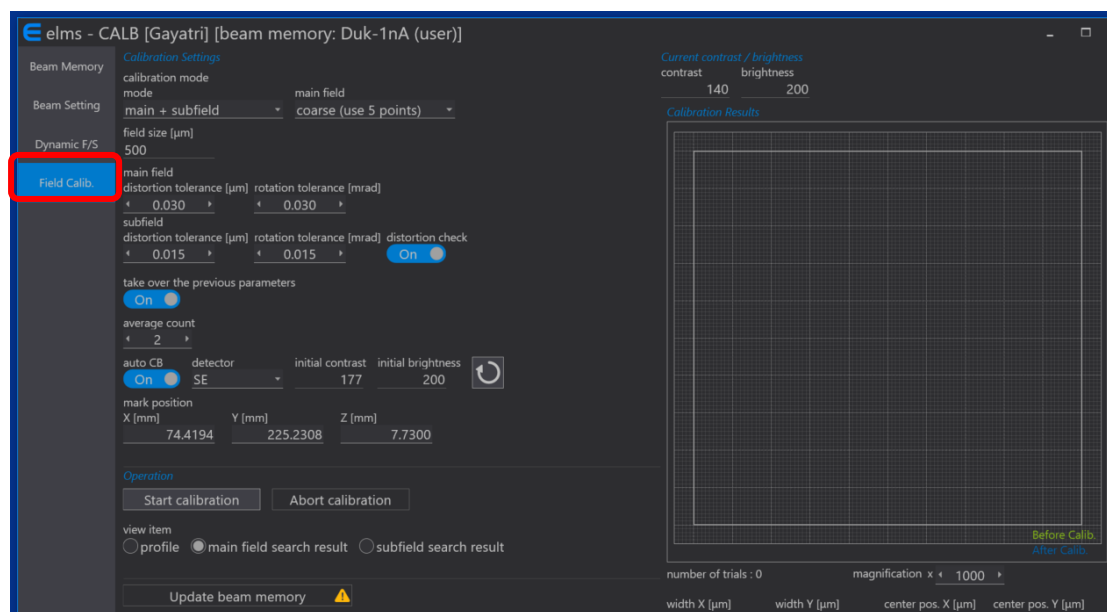
53. Once fully optimised, turn off the active **Scan Start** tracking and disengage the Dy. Calibration buttons.

54. Click on

Update beam memory

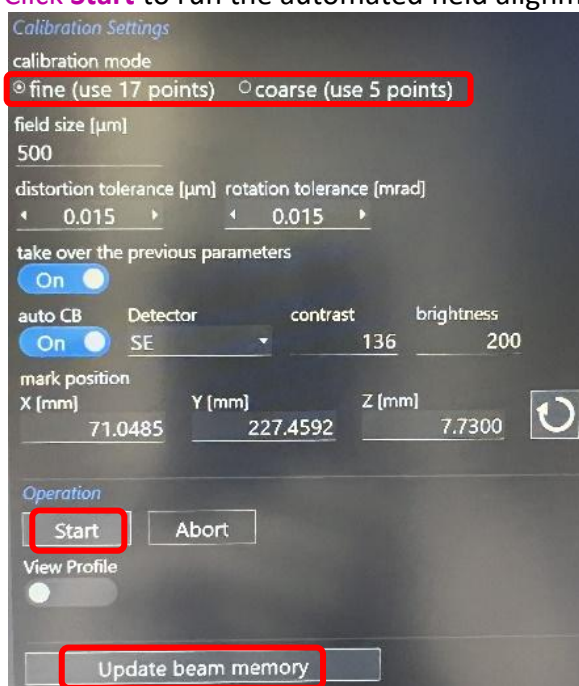
Executing Field Alignment

55. Click the **Select Field Calib** operational tab.

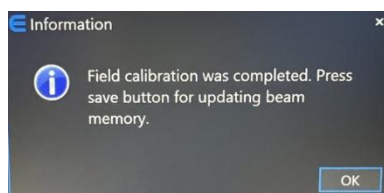


56. Select the calibration mode (coarse/fine)

57. Click **Start** to run the automated field alignment routine



58. Wait for the program to complete the calibration matrix before proceeding

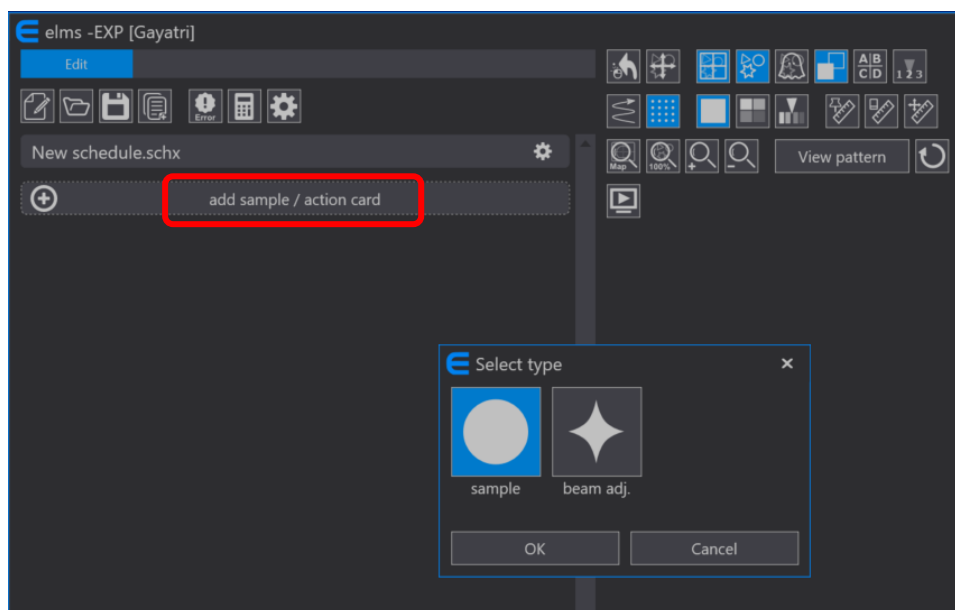
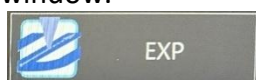


59. Click ok and update the Beam Memory

Set up the Exposure

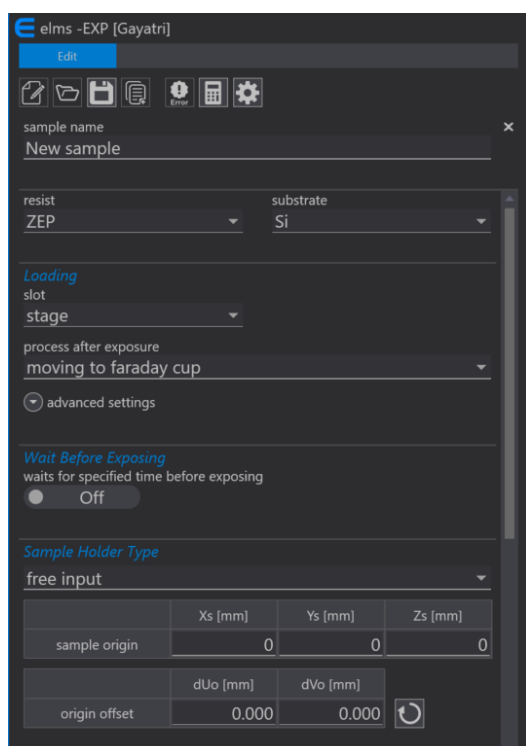
60. Return to the primary workstation monitor and navigate to the **main ELMS Launcher** software interface

61. Click on the **EXP (Exposure)** module button. This action will launch the main exposure execution window.



62. Within the active EXP panel, click on the **Add Sample / Action Card** button to initiate the session profile

63. A secondary pop-up selection window will appear. Select **the sample** and Click **ok**
Once your sample card is generated, an extensive parameter menu will populate on the screen.



elms -EXP [Gayatri]

Edit

sample name
New sample

resist
ZEP

substrate
Si

Loading
slot
stage

process after exposure
moving to faraday cup

advanced settings

Wait Before Exposing
waits for specified time before exposing
Off

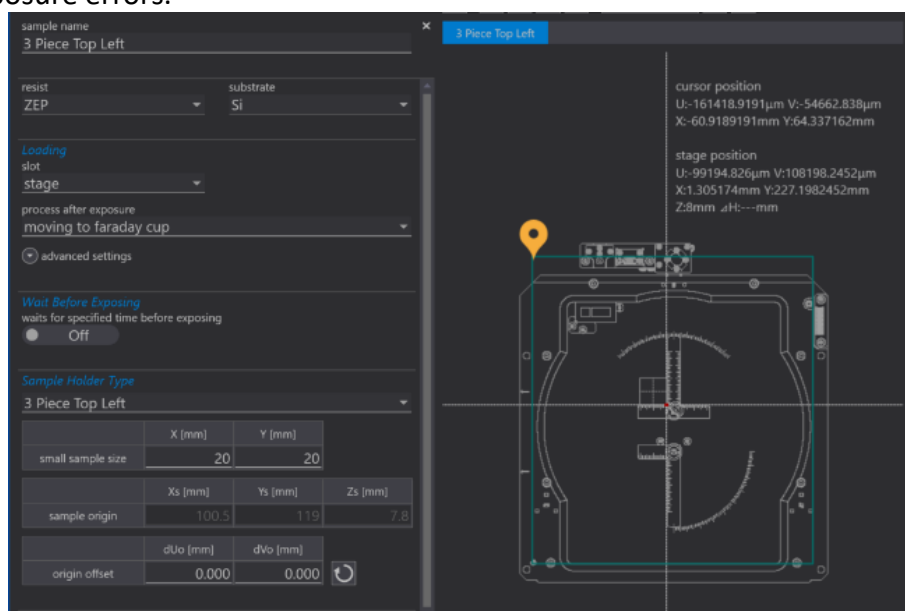
Sample Holder Type
free input

	Xs [mm]	Ys [mm]	Zs [mm]
sample origin	0	0	0

	dUo [mm]	dVo [mm]
origin offset	0.000	0.000

64. Carefully fill in your specific sample dimensions and target layout criteria as demanded by your lithography run
65. Navigate to the **Sample Holder Configuration** drop-down menu
66. Select the exact physical holder block that you loaded into the tool during the mechanical loading phase (e.g., *1x4"*, *3x2" combination block* or *2" wafer x 6 slots*).

Note: Selecting an incorrect layout template here will result in beam alignment failures and spatial exposure errors.



sample name
3 Piece Top Left

resist
ZEP

substrate
Si

Loading
slot
stage

process after exposure
moving to faraday cup

advanced settings

Wait Before Exposing
waits for specified time before exposing
Off

Sample Holder Type
3 Piece Top Left

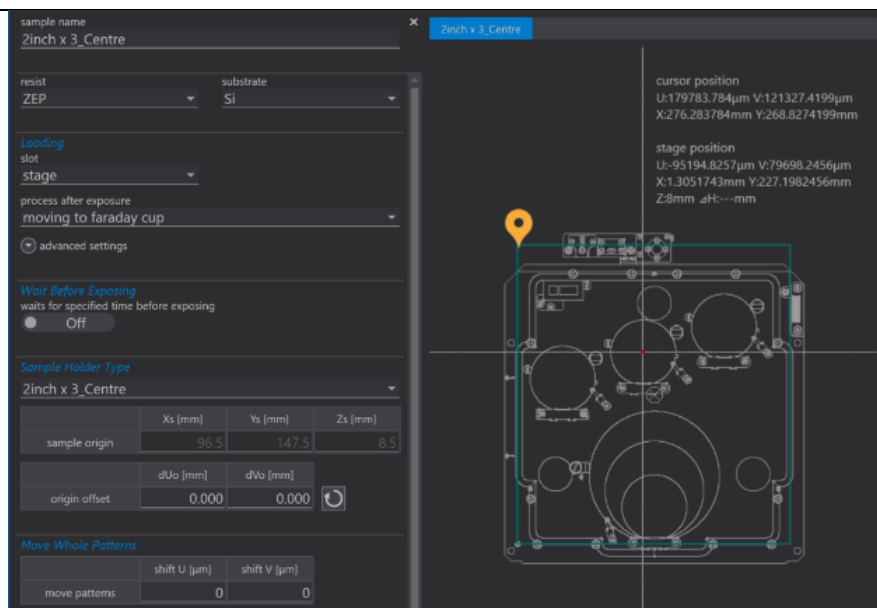
	X [mm]	Y [mm]
small sample size	20	20

	Xs [mm]	Ys [mm]	Zs [mm]
sample origin	100.5	119	7.8

	dUo [mm]	dVo [mm]
origin offset	0.000	0.000

cursor position
U:-161418.9191μm V:-54662.838μm
X:-60.9189191mm Y:64.337162mm

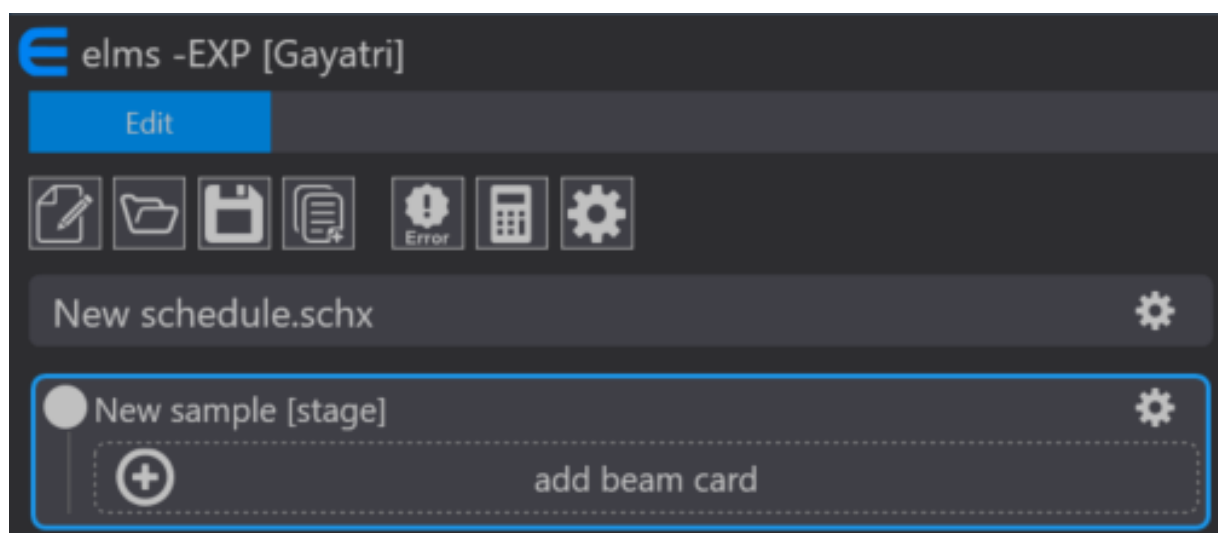
stage position
U:-99194.826μm V:108198.2452μm
X:1.305174mm Y:227.1982452mm
Z:8mm ΔH:--mm



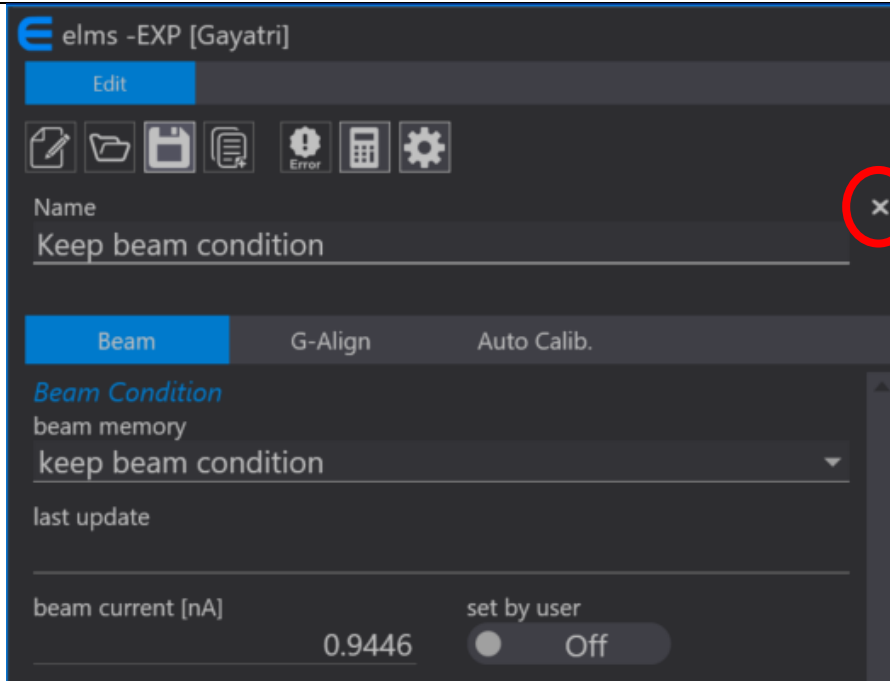
67. After verifying all input parameters, click the **x** icon in the upper-right corner of the menu block to securely commit the configuration to system memory and close the configuration sheet.

Initialising Beam and Layout Pattern Cards

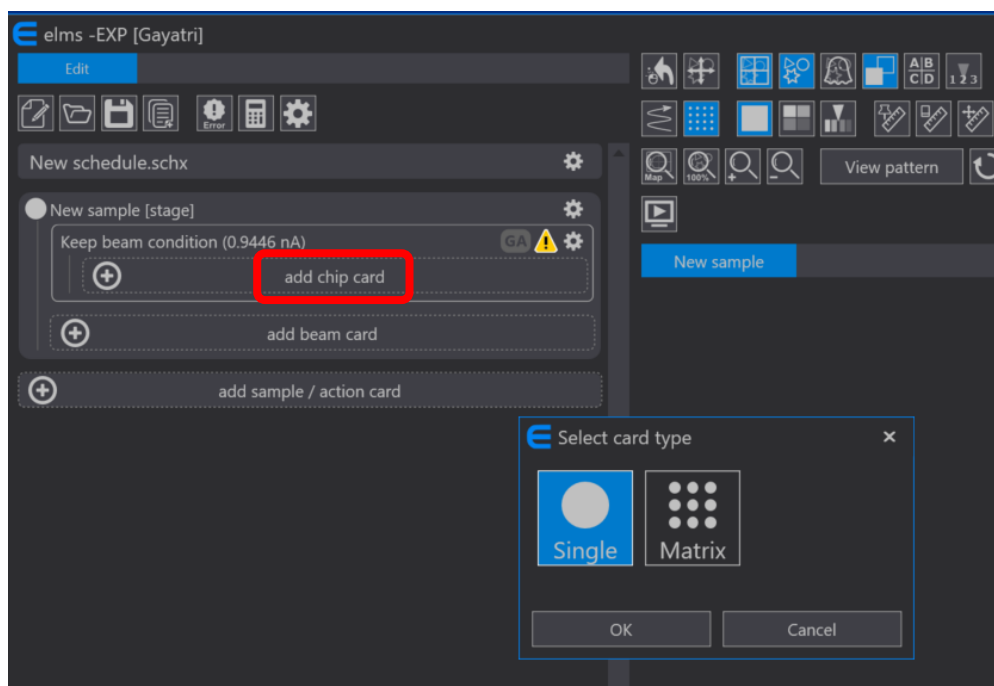
68. From the primary exposure workflow dashboard, click on the **Add Beam Card** option



69. Review the automatically populated **Beam Conditions** to ensure they perfectly match the active current profiles you validated during your calibration

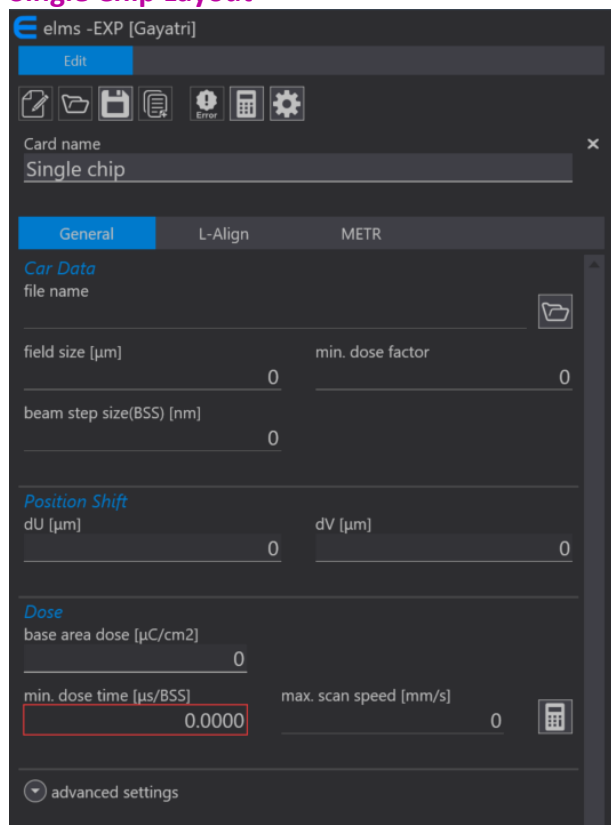


70. Select **Auto Calib** and deactivate the active buttons.
71. Click the **x** icon to close.
72. Click on the **Add Chip Card** button to open the pattern distribution wizard

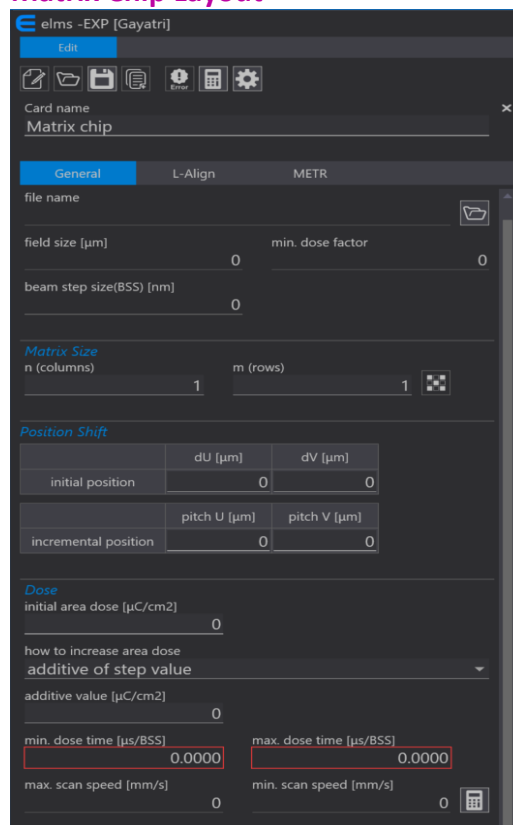


73. Select either a **Single** chip layout configuration or a **Matrix** layout arrangement, depending on whether you are exposing an individual pattern or a recurring grid across your substrate.

Single Chip Layout



Matrix Chip Layout

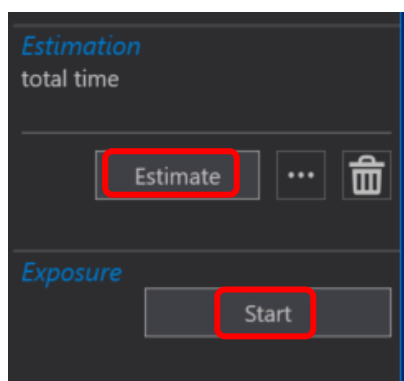


Matrix Exposure Parameters, Optimisation, and Job Launch

74. If utilising a **Matrix array** distribution layout, you must precisely populate the multi-variable data fields within the active control window:

- **Design File Assignment:** Click the file browser icon to locate, verify, and upload your compiled design layout file (must be in .car format).
- **Position Coordinates:** Input the absolute spatial starting coordinates (X and Y) to anchor the pattern array perfectly on your substrate.
- **Matrix Grid Dimensions & Step Pitch:** Enter the target rows and columns for your grid array, alongside the precise physical step increments between individual chips.
- **Dose Selection Arrays:** Define your base **Initial Dose**, your dynamic **Dose Increment** scaling values, and your **Step Size** parameters to execute a dose matrix if required for resist optimisation.

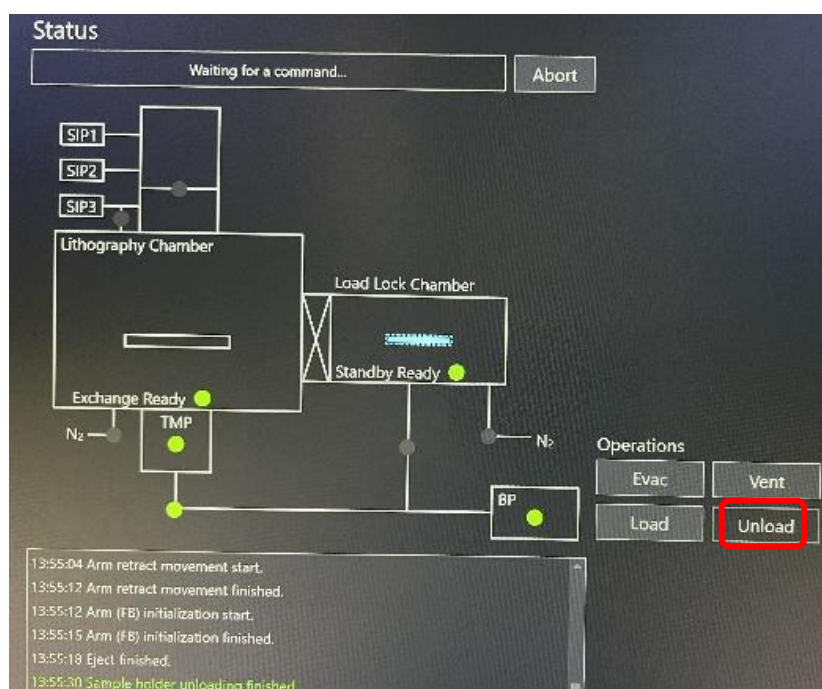
75. Once all mandatory operational data fields are fully populated, click the **Estimate** button. The system will calculate and display the total overall runtime for the pending exposure.



76. After validating the time projection, click the **Start** button to prepare the job execution pipeline.
77. When prompted by the system interface dialogue box, save your entire compiled exposure layout as a formal schedule file (utilising the .schx file extension) inside your user directory.
78. The system will automatically lock the user interface and immediately initiate the automated exposure process.

Sample Unloading

79. Once the exposure process is entirely complete, the stage will automatically navigate back to the Faraday Cup position/stay in place to unload itself automatically as per your preference selected in the **sample/action card**.
80. If the FC or stay in place option is selected, click the **Unload** button on the control UI



81. Wait safely until the automated mechanical transition finishes and the system log window prints the confirmation message: "Sample unload finished"
82. Approach the physical instrument control panel situated at the front of the Load Lock (LL) chamber. Press the **VENT** button to equalise the vacuum chambers.



83. Wait for the venting cycle to finish; the orange backlit **VENT** button will turn off once the internal pressure balances with the room environment.
84. Manually open the Load Lock lid. Slide the safety mechanical restraint pin (located at the right edge of the LL chamber assembly) into the parallel hole on the side of the lid bracket to safely lock the heavy lid in its open vertical position
85. Carefully remove the sample holder and mount it securely back onto the **designated Holder Stand**.



86. Disengage the safety pin and close the Load Lock chamber lid



87. Press the physical **EVAC** button on the instrument panel to return the chamber to its standby vacuum state.
88. Return to the computer workstation and **Log Out** from your active system session
89. Carefully disengage the manual holding clamps with your gloved fingers to avoid scratches on the holder and unmount the processed substrate from the sample holder
90. Store your exposed sample safely inside a closed, black lockable plastic carrier box for safe transport.
91. Place the empty sample holder back into its designated storage box

Post-Processing & Development [Ref. IM_160-P3.51B_WB2]

92. Transport your sample inside its sealed container to Wet Bench 2 (**WB2**) for chemical processing.
93. Perform development chemistry based on the precisely optimised processing times calibrated for your specific resist type.
94. Execute an Isopropyl Alcohol (IPA) rinse bath step (as per the specific chemical properties of the resist variant used).
95. Perform a Deionised (DI) water final rinse step if required by the resist protocol.

TRANSPORT METHOD for hazardous substances, biological, animal, or radioactive materials or plant equipment

Chemical & Material Transport

- **Containing Hazardous Samples or substances:**

All samples, substrates, and chemical components must be safely moved between lab bays using fully closed, impact-resistant plastic carrier boxes equipped with secure locking latches

WASTE DISPOSAL

Cleanroom Waste Disposal Requirements

- **General Waste:**
Dispose of cleanroom wipes, tapes, and other consumables in the standard waste bins located in the yellow lithography rooms and gowning area.
- **Sharps Handling:**
Immediately dispose of cracked or broken substrate pieces, used silicon chips, and glass shards in the designated sharps containers in the yellow rooms.
- **Chemical Hazardous Waste:**
Dispose of chemical hazardous waste only in the designated yellow contamination bins.

COMPLETION OF WORK – List steps to make the area safe (include clean up, any waste disposal & service/maintenance requirements)

Work Area Completion & Maintenance Checklist

Users must explicitly complete the following actions before leaving the tool bay vacant:

- **Area Clean-up:**
Thoroughly clean down the laboratory workbench and instrument surfaces after concluding work. Ensure no loose pieces of tape, shattered glass, or used wipes remain on surfaces.
- **Component Organisation:**
Double-check that all tools (tweezers, holder stand) and specific sample holders are placed back in their respective protective boxes.
- **Safety Compliance:**
Verify that all chemical bottles used are sealed tightly and that the tool's Load Lock chamber is left under an active vacuum state (**EVAC mode**).

Workers must read and completely understand the relevant equipment risk assessment and this instruction manual before they are allowed to work on the activity without direct supervision.