Tescan EBL/SEM
Standard Operating Procedure
AggieFab
Texas A&M University
Update: 8/12/2025

Contents

❑ SCOPE

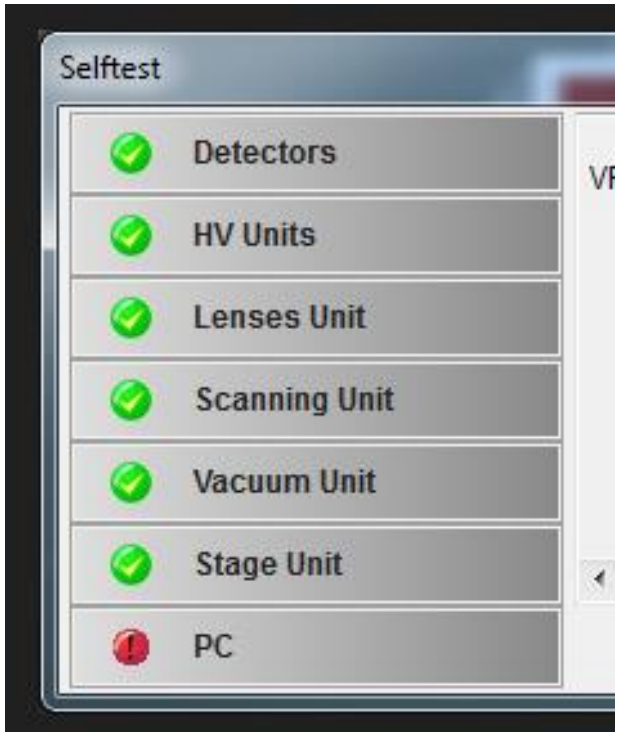
- The purpose of this document is to describe requirements and basic operating instructions for the Tescan SEM/EBL System. The use of this tool is limited to approved processes only.

❑ SAFETY

- Be sure that you are trained and signed off to use this equipment.
- Use care when operating around high voltage or high current.
- If you are unsure about any procedure or indication while operating this equipment be sure to contact a staff member or trainer for assistance.
  - Primary contact: Sung Oh Woo, sung.woo@tamu.edu

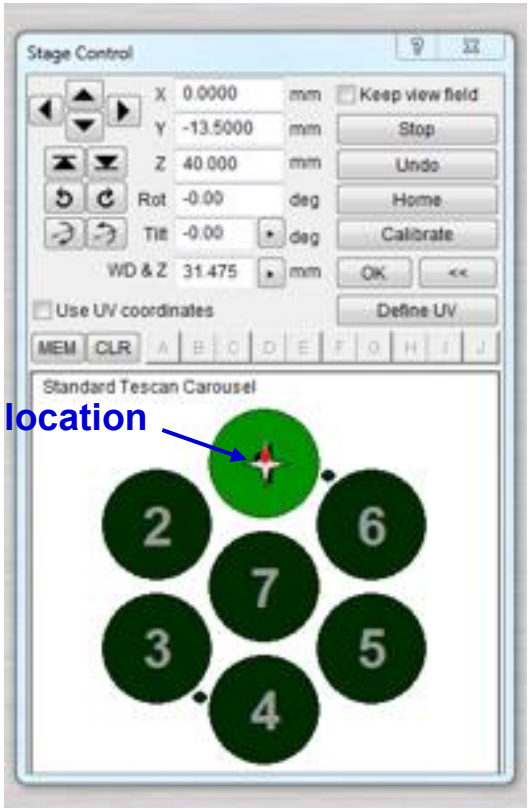
Start

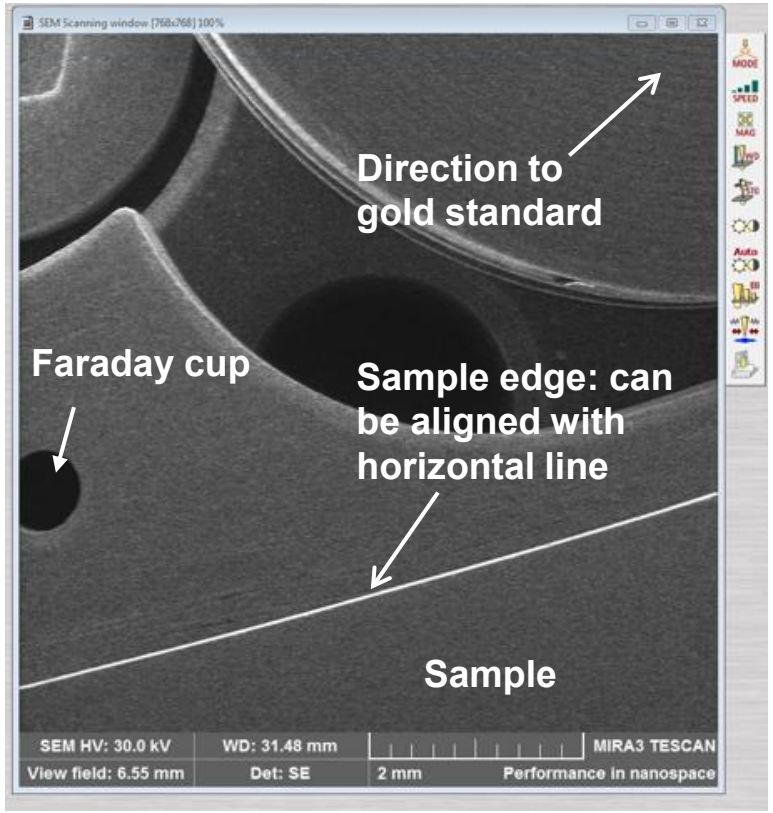
- Login with your account
- The MIRA3 control software always appears. Otherwise, click the MiraTC icon.
- Self test will be performed upon login



Beam alignment (1/4)

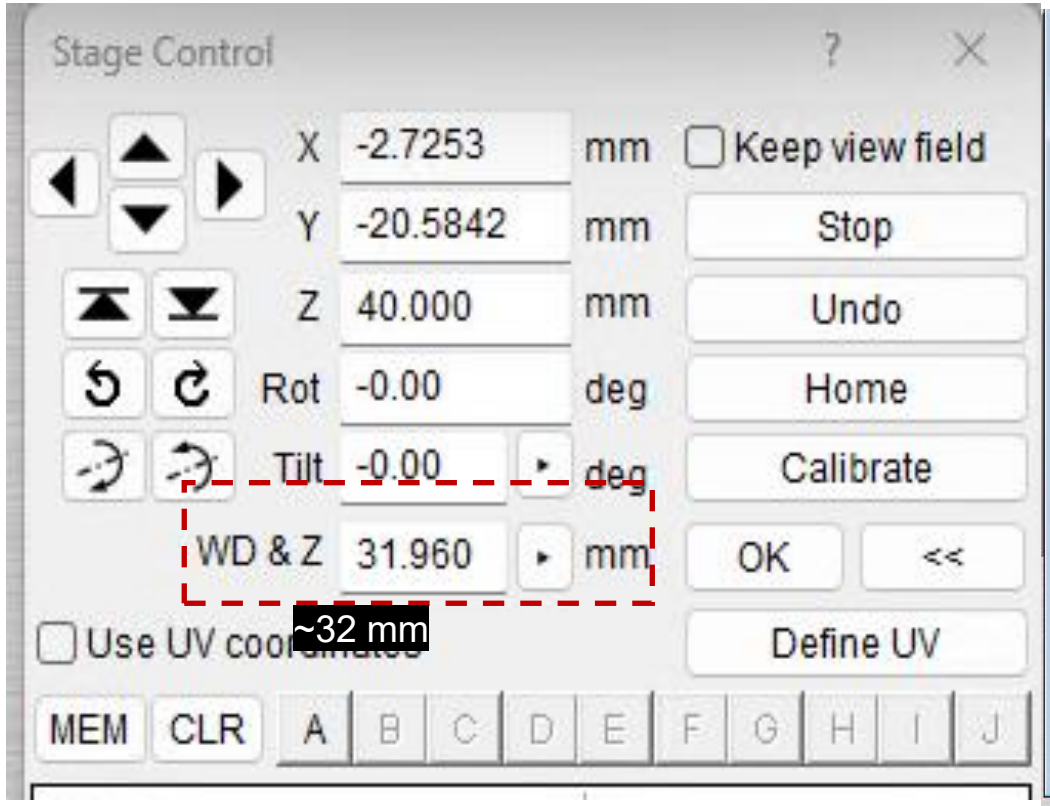
1. Click **‘1’** on the SEM control to avoid exposure at the center of sample
2. Start e-beam: ‘Beam On’ button
   - The screen shows similar image with the following SEM picture
   - Set magnification low, < 100X
3. Select proper BI (BI=10 for smallest beam spot size)

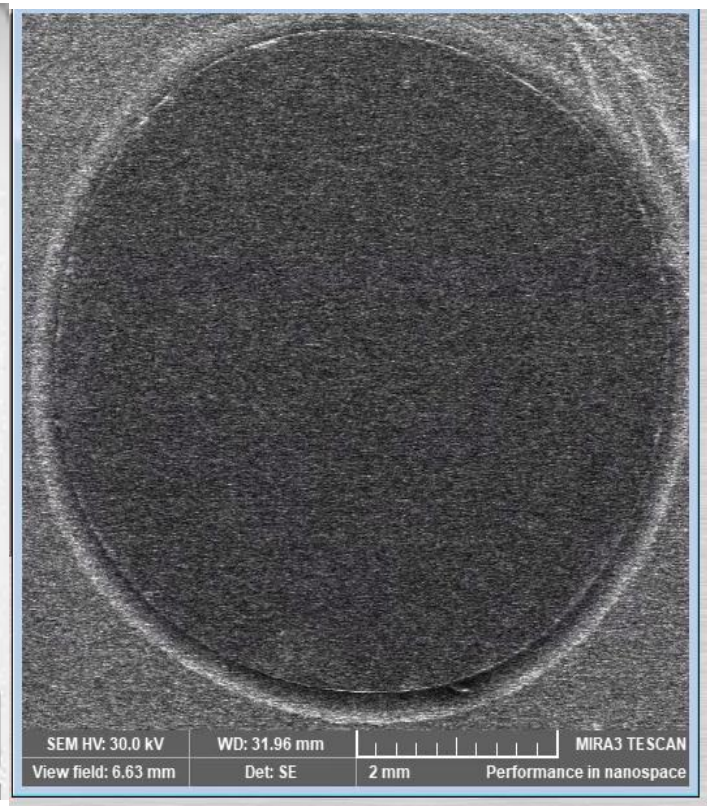


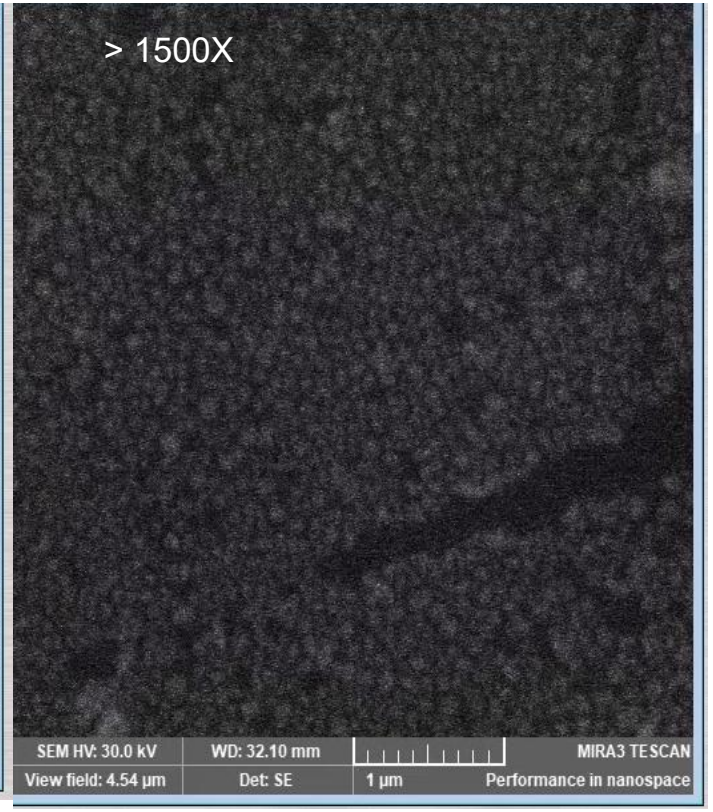


Beam alignment: (2/4)

1. Locate the gold standard (direction can be found from previous slide)
2. Focus the surface at the magnification of 1000X or higher
   - At this moment, Z&WD (working distance) > 30 mm
   - Focus on the gold standard, like right image
     - No fine focus is needed at this moment

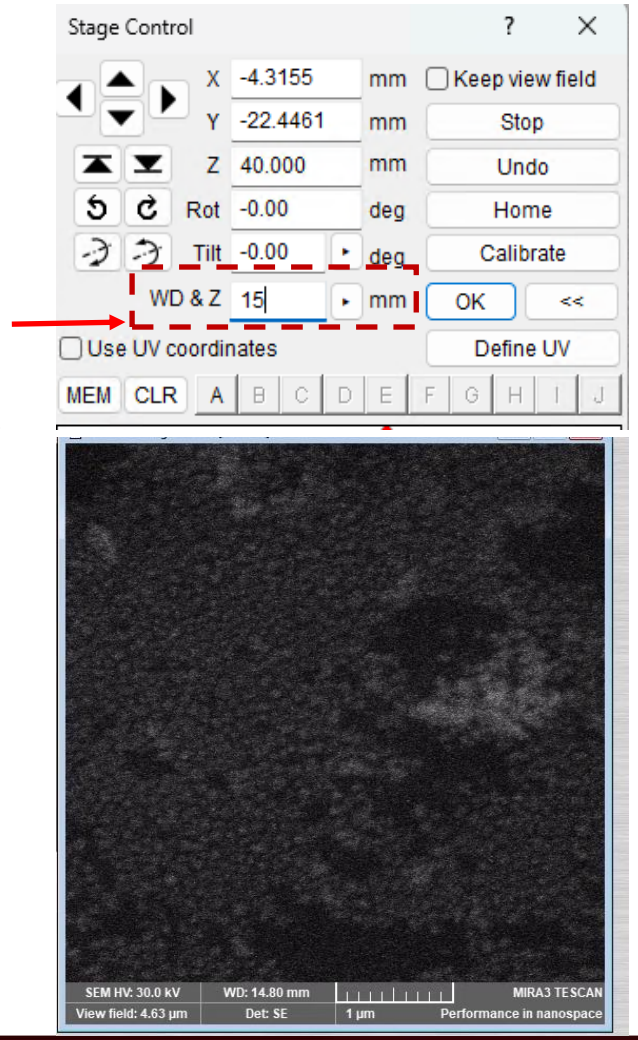




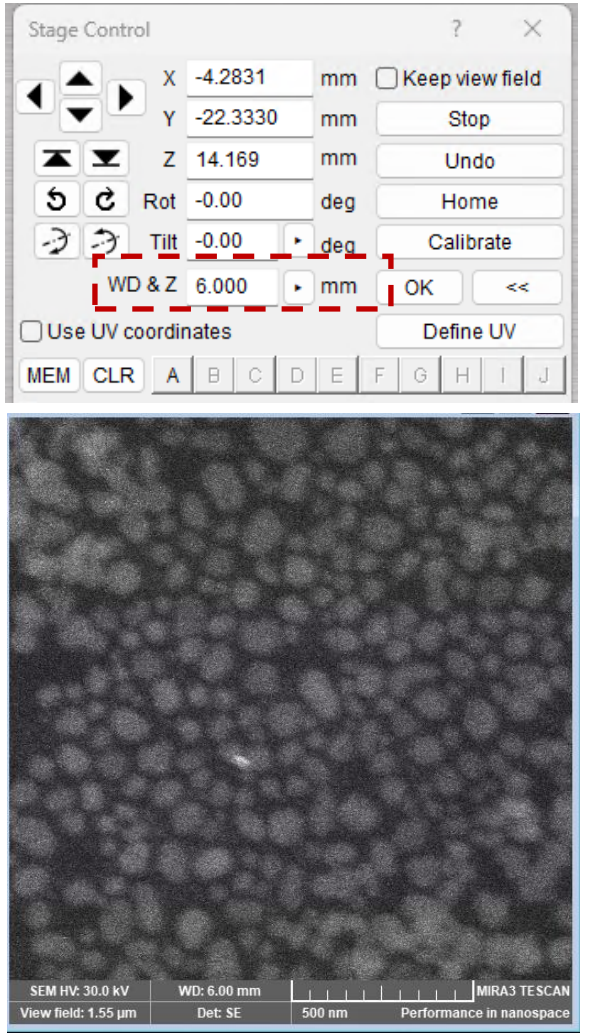


Beam alignment (3/4): bring WD to 6 mm

Type & Enter or click 'ok'

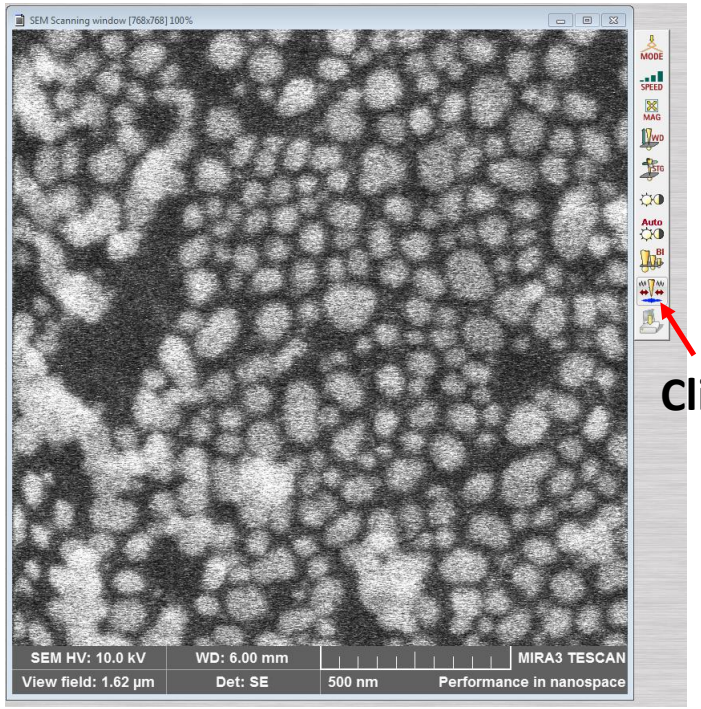


Three steps
- WD 15 mm & focus
- 10 mm & focus
- 6 mm & focus & stigma

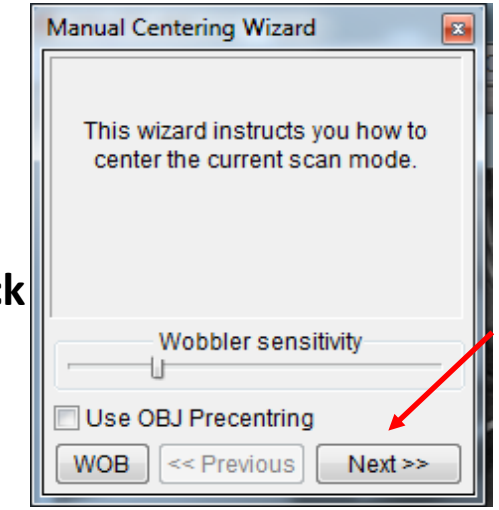


Beam alignment: 4/4

- Do focus & stigma
- Do wobbling correction at magnification of 100,000 X or higher



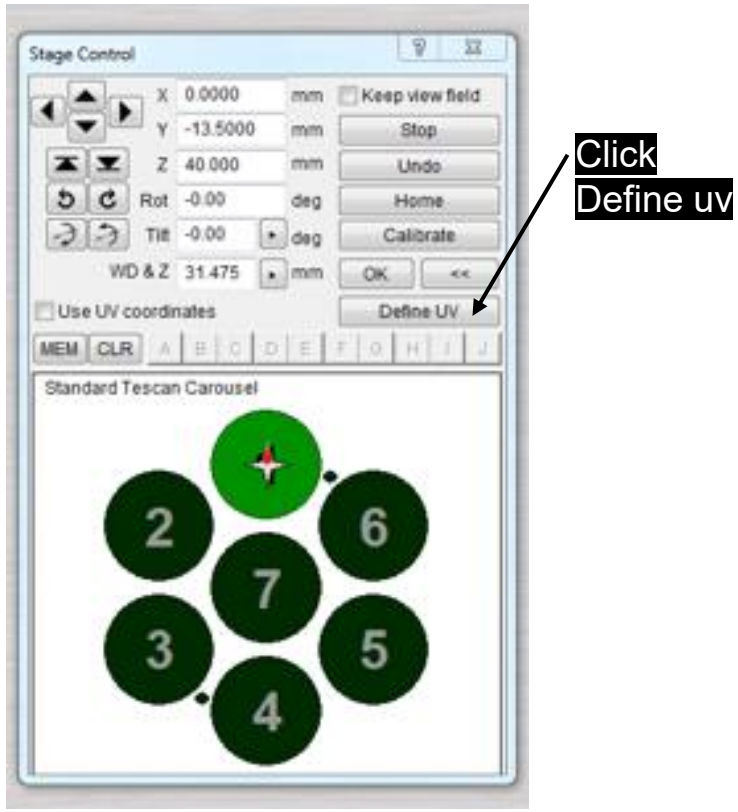
Click



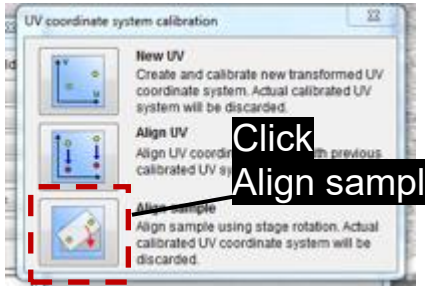
- **Click Next**
- **Do the wobbling**
  If the images are shaking laterally while WOB activated, correct it until any particles shows only focus-defocus mode.
- **Click finish**

Sample alignment

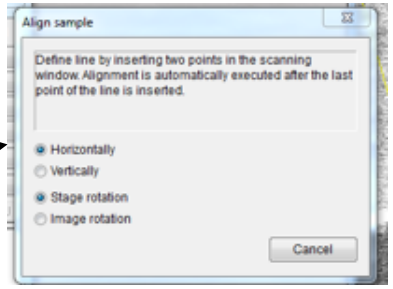
1. Come back to **‘1’** position
2. Sample alignment: click ‘**Define UV**’

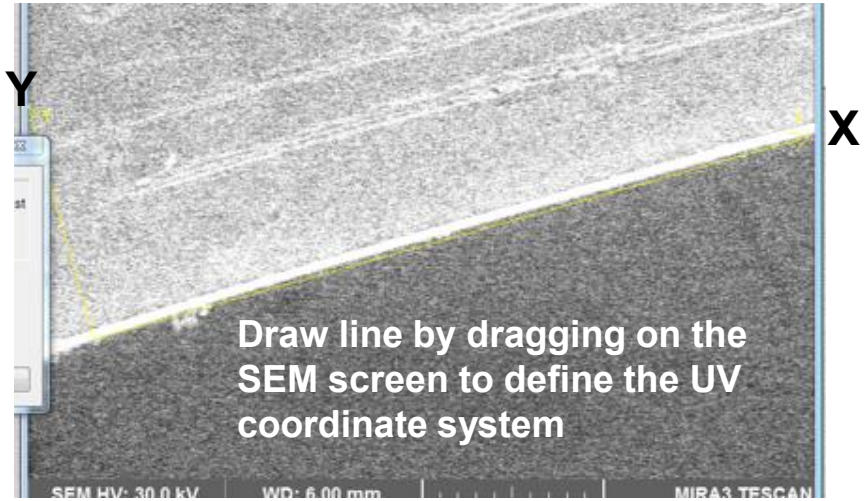


Click
Define uv



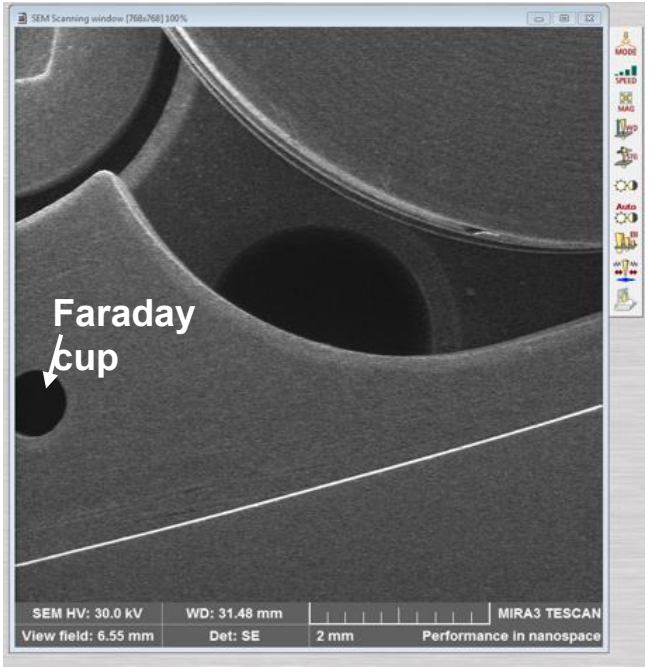
Click
Align sample

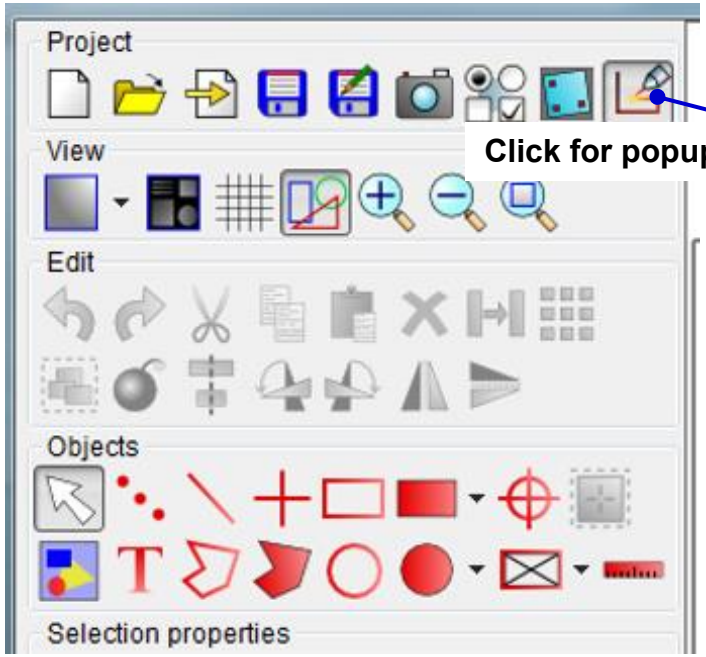


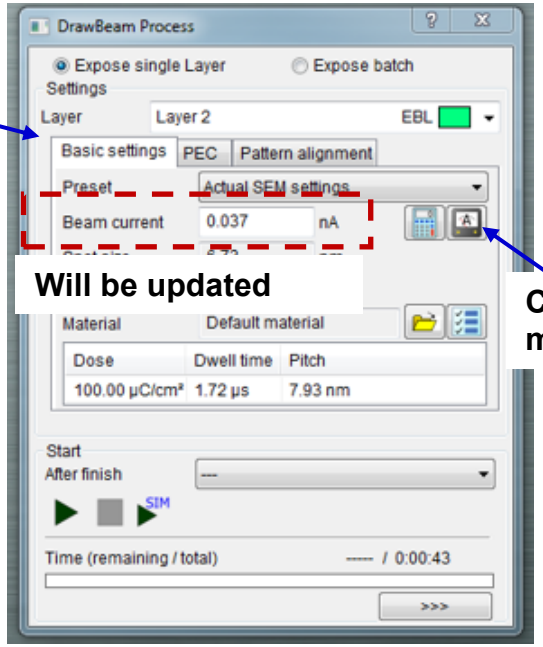


Electron beam current measurement

1. Move to Faraday cup & Zoom in completely
2. Select proper BI (beam intensity)
   - For multiple BIs, measure all the currents corresponding to Bis
   - Beam alignment should be done with the BI corresponding to smallest beam current
3. Open the DrawBeam Process
4. Measure the beam current → update the 'Beam current' value

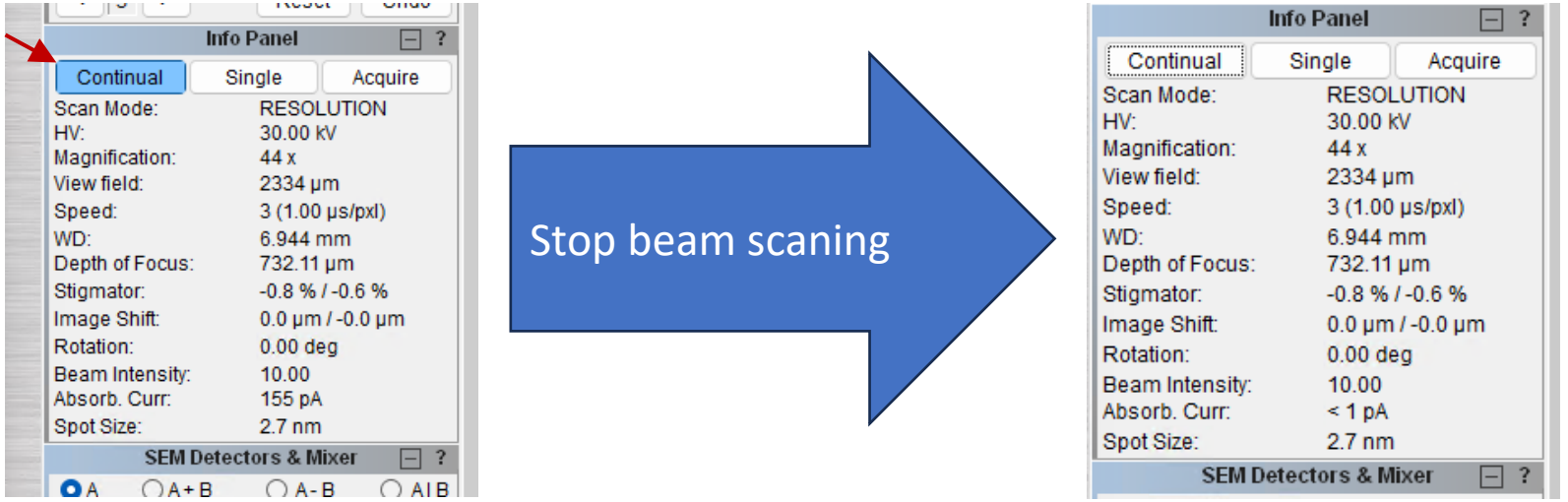






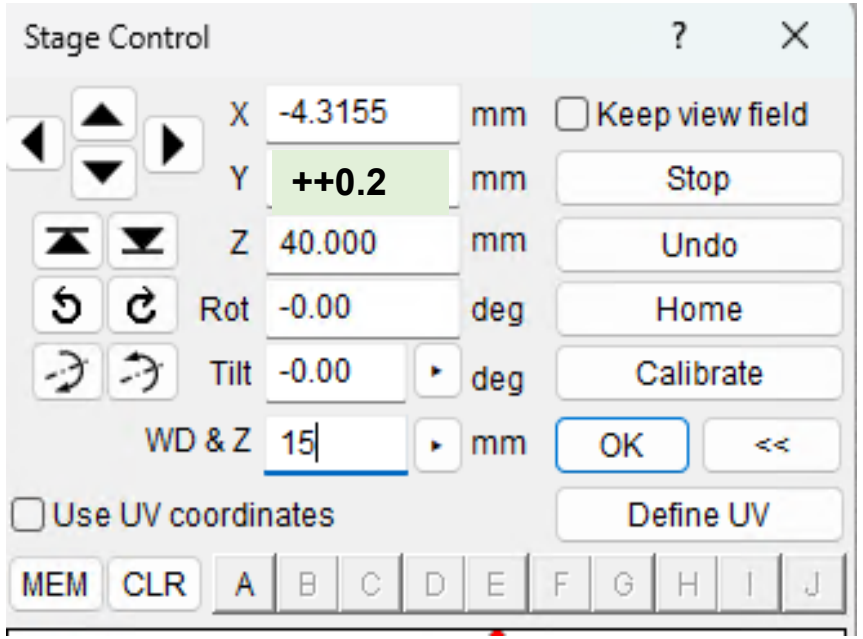
Exposure on the substrate (1/4)

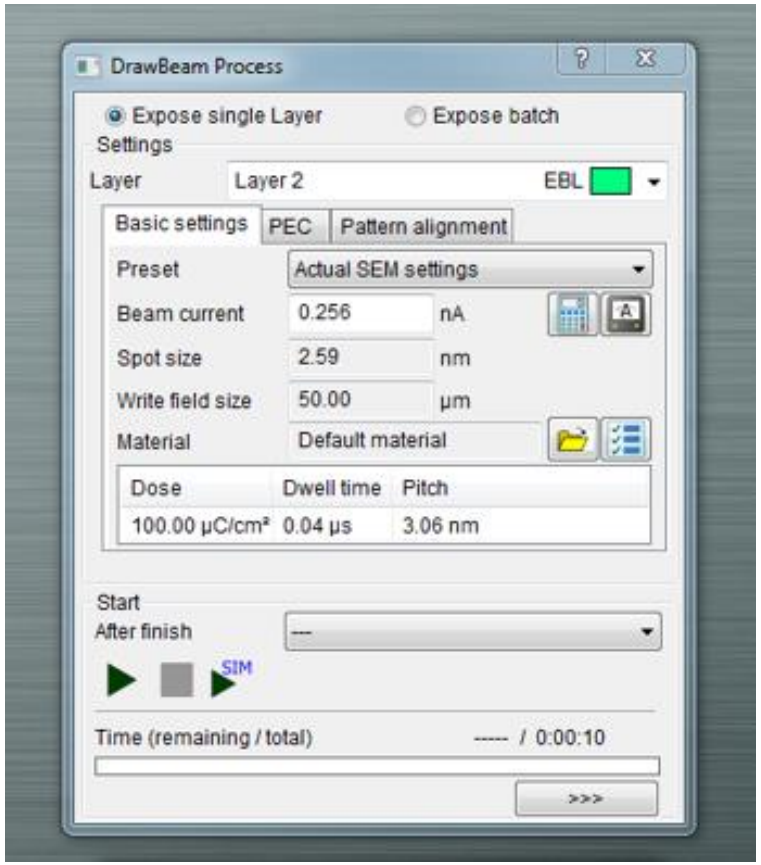
1. Locate at the sample area
    1. Find a location where focus can be made
    2. Or, a scratch has been made, locate the end of the scratch
2. Focus & stigma at high magnification (e.g. 100,000X) – during focusing, PMMA will be damaged
3. Move to unexposed location
    1. Turn off the beam – click ‘Continual’



Exposure on the substrate (2/4)

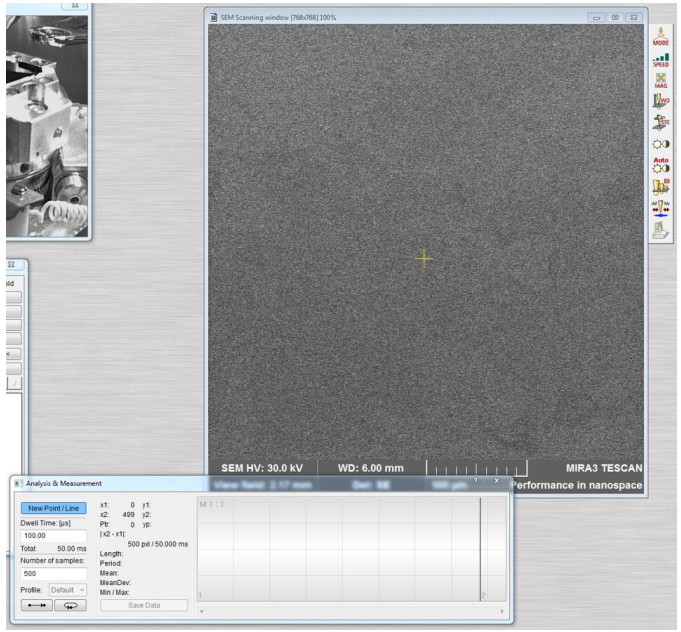
1. Move 100 ~ 200 μm away (downward) to avoid e-beam exposed area
   - E.g., **“++0.2”** → send the stage 200 μm along positive direction
2. Start exposure

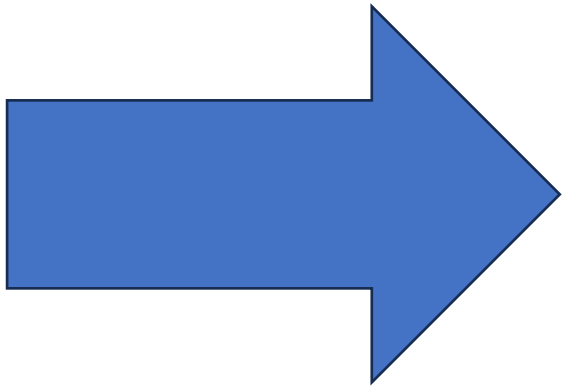


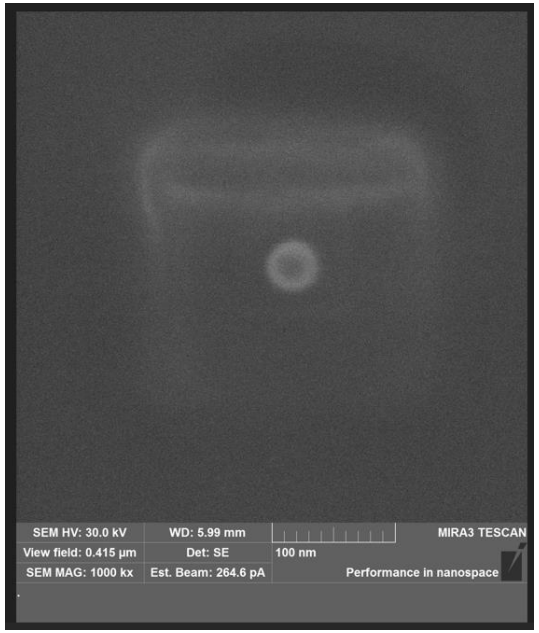


Exposure on the substrate (3/4)

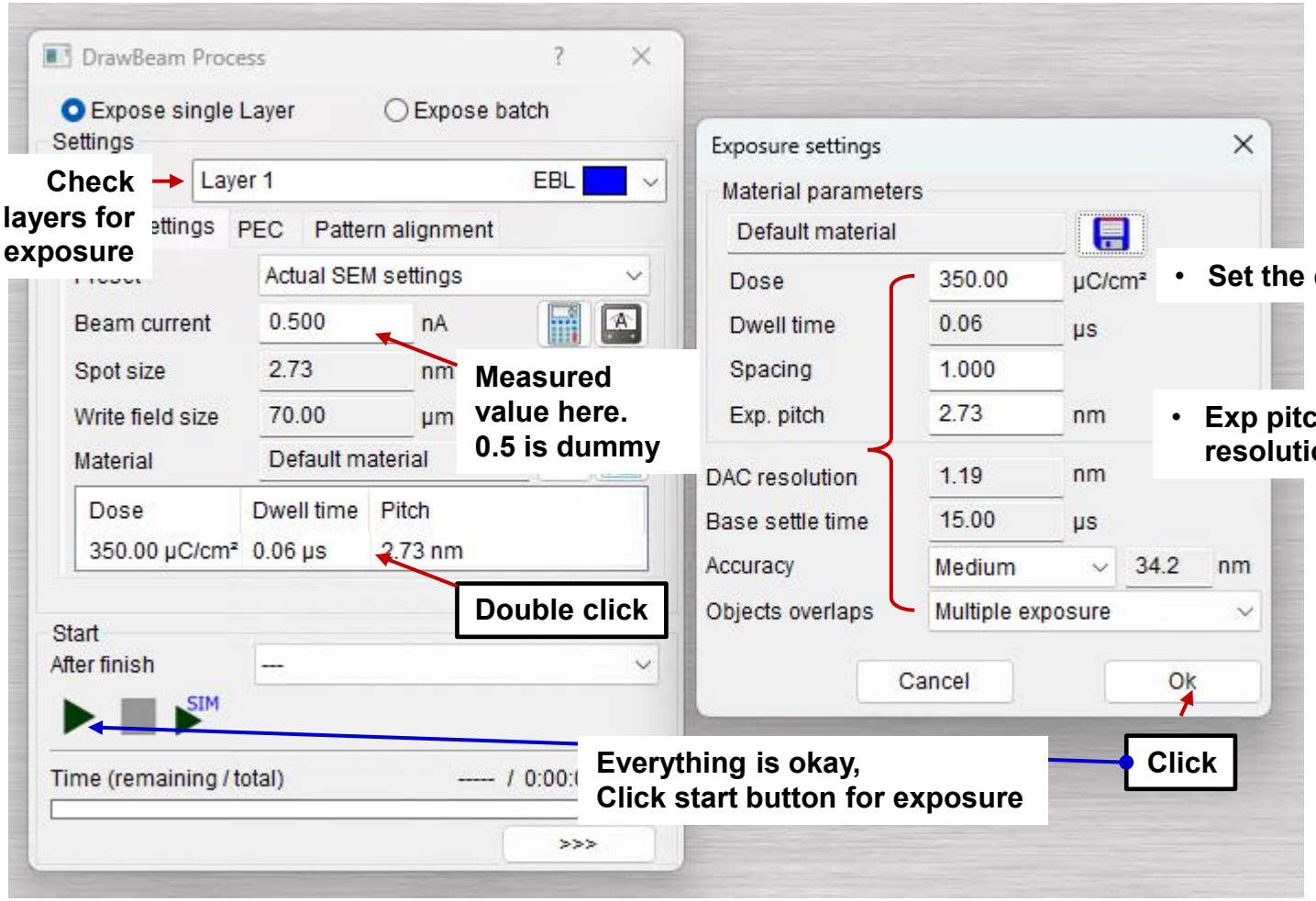
1. Making a beam spot: checking the beam shape (stigma) & focus
   - Max magnification → Analysis & Measurement → click at the center of SEM window → yellow cross
   - Click ‘Start button’
     - This takes 30 – 60s depending on current stigma & focus
2. Beam shape
   - Perfect circular shape (right image): move forward for exposure
   - Not clear oval or linear shapes: adjust stigma & focus
   - Nothing appeared: go back to previous location and do focus and stigma, then repeat making beam spot



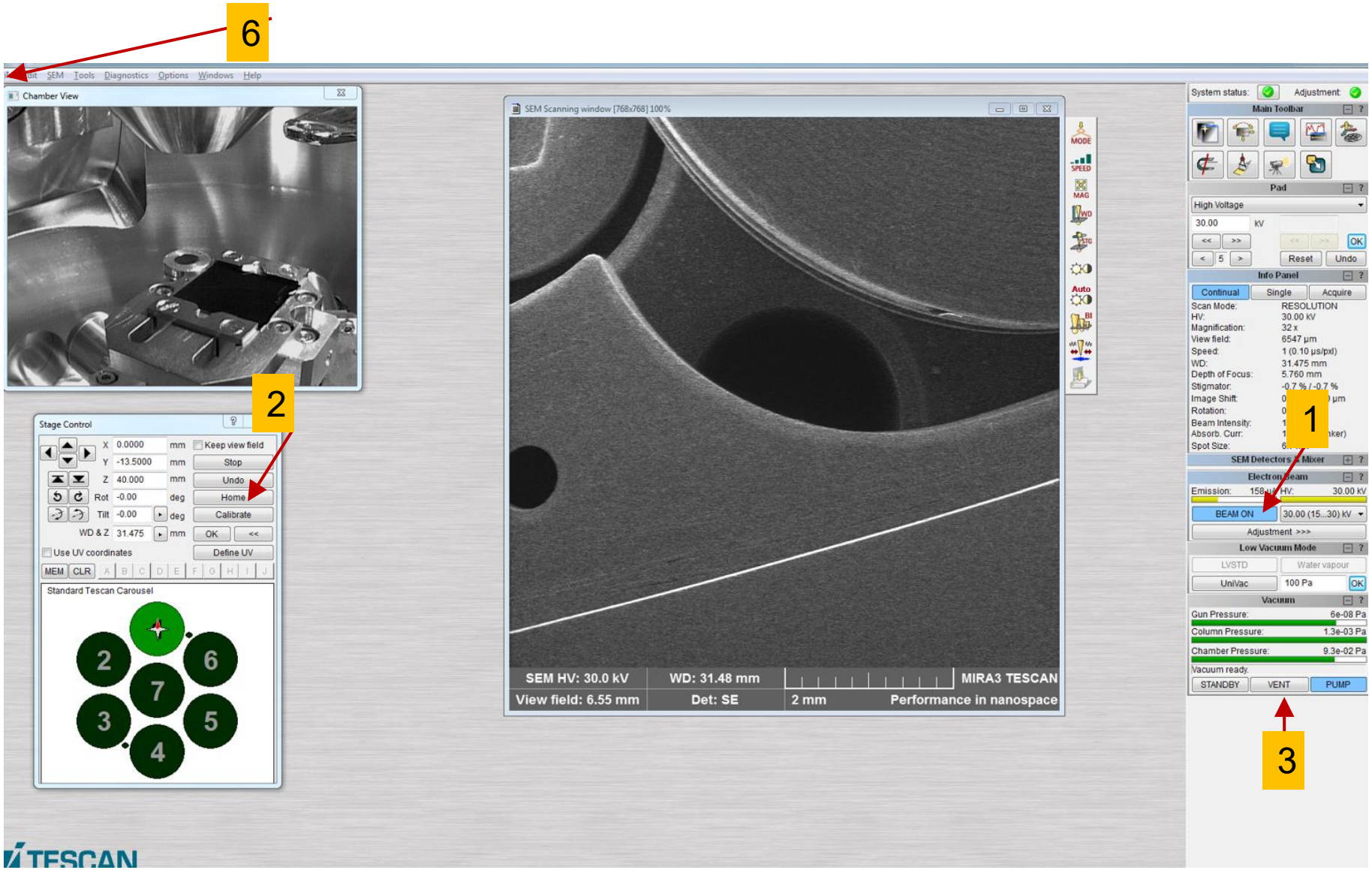




Exposure (4/4) – set the exposure parameters



Shutdown



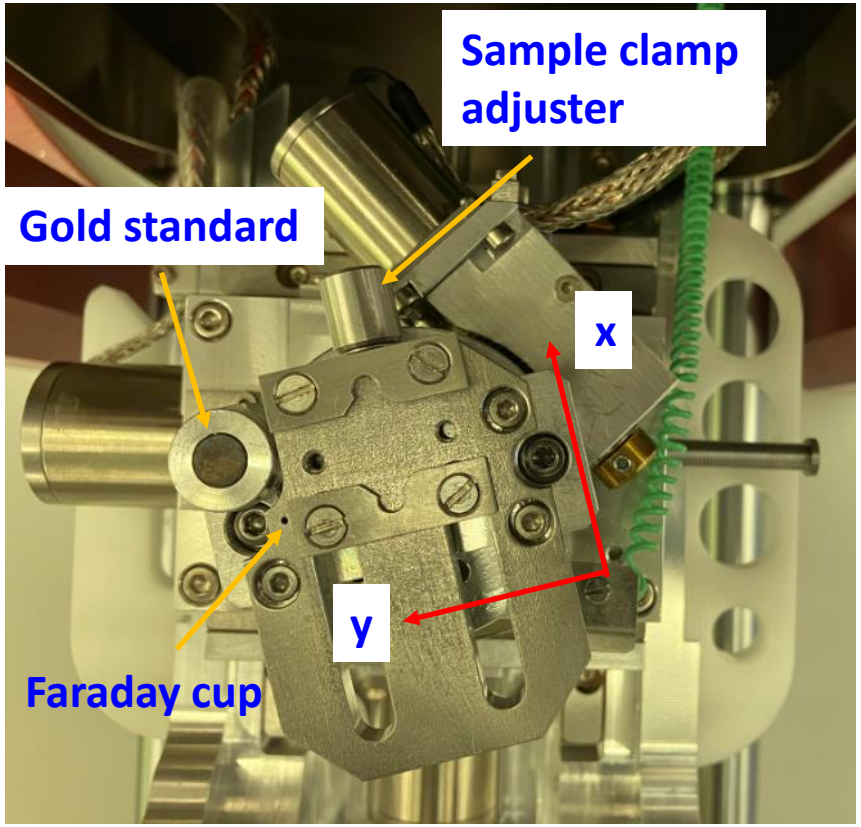
1. Shut off Beam
2. Home stage
3. Vent
4. Unload sample
5. Pump – wait until the pressures turn to green
6. File – log off
7. No for Standby mode

Appendix

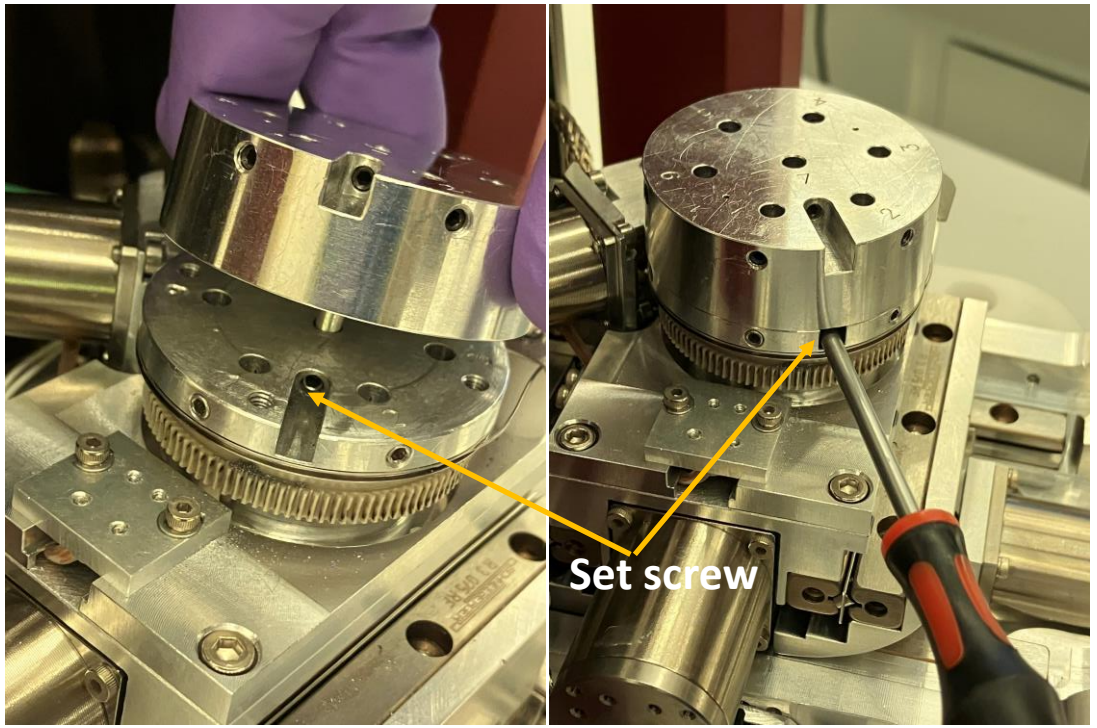
Sample stage

- If another stage needs for the operation, switch one to the other

EBL stage



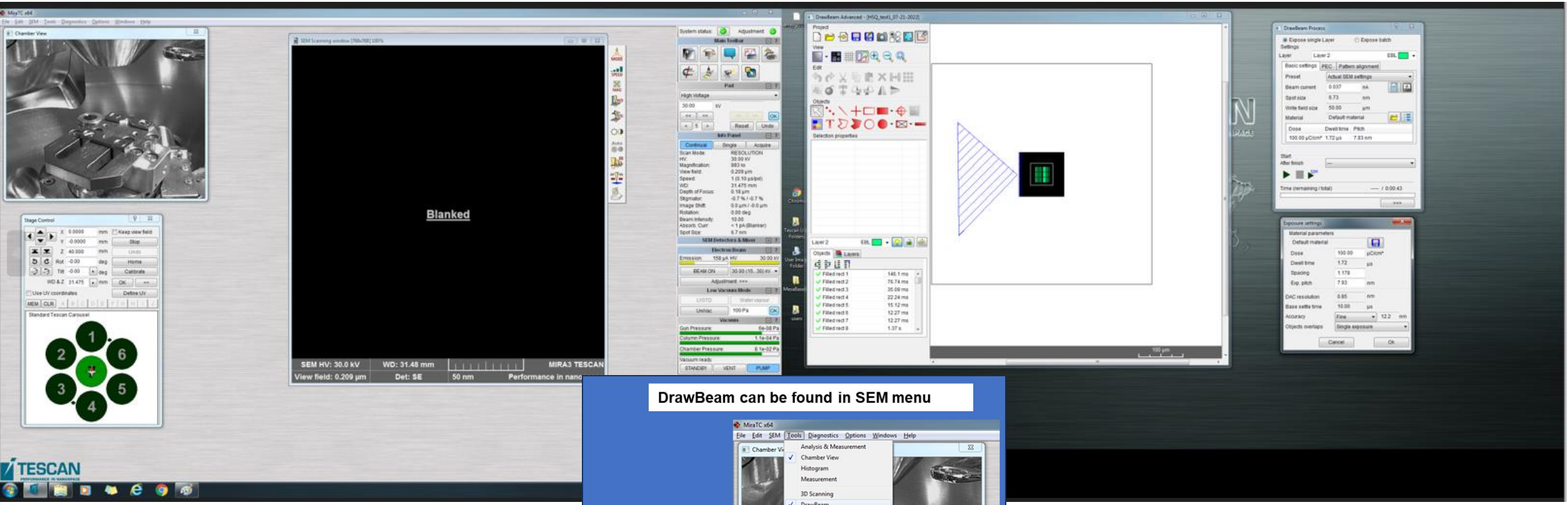
SEM stage

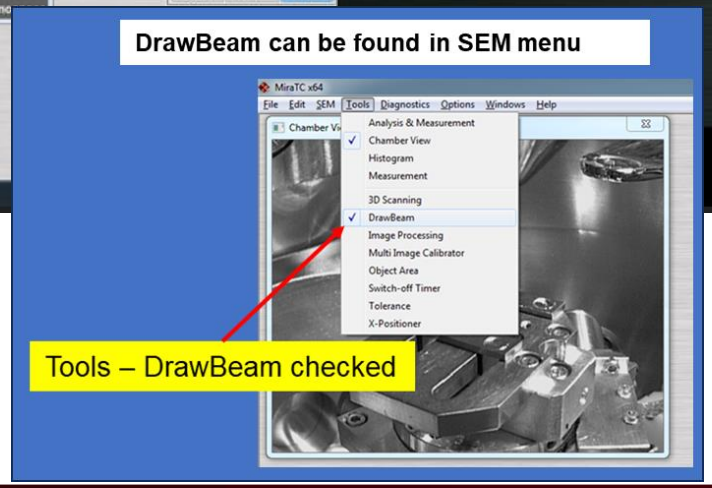


Login screens: two screens

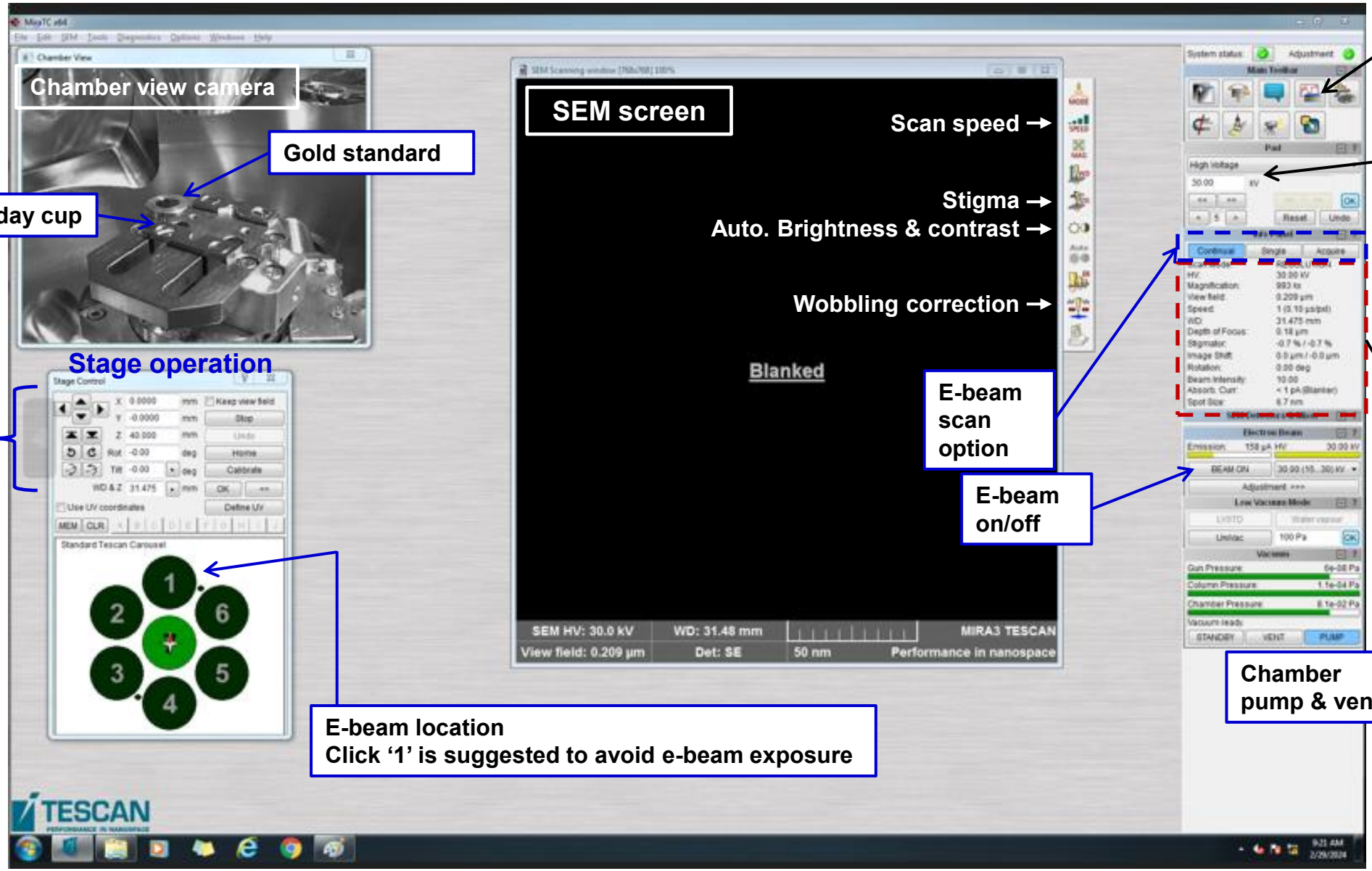
SEM

Lithography (DrawBeam)

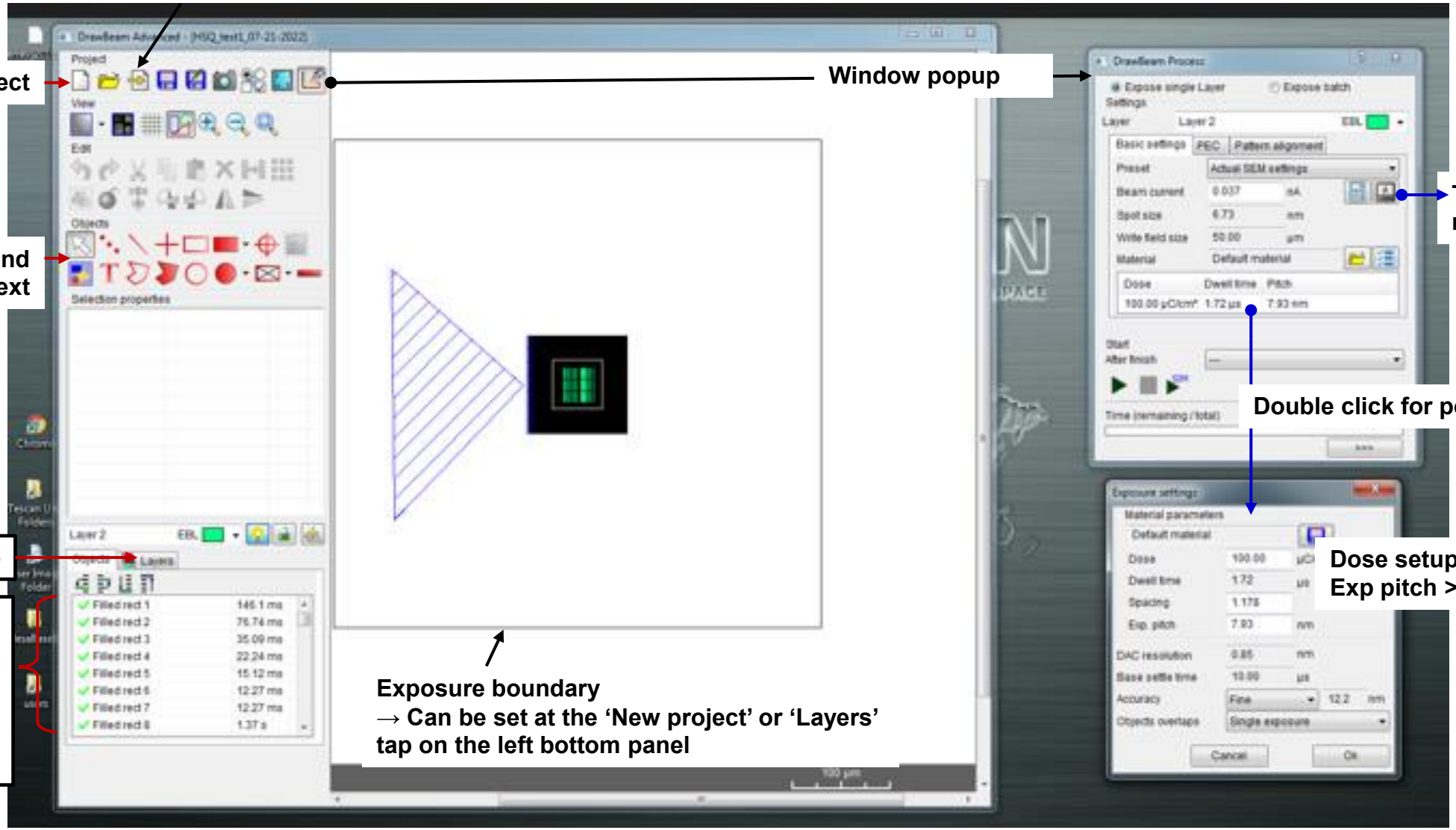




SEM functions



EBL: DrawBeam



Revision history

SIGNATURES AND REVISION HISTORY

1. Original author of this document: Mitchell Roselius
   - Original author Title or Role: Student worker
   - Date of original: 2/25/2021
2. Revision B notes: Update of the graphical procedures.
3. Revision C notes: Photos and description added

Approvals:
Technical Manager Signature: *Sandra G Malhotra*

Date: 7/11/2025

Revision	Author	Date
Original Issue	Manouchehr Teimouri	3/5/2018
Rev A	Mitchell Roselius	2/25/2021
Rev B	Sung Oh Woo	7/1/2025
Rev C	Sung Oh Woo	8/12/2025