




	<b>Operational SOP</b>	Date	May 19, 2023
	<b>Quanta FEG 250 E-SEM</b>	Revision	1.0
		Equipment Manager	Nicolas Briot

<p><b>Purpose:</b> Basic operation of the FEI Quanta FEG 250 E-SEM</p>	
<p><b>Required PPE:</b></p> <div style="text-align: center;">   Nitrile or Latex Gloves </div>	


**Quanta FEG 250 E-SEM**

<b>Potential Hazards:</b>	
	This instrument generates x-ray radiation when the electron and/or ion beam are ON.
	Some parts of this instrument create strong magnetic fields, although not extending more than 15 cm (6 in).

<b>Reference Documents:</b>
<ul style="list-style-type: none"> <li>• <a href="https://youtu.be/BY9oEgMOU50">https://youtu.be/BY9oEgMOU50</a> a video tutorial on some aspects of FEI Quanta 650 (similar to the 250) from Northwestern University</li> <li>• Scanning Electron Microscopy and X-Ray Microanalysis, 4th Edition, Goldstein et al.</li> </ul>

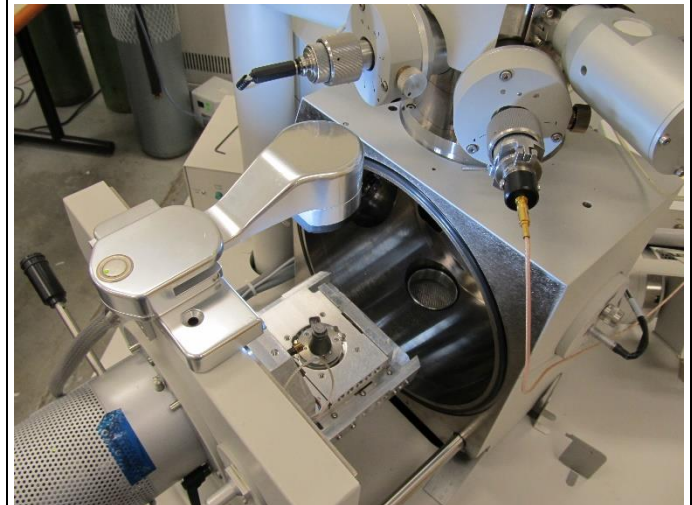
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<b>Required Equipment &amp; Materials:</b> <ul style="list-style-type: none"> <li>• SEM holders</li> <li>• SEM mounting accessories</li> </ul>
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Steps	Key Points
0. Mount sample onto the selected SEM holder (refer to individual training).	
1. Sample Loading <ul style="list-style-type: none"> <li>• Open the “Beam” tab if it is not open already. (The leftmost tab with an icon of a control knob).</li> <li>• Vent the main chamber by pressing the “Vent” button. When the chamber has vented, the chamber door will slide open slightly.</li> <li>• Slowly and carefully slide open the door.</li> <li>• Load and secure sample onto stage as pictured using the appropriately sized screwdriver. Adjust the stage height and confirm that the sample surface is just below the 10 mm mark on the height gauge.</li> <li>• Perform step 2, “Acquire Navcam Image”.</li> <li>• Close the door and hold it shut. Pump the main chamber to the appropriate vacuum level (usually “High Vacuum”) by pressing the “Pump” button. It is no longer necessary to hold door shut when the vacuum sucks the door in slightly, forming a seal.</li> </ul>	

**2. Acquire Navcam image**

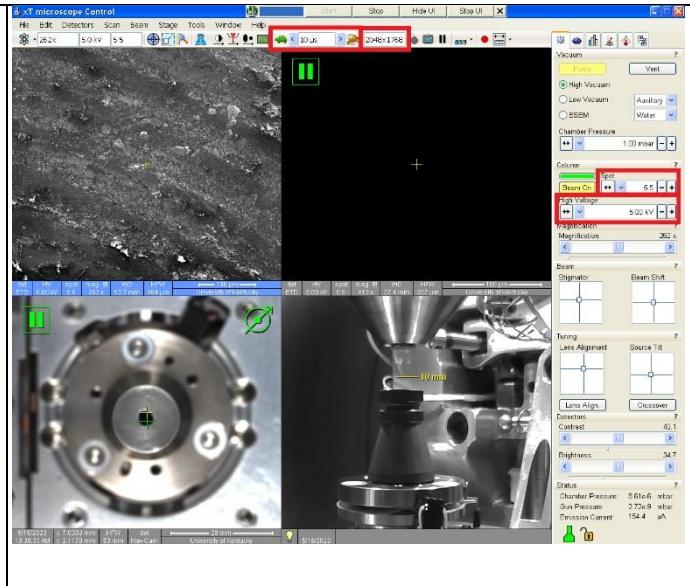
- Select the Nav-Cam quad on the user interface (the quad in the bottom left).
- Swing the camera arm (on the top of the chamber door) out over your sample(s). The stage will automatically move into position if it has not already.
- Wait a few seconds for the camera exposure to adjust.
- Press the button on the camera to take a Nav-Cam image. It will automatically be applied to the selected quad.
- Swing the camera arm back into its original position.



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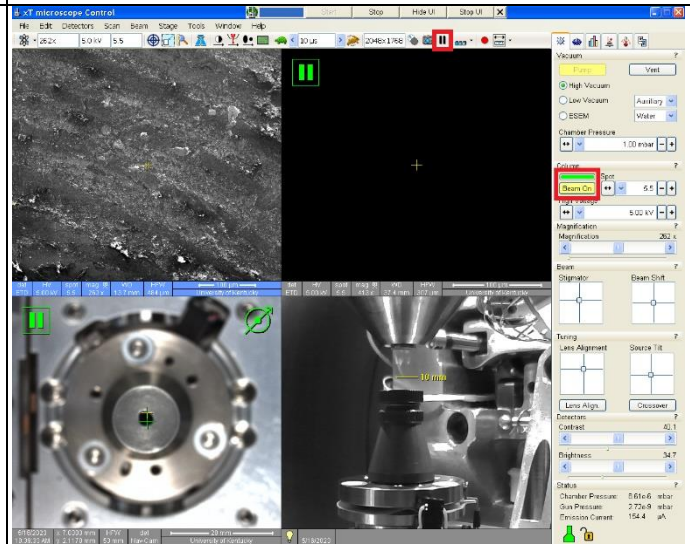
### 3. Select appropriate electron beam settings

- Select an appropriate accelerating voltage for the sample (refer to individual training).
- Select an appropriate spot size for the sample. This will determine the electron beam current (again, refer to individual training).
- Select a low to medium image resolution.
- Select a low dwell time for fast scanning, usually around 100 ns to 1  $\mu$ s.




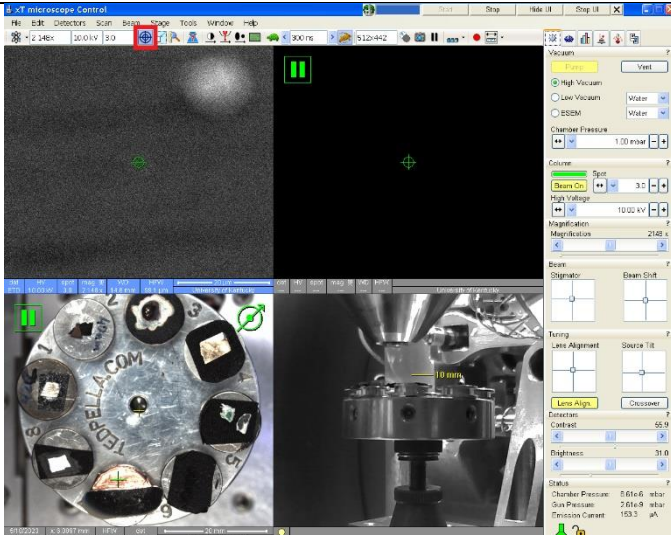
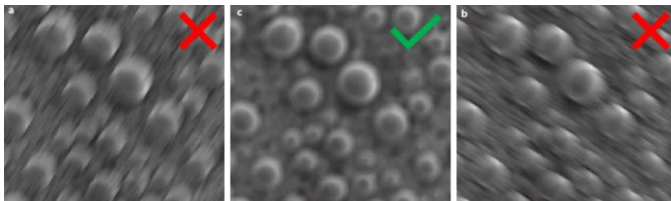
### 4. Turning the electron beam ON


- Select an electron beam image Quad (typically top-left quad)
- Turn the beam on by clicking the “Beam On” button in the “Beam” tab.
- Click on the pause button (or F6) to start scanning





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<p>5. Lens Alignment</p> <ul style="list-style-type: none"> <li>Adjust the beam focus to resolve small features (start at low magnification and increase progressively).</li> <li>Click on the button in the shape of a bullseye. Minimize the features' translation as the focus shifts by clicking and dragging the green crosshair.</li> <li>Click on the bullseye button again to resume normal viewing.</li> </ul>	
<p>6. Stigmation</p> <ul style="list-style-type: none"> <li>There is an astigmatism present if features appear to stretch when the focus is adjusted.</li> <li>To correct the astigmatism, focus the image so that no deformation is visible (see on the right), then adjust the stigmator knobs to obtain the best possible image.</li> </ul>	 <p style="text-align: center;"><i>From Scanning Electron Microscopy and X-Ray Microanalysis, 4<sup>th</sup> Edition, Goldstein et al.</i></p>
<p>7. Image Acquisition</p> <ul style="list-style-type: none"> <li>Optimize the focus, stigmation, brightness and contrast (F9 for auto brightness &amp; contrast) for the region of interest.</li> <li>Increase the dwell time (for a slower scan) and image resolution.</li> <li>Click on the pause button (or F6) once.</li> <li>Wait until scanning stops.</li> </ul>	

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8. Saving Images

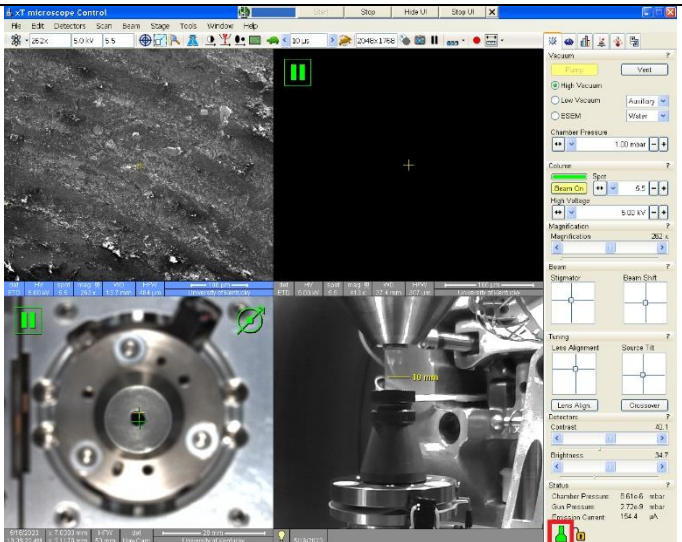
- Click on *File > Save As*
- Navigate to save on the D:\User Files drive.
- Use or create your personal folder.
- Save images in .tif 16bit format or 24bit if you are using color annotations.


9. Shutdown Procedure

- In the *Beam* tab, click *Beam Off*
- Vent the main chamber using the “Vent” button in the “Beam” tab.
- Remove any samples from the chamber.
- Pump the main chamber using the “Pump” button in the “Beam” tab.
- Confirm that the main chamber reaches a vacuum using the graphic shown in the image. A proper vacuum has been made when both chambers in the graphic are green.

10. Session Log

- In the instrument logbook, list all required information.
- In addition, list any issues, malfunctions, or incidents, and report them to the instrument supervisor.



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11. Remove sample from the SEM holder, place the holder in the desiccator storage, and clean the sample preparation area.



