




	Operational SOP	Date	May 31, 2023
	Helios NanoLab 660 / G3	Revision	1.0
		Equipment Manager	Nicolas Briot

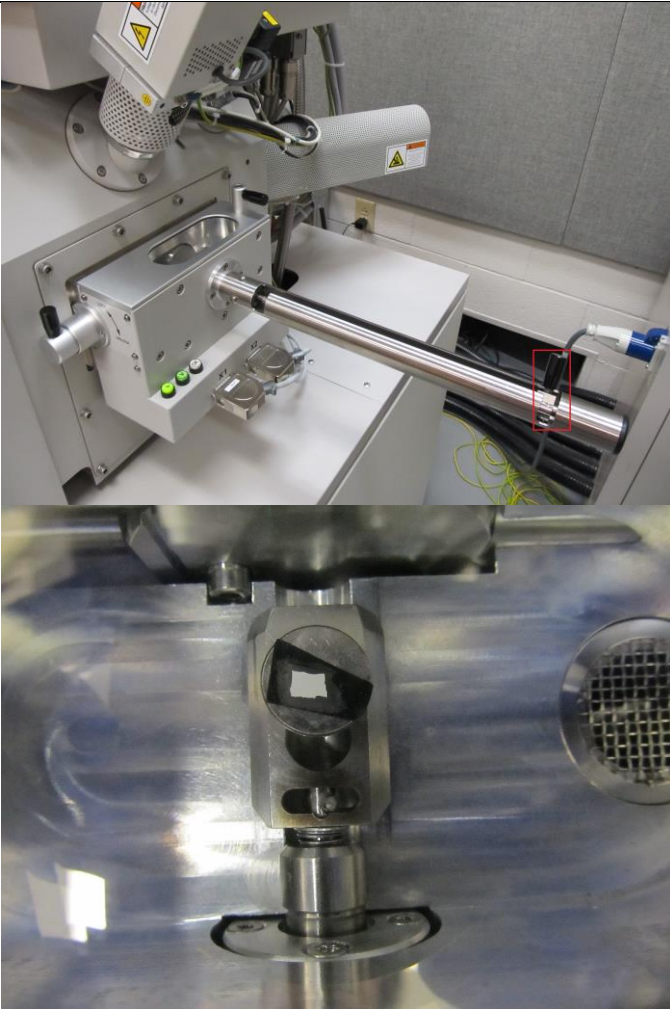
<p>Purpose: Basic operation of the Helios NanoLab 660 / G3 FIB-SEM</p> <p>Required PPE:</p> <div style="text-align: center;">  <p>Nitrile or Latex Gloves</p> </div>	 <p style="text-align: center;">Helios NanoLab 660/G3</p>
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<p>Potential Hazards:</p>	<div style="margin-bottom: 20px;">  <p>This instrument generates x-ray radiation when the electron and/or ion beam are ON.</p> </div> <div>  <p>Some parts of this instrument create strong magnetic fields, although not extending more than 15 cm (6 in).</p> </div>
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<p>Reference Documents:</p>	<ul style="list-style-type: none"> • Scanning Electron Microscopy and X-Ray Microanalysis, 4th Edition, Goldstein et al.
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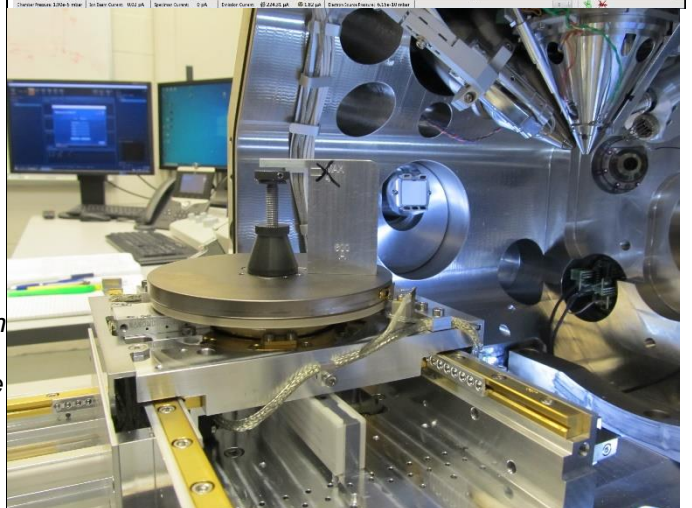
<p>Required Equipment & Materials:</p>	<ul style="list-style-type: none"> • SEM holders • SEM mounting accessories • Ethanol (optional)
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Steps	Key Points
<p>1. Mount sample onto the selected SEM holder (refer to individual training).</p> <ul style="list-style-type: none"> If your sample is small enough, load your sample (on its SEM holder) onto the load lock holder (refer to individual training). 	
<p>2. Sample loading using the load-lock</p> <ul style="list-style-type: none"> Ensure that the transfer arm is set to its resting position shown in the first image. Vent the load lock by pressing the green "V" button. Open the top window of the load lock. Place your sample into the load lock, rotate the transfer arm fully counterclockwise, and push it into the spring on the transfer arm. Rotate the transfer arm fully clockwise to its resting position to lock your sample into place as shown in the second image. Close the load lock window, then pump the load lock by pressing the "P" button. Once the load lock has been fully pumped (there will be a click), open the transfer door by rotating down, pulling, then rotating up the knob on the load lock side. Insert the sample by turning the transfer arm counterclockwise to the 12 o'clock position (but no further!) and inserting the transfer arm fully. Seat the sample onto the stage by turning the transfer arm fully counterclockwise, pulling it back, and then rotating it fully clockwise. Pull the transfer arm fully back (the sample should now be mounted onto the stage), then rotate it clockwise to its resting position. Unlock, close, and relock the transfer door. 	

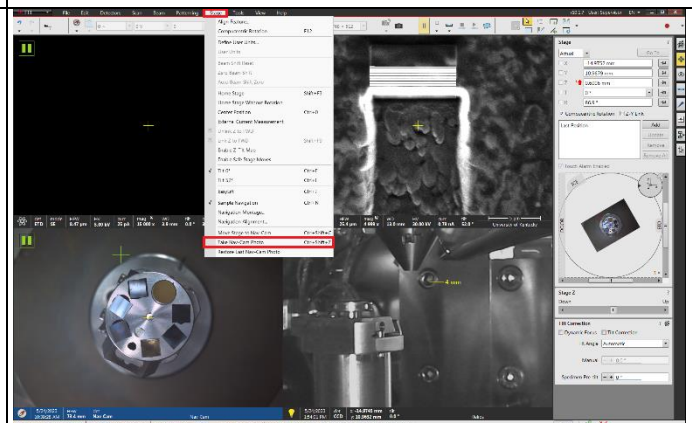
3. Sample loading using the main chamber
- Go into the utility room (watch your step). Open the appropriate gas cylinder to provide nitrogen gas for venting (refer to individual training, do not operate without training).
 - Vent the main chamber by clicking the “Vent” button in the “Beam” tab.
 - Once vented, open the chamber, remove the stage attachment for the load lock, and insert the desired stage attachment/holder (refer to individual training).
 - Load your sample onto the stage. Check that your sample is at the appropriate height using the gauge block (refer to individual training, ignore the 4 mm mark)
 - Pump the main chamber using the “Pump” button in the “Beam” tab.
 - Close the cylinder in the utility room.


It is preferable to load your samples via the load lock rather than through the main chamber. Loading through the load lock is easier and faster once you know how and does not require you to degrade the vacuum of the main chamber.



4. Acquire Navcam image

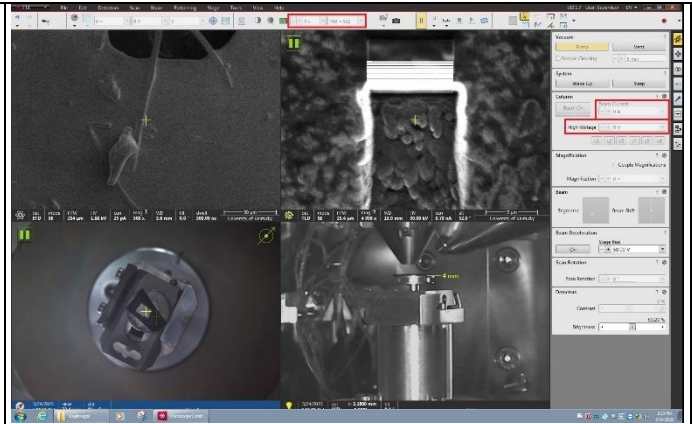
- Take a Nav-Cam photo by clicking on the “Stage” tab then the “Take Nav-Cam Photo” button or using the Ctrl + Shift + Z shortcut.
- Wait until the sample comes back to its original position.
- Navigation to the region of interest is now possible by double clicking on it in the Nav-Cam image.




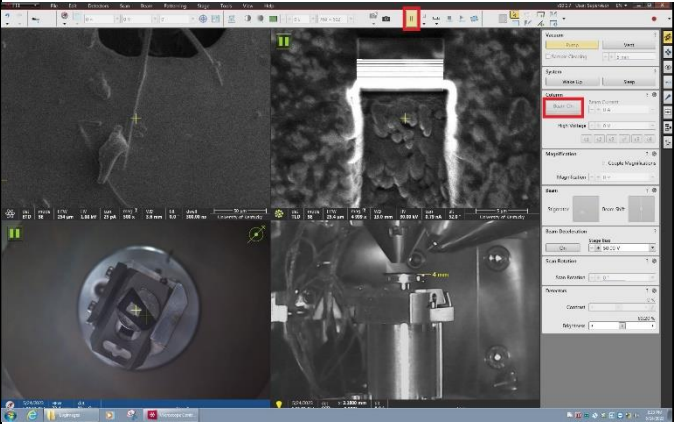
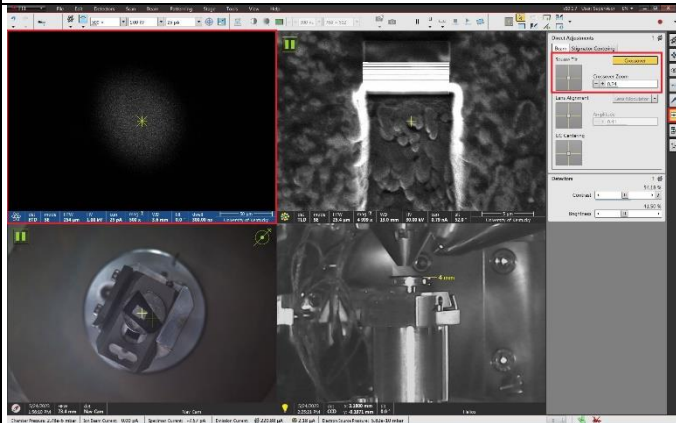
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5. Select appropriate electron beam settings

- Select an image quad set to the electron beam, usually the top-left quad.
- Select an appropriate accelerating voltage for the sample (refer to individual training).
- Select an appropriate beam current for the sample (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 μ s.



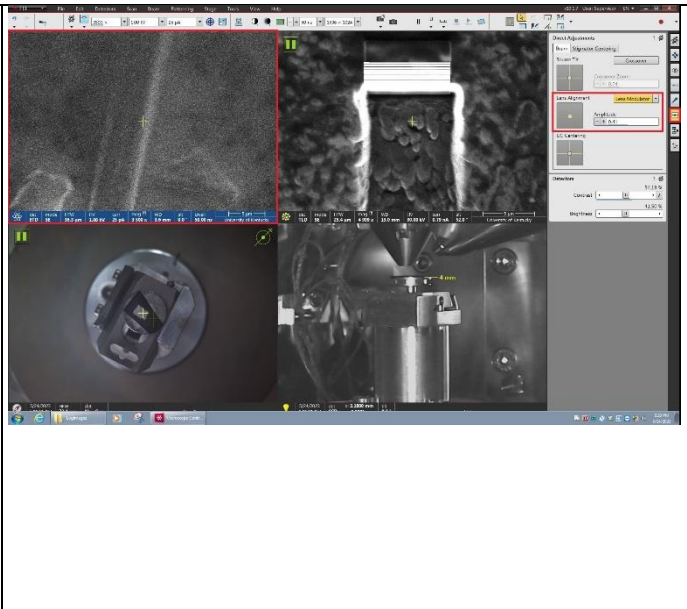
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Steps	Key Points
<p>6. Turning the electron beam ON</p> <ul style="list-style-type: none"> Ensure that an image quad set to the electron beam is still selected (typically top-left quad). Turn the beam on by clicking the “Beam On” button in the “Beam” tab. Click on the pause button (or F6) to start scanning. 	
<p>7. Beam Crossover Alignment</p> <ul style="list-style-type: none"> To adjust the crossover, open the “Direct Alignments” tab, the “Beam” subtab, and click on the “Crossover” button. Center the bright area of the image on the green “X” by clicking and dragging either axis of the associated figure, or the grey box in the figure. <ul style="list-style-type: none"> You may need to adjust the brightness, contrast, or crossover zoom to get a better view of the bright area. To exit this mode, click on the “Crossover” button again. Repeat this step whenever you change your current or accelerating voltage, particularly if you cannot form an image after doing so. 	

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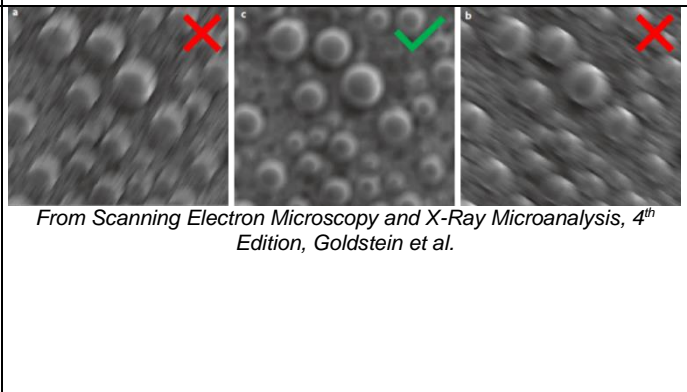
8. Lens Alignment

- Focus on a small feature (>2,000X mag).
- Adjust the focus and stigmators to obtain a decent image.
- In the “Direct Alignments” tab and “Beam” subtab, click on either the “Lens Modulator” or “HV Modulator” button, depending on the software recommendation.
- Minimize image translation by clicking and dragging either axis of the associated figure, or the grey box in the figure.
- To exit this mode, click on the “Lens Modulator” or “HV Modulator” again.



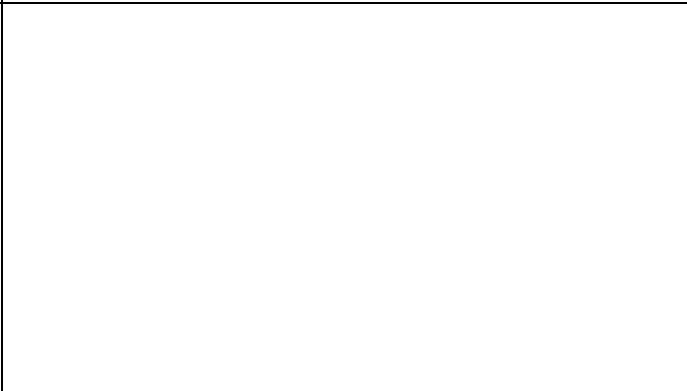
9. Stigmation


- There is an astigmatism present if features appear to stretch when the focus is adjusted.
- 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.



10. Image Acquisition

- Optimize the focus, stigmation, brightness and contrast (F9 for auto brightness & contrast) for the region of interest.
- Increase the dwell time (for a slower scan) and image resolution.
- Click on the pause button (or F6) once.
- Wait until scanning stops.



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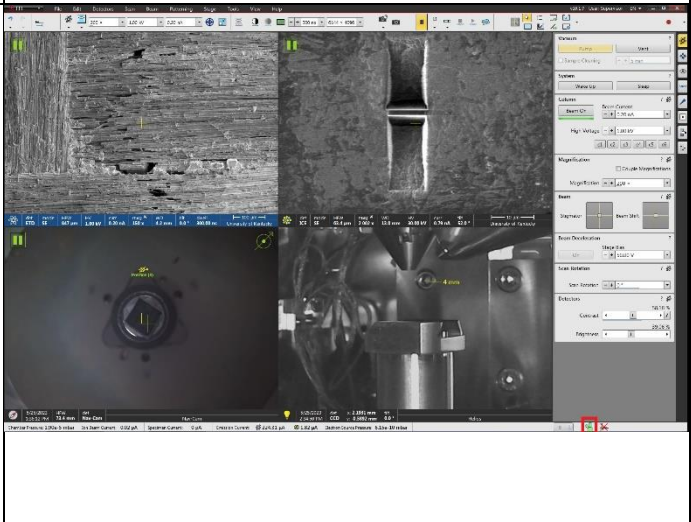
11. Saving images

- 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 using color annotations.



12. Shutdown procedure


- Turn the beam off by going to the “Beam” tab and clicking the yellow “Beam On” button.
- Ensure both the electron and ion beam are off and all insertable detectors retracted.
- Unload all samples by following the sample loading procedures in reverse.
- Ensure that the main chamber is under vacuum, check that the icon in the bottom right shows both chambers as green.



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



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History of Revisions

Revision Number	Revision Date	Revised By	Reason for Revision
0.0	06/23/22		Initial Draft
1.0			Template Update
2.0			Revised HMI screen graphics