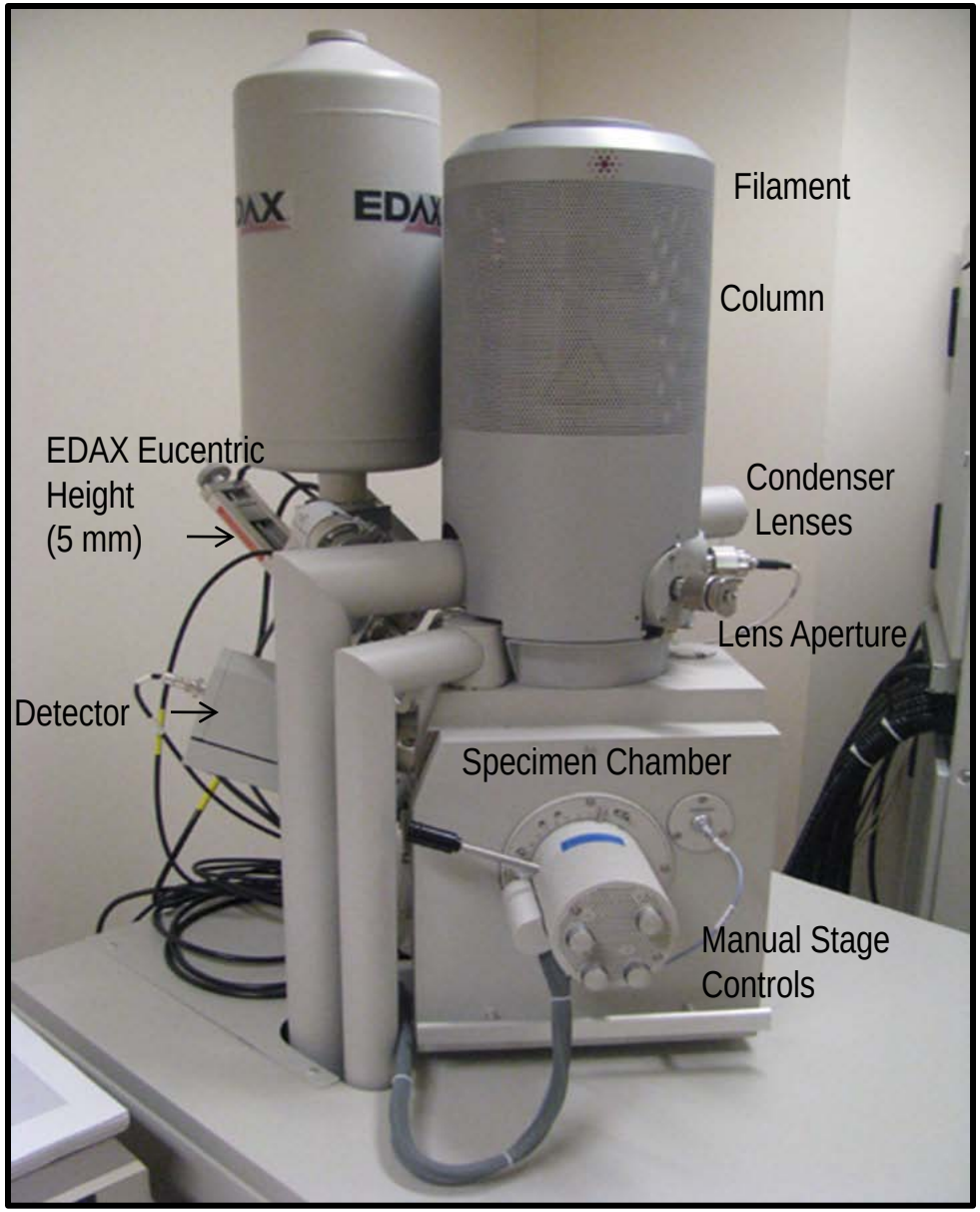
Scanning Electron Microscope

(FEI Nova NanoSEM 2300)

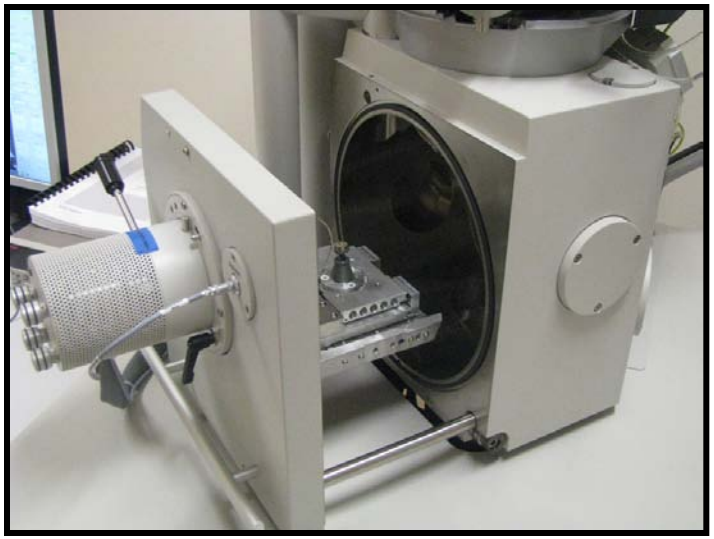
September 2010



FEI Nova NanoSEM 2300

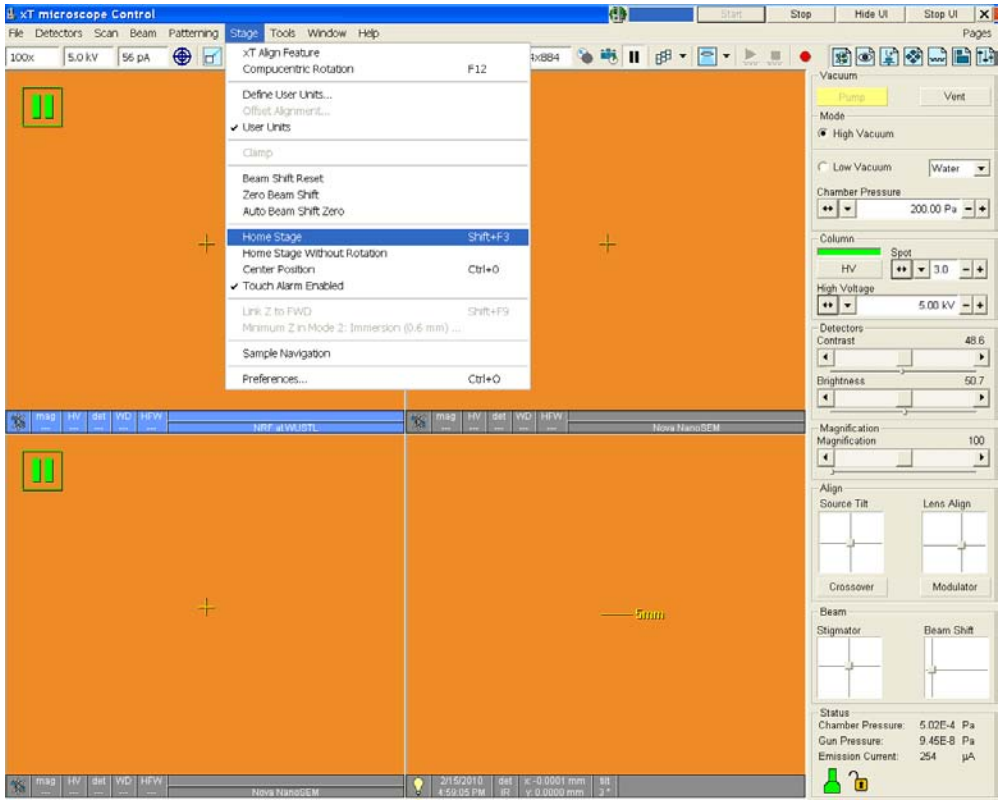
No magnetic samples for immersion mode; for inquiries contact wendtk@seas.wustl.edu

Specimen Chamber



Home stage

Click **Stage**. Home stage with rotation.



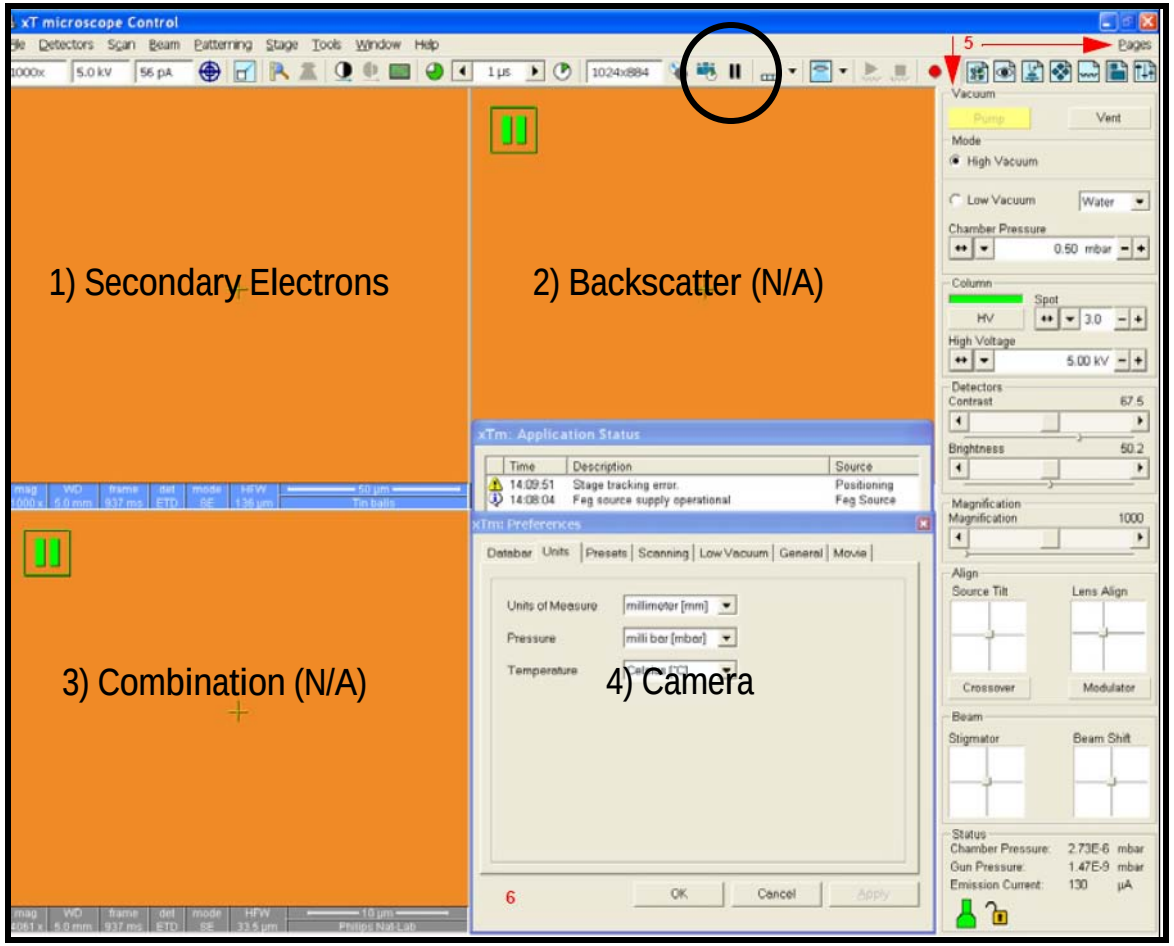
Note: Never connect internet to these two computers and use usb drive to transfer files.
Note: Turn off computer to reboot if any software freeze occurs during an experiment.
Note: Never touch any button on the front panel or the control panel, report problems.

Single versus Quad Images

Toggle between highlighted window and quad view with **F5**
(Only windows 1 and 4 are available.)

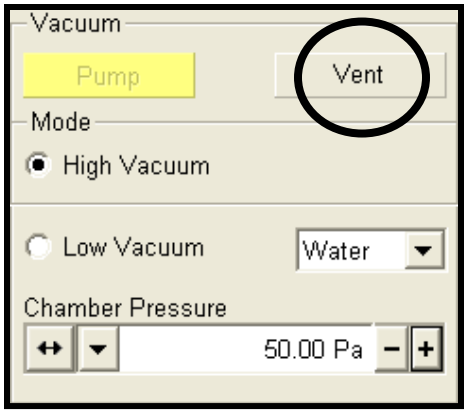
1. Activate window by clicking on it; panel will turn blue.

2. Unpause window by clicking on pause icon at top of screen.



Load sample

1. Blow samples with the nitrogen gun before loading samples.

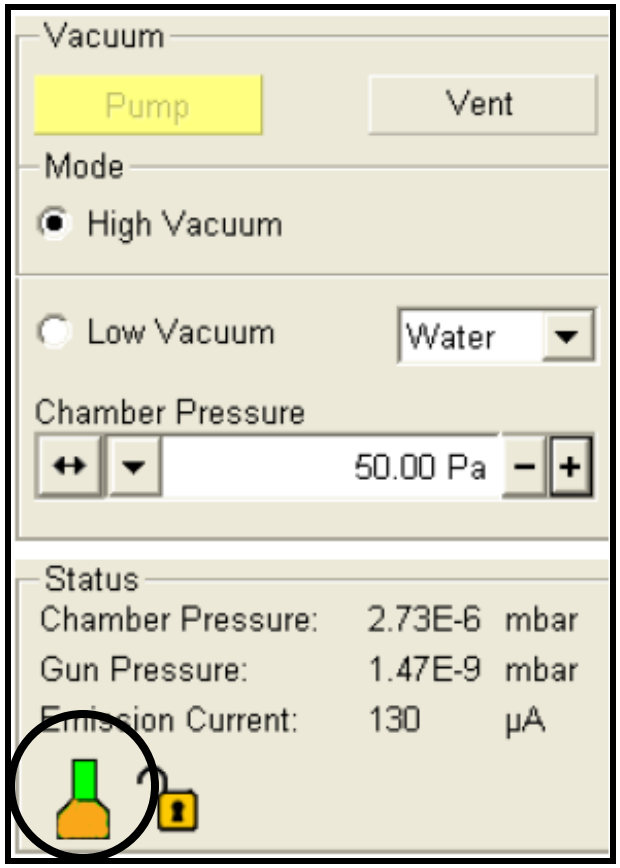


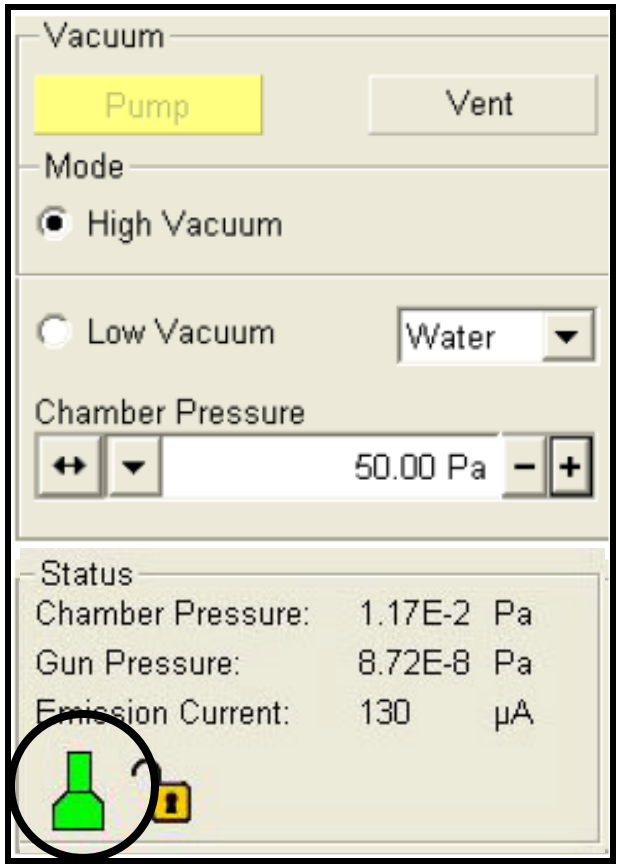
2. Put gloves on and select **Vent** in the **Vacuum** submenu. If chamber takes longer than 1 minute to vent, click **Pump** and notify Instrument Manager.
3. Insert sample stub and tighten using locking screw.
4. Close the chamber door and select **Pump**.

Always wear gloves when loading samples into the chamber.
Load sample while nitrogen purge is active to avoid chamber contamination.
Do not over-tighten the locking screw, finger tight is adequate.

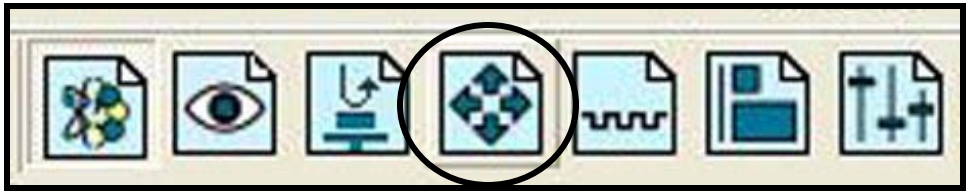
Start-up Procedure – Pump chamber with sample

1. Wait for chamber to reach desired pressure. Bottom half of icon will turn green when chamber under vacuum.

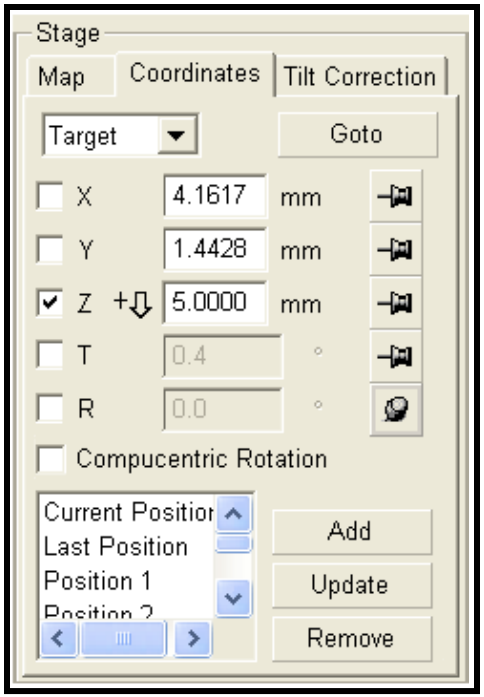




Start-up Procedure – Establish Coordinates



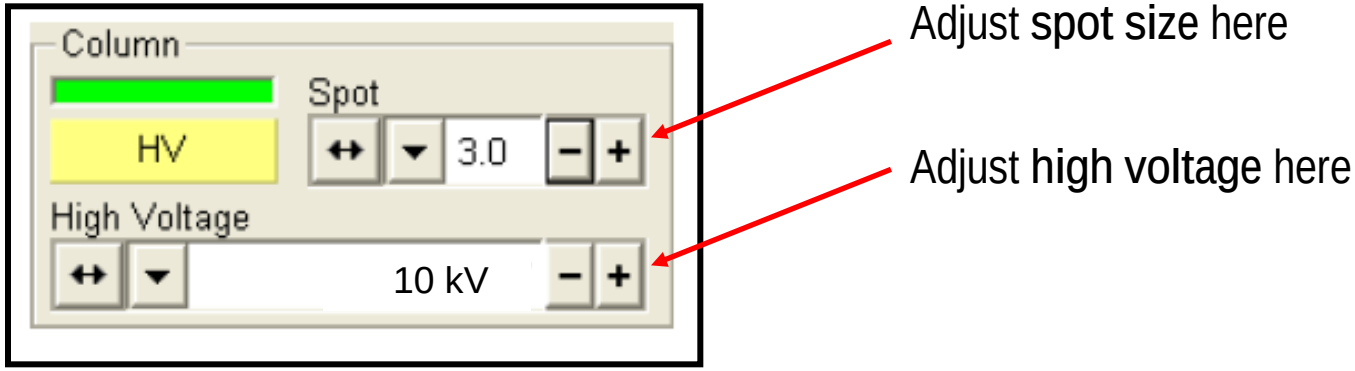
Open Coordinates to view coordinates on stage (X:0, Y:0 is center).



Start-up Procedure – continued

1. Select proper accelerating voltage and spot size for your sample.

Note: Lower kV (3-5) is better for non conducting samples
High kV (>10) is better for conducting samples



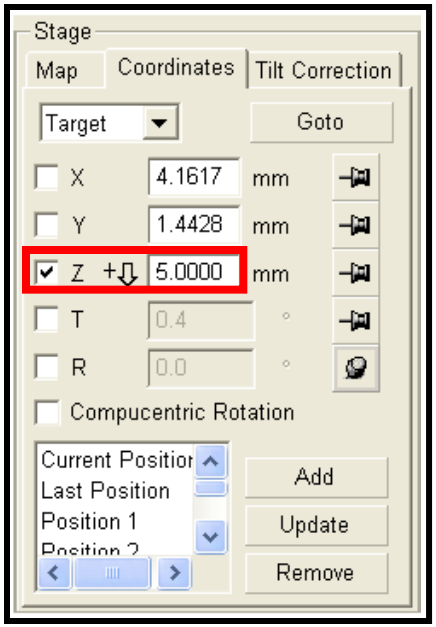
2. Turn on the accelerating voltage by clicking on HV button
3. Auto adjust brightness and contrast (F9).

Calibration of Working Distance and Stage Adjustment

This is a crucial step that should be conducted very carefully. If the calibration is not performed properly, the microscope can be seriously damaged.

WD: (Working distance) Distance between focal plane and nose piece

Z: Distance between sample and nose piece.



1. Focus on the sample with > 2000 X magnification.
2. Click  to link Z and WD.
3. Move sample stage up close to **5 mm mark** by clicking center button and dragging upward. Do not go past the 5 mm mark.
4. Focus on the sample with > 2000 X magnification at 5 mm. Click  to link Z and WD.

Magnification is controlled by changing "+" or "-" on the keyboard.
The focus can be adjusted by moving the mouse to the left and to the right while pressing the right-button of the mouse
Make sure your image looks as focused as possible

Operating Parameters

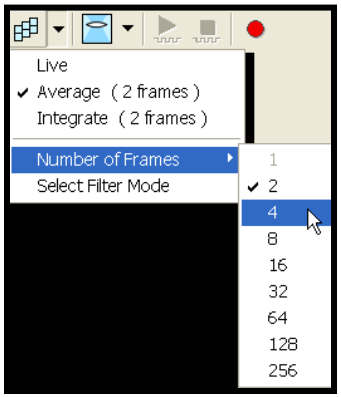
Field-Free (ETD): Use for imaging large areas or finding your sample. (All samples.)

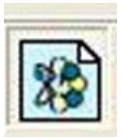
Immersion (TLD): No magnetic samples. Use for higher resolution imaging; only works at certain working distances. WD: 5 mm for 1-15 kV; 6.5 for 20 kV; 6.7 for 30 kV

EDX: universal samples, use for elemental analysis (refer to EDS manual).

Beam Optimization – Lens Alignment

Select Live mode (Scan/Live)



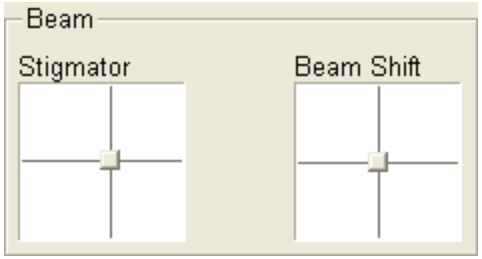
Select  and **Align** Tab.

1. Click on "Modulator" in **Lens Align** and drag on the crossbars to correct image translation. The image should pulse in and out but not move side to side.

1. Right click on modulator and adjust sensitivity to "Fine" to make any final adjustments. Final image should oscillate in/out of focus. Turn off lens modulator.

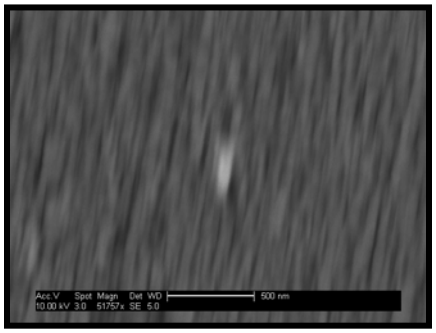
Beam Optimization – Stigmation Adjustment

1. Obtain best possible focus on image.
   Image **should not be elongated in either direction** (see examples below)

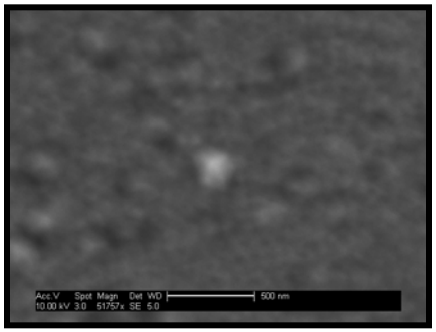


2. **Right click** on the **beam shift window** to **zero out beam shift**
3. **Drag stigmator cross bars** to adjust X & Y until image resolution is well defined.

4. **Re-focus image** by dragging right mouse button left and right



Unfocused image with severe beam stigmation



Properly focused image with severe beam stigmation

Image Acquisition and File Saving

Preset scans: photo (F2, **high res**)  and **snapshot** (F4, **medium res**) 

Scan and capture: pause button 

Average: useful to **non-conductive** samples. 

Integrate: **adds up frames** to single averaged image. 

Save files as TIF/JPG/BMP.

Step	Action
1.	Select the area of interest and set the **Magnification**, the **Scan condition** and the **Pixel** resolution that are required in the captured image.
2.	Make the best image using any suitable method you are familiar with.
3.	Use the **Snapshot / Photo (F2) / Pause (F6)** function. The scan makes one screen / quad pass (or several passes when the number of integrated frames is larger) and pauses.
4.	The image can now be saved by **Save (Ctrl + S) / Save As...** function in the **File** menu.
5.	The scan can be released by clicking on the **Pause (F6)** button on the toolbar.

The conditions for good image quality are:

- Slow scan speed (longer dwell time) of the beam.
- Select a pixel resolution from the dropdown list box to suit the detail in the image, i.e. no tearing pixelated edges.
- Increase the magnification at least 2x above the desired value, focus and stigmate (using the reduced area), then return the magnification back.
- Use the Videoscope to correct the Contrast and Brightness accurately, otherwise use the Auto C&B.

Shutdown Procedures

1. Click **HV** to turn off accelerating voltage.

2. Activate Quad 4 and **Unpause**.

3. Select **Vent** in Vacuum.

4. Wait for specimen chamber to come up to atmospheric pressure. With gloved hands, loosen set screw and take out sample stub.

5. Close the chamber door.

6. Select **Pump** in Vacuum. **Wait** for chamber vacuum status **to turn green.** 

.