

SEM Operating Procedures

Revised 7/25/06

Power Up

1. Log In
2. Power on switch on front panel of beam
3. Record in log book: vacuum pressure of IP1, IP2, IP3

Filament chamber = top cylindrical column; holds the filament, column, etc.

Sample chamber (SC) = large chamber under filament chamber where substrate is subjected to electron scanning

Sample exchange chamber (SEC) = small antechamber used for loading wafers.

Loading Sample

1. Check that the stage is in 'home' position, as listed on the stickers on the stage drivers.
2. Check all chambers are closed:
 - a. Check SC Air Lock valve is closed
 - b. Manual gate between SC and SEC is closed
 - c. Check SC/SEC switch is on SEC
3. 'AIR' the SEC chamber
4. When SEC door releases, open it and load sample, then close SEC door.
5. 'EVAC' the SEC chamber; wait until 'high' vacuum is indicated on the panel
6. Open portal between SC and SEC using the manual gate
7. Carefully insert sample fixture snugly in the stage, unload sample, and remove probe from SC.
8. Close the manual gate
9. Make sure 'high' vacuum is achieved in SC.
10. Open SC to expose filament to sample with the toggle switch on the panel.
11. Again, make sure 'high' vacuum is achieved in SC

Operation

- **Initializing**
 - Flashing the filament vaporizes organic material that may have deposited on the filament, which will ultimately improve stability and imaging quality. However, emission current will fluctuate for approximately 30 minutes after flashing. To flash:
 - On the control panel, press the 'Flash standby' button, it should blink
 - Press the 'Adjust' button to its left
 - Observe maximum applied current and record in log book as the flash current.
 - Press HV 'On' switch
- **Imaging**
 - Selection of secondary electron detector

- PF2
 - As a guideline: Upper detector for WD < 18; Lower detector for longer WD or tilted specimen
 - ABC = Automatic brightness/contrast adjustment
 - Manually control brightness/contrast using image or MONIT
 - MONIT – waveform view of brightness/contrast; containment of line around center is best; press this button again to exit this mode
 - Initial focus using the focus pad
 - SEARCH → FOCUS buttons
 - Adjust focus manually
 - Adjust applied voltage: PF1
 - Total range is from 0.5 – 30 kV
 - For resist under thin metal, use 0.8-5.0 kV
 - Adjust column after any change in applied voltage: **PF3**
 - Adjust brightness, focus, and stigmation
- **More function keys**
 - **PF3** - Column Adjust
 - Column adjustment requires practice and training for proper beam alignment. Contact the cleanroom manager for more information.
 - **PF7** – Auto data display = 20-30 range
 - **PF12** – measure data – use ‘cursor’ knobs
- **See Image Capture on following page for instructions for high resolution image recording.**
- **See ‘Measuring with SEM’ on following page for instructions in measuring accurately.**

Power down

- Press ‘HV Off’ to power down applied voltage
- ‘Lock’ SC chamber
- Zero x, y, R, and tilt with values indicated on ‘Exchange Position’ tag
- Ensure high vacuum in SEC. Open manual SEC portal and carefully retrieve sample; close portal.
- VENT SEC chamber
- Open outer SEC door and remove sample from handle; close SEC door
- Evacuate SEC – wait until high vacuum
- Power off front panel
- Log Off

**As always, if you find the machine working incorrectly or have any difficulties, please notify the cleanroom manager *immediately*.

Image Capture

Login to the PC either under your CAMD account or Public ID (password: LsuCamd6980; domain: CAMD).

To capture an image:

1. Open the Quartz PCI software
2. Press 'single image' on the toolbar or Acquire → Single Image
3. Press a slow scanning mode (3 or 4) on the SEM panel
4. Press 'direct' on upper right of SEM panel
5. After image is acquired, press 'stop acquisition' on the toolbar

If you want to adjust contrast and brightness of the captured image:

1. Go to Process → Histogram
2. On the graph, drag the center x-axis marker to the green portion of the histogram. To learn more about this feature, press 'Help' located at the bottom right of this window.

To save the image you can use the Database. It is set up and ready for images. Or you can bypass the database by Exporting the image. Save it in F:\sharefolder\yourname or download on a jump drive with the available USB adapter.

Measuring with SEM

Obtaining accurate measurements is not trivial. Many parameters can adversely affect results, and all dimensions should be considered to have some error. Most inaccuracies originate from the nature of SEM. Measurement error will be limited to 2% - 3% if the following steps are taken:

1. Ensure beam is aligned properly, especially when changing accelerating voltage.
2. Measure using the CRT monitors, not the image capture software.
3. Ensure the Rastor Rotation is off when possible. Using the rastor rotation generally doubles the error. By-pass this feature by turning 'off' these switches on the panel located to the right of the CRT screens. You can situate your sample using the stage controls.
4. Measure using slow scan speeds (3 or 4).
5. Use the middle 2/3 of the CRT screen for measuring both x and y axes. As the measuring lines approach the edge of the monitors, error increases. Adjust magnification if necessary to fit features within this area.
6. It is best to periodically measure a feature that is 'known' so that error at the specified voltage and working distance can be approximated. This 'standard' should be a group of features instead of a single small feature; this allows averaging of feature sizes which could be individually affected by processing errors.