

## Hitachi S3000 SEM

The Hitachi S3000 is a compact SEM that utilizes a standard tungsten filament. The S3000 is capable of imaging up to 100,000X and up to 3nm resolution. Accelerating voltage can be varied from 300V to 30kV and the beam diameter can also be adjusted. It features motorized XYZ stage with full 360° rotation and 0° to 60° tilt.

### Safety

- **High Voltage** - High Voltage is used throughout the system. System maintenance may only be performed by Hitachi or RSC Staff. Do not remove any tool covers or defeat any interlock on this system.
- **Moving Components** - The user must observe caution when opening and closing the chamber door.

### 1.0 Pre-Operation

- 1.1 Tool Reservations may be made via the RSC Reservation Page.  
<https://rsc.aux.eng.ufl.edu/sc/default.asp>
- 1.2 Change gloves. **WARNING** No solvents are allowed near the machine, change your gloves before operation!
- 1.3 Log on and off the tool from the local TUMI terminal.

### 2.0 Restrictions

- 2.1 No liquids are allowed in the SEM.

### 3.0 Software Navigation

3.1 Start the SEM software if not already open by clicking on the SEM icon

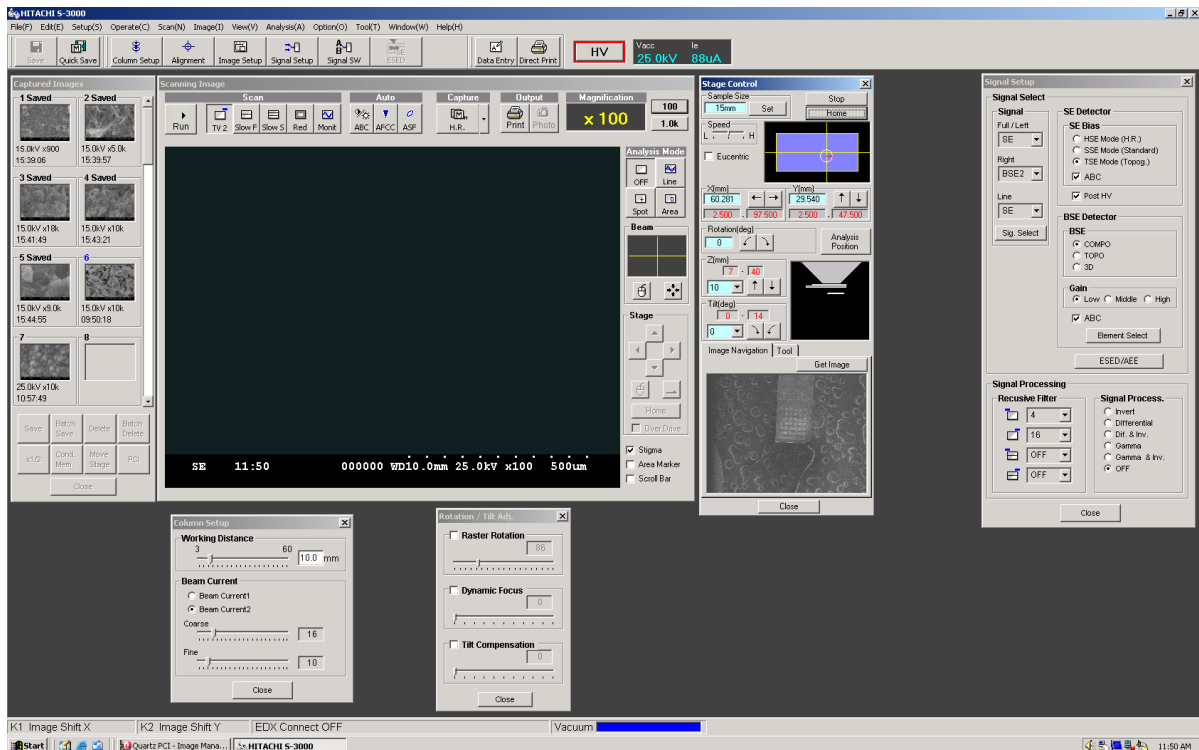
3.2 Turn on the chamber IR camera by powering on the IR camera power supply and the IR camera monitor. This will allow the operator to observe the sample clearance during sample navigation and help avoid a sample/instrument collision.

The IR power supply button is on the front and the monitor power button is on the back of the monitor.

The IR chamber scope must be on when loading or unloading samples to ensure that the sample will not impact the column or BSE detector.



3.3 Below is an image of the software interface for this SEM.



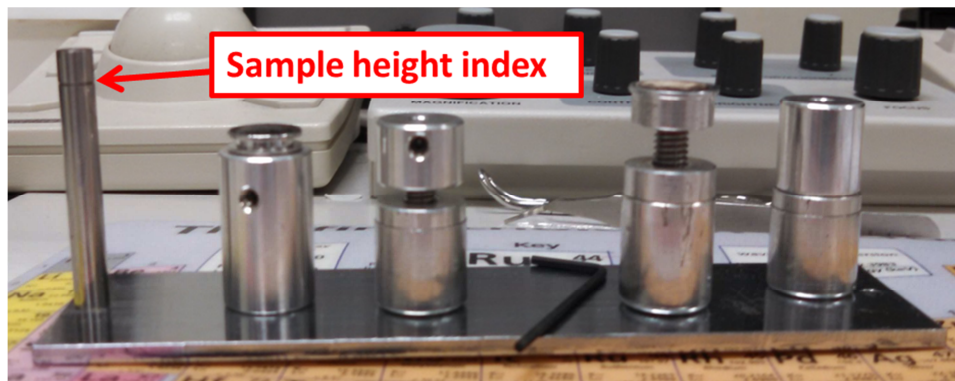
There are operator windows for SCANNING IMAGE, STAGE CONTROL, SIGNAL SETUP, CAPTURED IMAGES, COLUMN SETUP.

## 4.0 Load Sample

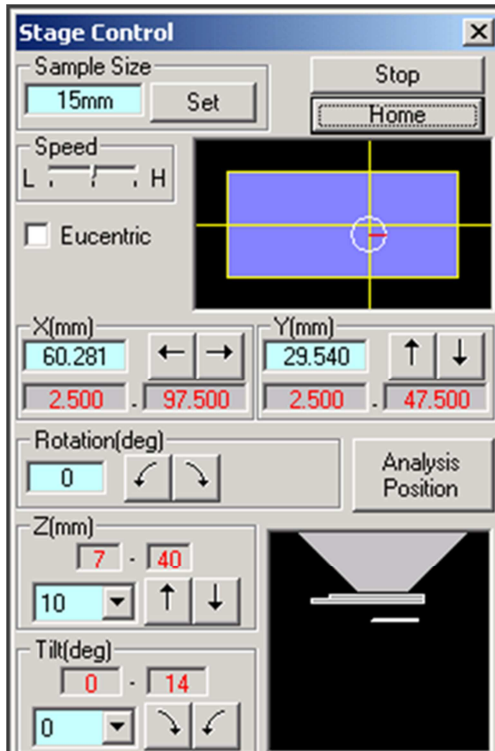
- 4.1 Mount sample in holders with screws, vise clamp design, or carbon tape. The standard FEI mount will be used for all sample mounting.

**Do not use carbon or silver paint unless you are using your own sample mount. Paint must be completely dry before loading sample into the SEM.**

- 4.1.1. The mounted sample must be as close to but not exceed the height index on the mount guide. Samples taller than this height index risk touching the SEM column when imaging at short working distances.



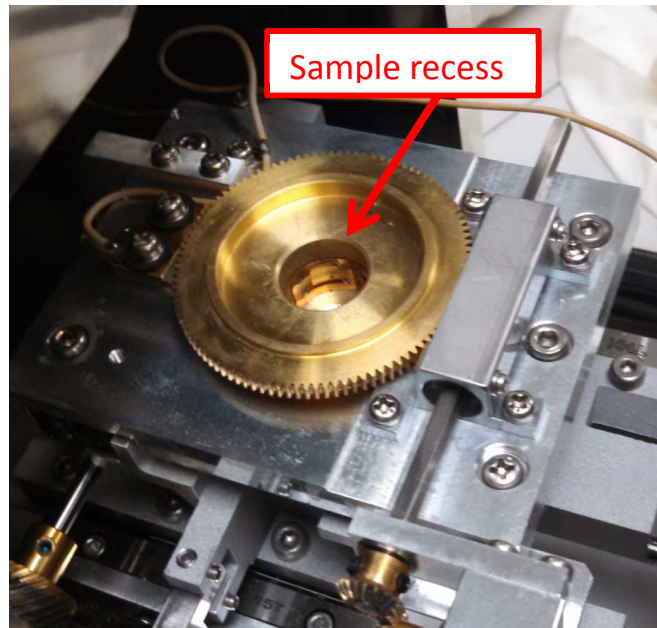
- 4.2 Select HOME on the STAGE CONTROL window. This will place the stage in the correct position for sample loading and unloading.



4.3 Press the EVAC button on the front of the SEM console,



- 4.3.1. The HIGH green light will turn off and the LOW red light will become lighted. After a few minutes, the chamber can be opened.
- 4.4 Carefully slide open the chamber. Insert the sample holder into the recess in the stage. Ensure that the holder is fully inserted into the stage recess.



4.5 Carefully close the chamber and monitor the IR camera image for a potential sample collision. **Push firmly on the door**, press and hold the "EVAC" button on the front of the SEM. Hold the chamber closed until you hear the pump come up to speed and the chamber door is secure. The EVAC light will light green and the HIGH lamp will be green. When the vacuum indicator in the SEM software is **blue** (bar at the bottom center of screen), the system is ready for operation.



## 5.0 SEM Operation

5.1 In the STAGE CONTROL window, select the size (diameter) of the sample holder that is currently loaded in the SEM.

Click the “Set” → window → dropdown menu to select the diameter, then OK. When selecting the proper size, the stage travel limits will change accordingly and reduce the chance of sample/chamber collision.

5.2 Set the stage Z to 10mm. This is a typical working distance for most of the imaging performed in this SEM. It is recommended to decrease the stage Z setting in small increments and monitor the stage movement in the IR camera monitor to avoid a sample/column collision..

Monitor the IR camera image for potential sample collision when moving the sample. The STOP button (upper right corner of the STAGE CONTROL window) becomes active during any stage movement and is used to stop the stage movement. It is a best practice to keep the mouse pointer over the STOP button while the stage is in motion.

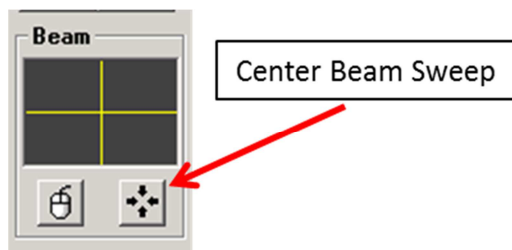
5.3 Select the “HV” icon to turn on the electron source. The source is on when the HV button is outlined in RED.

5.4 Select the accelerating voltage in the **Vacc** window on the upper tool bar. This will open the kV menu for selection.

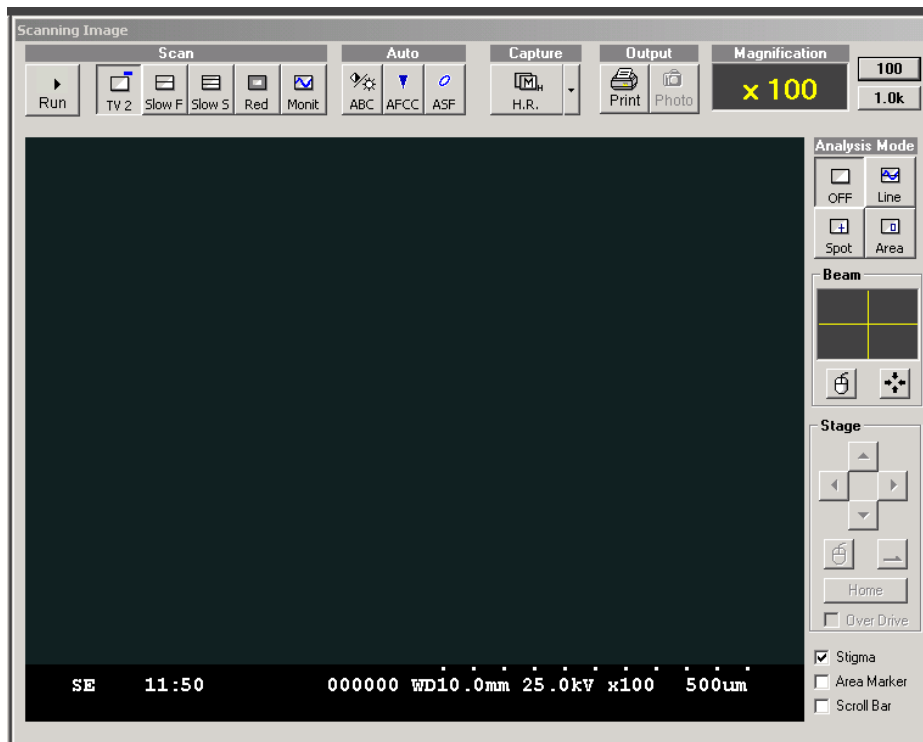
5.5 Select beam spot size (beam current) in the Column Setup window. The options are:

- Beam Current 1 – high resolution imaging
- Beam Current 2 – low resolution imaging
- Course adjustment and Fine adjustment

5.6 Center the beam sweep in the SCANNING IMAGE window. This centers the scan field and removes the previous operator’s image shift.



5.7 Select the TV scan mode for the fast raster rate. TV2 provides a decent image for general sample imaging and beam tuning.



5.8 The Track ball controls the sample stage for navigation.

5.9 Select the auto contrast/brightness “ACB” button in the software or manually correct the contrast/brightness from the knob box.



5.10 Focus on the top surface of your sample using the FOCUS and MAGNIFICATION knobs.

- 5.11 Adjust the stigmation for both X and Y to obtain as clear an image as possible
- 5.12 Select the working distance by selecting the appropriate Z from the STAGE CONTROL window. Re-focus and re-stigmatate as needed.

**CAUTION**  **CAUTION**

**THE MINIMUM WORKING DISTANCE FOR THE SEM IS 10mm.**

- 5.13 Select your desired aperture 0 to 4. Position 0 is no aperture (largest) and position 4 is the smallest aperture.

Press the “ALIGNMENT” button on the top menu bar to begin aperture alignment. The alignment menu pops up and the image wobble starts automatically.

- 5.13.1. Align the aperture by using the X-Y knobs on the SEM column.



Move knobs until image no longer moves Up/Down and Left/Right. When the aperture alignment is complete, close the alignment menu and the image wobble will stop.

Use the Auto Gun Alignment (AGN) to correct the Gun tilt and Gun shift.

Retest the image wobble (ALIGNMENT) again.

- 5.14 Adjust the “FOCUS”, “STIGMATOR”, and “MAGNIFICATION” knobs to obtain the best image. This works best at a faster scan rate like TV1 or TV2. You can choose the small area raster by clicking the RED button under the Scan title in the Scanning Image window.

If different kV is desired, this can be changed without shutting down the



HT. Simply select from the menus and double click. Resetting of the Gun Conditions and Aperture alignment are required after changing the kV.

- 5.15 Find a region of interest and optimize focus. Adjust sample position, rotation, and tilt if required.

Watch the sample and holder in the IR chamber scope image while moving sample to ensure no contact is made with the column or detector.

- 5.16 Select the proper scan speed under the Scan title in the Scanning Image window. Each scan speed button has two options when clicked.



**TV1-2, Slow F 1-2, Slow S 3-4, Red = reduced area**

- 5.17 When the image is optimized, press the icon under the Capture heading in the Scanning Image window to capture the image. There are 3 different capture settings: Standard, High Resolution, Integration.

The Captured Image menu holds up to 16 captured images.

- 5.18 To save the captured image, select the image in the Captured Image list and click on the "SAVE" button that becomes available after the image is selected.

- 5.19 To input text or measurements on a captured or saved image, click on the PCI button at the bottom of the Captured Image menu. Another program (Quartz PCI) will open that you can select TEXT, RULER, and other annotations to add to the image. After the text/measurement has been added, the image can be saved through the Quartz PCI software and this allows for other image types to be saved.

When you have completed your SEM session, please delete your images from the Captured Image list.

## 6.0 Unload Sample

- 6.1 Select the "HV" icon to turn off the gun and let it sit for a few minutes to cool off before venting the chamber.

- 6.2 Select the Home position on the STAGE CONTROL window. The stage Z should read 27mm once the stage movement has stopped.
- 6.3 Press the "EVAC" button on the front of the SEM. The LOW light will become red. Chamber can be opened when after a few minutes.
- 6.4 Open chamber and remove adapter holder from stage by gently pulling straight up.
- 6.5 Close the chamber and **push firmly on the door**, press the "EVAC" button on the front of the SEM. The HIGH light will become green.
- 6.6 Remove the sample from the sample holder.
- 6.7 Turn off the IR camera power supply and the IR camera monitor.
- 6.8 Remove images from computer via a USB drive.
- 6.9 Log off the SEM via the local TUMI computer station. Record any notes to staff or updates to the instrument status log.