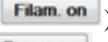


Note: This guide is NOT complete operation manual of HT7700. It is only for your daily operation quick reference.

Remember:

1. Please send me a copy of your publication (e-format preferred) if you have TEM results taken with this microscope.

BEFORE YOU START

- Check conditions of HT7700 before login FOM access control.
 - EVAC Control (right-click ): Blue everywhere except specimen area. PEG <1.2 e-3 Pa.
 - HV-Filam. Control():
 - Acc. Voltage=ON (Green rectangle at upper left corner of HV on button ).
 - Filam. Voltage=OFF (No green rectangle at upper left corner of “Filam on” button ).
 - Filam. Current=OFF (No green rectangle at upper left corner of “Beam on” button ).
 - Sample position X=Y=0, $\alpha=0$ 
 - Aperture position: Condenser Aperture=1; Obj. Aperture = 0 and Selected-area Aperture = 0 (on TEM column).

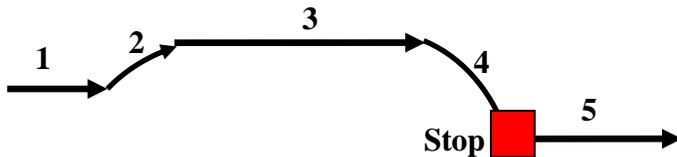
START-UP

1. Check FOM-online to see notes by previous user. Log in Access Control with FOM.
2. Fill LN₂, wait one minute till boiling then top off LN₂ again.
3. Check High Voltage value in HV-Filam. Control:
 - If Acc. Volt. Present is not the voltage you want to use:
 - (1) Make sure the Filam. Voltage (second window) is set to Auto.
 - (2) Set to desired value (40/60/80/100/120 kV) and hit “HV on”. Acc Volt change takes about 20 minutes. You may load sample while waiting.

Load specimen

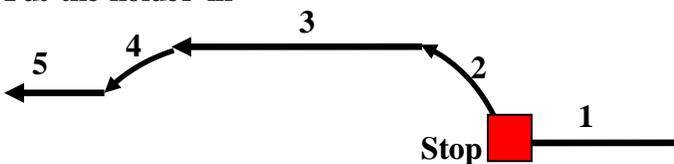
1. Stage Control : Make sure x, y α is zero. (If it is not zero, hit small square beside “Reset” to zero the stage).
2. Load Specimen. Remember to check the O-ring!

Take the holder out



- 1: Gently pull it out till it stops
2. Turn it 15° clockwise
3. Gently pull it out till it stops
4. Turn it 30° counterclockwise till it stops.
- Stop:** Set the EVAC-AIR switch to AIR.
5. Gently pull it out straight (so we do not bend the holder).

Put the holder in



- 1: Gently push in till the holder stops
- Stop:** Set the EVAC-AIR switch to Evac.
2. Once green light on (alarm on), turn it 30° clockwise.
3. Let it slid in (hold it so it can slide in gently).
4. Turn it 15° counterclockwise
5. Let it slide in gently.

Start Filament voltage and Emission current

1. If you changed HV in Start-up step 3 above, wait until the Acc. Voltage Present = Preset AND Filam. Voltage Present=Preset.
 - If you did not change HV:
 - (1) HV-Filam. Control: Make sure the Filam. Voltage is set to Auto,
 - (2) Hit “Filam. on”. This takes ~10 minutes
 - (3) Wait until Filament voltage Present = Preset value.
2. Make sure Emission Current is set to Auto. Hit “Beam ON” button.

TEM Alignment

1. Press Lens Reset (left window  or knob set).

2. Column Mode Control () . Select proper mode depends on your sample and preference, typically settings: HC (high contrast)/HR (high resolution; Brightness link; Spot size (typically 2 or 3).
3. Make sure Screen is in , click Run button in *Multi-view* operation window.
4. Find beam: Decrease mag and move sample around if cannot see beam (or use Lowmag mode if necessary).
5. Insert Condenser Lens (CL) aperture #2 (you may also use different size of aperture).
6. Condenser lens aperture alignment: Under the smallest beam (brightness), use beam shift to center beam; spread beam, use CL aperture x-y knob (on column) to center beam again.
7. Condenser lens astigmatism: If beam is not round, adjust Cond. Stigm by selecting 'CS' in the BD controlling window; in the worst case, you can load a recent alignment file (left window, right-click PDS control)
8. Set up Eucentric height: Find sample and adjust sample height, press Lens Reset button if you changed focus
 - a. Turn on image wobbler 
 - b. Adjust Z-height thumb screw (on column) to minimize image vibration.
 - c. Turn off image wobbler.
9. HV Center alignment.
 - a. Make sure Modulator is set to High Voltage , turn Mod. On
 - b. Perform HT centering with BT x&y under >20kx.
 - c. Turn Modulator Off.
10. (Gun Tilt and GH alignment are normally not necessary on HT-7700. Below is for advanced user only) Beam Deflection (BD Control)
 - a. Check/Perform GT alignment: >30K, turn off filament a little bit off, change gain and exp on CCD to see the shadow image.
 - b. Check/Perform GH alignment.
 - c. Check/Perform tilt balance alignment.
 - d. Check/Perform shift balance alignment.

TEM imaging with Orius SC 1000A camera

1. Gatan PC: Set Exposure mode to User and exposure time to 0.2 second.
2. Click Camera Inserted.
3. Click Start View.
4. Find area of interest, adjust focus and stigmator. At higher mag (>100kx), you may use Process-Live-Reduced FFT to check focus and astigmatism.
5. To save image in DM3 format, go to File menu – Save As. You may temporarily save your file in MyDocuments\Users folder during experiment. After experiment please MOVE your files to TEMServer (Z:\) under folder with your own name. Any file saved in public folder will be deleted right away. MyDocuments\Users\ folder is also dumped regularly.
6. To save image in other formats, choose Save Display As.

Selected Area Diffraction (SAD)

1. Align microscope under ZOOM-1 mode.
2. Center area of interest to center of screen. Spread beam with Brightness knob.
3. Insert desired size of SAD aperture.
4. Press Diff button in Column Mode Operation (left window) and spread beam to have smallest transmitted spot.
5. Use MAG knob to adjust camera length.
6. If the transmitted spot is not at center of screen, press PA button (BD panel) and use Def X and Y knobs to center it.
7. Press ZOOM-1 button to return to image mode as soon as all adjustment are done in order to avoid CCD damage.
8. If you want to record SAD pattern with CCD camera, make sure use the BEAM-STOP and NEVER use auto exposure, and set exposure time to 0.1 second, decrease brightness before you click Acquire. Increase exposure time SLOWLY and re-acquire if necessary. Return to image mode as soon as acquisition is complete. Use camera length 200 mm for the CCD.

STEM mode Alignment

1. Click STEM to go to the STEM mode, select desired STEM modes: "Lowmag", "Normal" or "Highmag".
2. Select detector: "TE" for bright-field and "ZC" for annular dark-field detector.
3. Set up the Eucentric height: STEM has different Eucentric height than TEM; Find sample and Adjust Z-height thumb screw (on column) to get a clear STEM image.
4. Adjust Condenser lens Stigm: go the high magnification, by adjusting Stigm to make the image more clear and in focus, like what we do on a SEM (you may wish to use a reduced area for adjusting Stigm, click on "Rec").
5. Use "DEAL" alignment to center the bright observing area (in TE mode) or dark-area (ZC) at low magnification, if the detector is not aligned.
6. Fine focus and take images (click on "capture"), and then save them as tif.

EDS in STEM mode

1. TO be added

Spectrum Imaging or Spectrum linescan

1. TO be added.
-

Change specimen

1. Remove Objective Lens Aperture (on Column).
 2. Reset sample position to $x=0$, $y=0$, $\alpha=0$  (hit small square beside “Reset” to zero the stage).
 3. Filam. Current=OFF (Beam Off button).
 4. Remove specimen holder from the microscope.
 5. Load new specimen, and then Beam On.
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Shutdown

1. Remove Objective Lens Aperture and Selected Area Aperture (bottom two apertures on column)
2. Filam. Current=OFF (Beam Off button)
3. Filam. Voltage=OFF (Filam. Off button)
4. Reset sample position to $x=0$, $y=0$, $\alpha=0$  (hit small square beside “Reset” to zero the stage).
5. Remove specimen holder from the microscope.
6. Insert empty holder back into the microscope.
7. Transfer files to TEM server.
8. Logoff your session in FOM.