

Using the 3200

Once you have your sample in the microscope, here are the things you should do before taking pictures. The first 3 items can be done before opening the beam valve since you don't even need to see the beam to do them:

- 1) Set the focus to “[standard focus](#)” by pushing the “STD FOCUS” button on the right side of the right-hand knobset (this is the button with a plastic cover);
- 2) [De-gauss the energy filter](#): Push the “Degauss” button in the lower right corner of the “Filter Tuning” window.
- 3) [Cycle between spot size 1 and 5](#) several times using the knob at the lower left of the left-hand knobset;

Now you can open the beam valve (step 4) and perform the rest of these operations while looking at the beam:

- 4) [Open the beam valve](#) (button at upper left of the left-hand knobset); this valve can also be opened from TEMcon (buttons below “Emission status” in the High Voltage Control window);
- 5) [Find the beam](#) (drop to lower magnifications if necessary) and center the beam on the fluorescent screen using the Shift X/Shift Y knobs on the left and right knobsets
- 6) The first user of the day will need to [insert a condenser aperture](#); push the “CLA” button on the top/middle of the left-hand knobset and select an aperture from the row of buttons immediately below this button; the apertures are labeled “OPEN” (no aperture) or with numbers (1-4); the smaller numbers are larger apertures (allow more of the beam to pass through them); if you do not insert an aperture before opening the beam valve, you will potentially cause more radiation damage to your specimen than if you have an aperture inserted; the beam will also not behave as well as it does with an aperture inserted; center this

aperture if necessary ; you may also need to adjust the condenser lens stigmatism;

- 7) Make sure that the magnification is at least 20,000x and push the button labeled "SPCTR" on the right-hand knobset (above the magnification control knob and to the right of the button that puts the 3200 into diffraction mode); the 3200 is now in spectroscopy mode, and you will see the energy loss spectrum spread across the phosphorescent screen; center the brightest point in the spectrum on the screen using the knob at the bottom of the "ENGY FLTR" region of the left-hand knobset; this knob will move the spectrum along its "length," and the only centering that can be done is left/right; the brightest point in the energy loss spectrum should more or less align vertically with the black dots on the larger or focusing screens;
- 8) Focus the beam to as small a point as possible using the Brightness control; this will produce a diffraction pattern (powder pattern) around the focused beam; this powder pattern is easily seen when something like the replica diffraction grating is the specimen, but even a carbon film will produce weak diffraction rings from the amorphous nature of the carbon layer; the magnification at which this should be done will depend on how far from the eucentric point the specimen is: the closer the specimen is to being eucentric, the higher the mag necessary to see these powder pattern diffraction rings;
- 9) Raise or lower the stage (using up/down arrows on small right-hand knobset) to minimize the size of the diffraction pattern around the focused beam; this is putting the specimen at the eucentric point of the microscope, which is (among other things) where the TEM is designed to operate best;
- 10) This should put the microscope very close to focus; you can either align the 3200 at this point, or simply adjust the voltage axis (steps 11 thru 14) and start recording images;

The following steps should be performed at some point before you begin to record images. It helps to find something “point-like” to use for the following steps:

- 11) **Focus at 100k** (or the mag where you intend to record images) then spread the beam to fill the large screen; examine the sample using the focusing screen (button in upper left corner of right-hand knobset) and the binoculars (you may need to adjust the focus of the binoculars in order to see things clearly using them); you must be very close to focus (minimum contrast) at this point;
- 12) **turn on the HT wobbler** (button along top of right-hand knobset); this causes the high tension to wobble (oscillate in strength) and if you are close to focus, makes the image cycle between over-focus and under-focus; the point-like object you are using for focus may move sideways and/or up-and-down as the image changes focus;
- 13) Toggle the “BRIGHT TILT” button (left-hand knobset) on; minimize the movement of the sample (point-like object) as the image oscillates between over- and under-focus using the DEF/STIG knobs on both knobsets;
- 14) An alternative to the HT wobbler is simply to shift from “at focus” (minimum contrast) to significantly under-focus; use the process described in step 13) to eliminate any movement caused by the change in focus;

You are now ready to collect images. Remember that these last steps (the voltage axis alignment) should be done at any magnification where you record images, and also bear in mind that this will need to be repeated when magnifications are changed significantly (a factor of two or more).