

3200FS Alignment

Here is the basic procedure for aligning the illumination system of the 3200FS. Due to the brightness of the beam, all these procedures can be done at relatively high magnification (on the order of 100,000) and should definitely be done at a magnification of at least 20,000. Once a user knows how to do these steps, they will only require 5 or 10 minutes at the beginning of a session and should be followed to fine tune the alignment of the microscope every time you use the 3200FS.

Before doing anything, remember to fill the anti-contaminator with liquid nitrogen and to make certain that the operating voltage is 300kV. You will then need to insert a sample and open the beam valve: the beam valve will not open unless there is a holder inserted into the column.

NOTE: While you are doing this alignment, you should make certain that features such as the Minimum Dose System (MDS) and Free Lens Control (FLC) are turned off. If either of these options are running, you will see “MDS = on” and/or “FLC = on” written at the bottom of the main TEMcon window (beside the blue text that should always read “Connected”). If you do not know how to turn either of these off, ask the staff.

Verify that you are in TEM mode (left-hand knobset, “PROBE CONT” area), that you have a beam and that you are using spot size 1 (brightest beam) and an alpha setting of 3 (most convergent setting for the condenser lens). Set the magnification to 100,000. The following steps are very similar (if not identical) to the first block of steps listed in the “Using the 3200” document. You do not need to find a point-like object and adjust beam tilt.

1. Insert the condenser aperture you want to use and center it.
2. Press the standard focus button (“STD FOCUS” button on the right-hand knobset, normally shielded with a plastic cover).

3. Focus the image by using the z-axis control.
4. Switch to spectrum mode (press the “SPCTR” button on the right-hand knobset) and center the brightest point of the energy spectrum (the zero-loss peak) using the “FL” knob at the bottom-middle of the left-hand knobset.
5. Return to imaging mode by pressing the “SPCTR” button again.
6. Make sure that the condenser aperture is well centered. [The next steps in the procedure will not work properly if the aperture is not well centered.](#)

Gun – Condenser Alignment

7. While using spot size 1 (“SPOT SIZE” knob at lower left corner of the left-hand knobset), bring the beam to crossover using the “BRIGHTNESS” knob on the left-hand knobset and center the beam using gun shift. The easiest way to activate gun shift is to toggle the F2 button in the row of buttons across the top of the right-hand knobset. This gives control of gun shift to the “SHIFT” knobs on both knobsets.
8. Turn on the Anode wobbler (in the wobbler region of the “Alignment Panel” GUI) and make the illumination wobble concentrically using gun tilt. When F2 is toggled on, the “DEF/STIG” knobs on both knobsets control gun tilt. Turn off the Anode wobbler and re-center the beam using gun shift if necessary. NOTE: This gun tilt adjustment using the anode wobbler can be performed at any time during the gun alignment, but should be done after at least one iteration of cycling between spot sizes 1 and 5.
9. Switch to spot size 5 and toggle the “BRIGHT TILT” button (middle of the right side on the left-hand knobset). Bring the beam to crossover (Brightness knob) and center using the “SHIFT” knobs on both knobsets. In bright tilt mode, these control beam shift (CLA shifts).
10. Switch back to spot size 1, bring beam to crossover and center using gun shift (toggle F2 again – this deactivates bright tilt mode and gives gun

shift and gun tilt control to the SHIFT and DEF/STIG knobs as before). You should not need to use the Anode wobbler to adjust gun tilt again, but it is always useful to make certain this is the case, especially in cases where the beam using spot size 5 was very far from the spot size 1 beam.

11. Repeat steps 8 & 9 until there is minimal movement of the beam at crossover when changing from spot 1 to spot 5. If the beam seems to be horribly mis-shaped (*e.g.*, oval when far from crossover) at any point during this or you are unable to reach the point of minimal movement when shifting between spot size 1 & 5, **STOP WHAT YOU ARE DOING AND ASK FOR HELP.**

Condenser Lens Astigmatism Adjustment

12. Using the spot size you want for the remainder of your EM session, bring the beam to crossover (Brightness control).
13. Reduce the beam astigmatism by toggling on the “COND STIG” button on the left-hand knobset and using the DEF/STIG knobs. When the beam is at crossover, astigmatism is at a minimum when the crossover beam is smallest. If you have properly adjusted the astigmatism, the beam will be round and will remain round as you pass through the crossover point (*i.e.*, the beam on either side of crossover is round). If there is still appreciable condenser lens astigmatism, the beam will be oval on either side of crossover, and the long axis of the oval will rotate by 90° as you pass through crossover.
14. If you notice that the condenser lens aperture appears to be mis-centered at this point, re-center it. A mis-centered condenser aperture causes the beam to sweep from side to side as it passes through crossover. **If the aperture is horribly mis-centered at this point, center it and repeat steps 7 through 11.**

Condenser Lens Deflector Coil Alignment (Pivot Point Adjustment)

15. While using spot size 1 and a magnification of 100k, bring the beam to crossover and center using beam shift (CLA shifts – toggle the BRIGHT TILT button on the left-hand knobset and use the SHIFT knobs).
16. Adjust the CLA Tilt interlock ratio:
 - a. In the “Alignment Panel for Maintenance” window, toggle the “Tilt” button in the “Compensator” region and the “TiltX” button in the wobbler region.
 - b. Using ONLY the DEF/STIG knob on the left-hand panel (this is marked as the DEF/STIG X control), converge the pair of beams to a single point.
 - c. Toggle TiltX off and TiltY on, and converge the pair of beams using ONLY the DEF/STIF Y knob (DEF/STIG knob on right-hand knobset)

Voltage Axis Alignment (Beam Tilt adjustment)

17. Select a magnification over 100,000, center the beam using beam shift (CLA shifts – toggle the BRIGHT TILT button on the left-hand knobset and use the SHIFT knobs) and center a point of interest by moving the stage.
18. Spread the beam to cover the phosphor screen fully (Brightness knob), focus and toggle BRIGHT TILT on (left-hand knobset).
19. Turn on the HT wobbler (“HT WOBB” button in the row of buttons across the top of the right-hand knobset) and use the DEF/STIG knobs to eliminate any directional expansion as the High Tension is wobbled.
NOTE: this beam tilt adjustment only works well at magnifications at and below 100,000x. For higher magnifications, use the procedure described in the last step of the document called “Using the 3200.”