

FULL BEAM ALIGNMENT - JEOL JEM 1200EX

Amended October 2001

ELECTRON GUN ALIGNMENT (filament MUST be saturated when in operation)

Check that the BEAM CURRENT is at $\approx 85 \mu\text{A}$ (or $\approx 15 \mu\text{A}$ more than standing BEAM CURRENT), and adjust using GUN BIAS if required. Condense beam and decrease filament current slowly to produce an image of the filament. You may need to adjust the BRIGHTNESS to obtain a sharp image. The image should look symmetrical (evenly dark). If not correct using **GUN ALIGN TILT**. Turn current to filament up to stop and re-centre beam using SHIFT X-Y controls. If beam is not saturated, i.e. the image of the filament can still be seen; move the filament current stop by **very small increments** until the image of the filament **just** disappears (this is the saturation point of the filament). Check that the BEAM CURRENT is still at $\approx 85\mu\text{A}$

SPOT SIZE ALIGNMENT

Condense beam and change to spot size 5 (flick switch; LHS). Centre beam using SHIFT X-Y controls. Change to spot size 1 and centre beam using **GUN ALIGN SHIFT** controls. Repeat procedure until movement between spot size 1 and 5 is minimal or there is no movement. Return to spot size 2 when complete.

CONDENSER APERTURE

Expand beam nearly to edges of screen. Centralise by adjusting the condenser lens adjustment screws (on aperture apparatus) so that beam expands equally toward the edges of the screen. Re-centre beam using SHIFT X-Y controls when complete. Check that the beam expands to the edges symmetrically. If not redo.

CONDENSER ASTIGMATISM ADJUSTMENT

Press **COND STIG** (LHS) Adjust beam using DEFLECT X-Y (below SHIFT X-Y controls, adjust one control at a time) until circular as you expand and condense the beam about the centre of the screen. Return to BRIGHT TILT when complete. It is probably easier to make the beam approximately circular before checking with the BRIGHTNESS control. Re-centre beam using SHIFT X-Y controls if required. If you change to a different spot size, you may have to re-perform the adjustment.

After inserting specimen, re-centre beam using SHIFT X-Y controls if required. Focus onto sample and check focus using **WOBLERS IMAGE-X** and **IMAGE-Y** (RHS; the usefulness of the wobblers decreases as mag is increased).

FOCUSING

Under focusing produces an image with a **white** fringe. Over focusing produces an image with a **black** fringe. At FOCUS neither can be seen and the image is at **GAUSSIAN FOCUS** and has **least** contrast (can look out of focus). When taking micrographs the best results are obtained when very slightly under focus (this varies between different specimens). Focusing on a hole can help, if you can find them within the close vicinity of the image.

EUCENTRIC HEIGHT ADJUSTMENT

Perform correction at 30K mag and adjust between $\pm 30^\circ$ max. Select an isolated object, centre and focus (use wobbler/s if required). Unlock goniometer hand wheel (push vertical lever away from you; light goes out), and slowly turn the goniometer. If the image moves towards the edge of screen, move the image back halfway towards the centre using adjustment knob on side on goniometer (Z height). Turn the goniometer slowly back to 0° , re-centre image using translators and re-focus image if required. Perform adjustments until minimal/no movement of the image is apparent. Lock the goniometer hand wheel (pull vertical lever towards you) and turn off wobbler/s. Re-centre beam using SHIFT X-Y controls if required.

WOBLER ALIGNMENT

It is important that you are at **focus** and **eucentric** (on an object) before performing this part of the alignment, else you will not get enough adjustment of the wobbler alignment controls.

Change mag to ≈ 10 K, condense beam and press the X-IMAGE WOBLER button (RHS) Superimpose the images by adjusting the X-controls (underneath keyboard). Repeat for Y-IMAGE WOBLER. If the image moves off screen re-centre use the GUN ALIGN SHIFT controls to re-centre. Re-centre beam using SHIFT X-Y controls if required when complete.

OBJECTIVE APERTURE (increases contrast of sample image; can also be put in place to prevent/minimise beam damage to sample)

Place OBJECTIVE APERTURE in (lever pointing to left) and expand beam slightly. Centre the aperture using screw adjusters on objective lens aperture apparatus and return to MAG 1 when complete. Re-centre beam using SHIFT X-Y controls if required. Going to low mag will help to locate the aperture if you lose it. The smallest can be the hardest to find if lost (ask EM staff to help).

SELECTED AREA ADJUSTMENT

Put the SELECTED AREA APERTURE in and centralise using the adjustment screws. Condense beam and press **DIFF** (RHS). Focus beam using the **DIFF FOCUS** control (to

produce the **CAUSTIC SPOT**; RHS of DIFF button). **EXERCISE CARE WHEN LOOKING AT THE SPOT THROUGH BINOCULARS AS IT IS VERY BRIGHT.** Centre beam using **PROJECTOR ALIGN X-Y** control knobs (underneath keyboard). Take the **SELECTED AREA** aperture out and centre the **OBJECTIVE APERTURE** around the caustic spot. Return to **MAG 1** and re-centre beam using **SHIFT X-Y** controls if required.

CURRENT CENTRING AND OBJECTIVE WOBBLE

At 40K mag, select an isolated object, focus (focusing onto the edge of the image may help) and press **BRIGHT TILT** and **OBJ WOBBLE** (RHS). Adjust using **DEFLECT X-Y** controls so that image appears to expand and contract symmetrically about a central point. Using the small screen and binoculars may help. Re-centre beam using **SHIFT X-Y** controls if required.

VOLTAGE CENTRING AND HT WOBBLE

Change to 100K mag. Select an isolated object, focus (focusing onto the edge of the image may help) press **BRIGHT TILT** and **HT WOBBLE** (RHS) . Adjust image using **DEFLECT X-Y** controls so that image expands and contracts symmetrically about a central point. Using the small screen and binocular may help. Turn off **BRIGHT TILT** and re-centre beam using **SHIFT X-Y** controls if required.

ASTIGMATISM OF OBJECTIVE LENS

At low mag e.g. 30K, focus onto an isolated object preferably the edge of a round hole and gradually work up to approximately 200 - 300K mag. You must be at **focus** on the **carbon background** when you perform this part of the alignment. Using the binoculars, gradually change the through focus, to focus on the carbon background. Press **OBJ 2** (LHS) and adjust image to **minimise** streaking using **DEFLECT X-Y** controls (image should look grainy, or like wriggling worms). Re-centre beam using **SHIFT X-Y** controls for brightest image if required. Some will consider this part of the alignment the most difficult and is a question of practice. Seek help if you have difficulty.