Basic Procedures

Check beam parameters for brightness:

- spot size, C1: 2 or 3 (L3,R3 – higher setting reduces brightness)
- gun lens: 3 (under setup tab, higher setting reduces brightness)
- C1 aperture: 4
- C2 aperture: 3 or 4

Suggestions for finding the sample:

Turn off room lights, turn on dim lights.

Go to 2000X magnification, or, if necessary, to LM mode. Make sure objective and SAD apertures are removed. Adjust the beam with the intensity knob to see if there is any light visible on the screen. Translate the sample to find an area of interest: the edges of an ion milled hole or a grid opening for a carbon support sample.

Setting eucentric position

“Eucentric position” means that the specimen height is adjusted to be on the tilt axis of the goniometer stage.

There are two ways to set eucentric height of the sample:

First set the mag at 5000-20000X.

1) press “eucentric focus”. This presets the objective lens to be focused at the level of the goniometer tilt axis. Then adjust the “Z axis” up or down to bring the image into focus.

OR

2) Use the alpha wobbler, L2, to tilt the sample back and forth. Adjust the “Z axis” up or down to minimize image movement.

Imaging - Insert an objective aperture as follows:

Focus the beam with the intensity knob near to crossover, slightly larger than the small circle on the screen. Make sure it is on part of the sample, and not in a hole. Go to diffraction mode and press eucentric button. Immediately insert the beam stop and position it on the bright center spot.
Insert aperture #2. Center the aperture with respect to the transmitted beam (bright central spot) of the diffraction pattern using the aperture translate controls. You may view this on the CCD camera if desired. Return to image mode and spread beam CW.

Note: when in diffraction mode, the diffraction pattern can be translated with the multifunction knobs (diff shift).

**Focusing**

Using CCD camera, observe edge of hole as you change focus. Start at low mag (20kX) and coarse stepsize (6-7). Fringes around the edge mean you are out of focus. As you go through focus clockwise (defocus to overfocus), the fringe appears as a single white fringe, then disappears approximately at focus, then reappears as a black fringe in overfocus. Go up several steps in mag and repeat till you reach the desired magnification.

**Obtaining a selected area diffraction pattern:**

1. Check that the specimen is in the eucentric position and focus the image.

2. Insert the SAD aperture. Choose the appropriate size to cover the area of interest. Center it on the desired area. Ensure that beam crossover is centered with respect to the aperture. Then spread the beam CW.

3. Select diffraction mode (diffraction button) and desired camera length (magnification knob). **Immediately insert the beam stop** and position it on the center spot.

4. Focus the edge of the objective aperture with the focus knob (now the diffraction lens). This can be done on the CCD camera. Then remove the aperture.

5. Focus the diffraction pattern with intensity knob. You may do this on the fluorescent screen by focusing the center spot to a sharp crossover and immediately inserting the beam stop. Or you can insert the beam stop and focus the rings looking at the CCD image.

6. **Be sure to use the beam stop.** Do not leave an intense beam on the screen as it will cause burn marks on the phosphor screen.

7. Adjust diffraction lens stigmator.
To return to image mode:

1. Insert OA and center it on the transmitted beam (central spot of the diff pattern).
2. Deselect diffraction mode.
3. Remove SAD aperture.
4. Adjust intensity

Obtaining a CBD/microdiffraction pattern:

1. Center selected area of specimen on screen.
2. Choose appropriate spot size (C1); focus beam to crossover (C2) and position on selected area.
3. Press diffraction button; remove OA.
4. Vary C2 aperture, i.e. convergence angle, to change size of diffraction disks. For very small beam sizes/selected areas it may be necessary to slightly reposition beam or re-center aperture after changing C2 aperture. Observe in "M" mode to determine if this is necessary.

Note: Do not insert SAD aperture. As with SAD, reproducible L may be obtained by focusing on image (eucentric position) with objective lens and on OA with diffraction focus.

To return to image mode:

1. Insert OA and center it on the transmitted beam (central disk of the diff. pattern).
2. Deselect D.
3. Spread beam CW.