H8100 Daily Operation Guide

Note: This guide is NOT complete operation manual of H8100. It is only for your daily operation quick reference. For detailed operation manual, please refer to http://www.nuance.northwestern.edu/epic/manuals.htm

Remember:
1. Please send a copy of your publication (e-format preferred) to Jinsong (jinsong-wu@northwestern.edu) if you use any TEM results taken with this microscope! We highly appreciate if you include NUANCE Center in the Acknowledgement.
2. Adjust the alignment settings ONLY when necessary.
3. Refill Liquid Nitrogen if your experiment goes over 2 hours.

BEFORE YOU START
- Check conditions of H8100 before login the access control. (Turn on Panel Lamp at right side of control panel if necessary)
  - Vacuum lights (Gun=green, column=green, specimen=yellow, camera=green);
  - Sample position (X=0, Y=0, tilt=0), Apertures position (Condenser=1, Objective=0, Selected area=0);
  - Filament=OFF, HV=200 (CRT), probesize=miccro3, Zoom (left panel) &Bright (right panel) ON.
- Check FOM records to see notes left by previous user.

START-UP
2. Turn off HV (press Acc. Voltage READY/OFF twice); Load Specimen. Remember to check the O-ring!
3. Turn on HV (press Acc. Voltage READY/OFF once), press 200KV to increase HV.
4. Apply Filament Current SLOWLY (20 seconds per division). Stop at one division before maximum.

FIND BEAM
5. Check emission current (HV/BEAM meter, 0<current < 10 μA.).
6. Follow these steps to find the beam. Skip to next part (step 7) whenever you see the beam.
   - Dim or turn off room light. Remove cover of viewing chamber. Decrease MAGNIFICATION to see if beam appears. If yes, go to next part (step 7).
   - Press LOW MAG. If you see the beam, move a hole on your specimen to the center of the screen. Focus the beam to small spot through the hole on the sample; go back to ZOOM mode (press ZOOM). Adjust sample position and BRIGHTNESS to find the beam.
   - Call for help if you still cannot find the beam.

CHECK Gun Tilt
7. Change MAG to 20K. Adjust BRIGHTNESS to get the smallest beam spot.
8. Center beam with BRIGHTNESS CENTERING. It should look like fig. 1a or 1b.
9. Adjust GUN TILT slowly and see the feature change. Try to find the brightest and the most symmetrical position of the beam (fig.1a). (Do not touch GUN HORIZ knob at this step!)
10. Slowly increase Filament current until you see saturated beam as shown in fig. 1c.

CHECK Gun HORIZ (To remember the knobs used in this step, “1C-4G”)
11. Change MAG=8K. Make sure Probe Size on CRT is 3, center beam with BRIGHTNESS CENTERING.
12. Use SPOT SIZE knob (left sub panel) to select probe size 1, center beam with BRIGHTNESS CENTERING.
14. Repeat last two steps until beam is centered at both probe 1 and 5.
15. Set probe size back 3 when finish alignment.
16. Center beam with BRIGHTNESS CENTERING.

CHECK Condenser lens (C2) Aperture centering
17. Change BRIGHTNESS largely back and forth to see how the beam image changes.
18. If the beam spread and shrink uniformly like fig 2a, go to Find specimen part (step 23).
19. If it changes from fig. 2b to fig. 2c with changing brightness: a). Focus the beam to the cross-over, center it by using BRIGHTNESS CENTERING.
   b). Spread the beam out by turning BRIGHTNESS knob clockwise;
   c). adjust C2 position knobs on the aperture handler to center the beam.

CHECK Condenser lens stigmatisation
20. Change BRIGHTNESS largely back and forth to see how the beam image changes.
21. If the beam spread and shrink uniformly like fig 3a, Skip to next part (step 23).
22. If it changes from fig. 3b to fig. 3c with changing brightness, adjust COND STIG until it spread and shrink uniformly as shown in fig. 3a.

FIND specimen and SET eucentric height
23. Change MAG>=8K. Move specimen to find a small feature with sharp edge.
24. Check OBJ current on the CRT and set it to 5.25 (adjust FOCUS or press reset under the CRT)
25. Spread beam with BRIGHTNESS to cover whole screen, as long as you can still see specimen image.
26. Turn on Wobbler (right panel) and the feature may vibrate.
27. Adjust Thumb-screw on GONIOMETER to minimize the vibration.
28. Turn off Wobbler when you finish.
Voltage Center Alignment
29. Move specimen to find a very small feature with sharp edge on your specimen under MAG=10-25K. Decrease or increase MAGNIFICATION if necessary. Use binocular if necessary.
30. Spread beam with BRIGHTNESS to cover whole screen.
31. Turn on CCD Camera (in Search Mode): refer to CCD instructions.
32. Under CRT (left), make sure STOP button is lit on. Press PHOTO to raise viewing screen.
33. Center the small feature to the center of CCD with Specimen transition knobs
34. Turn on HV MODULATION (right panel). The image feature may vibrate. (Spread beam if you see beam vibrating other than image feature.)
35. Adjust BEAM TILT (right sub panel) to minimize the vibration of the feature.
36. Repeat last step at MAG 100k or higher if lattice imaging is needed.
37. Turn off HV MODULATION.

Objective lens stigmatism
38. Find and center a amorphous area in the CCD, under Process menu click Live and then Reduced FFT;
   Turn FOCUS knob (right panel) and watch for the inner circle in the FFT window; use OBJ STIG X&Y knobs (left sub panel) to make the inner circle as round as possible (increase time to 0.9 s, if contrast of the ring is low). Tips: dark fringe (over focus), bright fringe (underfocus).
39. Turn FOCUS knob to maximize the diameter of the inner circle in the FFT window. Now we are closed to the optimal focus value. Fine tune can be done by looking at the image carefully.

Take Picture
40. Always take picture with underfocus (white edge).
41. To take picture with digital CCD imaging, follow separate manual.
42. To take picture with negatives, change exposure time (left of CRT) to AUTO and check exposure time on CRT. Typical time is less than 5 seconds. Make sure that the STOP light under CRT is NOT lit. Press FEED and then PHOTO to take pictures.

Selected Area Diffraction (Skip if you don’t need SAED analysis)
43. Find and center an interesting specimen area
44. Insert and center a suitable SA APERTURE
45. Press SA (left panel)
46. Make sure that the * is at left corner of intermediate lens current Ii on the TEM monitor. If not, click UP/DOWN ARROW key to cancel any highlighted item on the TEM monitor. Input 5 from keyboard (left panel) and press RETURN. Focus SA aperture using DIFFRACTION SPOT knob (left panel) and binocular.
47. Make sure that the STOP light on TEM data monitor is lit. If no, press STOP once to make it lit.
48. Press DIFF (left panel). If the central spot is not at the viewing center, center it using the INTER ALIGN X and Y knobs (left sub panel). If the spot is not round, make it round using INTER STIG X and Y knobs.
49. Spread beam by turning BRIGHTNESS counterclockwise. Diffraction spots will become weaker and smaller.
50. Focus the pattern by adjusting DIFFRACTION SPOT (left panel).
51. Record a few SA diffraction patterns the CCD. Please use the beam stop if the transmitted spot is too bright!!

Bright Field/Dark Field Imaging (Skip if you don’t need Dark Field imaging)
52. Follow previous step, insert and center a suitable Objective aperture on Transmitted spot of SAED pattern.
53. Press ZOOM, remove SA aperture to see Bright Field image. Adjust focus and/or obj stigmatism if necessary.
54. Check exposure time and take image (see step 41).
55. Remove Obj aperture, insert SA aperture and press DIFF to go back to SAED mode. Center Obj aperture to one diffraction spot.
56. Repeat 52&53 to record Dark Field image. You may set manual exposure time if image is too dark.

TEM shutdown
57. Turn MAG down to 8000, center beam and spread beam to cover whole screen.
58. Move specimen to origin: X=0, Y=0, Tilt=0
59. Turn MAG to 6K
60. Slowly turn the Filament current to off (3 minutes)
61. Press Acc. Voltage READY/OFF twice to switch HV off
62. Check or set these settings to standby mode:
   * OBJ aperture OUT  * SA aperture OUT  * Condenser aperture=1
63. Make sure specimen position at origin, take specimen holder out of the column
64. Remove specimen and insert specimen holder back to TEM till STOP position. Push EVAC switch to evacuate.
65. If no negative film was used, turn on HV at 200kV, complete logbook and logout FOM software. Go to next part if there are negative films to be developed.

Film development and Refill (if negative films were used during the session)
66. Open N2 cylinder, turn off all lights (including CCD monitor, CRT and panel lamp).
67. Wear Gloves, and exchange film magazines.
68. Wait until vacuum is good (camera green light), turn on HV at 200KV and reset unused film number to 21.
69. Complete the log book, log out the computer, develop your films, and refill with blank negatives (21 pcs total).