CHECKLIST FOR VERIOS OPERATION

A. GENERAL

1. The SEM lab is a high visibility lab and must be kept clean and neat so please clean up behind yourself
2. The Verios 460L SEM is to be treated as ultra-high vacuum grade equipment, i.e., use gloves when handling samples, sample stubs, the sample shuttle, tweezers, tools, and any other object that is going into the SEM or will touch anything that is going in the SEM.
3. Magnetic samples are not allowed in the Verios except under very limited circumstances – see Chuck.

B. SAMPLES

1. Sample stubs should be clean and free of residual hydrocarbons.
2. Samples should be minimally volatile and free from contaminants, i.e., the sample is clean and won't outgas
3. If the sample is an insulator, then the region of interest should be located as close to the center of the stub as possible
4. Mount SEM stubs in the shuttle, tighten set screw gently (two fingers!)
5. Sample height is checked with the gauge and there is clearance between gauge and sample
6. Sample holder pin is checked to ensure it does not protrude beyond the bottom plane of the shuttle

C. SAMPLE LOADING

1. The shuttle is properly seated on transfer arm – the three rubies are seated in the grooves on the load arm
2. The shuttle has been clamped and did not move during the clamping process
3. The loadlock door is closed and the door is in solid contact with the gasket (push down on the back of the door)
4. Click "Load" in the navigation tab and watch the process making note that all steps occur without issue

D. PREPARING TO TURN ON THE BEAM

1. Confirm vacuum is $5*10^{-6}$ torr or less before turning on the beam
2. Double click on the sample of interest in NavCam image to place the sample under the beam
3. SEM is initially set for mode 1 operation – if the sample is <1 mm tall the starting working distance will be ~8 mm

E. IMAGING

1. Turn on the beam: Choose the landing potential, current, and stage bias desired
    a. 2 kV and 13 pA are a good starting point if you do not know what to choose
2. Click on quad1 to make it active, then un-pause the acquisition. Check that this is set to the ET detector in SE mode.
3. Find the region of interest, focus, correct astigmatism, and zoom until you have a reasonable image at ~10 kX
    a. Don't spend too much time making things perfect in mode1! Do this in mode2!
4. Link stage and check that the link was successful, i.e., the stage position and WD in data bar match
5. Decrease working distance to 6-4 mm. Users are encouraged to go in stages, i.e., ~2 mm per step, to be safe
    a. Shorter working distances make better high resolution images
    b. Longer working distances make better depth of field
6. Switch to Mode2, then check the focus and astigmatism correction (don't try to make it perfect yet!)
7. Align the electron-optical column, i.e., open direct beam adjustments and check
    a. Crossover (UC on: check the intensity then shape; UC on or off: place the brightest part of the spot on the green cross)
    b. Modulation (make the image stop shifting; recommend >25 kX, 30% modulation)
8. Perform the final focus and astigmatism correction – make the image as good as possible at this point
    a. Check the stage link!
9. If 2 kV and 13 pA do not provide good results, adjust the landing energy, current, and sample bias to suit
    - After changing beam conditions, check the direct adjustments as they will likely change

F. FINISHING YOUR SESSION

1. Pause the active acquisition(s)
2. Turn off stage bias
3. Turn beam off
4. Make sure that CCD camera is live (i.e., un-paused)
5. Retract any movable detectors (CBS and/or EDS and/or STEM)
6. Zero the stage tilt and scan rotation
7. Click on sample unload from the navigation tab and watch the process
    a. The system will take the stage to the sample exchange position automatically
8. After transfer, open load lock and press "release" button
9. Remove your sample – turn the set screw one turn only
10. Re-load the empty shuttle into the microscope
11. If you work longer than your reserved time, please check out using the Lab Management system