

Low Temperature (CCR) Startup

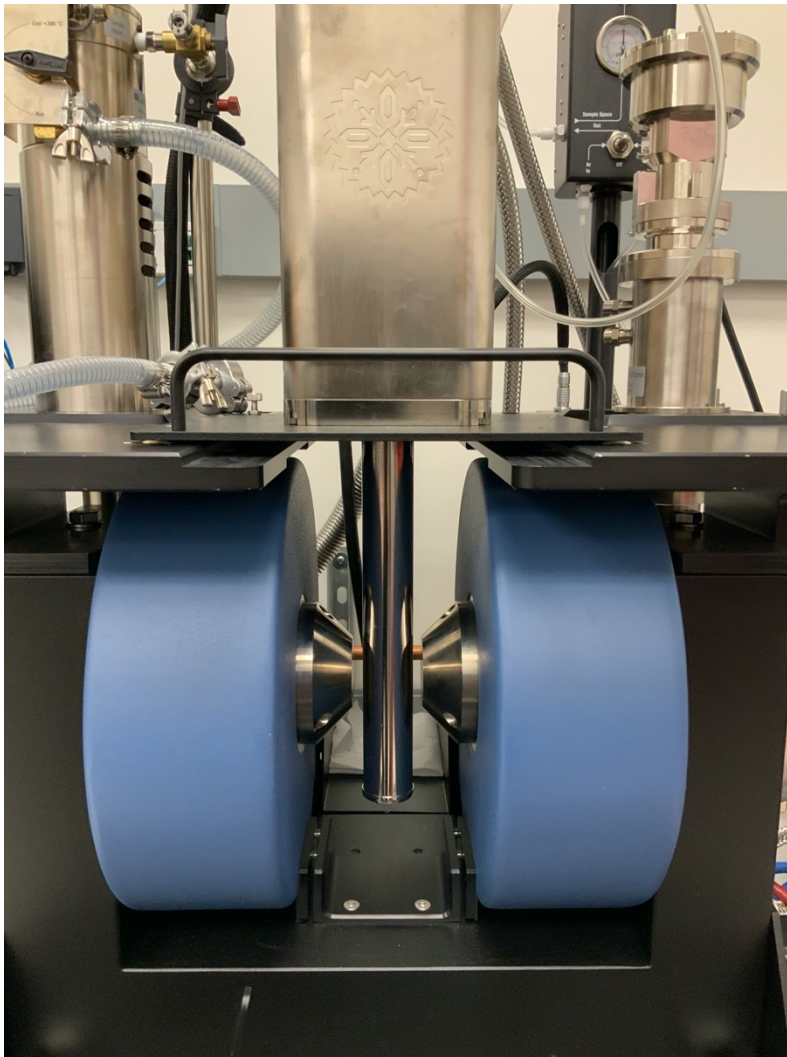
Standby Condition

1. The turbo pump is off (0 Hz). The CCR pumping line (the metal tube) is connected to the turbo pump.
2. A Helium cylinder is connected to the
3. Coax cables and control cables should be disconnected.
4. Nothing between magnets (CCR head back, Oven/RT on the left and right side).
5. Tables should be tidy.

Startup the CCR

1. Setting up for the CCR:

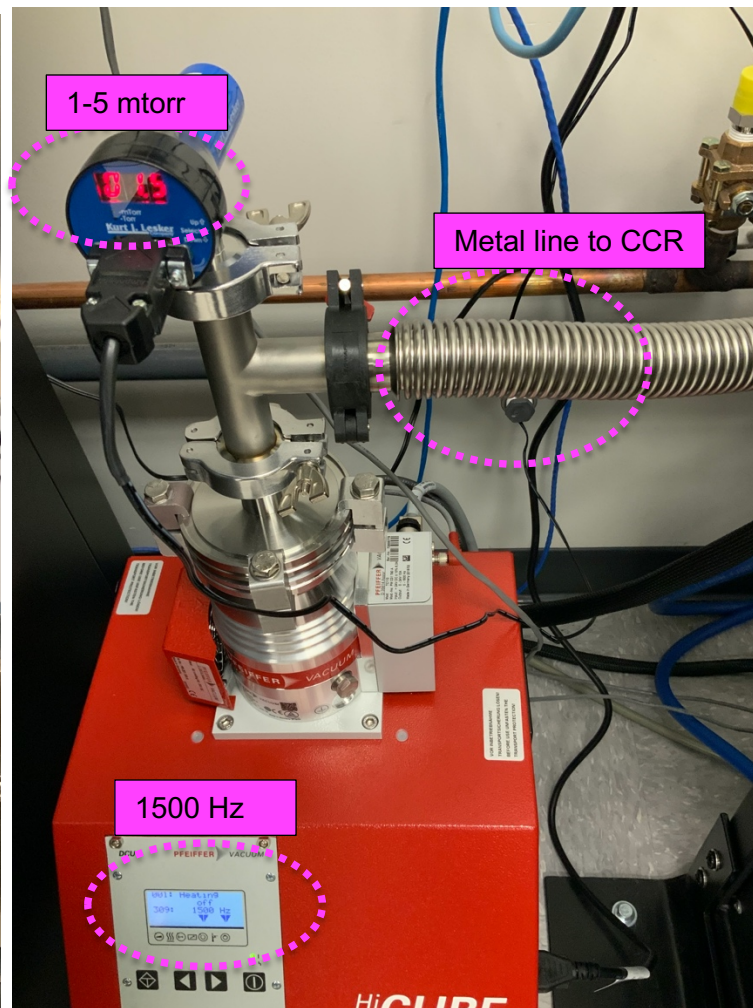
- a. Enable the Lakeshore on Badger.
- b. Make sure that the tool is calibrated to setting 3 (refer to previous use in the Lakeshore logbook). The CCR base will not fit in setting 1.
If the calibration is in setting 1, you will need to calibrate to setting 3 using the RT head.
- c. Pull the CCR head forward to the measuring station.



2. Pumping the CCR vacuum space.

The CCR vacuum space should be under vacuum with the valve closed. If, for any reason, the CCR vacuum space is at atmospheric pressure, reverse steps a) and b) below.

- Turn on the turbopump, wait until the frequency reads 1500 Hz, and the pressure should read between 1 - 5 mTorr.
- Slowly open the valve to the CCR vacuum space. The pressure may rise as you open the valve (air always leaks into the vacuum space, even if the valve is closed). Eventually, the pressure should return to 1-5 mTorr, at which point you can ensure the valve is fully open (rotate counter-clockwise all the way).
- The valve must remain open and turbo pump must remain ON during the entirety of your run.



3. Loading your sample

Wearing gloves, remove the insert from the CCR, and carefully lay it by the soldering station.

- a. Use tweezers and cryo wire to solder your sample onto the metal posts.
- b. Note that only indium solder should come into contact with the insert's copper base. Regular lead/tin solder is fine, just so long as it's solely in contact with your sample.
- c. Note: Use an indium soldering iron for the indium solder, and a standard iron for the lead/tin solder.
- d. Once your sample is mounted, carefully place the insert back into the CCR, and shut tightly.

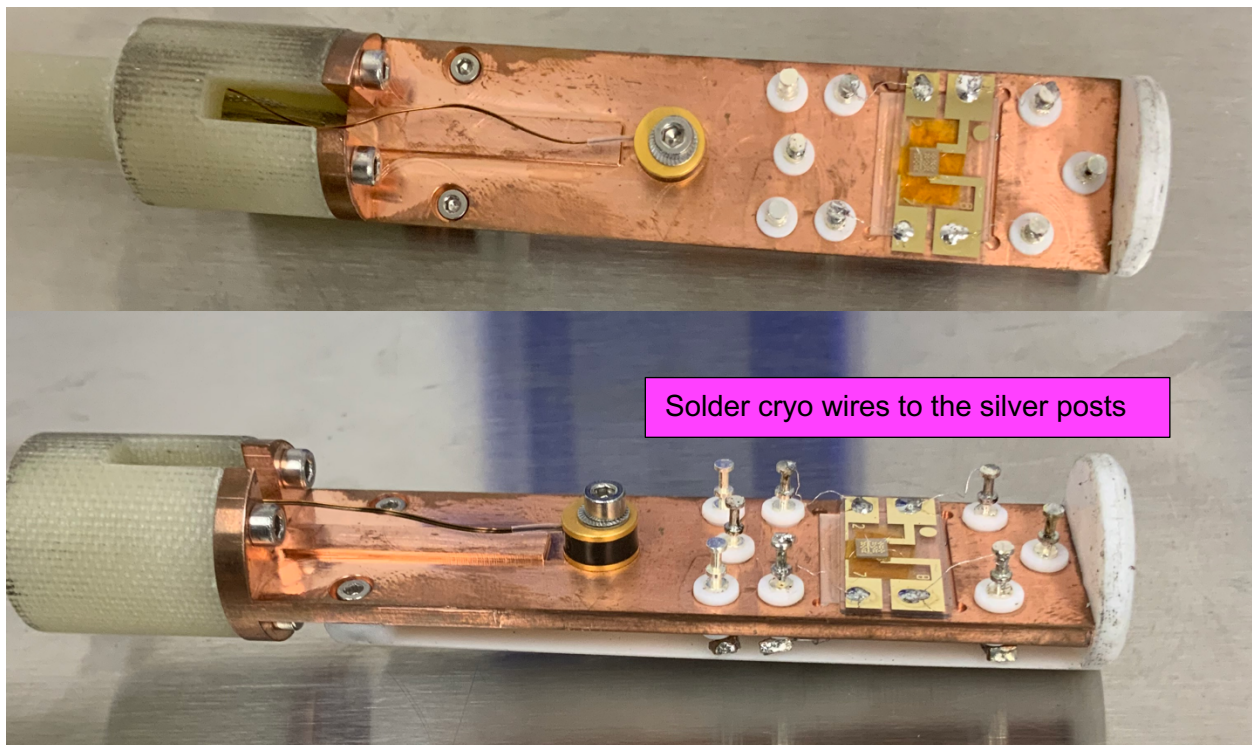
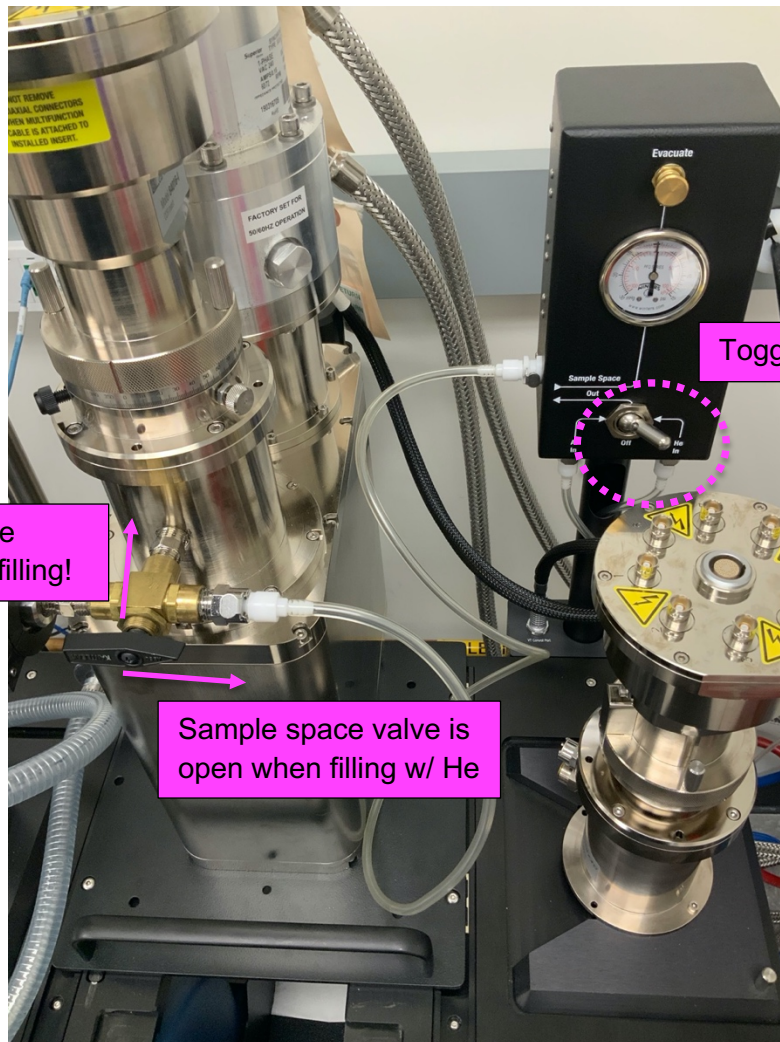


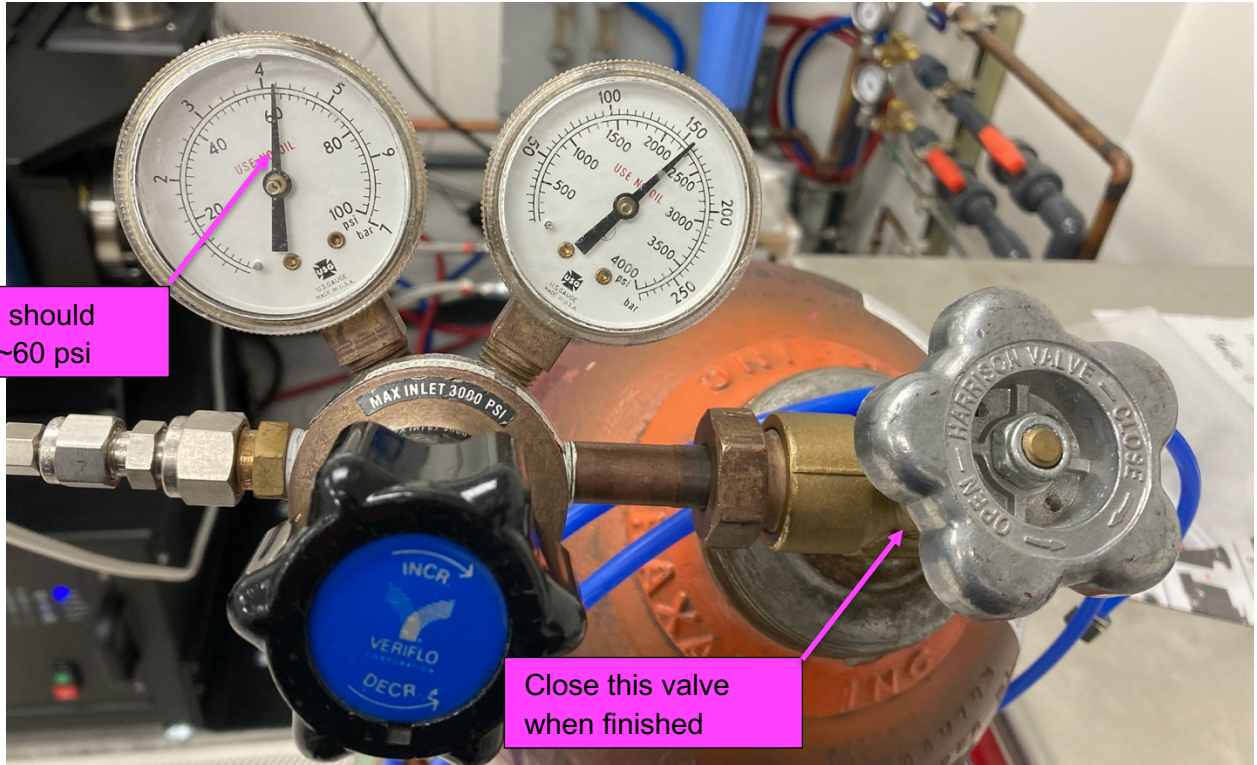
Figure 1: Sample soldered and ready to go

4. **Filling sample space with Helium by holding “Evacuate” at least 3 times**

NOTE: If there is no helium cylinder present, you cannot use the CCR!

- a. The gas line must be connected to the sample space inlet.
- b. The valve to the sample space must be open (i.e., the arrow is parallel to the pipe).
- c. The switch on the gas handler must be toggled to “He In”.
- d. The He gas cylinder must be open, and the pressure control should read 60 psi. (picture on the next page)
- a. Press and hold “Evacuate” until the dial rotates to about -15 psi. This should take about 8 seconds . . If the dial rotates *quickly*, or doesn’t rotate *at all*, something is wrong. It is likely that the valve to the sample space is still closed, or the valves to the Helium cylinder are closed.
- e. Once finished, close the valve to the sample space (arrow perpendicular to gas line) and also close the main valve of the Helium gas cylinder.



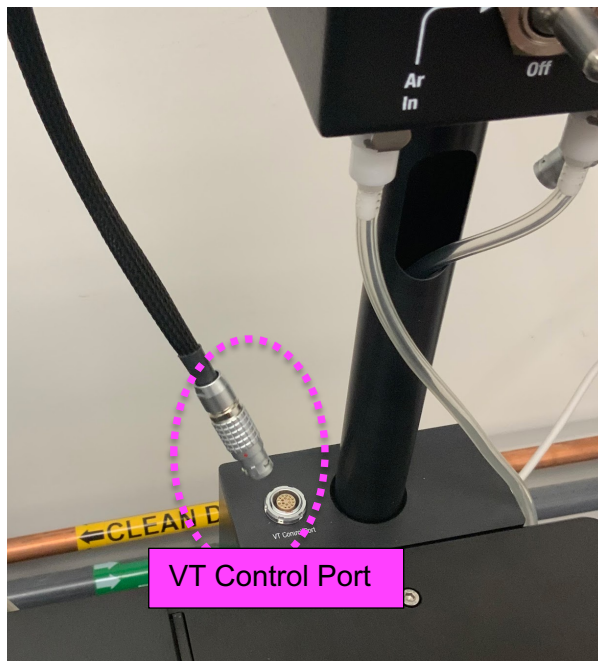


This dial should point to ~60 psi

Close this valve when finished

5. Connect the 8 coax cables and both control ports.

- a. There are two control ports, one in the middle of the coax cables, and another on the back side of the CCR head (picture below). The other port cable should be in the drawer. Connect this second port to the “VT Control Port”.
6. Turn on the Lakeshore magnets.
7. Turn on the CCR Compressor (picture below). It is important that the vacuum be below 10mTorr and the sample space filled with He before you turn on the compressor.
(Note that the compressor is quite loud, so don't be alarmed.)



8. Review the CCR Checklist prior to starting.

If everything checks out, then you can now open the Lakeshore software on the computer and start your experiment.

Shutdown the CCR

1. Export your data, and close the software.
2. Turn OFF the CCR compressor and the Lakeshore magnets.
3. Read the *NOTE below. Wait at least 2 hours with the CCR compressor OFF, vacuum ON, and the temperature set to 300 K.
4. Wearing gloves, retrieve your sample.
NOTE: A portion of the CCR insert may still be chilled, which will induce condensation and frosting. This is fine as long as you do not touch the frost.
 - a. Remove the VT control port cable and place it back into the drawer, leave the other control port with the 8 coax cables hanging in the arm.
 - b. Remove and lay the CCR insert onto the soldering station and use the soldering iron to detach the cryo wires from your sample. It is OK to leave the cryo wires attached onto the silver posts.
5. Place the insert back into the CCR head and close firmly.
6. Close the CCR valve to the vacuum space.
7. Turn off the turbopump
NOTE: It's important that you close the CCR valve first.
8. Push the CCR head back to its standby position.
9. Fill out the Lakeshore logbook!
10. Ensure that the space is clean.
11. Disable tool on Badger

*NOTE: The sample space temperature must remain at **room temperature** for at least 2 hours before proceeding (with the compressor OFF, vacuum ON, and temperature set to 300K). Normally, the moment sample space temperature reads 300 K, the rest of the insert is still at a very low temperature. Wait ~2 hours to give the entire CCR insert some time to come up to normal temperatures.

Ideally, you could leave the tool alone overnight with the compressor OFF and the vacuum ON. You can push the CCR back to its standby position so that others may use the RT head in the meantime.