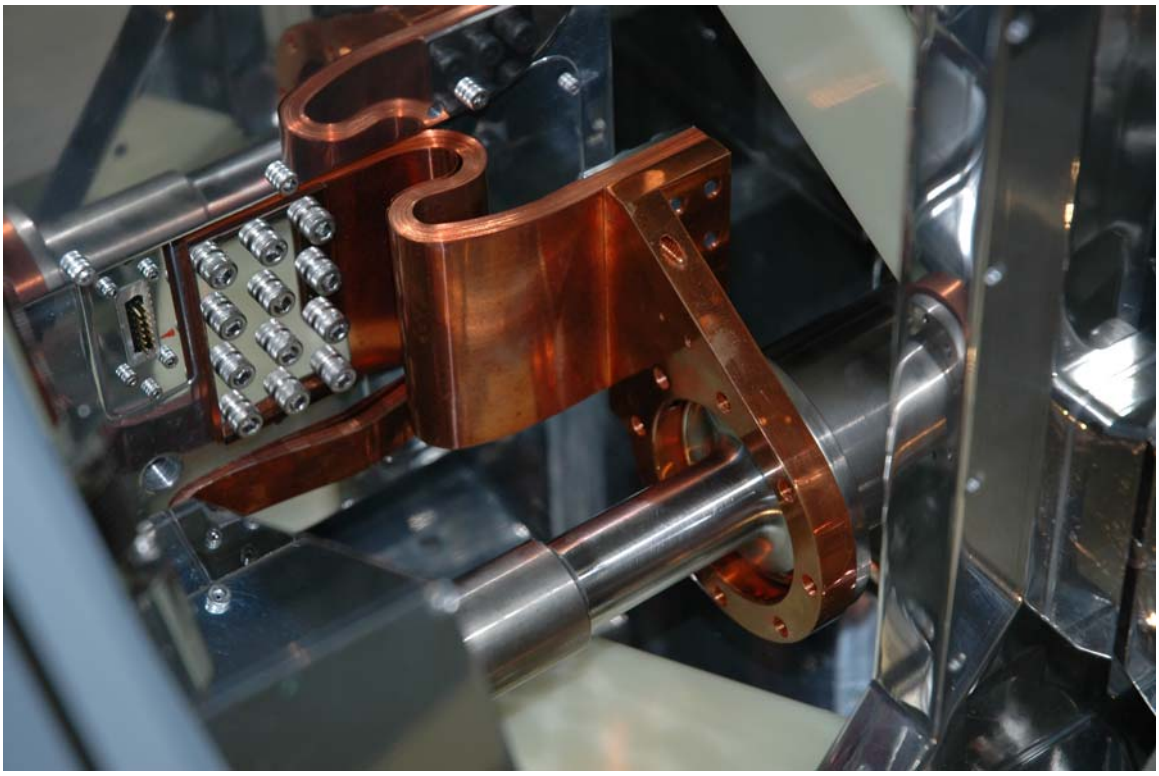
NICI Closed Cycle Cooler Replacement



Mauna Kea Infrared

Douglas Toomey 11/20/04

NICI will require that the cooler heads be replaced approximately every three years although this is dependent on the cleanliness of the helium gas system. Because of this NICI is design to make cooler changes relatively easy.

Safety Issues

Helium gas released in a closed room will reduce the partial pressure of oxygen and can be dangerous. If a closed room is used a Oxygen partial pressure meter and alarm must be used. With proper procedures helium will not be released but if the fittings are not handled correctly it can happen.

If NICI is not fully warm and the vacuum is broken water can condense on the internal parts and optics of NICI and the instrument function and performance can be degraded. Always make sure that the instrument is fully warm before breaking vacuum.

The coolers heads are heavy. Do not attempt this service with one person. Two people are required.

DO NOT disconnect the closed cycle cooler lines from the cooler heads until the instrument is fully warm or dangerous pressures can develop in the cold heads.

The cooler heads run on two phases of 170 volt ac. Make sure the power is turned off and the connector to the cold head is disconnected before proceeding with the service.

Read the CTI manuals before performing any service on the coolers.

Closed cycle cooler head replacement procedure

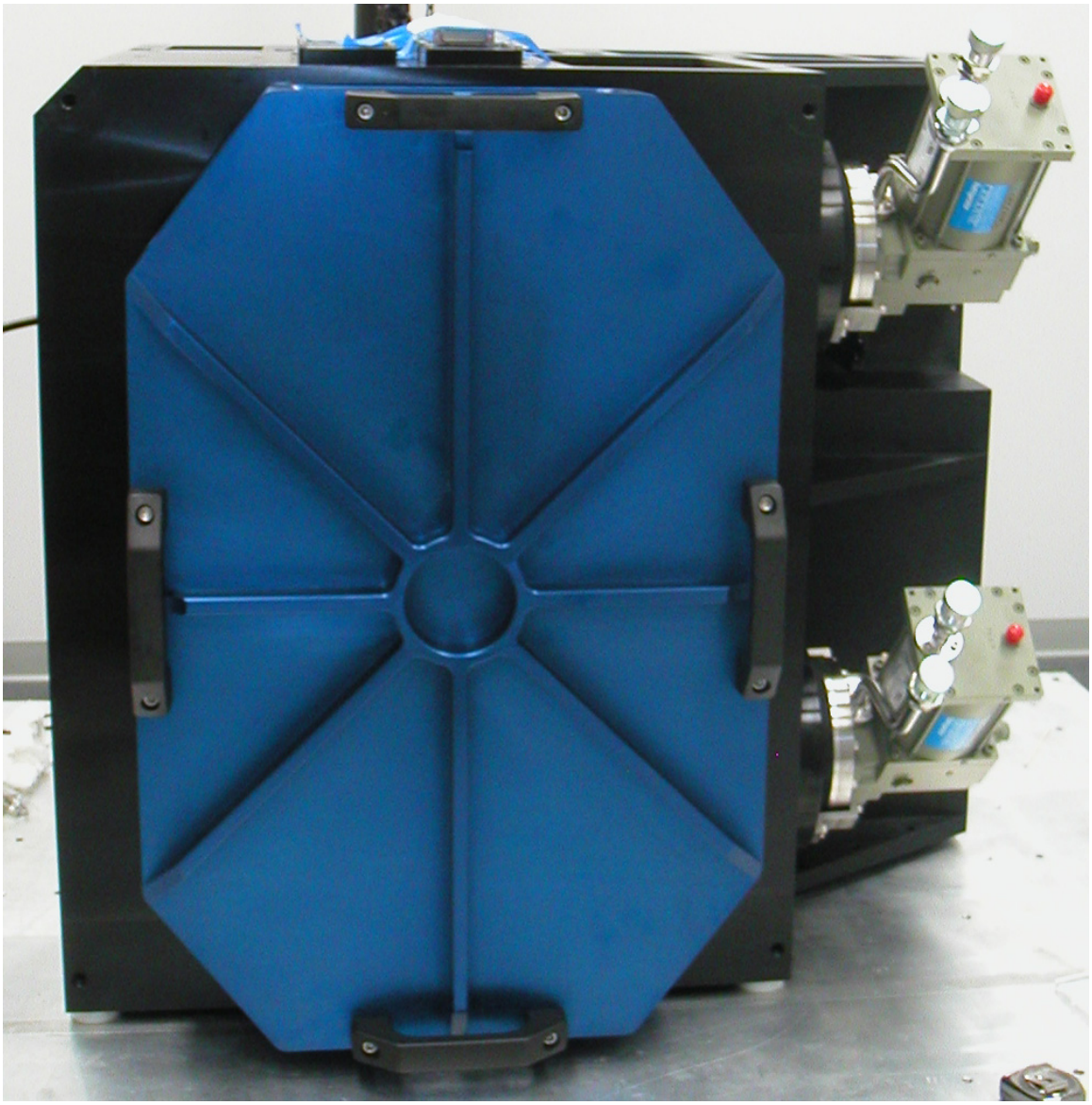
The cryostat must be fully warm. The temperature sensors do not guarantee that all of the inner parts are warm. Large mechanisms such as the dichroic wheel will lag behind the cold structure in warming up. Two days after the cold structure is at room temperature should be adequate for the mechanisms to warm up. Still avoid doing this process if humidity is very high.

Gloves should be worn for all internal work.

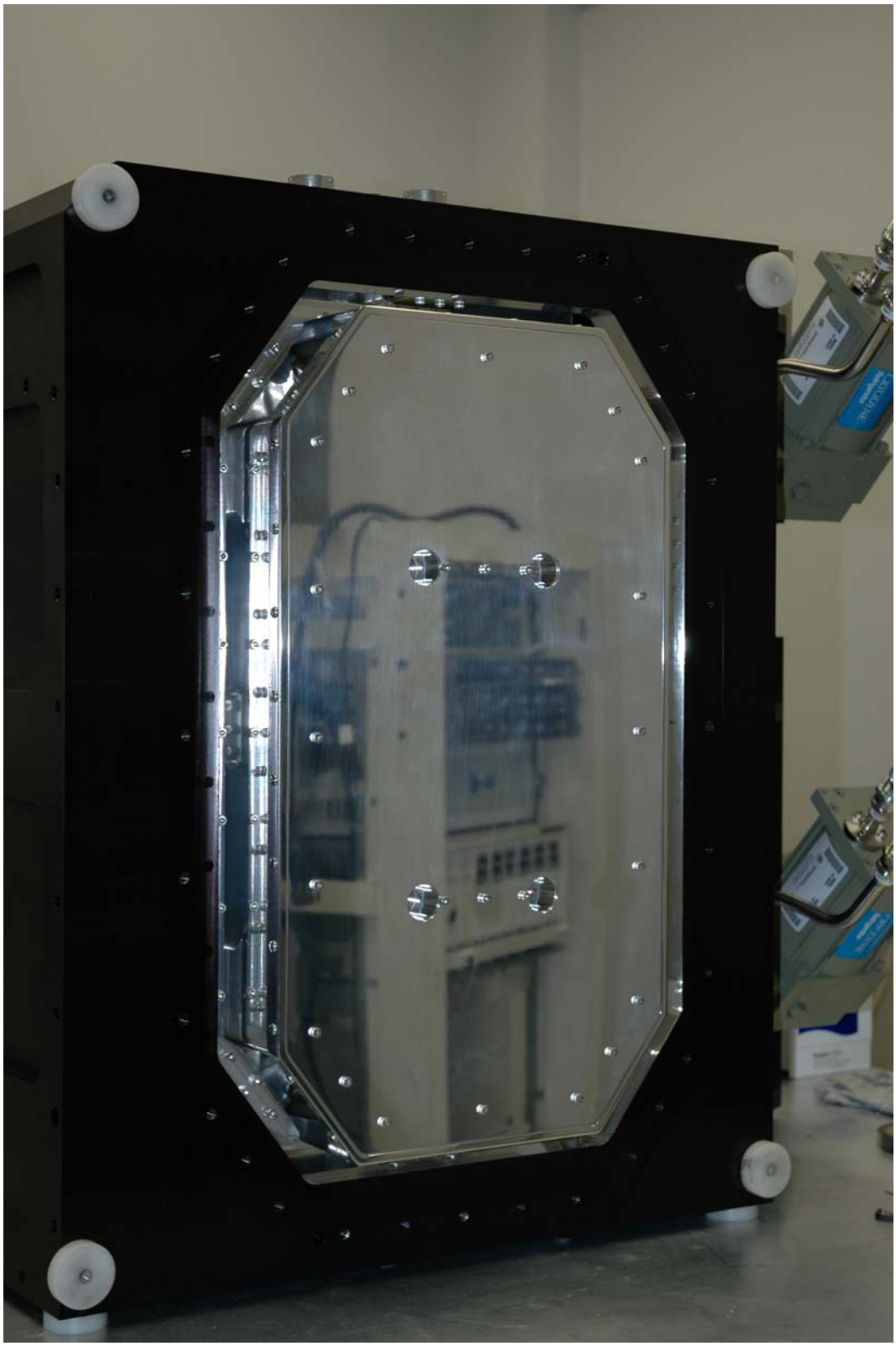
Work should be done in a clean area to minimize dust on the NICI optics.

The closed cycle cooler lines and power should be disconnected.

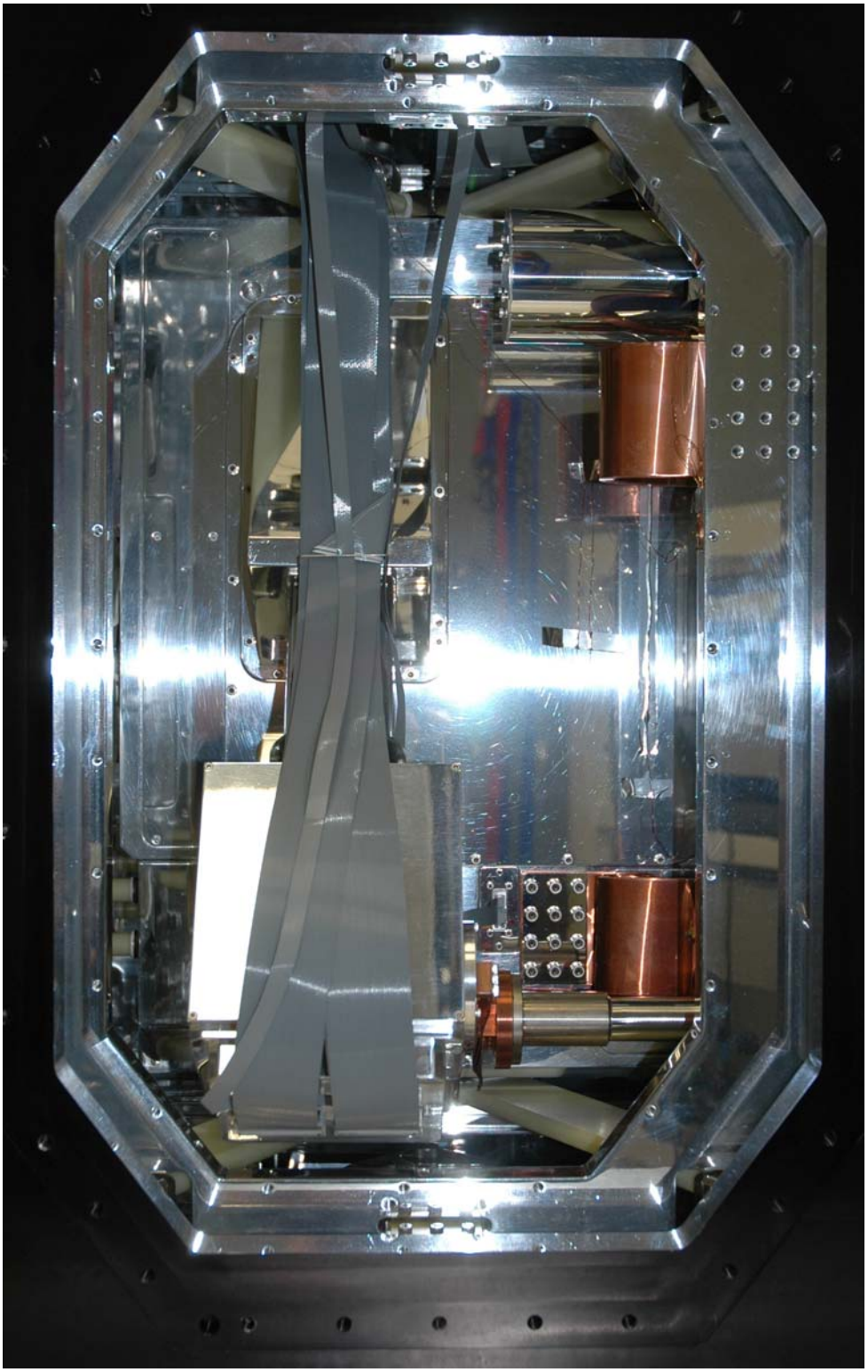
Vent the cryostat by opening the vacuum valve. It is preferable to backfill the cryostat with dry nitrogen so that all of the nooks and crannies get fill with clean dry nitrogen as opposed to wet air.



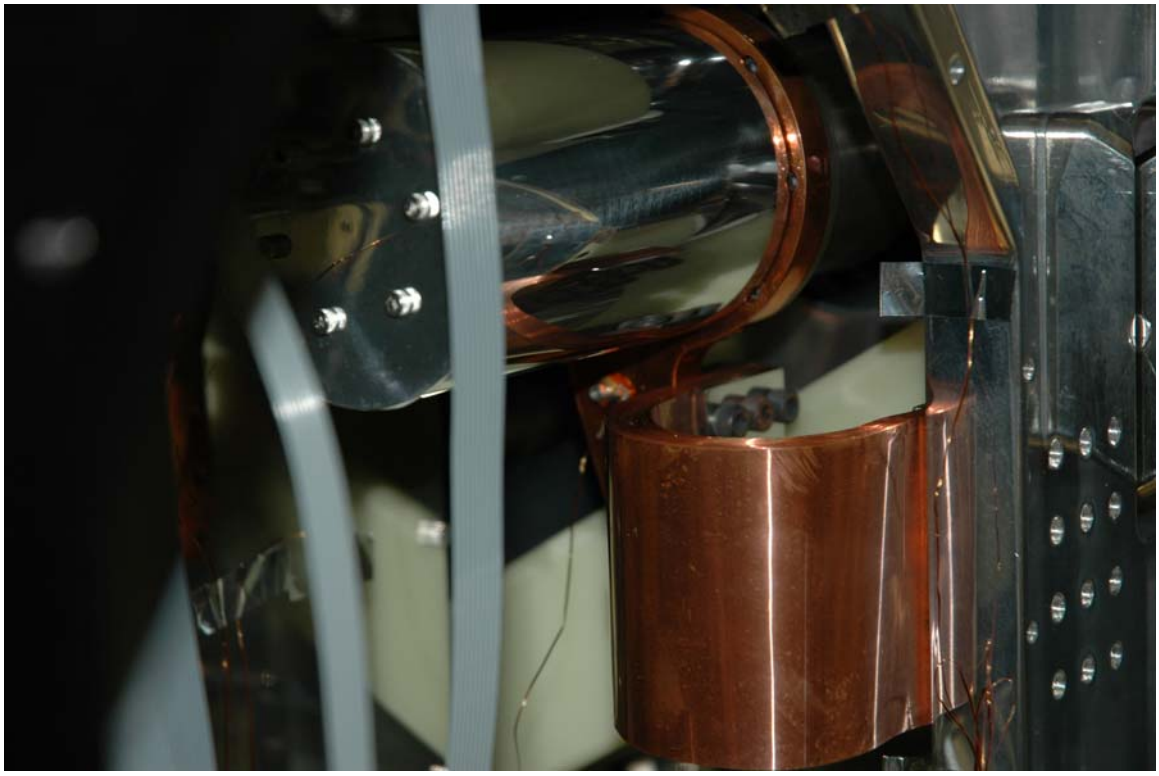
Remove the blue vacuum jacket cover.



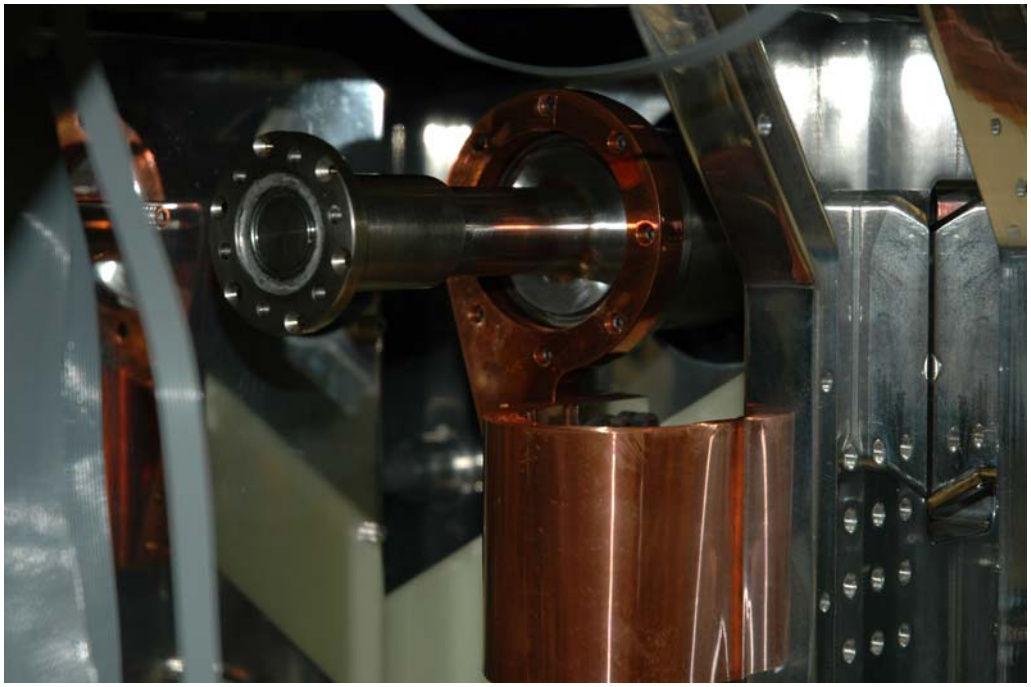
Remove the radiation shield cover. The four holes are for your fingers. Note the orientation of the punch marks that shows how the covers align.



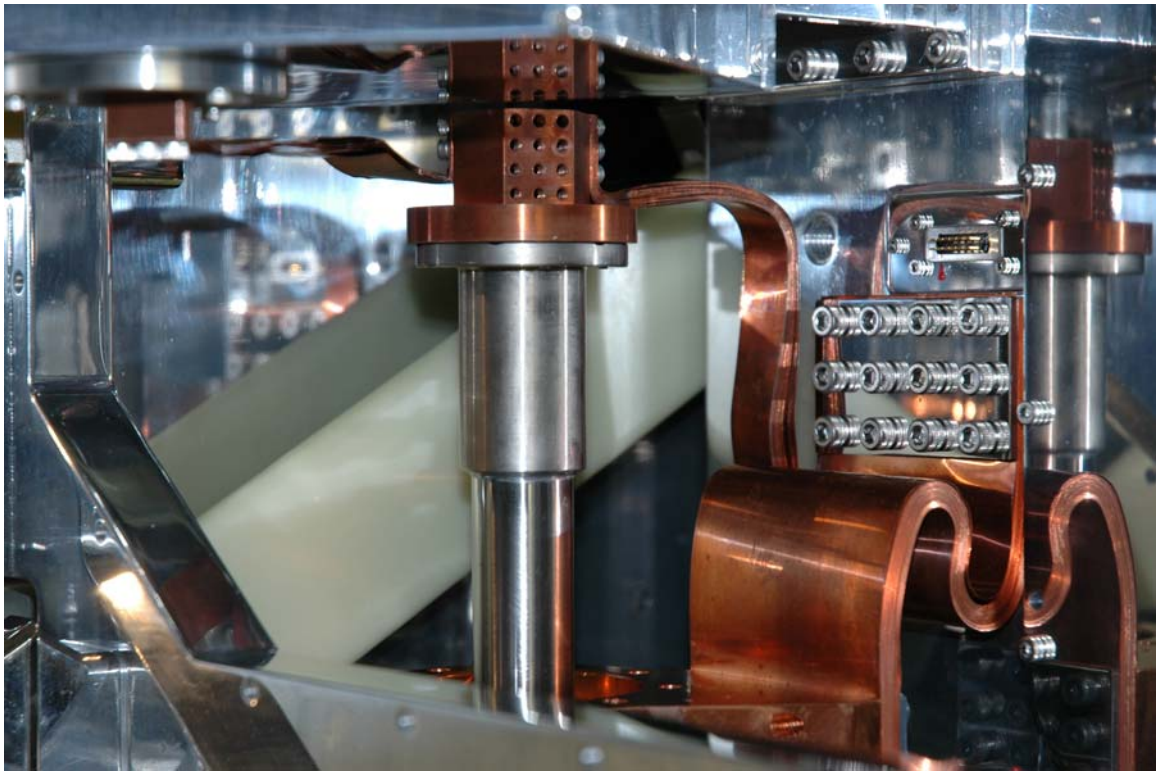
Both coolers are accessible now.



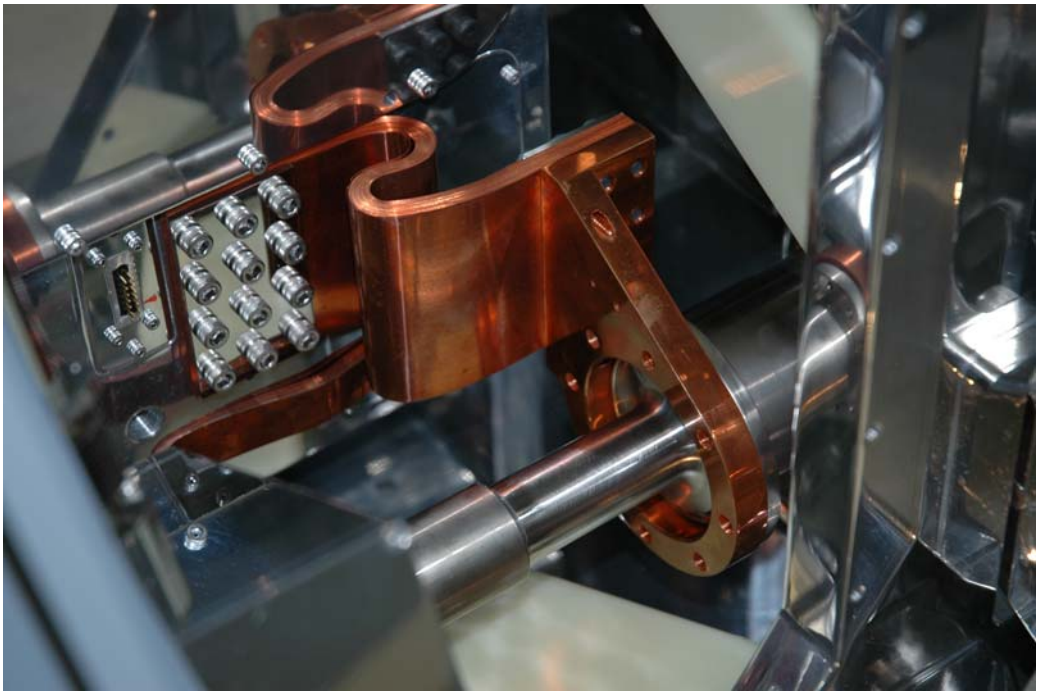
Remove the second stage getter from the radiation shield cooler. This is the shiny cylinder in the upper part of the picture. Next remove the temperature sensors from the copper plates on both cooler's first stages.



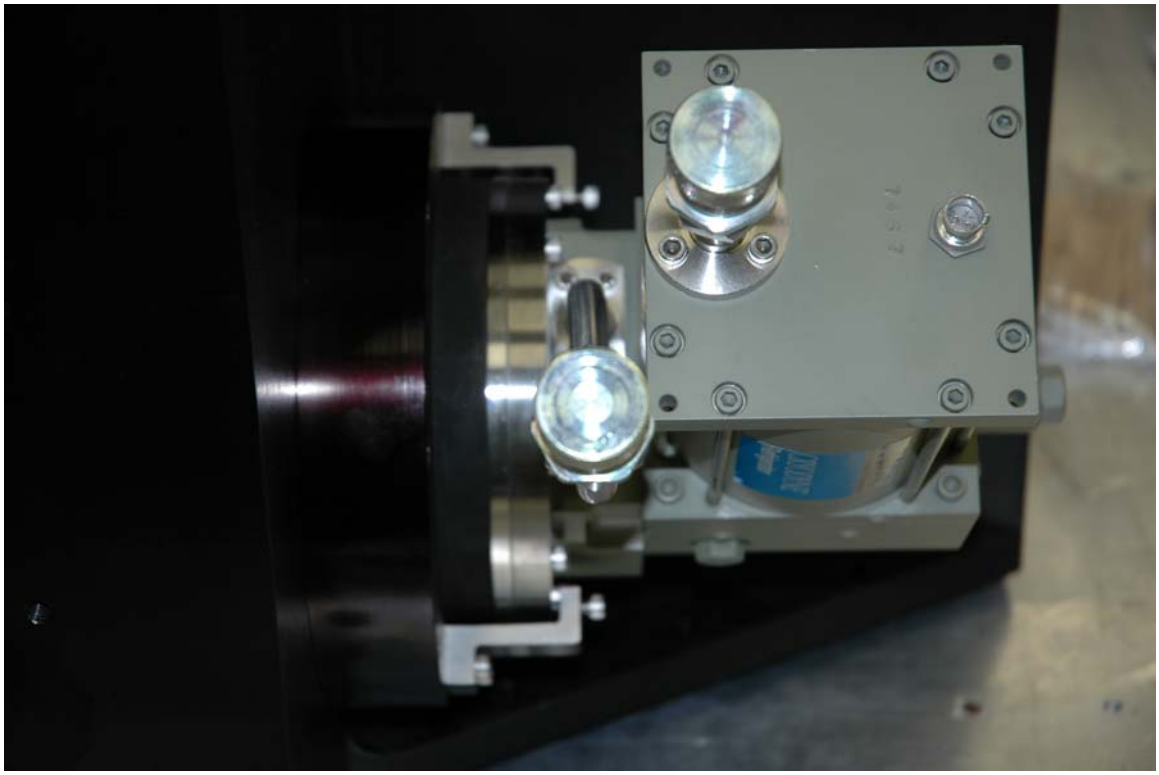
Next remove the black 6-32 screws from the first stage connection on the upper cooler.



On the lower cooler(cold structure) disconnect the straps from the block on the second stage to gain access to the screws that mount the block to the second stage. Then remove the screws that hold the block to the second stage(this can be done after removal if preferred).



Next remove the screws that hold the copper plate to the first stage.
The coolers are now disconnected internally.



Externally the cold heads are mounted to a bellows surrounded by a rubber vibration isolation ring. This assembly is held by an interface plate. There are three safety, Z shaped fingers that hold the cooler from tilting when there is no vacuum present in the cryostat. The top of the cooler flange will be hard against the adjustable screws in these safety fingers. Once these safety fingers are removed the cooler must be supported at all times or the bellows can be damaged.

Loosen and remove the screws holding the cooler head flange to the top of the bellows. With one person supporting the cooler head remove the three safety fingers. Slowly pull the cooler out of the cryostat.

The procedure is the same for the second cooler.

Reinstallation is just the reverse of this procedure.

Note that the 6-32 screws that bolt the copper plate to the cooler first flanges are torque to a maximum level to ensure good cooling. The screws used are black alloy steel. It is a good idea to use new screws each time. The screws must be cleaned before being installed but not too early or they will rust.

The oring must be cleaned and re-greased before reinstallation.

Do not use a ball end allen wrench to tighten the 1 stage screws. The ball can break off an wedge into the screw head which is a big headache.