

SHARC II Cryostat Instructions

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Pumping and Cooling the Dewar – August 2002

- 1. Evacuate the cryostat.** If the cryostat is already under vacuum, connect it directly to the turbo pump. **If the cryostat is at atmospheric pressure, first pump through orifice – KF-25 fitting with drilled #68 hole – for about 3 hours.** This is to prevent damage to the Mylar filters inside. I have not yet established a procedure for how long to pump. Overnight should do.
- 2. Turn filter wheel to 250.** This is the most commonly used filter (350 μm). The filter wheel freezes up during the cooling – so do not turn shaft – but has so far unbound every time when the cryostat reaches equilibrium temperature.
- 3. Precool with LN₂, starting with the LN₂ (shallower) reservoir.** Our procedure on campus has been to leave the cryostat on the turbo pump until the LN₂ reservoir is filled, then to close the pump valve, and then to fill the (deeper) LHe reservoir. Roughly 50 liters LN₂ will be required, so it is easier to use a hose from the storage Dewar into the reservoirs.
- 4. Top off LN₂ frequently until the boiloff stabilizes (about 4-6 hours).**
- 5. After a 12+ hour LN₂ precool, blow out LN₂ from LHe reservoir.** The idea is to insert a tube into the LN₂ all the way to the bottom of the reservoir, making a pressure seal where the tube enters the fill port. In July 2002, I left a ¼” stainless steel tube with an aluminum fitting glued on at the CSO, taped to the top of the clear plastic SHARC II supply box. This has the correct length to reach the bottom of the reservoir and to make a seal with the O-ring and cap at the top. Pressurize the reservoir to a few psi – with He gas preferably – at the hose barb normally capped off with a short black rubber hose with a blocked end. Attach a rubber hose to the top of the stainless steel tube to direct the LN₂ into a bucket. Blow out all LN₂ to prevent icing during the LHe fill.

6. **Transfer LHe into LHe reservoir.** The He gas during the cooldown of the LHe transfer tube can be used to blow out any remaining N₂. Typical cooldowns take 1¼ hours at approximately 1 psi, followed by a final fill at 5-7 psi, and consume 32 liters of LHe. Watch for icing at the beginning (frozen N₂ from inside the reservoir collecting in the fill line) and end (H₂O ice from the air at the top). The boiloff should stabilize within 2 hours, and the initial fill should last overnight. Place a downwardly-directed hose over the LHe port to prevent ice plugs.
7. **Optical alignment.** Skipping this in August 2002.
8. **Install instrument on the right relay optics port.** The rotator should be functional, homed, and sent to zero with “UIP>ROTATOR /RIGHT 0”. Lift cryostat and screw 2-4 conical alignment pins into black mounting plate. Lower cryostat onto relay optics with the filter wheel counter toward the control room and the LHe fill port toward the hex plate. There may be some hand-written numbers on the bottom aluminum plate that match up with numbers on the rotator. Once cryostat is sitting on rotator (located with the alignment pins), secure cryostat with 8@ ¼”-20 x ???” screws which go upward through the rotator into the black mounting plate. The screws should be in the same bag as the alignment pins, in the clear plastic SHARC II supply box. Remove alignment pins and replace with screws.

Assembling the Dewar – September 2002

1. **Inspect repaired fiberglass.** In August, 2-3 vertical sections of the bottom fiberglass ring were strengthened with additional fiberglass sticks, epoxied in place with black Stycast 2850FT. (The 5-6 square patches are from earlier in the year.) Please inspect the repair work from August, and remove all binder clips, wooden sticks, and tissue.
2. **Install multi-layer insulation (MLI) ‘diaper’.** The MLI blanket should be thick (approx. 20 layers) and approx. 20 inches wide. Wrap blanket around base of LN₂ shield and fiberglass support ring as shown in Figure 1. Keep inner free end away from filter wheel shaft to avoid it getting caught. Use aluminized Mylar tape to hold MLI in place.

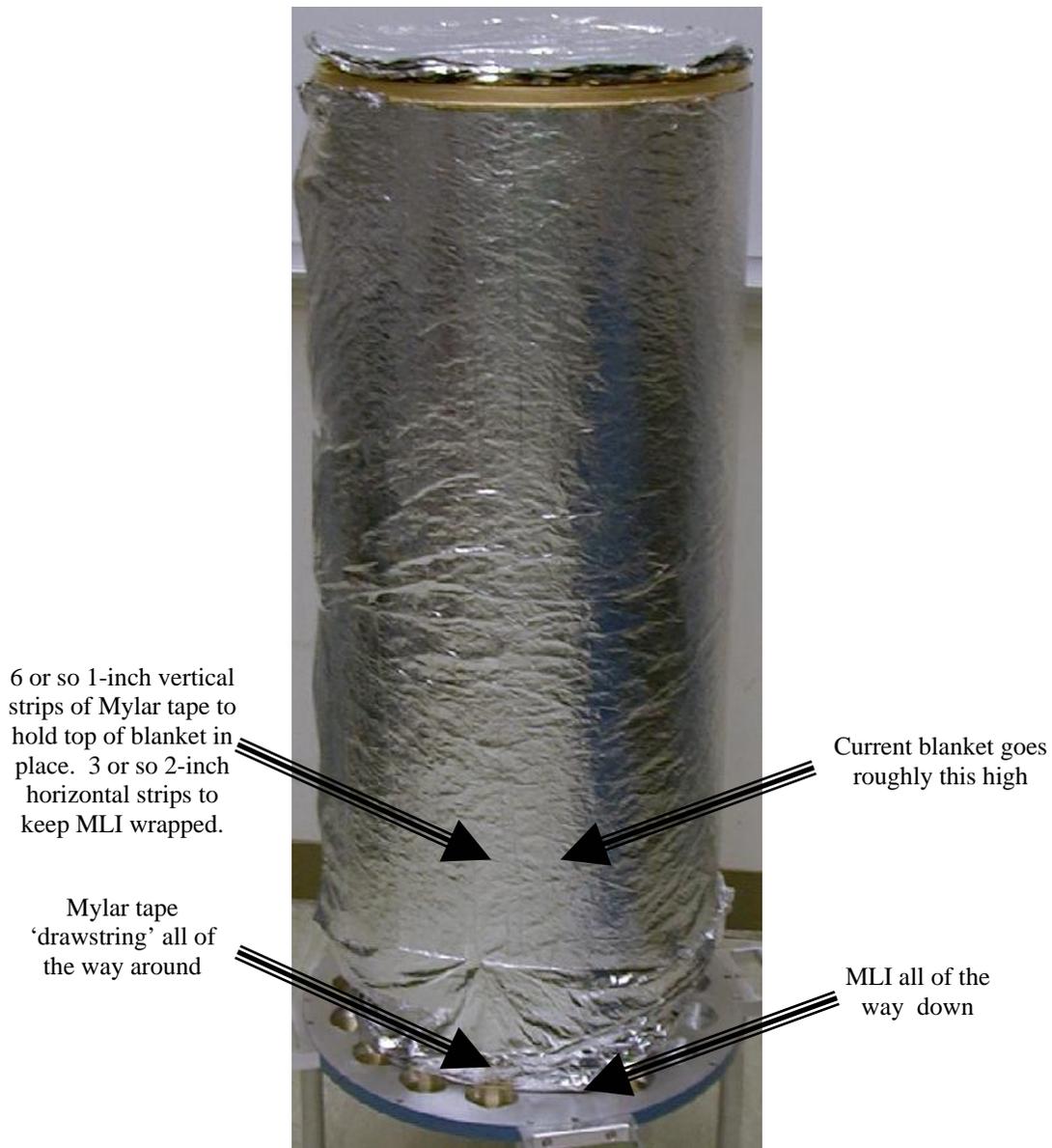


Figure 1. LN₂ multi-layer insulation (ca. 1999).

3. **Inspect plugs and welds on vacuum shell where 2 vacuum ports used to be.** Richard Gummer assures me they did a nice job! Clean inside of vacuum shell if necessary.
4. **Install vacuum shell.** Clean O-ring surfaces (flat on Dewar, grooves on shell). Lift up vacuum shell with forklift or crane. Clean O-ring and apply moderate amount of vacuum grease (Dow-Corning) to make it stick in groove. Lower shell onto Dewar. The long vertical weld aligns with the mark on the side with the off-center LHe fill tube (Figure 2). Attach with eight ¼"-20 screws, which should be in large acrylic utility

box. **The screws go in the holes without counterbores (maybe the only ones accessible with the RFI boxes on).** The two screws in front and back should have ring terminals for attaching grounding straps.

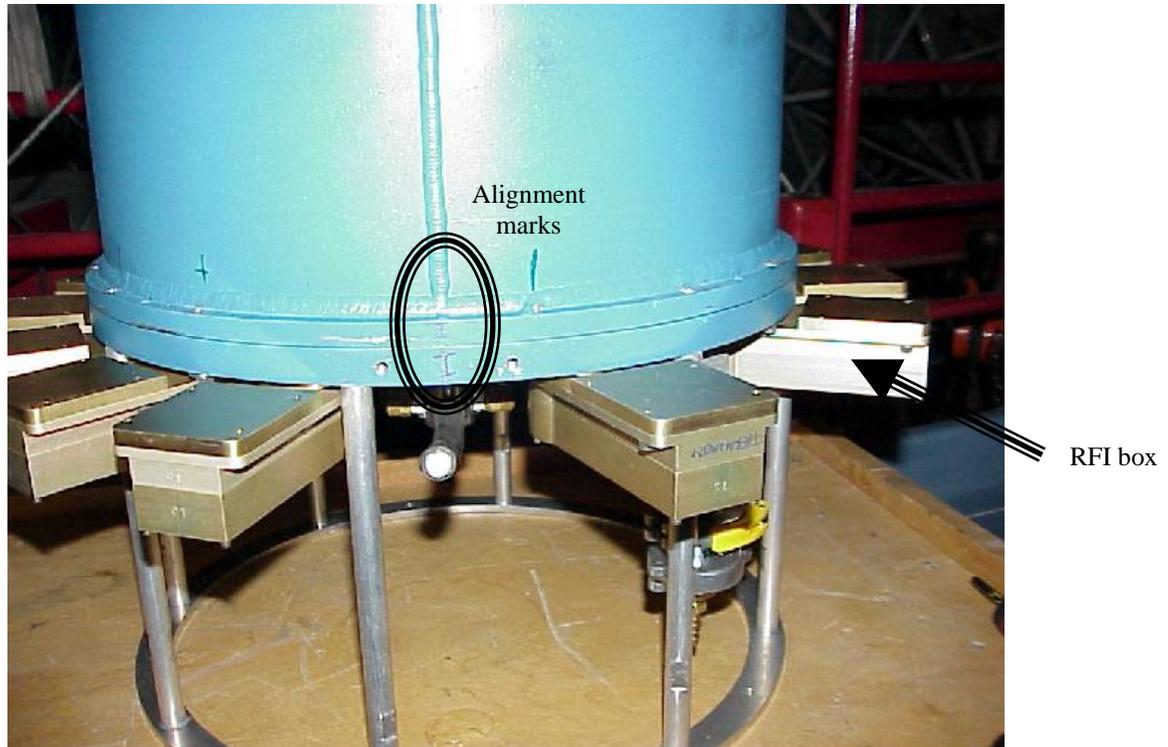


Figure 2. Alignment of vacuum shell and Dewar (red 'I' marks). This is the 'back' side of the Dewar, also called side 'A'.

- 5. Install centering fixture.** This consists of two concentric rings connected with Kevlar cords. Align as in Figure 3. The outer ring is held in place with 3 set screws; rotate ring to minimize Kevlar length. The inner ring is held in place with 5 or 6 4-40 screws. (One hole might be taped over.) Tighten hex cap screws to remove any Kevlar slack, but keep resonant frequency below audible range.

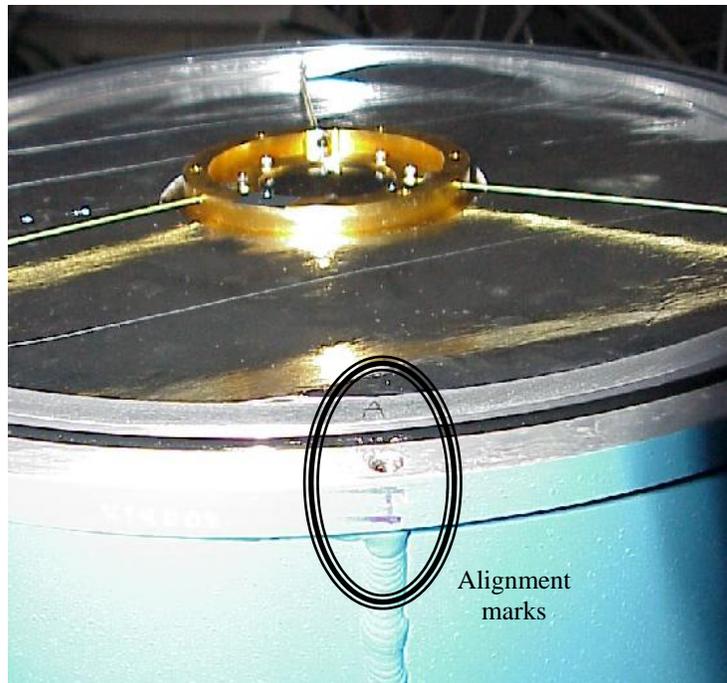


Figure 3. Alignment of centering fixture ('A') and vacuum shell (vertical weld).

6. **Install vacuum/window lid.** Clean O-ring surfaces and O-ring. Lightly to moderately grease O-ring. Align the lid, again by matching 'A' with the vertical weld. (See Figure 4.) The lid attaches with 8 $\frac{1}{4}$ "-20 screws. One or two are noticeably more difficult to turn.

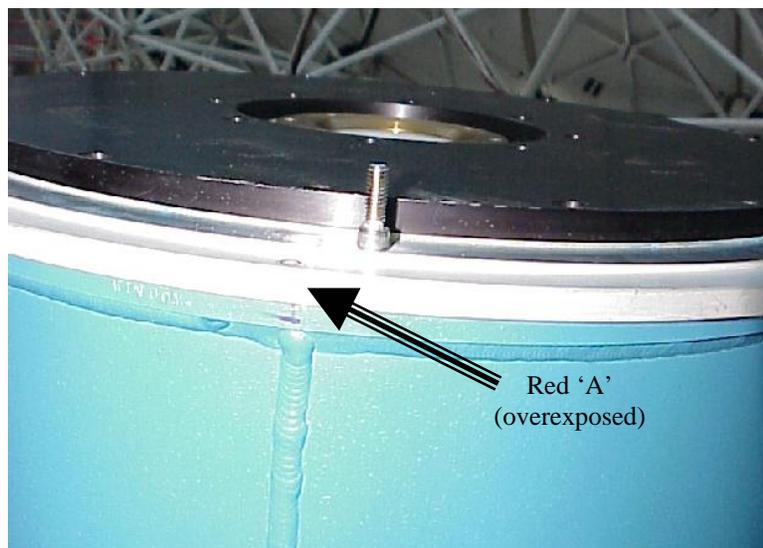


Figure 4. Alignment of vacuum lid and vacuum shell. As far as I know, the alignment of the vacuum lid is not important. However, consistency is probably a good idea.

Replacing the Quartz 77K Filter – December 2003

1. **Vent cryostat**, using the usual orifice, a KF-25 fitting with drilled #68 hole. This may take an hour or two.
2. **Turn over cryostat**, so that it rests on the aluminum ring, with the window pointed up. Note or mark alignment of vacuum lid (Figure 4 above).
3. **Remove vacuum lid**. There are 8 ¼”-20 screws holding it on.
4. **Remove quartz 77K filter**. Please wear rubber gloves when handling the filter. Take care in removing the retaining ring, held by 8 4-40 screws with split-ring washers. Note how the black poly film has separated from the quartz in a big bubble and around the rim, and that the separation can be seen by looking through the clear poly side (Figure 5).

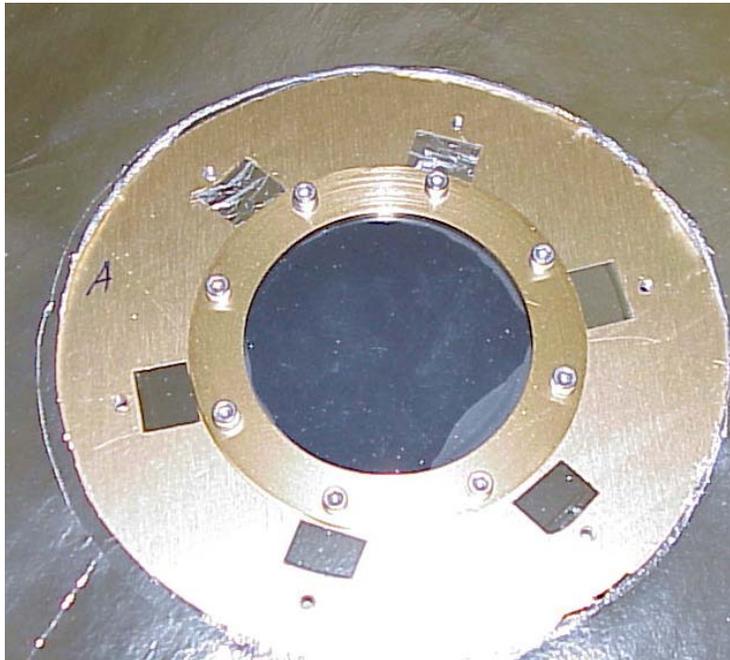


Figure 5. Damaged 77K quartz filter (photographed August 2003 when it was at the 4K position). The black poly on the underside has separated from the quartz around the rim and in a large bubble at lower right.

5. **Visually inspect quartz 4K filter**, if possible. Perhaps take some photos. If this one is starting to bubble, then I may want to order a replacement.

6. **Install replacement quartz 77K filter.** The filter should be installed with the black poly side down, and the clear poly side up. The retaining ring should be screwed down evenly, with the split-ring washers approximately half-way deflected.

7. **Replace vacuum lid.** Turn the cryostat over and pump down/cool down as usual. (See Pumping and Cooling the Dewar above.)

8. I'll pick up the damaged filter when I'm at the CSO January 7. Thanks!