Subject: **Notes From LBL Cooling Meeting on Tuesday Dec. 4th**
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Hi Guys,

Here are some minutes about our cooling meeting from last tuesday:

1. I returned from EB Industries with one welded sector tube. It was done without any fixturing, and here are some notes about my visit:
- The tubes were cleaned with emory cloth and then wiped with acetone. However, the tubes had been UHV cleaned prior to my visit.
- The tube was setup such that the end of the tube protruded approximately 5-10 mil above the surface of the fitting. This was done by eye under a microscope.
- The laser was focused on the center of the tube wall (not at all on the fitting) and programmed to follow the radius of the tube all the way around.
- Shield gas is argon, and the welding takes approximately 5 minutes, including all setup (probably less in production, actual laser time is 2 seconds).
- Both welds leak checked at EB to low 7 scale. They both then rechecked at LBL in the 10's. Probably just have lower background on the LBL leak checker?
- Repairing a leaky weld does not work. They have already tried with no success.
- EB is confident they can weld the long (6-10 foot) tubes for the forward tubing run. They need to develop a method, which will require spinning the tube rather than the laser, but they think they can do it. I am going to order them some tubing to experiment with (same as we have here).
- We will fabricate a complete sector circuit in February, when we have fittings back from the machine shop. This will include all tubes from PP1 to the sector and back (but may neglect the actual fitting types at PP1, if these are not decided yet).

2. Plans for sector production:
- We need to develop a "carrier" that will hold the tube and fitting in proper position for welding, and protect the flatness of the tube, which is easily distorted. The fitting needs to be aligned in the proper position along the tube somehow, and Fred proposed a small "probe" that engages the threading on the outside of the fitting. This would allow the fitting height to be dialed up or down as the welders desire (and lessen tolerances on our production). Each sector tube will have a carrier that it accompanies for the whole process. The tubes will be cleaned and assembled here, then bagged and sent to EB to be welded, checked, and rebagged for return. EB should have to do no cleaning at all. Jon and Tom J. will work on developing this holder as we get nearer to production.
- Jon and Tom J. do not believe all tubes can be made by march, so welding may occur after that, or in smaller batches, which will be determined later.

3. New Fitting Designs:
- Fred has finished drawings for the new indium fittings, and he has managed to reduce cross section to 32.8 sq. mm. The fitting looks very lean, so we will make these. He has drawn three sizes, which all use the same tool and all have the same outer dimensions. These sizes

are sector tube, exhaust tube (type 0), and capillary.
- Drawings for the lean luer lock (LLL or L^3) will be done by the end of the week, and we will be ready to shop out the parts by next week. We will make enough of each fitting type to fab 20 sectors, which means 40 fitting pairs. Fred will use the same shop that he used for the previous luer locks.
- The indium washer will be 50 micron Cu foil plated with 20 microns/side of Indium by vac deposition in Bldg. 25 (Pat) (well, this is the plan for now). It will be EDM'ed to the shape of the gaskets.

4. U-tubes:
- I will post a drawing of the U-tube design this week. Jon and Tom J. will then try to whip up a prototype from the 4 mm 3003 tubing we have. Since it's 3003, it will need to be annealed before bending, and then annealed again afterwards. The aging of the aluminum at room temp may be a problem, though. (Will the u-tubes have to be refrigerated before installation!??).

5. Other stuff:
- Tom W. has ordered 1/16th swage locks for our capillary tubing testing.
- Fred has found that 9 mm aluminum swage locks are not available for our type 1 tubing. This means we may have to swage that tubing to 10 mm (next larger size) or come up with some other solution. We will meet about PP1 sometime next week, in a meeting seperate from the cooling meeting, but maybe adjacent to it.

That's about it. Thanks alot for the great work on the new fittings, Fred. I know you're busy, so it's great you've gotten them done so quickly!

Neal