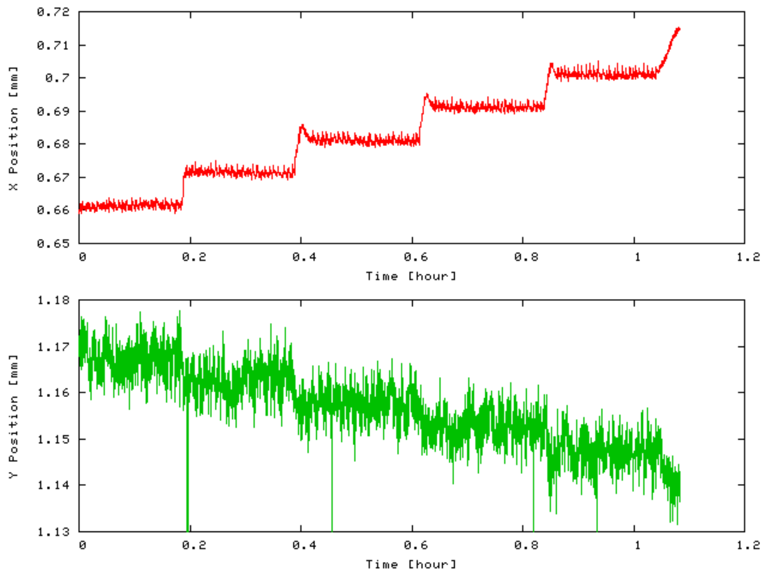
Monochromator cooling upgrades on 7ID.

Eric Dufresne

MHATT/XOR

TWG meeting, October 20, 2005

Background: Beam position versus coolant pressure



•The first crystal of our double crystal Si (111) cryogenically cooled High Heat Load monochromator is slightly sensitive to pressure variation in the cryogenic lines. Pressure variations during a LN2 cryocooler fill every 4 hours move the beam slightly (tens of microns). Pressure variations due to the Oxford cryocooler closed loop pressure control with the heater stick (0.3 PSI) move the beam by 5 microns every 15 seconds.

Four 1 PSI steps in the buffer Pressure (dx/dP=10 um/PSI, dy/dP=5 μm/PSI)

Pressure regulating valve (from TWG 041504)

Dry N2 gas pressurizing cryocooler HP buffer, regulated (<0.1 PSI) by Omega PRG101-60.
0-60 PSI range

Credits: first implemented on 11 and 12ID. Copy of 6ID system.

FY05 improvements

- To improve the pressure control, we installed a regulator with a smaller range and thus more sensitive control. The new model is Omega PRG101-25 (2-25 PSI regulator).
- To monitor the pressure, we installed also a high resolution pressure sensor Omega PX271A-030GI (4-20 mA 0-30 PSIG) measuring the closed loop pressure.
- We also took the cryocooler outside of the 7ID-A hutch so that the low pressure vessel can vent out to the experimental hall. This was meant to reduce the pressure bump during the fill and reduce the “painful” noise.
- Implementation of EPICS PID record for second crystal piezo, improving position stability while scanning energy.

New cryocooler deck on top of 7ID-A

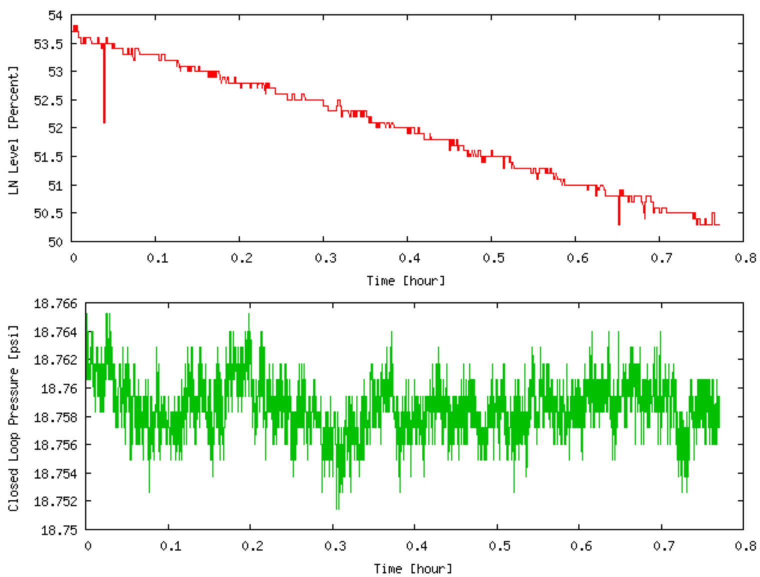
Unistrut frame with light Al floor 10525$. We added a lift plate to move equipment on (1356$) and some AC circuits.
We also bought new 45’ lines (2), 6.3k$ each (Quality Cryogenics).

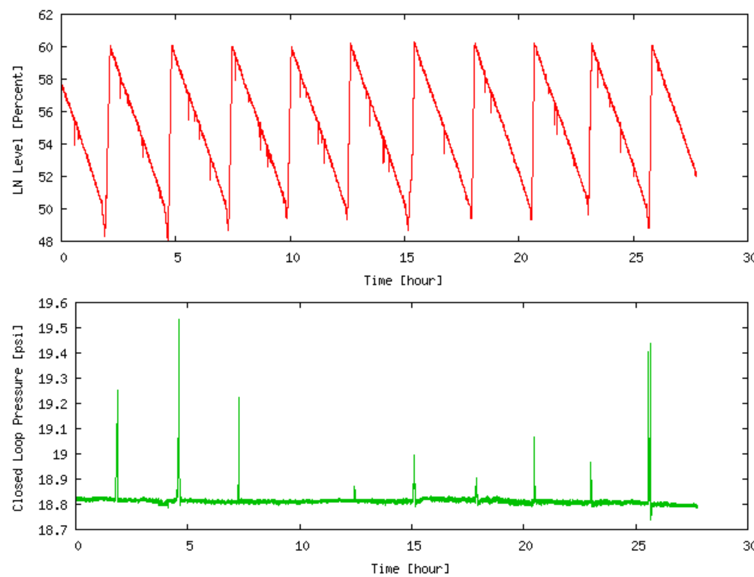
Benefits:

more room in and out of 7ID-A.
No more noise during fill.
Access for servicing during the run.

Inconvenience: harder to bring equipment upstairs.

Results from pressure sensor, using 2-25 PSI regulator (before platform built).

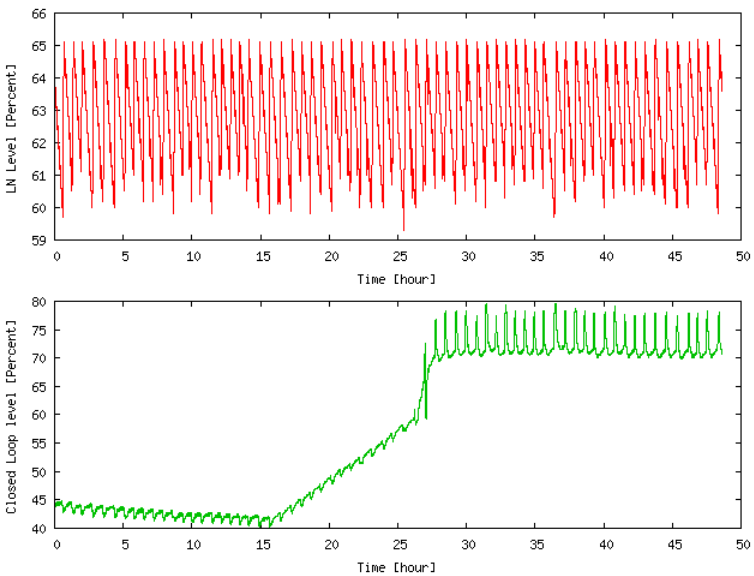




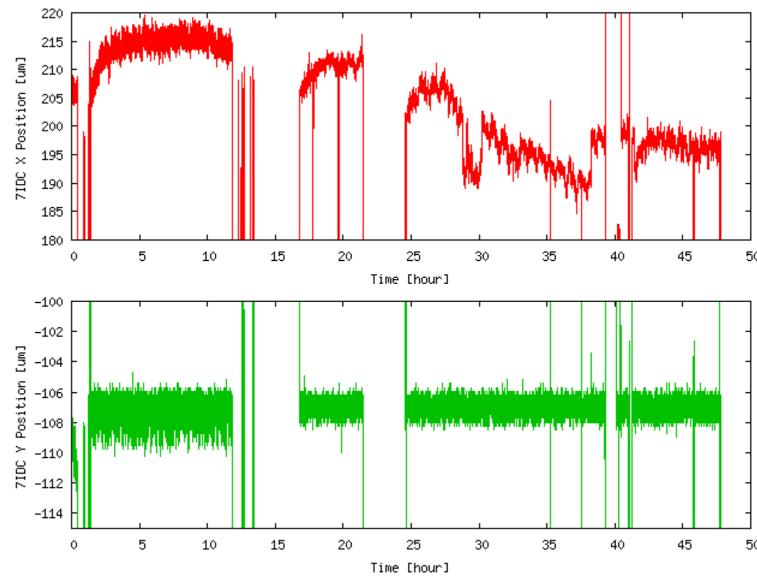
Average pressure 18.759 PSI
Standard deviation 0.002 PSI
0.01% stability away from fill

Pressure variation here up to 0.7 PSI during vessel fill.

Preliminary beamline performance with rooftop cryocooler



The buffer level drops from 0-15 hrs. After 15h, the regulator circuit is turned on. It fills the closed loop level to 72%.



Vertical beam position with feedback on: without regulator on stable to 0.69 µm RMS, with regulator on stable to 0.47 µm RMS.
Horiz: weekend sextupole problem.

Conclusions

- Very very little noise during fill when cryocooler is on the roof. No muffler needed, no long narrow vent line going out of a labyrinth.
- Reduced chances of O2 deficiency in 7ID-A.
- Pressure regulation can be as high as 0.01% RMS when not filling vessel.
- Preliminary result indicates very stable beam.
- EPICS PID loop stabilizes the vertical beam position to 0.5 μm RMS.

Acknowledgements

- Dean Wyncott (design, and installation of deck).
- Harold Gibson (pressure regulator and sensor system, overall project management).
- Dohn Arms (EPICS PID loop on piezo).