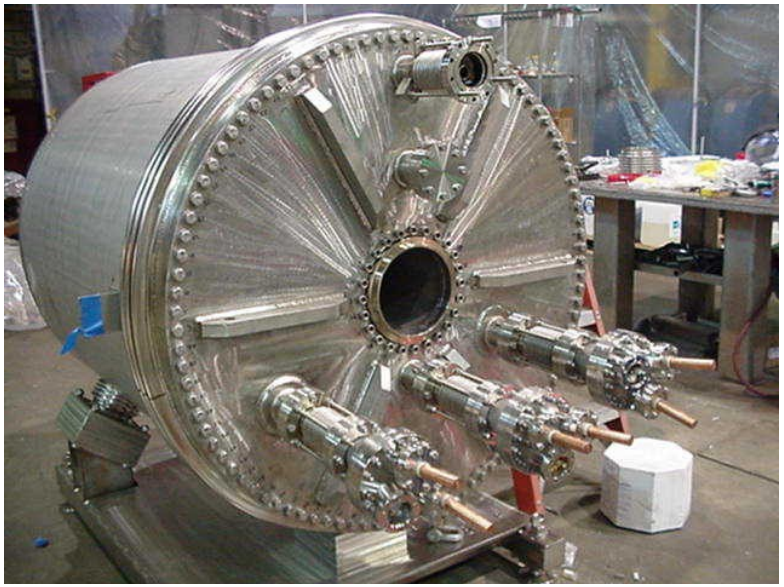


MERIT Pulsed Magnet –Inertially Cooled , 80K LN2 Cooled Between Shots

MERIT (n-ToF-011)

Magnet Status and Testing Plans
NuMu Collaboration Friday Teleconference: January 13, 2006

Peter H. Titus
MIT Plasma Science and Fusion Center
(617) 253 1344, titus@psfc.mit.edu, http://www.psfc.mit.edu/people/titus

Present Status

Magnet has Passed all Shop Electrical Tests
The Cold Vessel has been Pressure Tested to 16.6 atm – and Passed
Vacuum Jacket Fabrication and Tests at CVIP are Complete
The Magnet has been Shipped to MIT and Off-Loaded
Go to
http://psfcwww2.psfc.mit.edu/people/titus/#BNL%20Memos
Then BNL Pulsed Magnet Memos and Reports
Then click on top two avi files

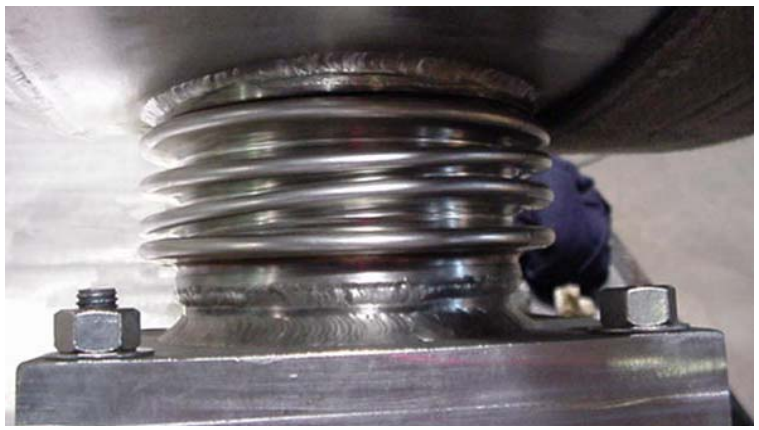
The Vacuum Jacket Held Vacuum during Shipment
The Magnet is at the Entrance to the Test Cell in Preparation for Lift over Shield Wall and Lowering into "Pit"
Lift Rig (CVIP Out-riggers are being Lengthened
N2Gas Pipe still in Fabrication
MIT Power Supply Over-Voltage Upgrades Complete – To be Tested with Known Load (VTF)

Nested Coils at Everson

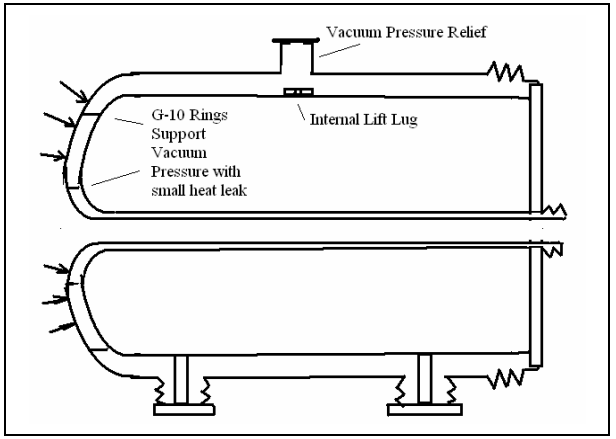
Assembled Magnet Entering The Test Cell at MIT, Tuesday Jan 10 2006

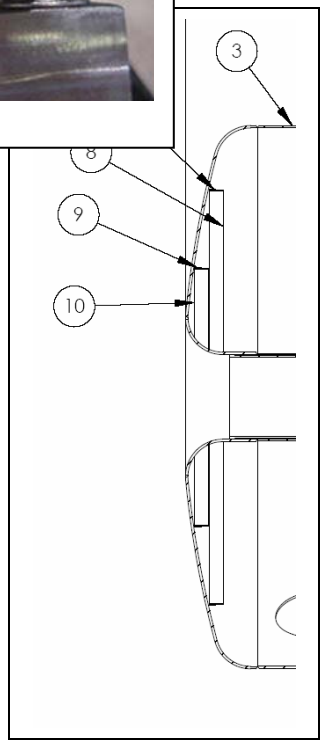
Vacuum Leaks Slowed Delivery in December

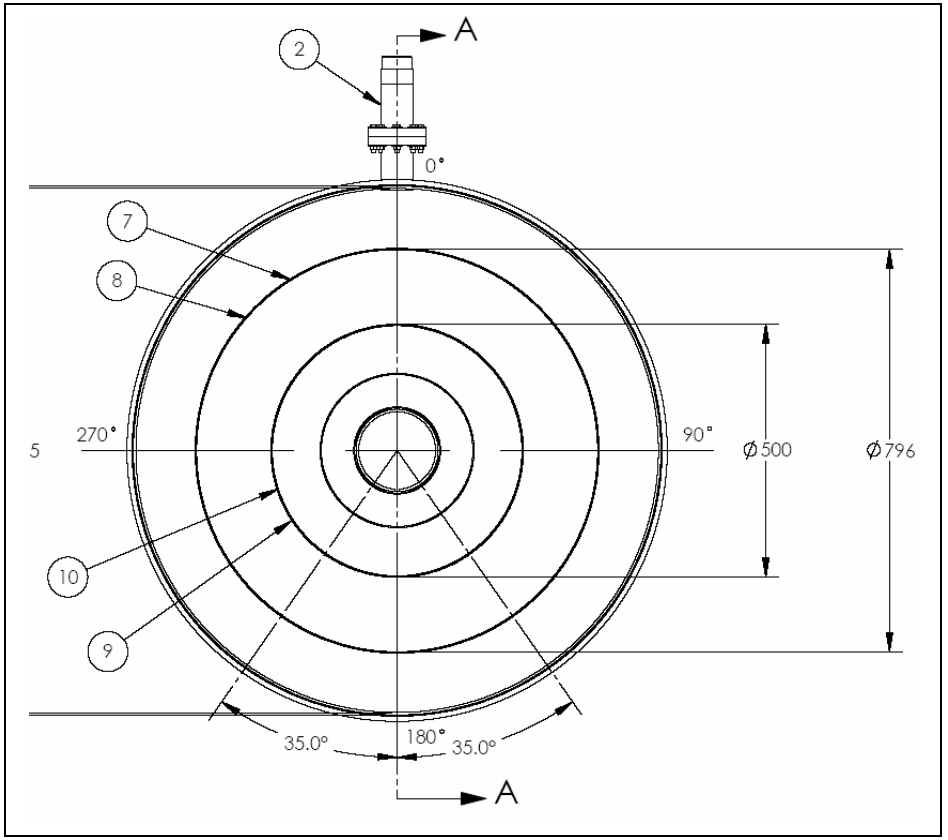
G-10 Ring Fit-up was the Problem. Acceptable Vacuum Load Support has been Demonstrated.

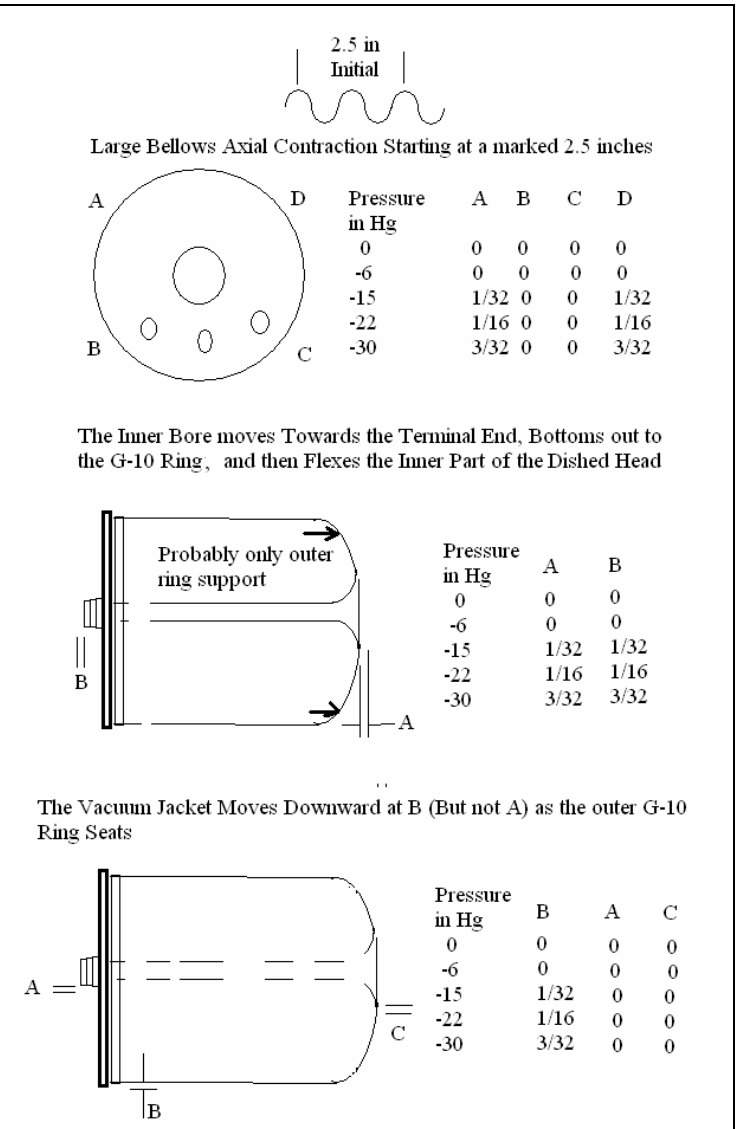


Bellows Displacement during Vacuum Test.





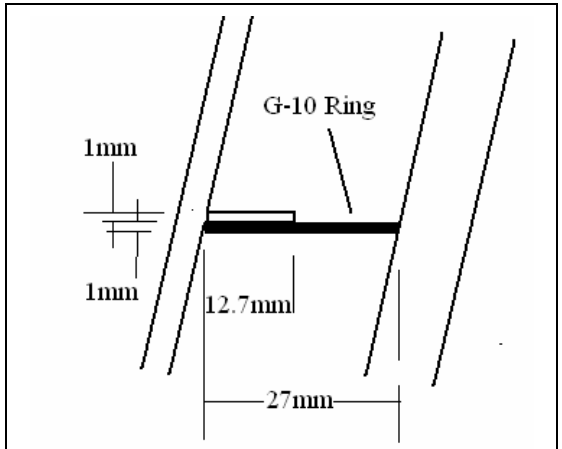




Displacements under Vacuum Pressure, Taken at CVIP December 29th 2005

Measurements indicate that the inner ring is not in contact. This allows the 3/32 displacement of the bore under vacuum. The shell "tips" slightly (but the bore tube doesn't) under vacuum.

Only 7% of the ring needs to be in contact to support the vacuum load.



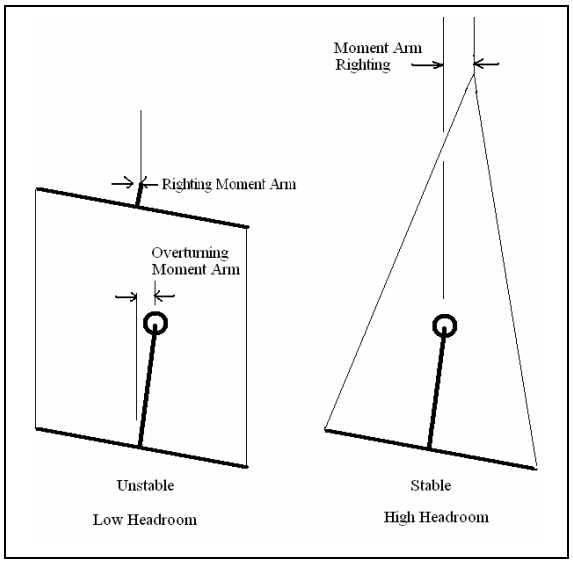
From CVIP Drawings #04022007,8,9,10

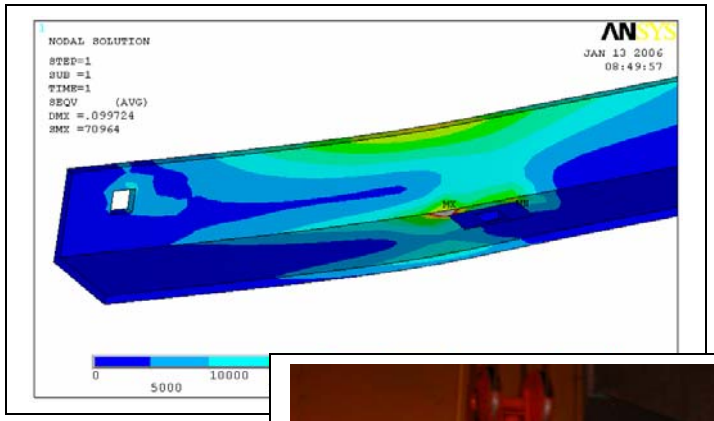
The vacuum pressure load on the dished head at the end of the vacuum jacket is (1.045*39.37)^2*pi/4*14.7=19542 lbs, or 86931 N. The compressive stress on the rings if they are evenly loaded is 86931/(.796*pi*.001+.5*pi*.001) = 21 MPa. The room temperature tensile strength is about 300 MPa, For the high density strip used for the hoop, the compressive strength should be similar. This would allow 21/300 =.071 or 7% of the two rings to be reliably in contact to support the vacuum load.

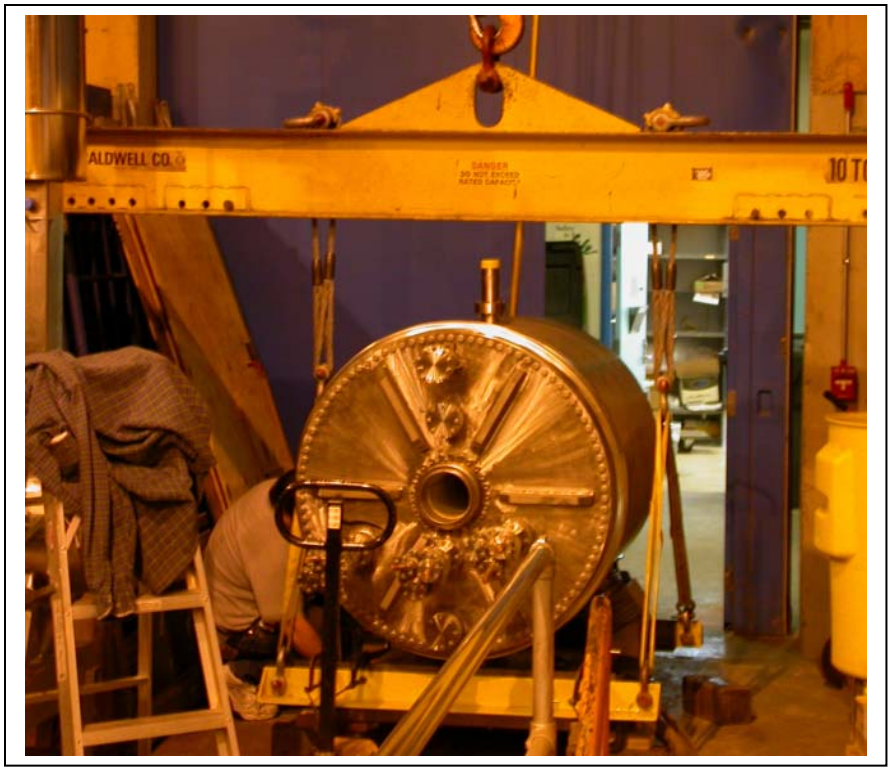
Lifting Rig is being Revised.

CVIP Angles were not Wide Enough

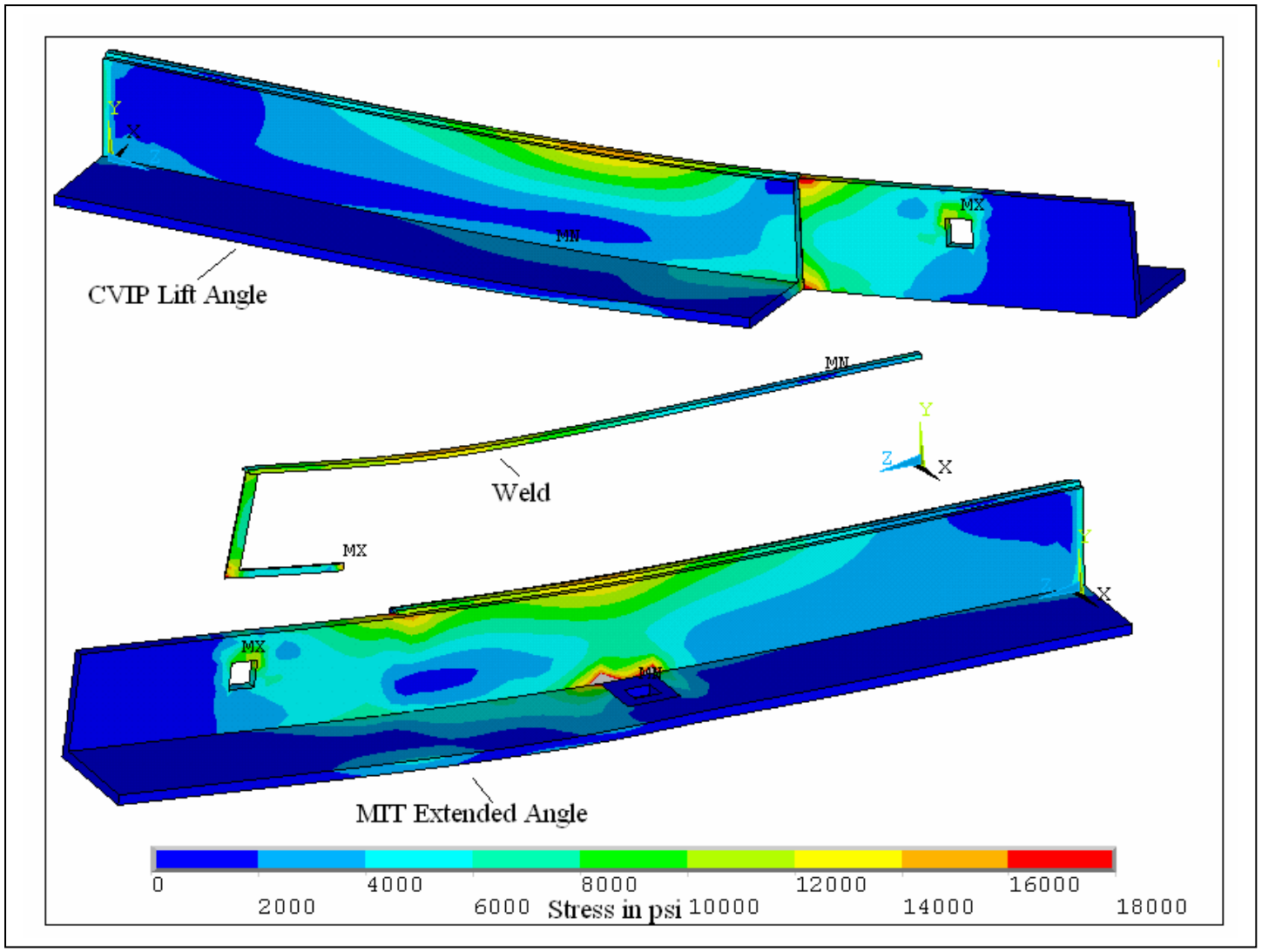
Wider Angles were not Strong Enough

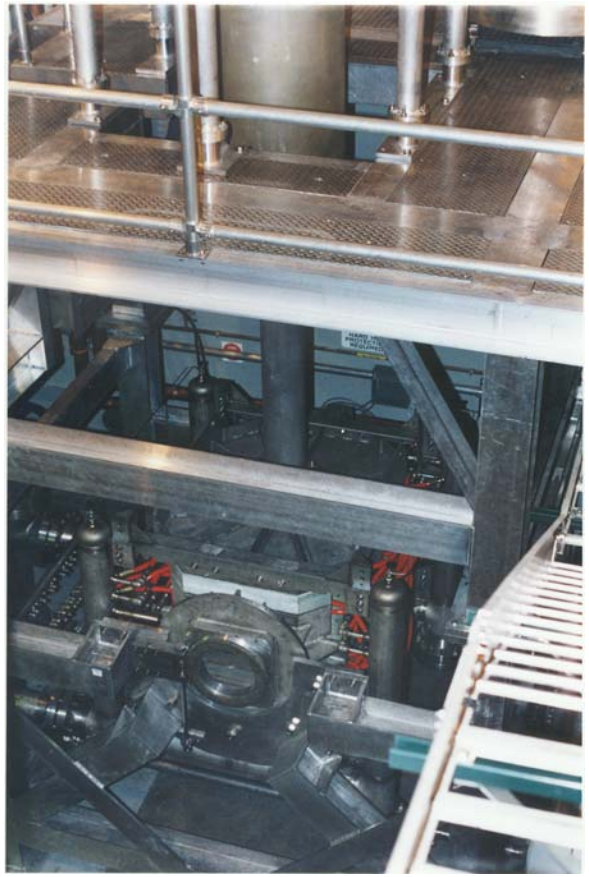






Lift Angle/Spreaders are Being Modified.





Lower Water Cooled Split Pair Copper Magnet - The BNL Pulsed Magnet will be in front of this, where the HXC Prototype cryostat is now positioned.

Plans for Testing at MIT:

The test location is the Pulsed Test Facility (PTF) at MIT-PSFC primarily used for testing of superconducting joints in a transient high field background.

PTF Upper Cryostat

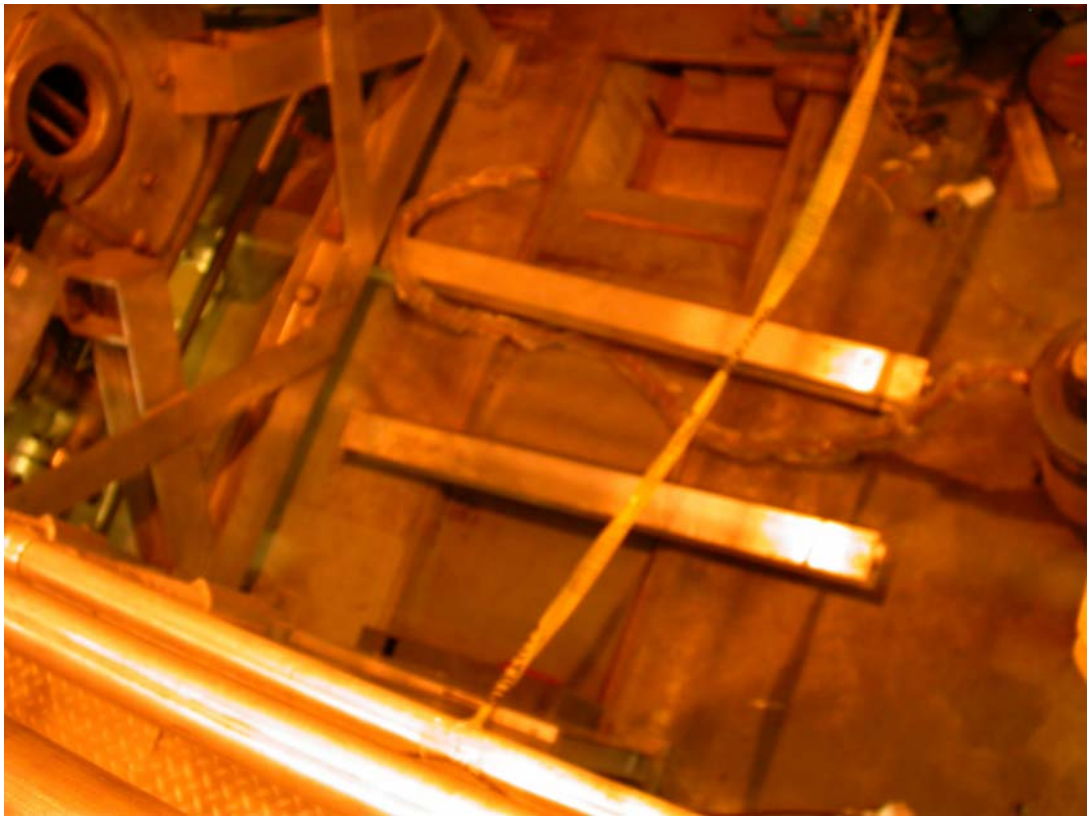
Test Area Status:
Extraneous Equipment Removed:

- **Split Pair Return Yoke,**
- **HCX Dewars,**
- **PTF Sample Lifting Equipment**

Diamond Plate Over Trench Removed.

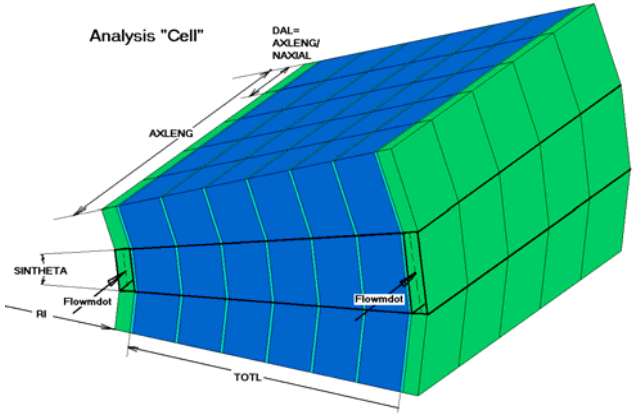
Aluminum I beam Bridging the Trough are in Place.

Area policing for magnetic materials in progress.

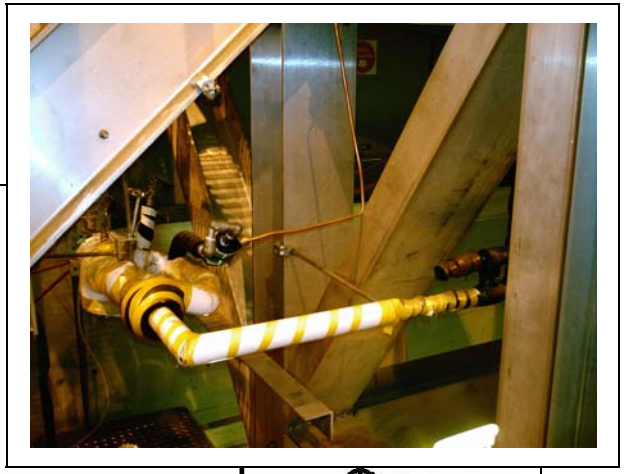


View of the test area floor.

Cryogenic System for the Test



The Simulation originally assumed axial gas flow. Circumferential grooves have been added to allow pool boiling cooling.



Modes Of Operation

1. Initial Cooldown - LN2 Filled and Partially Filled
2. Hold at Temp for Displacement Survey
3. Hold at Temperature and Low Current for Field Measurements.
4. 5T Pulse Partially Filled with LN2
5. Cooldown
6. 10T Pulse Partially Filled w/LN2
7. Cooldown
8. 15T Pulse Partially Filled w/LN2
9. Cooldown
10. 30 Hr Full LN2 Inventory Boil Off Using Cryostat 200Watt Heat Leak

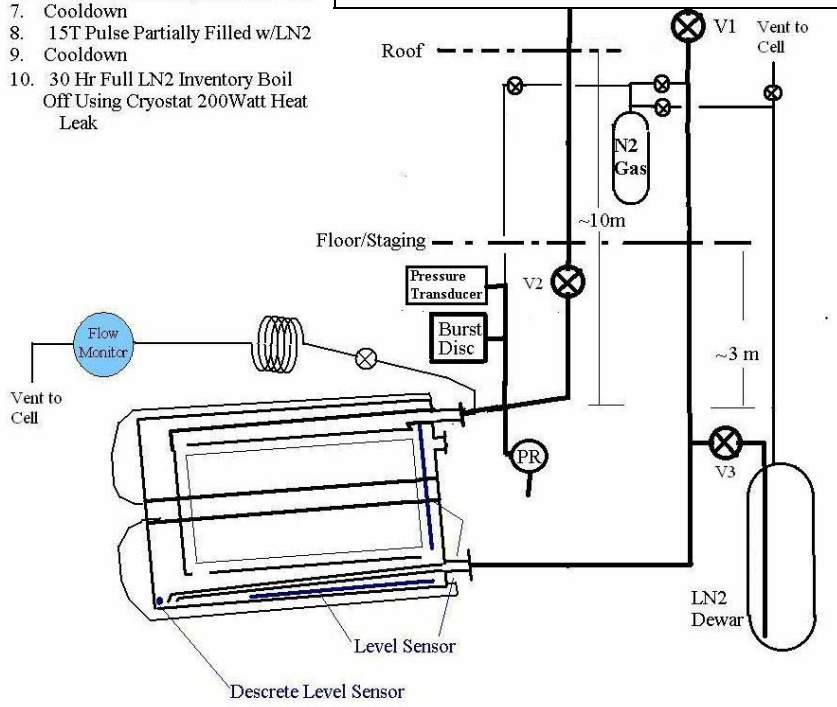
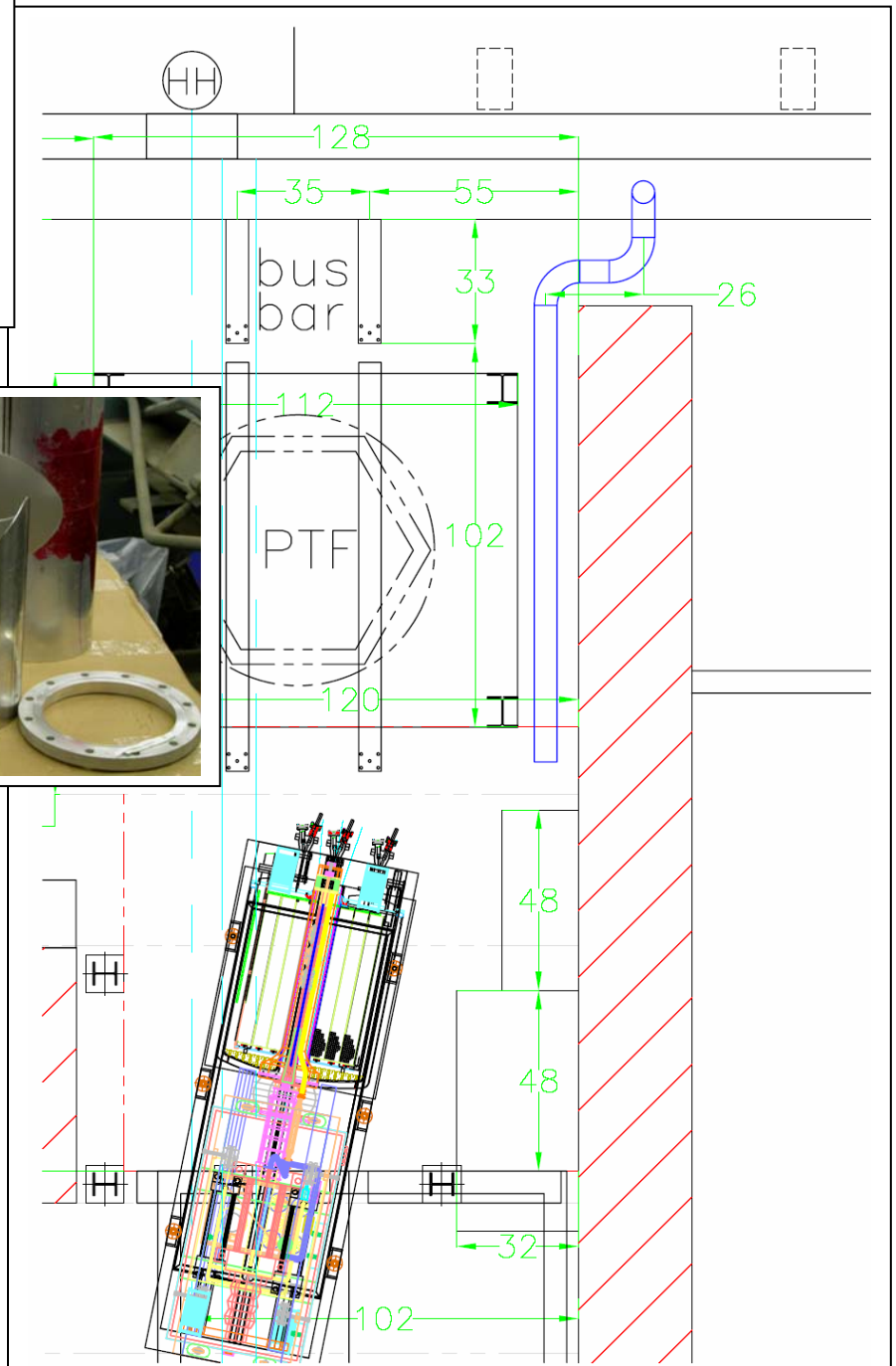


Figure 6.0-3 Cryogenic System Planned for Use at MIT

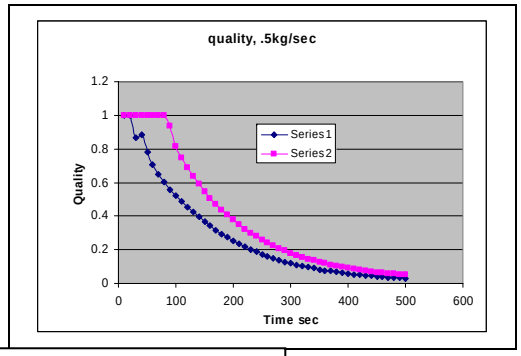
Vent Status:
Roof Penetration has been cut – Vent Pipes and Flanges are Being Machined

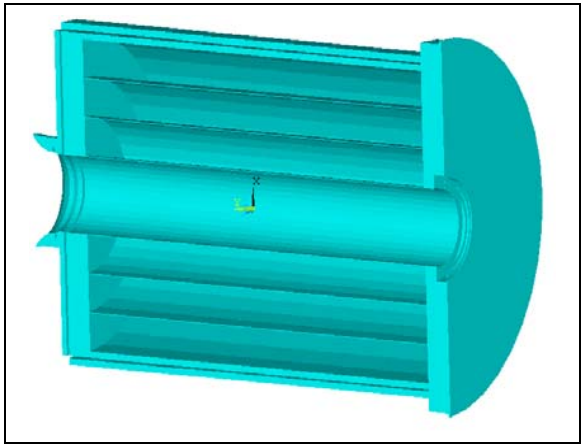


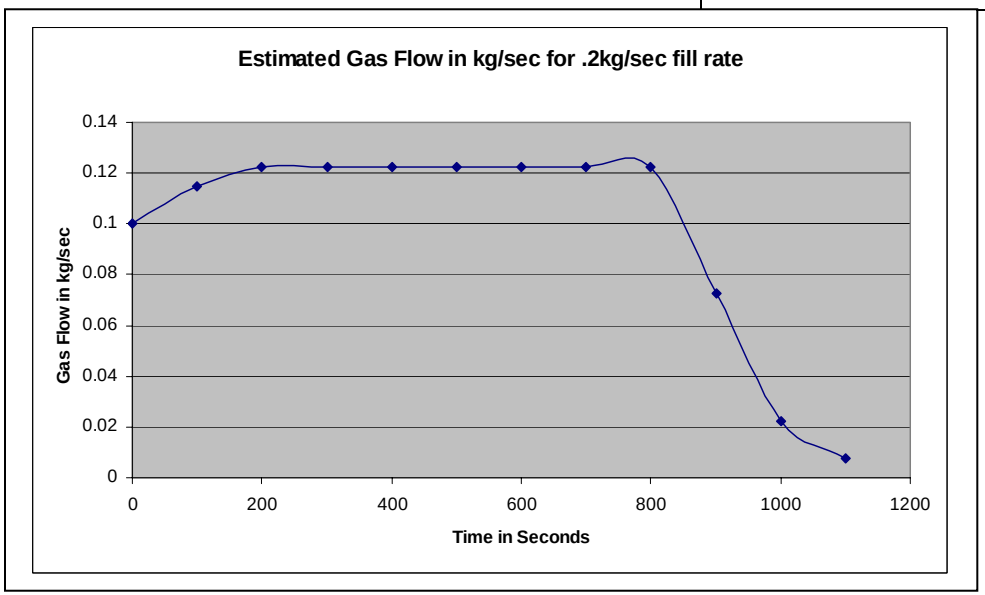
Fill Rate Effect on Cooling Time

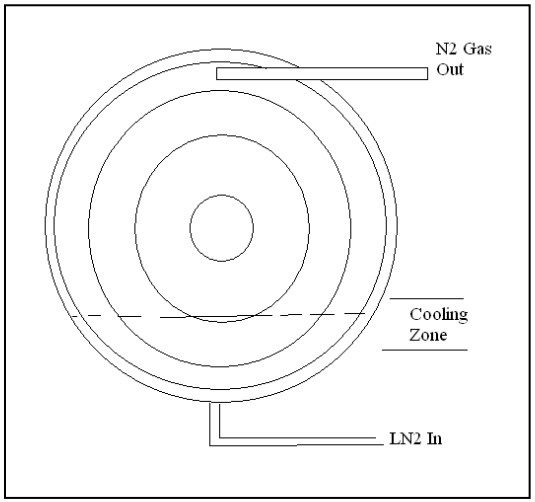
A fully submerged coil could vaporize .5g/sec and cool in 500 seconds

Rate of submergence limits the active cooling zone, extends the cooling time, and limits gas generation.









Total Kg of gas generated:	116.75	Resulting fro an assumed 1000 sec, 16.7min cool
Total Ilet Flow at .2kg/sec	200	

So a "Flat" Fill profile looks Viable in terms of Magnet Cooling

Total Gas Generation Needed:	126.0869 kg	
Fill Volume of Cold Vessel	104 kg	130 liters
Total LN2 Required:	230.0869	
Required Flow Rate 20 min Cool	**0.1917 kg/sec**	

-Consistent with Friedrich Haug's Calculations