

MICE Coupling Coil Update

MICE CM34 at RAL, UK

October 17, 2012

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Current Status of Coupling Coil

- **Cold Mass**

- Reservoir welded onto cold mass
- Cooling pipes welded into cold mass slots
- Epoxy impregnation of gap between coil and cover plate complete
- LTS lead stabilization complete
- Quench protection mounted
- Instrumentation mounted
- Pressure test of cooling pipe complete
- Vacuum check of pipe (discovered leak)
- High-pot test of coil complete



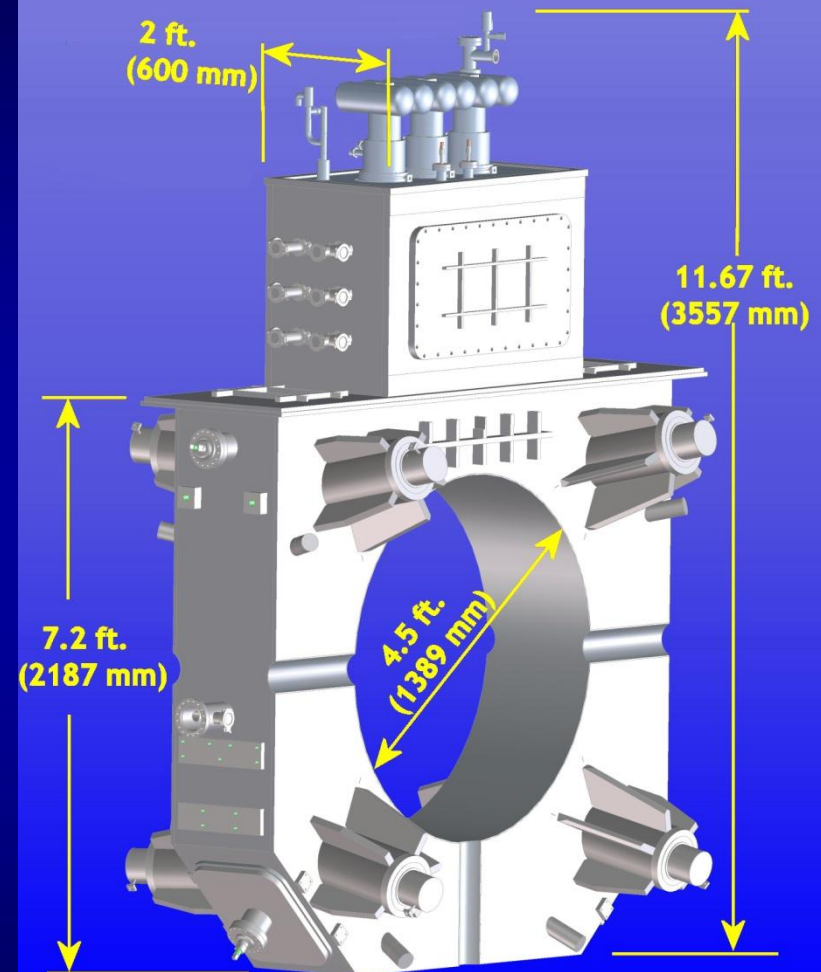
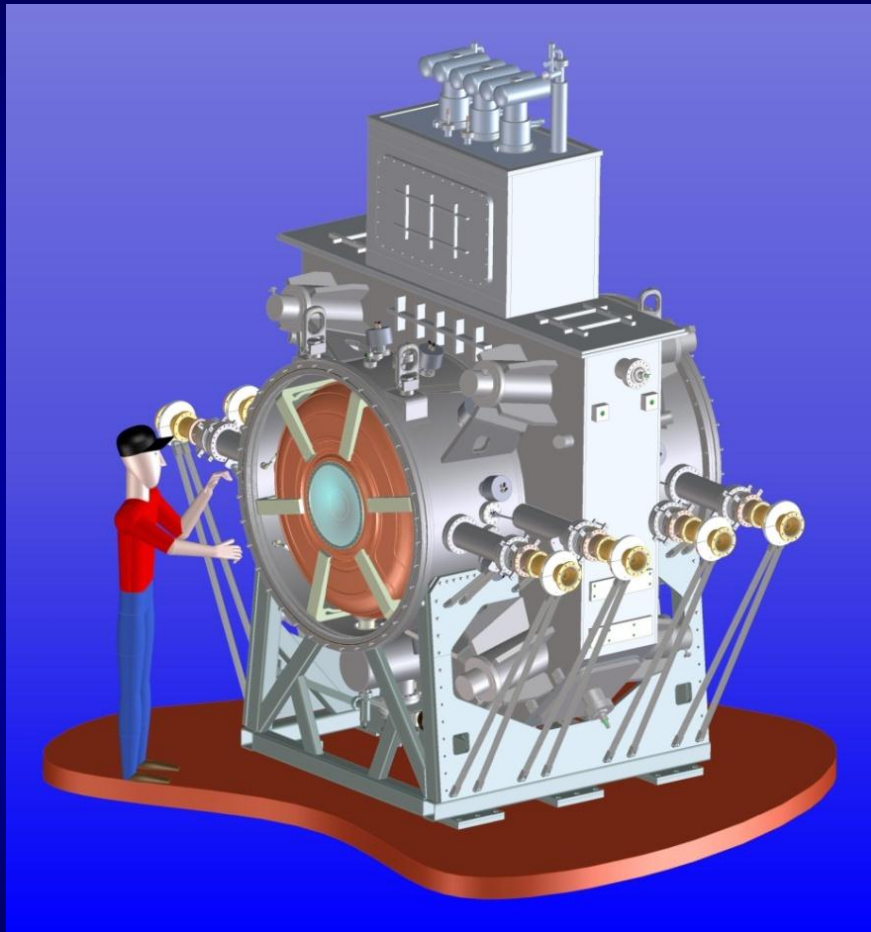
Current Status of Coupling Coil

- **Cryostat**

- Drawings from SINAP (China) complete
- Work order has been approved for the LBNL mechanical shop to start fabricating the first cryostat



Coupling Coil General Dimensions



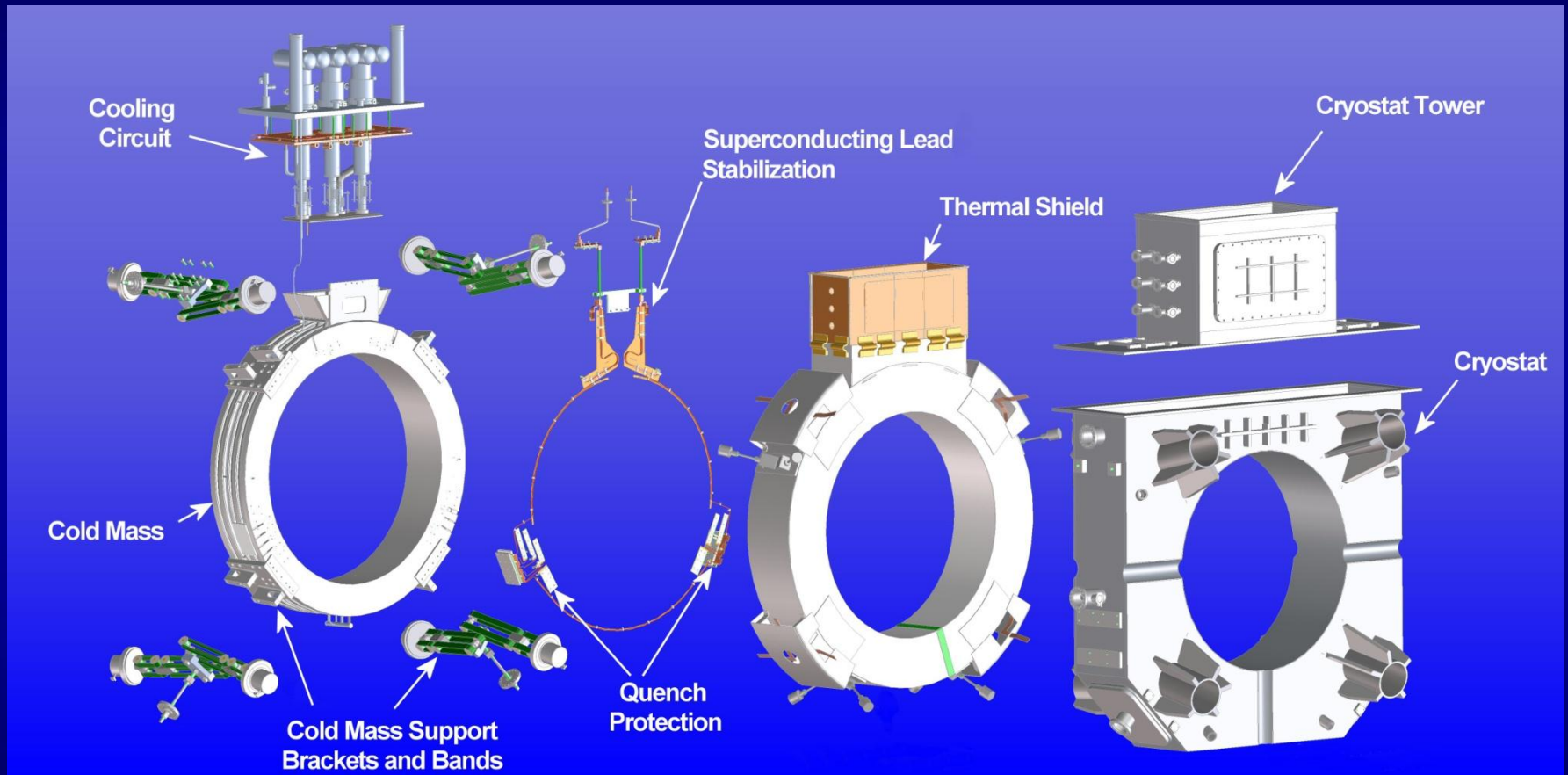
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Major Sub-Assemblies



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A Brief History of the Cold Mass

- Unfinished cold mass from China arrives at LBNL October 2011
- Design of cooling scheme, LTS lead stabilization and quench protection still incomplete
- LBNL engineers met with Brad Smith and his team at the Massachusetts Institute of technology (MIT) in March of 2012
- MIT group designed and LBNL implemented an LTS lead stabilization system and a quench protection system
- MIT group refined the cooling system designed by Tapio Niinikoski (CERN) and Li Wang (SINAP)



Cooling Pipes Welded onto Cold Mass

- Pipes welded into the slots of the cold mass



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Reservoir Welded onto Cold Mass

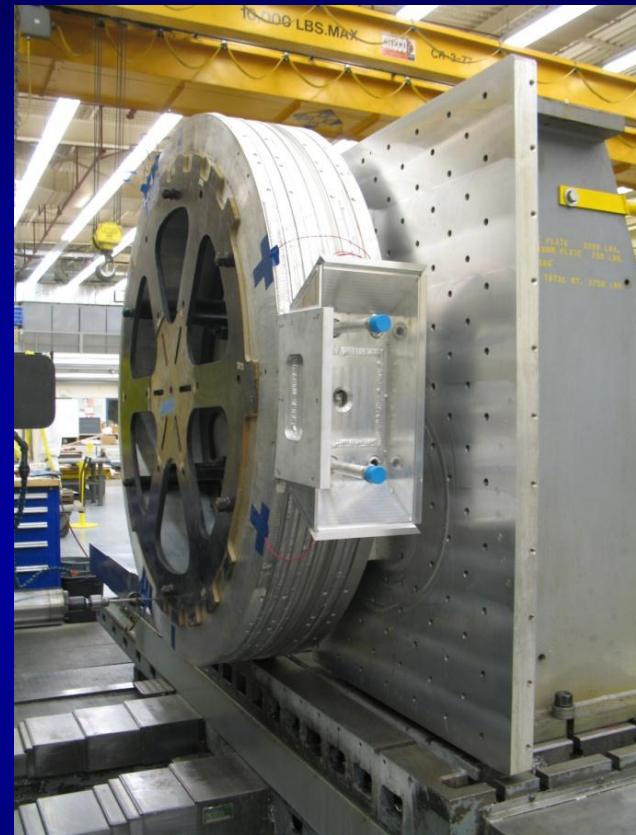


- Helium reservoir



- Helium reservoir welded onto cold mass

Cold Mass Preparation



- Cold mass on milling machine for drilling and taping of holes for the lead stabilization and quench protection hardware mounting bolts



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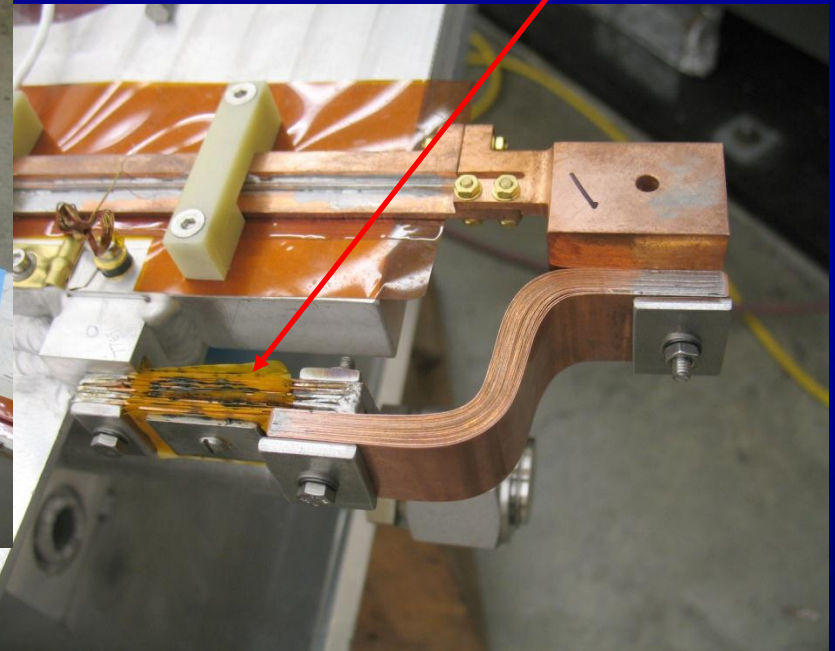
LTS Lead Stabilization

- Met with Brad Smith and his team in March 2012
- MIT group designed and LBNL implemented LTS lead stabilization



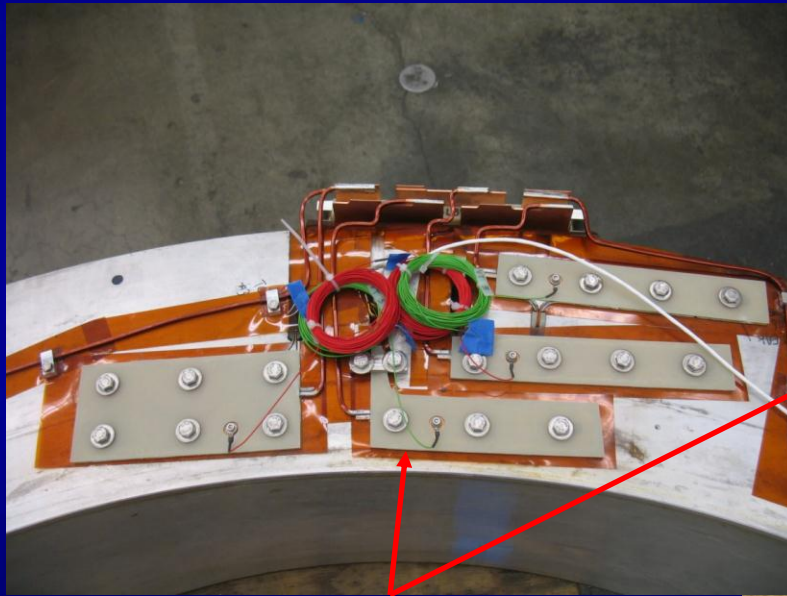
LTS lead stabilizers

HTS to LTS thermal intercept
(Bert Wang design)



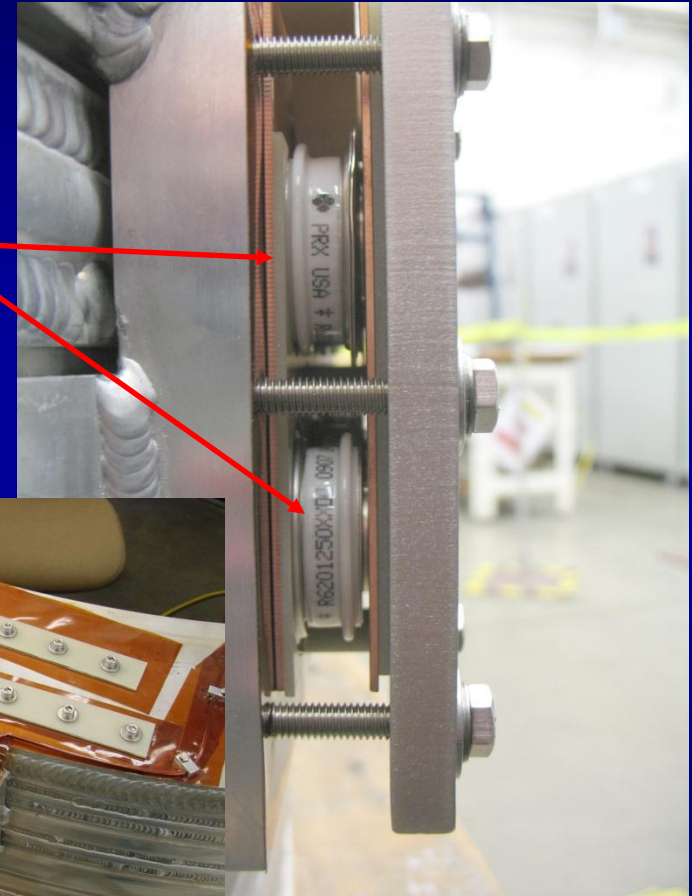
Quench Protection

- MIT group designed and LBNL implemented quench protection system

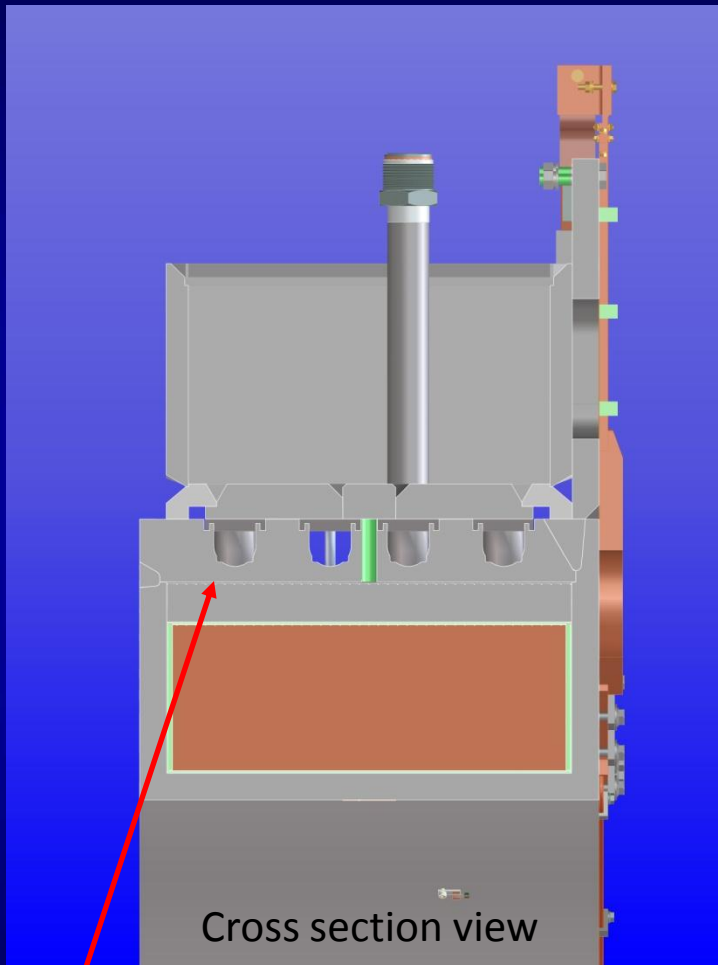


LTS loops secured to the cold mass

Diodes



Epoxy Impregnation



Cold mass in the paint shop oven for epoxy cure

Gap between cover plate and aluminum banding was filled with epoxy



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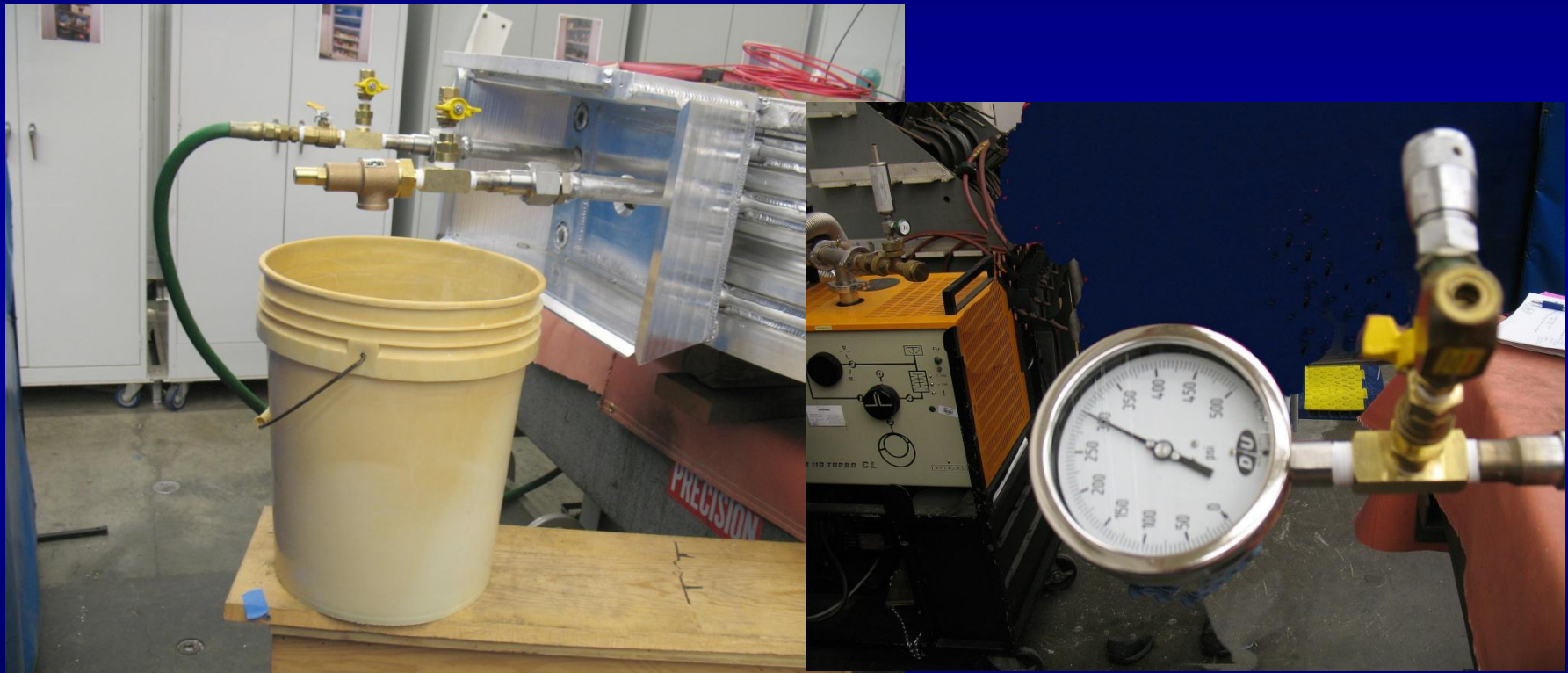
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Cooling Pipe Pressure Test

- Cooling pipe was hydrostatically tested, in steps, to a pressure of 300 psi
- No leaks detected



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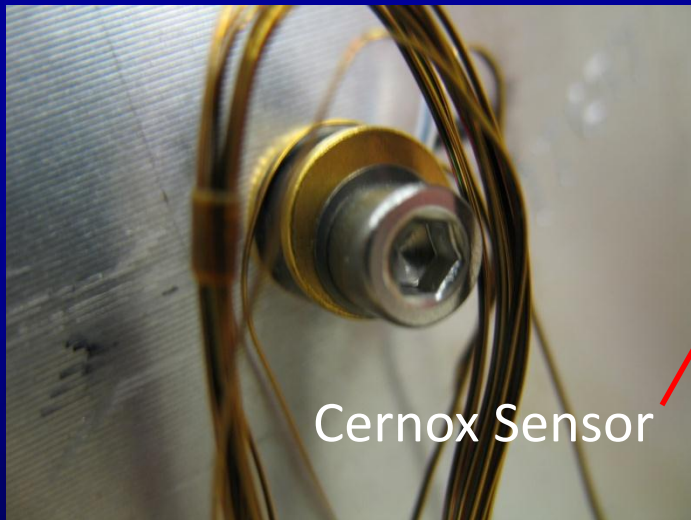
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Instrumentation

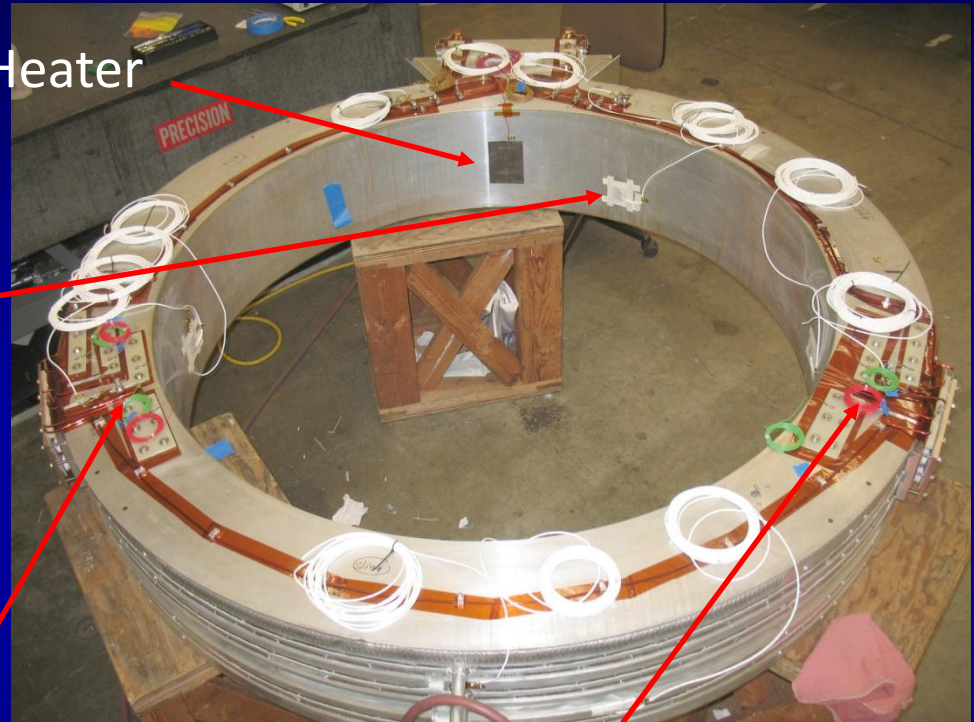


Strain Gauges



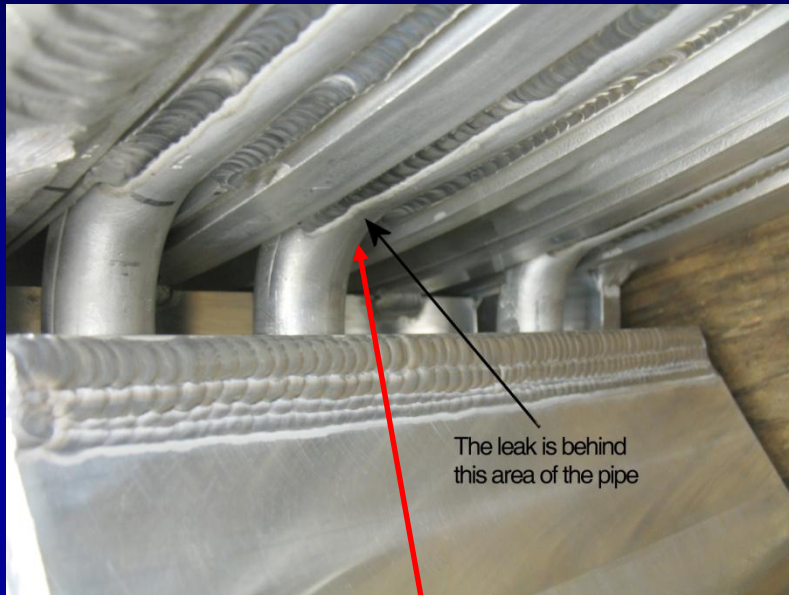
Cernox Sensor

Heater

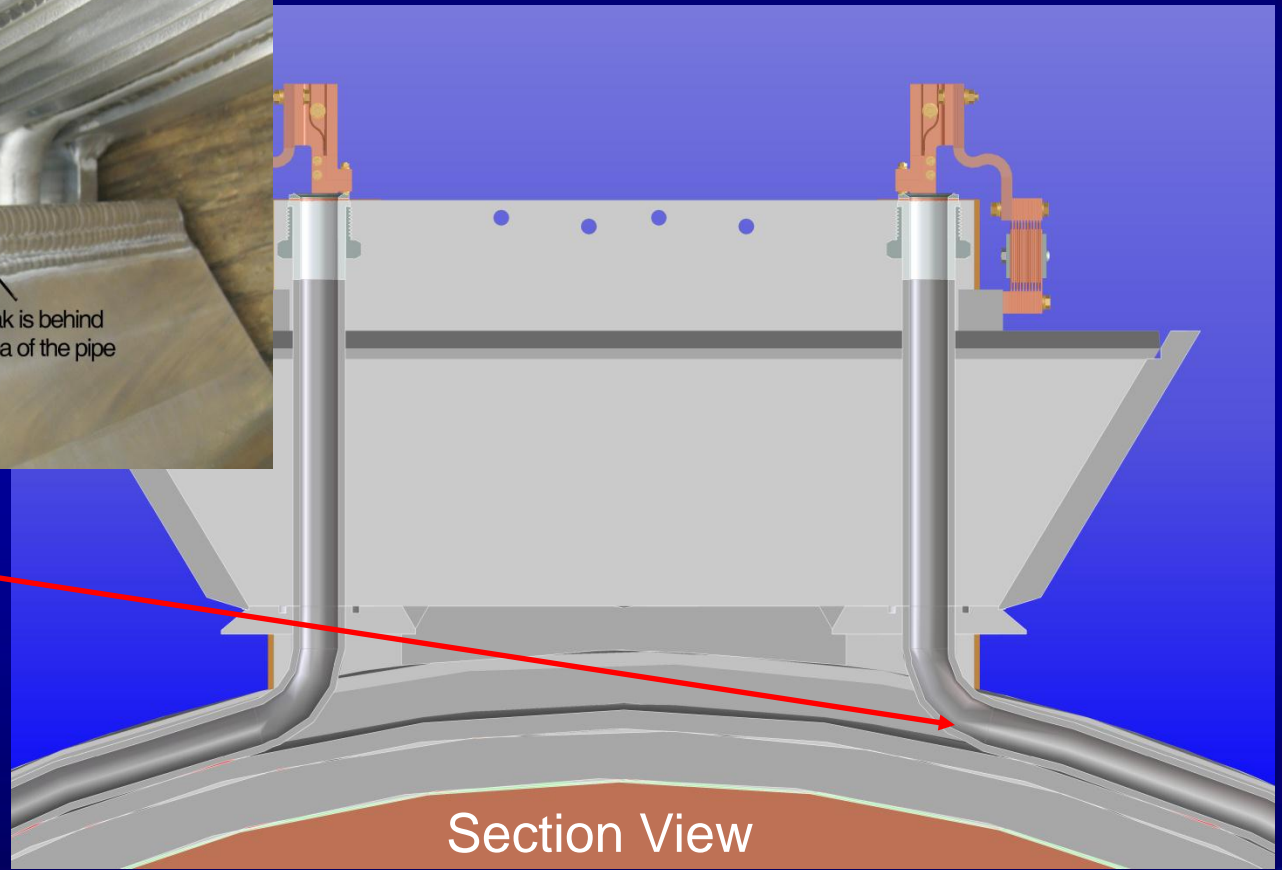


Voltage Taps

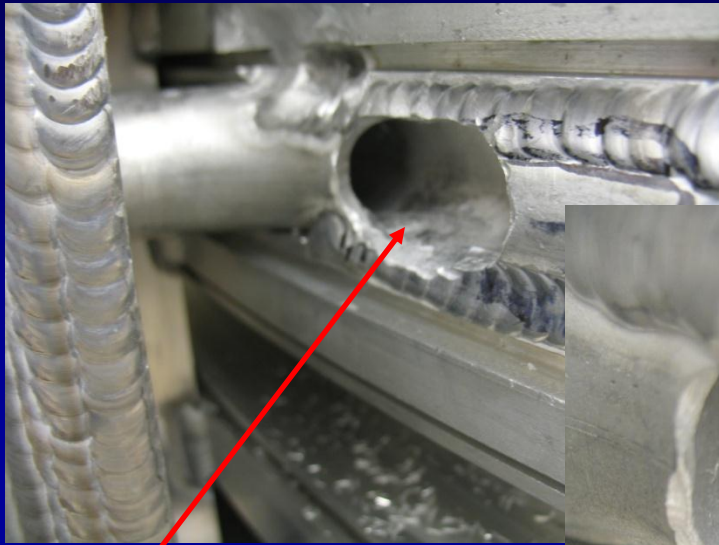
Cooling Pipe Vacuum Leak



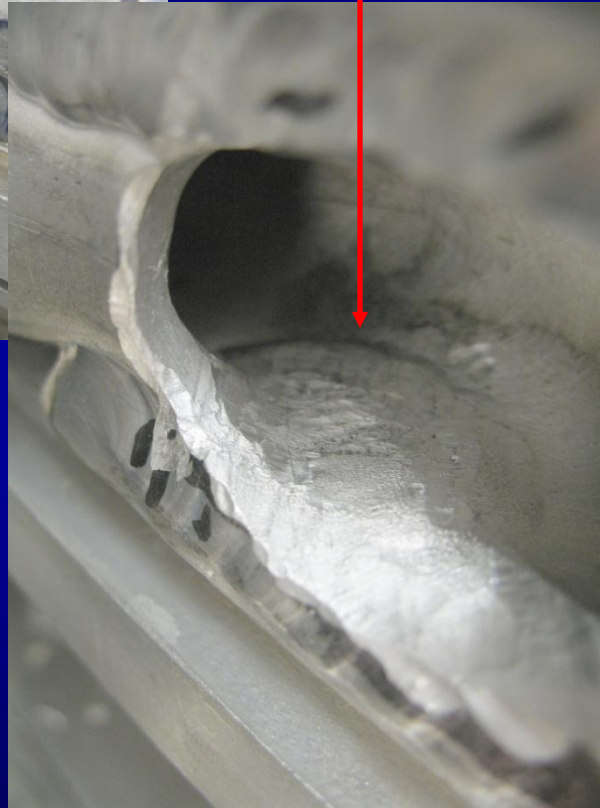
The vacuum leak was determined to be in this area behind pipe



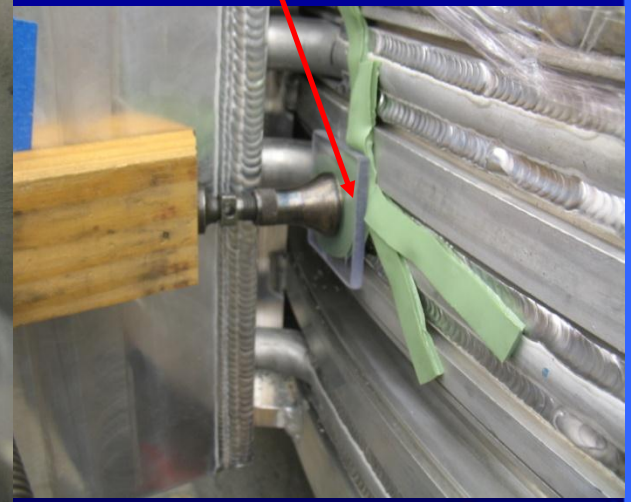
Cooling Pipe Vacuum Leak



Welding was done to attempt to seal the leak

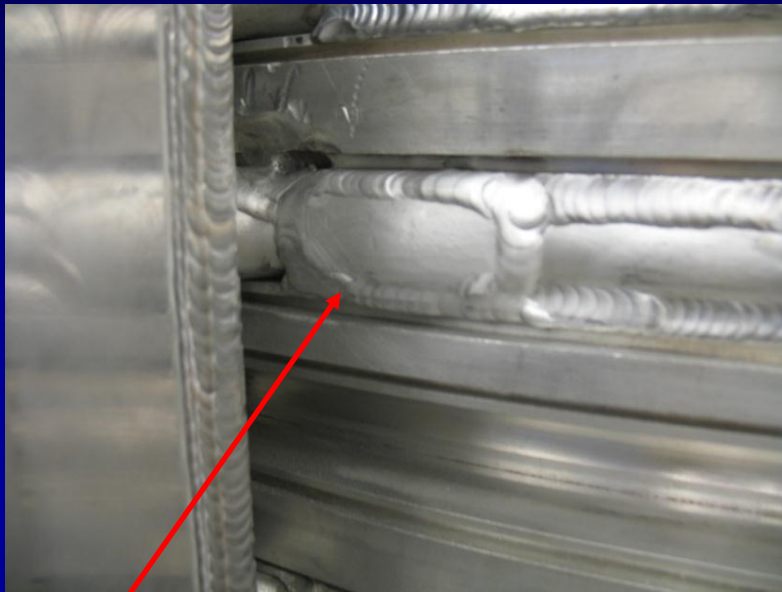


Plastic cover clamped into place over opening for vacuum check



The vacuum leak was determined to be at the back of pipe. An opening was cut into pipe so welding could be done, from the inside, to the back area of the pipe

Cooling Pipe Vacuum Leak



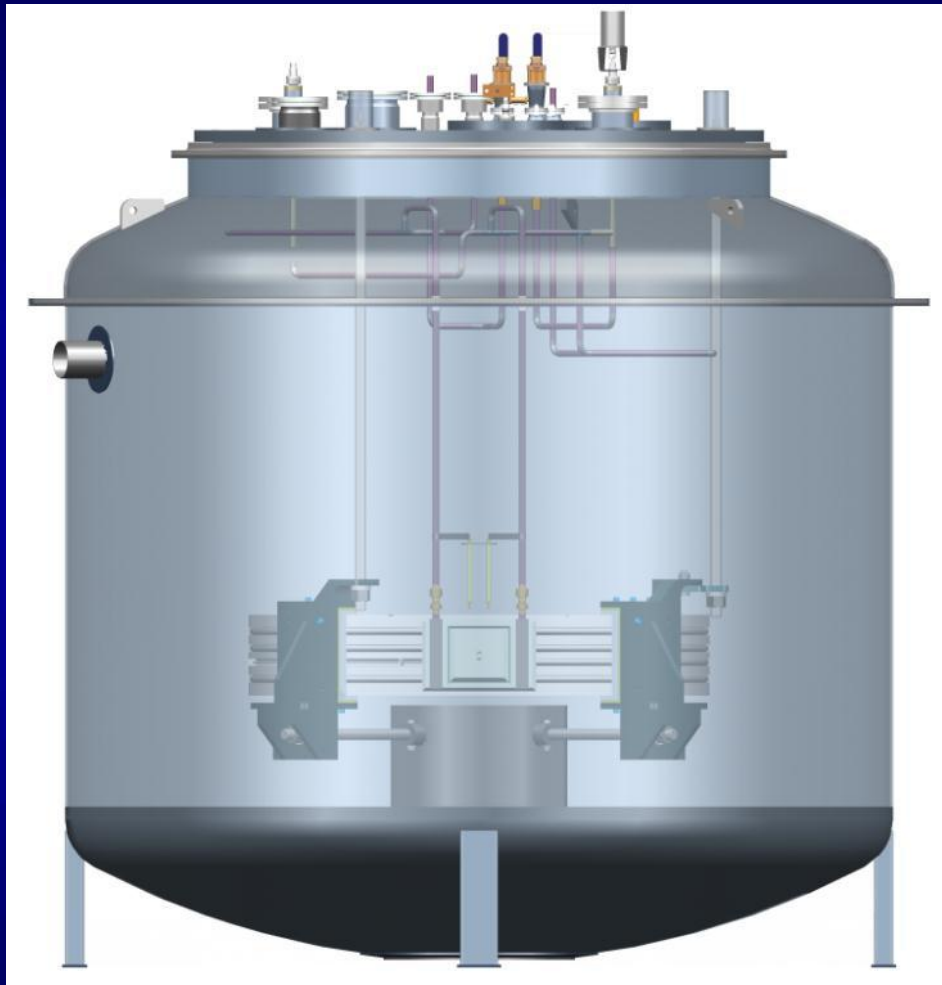
A permanent cover was welded into place over opening

Several attempts to seal the vacuum leak have failed. LBNL is currently waiting for guidance from Fermilab safety review panel for a by-pass repair

Leak determined to be towards the top of the pipe and welding was done, outside, to attempt to seal it



Fermilab Test Setup



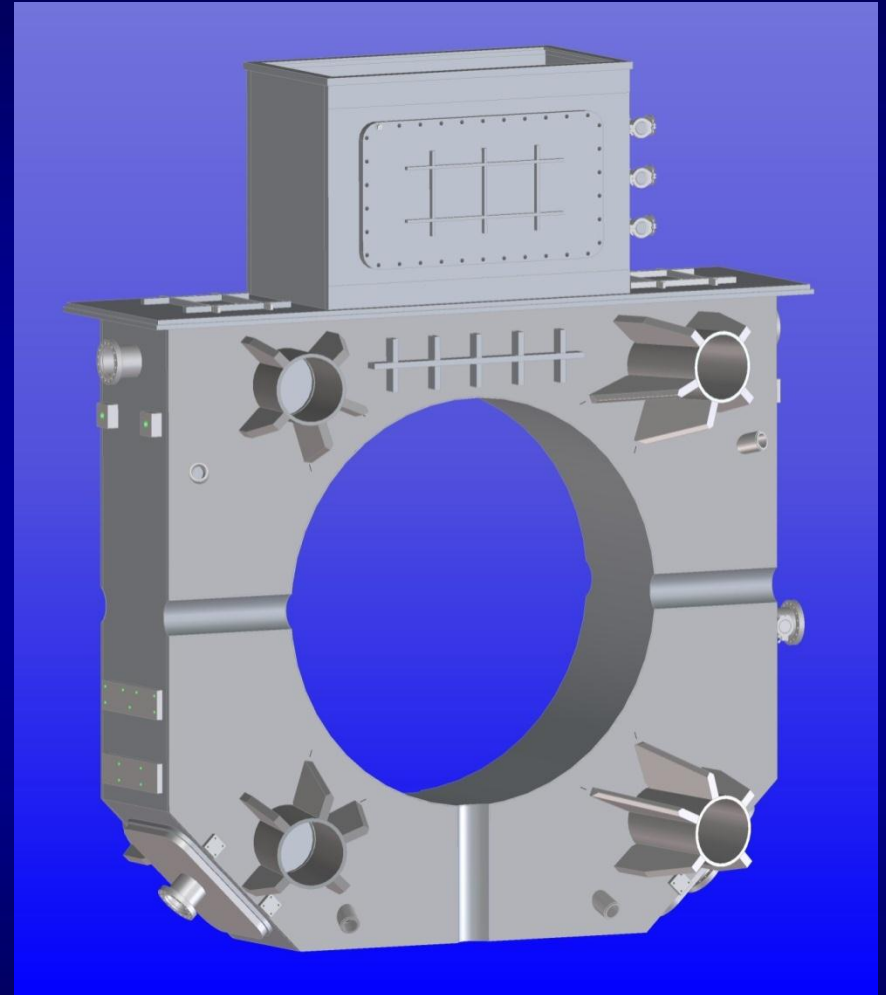
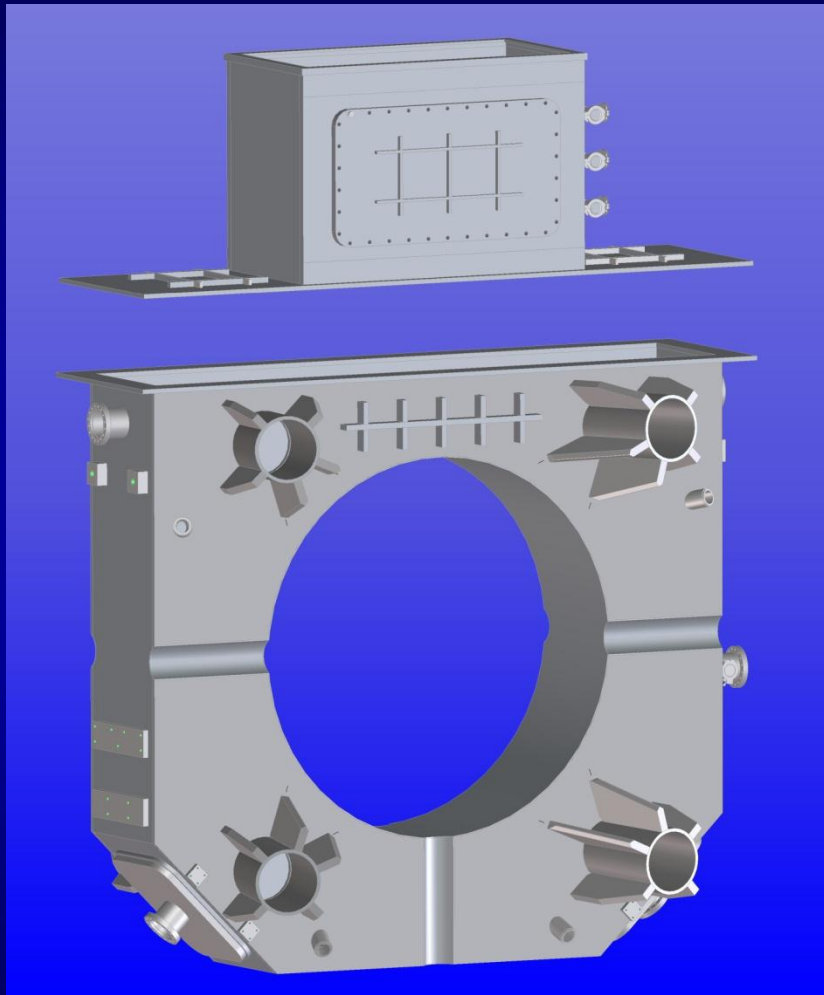
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Coupling Coil Cryostat



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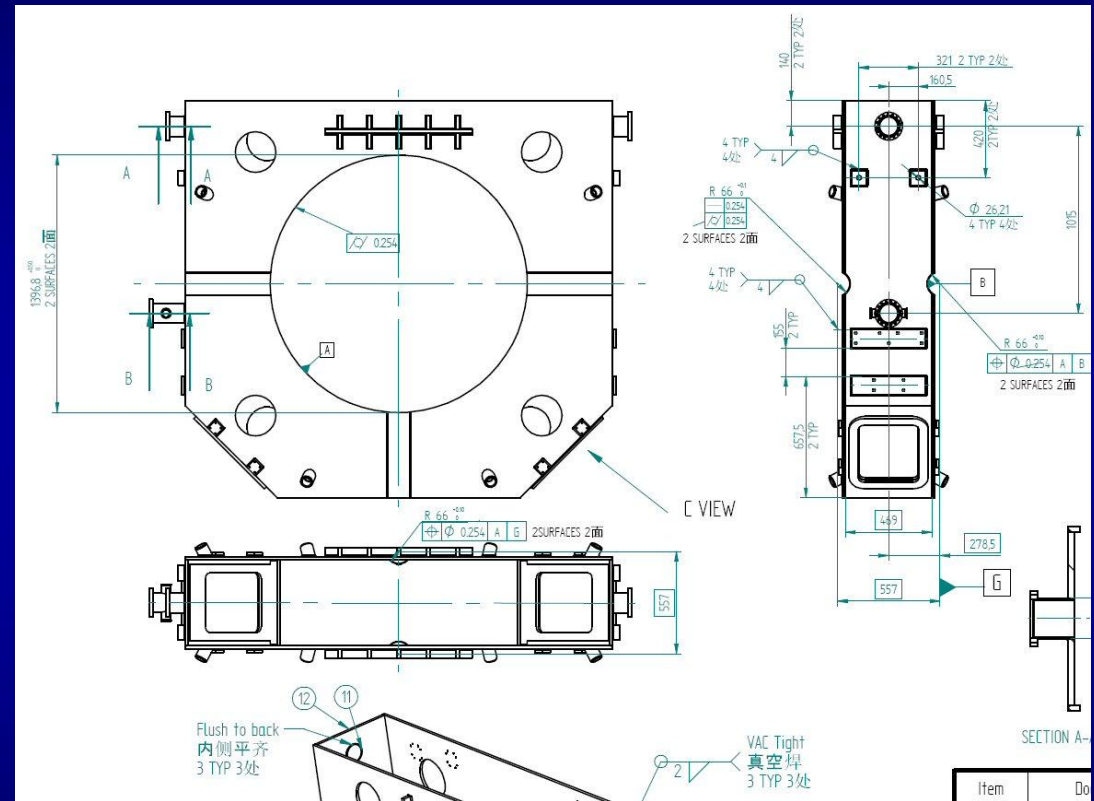
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Coupling Coil Cryostat

- Cryostat design is complete
- Drawings from SINAP (China) complete
- LBNL mechanical shop will fabricate the first cryostat
- Estimated to take 6 months to complete fabrication
- Drawings will be updated to reflect the “as built” cryostat



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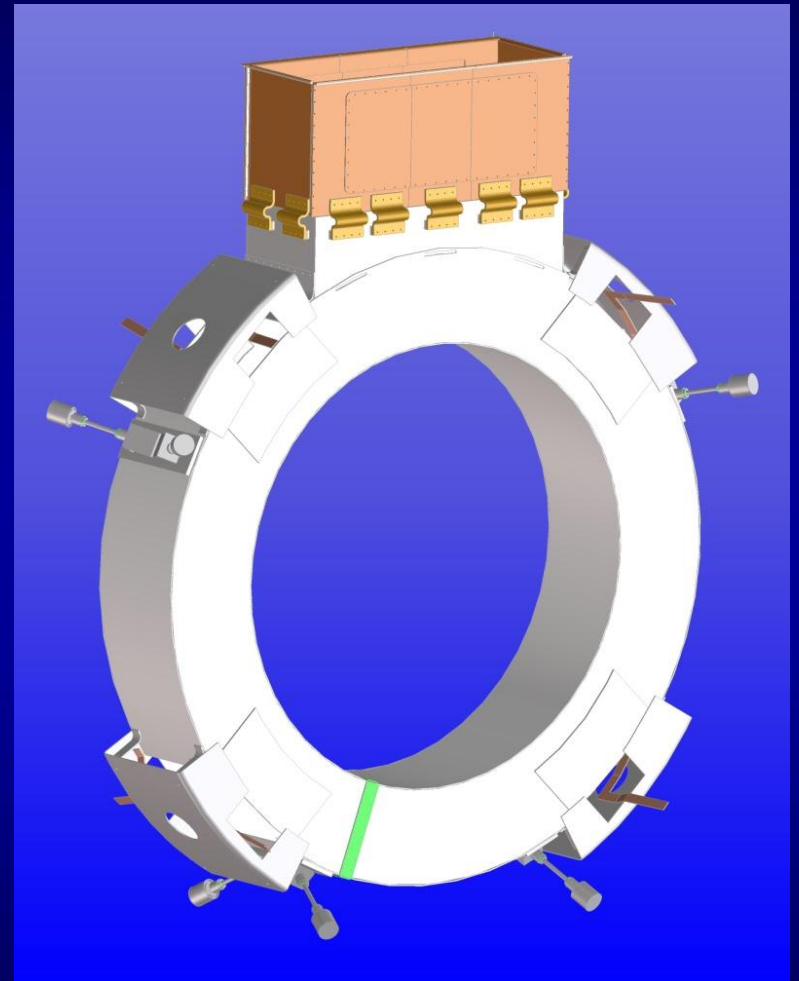
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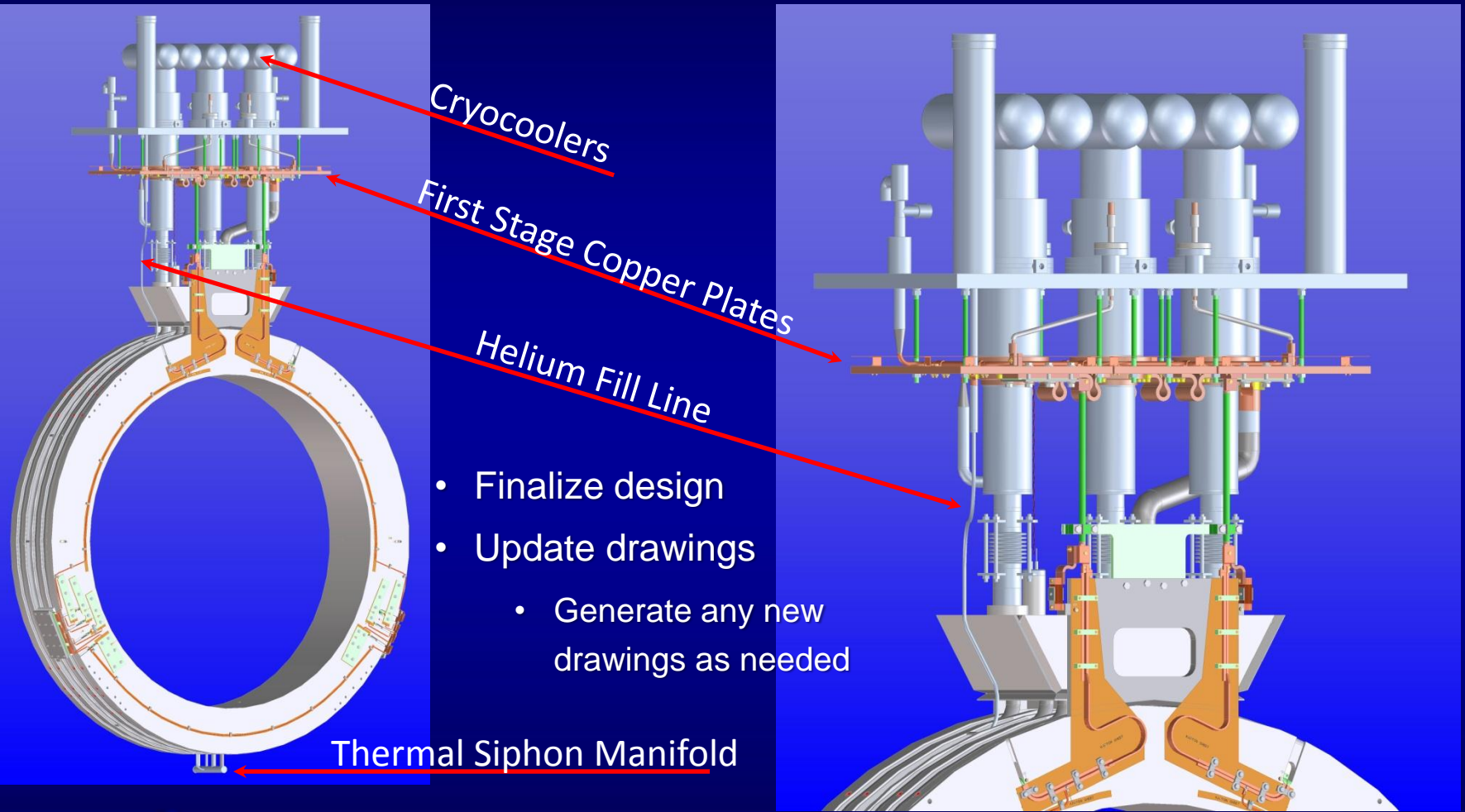


Coupling Coil Thermal Shield Drawings

- Drawings have been red lined but not updated
- Thermal shield design is nearly complete
- Some SINAP parts/drawings will need to be revised for better manufacturability



Cooling Circuit



Coupling Coil Future Work

- **Cold Mass:**

- Determine plan to repair the leaking cooling pipe with guidance from Fermilab safety review committee
- Vacuum check the two remaining pipes – Done
- Pressure test the remaining 2 pipes to 240 psi
- Implement the repair plan for the leaking pipe
- Pressure test the previously leaking pipe to 300 psi
- Vacuum check all of the pipes
- Ship to Fermilab for magnetic tests



Coupling Coil Future Work

- **Cryostat:**

- Fabricate first cryostat – 6 months to complete
- Update any drawings to reflect changes generated for “as built”
- Determine fabricator for the additional 2 cryostats

- **Thermal Shield:**

- Update red lined drawings
 - Modify some parts for better manufacturability
 - LBNL shops may fabricate the first thermal shield

- **Cooling Circuit:**

- Finalize design
- Update drawings
 - Generate any new drawings as needed

