



Plans to Fix Magnet 1

Michael S. Zisman
Center for Beam Physics
Accelerator & Fusion Research Division
Lawrence Berkeley National Laboratory

MICE Spectrometer Solenoid Review
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Magnet 1



- Original design based on Genoa effort
 - updated by LBNL team after INFN could not fund the fabrication
- Problems with Spectrometer Solenoid first arose in 2008
 - magnet 1 was assembled and tested, but did not reach full current
 - 196 A (need 270 A)
 - several problems were uncovered
 - alignment of cold mass to end flanges was poor
 - blockage of the siphon pipe prevented the stage 2 cold heads from delivering LHe to the cold mass
 - thermal shield temperature was too high (~93 K)
 - pressure rise during a quench was deemed too high
 - fixing these problems necessitated disassembly of magnet 1
- To reduce the schedule impact, installing fixes on magnet 2 while magnet 1 is being repaired

See MG slides for more detail



Magnet 1 Plans



- Present plans include

- implement ideas to improve thermal connection between coolers and shield
 - use copper sheets rather than Al cylinder
 - use Al-1100 strips on outside of shield to improve heat conductivity
 - thus lowering cold mass support intercept temperature
- make preparations for using additional 2-stage cooler
 - either augmenting or in place of single-stage cooler
 - one or the other (or both) will likely solve both thermal problems
 - decision to do this will depend on outcome of present magnet 2 tests
- modify fill pipe to facilitate clearing a blockage should one occur
- add voltage taps across HTS leads

Magnet 1 Shield

- Corresponding hole added to shield
 - shield is also being “beefed up” locally to improve heat transfer to edges
 - this is where cold-mass support intermediate temperature point is connected
 - extra heat load from higher temperature at this point is burden for stage 2 of coolers
 - ♦ probably more of an issue than bulk radiation load

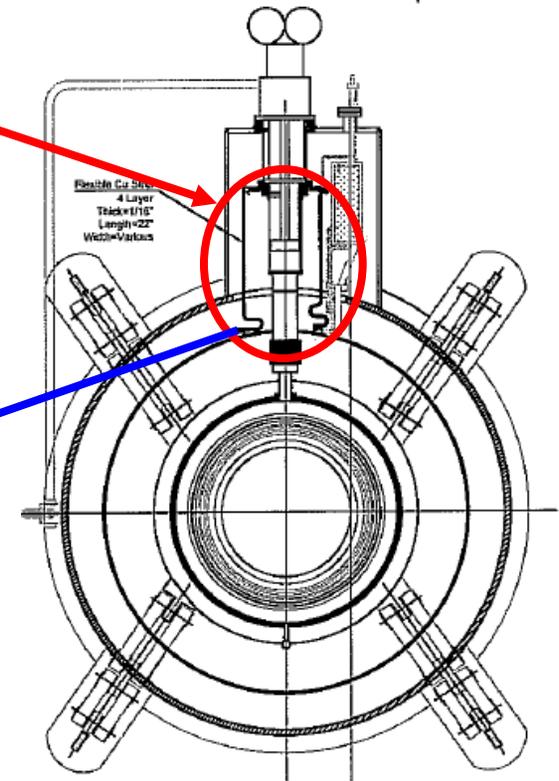


Attachment point for LN₂ reservoir

New connection for cooler added

Area where cold-mass support intercept attached

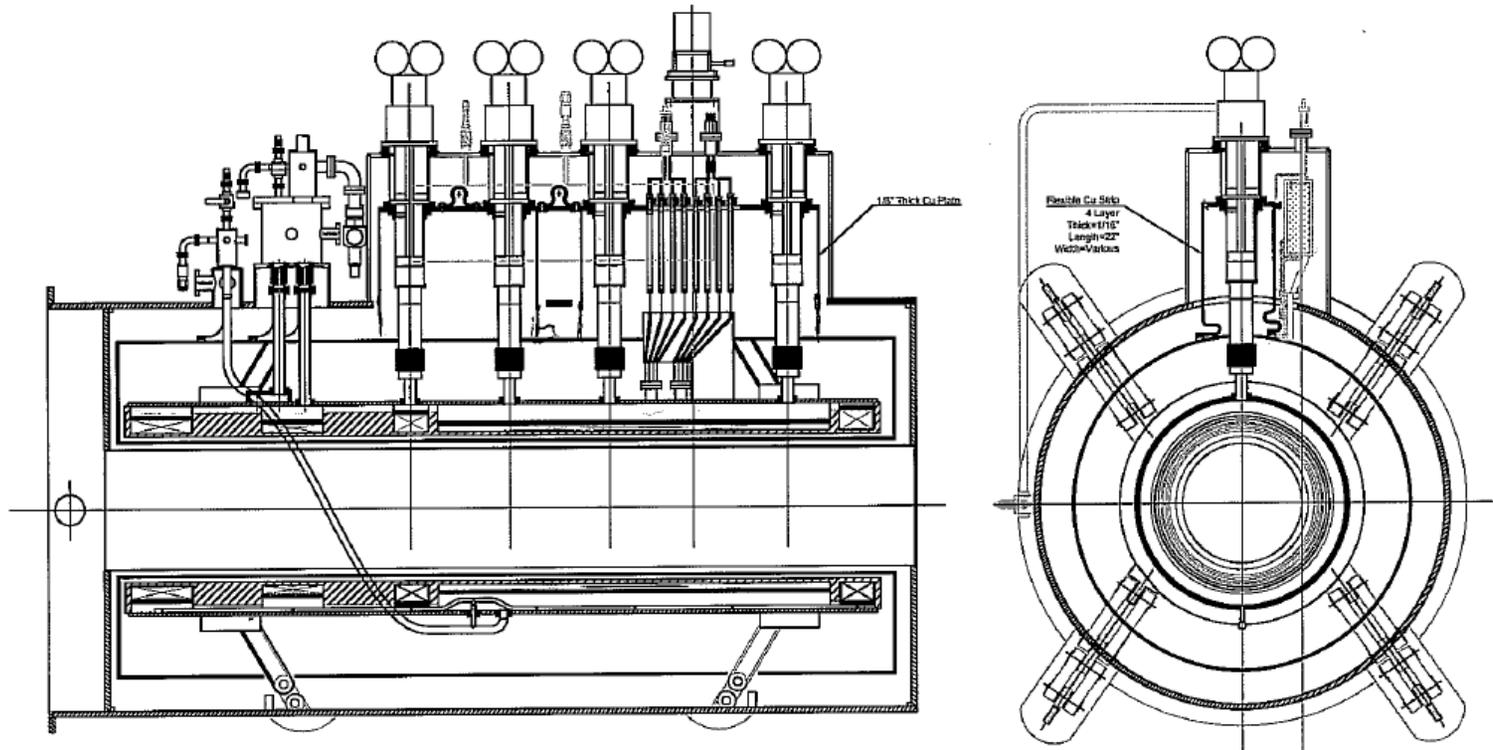
- Previous attempt to improve thermal connection between stage 1 of coolers and shield was a failure
 - aluminum bands were even worse than original copper strips
 - next iteration will make connections between stage 1 copper plates and shield with thicker copper straps



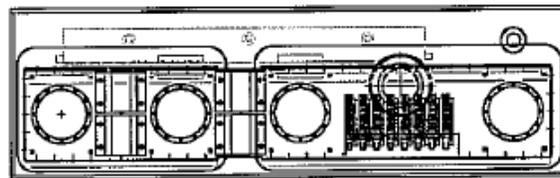
2-Stage Cooler Modification

- We could add a fourth 2-stage cooler as shown below
 - still leaves room for single-stage cooler, if it is needed

Side view:



Top view:



Magnet 1 Cold Mass (1)

- Additional connection for 4th 2-stage cryocooler has been created



New connection
for cooler added

Magnet 1 Cold Mass (2)

- Progress toward adding additional 2-stage cryocooler continues



Modified Fill Pipe

- Create “smoother” path for fill pipe
 - reduces possibility to create a blockage
 - makes it easier to clear if one occurs





Issues



- Need to decide whether we need fourth 2-stage cooler to maintain cryogen level
 - also, would the additional 2-stage cooler obviate the need for the single-stage cooler?
- There is hope that the improvements to the shield connection, along with the single-stage cooler, will suffice
 - if it works on magnet 2, the answer is clear
 - if it “almost” works, the answer is not so clear
- *We can answer the questions “sequentially”*
 - but, each trial costs time and money
- Present approach likely to require at least one additional cooler per magnet, and maybe two



Summary



- We have several clear options
 - improve shield connections
 - add single-stage cooler
 - add one more 2-stage cooler
 - add *both* coolers
- We are preparing for all possibilities to minimize schedule impact
- Is this the right approach?