

Spectrometer Solenoid: Plans to Fix Magnet 2

Spectrometer Solenoid Review

November 18, 2009

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Topics

- Proposed magnet fix
- Modified magnet geometry
- Other system improvements
- Fallback plans
- Schedule overview



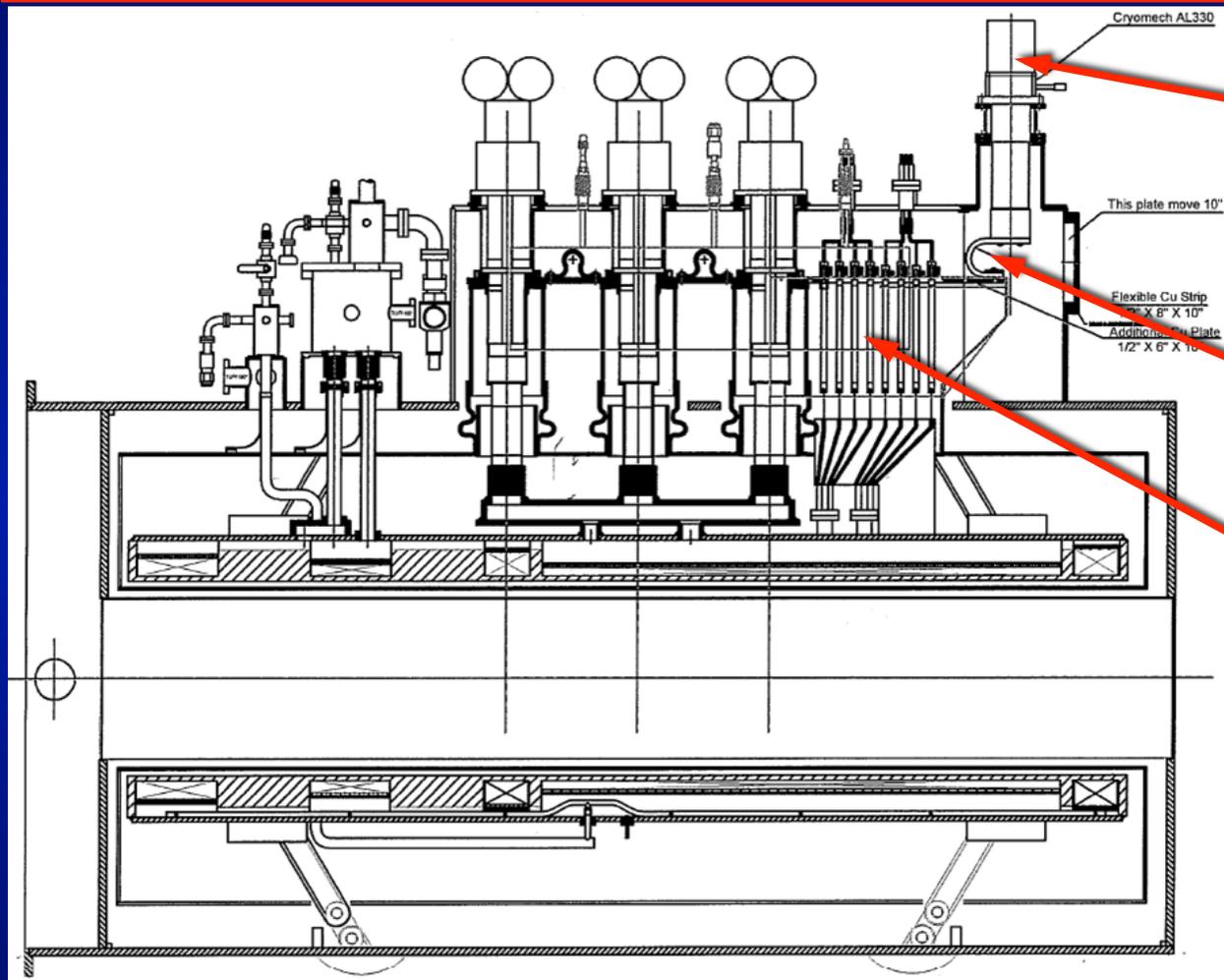
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Magnet 2 Added Cryocooler



Single-stage cooler

Thermal link

HTS leads



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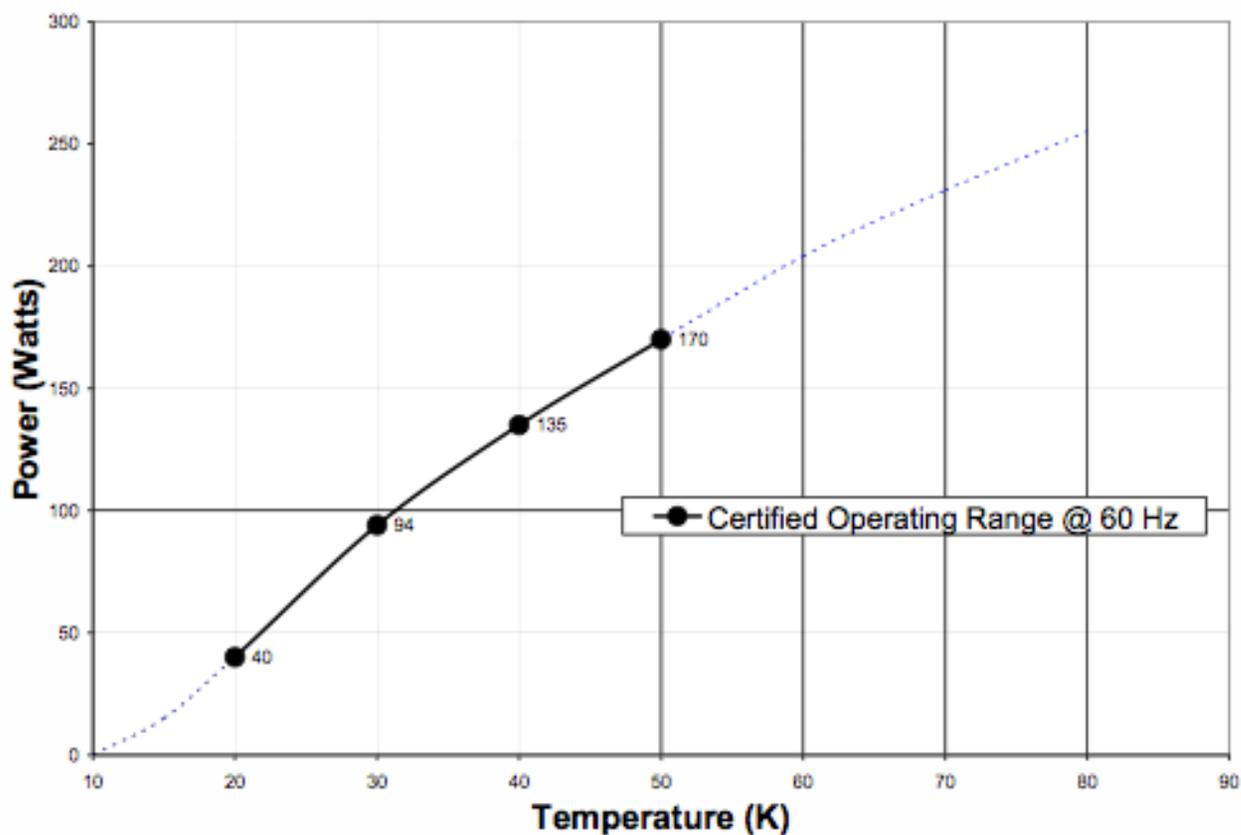
Added Single Stage Cooler

- A modification to Magnet 2 has been proposed which adds a single stage cryocooler to provide additional cooling to the HTS leads and won't require magnet disassembly
- The plan to add a single-stage Cryomech AL330 cooler (arrived 11/13/09) provides 170 W at 55 K and requires modifications only in the "turret" area
- The added cooling power should lower the upper HTS lead temperature sufficiently to train to full current
- The new cooler could remove enough heat to permit the other 3 two-stage coolers to maintain the cold mass LHe level (i.e. closed system)



Cryomech AL330 Performance

AL330 Cryorefrigerator Capacity Curve



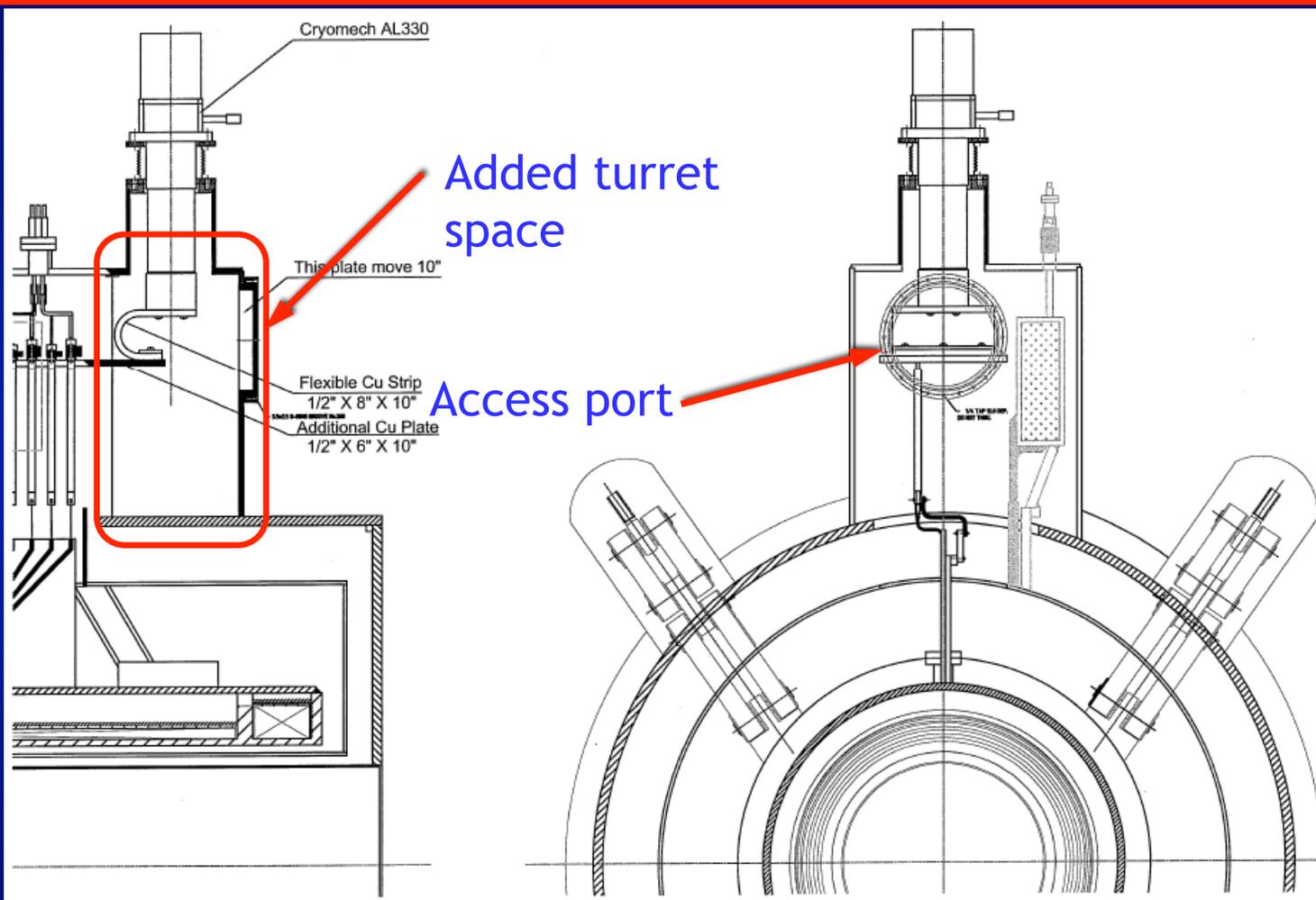
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Modification Details



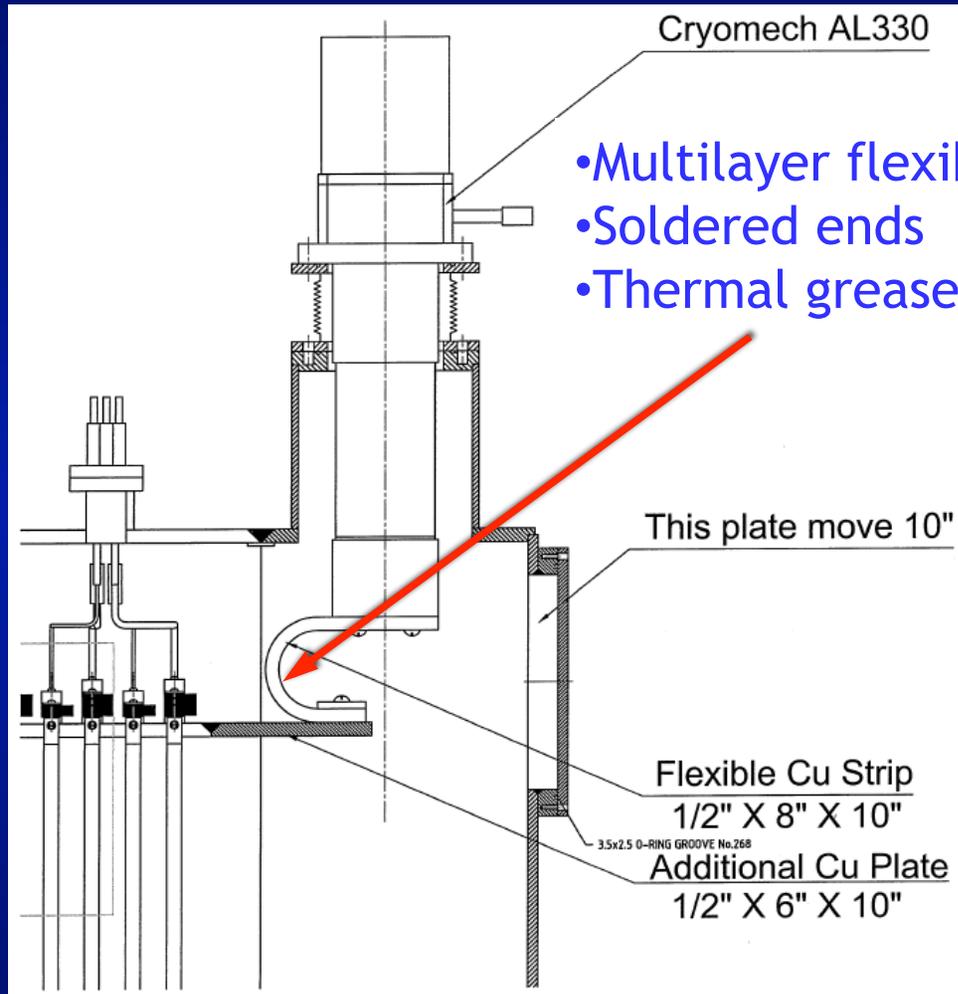
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Modification Details



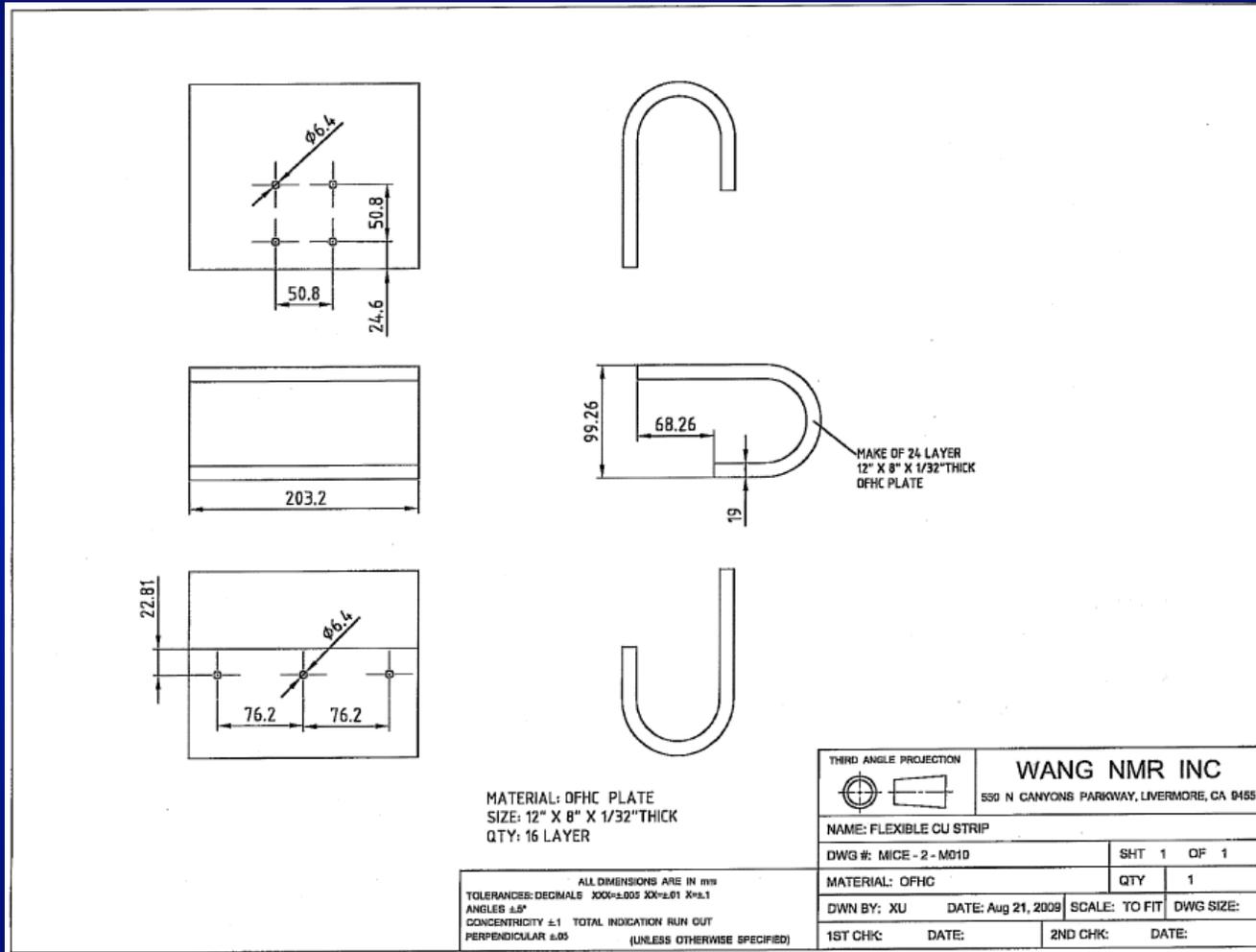
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Cooler Conduction Link



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Thermal Calculations and Measurements

- The thermal model of the magnet is being used to better understand the cooling mechanisms and heat loads
- Preliminary calculations indicate the upper HTS leads temperature will be $<70\text{K}$ during operation
- The temperature drop across the thermal link between the single stage cooler and the 1st stage copper plate is expected to be $\sim 10\text{ K}$
- An off line magnet lead test is being carried out by Wang NMR to measure all relevant temperatures and voltages during operation



Magnet 2 Fallback Scenario

- If the addition of a single-stage cooler to Magnet 2 does not result in a closed system, there are two options:
 - i) Accept the thermal properties as is and top up the magnet with external cryogenics as needed
 - ii) Disassemble and modify the magnet to improve the shield connections and to accommodate a fourth two-stage cooler (in addition to the single-stage cooler)
- The 2nd option will add 3 to 6 months to the delivery of the 2nd magnet to RAL and will create additional risks of damage or assembly errors in the repair process
- For these reasons, the first option is preferred



Schedule Overview

Task/Component Description	Calendar Year 2009					Calendar Year 2010										
	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	
Complete design of magnet modifications	█															
Procure single stage cryocooler	█	█	█													
Test recently delivered 2 stage coolers	█	█														
Set up and perform magnet lead test		█	█	█												
MICE review of Spectrometer Solenoid				◆												
Complete Magnet 2 fixes (w/added cooler)			█	█	█											
Complete power supply modifications		█	█	█												
Cooldown and train Magnet 2					█	█										
Ship Magnet 2 to FNAL (if successful)						█										
Magnetic measurement of Magnet 2						█	█	█								
Ship Magnet 2 to RAL								█	█							
Complete assembly of Magnet 1 w/all fixes			█	█	█	█	█									
Cooldown and train Magnet 1							█	█								
Ship Magnet 1 to FNAL								█								
Magnetic measurement of Magnet 1								█	█	█						
Ship Magnet 1 to RAL										█	█					
Disassemble Magnet 2 for modification*							█	█								
Re-assemble Magnet 2 w/all fixes*								█	█	█						
Cooldown and train Magnet 2*										█	█					
Ship Magnet 2 to FNAL*												█	█			
Magnetic measurement of Magnet 2*													█	█		
Ship Magnet 2 to RAL*															█	█

* These step are only required if the initial modifications to Magnet 2 are unsuccessful



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