Design, Construction and Test of Cryogen-Free HTS Coil Structure*

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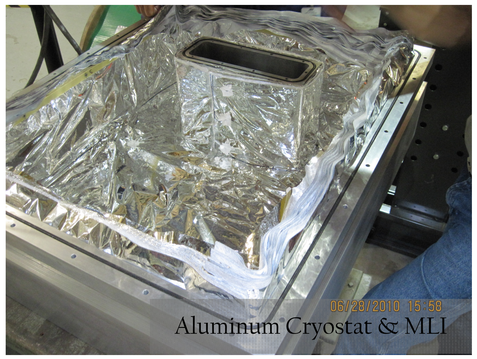
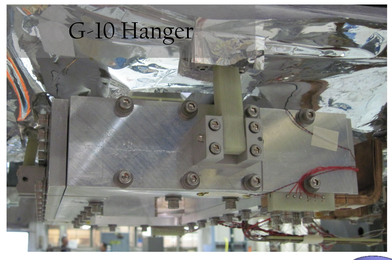
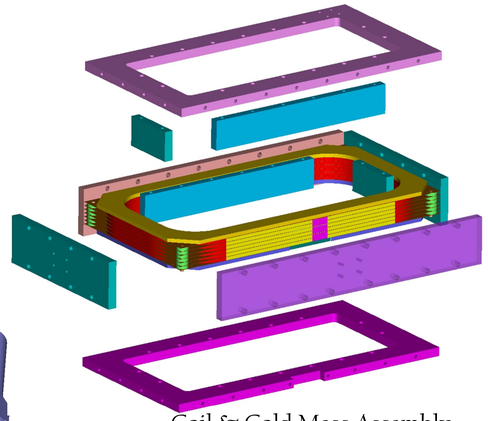
This paper will describe design, construction and test results of a cryo-mechanical structure to study coils made with the second generation High Temperature Superconductor (HTS) for the Facility for Rare Isotope Beams (FRIB). A magnet comprised of HTS coils mounted in a vacuum vessel and conduction-cooled with Gifford-McMahon cycle cryocoolers is used to develop and refine design and construction techniques. The study of these techniques and their effect on operations provides a better understanding of the use of cryogen free magnets in future accelerator projects. A cryogen-free, superconducting HTS magnet possesses certain operational advantages over cryogenically cooled, low temperature superconducting magnets.

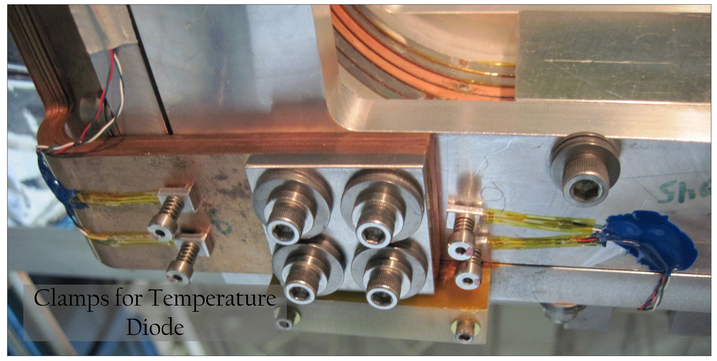
Design & Fabrication

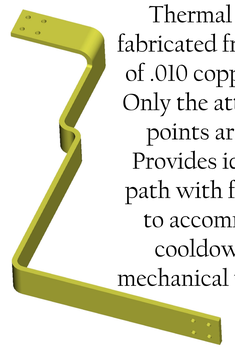


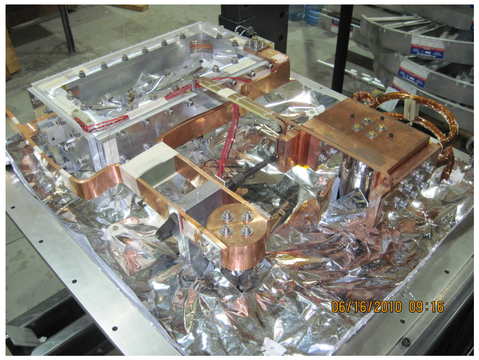
Aluminum Cryostat & MLI

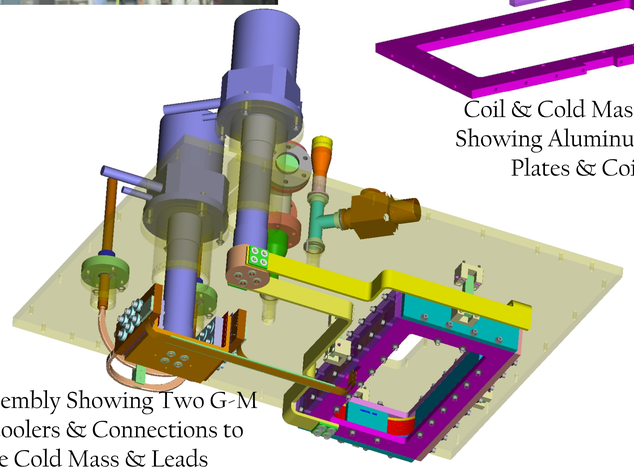

G-10 Hanger

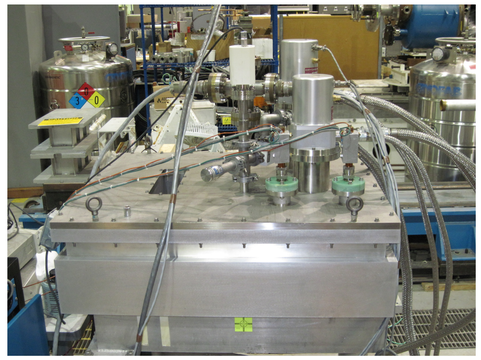

Coil & Cold Mass Assembly Showing Aluminum Surround Plates & Coil Pack

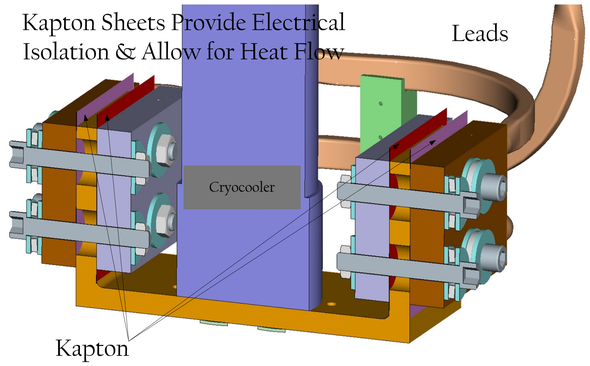

Clamps for Temperature Diode


Thermal Straps fabricated from layers of .010 copper sheet. Only the attachment points are solid. Provides ideal heat path with flexibility to accommodate cooldown and mechanical variations

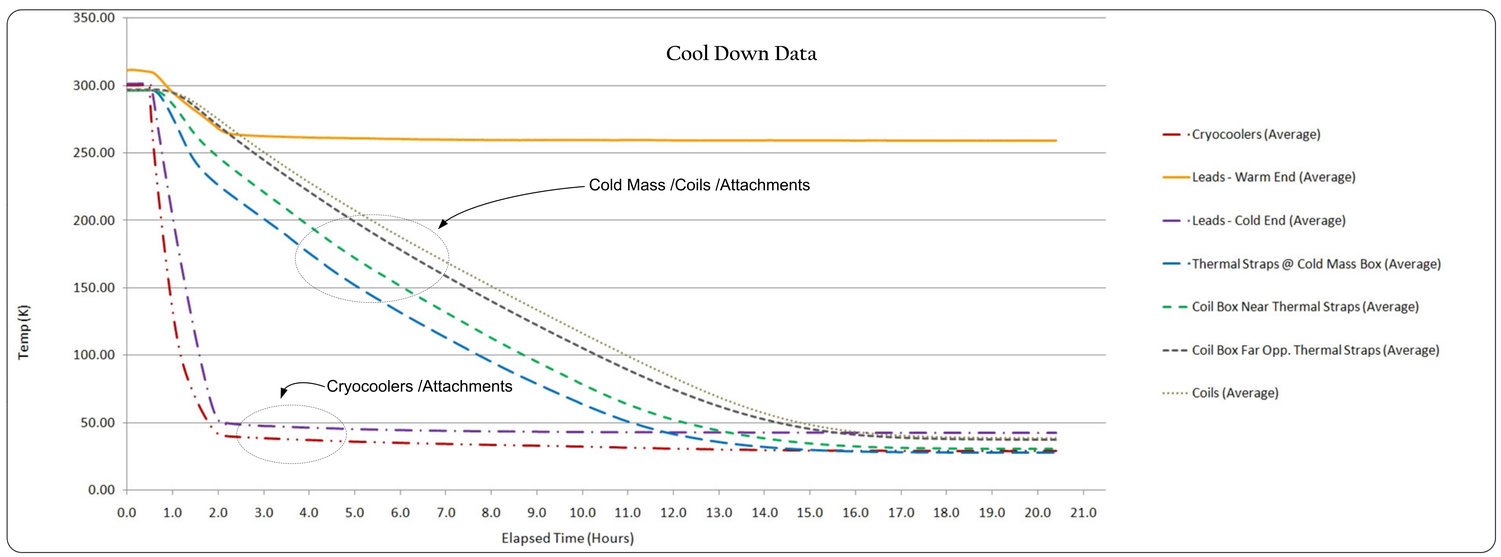


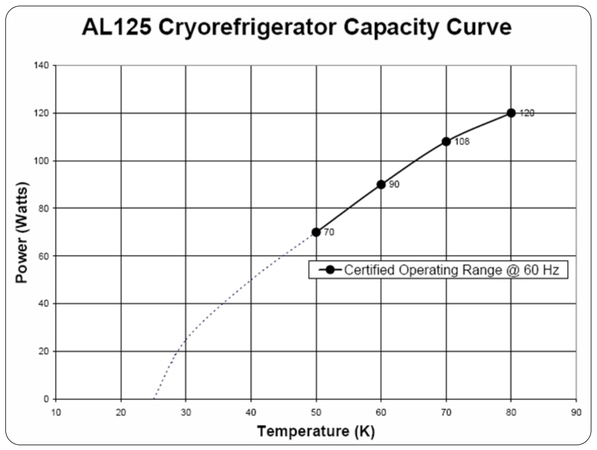

Lid Assembly Showing Two G-M Cryocoolers & Connections to the Cold Mass & Leads





Operations





Clamp for Temperature Diode

Correct pressure is important to accurate temperature readings. Shoulder screw and spring provide consistent clamping force. In all, 32 diodes were used to temperature-instrument the magnet assembly