70 T User Magnet Delivers 250 Pulses at NHMFL Pulsed Field Facility

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Introduction

The NHMFL Pulsed Field Facility has completed its first science operations in a high-energy magnet user-cell available for science investigations. The first operational magnet in this cell is a modified 75 T coil assembly developed for the DOE-NSF 100 T Multi-shot Pulsed Magnet Program. The cell was opened December 10, 2007 after magnet refurbishment and an upgrade to the station and support instrumentation.

The station's primary scientific user was John Singleton who performed measurements of quantum Shubnikov de Haas oscillations at fields up to 72.5 T.

Summary of Upgrade and Operations

The magnet and station upgrade entailed the design & construction of secondary fault containment structures on both the coil and blast box assemblies. External Zylon containment rings were installed around the coil's mid-plain, electrical bus-feed, and lower electrical interconnect joint regions. The blast box assembly was also upgraded by installing spring loaded "Belleville" washers on all major fasteners to reduce the impulse loads on bolts during shock loading. The Belleville washers were deemed necessary after earlier 80T prototype testing in 2006.

The two-coil magnet assembly was pulsed over 70 T two hundred fifty three times between December 2007 and March 2008. The external coil experienced an electrical fault without catastrophic structural failure. The internal coil of the magnet assembly experienced over 350 pulses without internal electro-mechanical failure.

Future plans for the high-energy magnet user cell entail the introduction of a new duplex-design user magnets designed to utilize the new 4 MJ capacitor bank now completing construction. The next generation of NHMFL pulsed magnets operate in a duplex mode meaning that two synchronized pulsed circuits will energize a magnet assembly. Duplex operation will allow extension of stand-alone capacitor magnet science operations to 80 T.

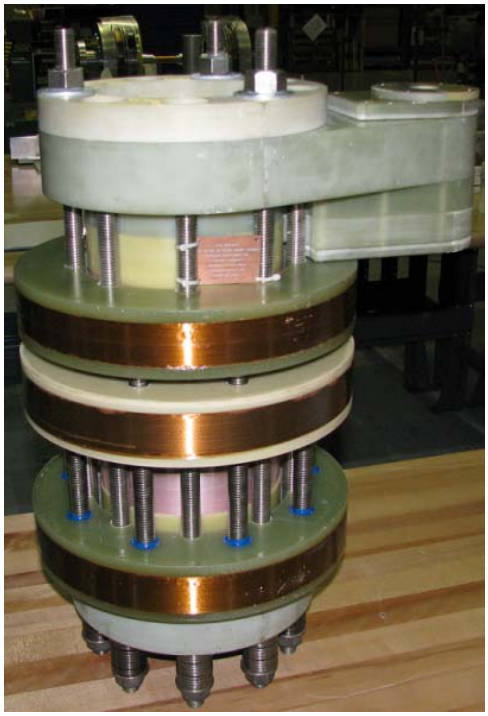

Figure 1 Side view of 75T magnet showing Zylon containment rings around coil assembly. The rings serve as secondary containment.

Conclusions

The 250 pulse performance of this prototype magnet has established the proof of principle for viable 70 T capacitor driven science magnets.

Acknowledgements

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References

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