

BNL Superconducting Magnet Division Work Toward Q6 Goal

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ARPA-E Q6 Quarterly Review

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BROOKHAVEN
NATIONAL LABORATORY

a passion for discovery



Q6 Goals for Magnet Division

- Task 5A; First coil built and tested to reach field > 10T.
- Task 9A: Verification of support structure and mechanical robustness – previously completed

Scientific and Engineering Staff

- Ramesh Gupta, Physicist, PI for Magnets
- Bill Sampson, Physicist
- Lakshmi Lalitha, Post Doc
- Piyush Joshi, EE, quench protection
- Jesse Schmalzle, ME, support structure & final assembly

Status

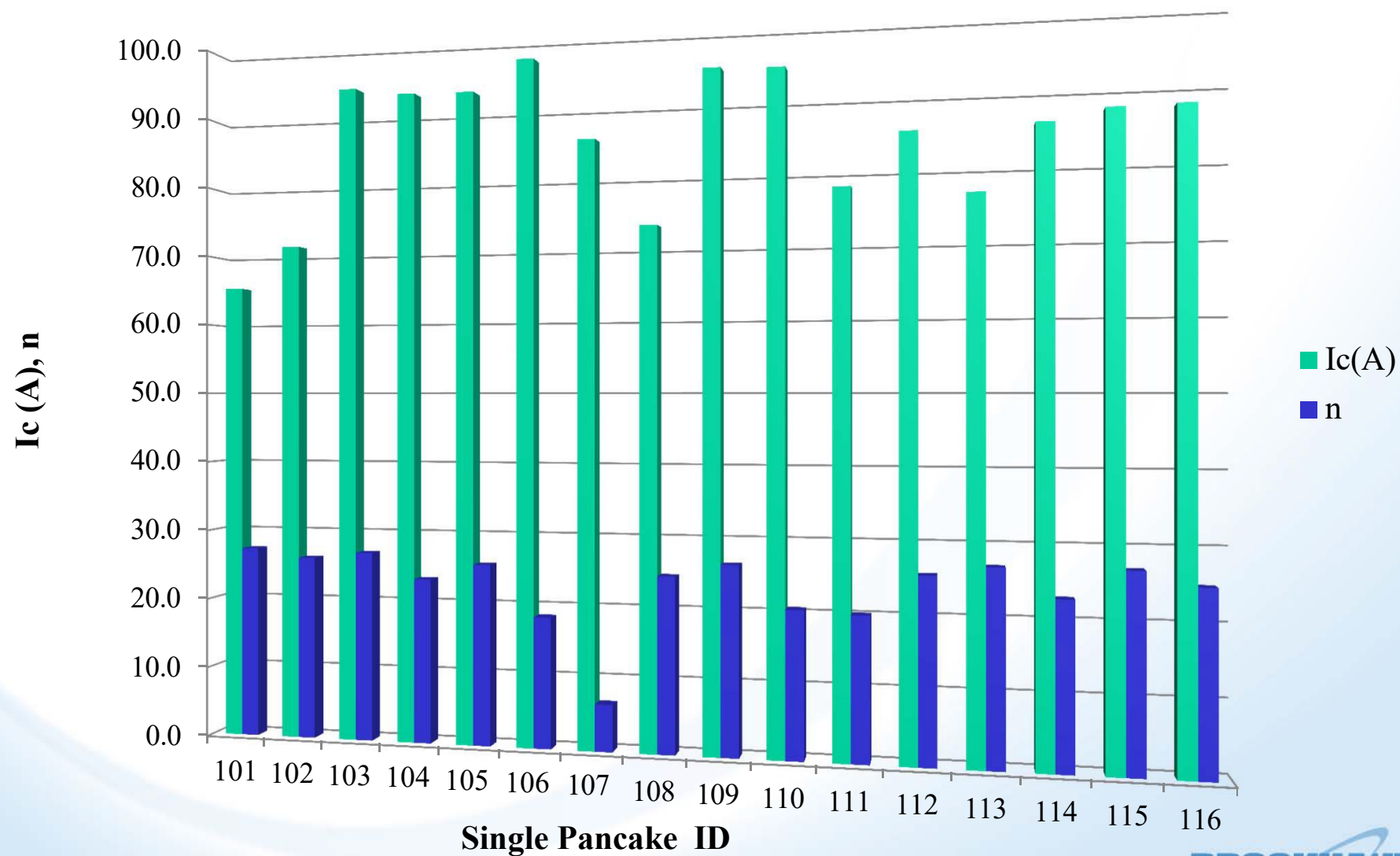
- 16 single pancake coils constructed
- 16 single pancakes assembled in 8 pairs, all tested at 77 K.
- 6 selected pairs assembled for Q6 Go/NoGo structure
- Quench detection and protection electronics upgraded for high voltage
- SMES coil for Q6 Go/NoGo Milestone tested ok at 77 K
- Same SMES coil reached 11.4 T/760A (4 K) quenched ok

Coils with voltage taps

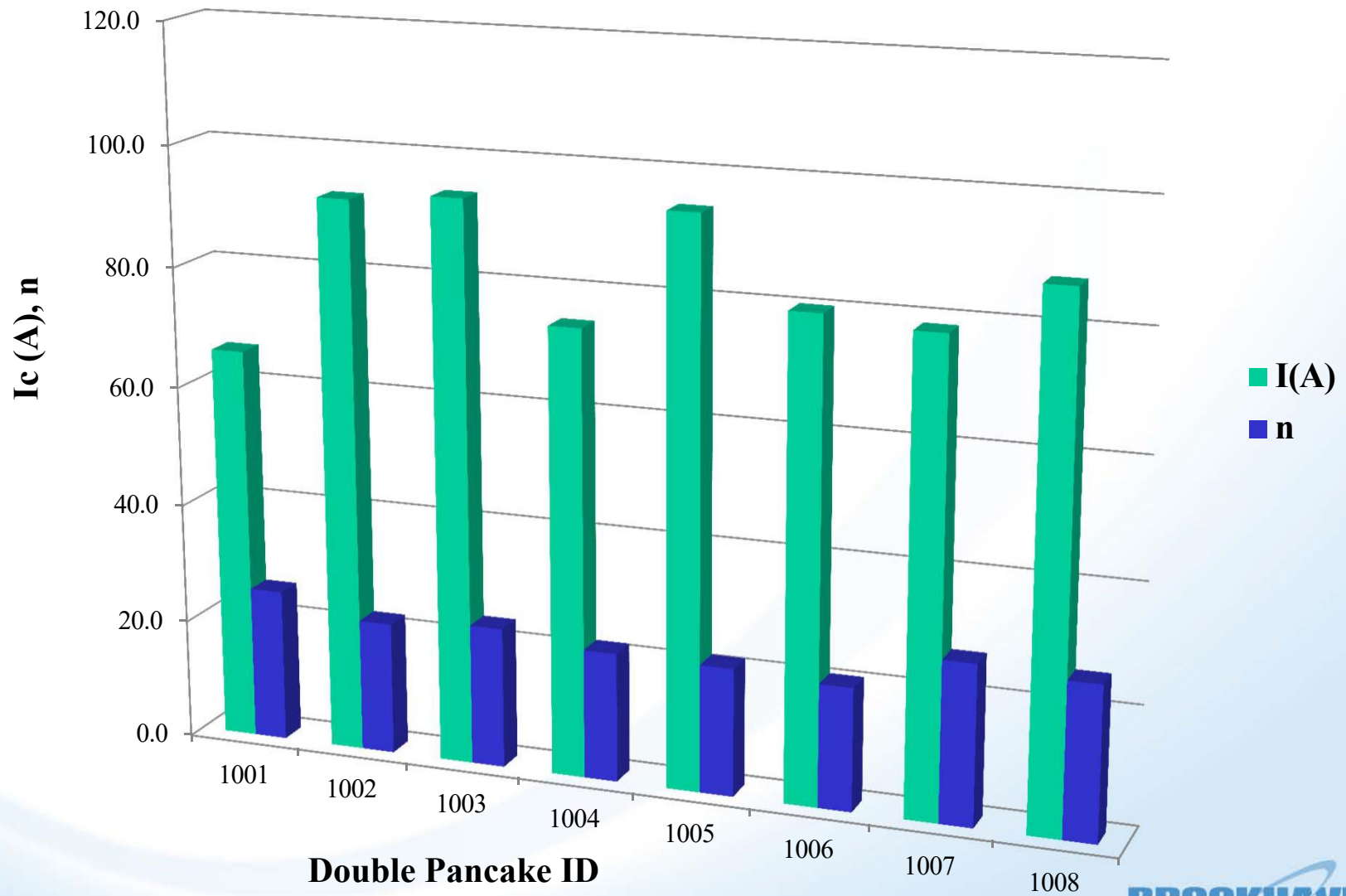
Voltage taps permit QA check at 77K that takes into account variation critical current with radius/self field. Taps are removed prior to assembly in SMES coil.



Single Pancakes in DPC assembly at 77K: based on $0.1\mu\text{V}/\text{cm}$ criterion

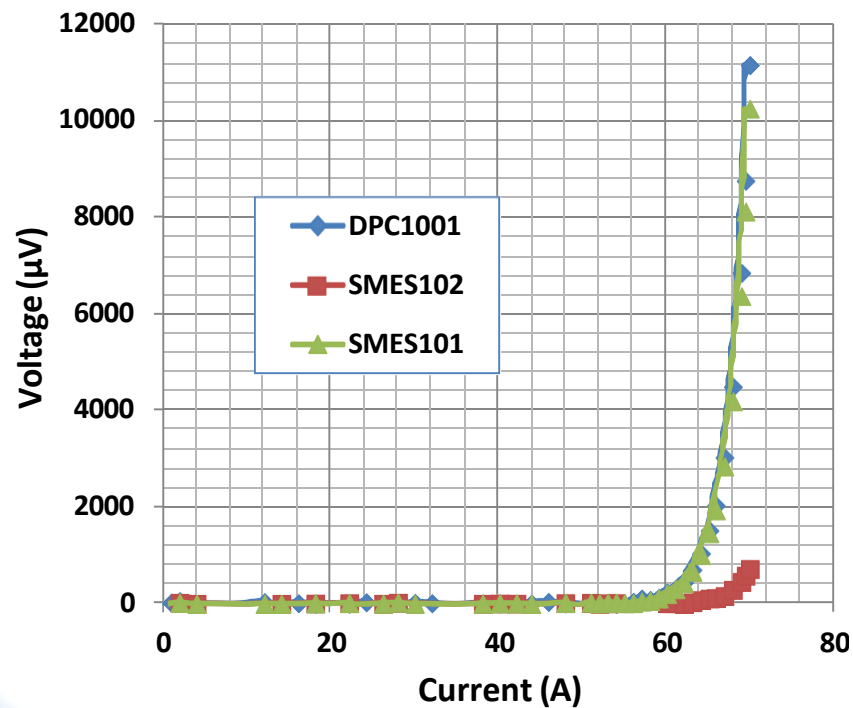


Pairs @ 77 K: based on $0.1\mu\text{V}/\text{cm}$ criterion

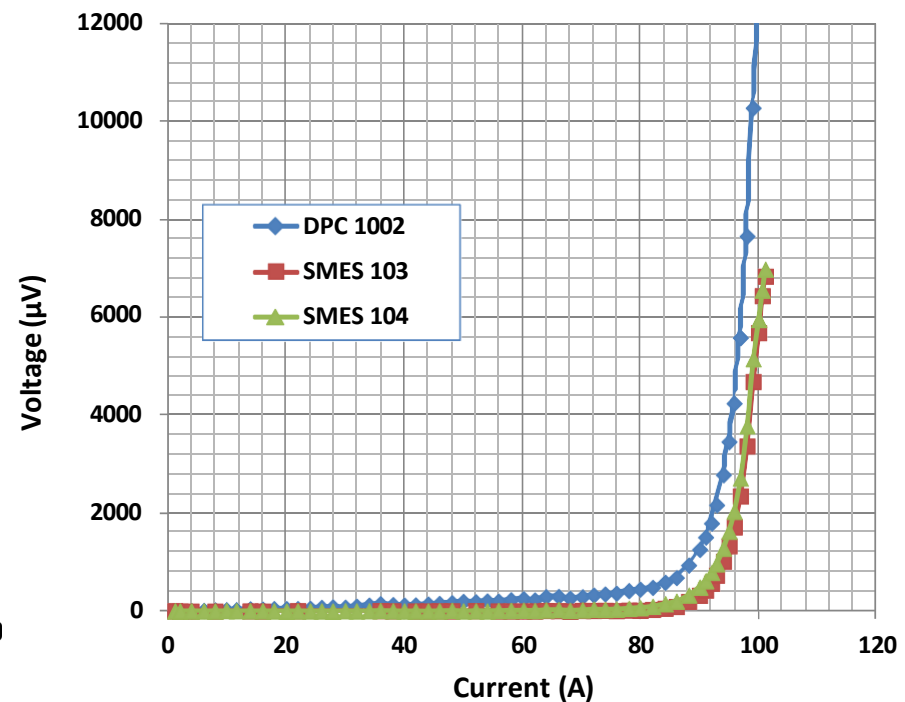


Test Results of SMES Coil (1)

Inner Pair at 77 K

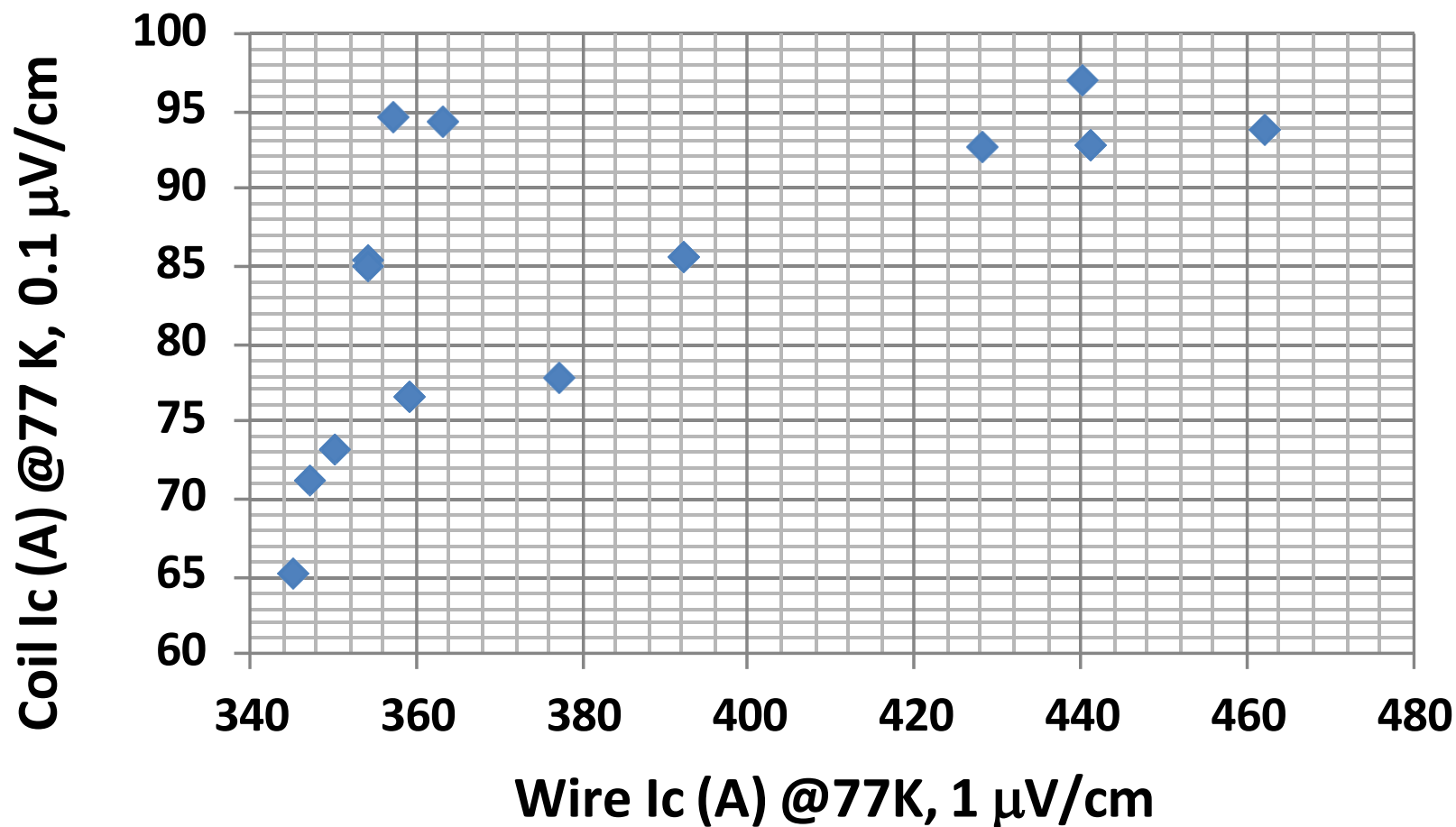


Two single pancakes with different critical current

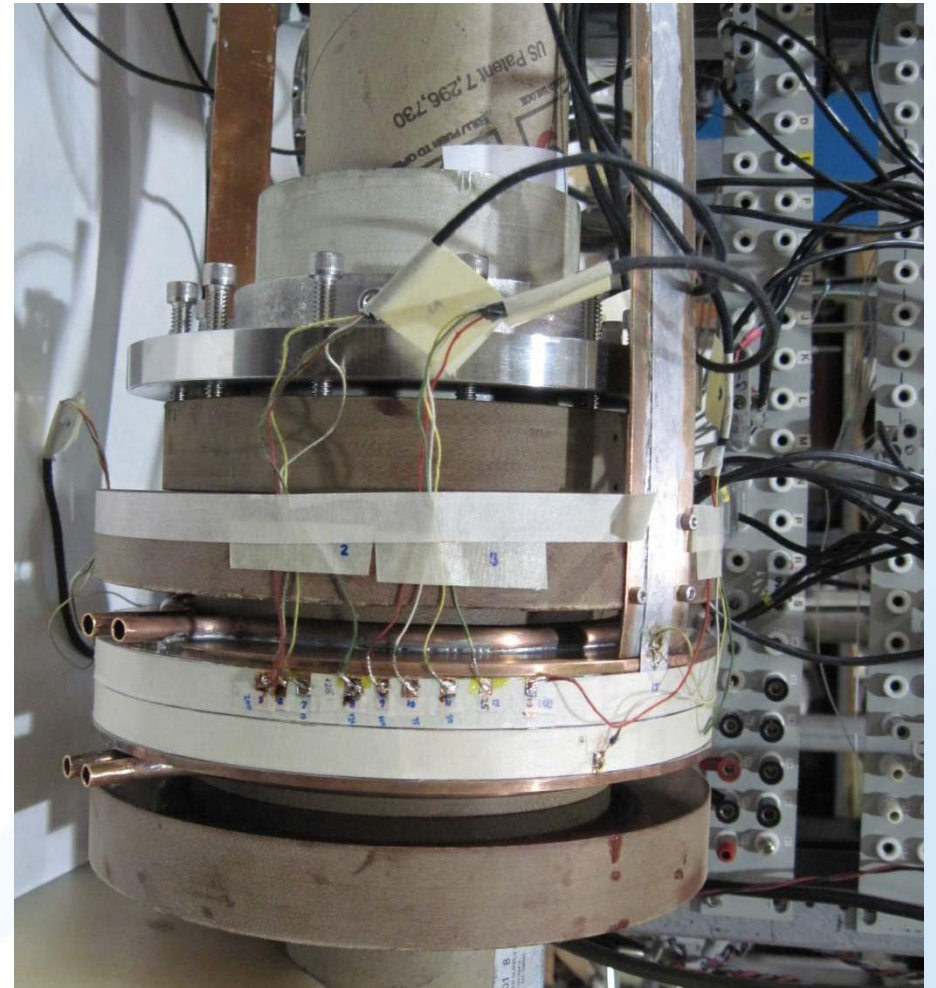
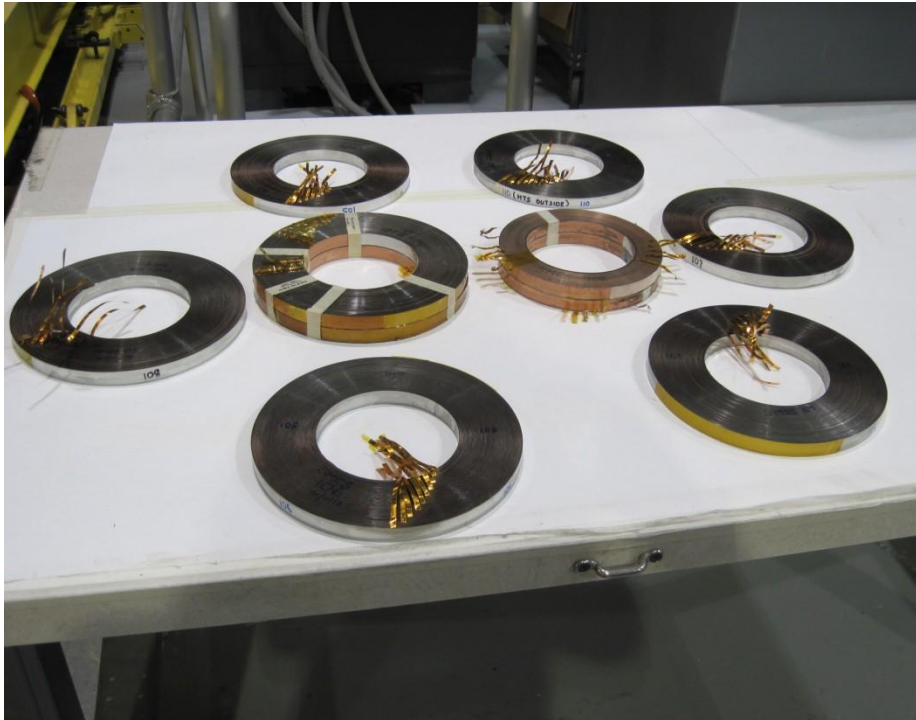


Two single pancakes with similar critical current

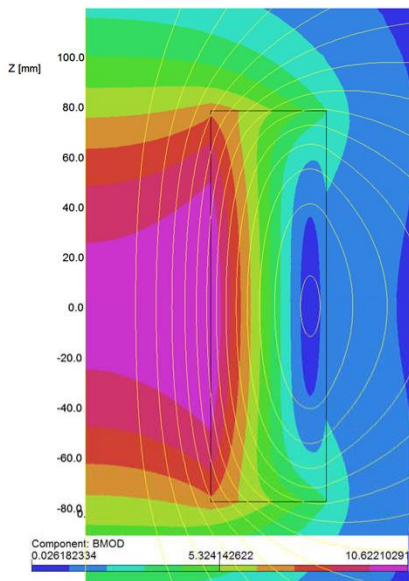
Correlation Between Minimum I_c in wire and I_c in Coil



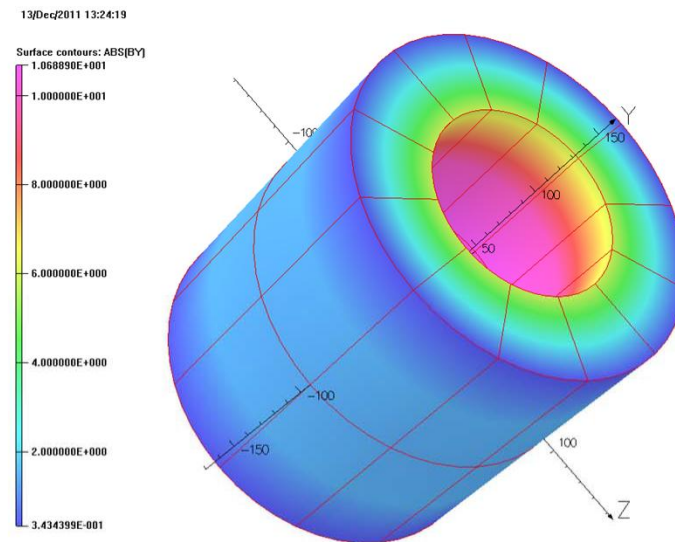
Single Coils and Pairs (left) 77 K Test Fixture (right)



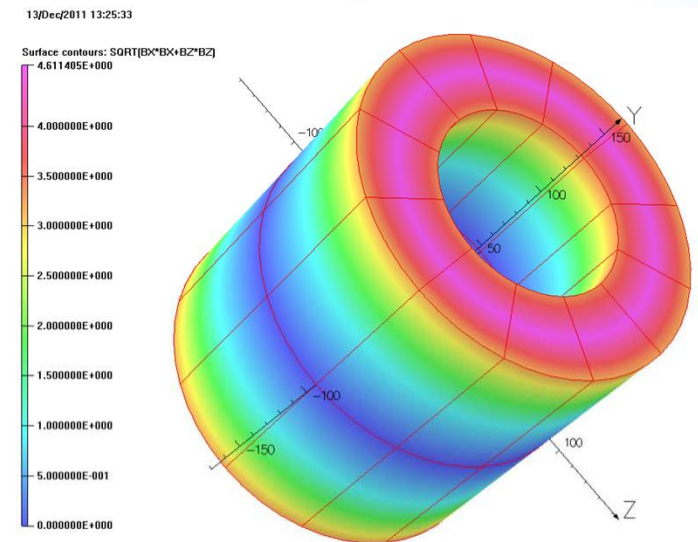
Magnetic Model of Q6 Milestone Test



2-d axis-symmetric model



*Parallel Component of the field
(maximum 10.7 T at design current)*

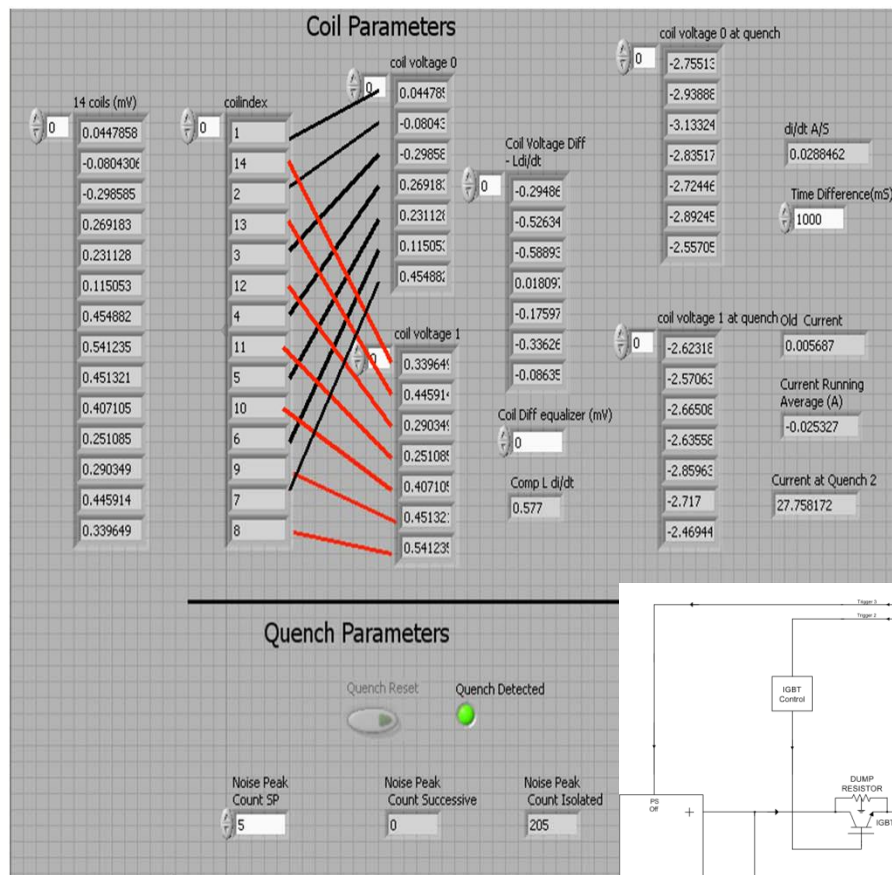


*Perpendicular component of the field
(maximum 4.6 T at design current)*

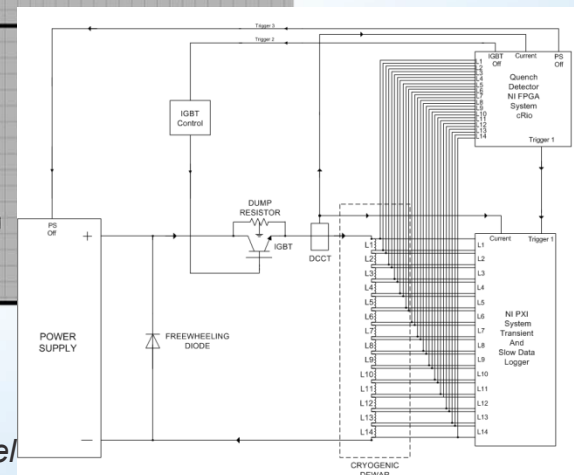
Quench Detection and Protection System



Part of the Hardware



LabView Screen Shot



Schematic of the 14 channel Quench Protection System

Assembly of pancakes on support tube



Initial stackup

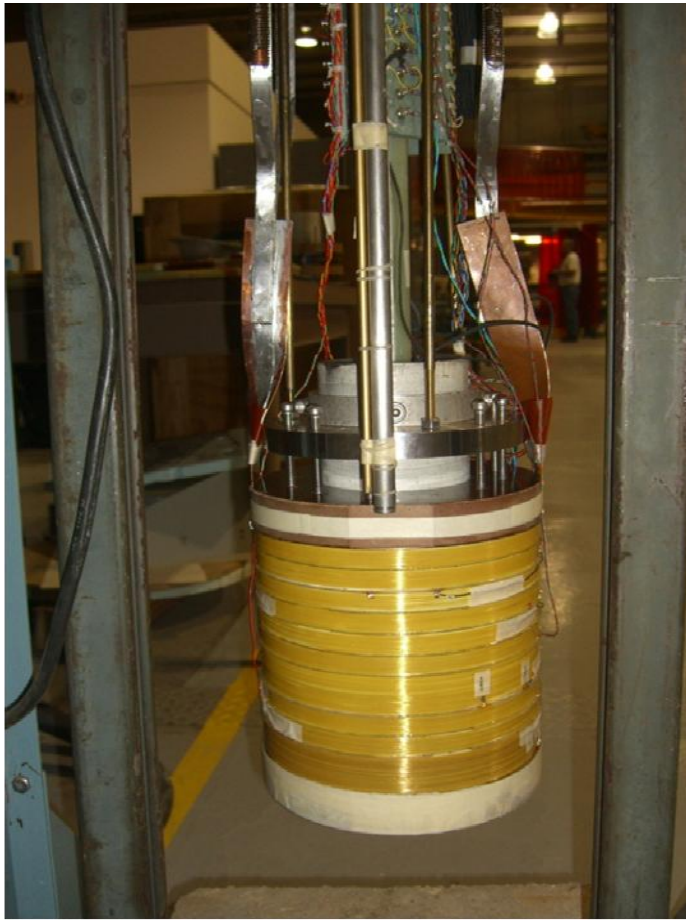


After wrap with
Nomex and masking
tape



After wet-wrap of Kevlar
and epoxy

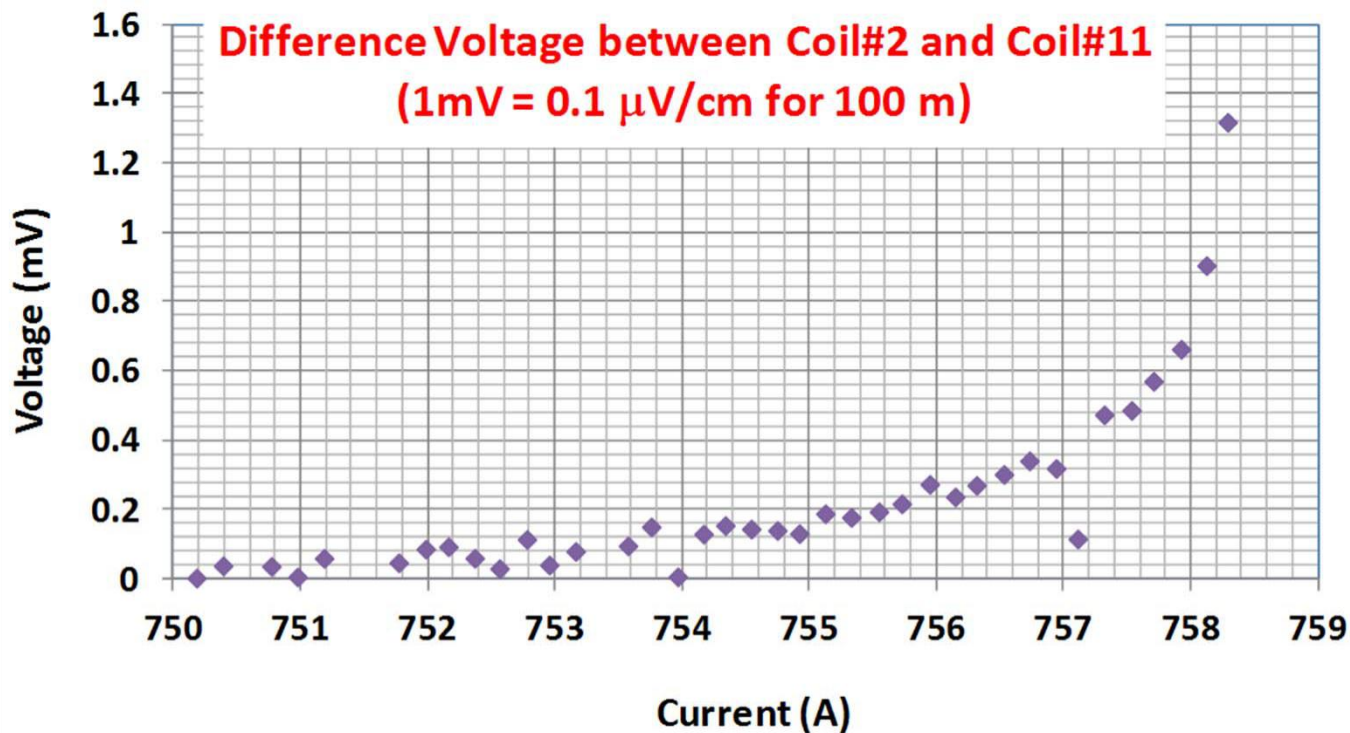
Assembly on “top hat”



About 50 signals from the magnet are recorded.

Magnet reached (760A) 11.4 T at quench (fast logger)

Plot shows slow logger data



Summary

Task 5A: Q6 goal (10 T) achieved!

Task 9A: Verification of support structure
and mechanical robustness – previously
completed