



Superconducting Magnet R&D Program

LARP Collaboration Meeting

Fermilab

February 26 – 27, 2004

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Outline

- FY04 Program
 - Open tasks
- FY05/06
 - Funding
 - Goals
- Action Items
- Organization



FY04 Magnet Program

- **Technology Development**
 - Racetrack quad
 - Support Structure R&D
 - Evaluate bladder and key structure
 - Labor + most M&S supported by base programs
 - Heat transfer measurements
- **Dipoles**
 - Mechanical analysis of BNL design
 - Heat transfer modeling
- **Cable R&D**
 - Keystoned cable
 - Map parameter space, new techniques?
 - Evaluation
 - Extracted strand measurements
 - Stress degradation measurements?
- **Quads**
 - Dual-bore studies
 - Racetrack quad evaluation



FY04 Action Items

- Until we prove differently, radiation damage is biggest concern
 - Conservative evaluation
 - Investigate possibility of experiments to measure limits
 - Materials
 - Superconductor
 - FY05 task will be to do tests
 - Need X % of Nikolai
 - User-friendly interface for aperture/magnet studies
- Conceptual studies to maximize effective aperture

Revised since Erice



FY04 Action Items (cont'd)

- **Heat Transfer of composite coils/cold mass**
 - Experiments to verify input parameters for models. Big impact on design. Need the details.
 - Can we increase heat transfer of composite coils?
 - What is maximum allowed cryo load? Need a working number
 - Advantages (if any) of 1.8K operation
- **Definition of the good field region for the dipoles that is more relevant for the aspect ratio of the beam.**
- **Build a quad ASAP**
- **Put together specifications and requirements book.**



FY04 Activities and FY05/06 Plans

- FY05 Budget
 - \$1,270
 - \$1,395

- FY06 Budget
 - \$6M



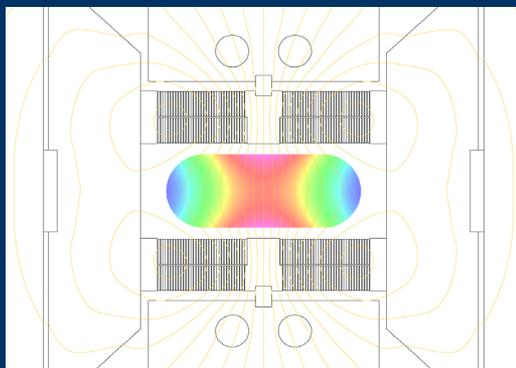
Tech Development

- FY04
 - Quad mechanical structure test
 - Sub-scale quad
 - Cable/Materials R&D
 - Design studies
 - Heat transfer/strain studies using sub-scale coil
- FY05
 - 2-layer coils for quad structure (follow with inner layer in '06)
 - No conductor cost - borrow from FY06?
 - No testing cost Further design studies – \$0k
 - \$600k
 - Iteration on n sub-scale quad (symmetric coils, improvements)
 - \$100k

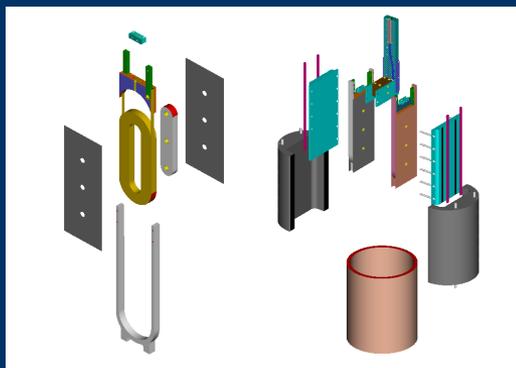
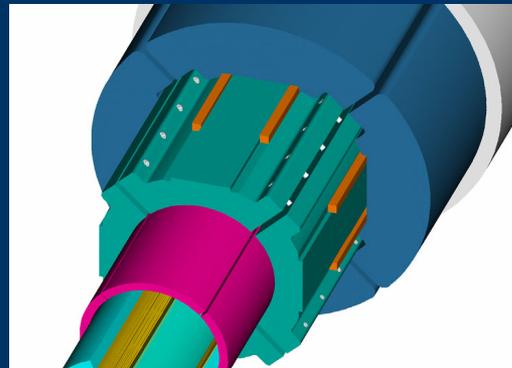


Technological Models

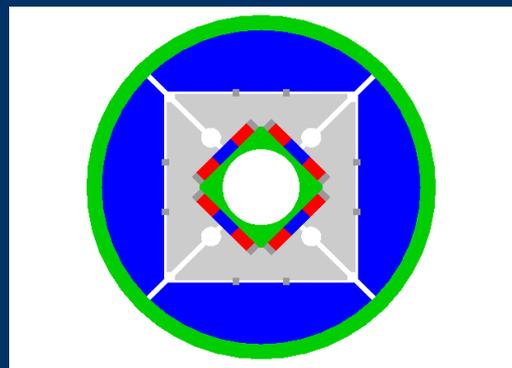
Split-coil/HD1 dipole



Quadrupole Structure



SM (common coil)



SM Quadrupole

Shell and Yoke Sub-Assembly





Dipoles (BNL)

- Aperture
 - 80 – 135 mm
 - $B_{\max} = 15$ T
- Max allowable heat load (cryo plant)
- FQ spec for high aspect ratio bore
- Max allowable deflection of coils
 - FQ
 - Quench
 - Mechanical support
- Do ends need to be kicked up?
- Significant help from Nikolai to proceed
- Develop integrated design independent of W&R and R&W
- '04/'05 Priorities
 - Finalize magnetic design
 - Mech analysis
 - Heat x-fer analysis
 - Develop cold mass structure
 - Build R&D coils, cold mass
- Issues
 - Cable instability
 - Deflections
 - Secondary 4K heating
 - Funding



Dipoles (BNL)

- FY05
 - \$500k = \$340k (labor) + \$160k (M&S)
 - Complete cold mass design
 - Thermal analysis
 - Build R&D coils (no cost cable)
 - Build “simplified” cold mass
- FY06
 - Test magnet in cryostat
 - Quench/field uniformity tests
 - Heat load/temp tests



Materials and Cable

- LBNL/FNAL

- Need a working spec for strand parameters
- Develop program to understand limits on cable parameters
 - Establish cabling procedures
 - Annealing
 - Re-rolling
- What is anticipated quantity of conductor we can expect from CDP?
- Materials? 1.1 FTE \$180k
\$10k M&S



Quads (FNAL)

- Conceptual design studies
 - Double-aperture IR quad
 - Results in March
- Need more IR design studies as guidance

- FY05
 - Engineering design of short model and tooling
 - Continue conceptual design
 - \$627k = \$370k (Labor) + \$250k M&S



Quads (FNAL)

- FY06

- Short model parts and tooling design/procurement
- Fabrication and tests of practice coils and mechanical model
- Fab and test of 1st simplified model (2-layer)
- \$1,925k = \$1,310k (labor) + \$600k (M&S)

2.5 FTE – 9.6 FTE



FY05 Sums

- Quads and Technology development

- Design studies
- Build a quad ASAP
- Continued sub-scale quad studies (new geometries)
- Materials studies
- Cable R&D

\$1,562k

Not \$1,270

- Dipole Development

- Complete cold mass design
- Thermal analysis
- Build R&D coils (no cost cable)
- Build “simplified” cold mass

\$500k

Not \$1,395



Priorities

- Construction and test of quad model
 - FNAL/LBNL consensus
- Keep fire under dipole R&D
- Two options
 - Asymmetric split
 - LBNL \$900k, FNAL \$200k, BNL \$200k
 - Sub-divide tasks on main priority to level distribution
 - Invoke service task sharing (e.g. testing)