Fermilab LARP magnet R&D FY04-FY06 status and plans

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Outlines

IRQ R&D major milestones

FY2004 goals

FY2004 IRQ R&D progress

FY2005 and FY2006 budget and plans

IRQ R&D milestones

- FY2012 – IRQ design, technology and component specs are developed and demonstrated on full-scale prototype
- FY2010 – accomplish short model R&D and start design of the full-scale prototype
- FY2006 – test 1st short model
- FY2005 – start design of the 1st short model
- FY2004 – conceptual design studies

IRQ R&D FY2004 Goals

- Evaluation of different design approaches to 2nd generation IR quads, their possibilities and limitations
- Development of the preliminary magnet requirements (aperture, field gradient, field quality, operation margin, etc.) and coordination them with AP group
- Preparation to the short model R&D phase, development of the conceptual design for the first model
- Technology development:
  - development and studies of cable prototypes for the IRQ models

FY2004 IRQ R&D: Q1

Magnetic analysis of single-bore block-type quads and comparison with the shell-type quad designs

- Block-type quads of two designs have been analyzed and compared with shell-type quads
  - Preliminary results were reported in December 2003 on BNL/Fermilab/LBNLvideo meeting
  - Details will be presented by Vadim Kashikhin and summarized in technical note
- Conclusion: shell-type design is more preferable for this application

FY2004 IRQ R&D: Q2

Magnetic analysis of the double-aperture IR quadrupoles

- Goal: studies of field quality restrictions on magnet aperture separation and aperture size
  - Results will be reported in March 2004 on a video meeting and summarized in technical note
- For the next steps we will need the results of
  - IR design studies
  - D1 development

FY2004 IRQ R&D: Q3

Evaluation of possibilities and limitations of different magnetic and mechanical structures for shell-type and block-type coils

- Mechanical analysis of large-aperture shell-type quad has been started
  - The status, plan and technical details will be presented by Giorgio Ambrosio
- LBNL contribution:
  - Studies of IR quad mechanical structure based on bladder technology – Schlomo Caspi
  - Study of racetrack quadrupole – Paolo Ferracin

FY2004 IRQ R&D: Q4

Development of a conceptual design of the first quadrupole short model

- Magnetic design concept
- Mechanical design concept
- Quench protection
- SC strand and cable
- Structural materials

- Discussions and decision:
  - BNL/Fermilab/LBNL video meeting,
  - next LARP meeting or special workshop (August-October)

Technology development

The main goal for the IRQ development:

- Strand and cable parameters for the first IRQ short model

Fermilab FY2004 plan:

- Strand Ic, RRR, M, stability for RRP 0.8(1.0?) mm strand
- Strand sensitivity to cable packing factor and keystone angle
- Strand sensitivity to cable compression
- Cable inter-strand resistance

Issues:

- coordination of technology development plans with IRQ magnet R&D
- coordination of Fermilab and LBNL plans and activities

Miscellaneous

- Contribution to D1 studies:
  - Alternative design with mid-plane spacers
  - D1 thermal analysis (TD-03-035)
  - No further plans
- Radiation studies:
  - Liquid poliimid study (Matrimid 5292)
  - Material radiation strength review (TD-03-053)
  - Next steps:
    - continuation of liquid poliimid (Matrimid 5292, etc.) study
    - cyanate ester/epoxy (by CTD, HUNSTMAN, etc.)

FY2005 plan and budget

Plan:

- start the engineering design of the 1st quadrupole short model and tooling
- continuation of the conceptual design studies of the double-aperture IR quad

Budget: 627k$

- 370k$(2.5FTE)+250k$(M&S)+7k$(travel)

Issues:

- Low (insufficient) level of FTEs!

FY2006 plan and budget

Plan:

- short model parts and tooling design and procurement
- fabrication and tests of practice coils and the mechanical model
- fabrication and tests of the 1st simplified (2-layer) short model

Budget: 1,925k$

- 1310k$(9.6FTE)+600k$(M&S)+15k$(travel)

Issues:

- Jump from 2.5FTE to 9.6FTE!