Design studies of IRQ based on shell-type coils

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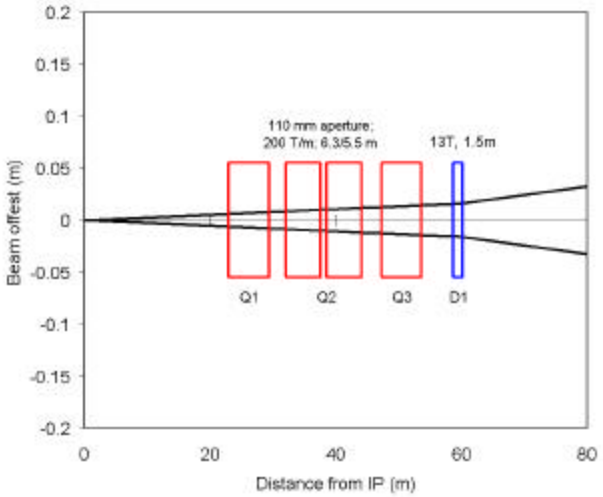
Task goals and sub-tasks

Task goal: development and optimization of IRQ based on shell-type coils for the LHC luminosity upgrade.

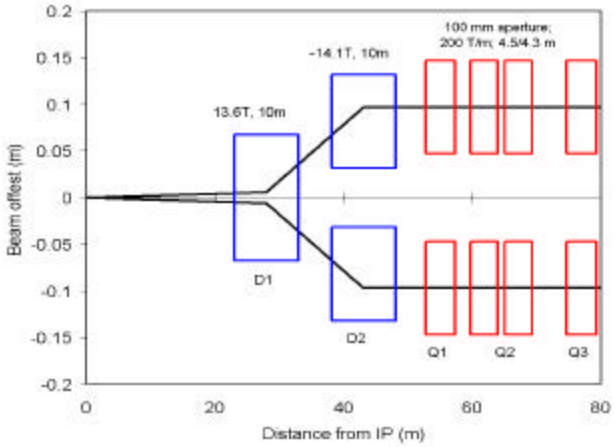
Sub-tasks: (research directions):

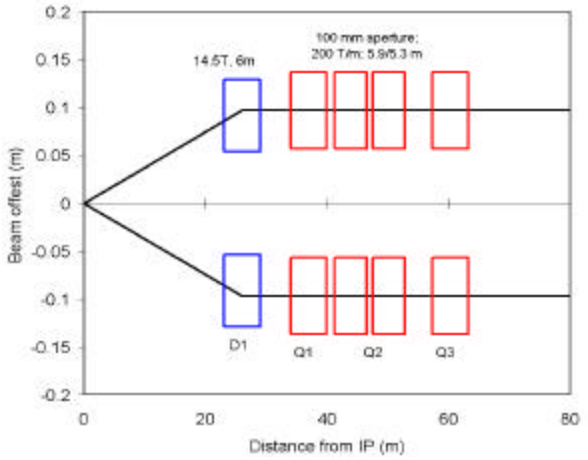
1. Conceptual design studies of IR quads based on shell-type coils including:
   - Large-aperture single-bore quads

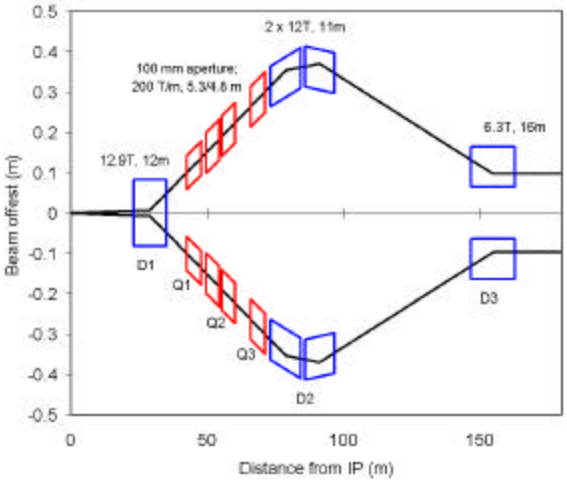


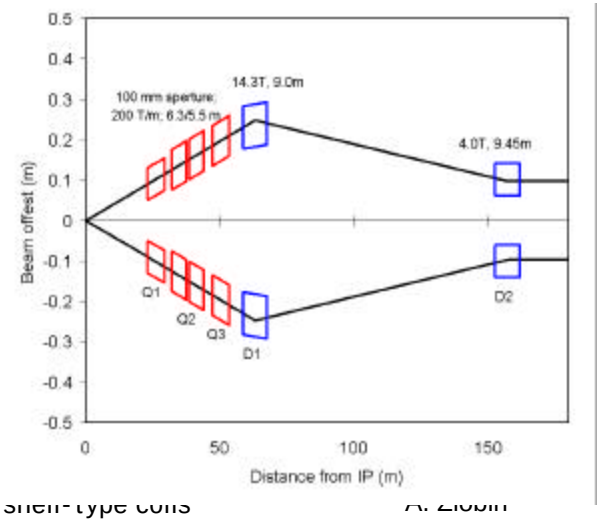
Sub - tasks

- Large-aperture double-bore quads with parallel and non-parallel apertures







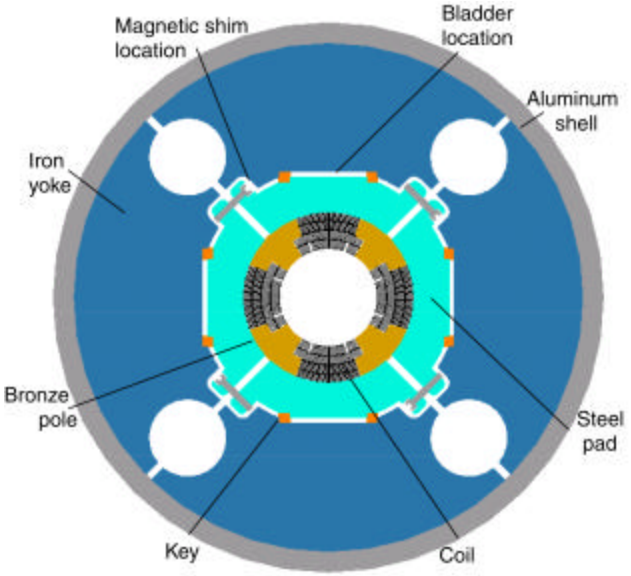


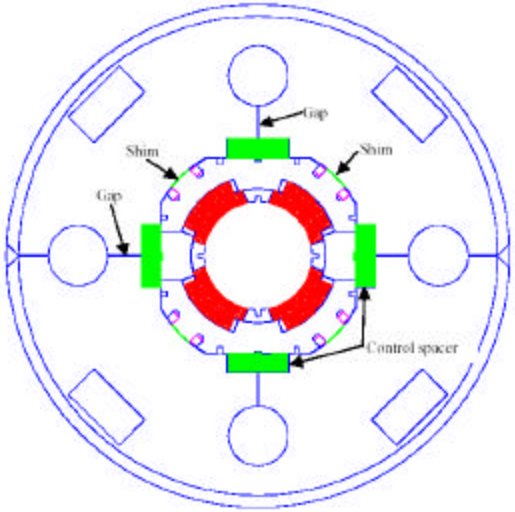
Sub-tasks

2. IRQ parameter space study including
   - gradient/aperture/length optimization based on magnetic, mechanical, thermal and quench protection limitations and IR optics requirements
3. Study and comparison of large-aperture shell-type and block-type IRQ
   - Aperture
   - Field gradient and field quality
   - Mechanics
   - Quench protection
   - Operation margin
   - Magnet life-time

Sub-tasks

4. Model magnet data analysis and model magnet proposal development or evaluation:
   - Evaluation of two basic mechanical structures: collar/yoke/skin vs. skin/key/bladder
   - TQ models with larger aperture (TQ1b, etc.)
   - TQ models with higher gradient (TQ1, TQ2b, etc.)





Sub-tasks

5. Development of IRQ long pre-prototype design based on shell-type 2-m/4-m long coils

6. Development of IRQ prototype design based on shell-type coils
   - prototype short models for field quality optimization
   - full-scale (4-6 m long) prototype

Sub-task list and priorities will be annually reviewed, coordinated with AP group, LARP magnet R&D working groups and if necessary corrected.

Basic milestones

FY2006

- analysis and comparison of two alternative mechanical structures
- reduction of heat deposition in shell-type IRQ and magnet life-tyme optimization
- TQ fabrication and test data analysis

FY2007

- selection of the 2m/4-m long pre-prototype mechanical structure
- conceptual design study of double-bore IRQ with non-parallel apertures (in case of positive crab cavity test results)

FY2008

- pre-prototype fabrication and test data analysis
- development of the prototype short model design

Task force, duration and budget

Task leader (proposed): Vadim Kashikhin (FNAL)

Sub-task leaders: to be identified later by task leader and DS L2 coordinator

Working group: FNAL and LBNL (and BNL if interested) magnet experts

Task duration: FY2005 (Q3) – FY2009+

Estimated budget: 100-200 k$/year starting from FY2006 (task budget will depend on task yearly plan and DS budget and priorities)