US LHC Accelerator Project
FNAL - BNL - LBNL

J. Strait
Fermilab

All Experimenters Meeting
24 November 2003
IR Final Focus Systems: Points 1, 2, 5, 8
- US-built quadrupoles (FNAL)
- Japanese-built quadrupoles (KEK)
- CERN-provided correctors
- Cryostats for all quadrupole assemblies (FNAL)
- US-built beam separation dipoles (BNL)
- US-built IR feed boxes (LBNL)
- US-built specialized absorbers (LBNL)

RF Region: Point 4
- Beam separation dipoles (BNL)

Wire and Cable for Main Magnets:
- Measurement of SC wire & cable (BNL)
- Cable production support (LBNL - complete)

Accelerator physics (all 3 labs - complete)

Project management and oversight (FNAL)
Fermilab:

- Designs, fabricates 18 MQXB quadrupole magnets
- Assembles multi-element cold mass assemblies into cryostats and tests them – 9 each Q1, Q2, Q3 cryo-assemblies.
- Designs and procures portions of the interconnect kits, providing integration support for each
- Provides engineering and test support for the DFBX
- Provides alignment and energy deposition support for the inner triplet region
LHC IR Quadrupole Design

LHC IR Quadrupole Magnet Features
- NbTi Coil; SS collar
- 70mm bore diameter;
- 400mm OD yoke; 416mm OD
- 2K operating temperature
- 205T/m collision gradient
- 215T/m maximum gradient
- 250T/m short sample
- Cryostat designed to accommodate 490mm KEK magnet and external heat exchanger for LHC IR energy deposition
LHC IR Quadrupole Cryostat

Extra radial space for KEK magnets

External Heat Exchanger for IP1/5 dynamic heat load
LHC IR Quadrupole Production in ICB

• 12 of 18 MQXB fabricated … but one has been dis-assembled…

• 3 of 9 LQXB (Q2) assembled and tested.

• 4 of 18 MQXA received from KEK and 4 are on the way.

• 1st LQXA (Q1) assembly started.

• Work will be completed in mid-FY2005.
LHC IR Quadrupole Test Results


Appears to be flawed or damaged superconductor ... under investigation.
>14 of 18 IR quads (produced by Toshiba to KEK’s design) are done. Performance matches that of FNAL quads.
LHC Spin-off: C0 IR Quads for BTeV

LHC optimized for C0:
- Coil cross section & mechanical support the same
- Operates at 4.5K
- Iron yoke OD reduced ~130mm
- Beam Height reduced to ~250mm
20 beam separation dipoles of four types, based on RHIC coils.

- 5 of 5 D1 (single aperture) complete; 4 are at CERN.
- 9 of 9 D2 (twin aperture) are complete; 1st is in transit to CERN.
- 3 of 3 D4 (twin aperture) built, to be tested.
- 6 of 6 D3 cold masses (two per cryostat) are built, to be cryostatted.
IR Feedboxes (LBNL + FNAL)

Fab and Assembly at Meyer Tool

HTS Lead Testing at Fermilab
IR Absorbers at LBNL

2 of 4 twin aperture absorbers are complete. All 4 to be shipped in January.

4 of 4 single aperture absorbers are at CERN.
SC Cable Testing at BNL

- Rate has been limited by slow deliveries from CERN.
- Will continue on “best effort” basis through mid-FY2005.

Production testing of SC cable for main LHC magnets.

Mean = 15090 A  
3σ = 650 A (4.3%)
237 samples out of 780 UL's
US LHC Accelerator Project well along to complete its work by FY2005.

- Fermilab IR quadrupole production is going well.  
  *These are among the highest performance accelerator magnets ever built.*
- Feedboxes (LBNL + FNAL) are in production at Meyer Tool.  
  *Fermilab is playing a crucial role in design and fabrication oversight and in HTS lead testing.*
- Beam separation dipoles (BNL) and IR absorbers (LBNL) are nearly complete.
- SC cable testing is proceeding well at BNL.

We have established strong and productive collaborations with CERN and KEK.