US LHC Accelerator Research Program

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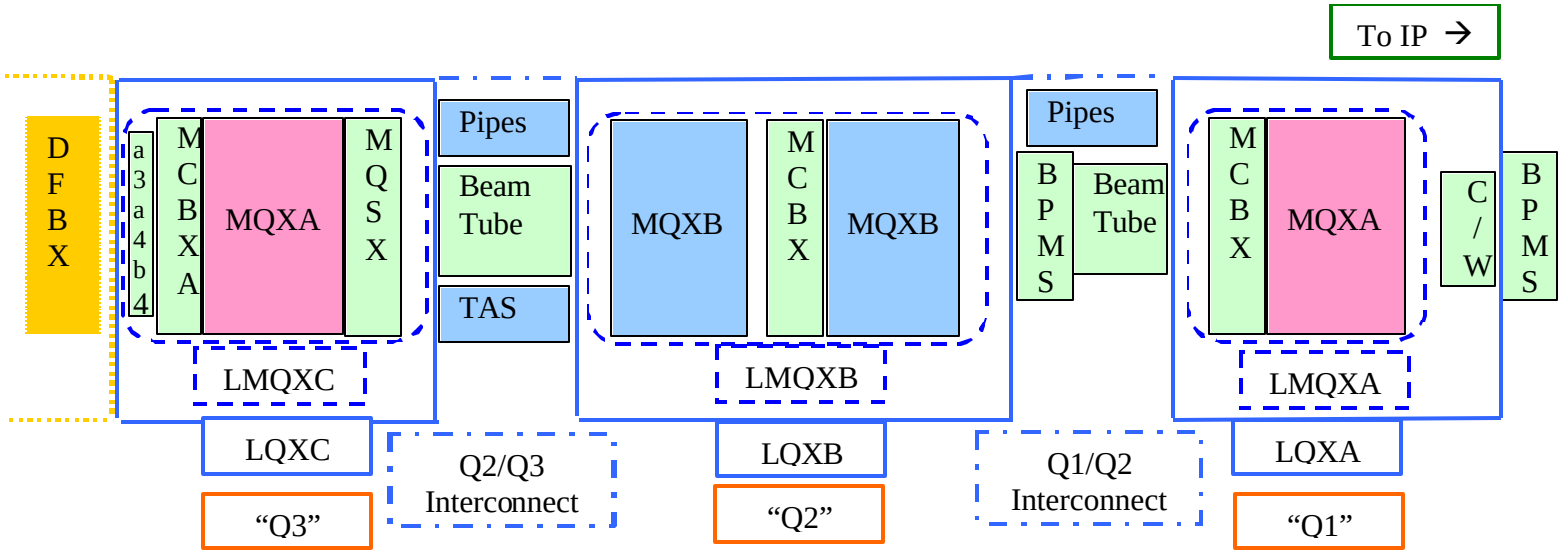
Part 1 Fermilab Participation in the LHC Hardware Commissioning

- Deliverables and Schedule
- Proposed Participation
- Beyond US deliverables

Michael Lamm
16 September 2003

Scope



Fermilab:

Designs, fabricates and tests the MQXB quadrupole magnet

Designs, fabricates, assembles and tests the LMQXx and LQXx Cryostats

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

Deliverables

-9 LQXA (test 1)

Assemble into cryostat:
MQXA (KEK/Toshiba 6.3 m HGQ)
MCBX (H-V Nested Orbit Corrector)
Absorber

-9 LQXB (test 9)

Build 18 MQXB (FNAL 5.5m HGQ)
Assemble into cryostat:
MQXB + MCBX +Buswork

-9 LQXC (test 1)

Assemble into cryostat:
MQXA, MCBX, MQSXA (skew quad +higher order) +Buswork

FNAL Hardware Schedule

-Schedule Calls for all LQXA-B-C to be delivered to CERN by end of FY05 2005

Schedule drivers are

End date of USLHC/

Milestones on Implementation Arrangement

The Actual Installation Schedule for CERN

-In FY04, FNAL present plan calls for us to ship

LQXB (5) December 2004, Feb 2004….

LQXA (7) April 2004, May 2004…..

LQXC (8) Mar 2004, April 2004….

Hardware Commissioning Time Frame

2004-2006

- Equipment Commissioning
  - installation
  - alignment and interconnect
  - cooldown and powering

2006

- Injection Test
  - exercise all systems IR8 to IR7

2007-2008

- Full machine commissioning
  - interplay between IR systems and rest of accelerator operations
  - dynamic heat loads

Installation Schedule for LHC IR		
IR	Install Begin	Install End
8L	Aug 2004	Dec 2004
1L	Nov 2004	Apr 2005
2R	Dec 2004	May 2005
8R	Jan 2005	Jun 2005
5L	May 2005	Oct 2005
5R	Sep 2005	Mar 2006
1R	May 2006	Oct 2006
2L	May 2006	Oct 2006
4R	Sep 2005	Jan 2006
4L	Jan 2006	Apr 2006

How Fermilab Would Like to Participate

-Installation of FNAL deliverables

Review installation procedures with installers

Overview installation of first few Inner Triplets

-Cooldown of Inner Triplet

Provide information from cooldown experience on test stand

Monitor cooldown of first few Inner triplets, study data, problem solving

Overview instrumentation of inner triplet

-Powering of Inner triplet

Overview of run plan

Overview operation/quench data as needed

This is ~0.5 FTE spread over several people in FY05 and FY06

How Fermilab Would Like to Participate II

-Planning of Hardware Commissioning

I am willing to oversee this activity over the next few years

-Resident physicist or engineer (1 FTE in FY05)

This will be an important bridge for US/CERN activities including magnet program

Participation/usefulness will likely continue into FY06-7 depending on how smooth is the LHC turn on….

In the past Fermilab has provided this person……

To be discussed in the second hour of our meeting

Beyond Deliverables

-Scope of LARP is focused on US deliverables. However it is logical to expand scope to include hardware which directly affects USLHC deliverable performance:

Global Cryogenic System

Extension of IR cryogenic participation

Global Integration and Commissioning of the Interaction Region

Could be part of Resident Physicist/Engineer task

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Part 2 Plans for FY04 and Beyond

Topics for discussion

- Proposed Participation
- Interfaces with CERN
- Resident LARP
- Structure

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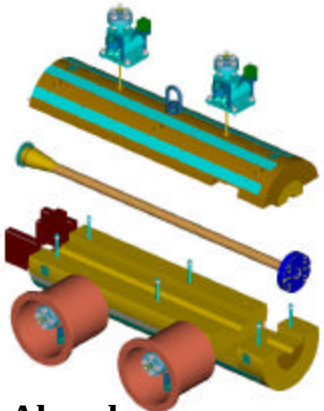
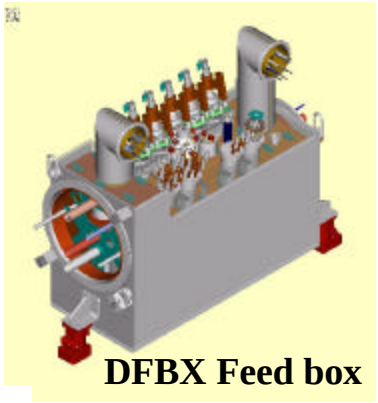
USLHC Deliverables

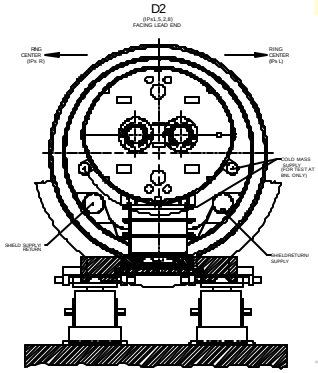
- US will provide “kits” for interconnect in the tunnel. We should follow throughout commissioning, specially for first IR
  - Participate in plan for installation and first operation of each system.
  - Oversee process, review inspection data etc.
  - Small but prolonged effort of various personnel spanning the installation process



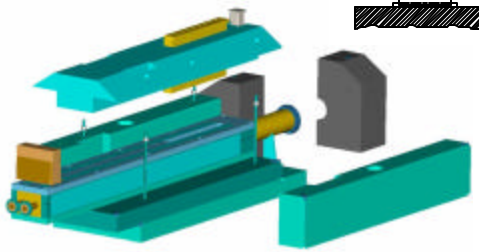
TAN Absorber



DFBX Feed box

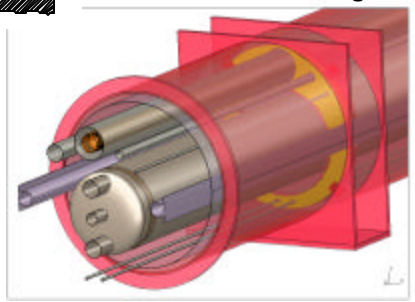


Beam Separation Dipoles



TAS Absorber

IR Quad



Hardware Commissioning at CERN

-Hardware Commissioning Working Group

Headed by Roberto Saban

Meet weekly Thursday afternoon

Minutes available on web

-Work closely with Ranko Ostojic to coordinate effort

-Actual installation performed by outside contractors

-CERN is quite receptive to US help

Short term 1-2 months during installation and early commissioning

Longer term help

6 months or longer, integrated into CERN commissioning effort

Estimate of Effort and Cost from LARP Proposal

	FY04	FY05	FY06	FY07	FY08	FY09
Labor Count						
Instrumentation FTE	1.1	2.4	5.6	6.5	6.7	5.9
Beam Comm & Acc Phys FTE	1	2.7	7	9.5	9.5	9.5
Hardware Commissioning FTE	0.5	2	2	2	1	0
TOTAL FTE	2.6	7.1	14.6	18	17.2	15.4
Labor Cost						
Instrumentation $k03	202	424	860	960	976	880
Beam Comm & Acc Phys $k03	200	490	1150	1550	1500	1500
Hardware Commissioning $k03	100	400	400	400	200	0
TOTAL $k03	502	1314	2410	2910	2676	2380
Travel						
Instrumentation $k03	10	17	46	60	59	59
Beam Comm & Acc Phys $k03	10	27	70	95	95	95
Hardware Commissioning $k03	8	30	30	30	15	0
TOTAL $k03	27	74	146	185	169	154
Materials & Services						
Instrumentation $k03	80	260	680	800	650	650
Beam Comm & Acc Phys $k03	10	20	30	40	40	40
Hardware Commissioning $k03			50	50	25	
TOTAL $k03	90	330	760	865	690	690
TOTAL COSTS (escalated)						
Instrumentation $k	300	744	1733	2048	1953	1897
Beam Comm & Acc Phys $k	227	570	1366	1896	1895	1952
Hardware Commissioning $k	111	509	525	512	249	0
GRAND TOTAL $k	638	1823	3623	4457	4098	3850

Hardware Commissioning only

	FY04	FY05	FY06	FY07	FY08	FY09
Labor Count						
Hardware Commissioning FTE	0.5	2	2	2	1	0
Labor Cost						
Hardware Commissioning $k03	100	400	400	400	200	0
Travel						
Hardware Commissioning $k03	8	30	30	30	15	0
Materials & Services						
Hardware Commissioning $k03			50	50	25	
TOTAL COSTS (escalated)						
Hardware Commissioning $k	111	509	525	512	249	0

- Proposed breakdown for FY04:
  - FNAL 0.2 FTE, BNL .15 FTE, LBNL .15 FTE
  - Mandate for Workshop is to sketch out participation in FY04
- Beyond FY04
  - Level of participation is adequate for our deliverables
  - Not enough $$$ to support a resident scientist

The following slides are points of discussion for the final hour of session

Effort comes from two sources:

- Physicists and engineers stationed at CERN for extended periods during the commissioning process
- Specialists stationed at CERN for short durations (1-2 months) during critical periods such as initial installation and cool down

Now is the time for a “reality check” the level of participation from each institution

Will there be “specialists” available? Over the entire commissioning time…..

Points of Discussion II

Interaction with CERN

How exactly would we interact with CERN?

How precisely do we need to define our role?

Our Organizational

Should we meet again (say in 6 months?)

Video Conference? (there is the monthly CERN-US video conference that is largely underutilized?

Points of Discussion III

What is the mechanism for the resident person at CERN

-Must be someone who is familiar with the project

-Has overview of project, able to solve problems

-Has skills useful to CERN

-Is available?

Other logistic issues…..

1 year vs. 6 month or 3 month stints

Keep furnished apartment for Hardware LARP??