Accelerator Systems Overview

Why this is the right thing to do

Budget profile & breakdown

Topic/lab matrix

Hardware & beam commissioning

Initial suite of 3 instruments

Additional instrumentation

Fundamental accelerator physics

Why? To maximise the HEP output of the LHC

The Accelerator Systems plan is a logical continuation of US-LHC first phase activities

It continues to address the mutual goals of

- advancing High-Energy Physics
- advancing U.S. accelerator science and technology
- exploiting and building on the strengths and interests of the US National Laboratories

It extends supporting R&D towards an LHC luminosity upgrade

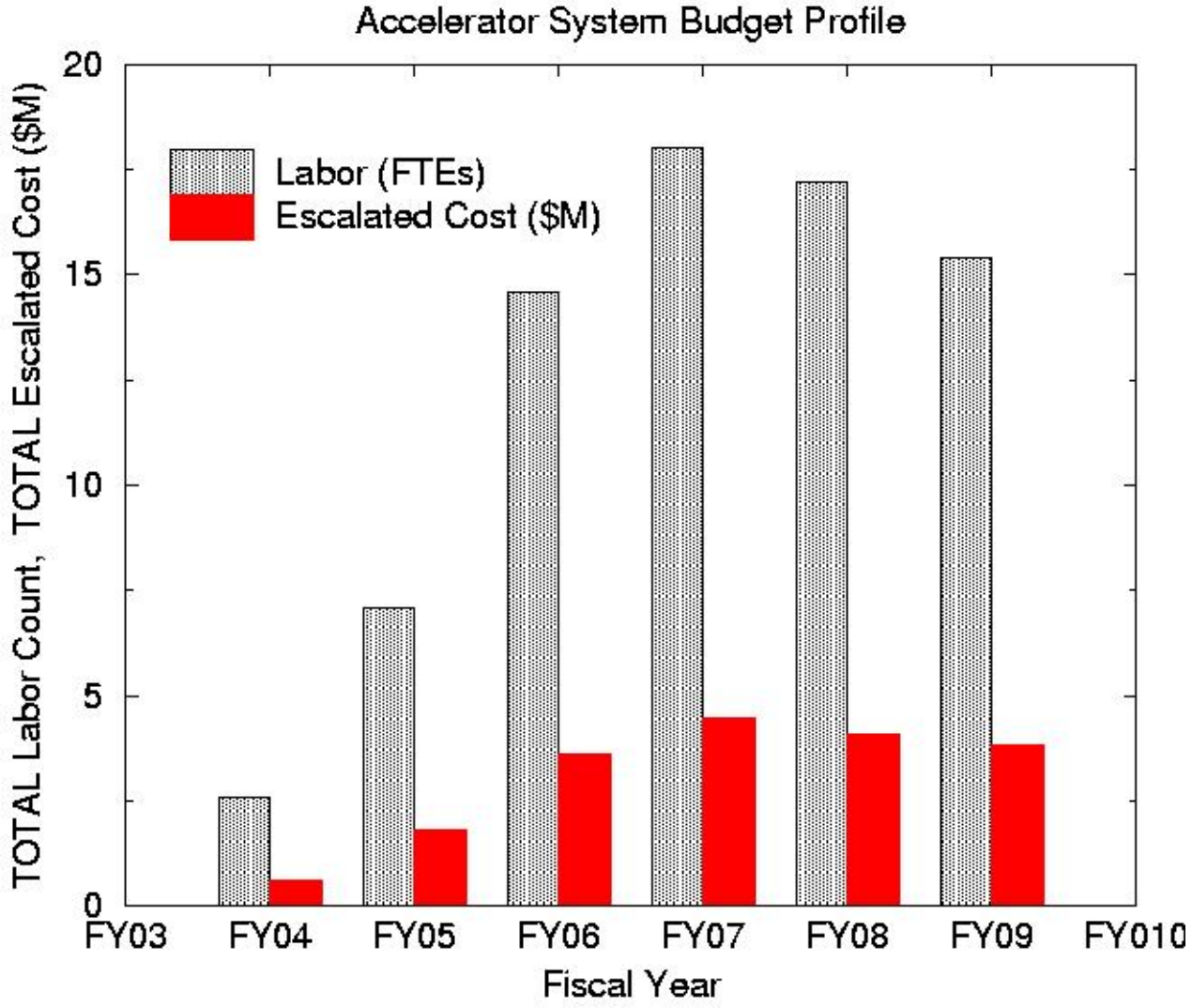
Accelerator Systems budget profile

The 3 Accelerator Systems areas:

1) Instrumentation

2) Beam Comm. & Fundamental Acc. Physics

3) Hardware Commissioning



Accelerator Systems budget breakdown

		FY04	FY05	FY06	FY07	FY08	FY09
Labor Count	FTE	2.6	7.1	14.6	18.0	17.2	15.4
Labor Cost	$k03	502	1314	2410	2910	2676	2380
Travel	$k03	27	74	146	185	169	154
Materials & Services	$k03	90	330	760	865	690	690
TOTAL COSTS (escalated)							
Instrumentation	$k	300	744	1,733	2,048	1,953	1,897
Beam Comm & Acc Phys	$k	227	570	1,366	1,896	1,895	1,952
Hardware Commissioning	$k	111	509	525	512	249	0
GRAND TOTAL	**$k**	**638**	**1,823**	**3,623**	**4,457**	**4,098**	**3,850**
Guideline	$k	635	1,820	3,620	4,460	4,100	3,840

Assumes "3 lab average" labor rate, and naïve (minimal) travel rate per FTE per year

Accelerator Systems topic/lab matrix

Program is truly multi-laboratory

(Bold face **Y** indicates a clear leading role)

Cross-integration between Instrumentation & Accelerator Physics activities

ACCELERATOR SYSTEMS TOPIC	page #	BNL	FNAL	LBNL
Hardware Commissioning	**15, 39**		Y	
Beam Commissioning	**15, 38**	Y	Y	Y
Initial Instrumentation	**37**			
Tune, Chromaticity & Coupling Feedbac	16	Y	Y	
Real-Time Luminosity Measurements	16		Y	**Y**
Longitudinal Beam-Density Monitor	17	Y		**Y**
Additional Instrumentation	**37**			
Beam-Beam Compensation Systems	17	Y	**Y**	
High Frequency Schottky	17	Y	Y	Y
AC Dipoles	18	**Y**		
Fundamental Accelerator Physics	**38**			
Beam-Beam Interaction	18	Y	Y	Y
Electron Cloud	19	Y		Y
Other Vacuum Effects	19	Y	Y	
Remote Operations & Maintenance	19	Y		Y
LHC Upgrade Related Activities	**38**			
Interaction Region Optics	25	Y	Y	
Interaction Region Compensation	25	Y	Y	
Energy Deposition	26		Y	
Beam Loss Scenarios	27		Y	

Hardware and Beam Commissioning

The LHC is complex & will be challenging to put into operation.

The participation of experienced U.S. scientists will speed up LHC commissioning, bring higher luminosity earlier

Participation is also a direct benefit to the U.S. programs, since commissioning colliders is a once-in-a-decade opportunity.

Maintaining a core of (young) experience is vital for the present and future capabilities of hadron colliders in the U.S.

Initial Instrumentation Suite

All three of the initial instruments are needed for efficient commissioning of LHC beam, and early high performance

They have been initially approved by the Program Leader with advice from the U.S. - CERN Steering Committee, with a refined approval of a more detailed plan yet to come

They push the state-of-the-art

In some cases their development will also contribute to the efficient operation of RHIC and the Tevatron

Initial Instrumentation Suite

1) Tune, Chromaticity, & Coupling Feedback
   - crucial for efficiency with intense beams suffering dynamic effects during & after injection, & all the way up the ramp
   - collaboration meeting on this topic, Fermilab, May 9 2003

2) Real-Time Luminosity Measurements
   - help keep the beams in exact collision.
   - assuming ArN2 is chosen, LARP will deliver the R&D on a time scale consistent with first collisions

3) Longitudinal Beam Density Monitor
   - vital, with 350 MJ of stored beam energy
   - observe fast (sub synchrotron period) beam dynamics

Additional Instrumentation

"Additional instruments" are more technologically speculative

- the Program Leader, advised by U.S.-CERN Steering Committee, will decide which devices to support at the appropriate time

- potential examples:
  1) Beam-Beam Compensation Systems,
  2) High Frequency Schottky Monitors,
  3) AC Dipoles,
  4) ....

Fundamental Accelerator Physics

Accelerator physicists must exploit the LHC for the same reason as High-energy physicists: it is the collider at the frontier.

Some fundamental activities (eg calculation & simulation) will mainly be done in the U.S., while others (eg experimentation) will require on-site presence.

This level-of-effort activity has about 3 FTE scientists, NOT including commissioning activities

Summary

Accelerator Systems goal is to maximize the HEP output of the LHC while advancing U.S. accelerator science & technology

3 areas: 1) Instrumentation, 2) Beam Commissioning & Fundamental Accelerator Physics, 3) Hardware Commissioning

- "plateau" at about 17 FTEs, 4 M$ per year

Program integrates Accelerator and Instrumentation Physics and Engineering topics, at all 3 U.S. Laboratories

Vital to maintain & develop present & future U.S. capabilities

3 Initial Instruments segue into Additional Instrumentation