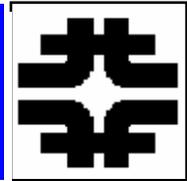




US CMS Research Program



URA Visiting Committee

Dan Green, US CMS RPM

April 22, 2005



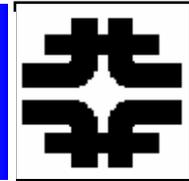
Outline



- **LHC and CMS Status**
- **US CMS Detector Construction – Endgame**
- **US CMS Research Program**
 - Management
 - M&O
 - S&C
- **US CMS Collaboration**
 - Recent growth
 - LPC, ROC and physics research



LHC Dipoles

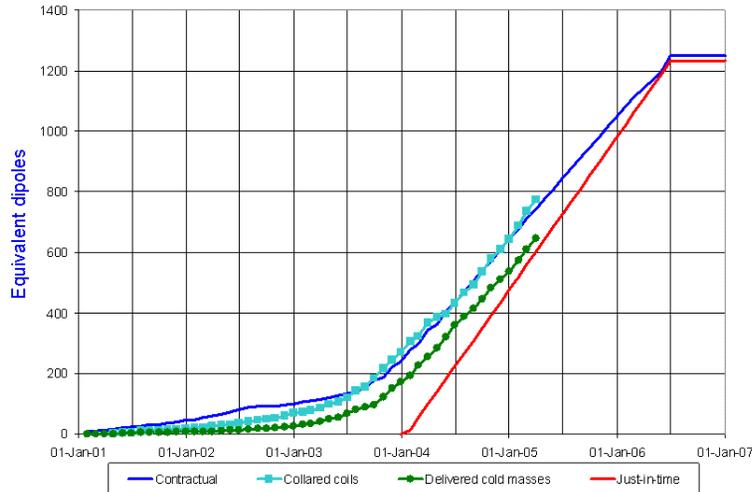


LHC Progress Dashboard



Accelerator Technology Department

Dipole cold masses



Updated 31 Mar 2005

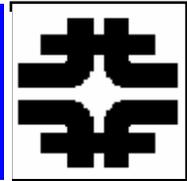
Data provided by P. Lienard AT-MAS

Plan for LHC is for first beams in mid 2007





Experiment Cavern UXC55 Delivered to CMS



February 1st,
2005

CMS now has almost all contracts complete. The schedule therefore is in the hands of the collaboration.





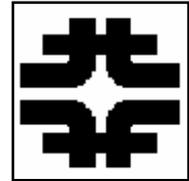
CMS Magnet: Cold Mass



- ❑ 1 Mar 05: Ceremony for Completion of Cold-Mass.
- ❑ All major industrial contracts for the Magnet now completed.
- ❑ All 5 coil modules connected
- ❑ Q1-06: Magnet Test and 'Cosmics Challenge'



CSC Commissioning at SX5

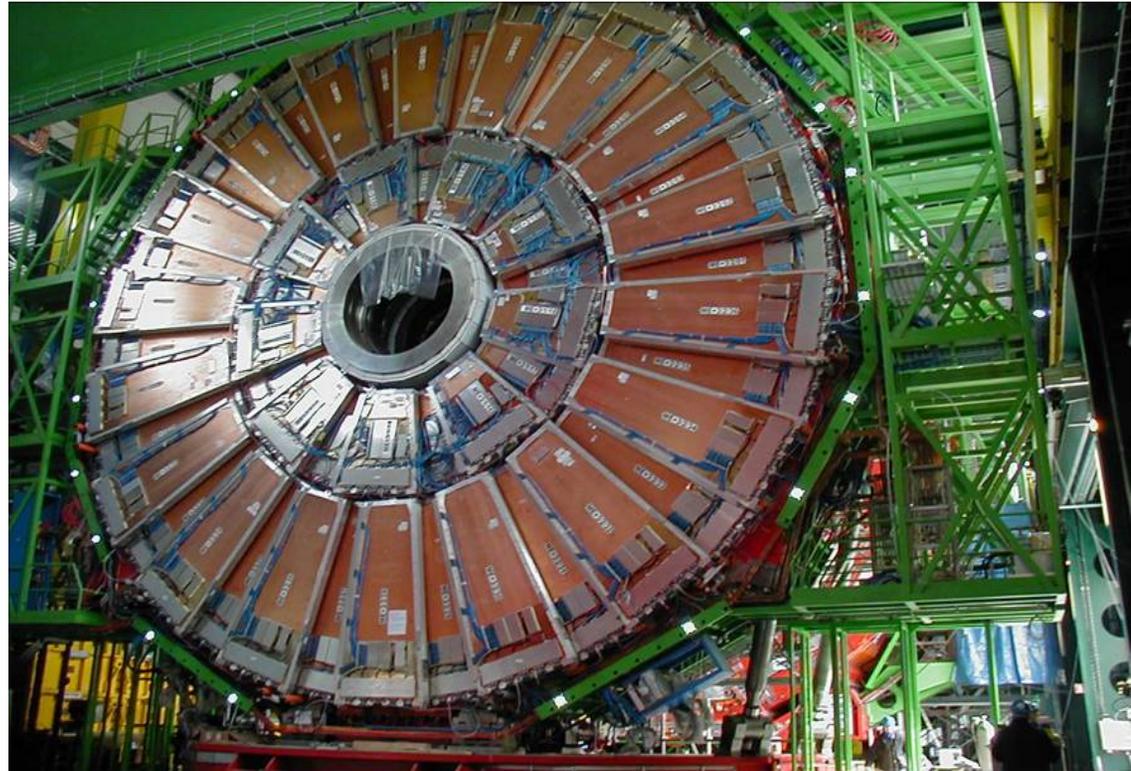


Approximately 150
CSCs
commissioned

60% installed

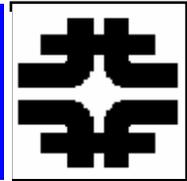
40% commissioned

**Slice test –
muon triggers
beginning in
Spring '05
with 12 CSCs
in stations
ME+2 and
ME+3**



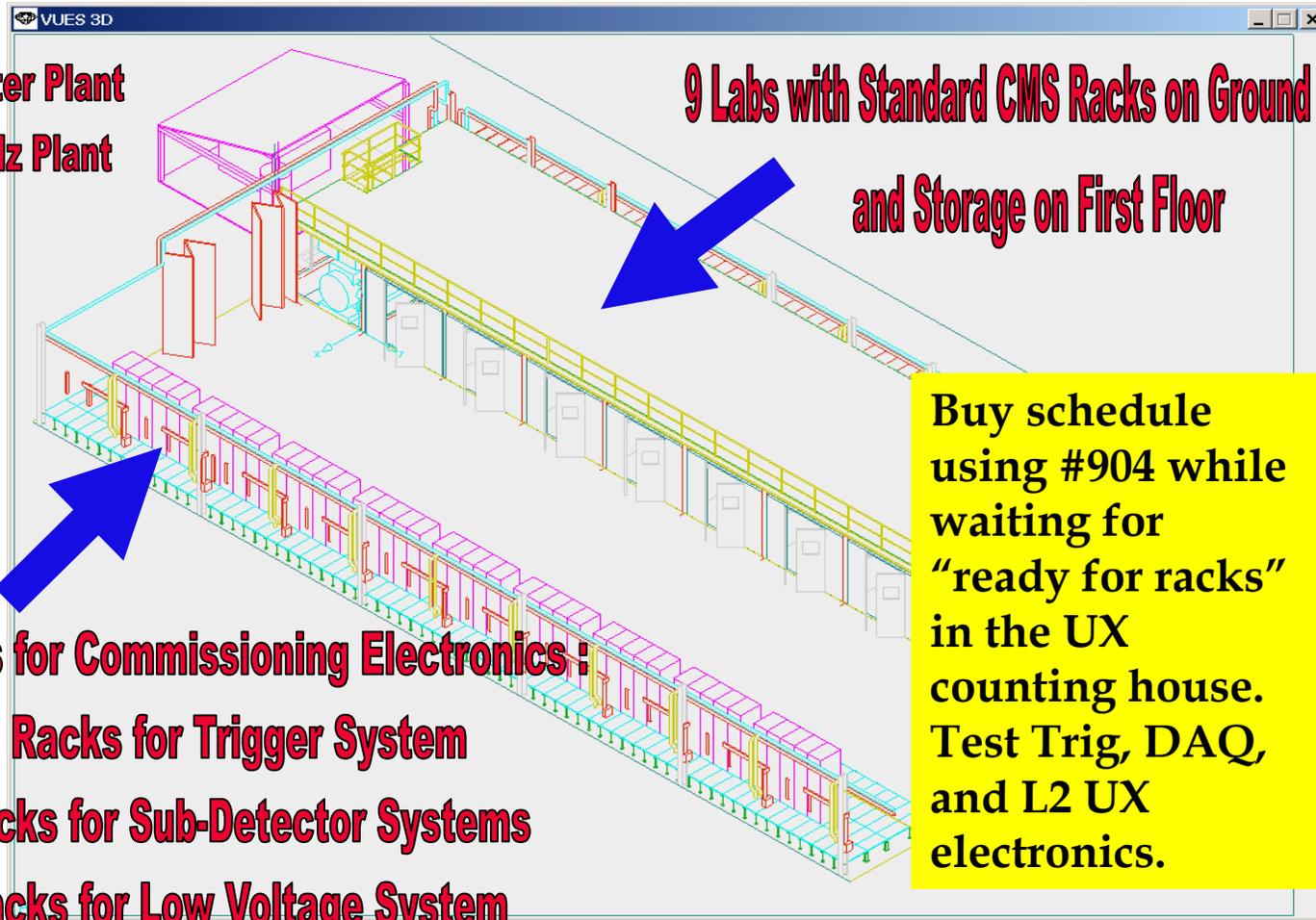
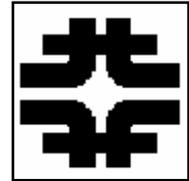


HF in #186 – First Installed





CMS Electronics Facility



**Chilled Water Plant
and 400 Hz Plant**

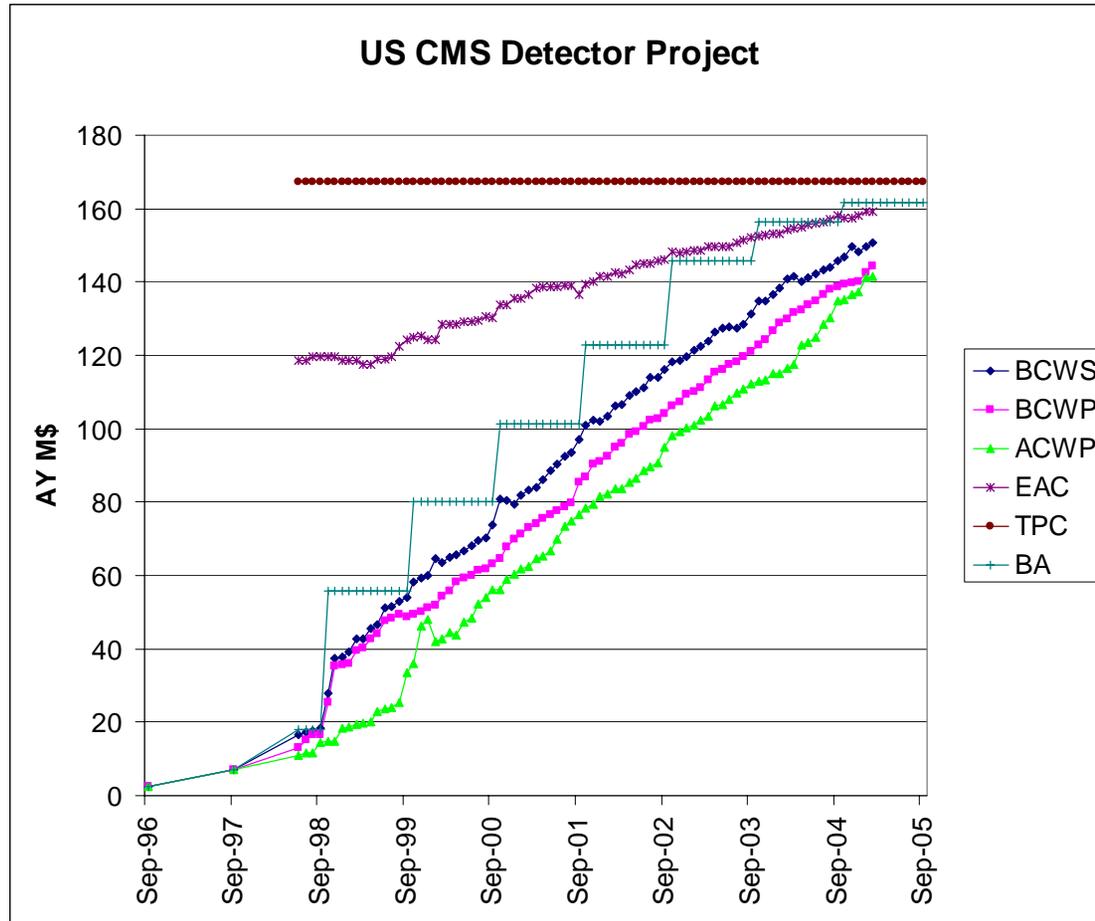
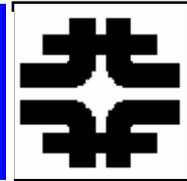
**9 Labs with Standard CMS Racks on Ground Floor
and Storage on First Floor**

**45 Racks for Commissioning Electronics :
15 Racks for Trigger System
15 Racks for Sub-Detector Systems
15 Racks for Low Voltage System**

**Buy schedule
using #904 while
waiting for
"ready for racks"
in the UX
counting house.
Test Trig, DAQ,
and L2 UX
electronics.**



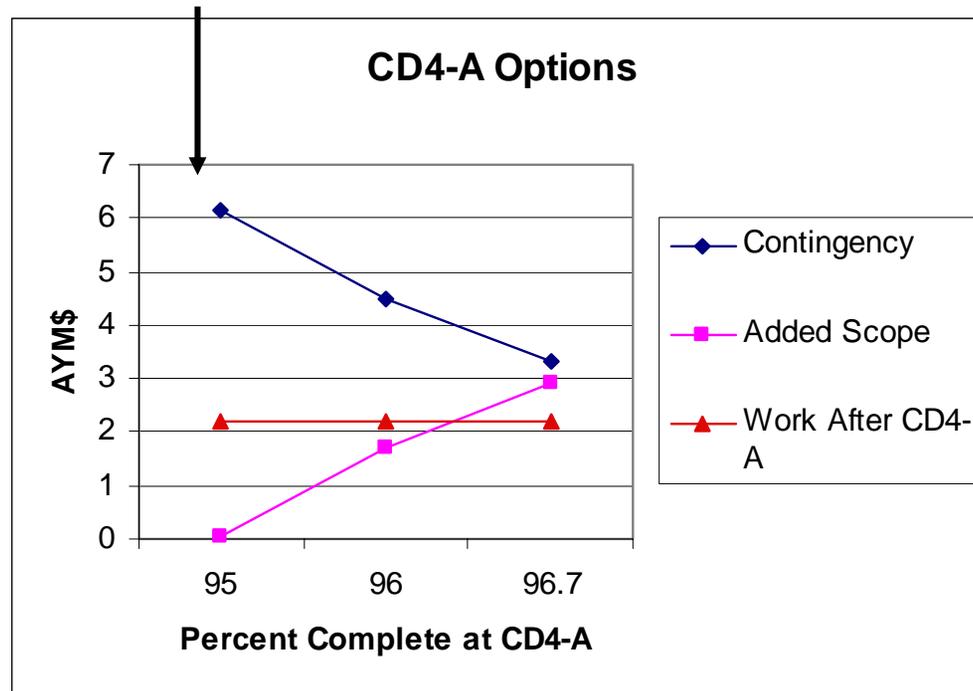
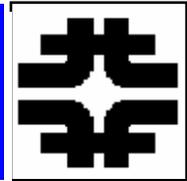
US CMS Detector Construction



ACWP is closing with the plan. Reporting is perhaps not done in a timely enough way. More work to clean up reporting remains. However, it is clear that CD4-A can be achieved at the end of FY05. this means construction is ~ done save for final installation. Remaining construction is in SiTrkr and FPIX.



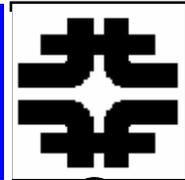
Construction Endgame Options



The choices were to add scope now to achieve a higher % complete which leads to less contingency after CD4-A. A conservative approach is to add ~ no scope and carry as much contingency into the end of project as is consistent with the successful conclusion of CD4-A. This plan was adopted for the LHC Projects. US CMS should have ~ 6 M\$ contingency for ~ 2 M\$ of remaining work.



CMS Tracker Construction Board

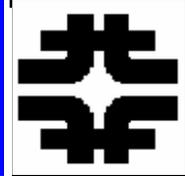


	Tracker Construction Board	TIB/TID	TOB	TEC	Tracker Integration Centre	Pixel Barrel	Pixel Endcap
	Chair: Peter Sharp	Guido Tonelli Ettore Focardi	Joe Incandela Duccio Abbaneo	Didier Contardo Stefan Schael	Gigi Rolandi TBC	Roland Horisberger Wolfram Erdmann	Roland Horisberger TBC
Module Production	Gian-Mario Bilei Francois Vasey	aaa	bbb	ccc	ddd	eee	fff
Detector Qualification	TBC TBC	ggg	hhh	iii	jjj	kkk	lll
Tracker Integration	Ariella Cattai TBC	mmm	nnn	ooo	ppp	qqq	rrr
Electronics Integration	Sandro Marchioro Patrice Siegrist	sss	ttt	uuu	vvv	www	xxx
Software Integration	Lucia Silvestris Ian Tomalin	yyy	zzz	111	222	333	444
		Tracker Operations Board					
		Tracker Up-grade Board					

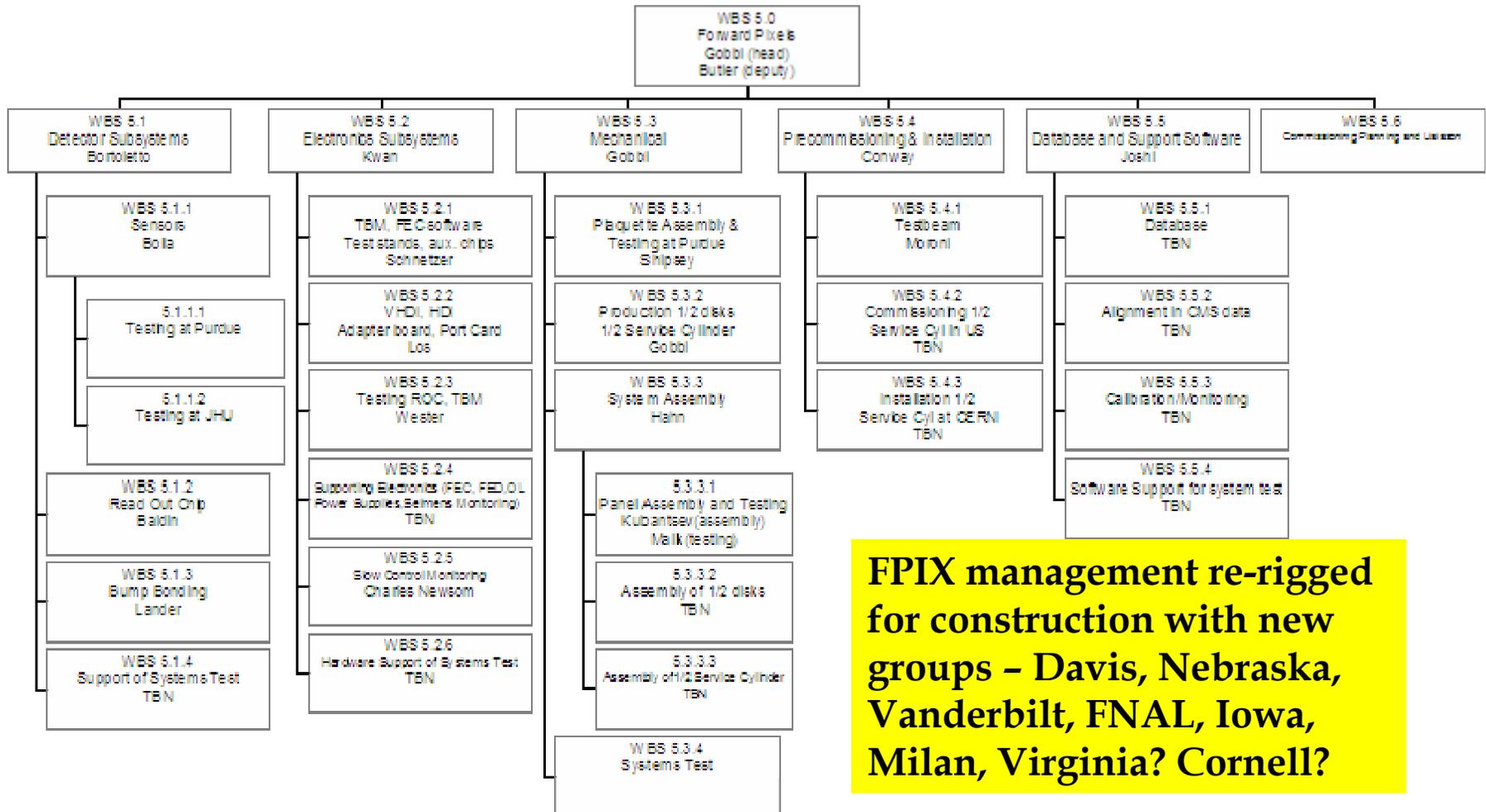
CMS Tracker reorganized: Jan.'05. n.b. Pixels now part of the Tracker Management. Stalled TOB construction now launched in the US. After launch , the integration center at CERN becomes the crucial element.



FPIX – L2, L3 Managers



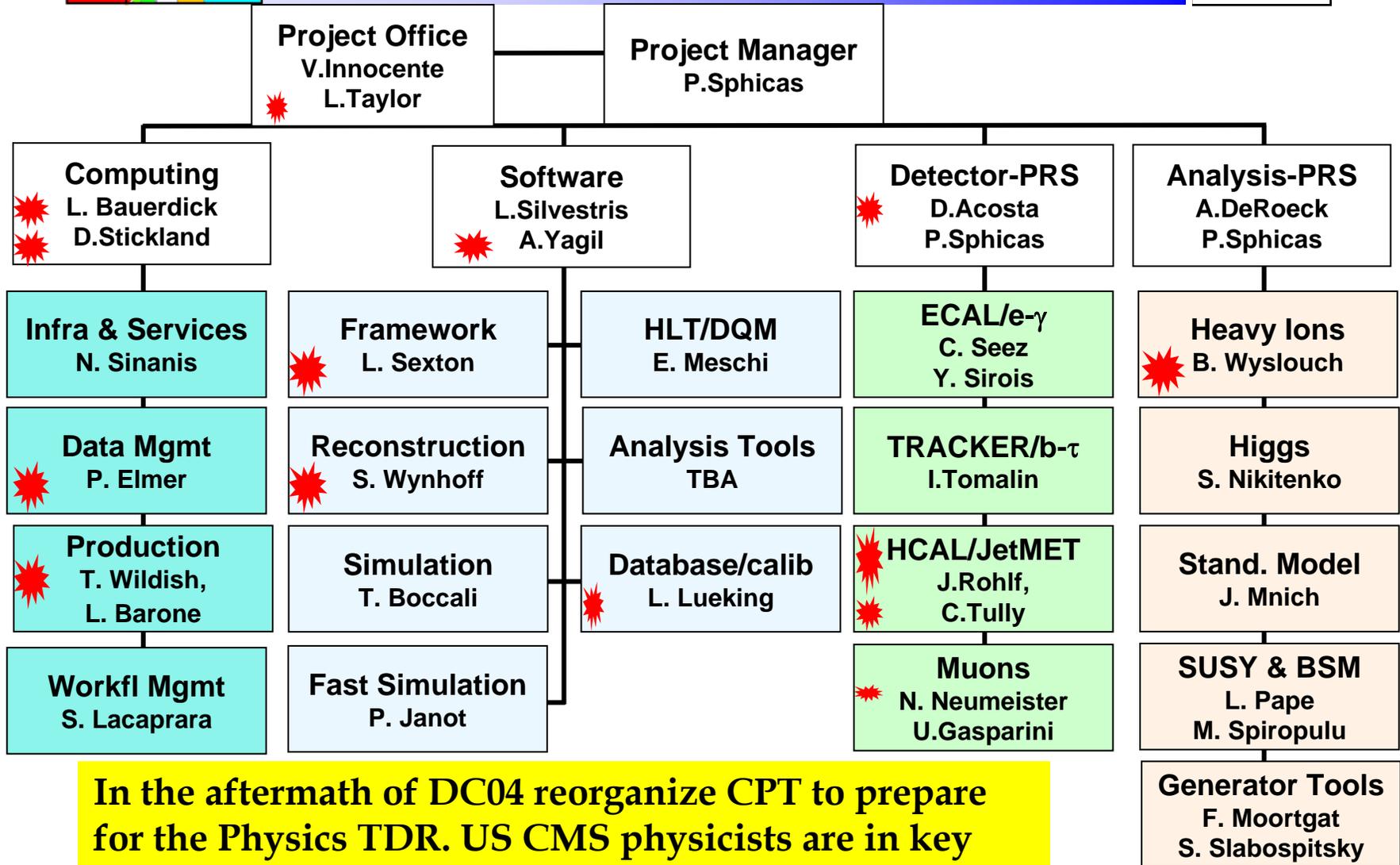
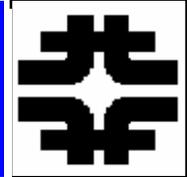
CMS FORWARD PIXEL DETECTOR



FPIX management re-rigged for construction with new groups – Davis, Nebraska, Vanderbilt, FNAL, Iowa, Milan, Virginia? Cornell?



CPT New Organization



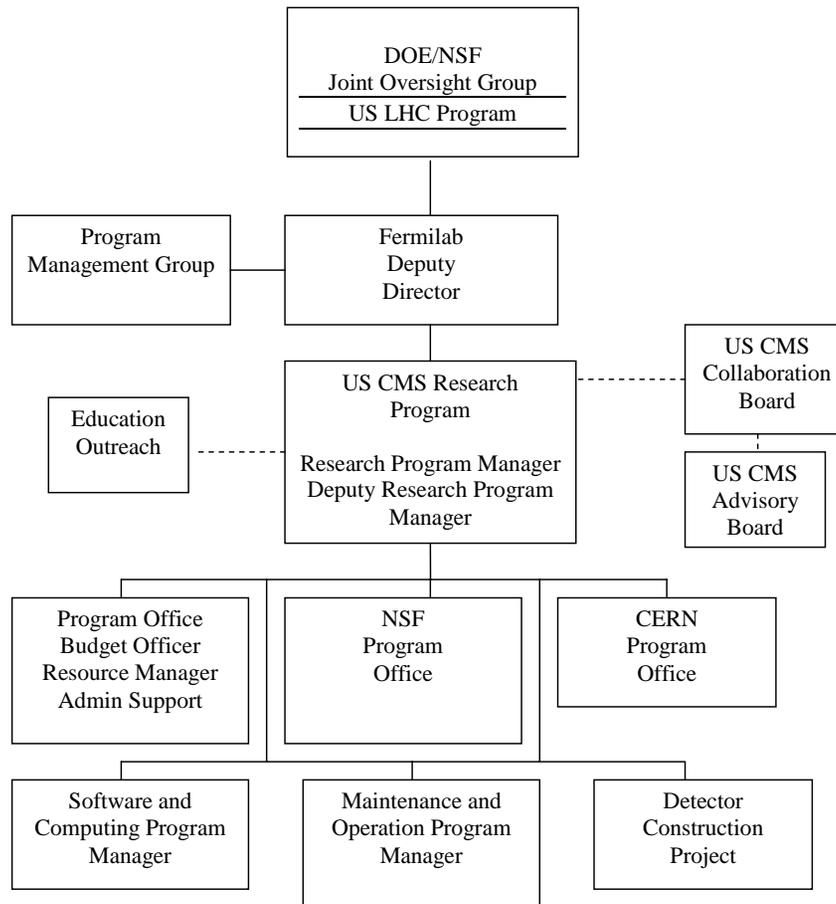
In the aftermath of DC04 reorganize CPT to prepare for the Physics TDR. US CMS physicists are in key managerial positions.



US CMS Research Program



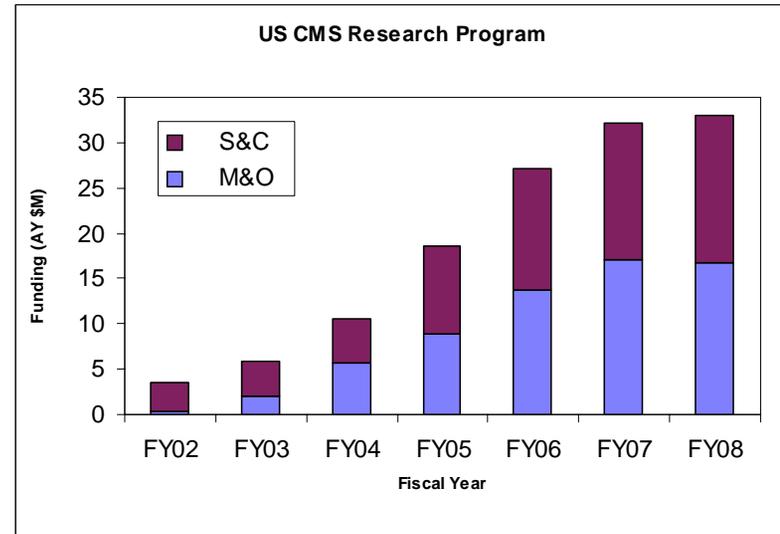
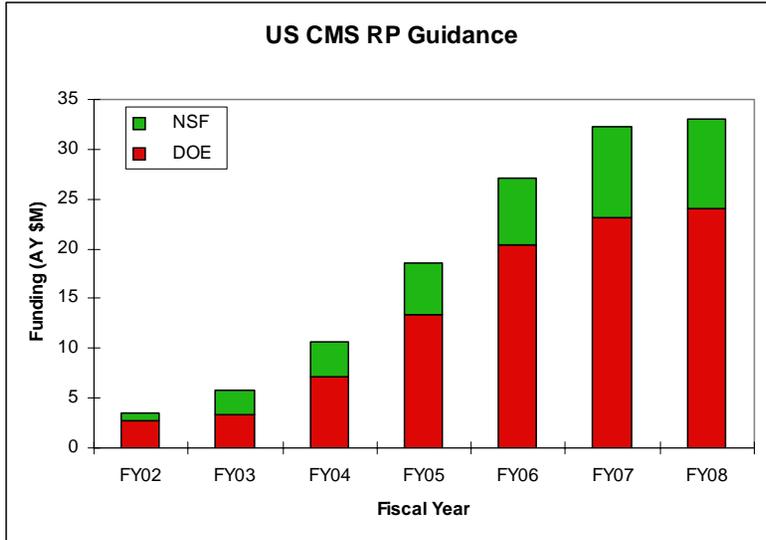
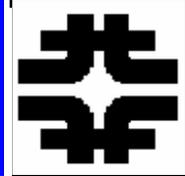
APPENDIX 7: U.S. CMS RESEARCH PROGRAM OFFICE ORGANIZATION



Management is in place. Regular meetings between RPM, DRPM, S&C and M&O. CR are done in the PMG at FNAL. Worked well during the FY04 changes in funding guidance. Successful annual reviews in early CY05.



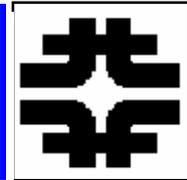
Funding Guidance



Agreed upon in FY04 for ramp up period. Issue is ~ 10% management reserve with travel/per diem at CERN and with poor exchange rate.



RP Milestones

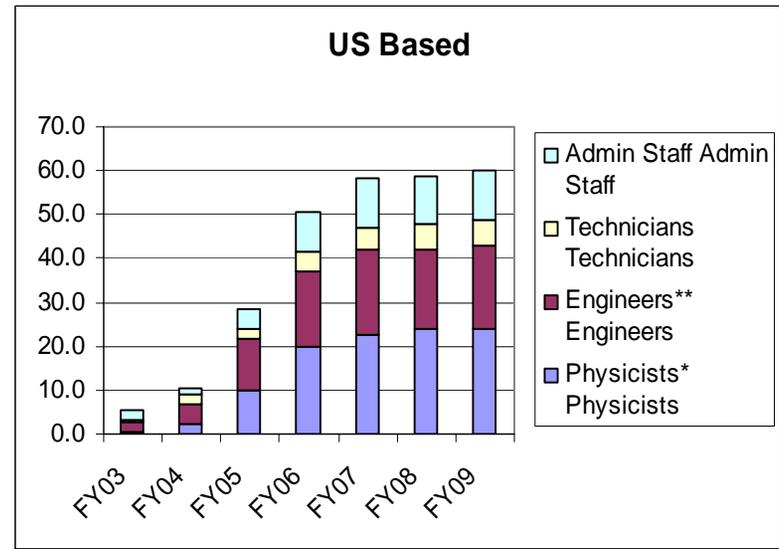
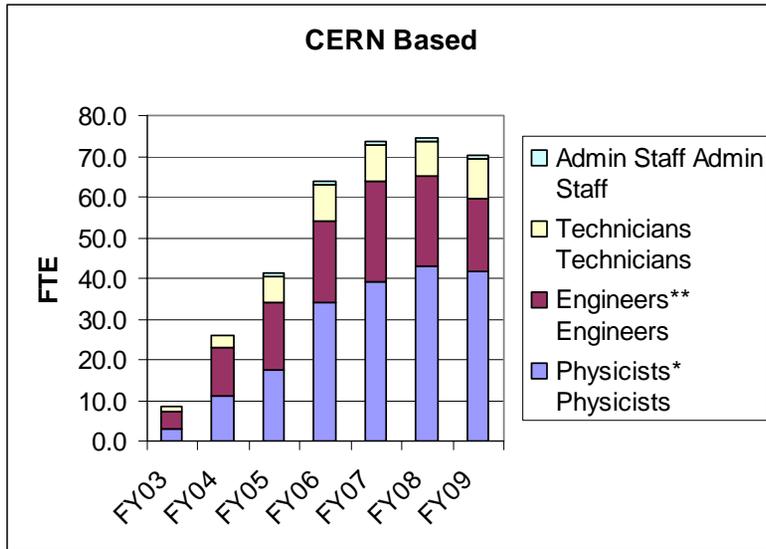


Milestone	2002		2003		2004		2005		2006		2007		2008	
	Oct	Apr												
1 <input type="checkbox"/> US CMS Research Program Milestones														
2 CMS Category A Costs Begin	●													
3 HB+ Optics Installation complete		●												
4 Submit DAQ TDR			●											
5 All 148 ME2/2 and 3/2 CSCs delivered from UC/UF to CERN				●										
6 Delivery of baseline core software for CCS and Physics TDR's					●		◆							
7 LPC Prototype Ready - 5% data challenge complete					◆		●							
8 CCS TDR submission							●							
9 ME-1/2 and ME-1/3 ready for installation								●						
10 LPC - Guest Appointments Start								●						
11 TOB completed								●						
12 Finish trigger installation								●						
13 EB Front-End Electronics Production Complete								●						
14 Local DAQ in USC ready for use								●						
15 Physics TDR submission								●						
16 Finish trigger commissioning								●						
17 LPC Installed WH11 - 20% data challenge complete								●						
18 DAQ D2S installed in USC to SCX								●						
19 Delivery of production-grade core software systems								●						
20 End Installation and Cabling of tracker in UX5								●						
21 CMS ready to close for beam								●						
22 LPC - Analysis of First Data Starts								●						
23 Pixel tracker at Pt 5, ready for installation								●						
24 End installation, test and debug of pixel tracker in UX5								●						
25														
26 <i>Baseline Milestone Symbol (CMS v34 Schedule)</i>				●										
27 <i>Projected Milestone Symbol</i>				◆										
28 <i>Achieved Milestone Symbol</i>				●										

US CMS RP reports quarterly to the DOE and NSF on cost and schedule since January 2003.



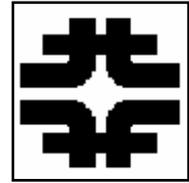
RP Issues



For MEG05 we did a preliminary assessment of US and CERN based staff. The vitality of the LPC and ROC make these estimates uncertain. Nevertheless, the MEG05 report quotes the 10% MR as too small. This reduced MR arises due to currency fluctuations, reduced guidance, and an attempt to add in the COLA for US engineers and technicians posted at CERN. Clearly, additional COLA for US physicists cannot be borne by the Research Program. Therefore, an enhanced support of US CMS core efforts is required if US CMS is to fulfill M&O obligations and do Physics.



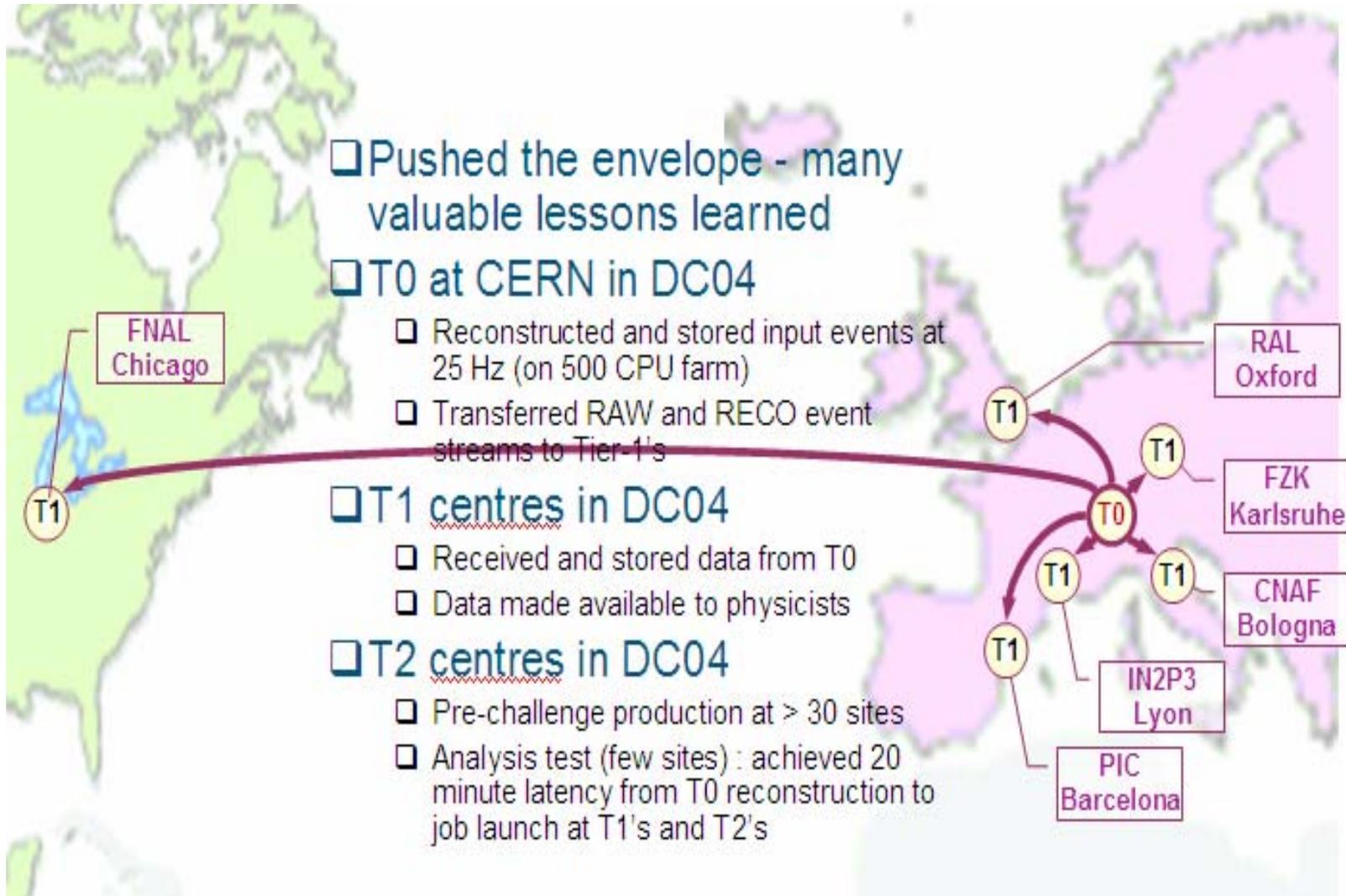
US CMS T2 Program



- Request for Proposal after the NSF funding situation became clear.
- Site visits by an expert committee.
- Decision on T2 Sites early in CY05
 - DISUN = UC San Diego, Caltech, U Fla., U. Wisconsin
 - Nebraska, Purdue, MIT (May 1 RP grant will fund them)
- Proposal for T2C being written.
- Aim is to ramp up to full T2 power by start of collisions.



DC04 – Data Challenge

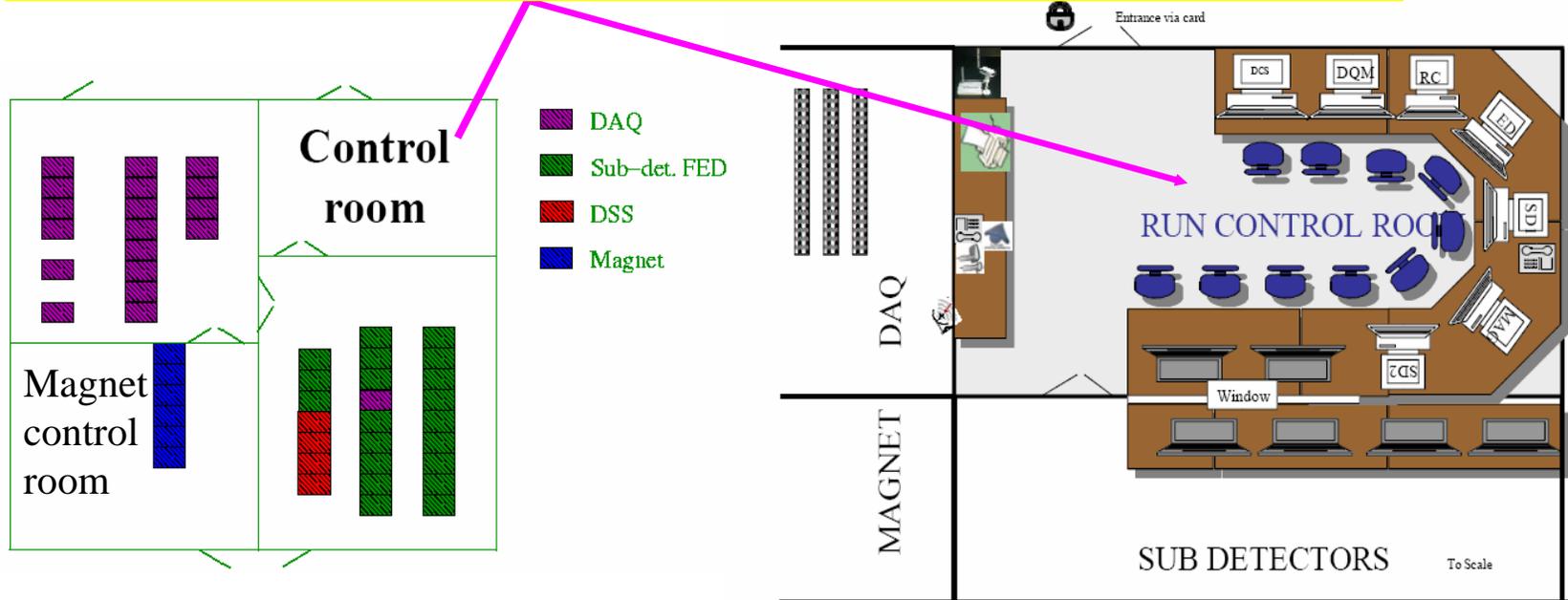




SX5 Control Room



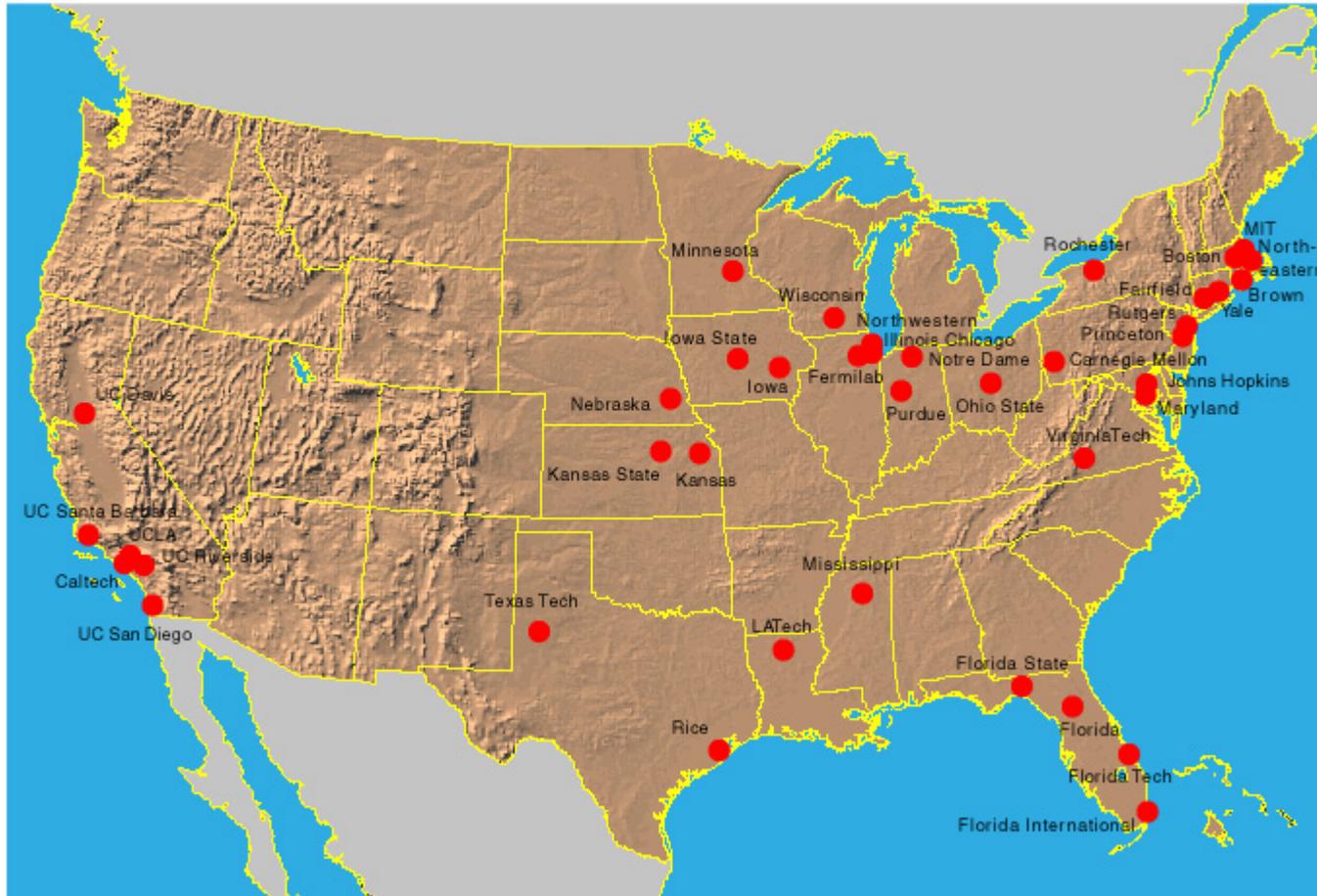
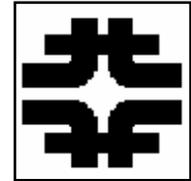
This test brings the new S&C framework to a test with the detector itself. This nexus will be when S&C and M&O mesh to combine to first form a unitary detector. US CMS plans to be involved in both SX5 and remote operations and data monitoring. These activities will segue into data taking.



A.Sharma & D.Lazic, CTF 2005.03.11

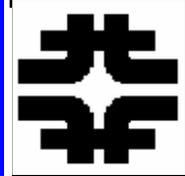


US CMS





US CMS Collaboration



Institution	Agency Support
Boston University	DOE
Brown University	DOE/NSF
University of California at Davis	DOE
University of California at Los Angeles	DOE/NSF
University of California at Riverside	DOE
University of California at San Diego	DOE/NSF
University of California at Santa Barbara	DOE
California Institute of Technology	DOE
Carnegie Mellon University	DOE
Fairfield University	DOE
Fermi National Accelerator Laboratory*	DOE
University of Florida	DOE
Florida Institute of Technology	DOE
Florida International University	NSF
Florida State University	DOE
University of Illinois at Chicago	NSF
University of Iowa	DOE
Iowa State University	DOE
Johns Hopkins University	NSF
University of Kansas	NSF
Kansas State University	DOE
Louisiana Tech University	DOE
University of Maryland	DOE
Massachusetts Institute of Technology	DOE
University of Minnesota	DOE
University of Mississippi	DOE
University of Nebraska	NSF
Northeastern University	NSF
Northwestern University	DOE
University of Notre Dame	NSF
Ohio State University	DOE
Princeton University	DOE
Purdue University	DOE
Rice University	DOE
University of Rochester	DOE
Rutgers University	NSF
University of Texas at Dallas	DOE
Texas Tech University	DOE
Virginia Technical Institute	NSF
University of Wisconsin at Madison	DOE
Yale University	DOE

Recent growth in the collaboration:

“Davis”

“Nebraska”

Vanderbilt

Cornell

Louisiana Tech

“Iowa”

“FNAL”

Virginia?

Colorado?

Wayne State?

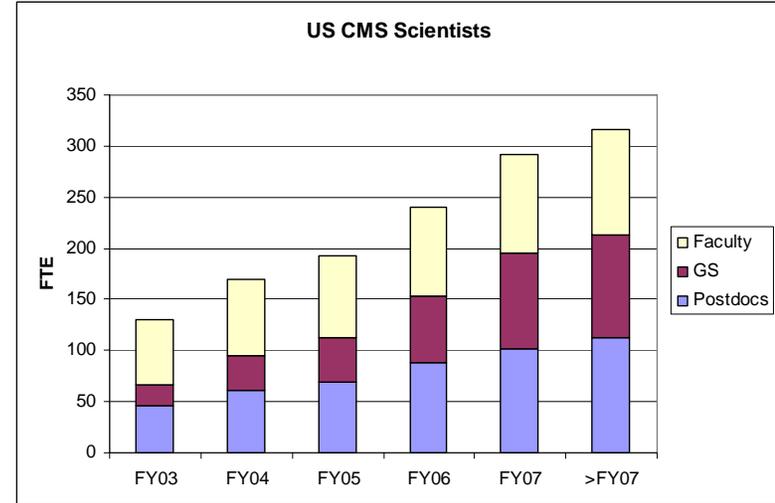
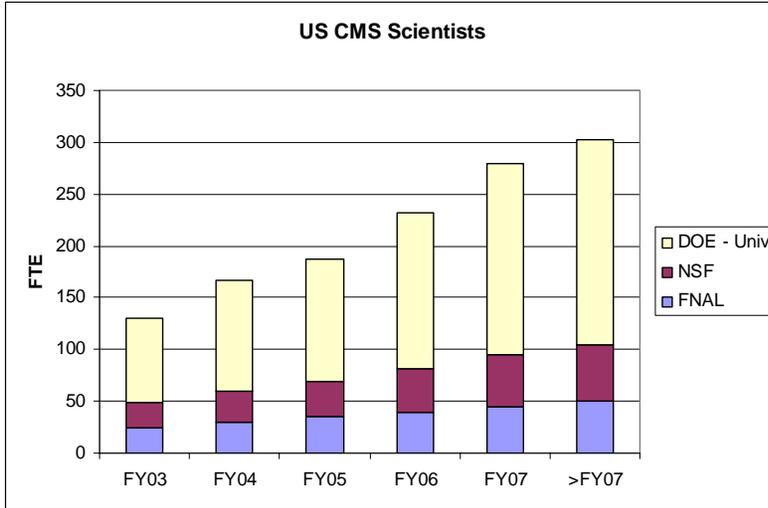
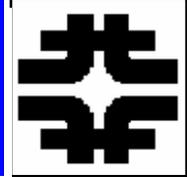
Texas A&M?

Oklahoma State?

Buffalo?

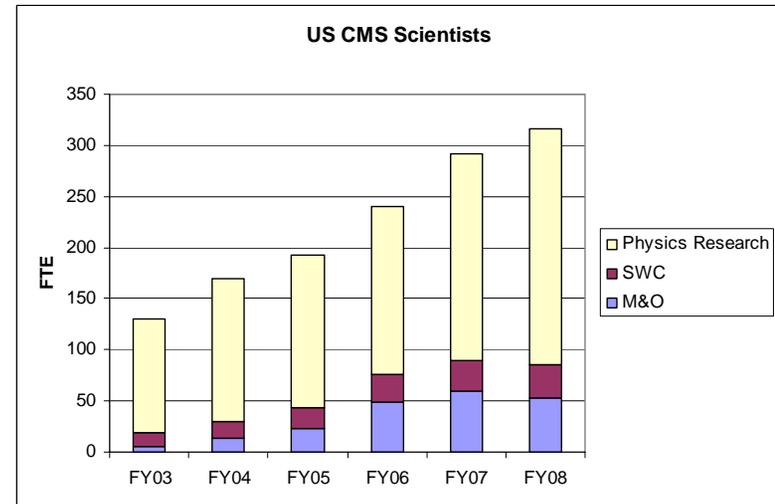


HEPAP Survey 10/04



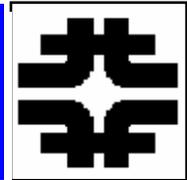
Expect ~ 2x growth due to redirection. Most scientists not needed for M&O or S&C. Thus there is a core of US physicists available to do physics research.

Try to make a place for these people to nucleate in a critical mass. Note that RP support level assumes no new groups!

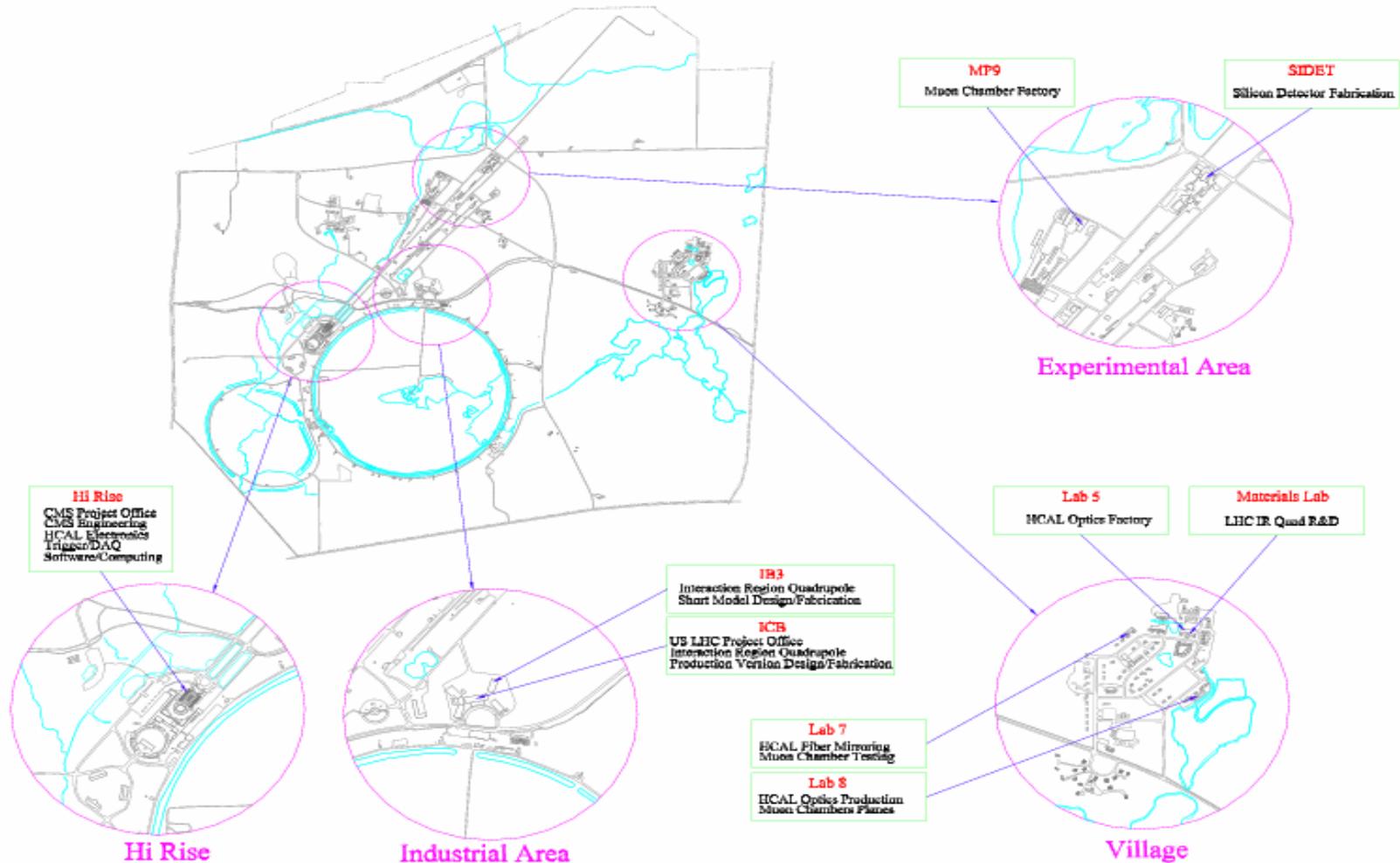




FNAL as Host Lab

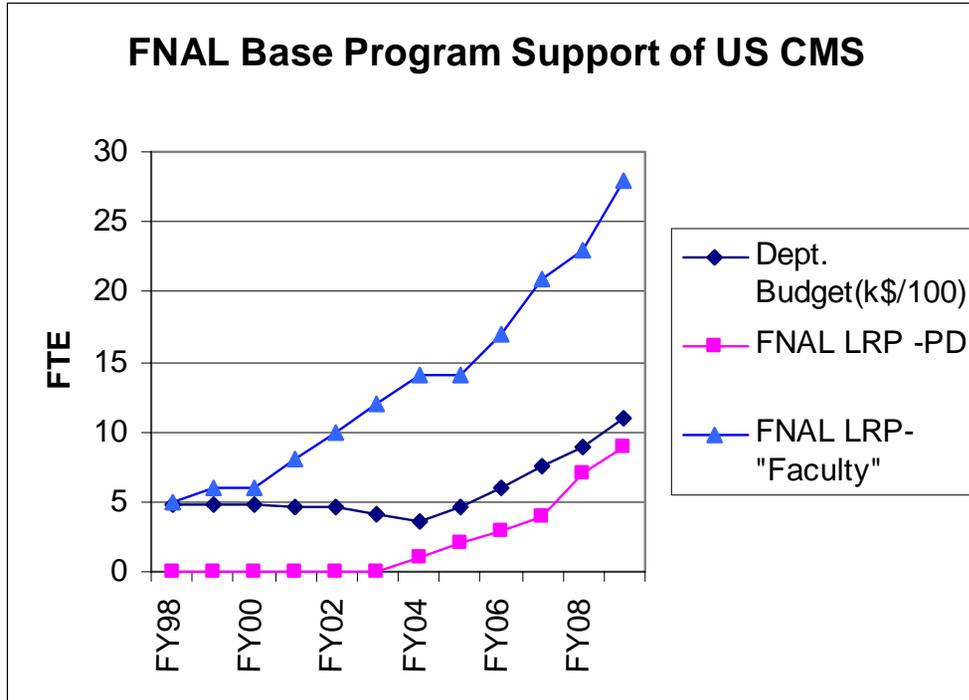


Fermilab Activity on the LHC





The US CMS FNAL Group



FNAL group in PPD has grown steadily since baselining in FY98. For example, BTeV folk and steady in scattering of CDF/D0 physicists. FNAL core budget now starting to increase along with PD positions.



What is the LPC? (S.E.)

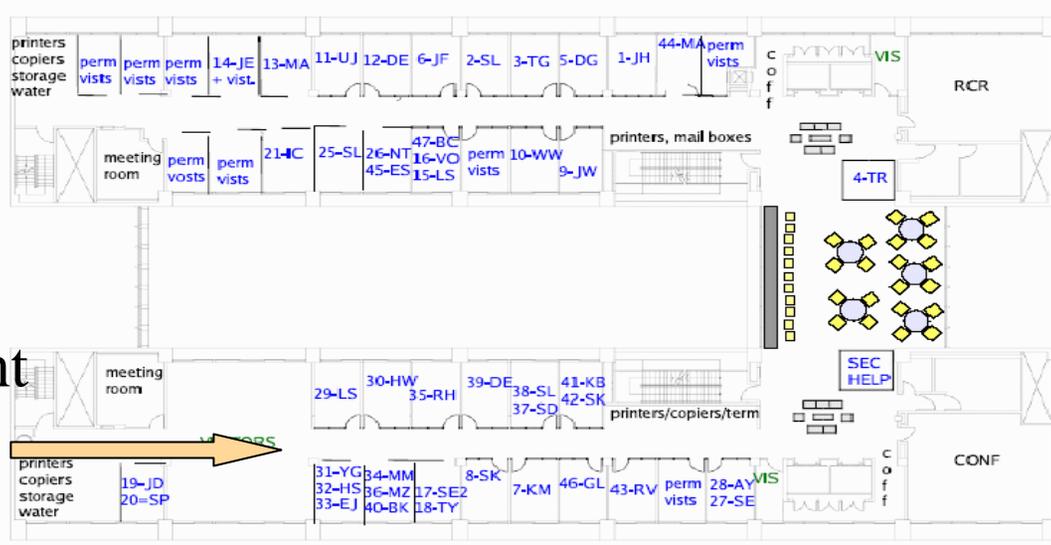


Located on the 11th floor of the FNAL high rise, the purpose of the LPC is position the US so it can make the strongest contribution to CMS physics possible

- a **critical mass** (clustering) of young people who are actively working on software (reconstruction, particle identification, physics analysis) in a **single** location (11th floor of the high rise),
- a resource for University-based US CMS collaborators; a place to find expertise in their time zone, a place to visit with their software and analysis questions,
- a brick-and-mortar location for US-based physics analysis, with such physical infrastructure as large meeting rooms, video conferencing, large scale computing, and a “water cooler” for informal discussions of physics.



Office Space



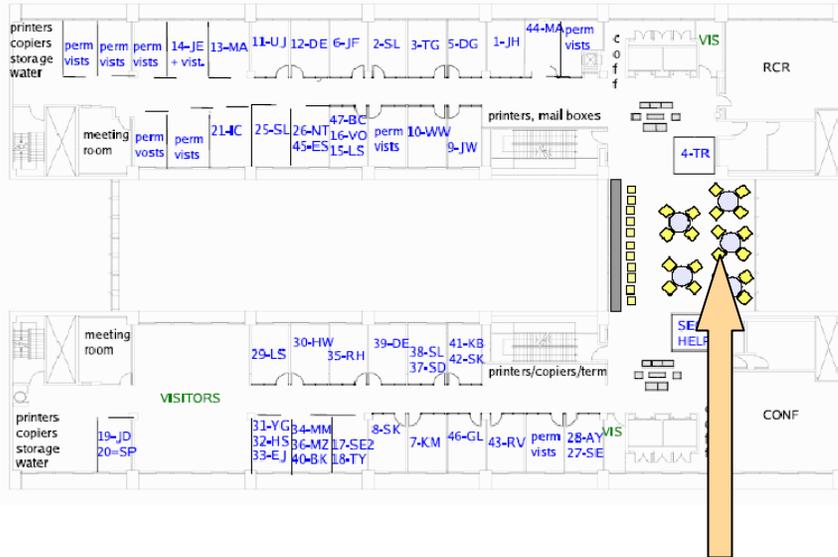
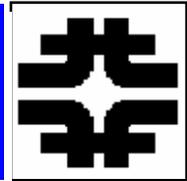
Transient offices

Room for 60 transients from Universities



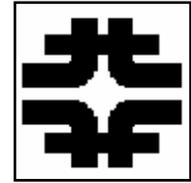


“Water Cooler”



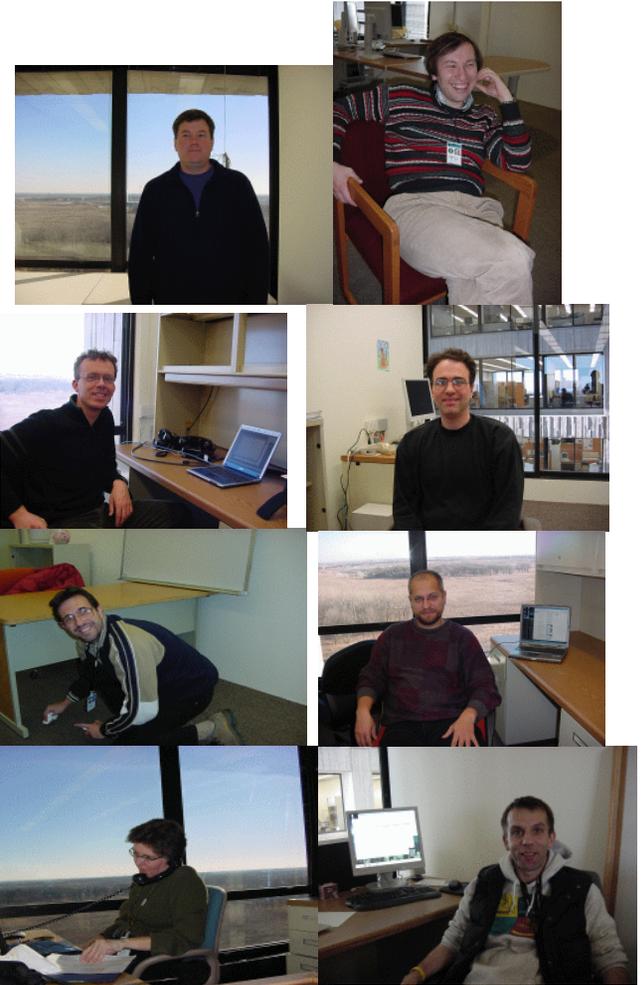


Working Groups



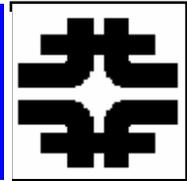
- **offline/edm:** Liz Sexton-Kennedy, Hans Wenzel
- **tracking:** Kevin Burkett, Sasha Khanov
- **e/gamma:** Yuri Gershtein, Heidi Schellman
- **muon:** Eric James , Martijn Mulders
- **jet/met:** Rob Harris, Marek Zielinski
- **simulation:** Daniel Elvira, Boaz Klima
- **trigger:** Sridhara Dasu

Each group has bi-weekly meetings with video conferencing. Groups match CMS PRS groups.





LPC University Involvement



Simulation: FNAL, Notre Dame, Kansas, UIC, Northwestern, FSU, Louisiana Tech, Kansas State, Rutgers

Jet/Met: FNAL, Maryland, Rutgers, Boston, Cal Tech, Princeton

Muon: FNAL, Carnegie Mellon, Florida, Purdue

e/gamma: FNAL, Northwestern, FSU, Minnesota

Tracking: FNAL, UIC, Nebraska

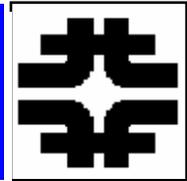
Trigger: Wisconsin, Florida, Northwestern, FNAL

Offline/edm: FNAL, Cornell

About 1/4 of the non-transient physicists on the 11th floor are University employees



LPC & US Universities

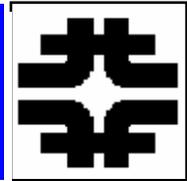


There are many different modes they can use this center

- a postdoc who is stationed at FNAL work on both CMS and a Tevatron experiment can have a desk on the 11th floor and be near people from both accelerators – synergy and enable full CDF/D0 exploitation.
- a CMS postdoc can be stationed at FNAL permanently for the same kind of advantages you get in the D0/CDF trailers
- postdoc stationed at your university can come for a month, to get up to speed on analysis basics and to form personal connections that will help his/her later work – serve as a center of CMS C&S expertise.
- students can come for the summer to give them a richer experience by having them interact with more people – critical mass
- Faculty can come every other week to help you feel connected to the experiment .
- Faculty can come for a day for help with a particularly knotty software or analysis problem



LPC Web Page



<http://www.uscms.org/LPC/LPC.htm>

LPC



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The LHC Physics Center at FNAL

The LHC Physics Center (LPC) at FNAL was established in April 2004 by Mike Witherell and Dan Green for the following purposes:

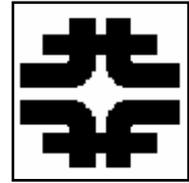
- a "brick and mortar" location for CMS physicists to find experts on all aspects of data analysis, particle ID, software, and event processing within the US, working during hours convenient for U.S.-based physicists
- a center of physics excellence within the US for LHC physics
- a place for workshops/conferences/gatherings on LHC physics
- a place for the training of graduate and postgraduate scientists from URA Universities.
- a "remote control room" that CMS physicists can use to participate in data taking and quality control for the CMS experiment in the U.S.
- a tool to help provide a graceful transition between the Tevatron and LHC experiments for those physicists participating in both, maximizing the manpower available to each during the transition time.

The center is run by [Avi Yagil](#) (FNAL) and [Sarah Eno](#) (UMD) and is located on the 11th floor of the FNAL hi-rise. The level-2 manager is [Kaori Maeshima](#). The members of our advisory board can be found [at this link](#). Our milestones can be found [at this link](#). The LPC makes use of the proximity of the [FNAL "Tier-1" computing center](#) and the Tevatron experiments. To learn more about our center, choose one of the following options.

[Working Groups](#)



Theory Community



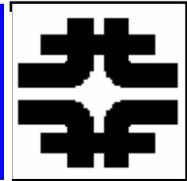
Informal brown bag “LHC Brainstorm” lunches organized by Steve Mrenna of the Computing Division.

The FNAL theory group is a great resource to improve the understanding of LHC physics issues.

TeV4LHC year long series of Workshops on the synergy between CDF/D0 and preparations for the LHC experiments.



Workshops



We have sponsored workshops that reach out to the Tevatron community, the theory community, US CMS and International CMS.

2005

May 2005

 **05** [CMS101](#)

2004

November 2004

 **18 - 19** [LPC e-gamma workshop](#)

 **17** [CMS101](#)

September 2004

 **13** [LHC Transition Workshop - CMS101](#)

August 2004

 **03** [LHC / Tevatron Tracking workshop](#)

April 2004

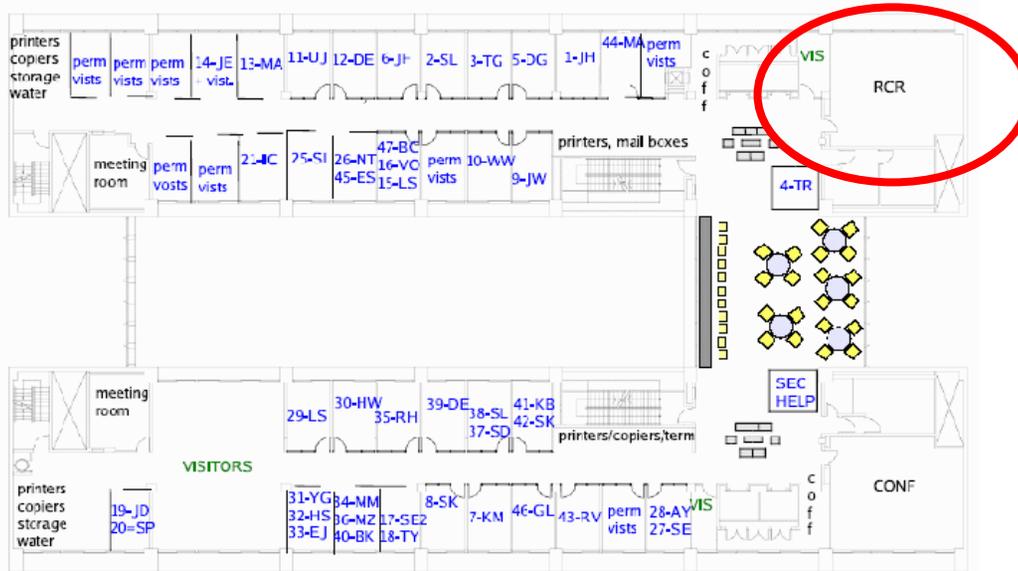
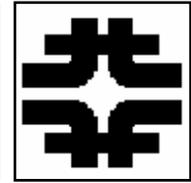
 **14** [Muon Workshop](#)

January 2004

 **28 - 29** [jet/met workshop](#)



Remote Operations Center



- for US CMS (Kaori Maeshima, FNAL, coordinator)
- for accelerator (FNAL staff at CERN Feb '05 to discuss)
- Will tie into the SX5 slice tests in CY05. Already prototyped in test beam runs in 2003 and 2004 – e log, teleconferencing, etc.
- Eric Gottschalk heads FNAL group looking into ROC requirements



Remote Operations Center



11th Floor WH



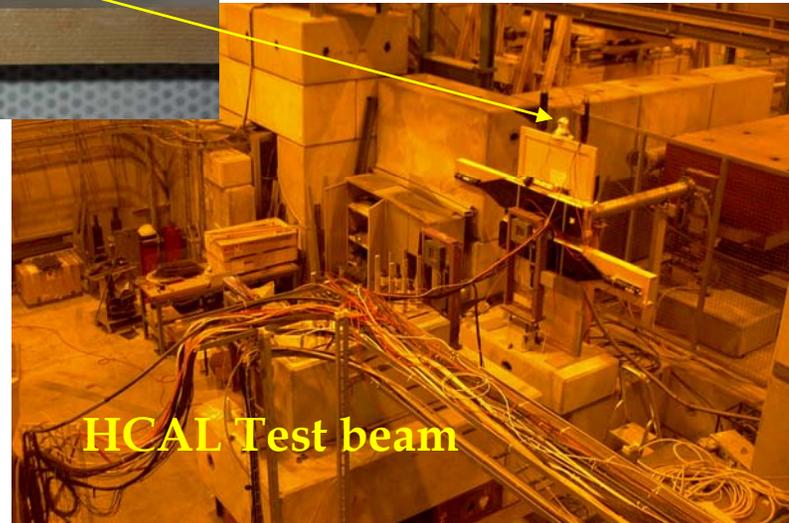
Virtually there,
24/7



CERN Analysis Room



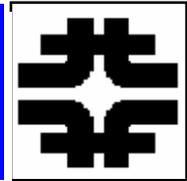
CERN HCAL
Control Room



HCAL Test beam



CMS Physics Week in Fermilab



**2005 US CMS Collaboration Meeting
and CMS Physics Week**

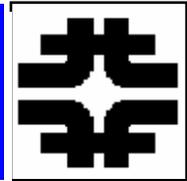
April 11 - April 15, 2005



The CMS Physics TDR is due at the end of CY05. This meeting reviewed the TDR status and was held at the US CMS LPC as local host. Clearly the LPC is making an impact on CMS S&C (e.g. EDM) and on CMS physics analysis.



Summary



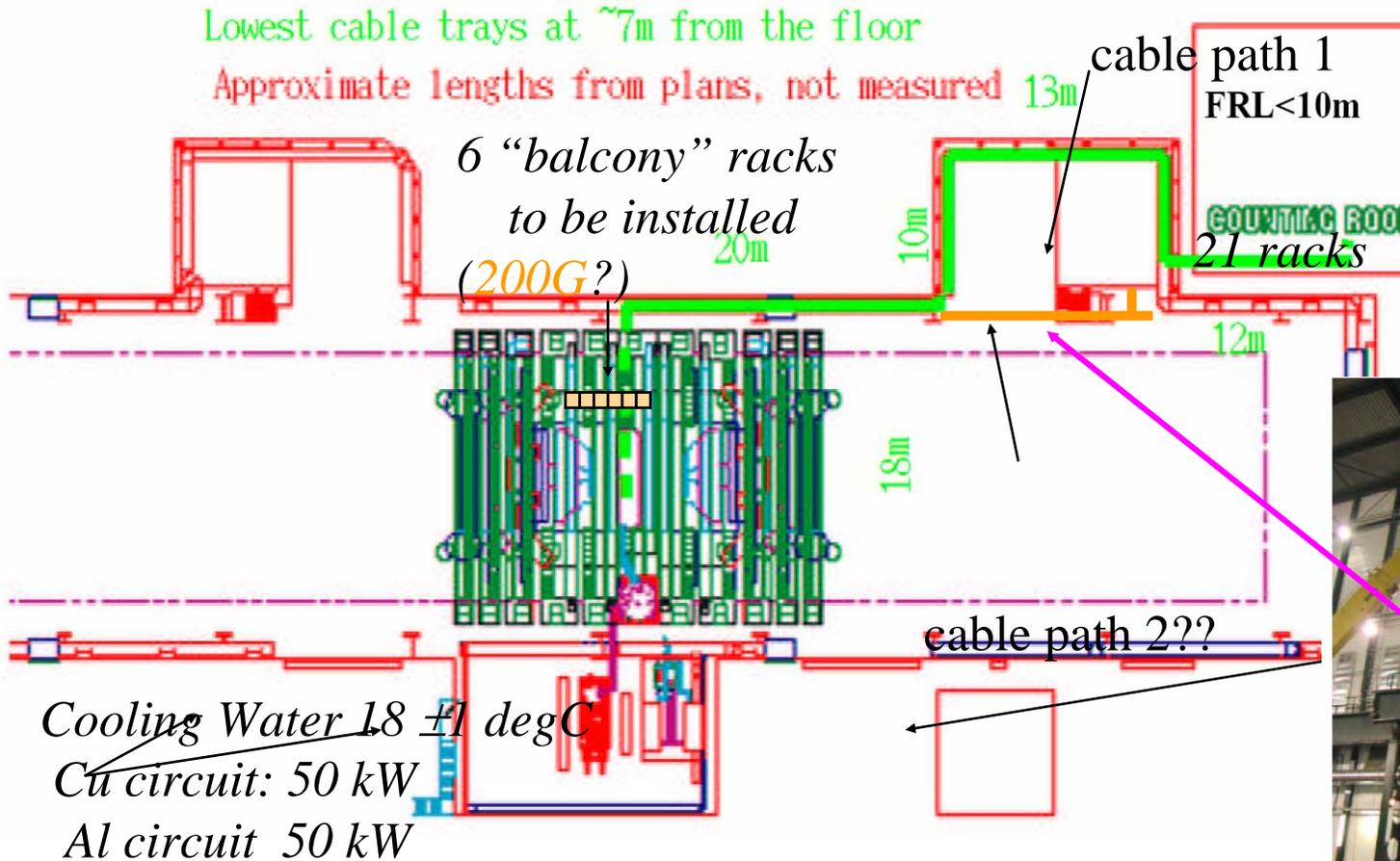
- Progress on CMS is now largely in the hands of CMS.
- US CMS plans to ~ complete detector deliverables at the end of FY05.
- The US CMS RP is ramping up rapidly. The management gets good marks for M&O and S&C at the latest reviews.
- The LPC/ROC is partially contained in the M&O baseline. There are also substantial contributions from FNAL as host lab (e.g. Tier 1 computing) and as a major collaborator. The LPC is a crucial part of the US CMS strategy to do physics and to have a smooth Tevatron-> LHC transition.



Magnet Test: SX5 Resources and Cabling

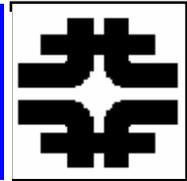


Gas, power (50HZ and 400Hz) , network, water and inertia systems in SX 5 and green barrack are limited



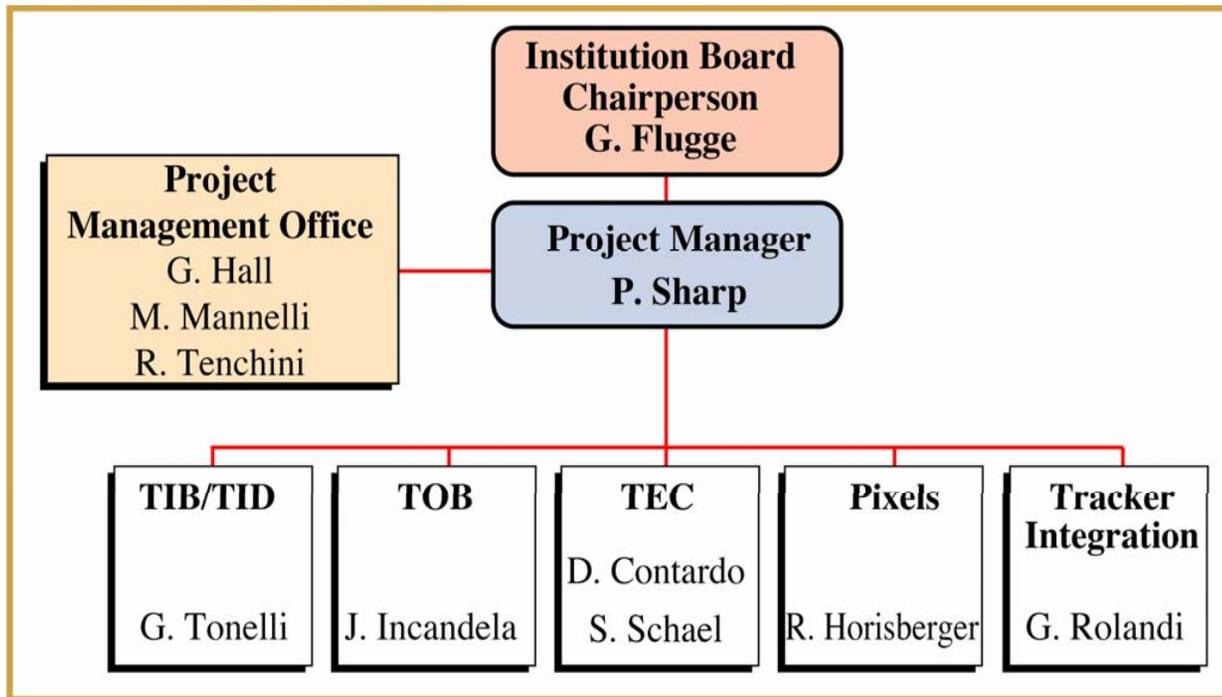


Tracker Management



Tracker Project

Tracker Management Board

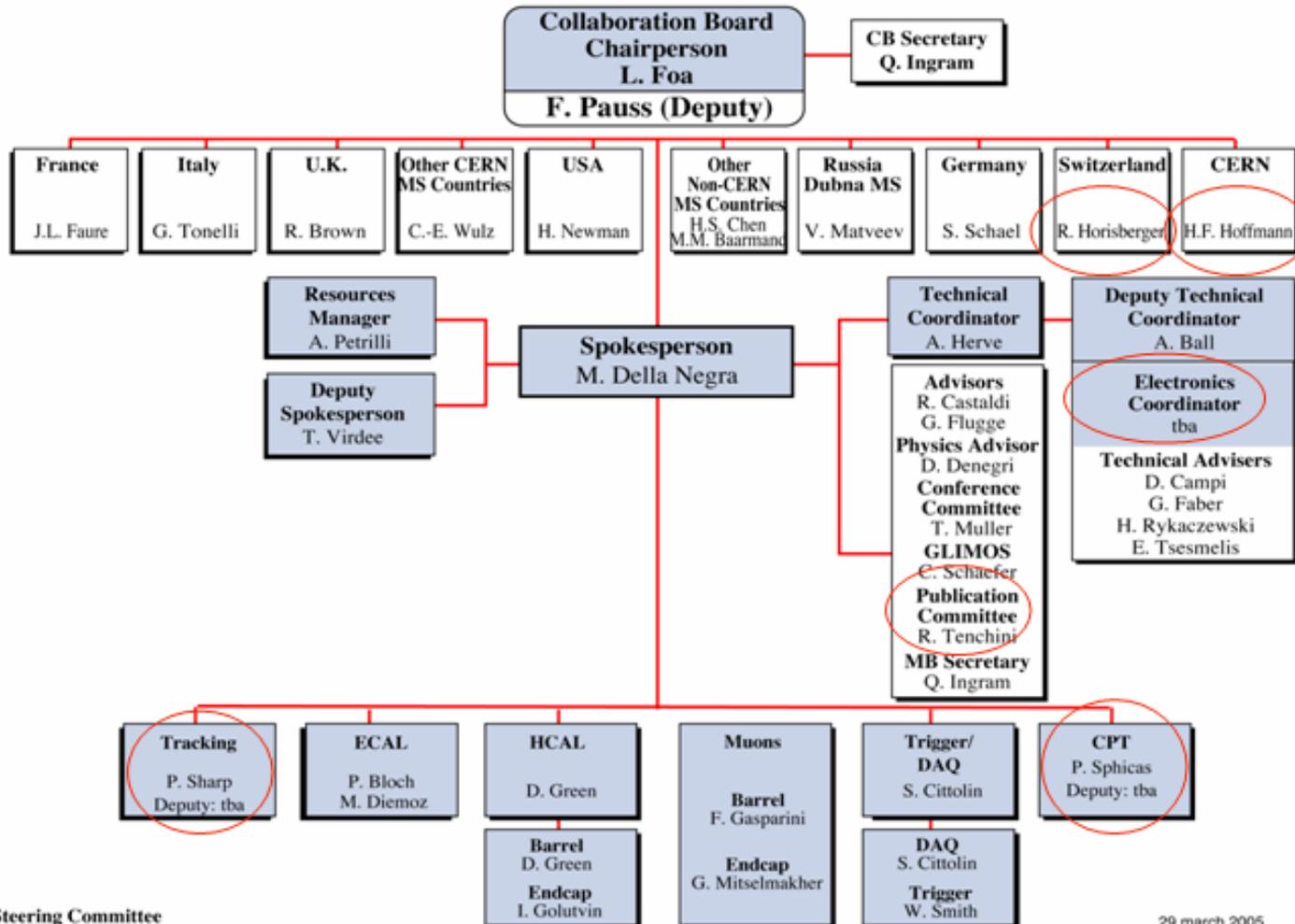


31 march 2005



CMS Steering Committee

CMS Management Board and Steering Committee



Steering Committee

29 march 2005