CERN-RRB-2004-062
28 April 2004

Status of the LHCb Experiment

LHCb RRB at CERN
28 April 2004

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CERN
and
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Contents of the presentation

1) Organizational Changes
2) Experimental Area
3) Detector Status
   i) Beam pipe
   ii) Magnet
   iii) VELO
   iv) Calorimeter
   v) RICH
   vi) Outer Tracker
   vii) Muon
   viii) Silicon Tracker
   ix) Trigger and Online
4) Computing Status
5) Cost Matrix Update
6) Conclusions

1) Organizational Changes

All the subdetector TDR's have been approved

(last ones for Trigger and Reoptimization in February 2004)

→ complete the project structures

Project	Leader	Deputies
Exp. Area	D. Lacarrere (CERN)	-
Magnet	W. Flegel (CERN)	-
VELO	J. van den Brand (NIKHEF)	M. Ferro-Luzzi (CERN)
RICH	D. Websdale (ICL)	O. Ullaland (CERN)
OT	A. Pellegrino (NIKHEF)	-
ST	U. Straumann (Zurich)	O. Steinkamp (Zurich)
Calorimeter	A. Schopper (CERN)	J. Lefrancois (LAL)
Muon	G. Carboni (Rome II)	P. Campana (LNF) and B. Schmidt (CERN)
L0 Trigger	R. Le Gac (Marseille)	-
Online	B. Jost (CERN)	-
Offline Computing	N. Brook (Bristol)	-
Core Software	P. Charpentier (CERN)	-
Reconstruction	T. Ruf (CERN)	M. Merk (NIKHEF) and O. Callot (LAL)
Physics	O. Schneider (EPFL)	-

Coordination panels for activities across the projects:

Trigger = L0 + L1/HLT

event building, CPU farm → Online project

software framework → Core software project

reconstruction → Reconstruction project

selection → Physics project

Offline issues = Computing infrastructure + Software + Physics

- Offline computing project
- Core software project
- Reconstruction project
- Physics project

Coordination Panel	Chair
Trigger	H. Dijkstra (CERN)
Physics, Software and Computing	O. Schneider (EPFL)

Other experiment coordination	
Electronics coordinator:	J. Christiansen (CERN)
Test beam coordinator:	R. Lindner (CERN)
Installation coordinator:	R. Lindner (CERN)
GLIMOS (Safety)	A. Smith (CERN)

And as before:	
Chair of CB	C. Matteuzzi (Milano)
Technical Coordinator	W. Witzeling (CERN)
Resource Coordinator	A. Smith (CERN)
Spokesperson	T. Nakada (CERN and EPFL)

New collaborating institute:

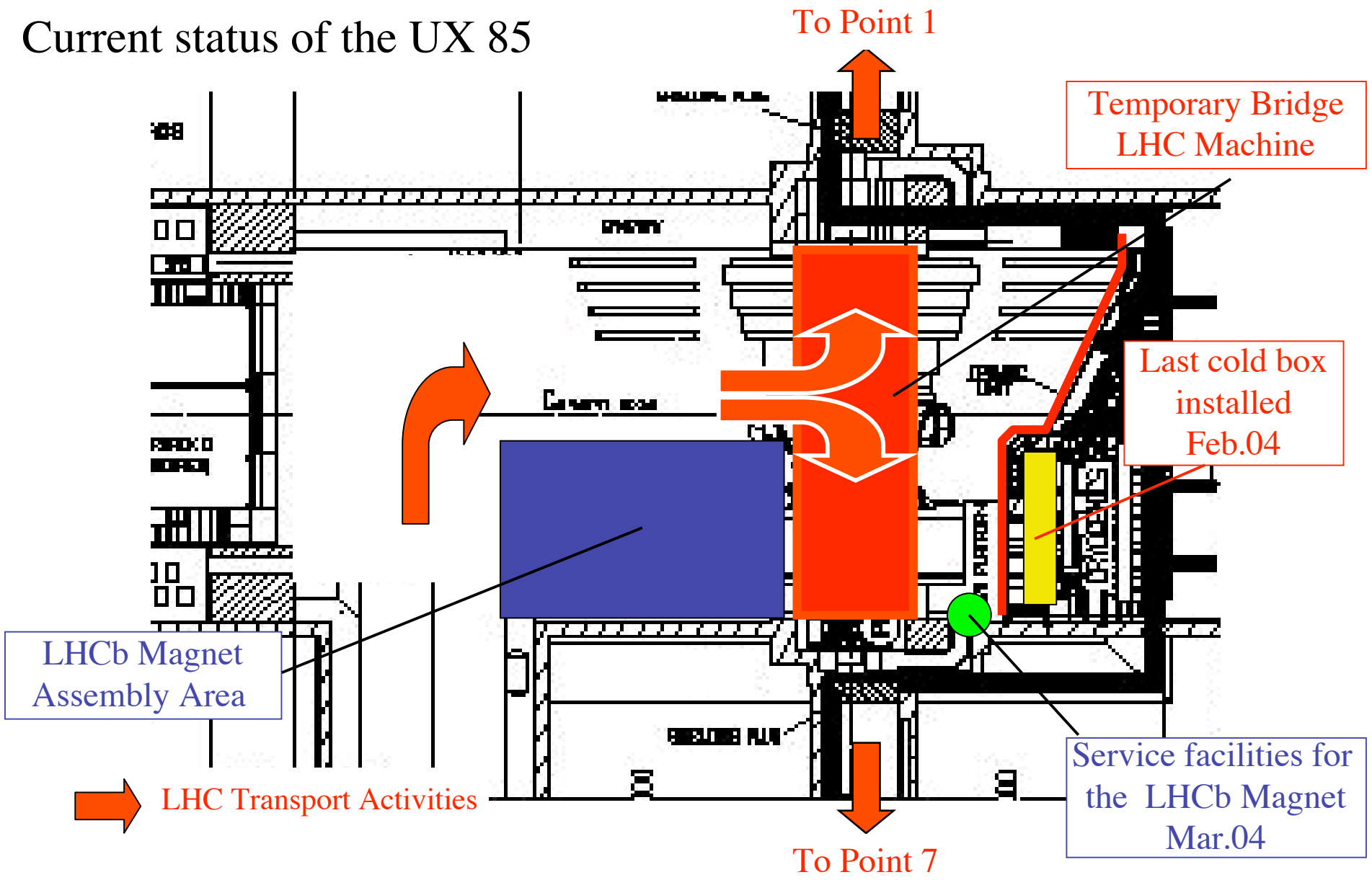
LPNHE (Universités de Paris VI et VII), Paris, France

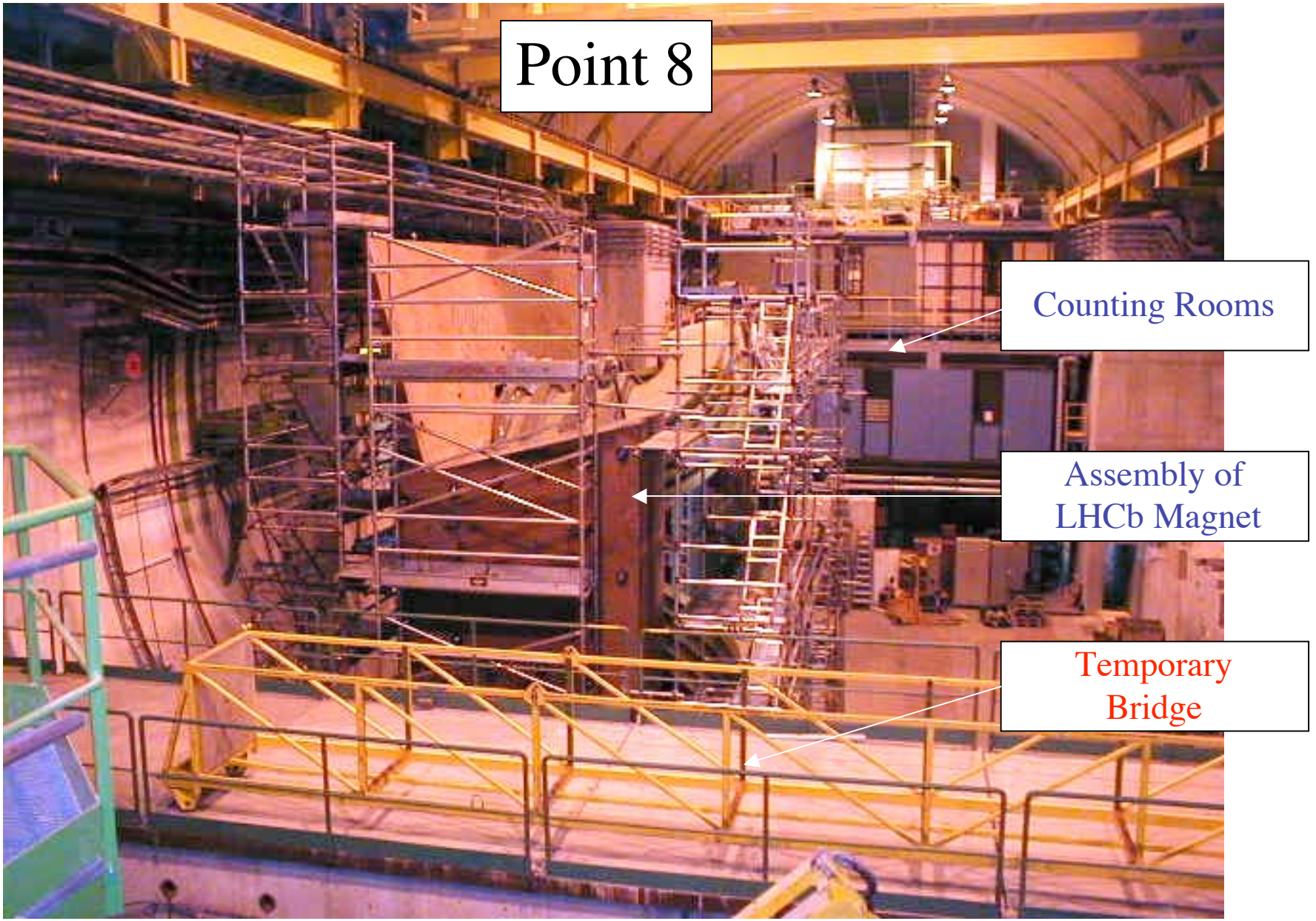
New Technical Associate institute:

University College, Dublin, Ireland

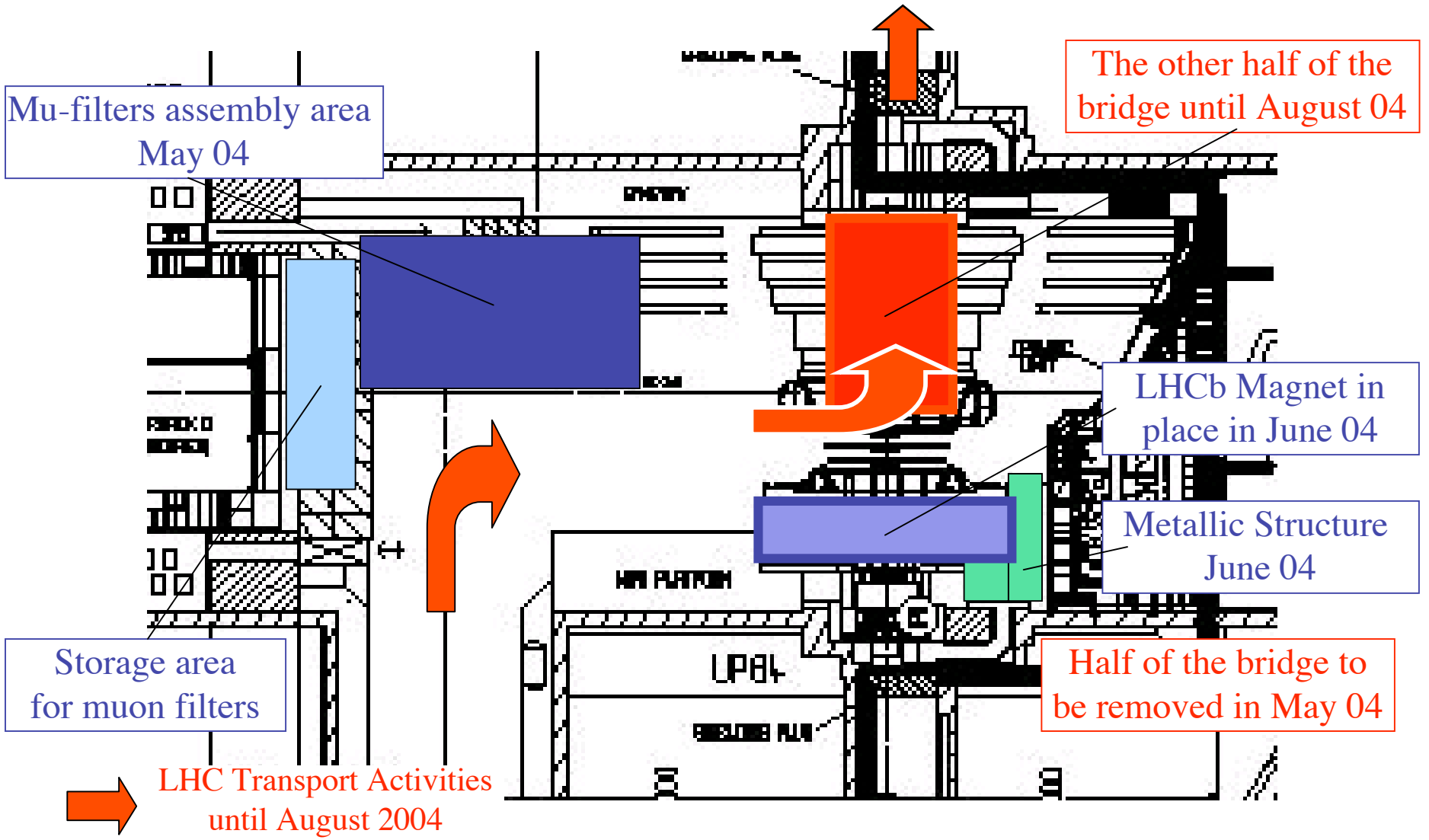
2) Experimental Area

Current status of the UX 85

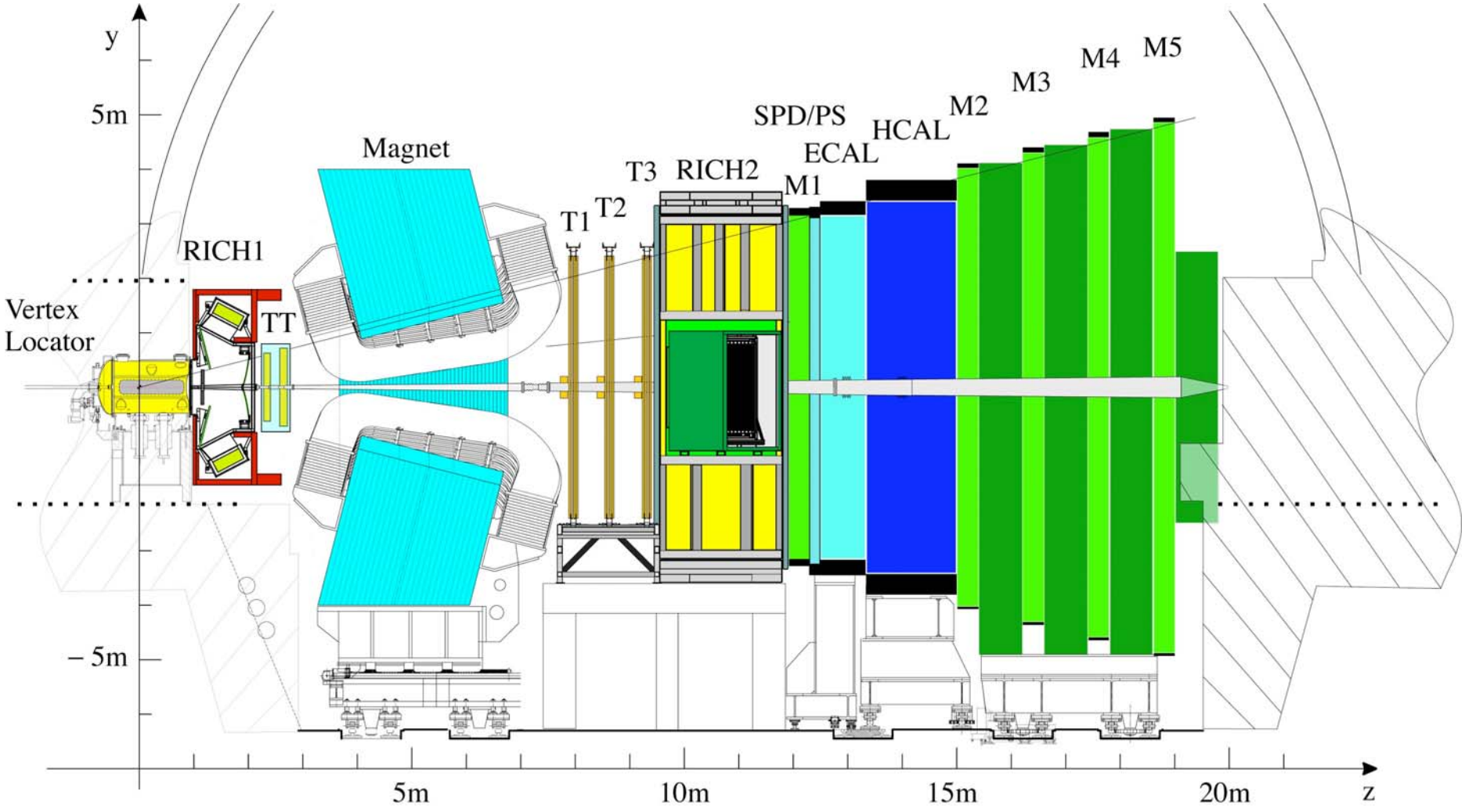



Point 8
Counting Rooms
Assembly of
LHCb Magnet
Temporary
Bridge

Plans for Q2-Q3/04



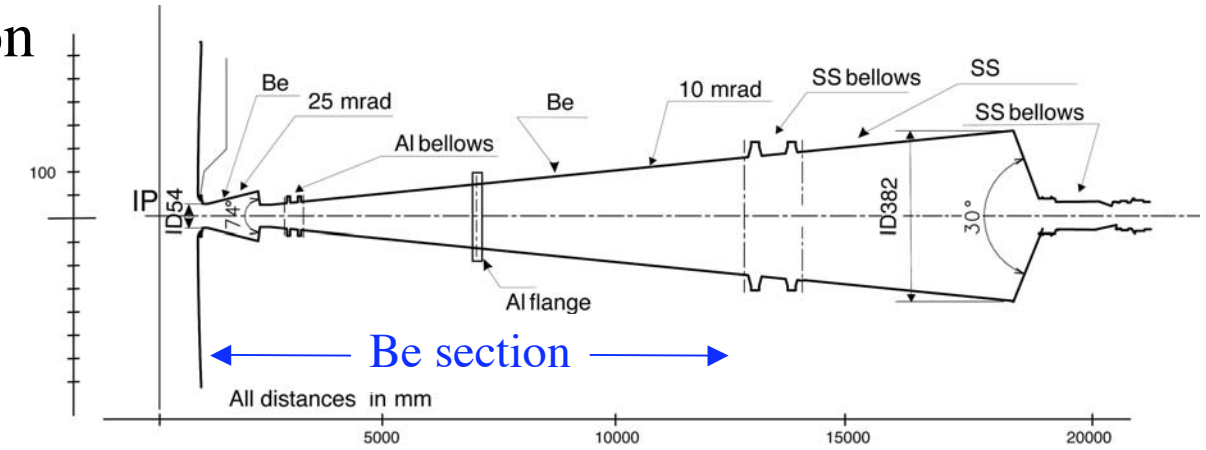
The LHCb detector



3) Detector Status

Detectors under construction

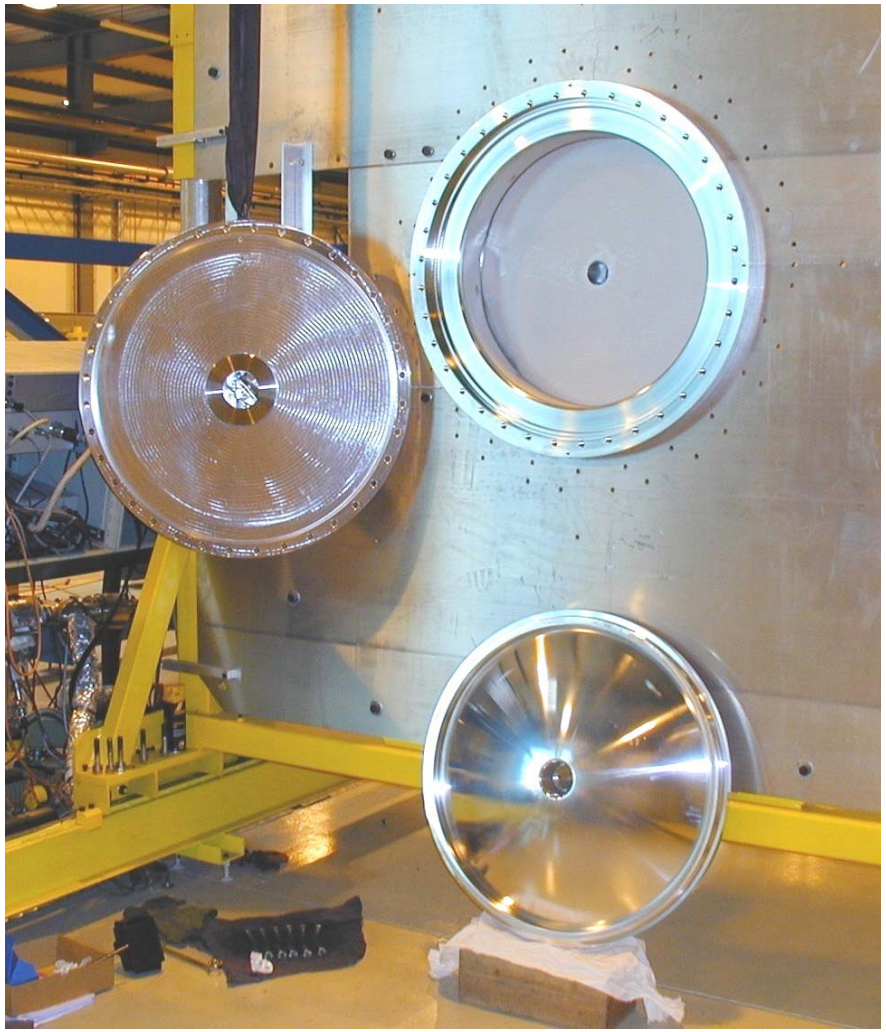
i) Beam pipe



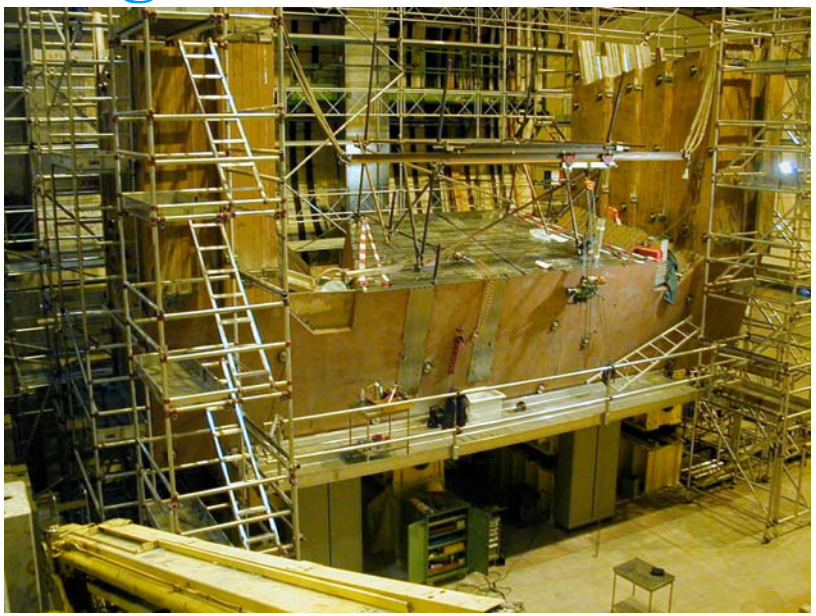
Prototype Be pipe for the 25mrad section qualified as the final product.

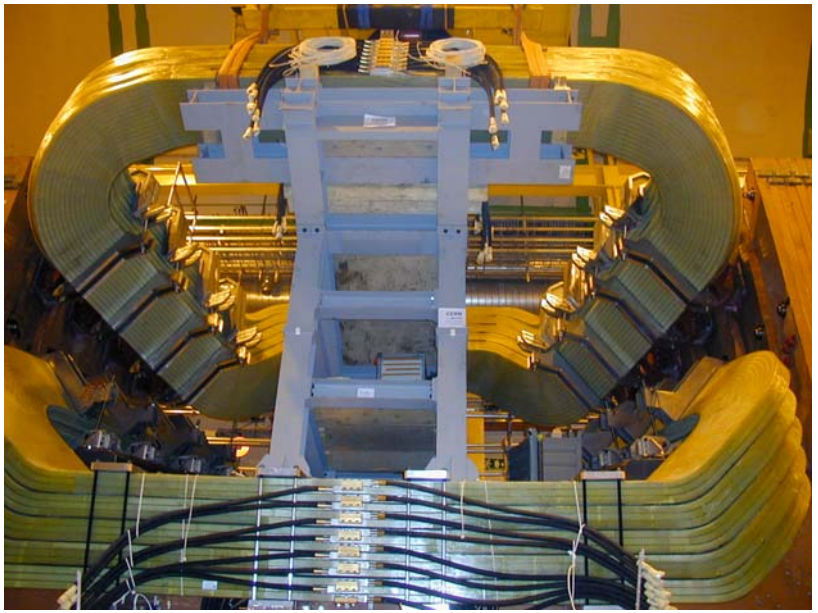
All the Be sections of the beam pipe have been ordered.

Qualification tests for the Al VELO exit window advancing:



ii) Magnet construction well advanced

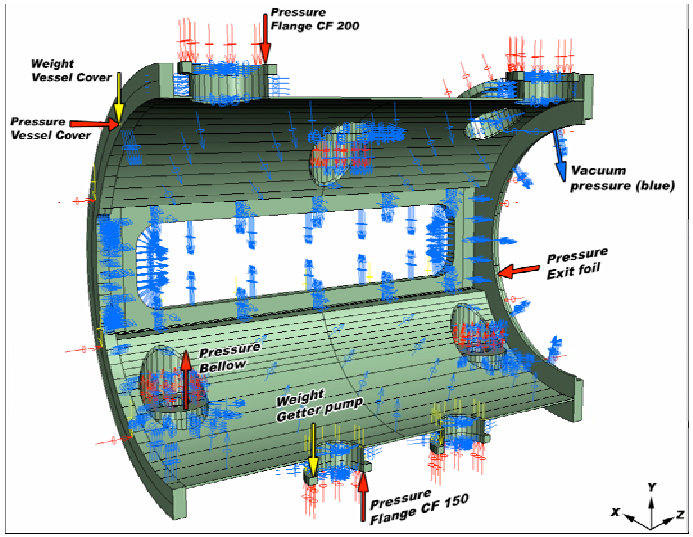




Roll-in to the final position in summer.

iii) VELO Production of the vacuum tank mechanics (NIKHEF)

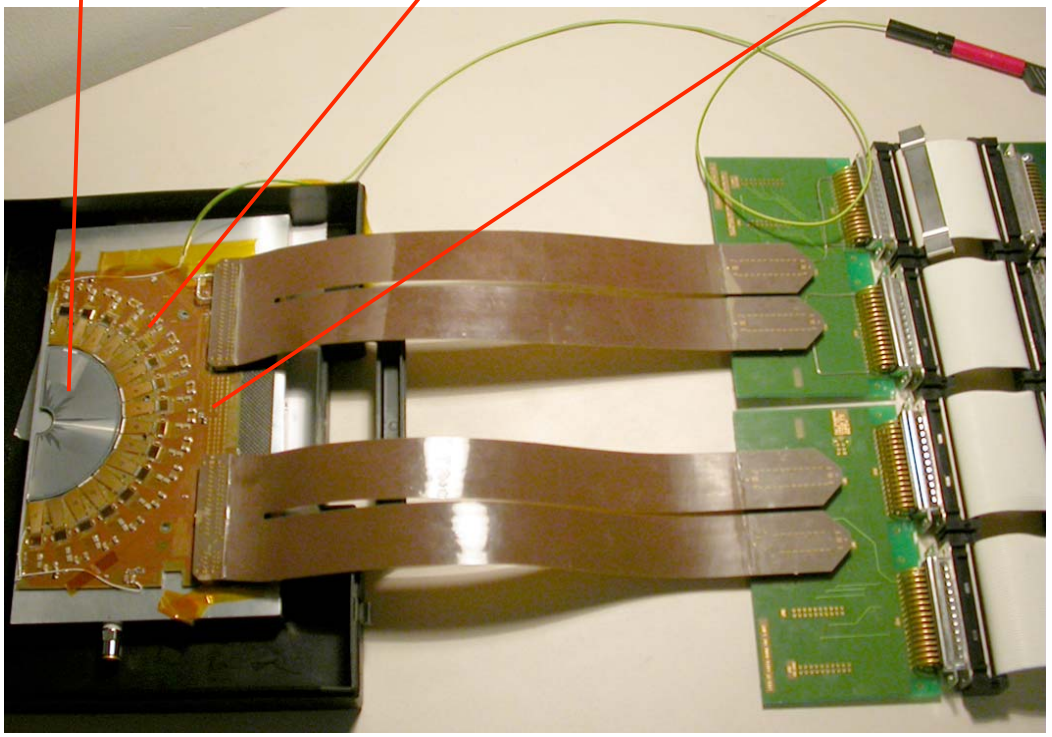
vacuum tank stand and vessel support completed



vacuum vessel ordered

differential pressure control system

Si sensors, front-end electronics and hybrid



Final prototype chain

Sensor purchase finalized
Hybrid pre-series production
Beetle 1.3 engineering run in May

iv) Calorimeter

ECAL module production @ ITEP

100% completed and delivered to CERN

HCAL module production @ IHEP

60% completed and delivered to CERN

20 modules still to be produced (production rate = 4/month)

PMT's for ECAL/HCAL

2175 delivered (total 7800 tubes, delivery = 625/month)

3 test-benches (LAL, CERN-operated by IHEP, ITEP)

1275 tubes tested, rejection rate <5%

Preshower SPD module production @ INR

17% of tiles completed

10k tiles still to be produced (production rate = 48 tiles/day)

PMT's for SPD/Preshower

8 stage MaPMT selected

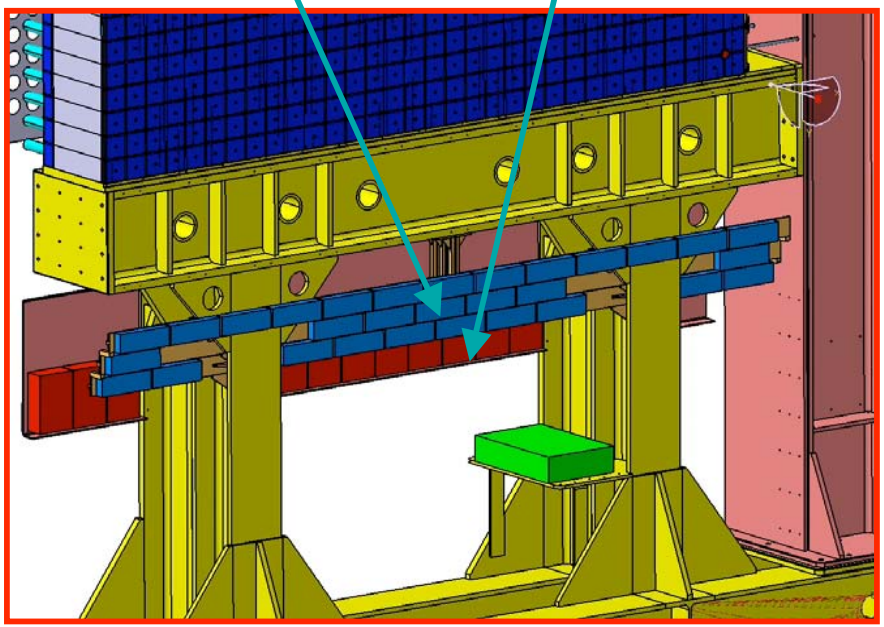
200 tubes needed: order by Summer 2004

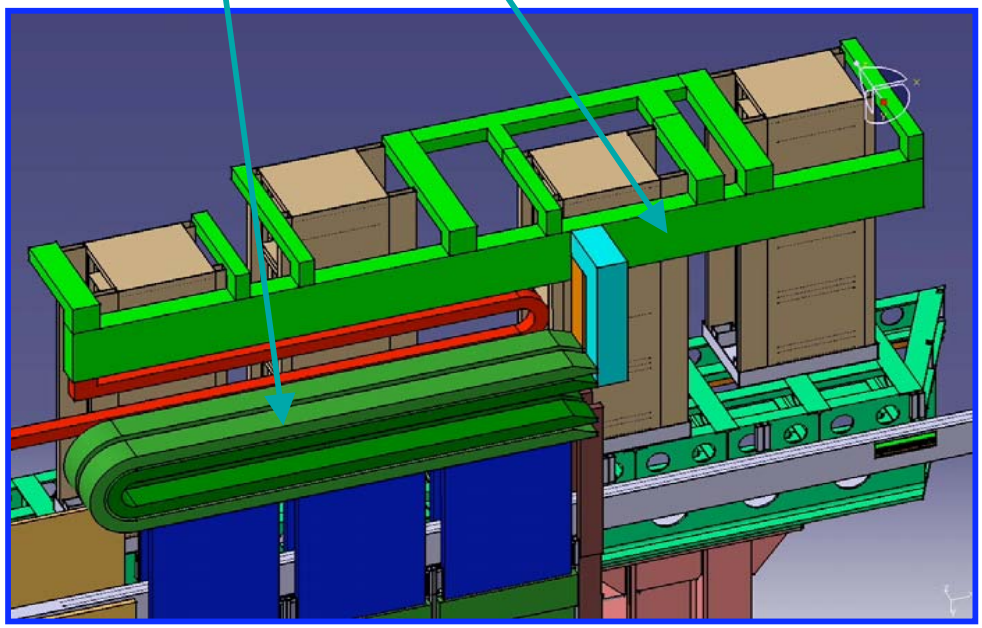
Support structure designed (Annecy)

Light distribution boxes (monitoring system)

HV distribution boxes (CW system)

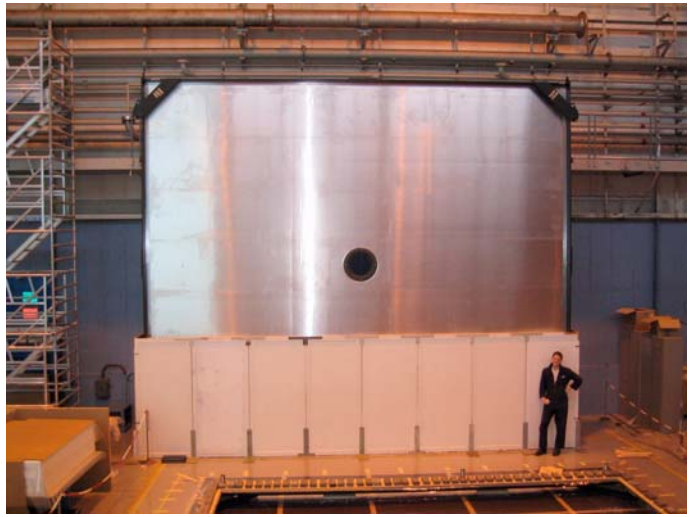
Cable trays (ECAL and PS/SPD)





Chariot to be ordered in May followed by electronics platform a few months later.

v) RICH RICH2 mechanics construction (CERN and UK)

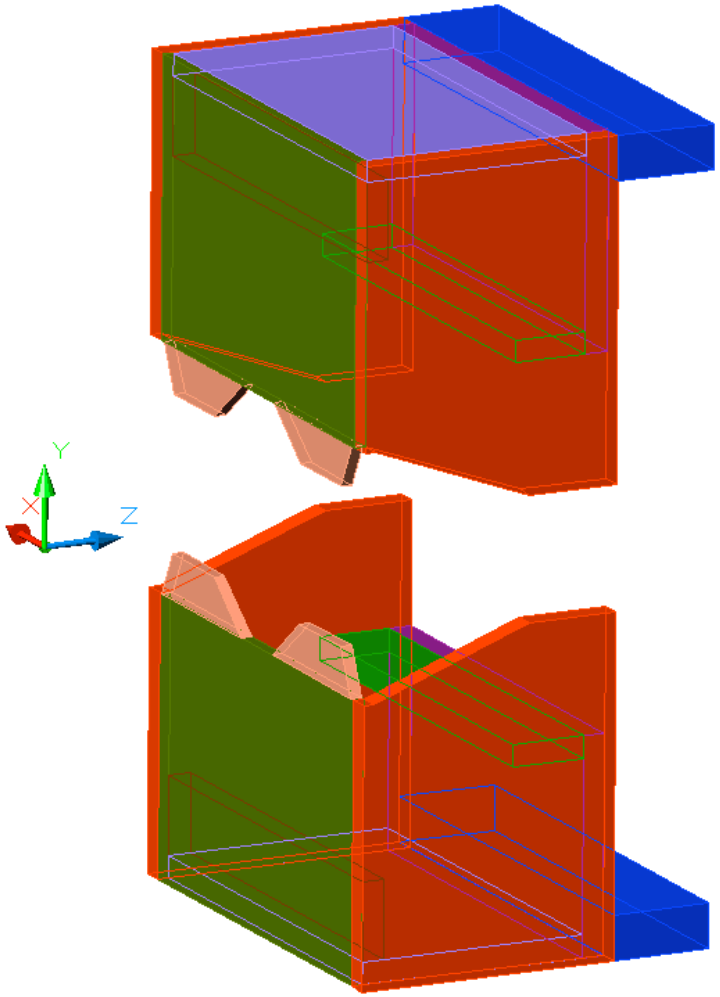


exit/entrance windows

mirror support

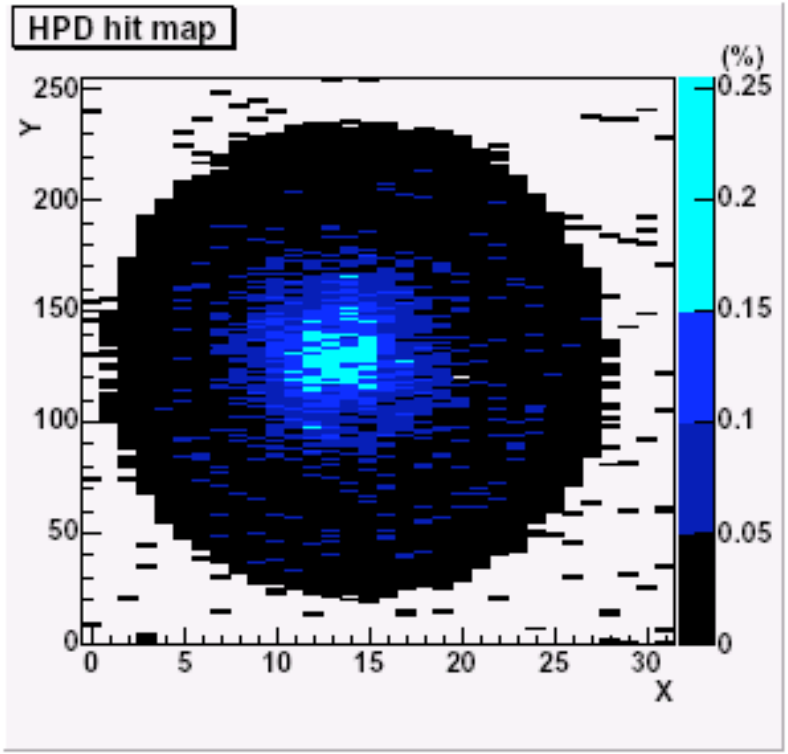
superstructure

RICH1 engineering design



magnetic shielding is a challenge
L1 trigger vs HPD
To be completed by Summer 2004

HPD status



HPD = final choice
Six final prototypes (40 MHz)
five perfect
No problem with the bump
bonding has been detected so far
Tendering procedure in progress

Detectors starting the construction

vi) Outer Tracker

Panel production @ Krakow

Chamber production @ Heidelberg, NIKHEF, Warsaw

Krakow

Heidelberg

NIKHEF

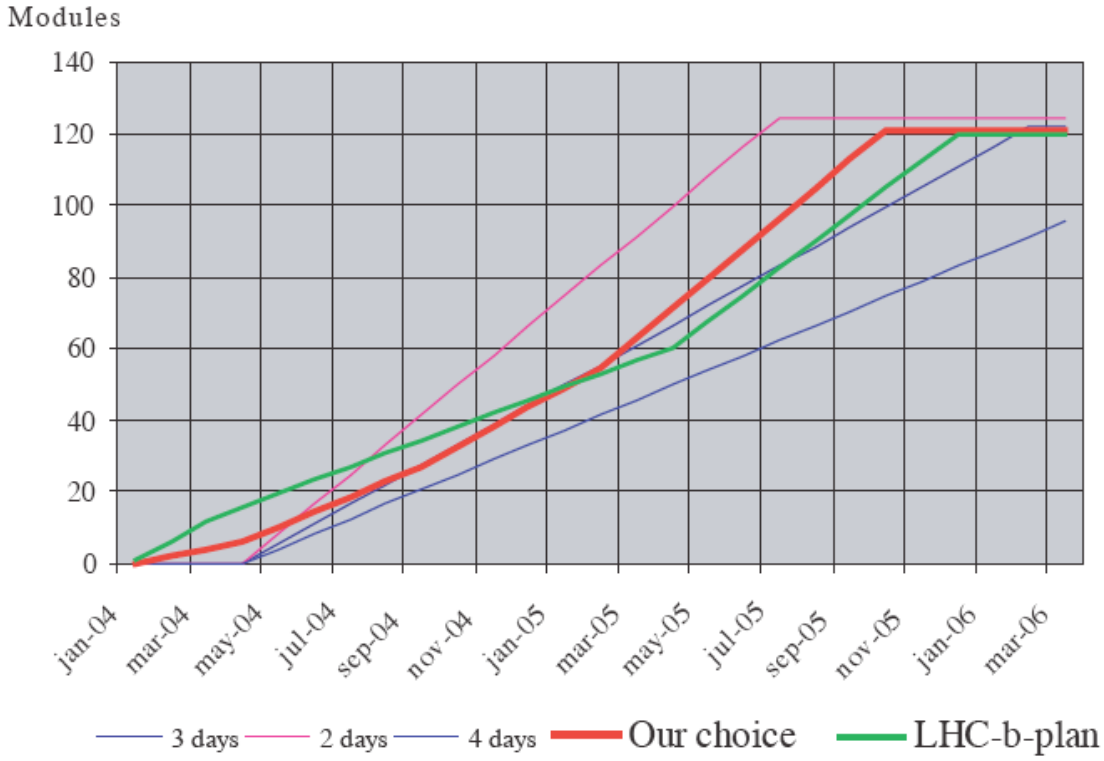
Warsaw

Effort devoted to bringing all centers into production

- All final production tools available in all centers
- Quality Assurance in all centers
- Exchange information, uniformity of construction and QA procedures

One module produced and tested at Heidelberg
Three modules produced and tested at NIKHEF
Two modules produced and tested at Warsaw

- Late by 4 months compared to the schedule.



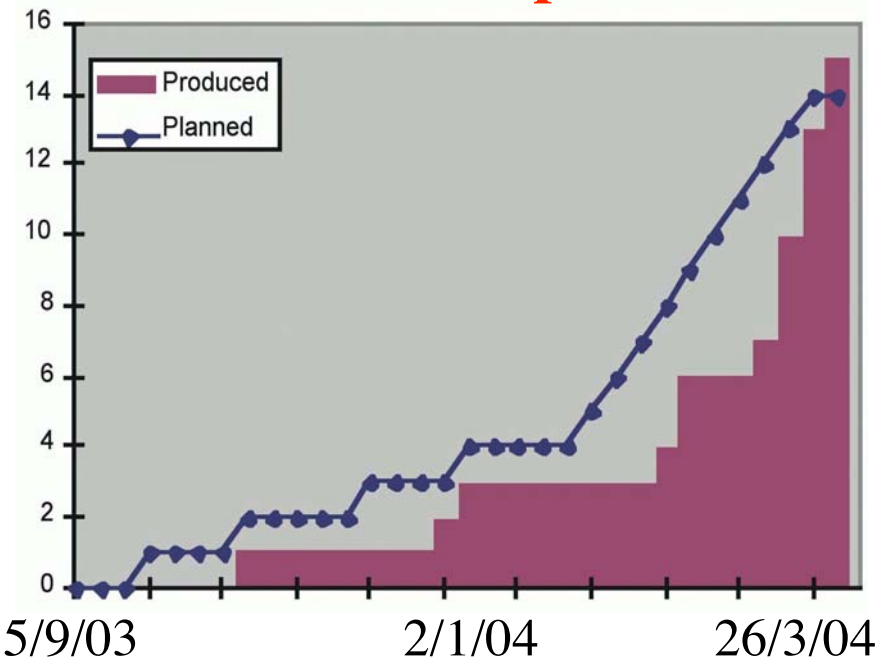
Plans to speed up the production rate under study (example @ NIKHEF)

vii) Muon system

MWPC Serial production has started

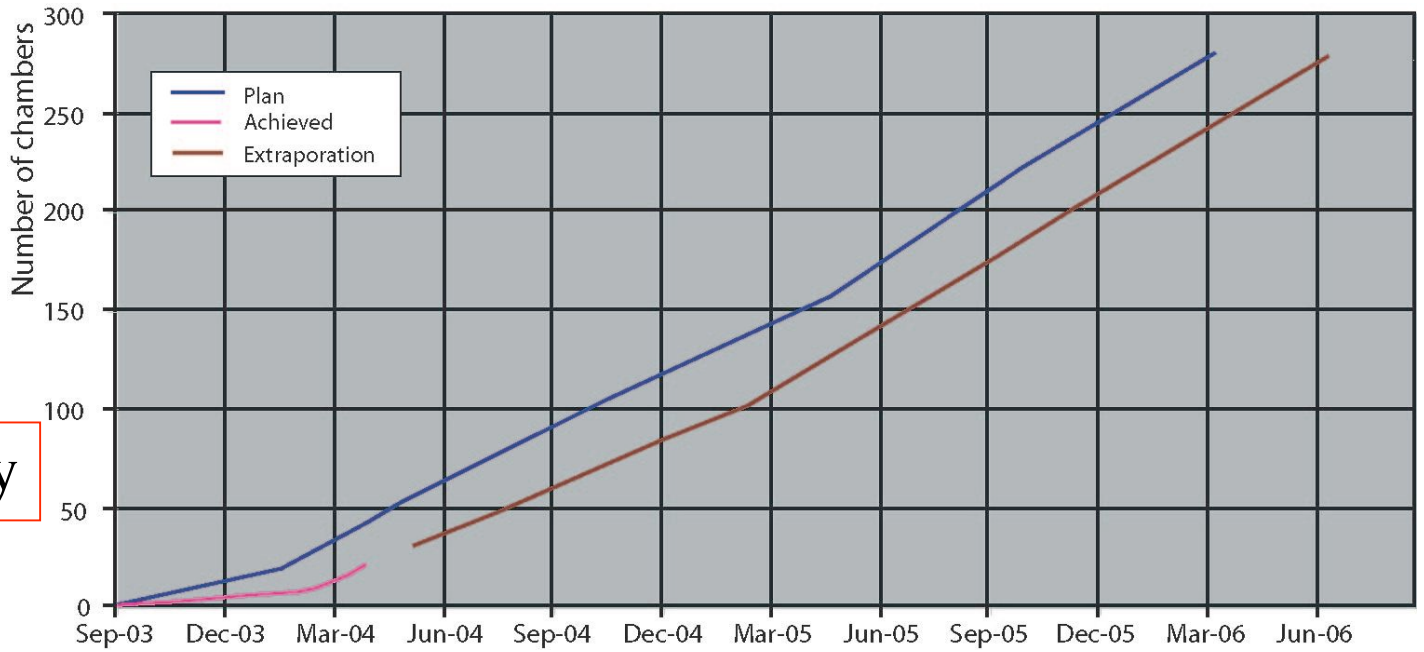
at CERN

on time



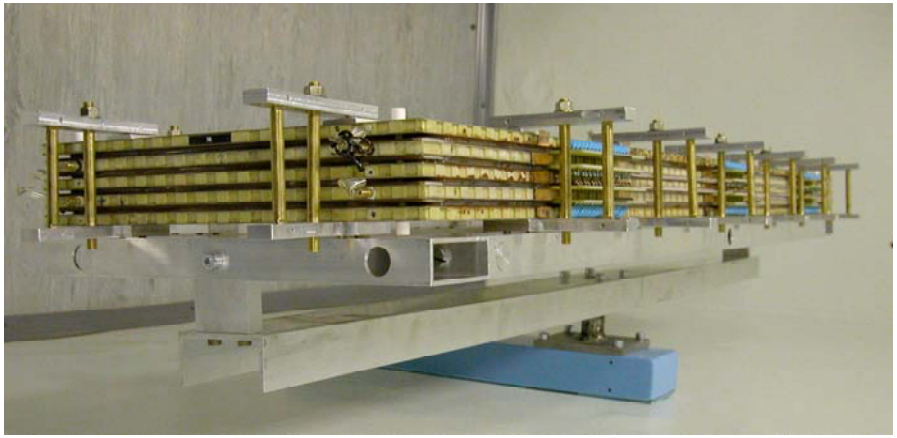
at Frascati

3 months delay



PNPI

wiring machine



Chamber being glued

Ten chambers produced
several months delay

Ferrara

First chamber being produced

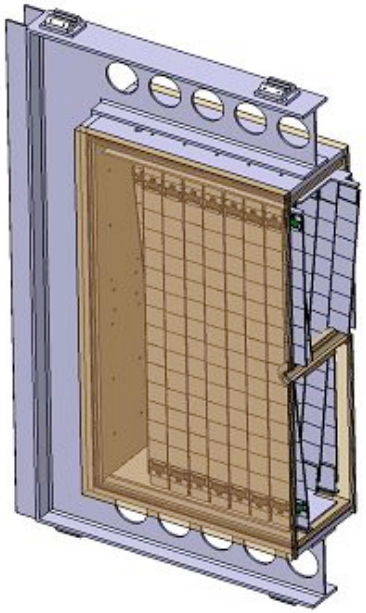
Firenze

getting ready for production

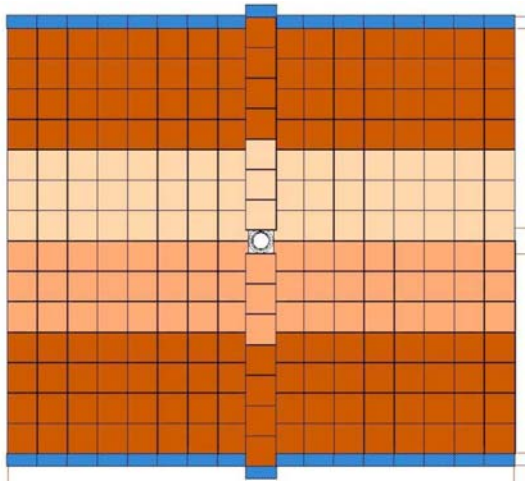
Subsystem finalizing the engineering design

viii) Silicon Tracker

Trigger Tracker

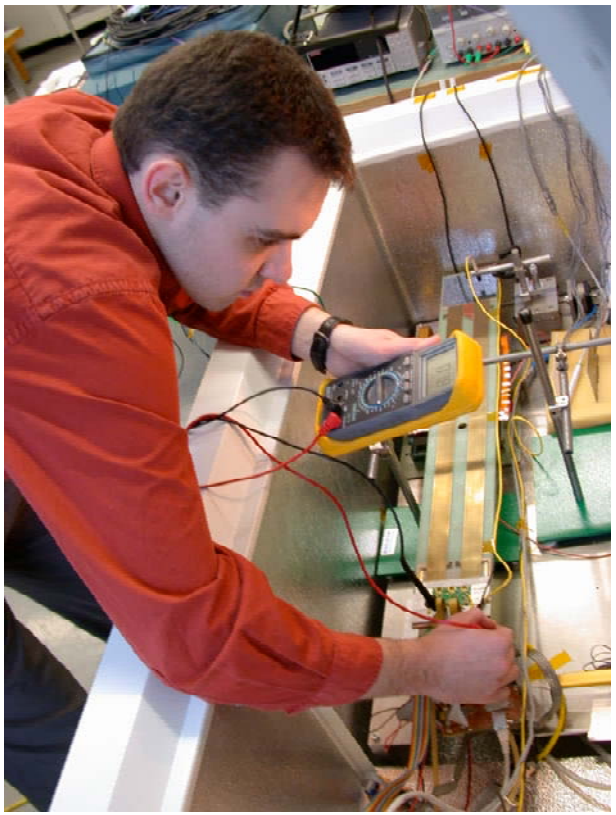


TT station



Sensor layout
using CMS type sensors

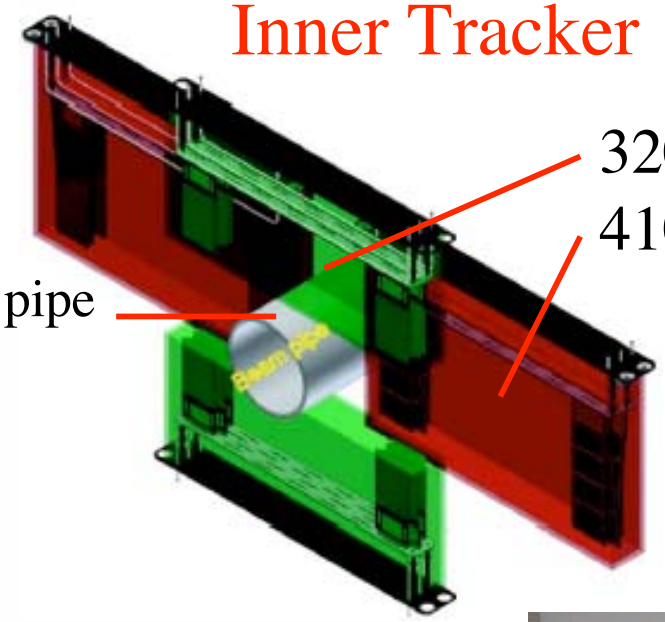
Testing of long Kapton cables

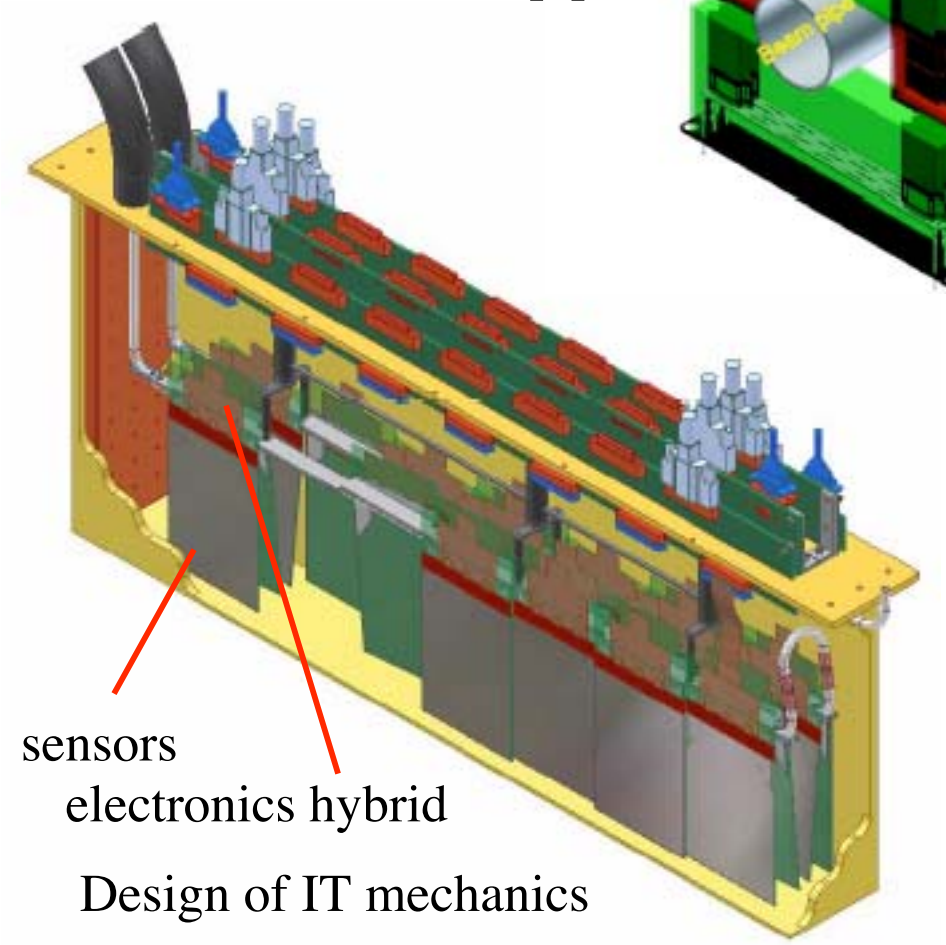


896 sensors, 280 4-Beetle chip hybrids

Sensor (CMS type) order is being prepared.

Inner Tracker





Design of IT mechanics

bonding facility

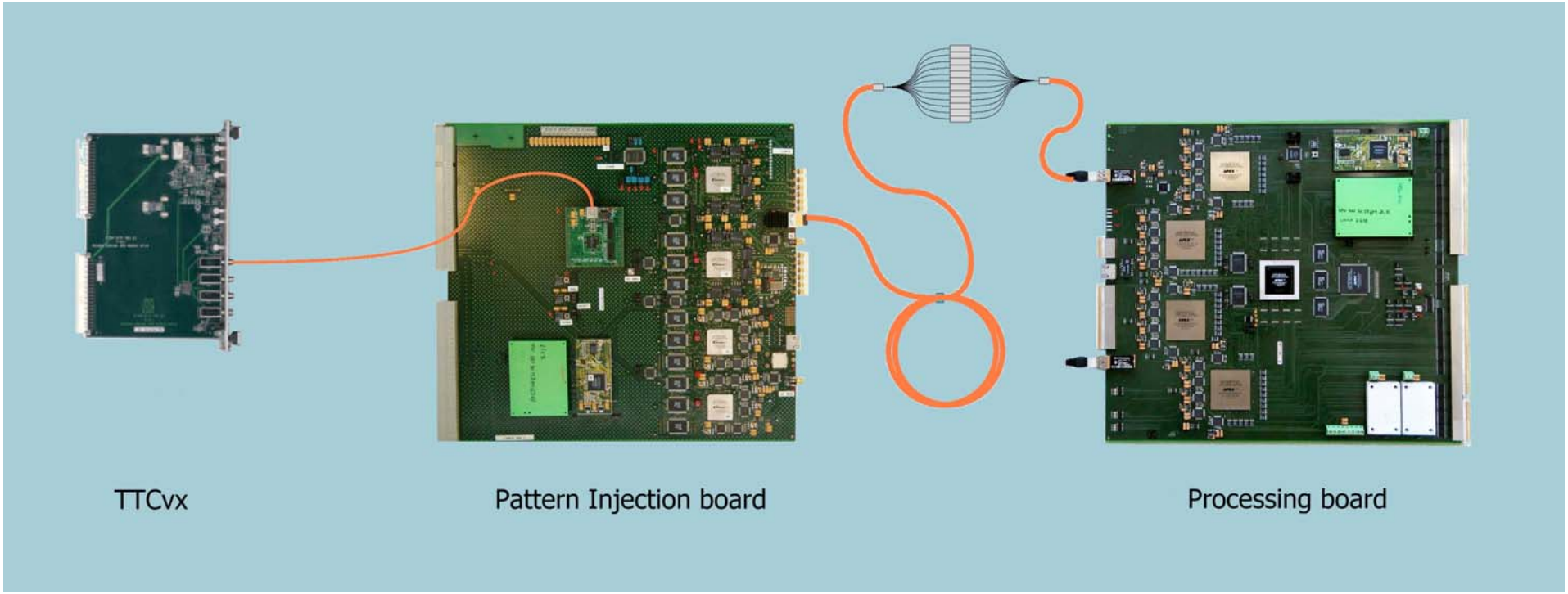
168 (320 μm) + 336 (410 μm) sensors are being ordered

ix) Trigger and Online

Level-0 Trigger project: finalising and testing the hardware components

- Calorimeter trigger
- Muon trigger
- Pile-up
- L0 decision unit

Example: Muon trigger test system



Level-1 and HLT = software trigger

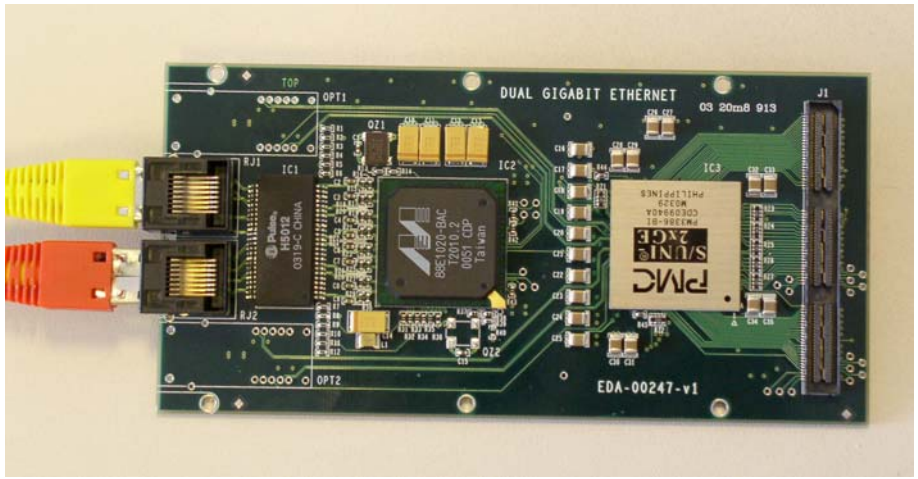
readout, event building, CPU farm: part of DAQ

software developed within the general software framework

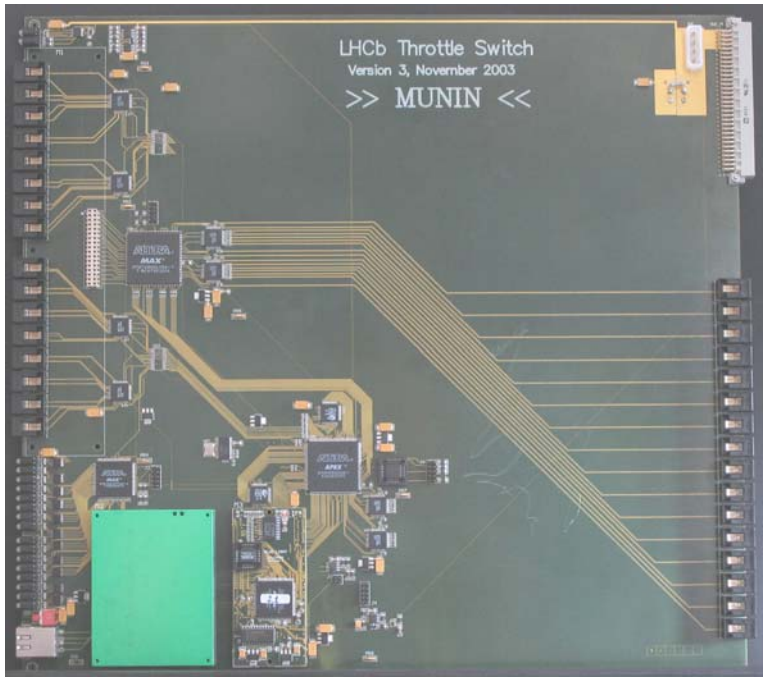
Online project

DAQ, Readout Control, Experimental Control System

Experimental Safety System



Giga-Bit-Ethernet readout board
Production and testing prepared
by Tsinghua



One of the Readout Control Cards
CERN/Warsaw

4) Computing Status

Aspects of offline computing:
- Computing infrastructure
- Core software
- Application software
  - Subsystem, Event reconstruction, Analysis

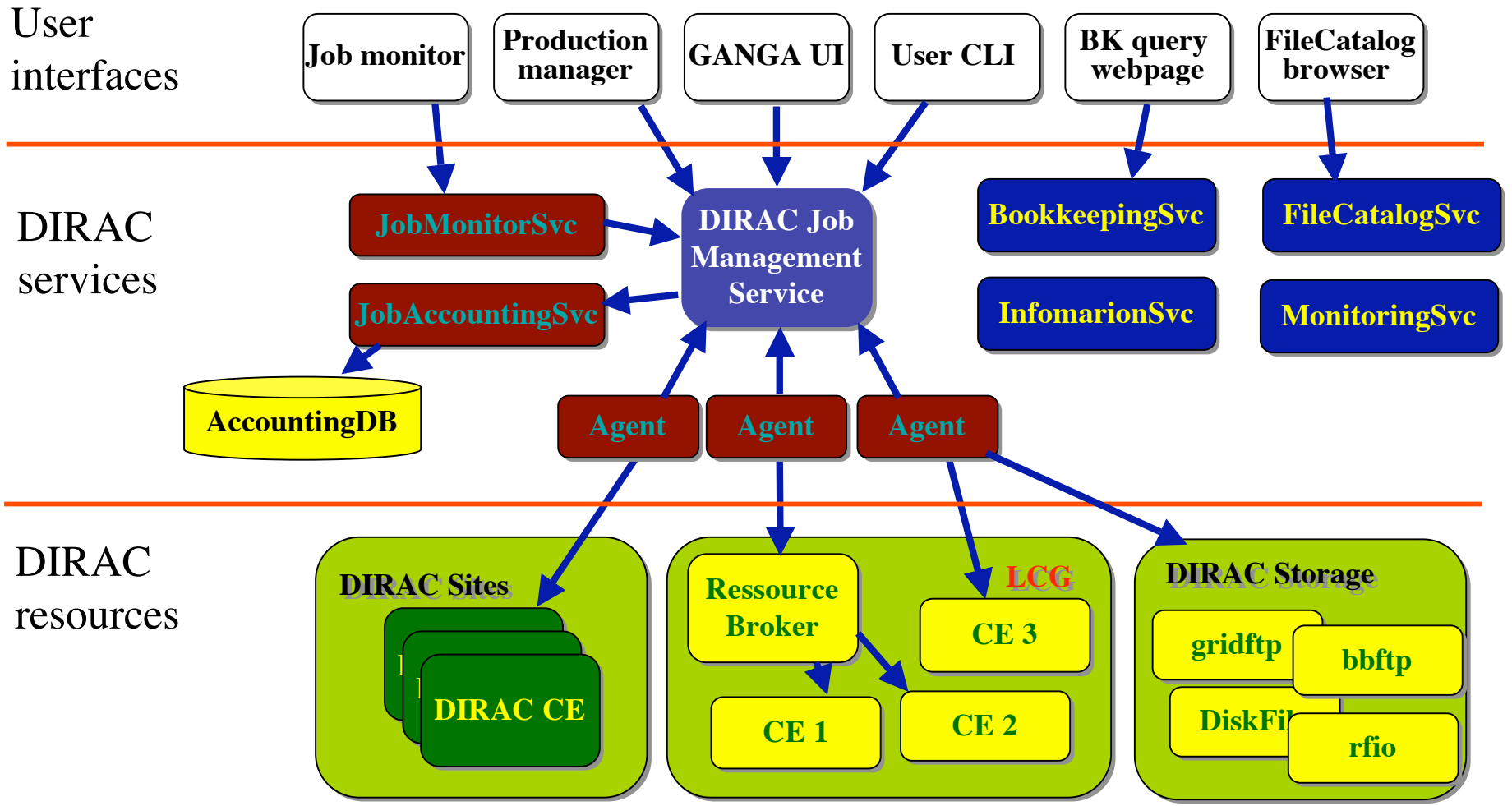
Subsystem software is a responsibility of the subsystem projects

Software manpower for core software is a remaining problem
- -trying to maintain the level of manpower (particularly from CERN)
- -encouraging additional commitment by the outside institutes
  - e.g. software agreement

  LAL-Orsay, UK institutes, UFRJ,

  CPPM-Marseille, Spanish institutes
- -prioritizing the tasks

Data Challenge 2004



170 million MC events generation, reconstruction and analysis in a distributed computing environment starting in May

5) Cost-Funding Matrix Update

Reminder from the last RRB

	MoU	RRB(October 2003)
Cost	75.05 MCHF	72.74 MCHF
	Reoptimization ↘	
	Muon technology change ↗	
Funding	73.30 MCHF requested	70.86 MCHF MoU signed (or about to be signed)
		large missing = Brazil ☹
		increased funding = Italy ☺

Agreed guidelines for the revision of Cost-Funding matrix:

1) Move CERN and Common Funds first to balance
2) Move national funding among the already committed subsystems

Changes from the time of RRB October 2003

HPD chosen as the RICH photon detector

Reduction of the RICH cost: 9566 kCHF → 8486 kCHF

(MoU = 7.7 MCHF, change due to reoptimization
covered by shifting UK and CERN funding)

Total Cost = 72.734 MCHF → **71.654 MCHF**

CERN fund is partially used to balance the other subsystems

RICH (under funding: 500 kCHF → 0)

Silicon Tracker (under funding: 211 kCHF → 0)

DAQ+CPU farm (under funding: 1016 kCHF → 667kCHF)

This level of under funding can be dealt with by starting with a filter farm with 2/3 of CPU's, if no other solution could be found.

The LHCb collaboration would like to ask the authorization from RRB to use this cost-funding matrix as a base for the future (≥ 2005) budget.

	Total funding	CF funding	Project funding	VELO	ST	OT	RICH	PS/SPD	ECAL	HCAL	MUON	L0 Trig	DAQ+ farm	ECS,TFC Comp. inf.	Infra	Magnet
Funding Agency																
Brasil																
China	100	28	72			72										
France IN2P3	7 500	2 100	5 400					1 220	2 000	600		1 580				
Germany BMBF	3 757	864	2 893	370	356	2 167										
Germany MPG	2 200	834	1 366		1 366											
Italy INFN	10 000	2 850	7 150				1 000				4 850	430	870			
Italy INFN spec. contr	600		600								600					
Netherlands	6 300	1 800	4 500	1 250		3 000						250				
Poland	500	140	360			360										
Romania	300	90	210							210						
Russia	2 500	700	1 800					215	582	573	430					
Spain	2 000	570	1 430		800			430						200		
Switzerland	7 900	2 250	5 650	2 142	2 508								500	500		
UK	10 300	2 940	7 360	1 060			6 300									
Ukraine	200	60	140		70					70						
CERN	12 350	3 520	8 830		770		1 186		2 020	1 480	540		1 249	1 585		
CERN spec. in kind contr	4 000		4 000								4 000					
CERN spec. Russian con	350		350					40	100	100	110					
From CF						631		760	3 210	1 320	400		2 425		4 000	6 000
Total project			52 111	4 822	5 870	5 599	8 486	1 905	4 702	3 033	10 530	2 260	2 619	2 285		
Total CF		18 746				631		760	3 210	1 320	400		2 425		4 000	6 000
Total funding	70 857	18 746	52 111	4 822	5 870	6 230	8 486	2 665	7 912	4 353	10 930	2 260	5 044	2 285	4 000	6 000
Updated Cost (Sep 03)	71 654			4 822	5 870	6 230	8 486	2 700	7 960	4 400	10 930	2 260	5 711	2 285	4 000	6 000
Funding balance	- 797							- 35	- 48	- 47			- 667			

Several major orders are still to be placed

→ still some uncertainty in the cost

Increase of Chinese contribution being discussed

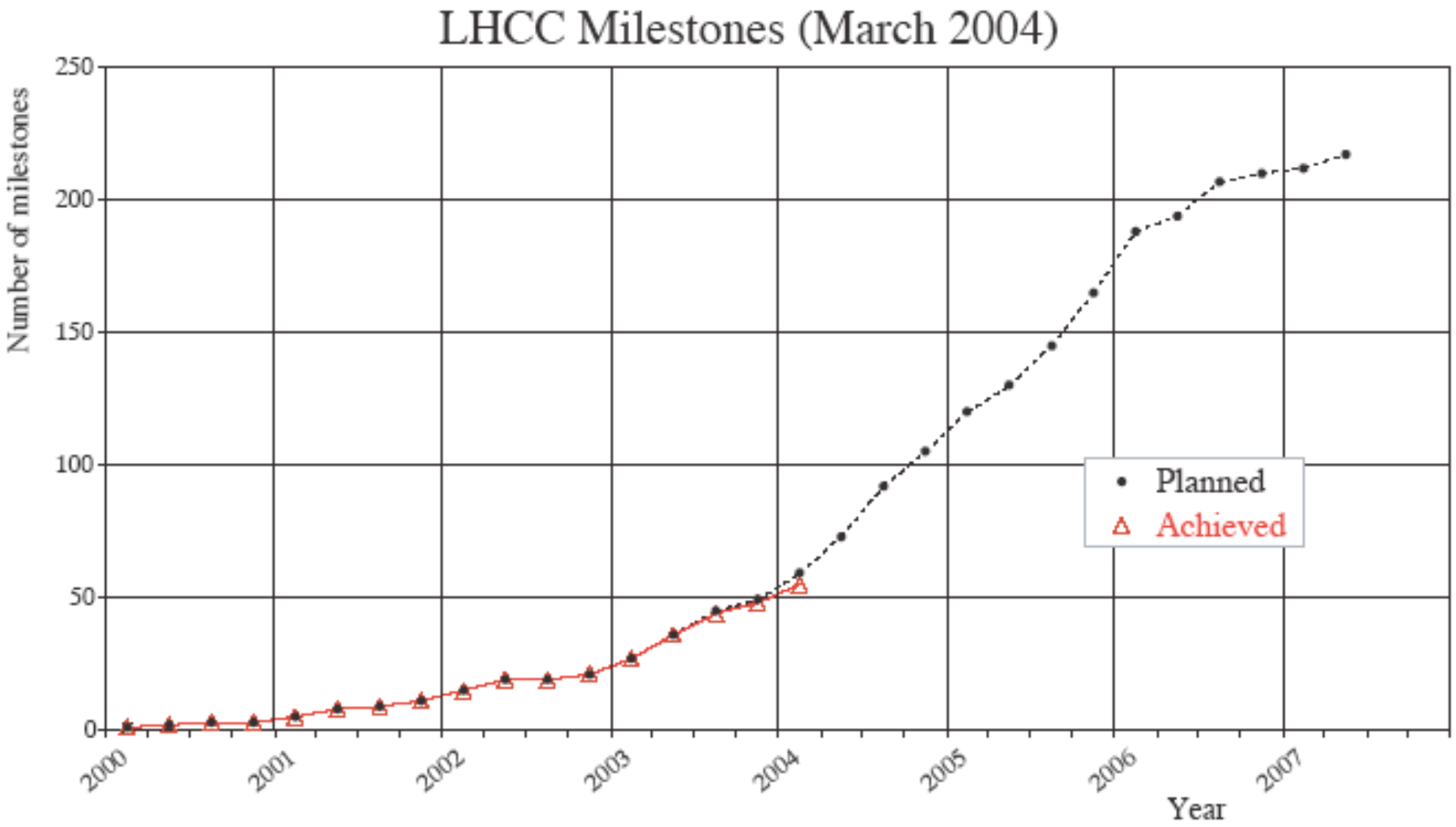
→ possible increase in funding

6) Conclusions

1) Detector construction is advancing well
   - Construction of magnet close to its completion
   - Calorimeter system and RICH-2 mechanics construction well advancing
   - Muon MWPC production started in some centres. Others to follow. Delay in starting up the production; to be followed carefully
   - OT production started in three centres. Delay in reaching the production speed; to be followed carefully
   - VELO mechanics construction making good progress
   - HPD purchase started
   - Si sensor purchase started

   (delay in purchasing at CERN due to the procedural changes)

2) Detector cost is kept within the budget
3) Collaboration is committed for Day One physics


LHCC Milestones (March 2004)
Number of milestones
250
200
150
100
50
0
2000
2001
2002
2003
2004
2005
2006
2007
Year
Planned
Achieved