

CMS

Status Report

T. Virdee
RRB26 14 April 2008

Collaboration News
Construction Progress
Perspectives and Schedule
Financial Plan

Compact Muon Solenoid

Stat. Rep. Doc: CERN-RRB-2008-025



CMS Collaboration

AACHEN-1, AACHEN-3A, AACHEN-3B, ADANA-CUKUROVA, ANKARA-METU, ANTWERPEN, ATHENS, ATOMKI, AUCKLAND, BARI, BEIJING-IHEP, BOGAZICI, BOLOGNA, BOSTON-UNIV, BRISTOL, BROWN-UNIV, BRUNEL, BRUSSEL-VUB, BRUXELLES-ULB, BUDAPEST, CALTECH, CANTERBURY, CARNEGIE-MELLON, CATANIA, CCCS-UWE, CERN, CHANDIGARH, CHEJU, CHICAGO, CHONNAM, CHUNGBUK, CHUNGLI-NCU, COLORADO, CORNELL, DEBRECEN-IEP, DELHI-UNIV, DEMOKRITOS, DESY, DONGSHIN, DUBLIN-UCD, DUBNA, EINDHOVEN, FAIRFIELD, FERMILAB, FIRENZE, FLORIDA-FIU, FLORIDA-STATE, FLORIDA-TECH, FLORIDA-UNIV, FRASCATI, GENOVA, GHENT, HAMBURG-UNIV, HEFEI-USTC, HELSINKI-HIP, HELSINKI-HUT, HEPHY, IOANNINA, IOWA, IPM, ISLAMABAD-NCP, JOHNS-HOPKINS, KANGWON, KANSAS-STATE, KANSAS-UNIV, KARLSRUHE-IEKP, KHARKOV-ISC, KHARKOV-KIPT, KHARKOV-KSU, KONKUK-UNIV, KOREA-UNIV, KYUNGPOOK, LAPP, LAPPEENRANTA-LUT, LEGNARO, LIP, LIVERMORE, LONDON-IC, LOUVAIN, LYON, MADRID-CIEMAT, MADRID-UNIV, MARYLAND, MEXICO-IBEROAM, MEXICO-IPN, MEXICO-PUEBLA, MEXICO-UASLP, MILANO-BICOCCA, MINNESOTA, MINSK-INP, MINSK-NCPHEP, MINSK-RIAPP, MINSK-UNIV, MISSISSIPPI, MIT, MONS, MOSCOW-INR, MOSCOW-ITEP, MOSCOW-LEBEDEV, MOSCOW-MSU, MOSCOW-RDIPE, MUMBAI-BARC, MYASISHCHEV, NAPOLI, NEBRASKA, NICOSIA-UNIV, NORTHEASTERN, NORTHWESTERN, NOTRE DAME, NUST, OHIO-STATE, OVIEDO, PADOVA, PAVIA, PEKING-UNIV, PERUGIA, PISA, POLYTECHNIQUE, PRINCETON, PROTVINO, PSI, PUERTO RICO, PURDUE, PURDUE-CALUMET, RAL, RICE, RIE, RIO-CBPF, RIO-UERJ, RIO-UFRJ, ROCHESTER, ROCKEFELLER, ROMA-1, RUTGERS, SACLAY, SANTANDER, SAO PAULO, SEONAM, SEOUL-EDU, SEOUL-SNU, SHANGHAI-IC, SKK-UNIV, SOFIA-CLMI, SOFIA-INRNE, SOFIA-UNIV, SPLIT-FESB, SPLIT-UNIV, ST-PETERSBURG, STRASBOURG, SUNY-BUFFALO, TAIPEI-NTU, TALLINN, TASHKENT, TBILISI-IHEPI, TBILISI-IPAS, TENNESSEE, TEXAS-TAMU, TEXAS-TECH, TIFR-EHEP, TIFR-HECR, TORINO, TRIESTE, UCDAVIS, UCLA, UCRIVERSIDE, UCSB, UCSD, UNIANDRES, VANDERBILT, VILNIUS-ACADEMY, VILNIUS-UNIV, VINCA, VIRGINIA-TECH, VIRGINIA-UNIV, WARSAW-IEP, WARSAW-INS, WARSAW-ISE, WAYNE, WISCONSIN, WONKWANG, YEREVAN, ZAGREB-RUDJER, ZURICH-ETH, ZURICH-UNIV

April 2008: 184 Institutions with about 2930 scientists and engineers

Voted In since Oct 2007 RRB

Full Membership

Wayne State University, Detroit, USA (Paul Karchin)

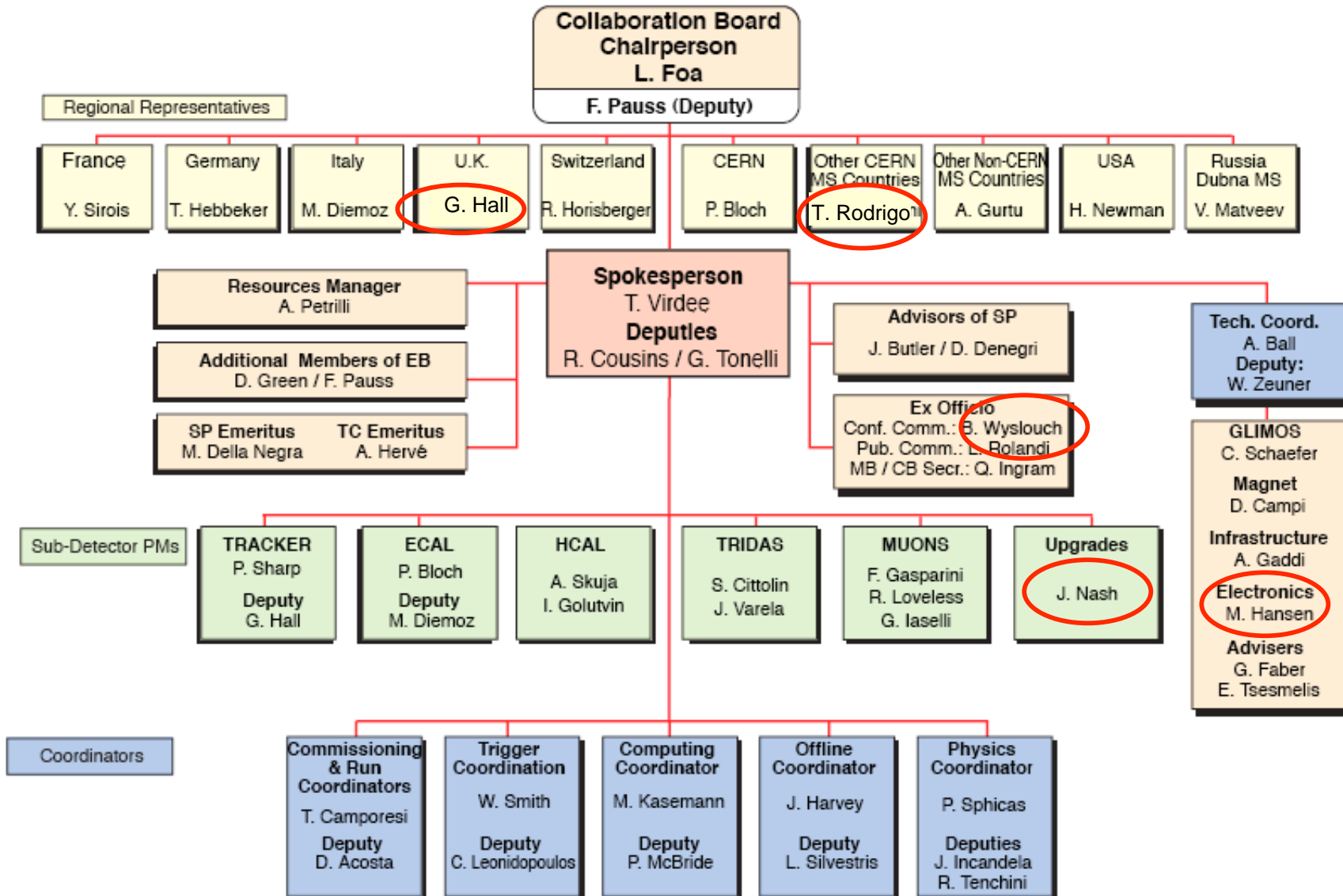
Associate Membership

Central Laboratory of Mechatronics and Instrumentation of the Bulgarian Academy of Sciences, Sofia (Roman Zahariev)



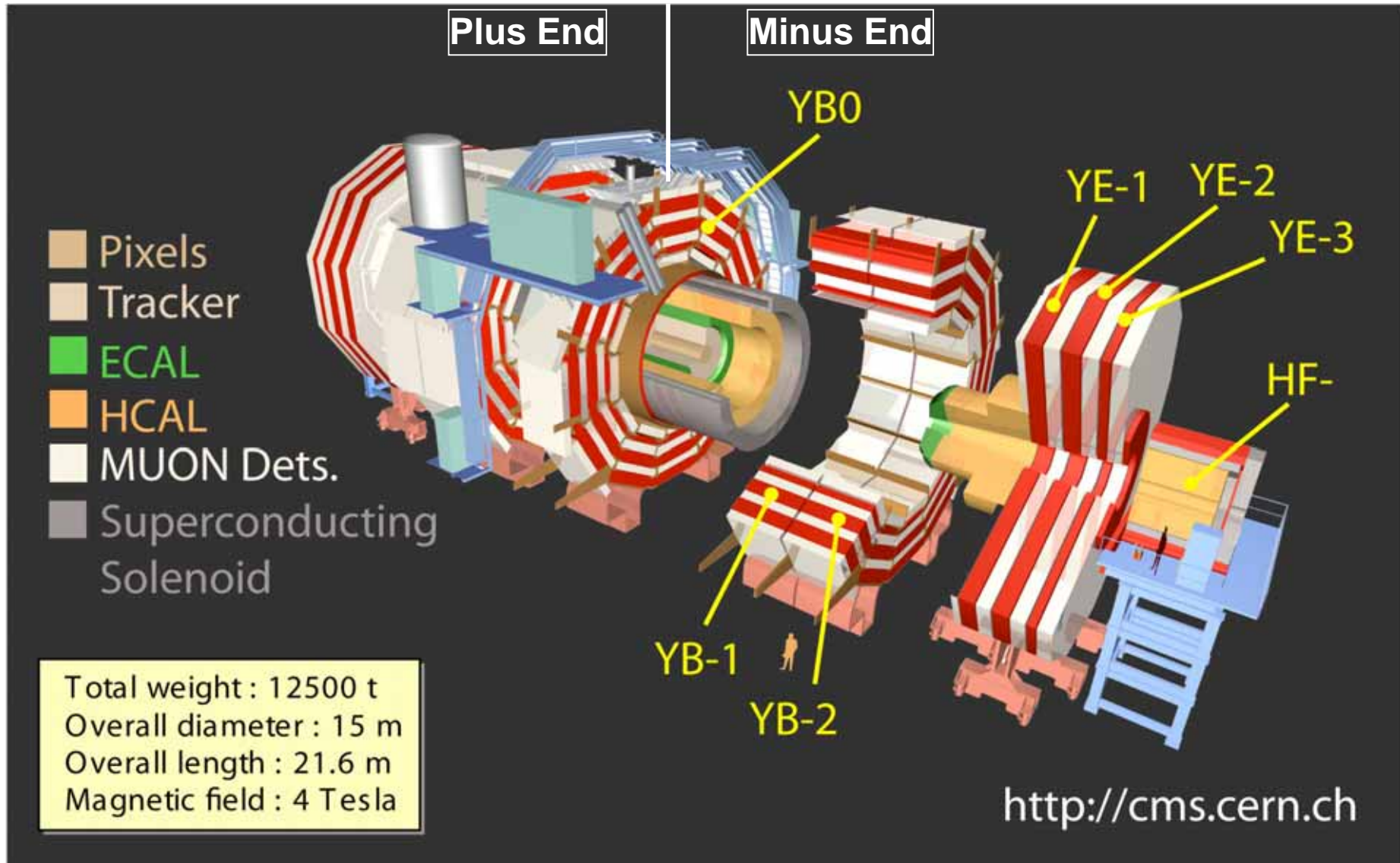
CMS Management Board

D. Green (FNAL) has been elected as Chairperson of CB (Term: 1 Jan09 - 31 Dec10)





Exploded View of CMS





**CMS has made considerable progress
since the Last RRB**

Illustrate this mostly with photographs

Visit of CMS after this RRB



Situation in Feb 2007





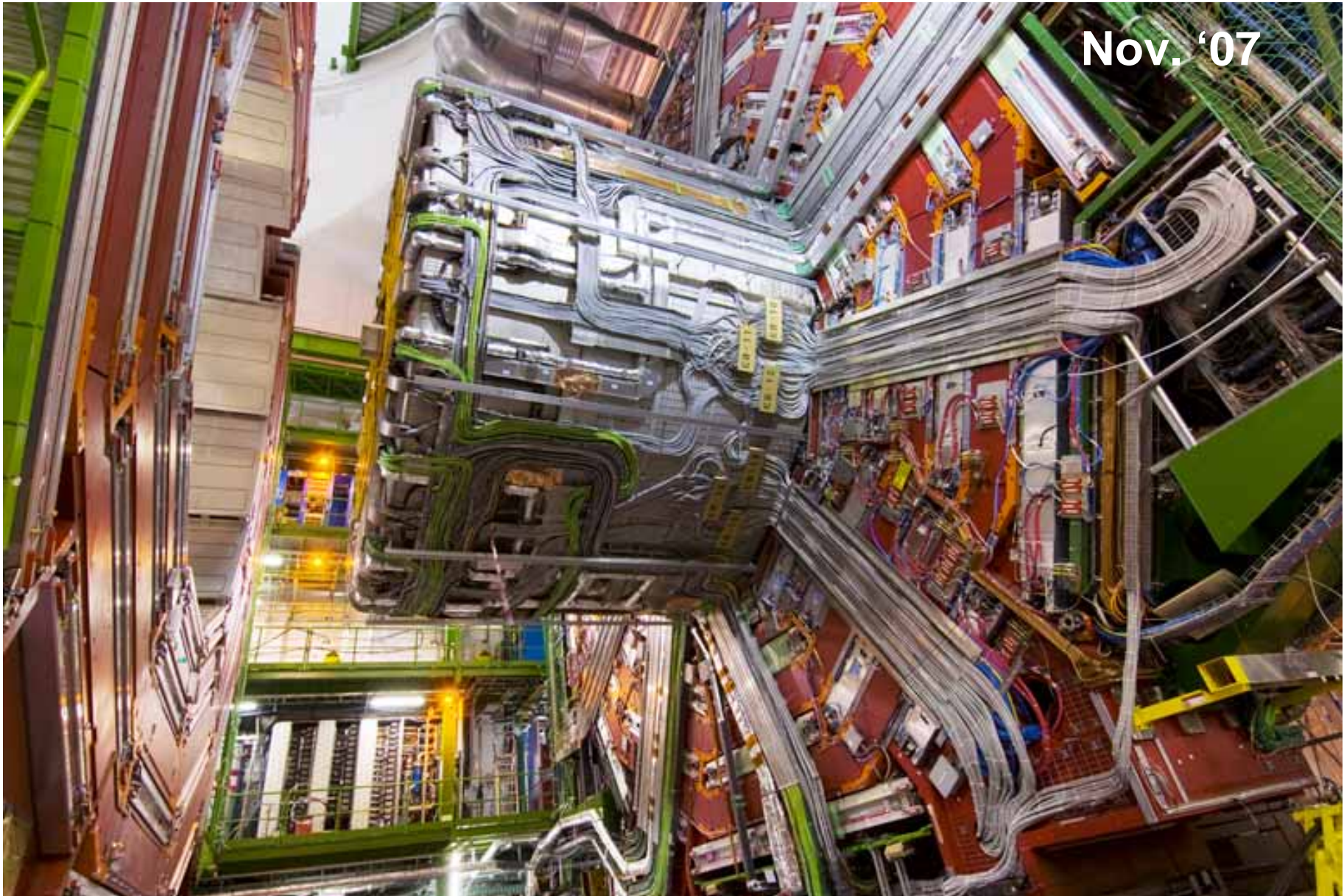
Last RRB: Situation with YB0 Services





Completion of Services Installation on YB0

Nov. '07





Tracker Delivered to Point 5



~ 3 am 13/12/07.

Message from Austin Ball at 4 am

Package arrived safely.

Contents:

1 Silicon Tracker.

10M channels.

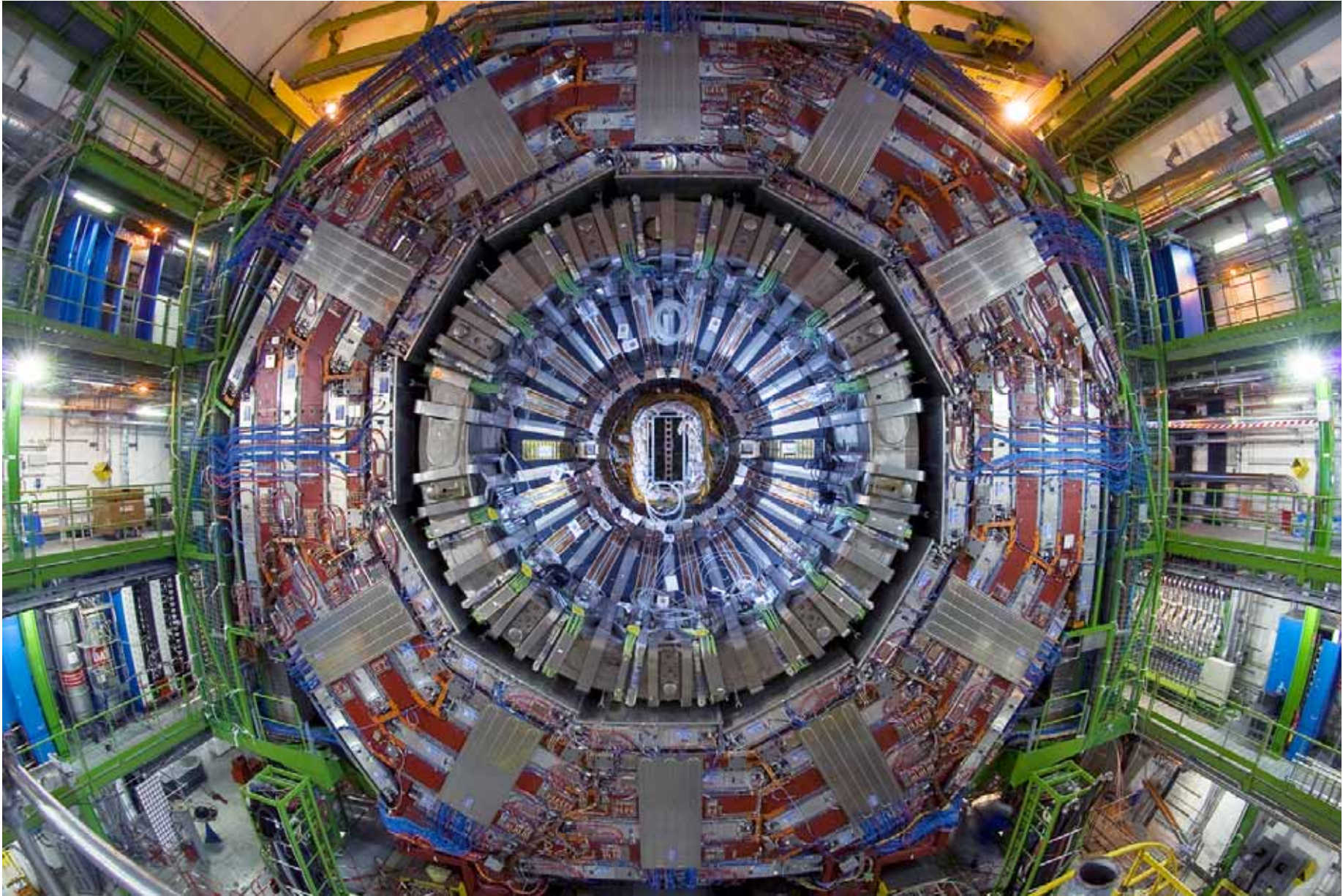
Some assembly required.

Batteries not included.

Cheers, A



Tracker Insertion (15 Dec'07)





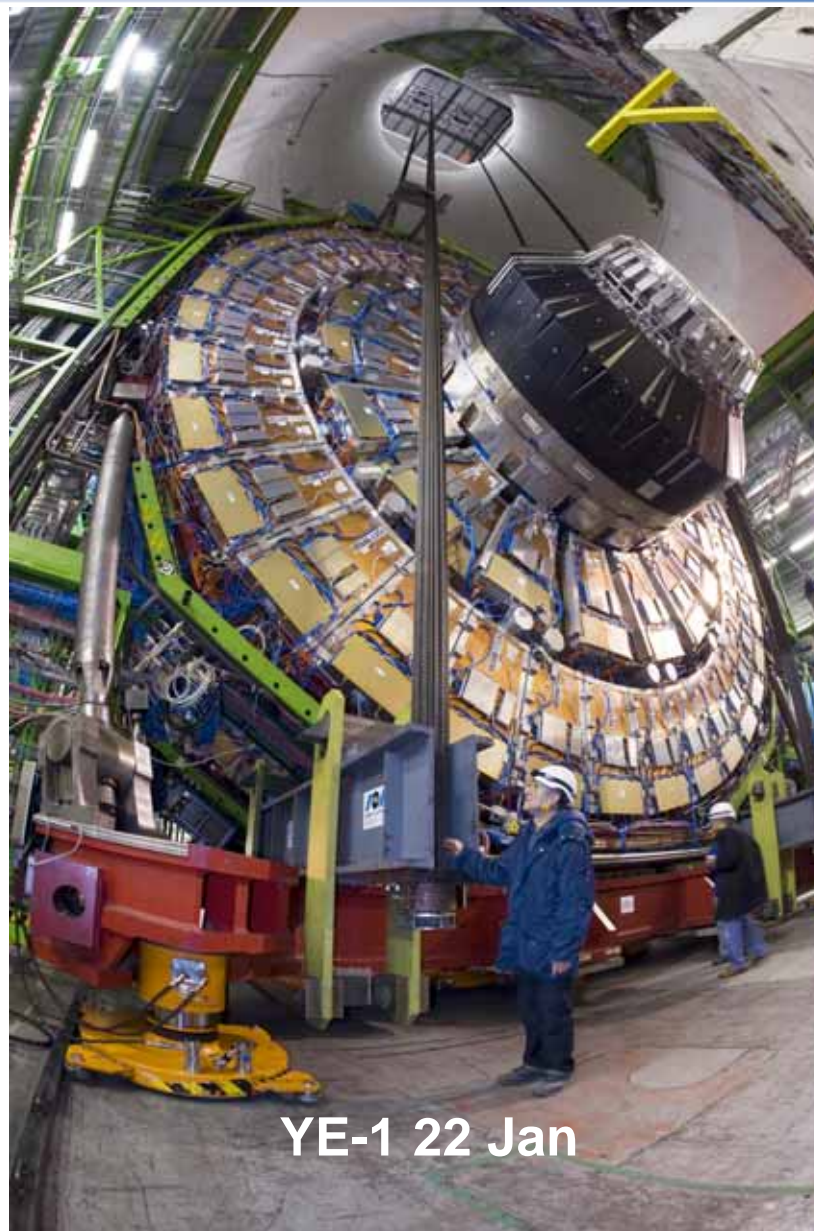
Lowering of Last Heavy Element: YE-1

All 15 **heavy elements** are underground.

YE-2 and YE-1 were lowered in Jan08

Ended a surface construction phase that lasted over 8 years.

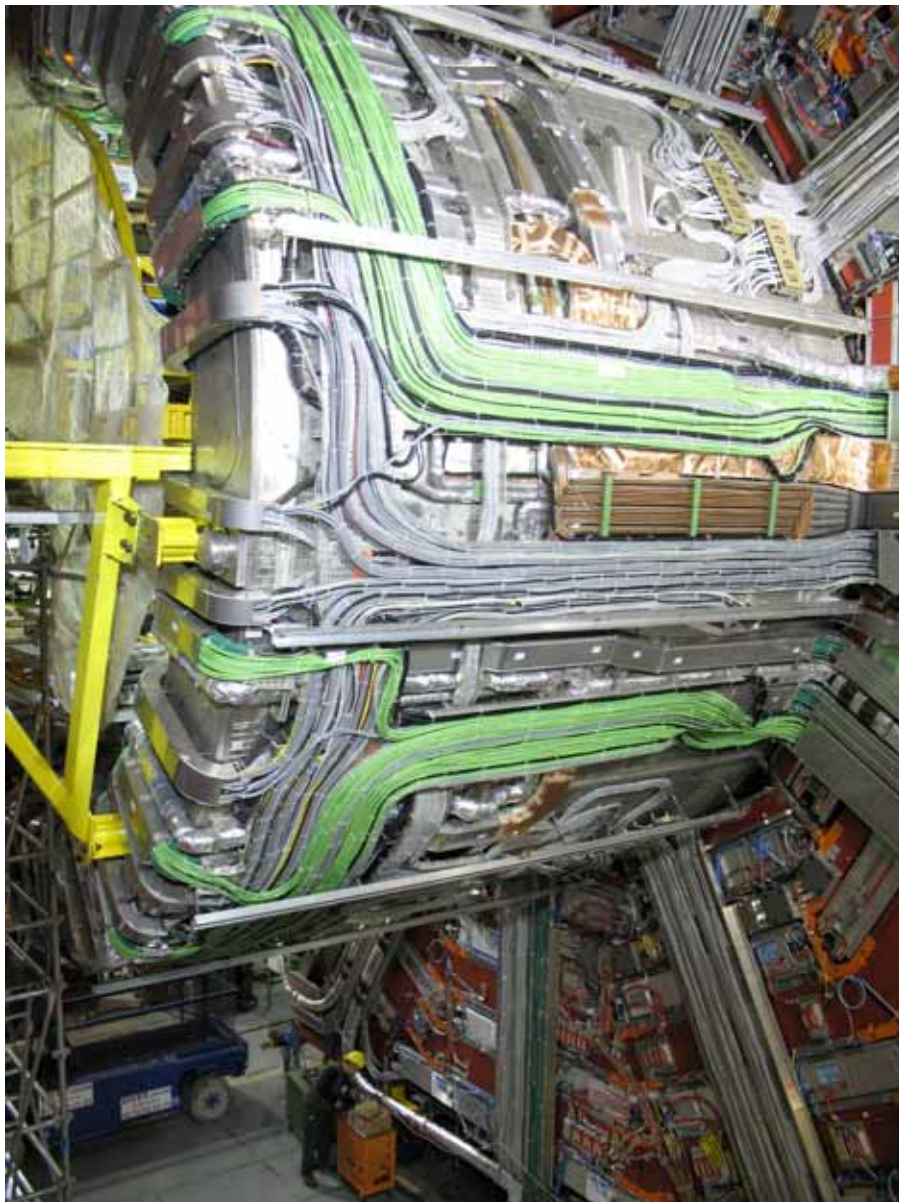
Definitive closure of CMS has started: all 5 barrel wheels are now locked into position.



YE-1 22 Jan

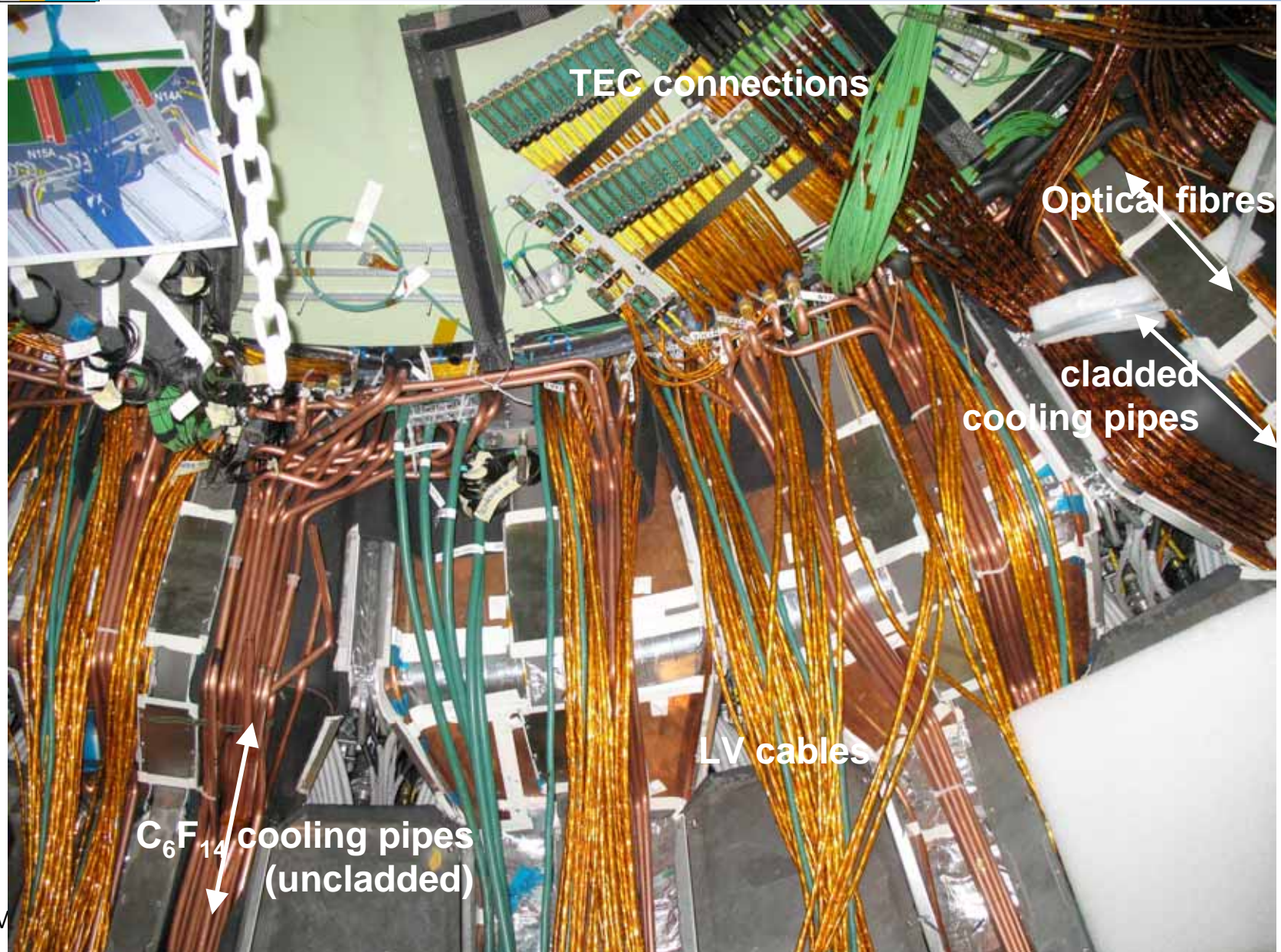


Installing Thermal Screens





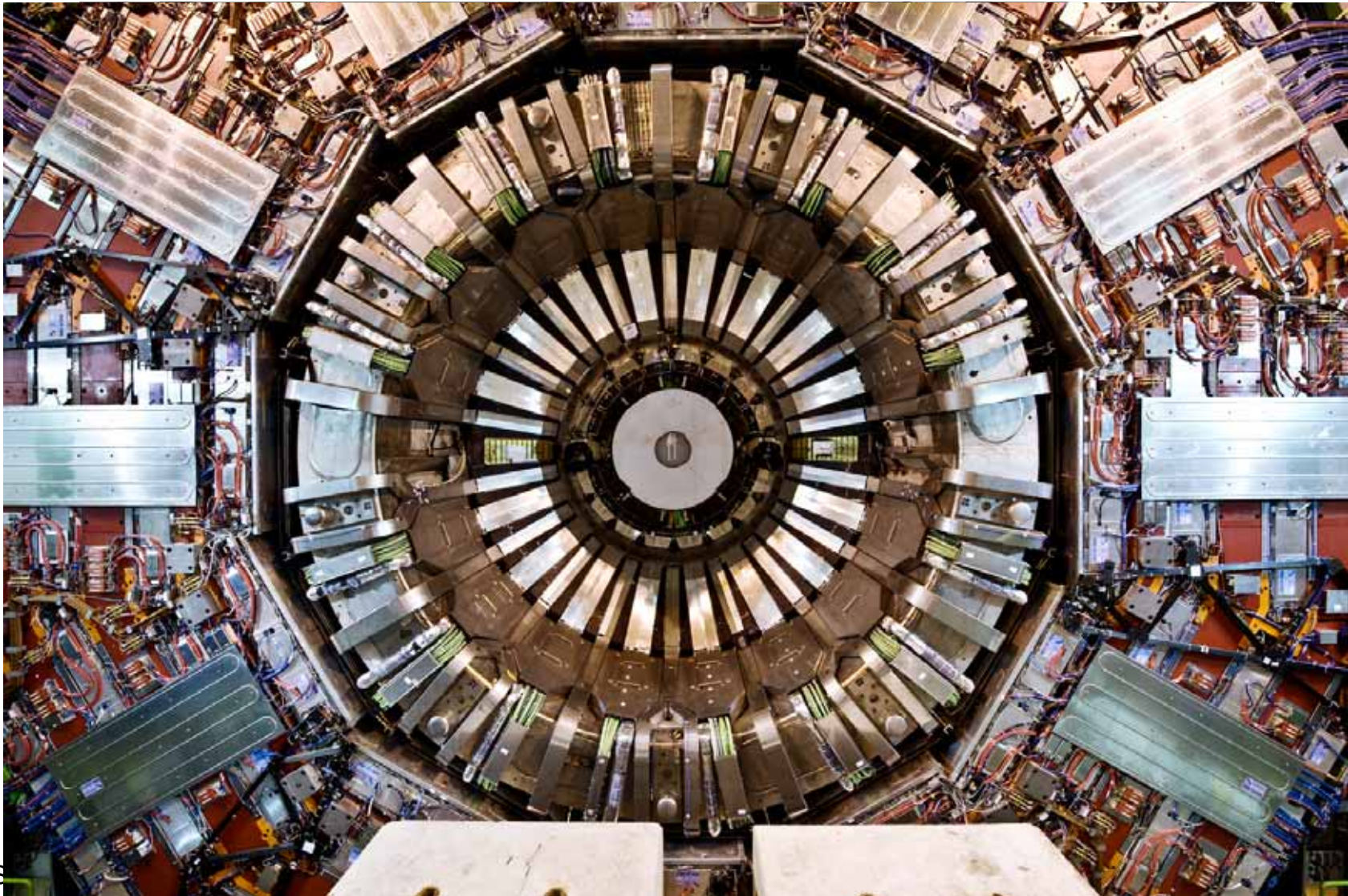
Connecting the Tracker





Tracker Connected

Connections from bulkhead to PP1 DONE before Easter



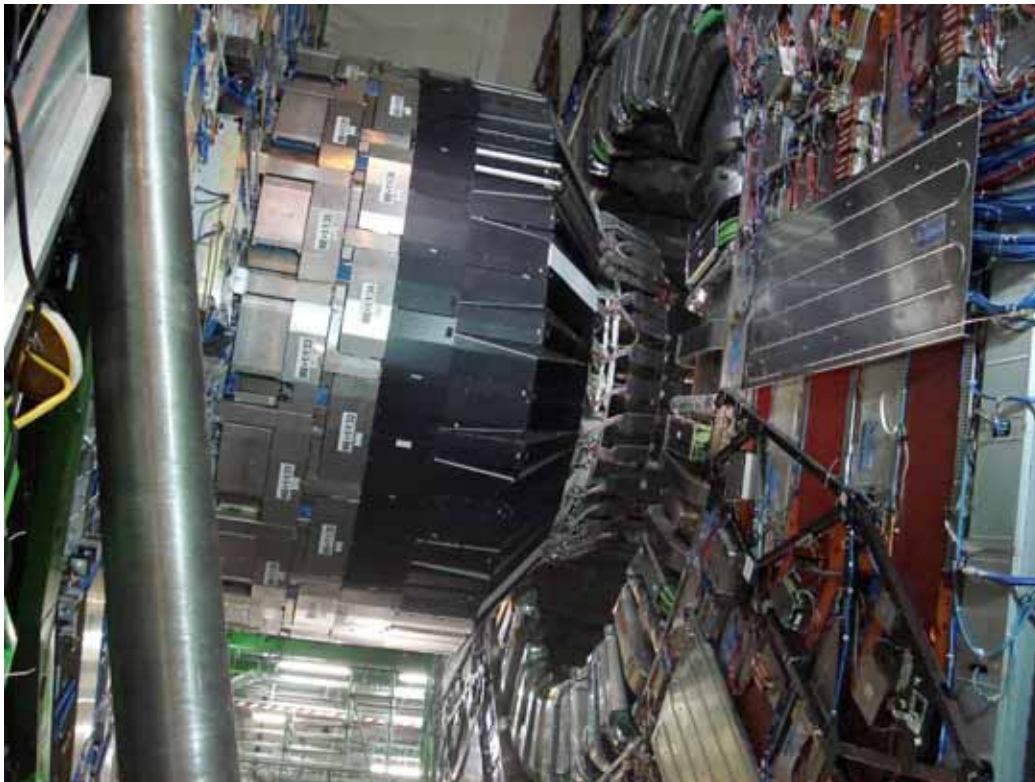


Trial Closure of + end

Test closure from 10.5 m fully open position, before beampipe adds additional complication.

Successfully completed on 10, 11 April.

Clearances and timescale are as designed



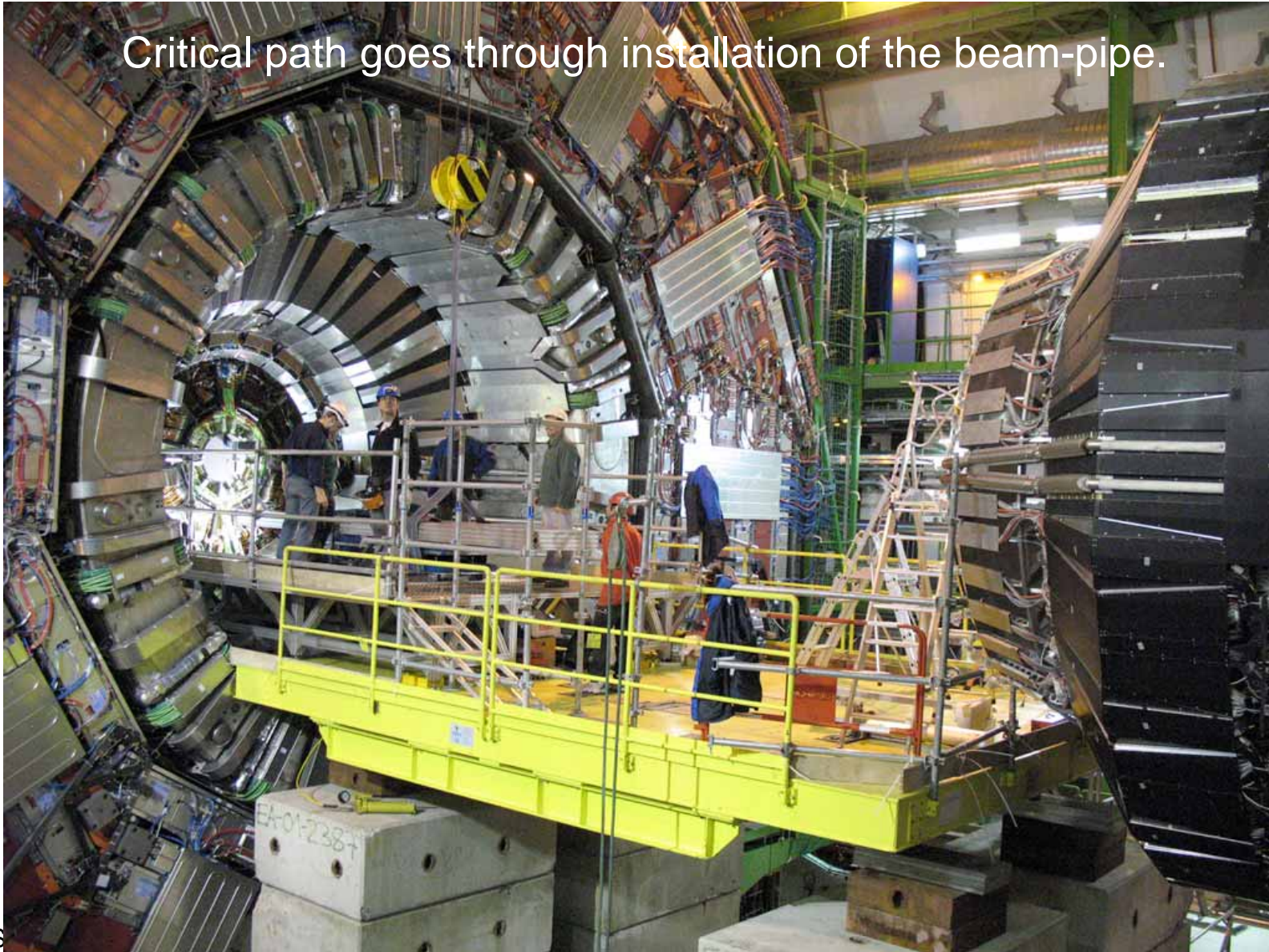
Preliminary Conclusions

- Movement of YE+1 along beamline can be controlled to few mm in x,y and Δz .
- Barrel-endcap locking system needs a small modification
- Procedures & manual, expert-driven, diagnostic systems to be further developed.



Current Situation at Point 5

Critical path goes through installation of the beam-pipe.





Other Progress Since Last RRB (I)

- **Solenoid:** Cooled down - will inject a low current at a convenient moment soon.
- **Tracker:** Inserted on 15 Dec 2007, aligned to ± 1 mm, and connected (980 pipes, 3350 optofibres, 2330 cables).
Commissioning ongoing - initial tests indicate v. good noise performance (see later).
The cooling plant suffered a serious failure due to a manufacturing fault as it was being commissioned \rightarrow the fluid (C_6F_{14}) was contaminated and has needed replacement. Corrective actions have been taken to prevent recurrence. Currently commissioning the plant.
Pixels: Forward rfi, barrel all layers mounted, - side assembled and tested. Plus side integrating with supply tube - ready end-Apr.
- **ECAL:** All 36 supermodules commissioned in CMS. Last endcap crystals delivered on schedule in early March. Barrel crystals ordered for the spare SM.
Supercrystals (5x5 crystals) mounted on 3 out of the 4 endcap Dees.
- **Infrastructure Readiness** - use HAZOPs procedure to evaluate readiness for sustained operation



Other Progress since Last RRB (II)

- **Commissioning:** *in situ* commissioning going apace (including cosmic data-taking) see later.
- **DAQ:** USC: Final system has been installed.
SCX: first 800 computers for the online farm (1/8th of final power). Ordering 400 of PCs to attain L1 → HLT of 36 kHz for first physics
The HLT timing (~ 40ms/event) has now been demonstrated on 20 PCs in online environment (HiLTON).
- **Software & Computing Infrastructure:** Functional tests (for CCRC - Combined Computing Readiness Challenge) successfully done in Feb. Much work invested for release CMSSW_2_0 to be used in CCRC, CRAFT (Cosmic Run at 4T), CSA08 (Computing, Software and Analysis Challenge) in May. Development has started on CMSSW_2_1 cycle to prepare for data taking.
- **Preparation for physics** focus on startup integrated luminosities of 1, 10 and 100 pb⁻¹, associated issues of calibration and alignment, and early physics.



Finishing Construction: Pixels and ECAL EE

Pixels

Install after bakeout of LHC beam pipe (Early June).



ECAL Endcaps

1st EE Dee rfi by mid-May '08.
Last EE Dee rfi by end of July.





Open Day at CMS (5-6 April)



Almost 6000 people passed through SX5 on their way underground (UX5) including a delegation from the Mairie of Cessy, the host village.

CMS Status RRB26 TSV





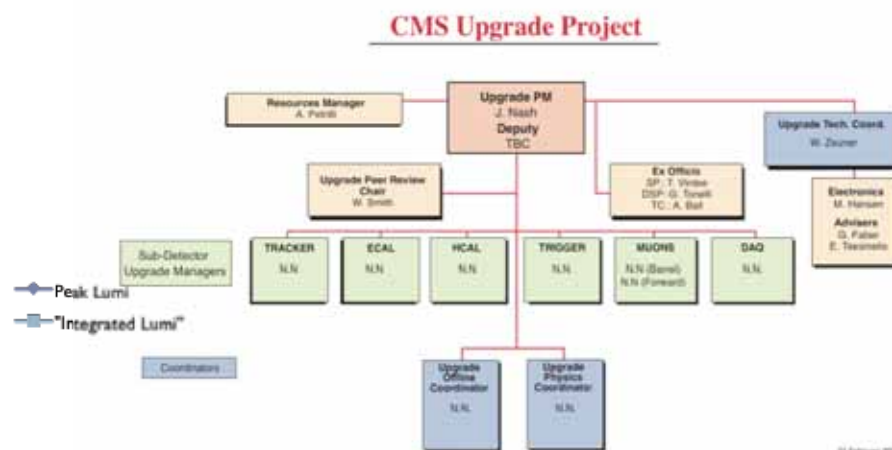
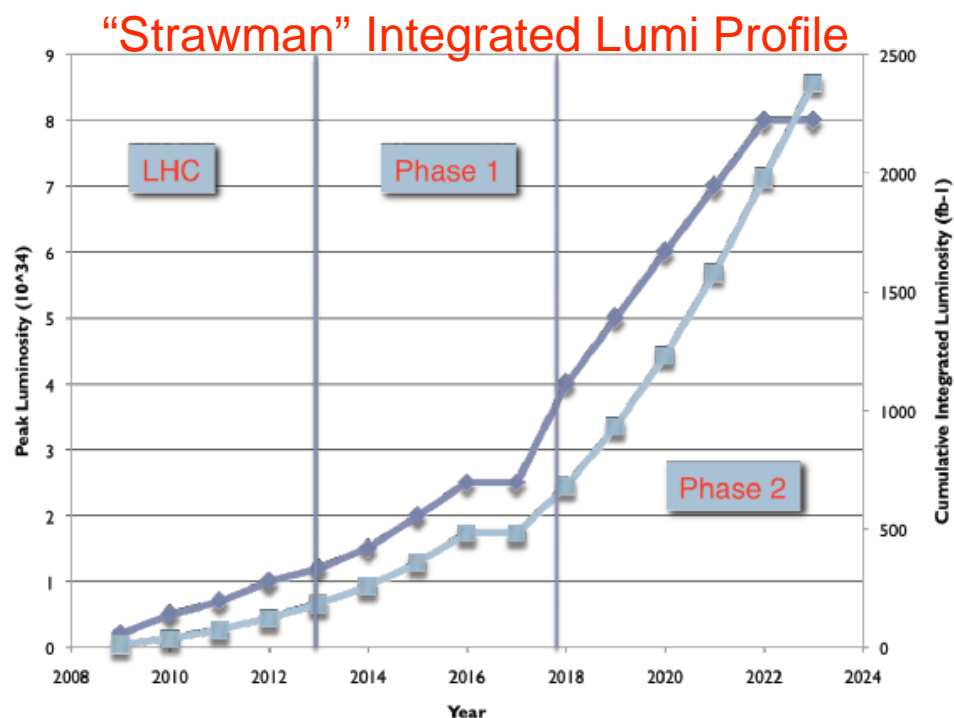
SLHC Upgrades

LHC Upgrades will be carried out in phases. Kick-off Meeting at CERN 9 Apr.

Phase 1: ≥ 2013 - Concentrates on a change to the insertion to allow $2 \times 10^{34} \text{ cm}^{-2}\text{s}^{-1}$.

Phase 2: ≥ 2017 Concentrates on upgrade of injector chain to go to $\sim 10^{35} \text{ cm}^{-2}\text{s}^{-1}$.

CMS is organizing the work to take this into account. **More details at next RRB.**



Get people in place by June



Sub-detector Commissioning

Some examples:

- i) on the surface
- ii) *in situ* underground



Si Tracker Performance: Efficiency



CMS Status RRB26 TSV

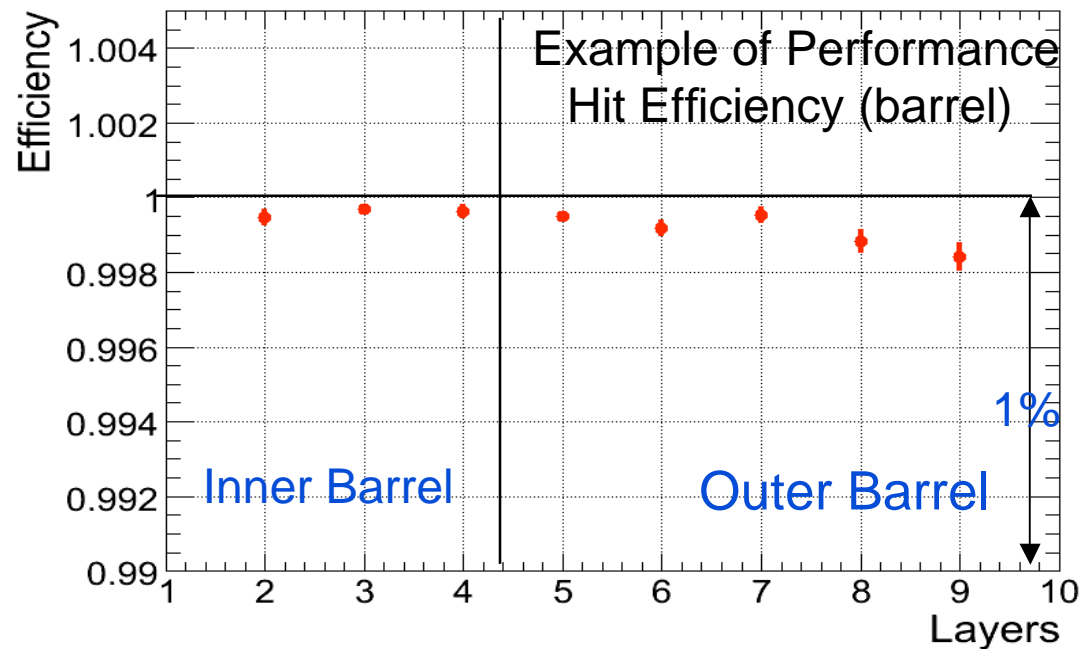
On the Surface (TIF)

Reminder from Last RRB

The Quality of the CMS Tracker is Excellent

Dead or Noisy Strips $< 3 / 1000$

Signal: Noise $> 25:1$ in Peak Readout Mode

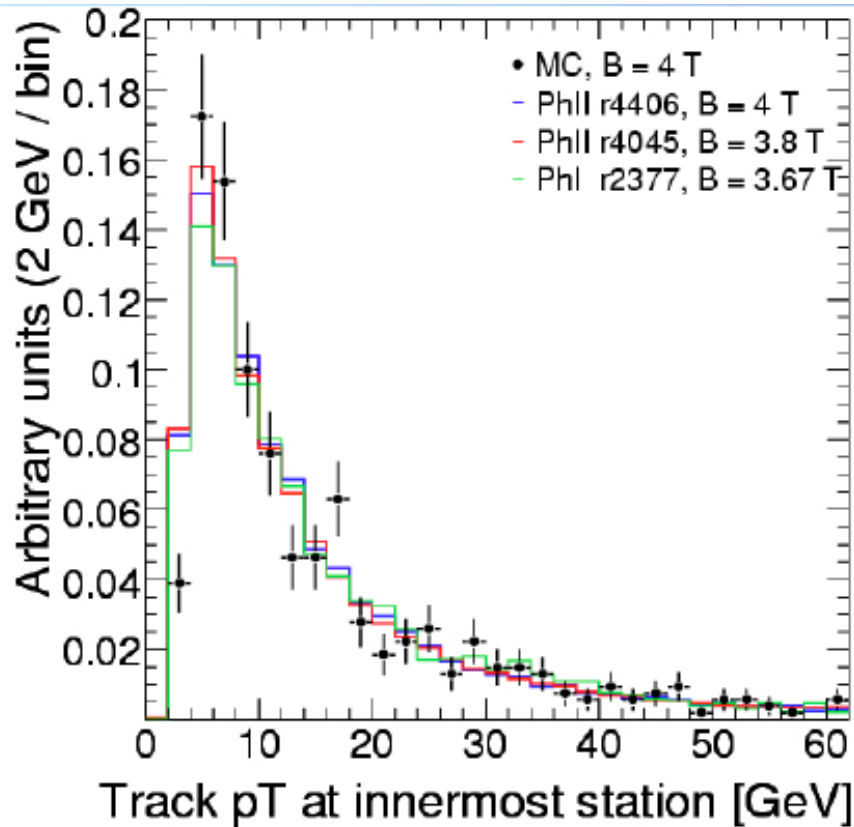




A Measurement !

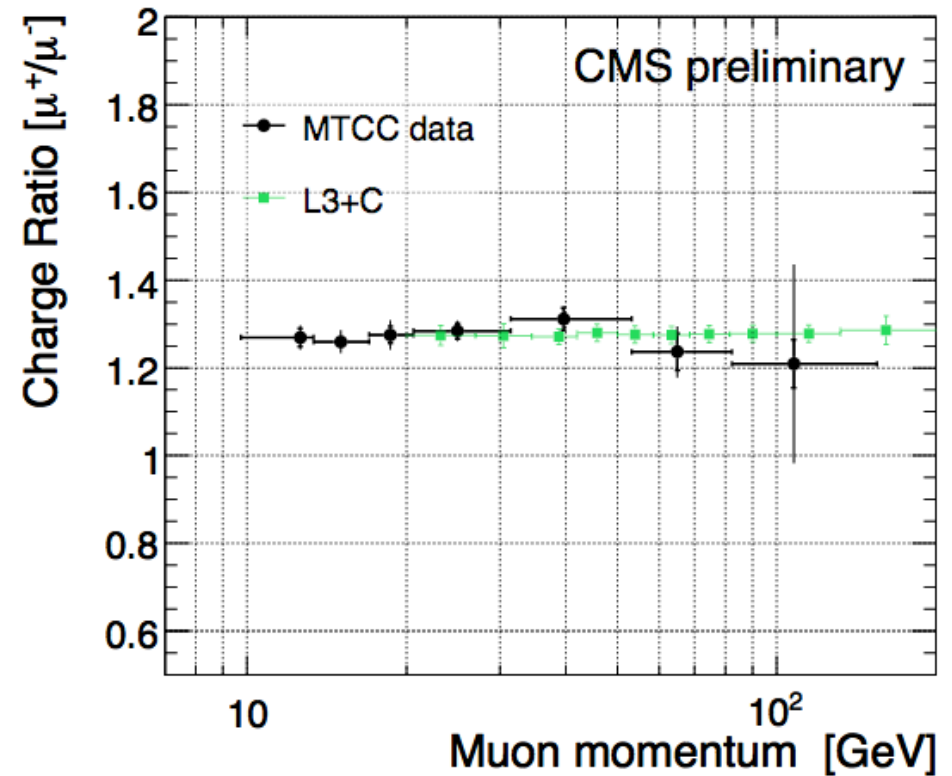
MTCC: on the Surface

Cosmic muons momentum distribution)



MTCC: on the Surface

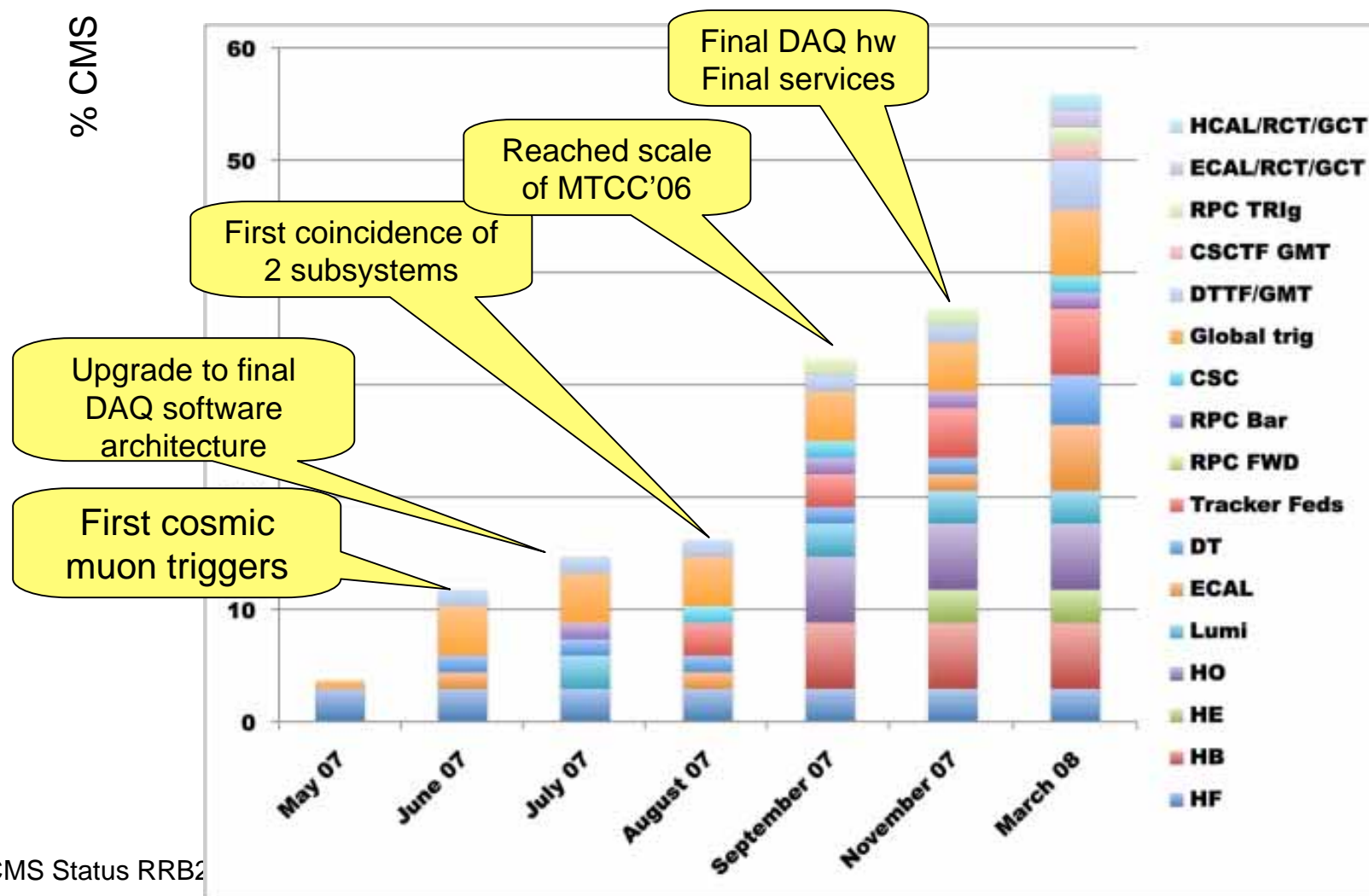
Cosmic muons charge ratio (μ^+/μ^-)
(Awaiting definitive alignment constants)





Global Runs Underground

Subsystem -subdetector and trigger separately - are added as they came in: size of the box represents which fraction was included (0, 25%,50%,75%, 100%)





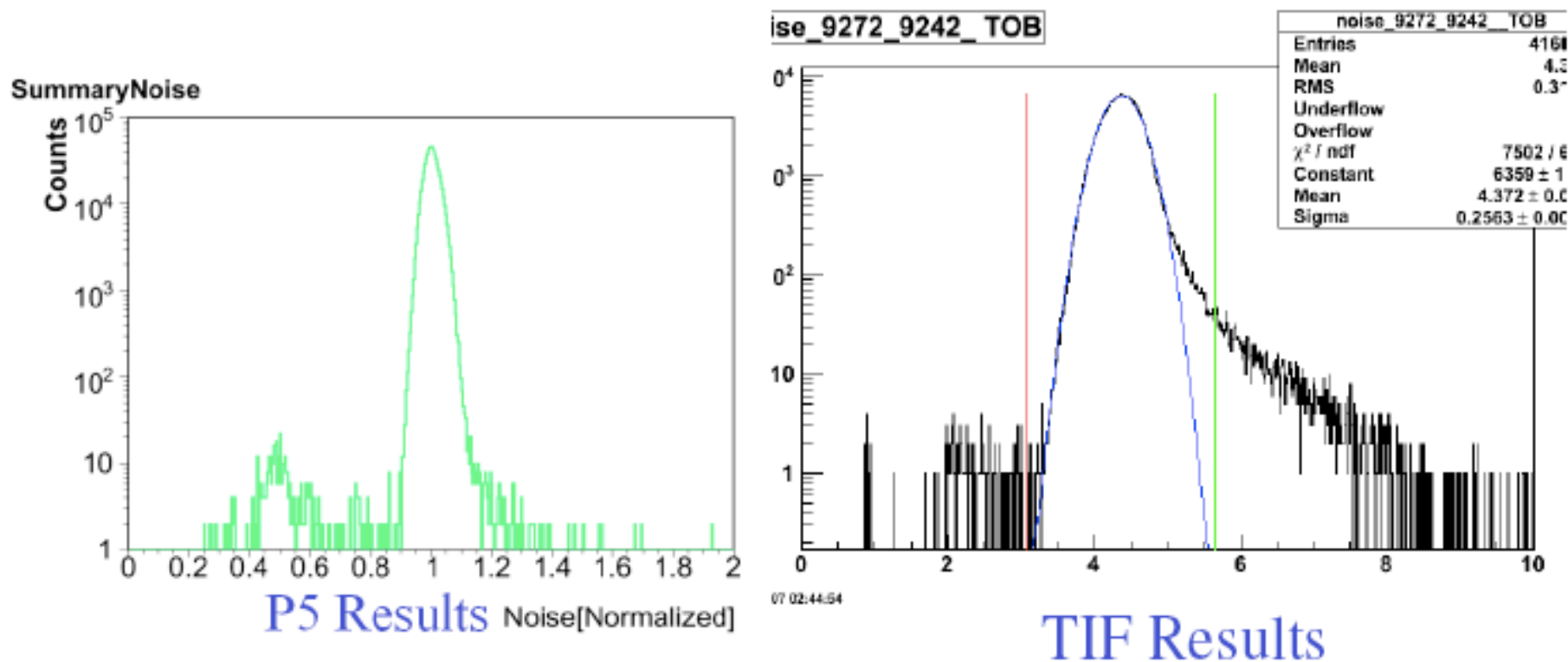
Commissioning: Current Status

- All of **HCAL** (except minus-endcap) powered up and readout
- All **ECAL** services commissioned, 36 SMs powered up. All supermodules available for readout
- **Muon DT**: LV supplies for 5 wheels. Three full wheels readout at one time
- **Muon RPC**: sectors in 3 wheels operated at one point. Provided trigger stably through last global runs.
- **Muon CSC**: + side commissioned, minus-side commissioning started
- **Tracker**: 100% of FEDs have been readout together, a 'Rod' has been part of the GREN. Proven that the tracker DAQ can sustain > 50 KHz
- **Pixel** "panel in a box" tested out successfully during February and March , proving functionality of Pixel Off detector electronics and readout capability in excess of 50 KhZ trigger rate.
- **Level-1 Trigger**: All central HW is installed (Jet trigger being commissioned, RPC front end HW partially installed)
- **cDAQ**: Hardware status: USC (100%), SCX (EVBuilder 50%, HLT 10%, StorageManager 50%). Percentages are referred to 100 KHz L1 rates. Tender for additional slice closed, order in preparation.



Tracker: *in situ* Check Out

~ 7% of the Tracker Tested at UX5

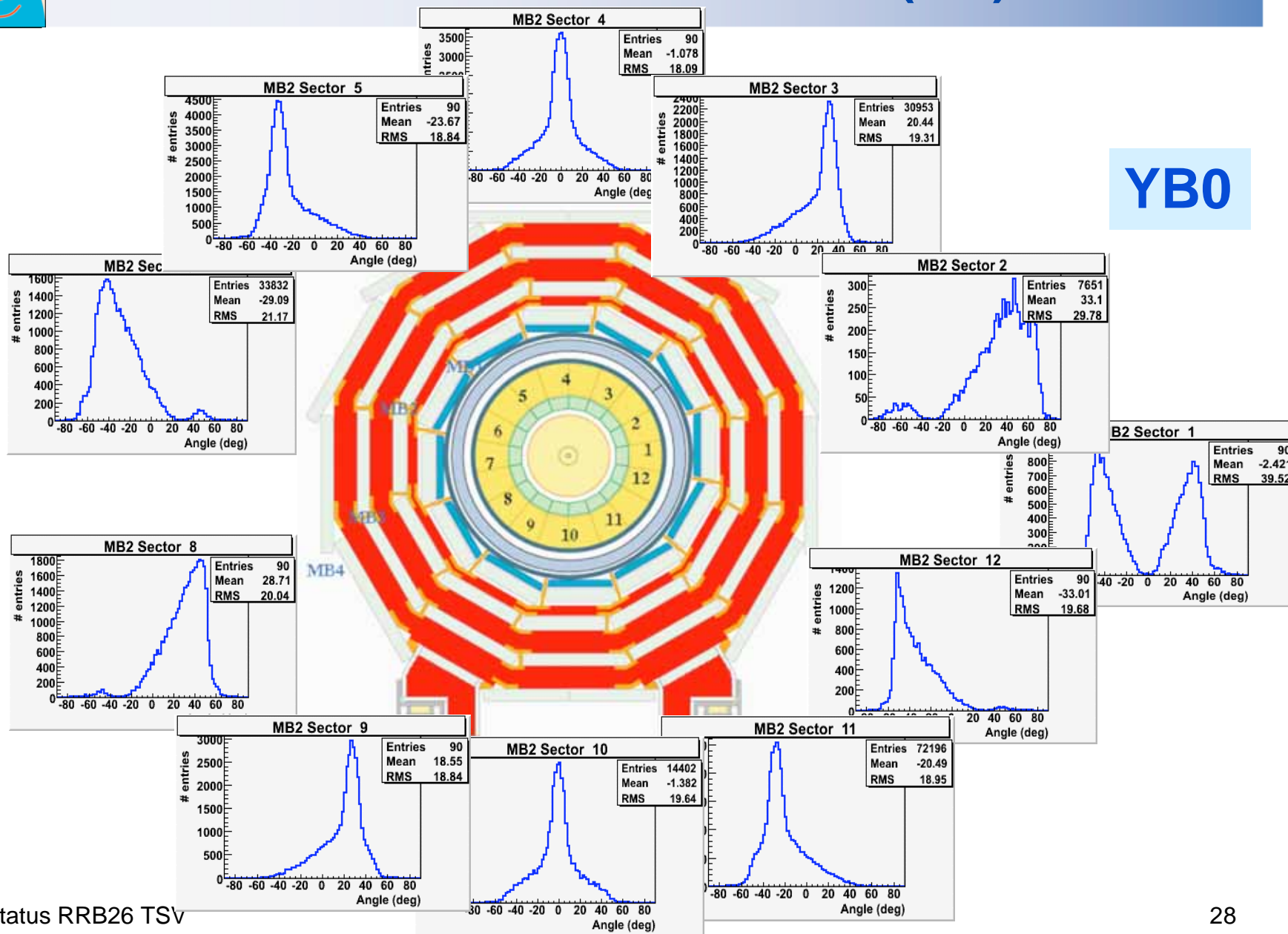


Preliminary Comparison of the Noise from TOB RODs in the Installed Tracker in CMS at UX5 with the Noise observed at the TIF



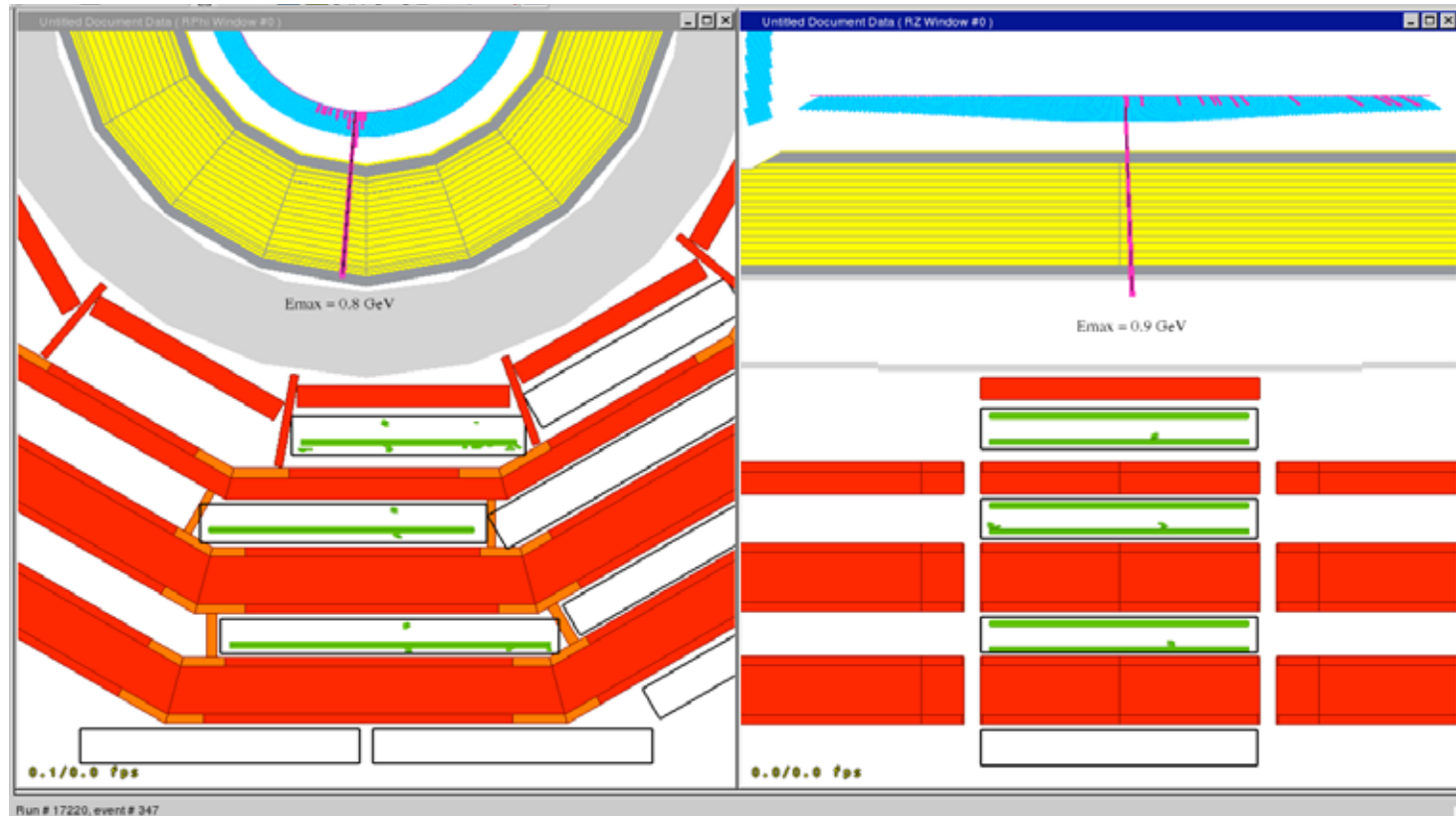
Cosmic Muons in DTs (UX)

YB0





YB0 & ECAL in Nov. Global Run



- ECAL & DT chambers synchronized with the CMS clock
- The DT trigger is synchronized with the DT ReadOut
- The DT trigger is integrated with the **CMS Global Trigger**
- The ECAL & HCAL trigger is synchronized with DT readout
- The ECAL & DT r/o is integrated with the **GLOBAL DAQ**
- Shifters also at FNAL, read out FEDs from each sub-detector



Commissioning of Software, Computing and Physics Analysis



CMS Offline Software

During CSA07 software applications were operationally very stable

- ◆but no contingency left in memory footprint and event size

Big effort made to improve performance monitoring

- ◆tools now run routinely as part of software release process

Changes to the data model, IO subsystem etc. have brought memory requirements close to nominal budget (1 GB)

- ◆different processing steps (gen, simu, HLT, reco ..) can now be run together which is a big simplification for CMS Operations and Computing

Contents of RECO and AOD datasets have been reviewed to remove duplication and to optimise formats

- ◆e.g. latest measurements show an ~30% reduction in size of RECO dataset

Fast simulation has been commissioned for production work

- ◆~500M event production in progress for studying trigger tables, ..

All improvements included in latest release : CMSSW_2_0_0

- ◆will be stress-tested in cosmic runs (CR0T, CRAFT) and in CSA08

Further improvements now being implemented in CMSSW_2_1_0 in preparation for data-taking (to be released end of May)

- ◆3.8T field map, DQM and certification algorithms, further optimisations, ..



Computing Progress and Plans

Full Computing Grid infrastructure in continuous use for event production

- ◆ During and since CSA07 > 4PB of data produced and analysed
- ◆ Detailed analysis of system performance, including software, was performed
- ◆ A CMS taskforce was started to bring the elements of the Computing Infrastructure into stable and scalable operations

In February important CMS computing tests successfully completed during CCRC08-phase1

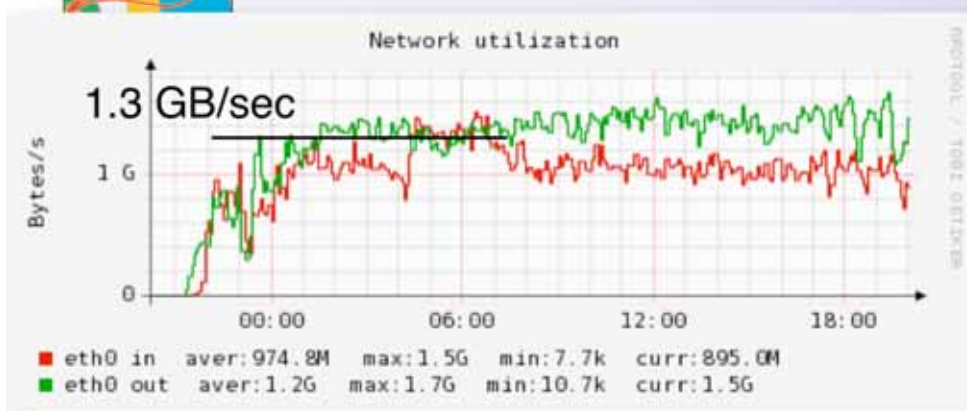
Preparations on track for iCSA08 tests_in May 08

- ◆ Exercise computing and analysis similar to the first 3 months of data taking
- ◆ Full simulation of 150M events in 2 weeks (until now 65M/month)
- ◆ Calibration and Alignment and examples of early Physics Analysis will be exercised
- ◆ We will make full use of the CAF

CCRC08/iCSA08 with computing tests to stress the whole infrastructure (Tier0-Tier1-Tier2 centers) at 100% scale



Some CCRC Phase 1 Test Results



Writing data to CASTOR at CERN

T1	Data Volume [TBs]	# files	# of tapes	<# files> /tape	Submission staging request time [min]	Total staging time [h]	<MB/s> Tape to Buffer
ASGC	13.2	5632	360	15.6	18'	22	~150 MB/s
CNAF	10.8	7235	426	17.0	~45'	79	~40 MB/s
FNAL	10.0	5736	270	21.2	~13'	25	~110 MB/s
FZK	10.0	4000	50	80	180'	27	~90 MB/s
IN2P3 ?	10.0	11061	68	163	2'	120	~23 MB/s (~100MB/sec?)
PIC	11.6	4744	38	125	~300'	33	~100 MB/s
RAL	10.5	5376	19	283	~10'	10	~290 MB/s

Tier-1 data staging from tape (and successive reprocessing)



Reconstruction at CERN



Data export from CERN to Tier-1



Reminder: Early Physics Programme

- Prior to beam: early detector commissioning
 - Readout & trigger tests, runs with all detectors (cosmics, test beams)
- Early beam, up to 10pb^{-1} :
 - Detector synchronization, alignment with beam-halo events, minimum-bias events. Earliest in-situ alignment and calibration
 - Commission trigger, start “physics commissioning”:
 - Physics objects; measure jet and lepton rates; observe W, Z, top
 - And, of course, first look at possible extraordinary signatures...
- Physics collisions, 100pb^{-1} : measure Standard Model, start search
 - $10^6 W \rightarrow l \nu$ ($l = e, \mu$); $2 \times 10^5 Z \rightarrow ll$ ($l = e, \mu$); $10^4 t\bar{t} \rightarrow \mu + X$
 - Improved understanding of physics objects; jet energy scale from $W \rightarrow jj$; extensive use (and understanding) of b-tagging
 - Measure/understand backgrounds to SUSY and Higgs searches
 - Initial MSSM (and some SM) Higgs sensitivity
 - Early look for excesses from SUSY & $Z \rightarrow jj$ resonances. SUSY hints (?)
- Physics collisions, 1000pb^{-1} : entering Higgs discovery era
 - Also: explore large part of SUSY and resonances at \sim few TeV



Physics Preparation: Next Steps

■ Three major axes of work:

◆ Complete & Deploy Physics Analysis Tools

Document and train people

◆ Vertical Integration of physics plan

From Detector to Physics objects to analysis to the final plot in the publication

◆ Commission “physics analysis paths”; from T0 to T2, the “how” of the analyses

Doing analysis on the desktop (starting from the T0...)

■ In collaboration with trigger coordination:

◆ Trigger table definition (and monitoring) + Definition of primary datasets (and streams and Express Line)

● e.g. V Short Term: May 08: CCRC/CSA08

● Participate with quasi-real-time physics analysis. Pick a few topics

● Inclusive charged particle spectrum

● Underlying event measurement

● Measurement of inclusive jet spectrum/dijet angular distrib.

● Observation of dilepton peaks (J/psi, Upsilon, Z...)



Schedule Overview



Preparation of LHC Startup

Cosmic Run at 0T (end-April/beg-May)

- Functionality and performance tests of sub-detectors (incl Tracker)

CCRC/CSA08 (May)

- Functionality and performance tests of computing systems done in Feb.
- CCRC: 4 week challenge in May

Emphasis for CMS is a stress test of computing operations for data-taking at scale simultaneously with other expts.

- CSA08: CMS offline workflows to demonstrate readiness for LHC data (calibration, skims, express analyses)

Focus on 1, 10 pb⁻¹ scenarios

CRAFT (End-June)

- Cosmic Run at 4T

Test of magnet and the sub-detectors + CMS online and offline workflows to demonstrate readiness for data-taking operations

Beams (July)

Single beam, beam halo, beam-gas, collisions

1) Detector Installation, Commissioning & Operation

Cooldown of Magnet started

Tracker Connected

Cosmic Run 0T

Magnet Low i Test

Pixels installed, Install EE endcap

**CMS Closed, Cosmic Run 4T &
Ready for Beam**

Comment:

Will need 2 months advance
warning of injection of beam.

Jan

Feb

Mar

Apr

May

Jun

Jul

Aug

Sep

Oct

2) Preparation of Software, Computing & Physics Analysis

2007 Physics Analyses Results

Functional Tests CCRC

Combined Computing Readiness Challenge

S/w Release 2_0

(CRAFT, Production startup MC samples)

CCRC/CSA08

S/w Release 2_1

(All basic s/w components ready for LHC)

V36 Schedule

2nd ECAL endcap rfi in July



Conclusions

- CMS is continuing to make good progress. All CMS detectors are installed except for pixels and endcap ECAL.
- CMS is aiming to close the experiment at the end of June and take cosmics data at operating field (3.8T).
- In June all detectors should be installed except for one ECAL endcap. Critical path goes through the installation of the beam-pipe.
- Commissioning, including using cosmics, with evermore complete setups (complexity and functionality) proceeding apace. Work already carried out so far gives confidence that CMS will operate with the expected (TDR) performance.
- CMS is eager to take collision data at nominal or close to nominal energy.



Excerpt from LHCC Report to RRB

CMS remains on course to commission in the underground experiment cavern the solenoid magnet and the initial detector and to take beam as soon as it becomes available as of mid-June 2008.





Preamble

Reminder from October 2006 (RRB23)

Upon the recommendation of the CERN management CMS prepared a **global financial plan** up to 2010 evaluating not only the shortfall for the low luminosity detector, but also the funds needed to introduce the staged items for the design luminosity ($10^{34} \text{ cm}^{-2}\text{s}^{-1}$).

The items were presented in a **prioritized way in 3 steps**.

Step 1: complete the low luminosity detector (17.5 MCHF for crystals, CF and C&I)

Step 2: complete the DAQ (8.4 MCHF).

Step 3: upgrade to design-luminosity detector (16.6 MCHF).

The rescoping of the forward RPC (RE) system was also proposed.



Status of Funding Steps

Table 2: Status of Requests for Additional Funding (kCHF)

	Step 1	Step 2	Step 3	Comment
Austria	211	45	171	← Austria
Belgium-FNRS	136	77		
Belgium-FWO	136	34		
Brazil	n.a.			Request made for Step 2
Bulgaria				Awaiting response
CERN	4,569	297	1,119	
China	Endcap RPC	Endcap RPC	Endcap RPC	
Croatia	15			
Cyprus				Awaiting response
Estonia	5	8	31	← France CEA
Finland	272	49		Funding in 2010 and 2011
France-CEA	341	58	218	Step 3 likely in 2009
France-IN2P3	n.a.	2,000	n.a.	
Germany BMBF	919	169	637	
Germany DESY	n.a.	2,000	n.a.	
Greece				News in Oct RRB
Hungary				Discussing
India	Endcap RPC	Endcap RPC	Endcap RPC	Request Submitted, News in Oct RRB
Iran	Endcap RPC	Endcap RPC	Endcap RPC	Discussing
Ireland	n.a.	4	16	
Italy	2,500			Step 1 likely to be partially covered
Korea	Endcap RPC	Endcap RPC	Endcap RPC	← Korea
Mexico	n.a.			Awaiting Response
New Zealand	n.a.	12		Discussing Step 3
Pakistan	Endcap RPC	Endcap RPC	Endcap RPC	
Poland	132	49		
Portugal	108	21		
RDMS-DMS				Discussing
RDMS-Russia				Discussing
Serbia	20			
Spain	344	140		
Switzerland	n.a.	124	466	
Taipei	121	45		Request for Steps 1&2 in 2009/2010
Turkey	47	74		← Turkey
U.K.	575	202	762	
USA-DoE/NSF	5,252	1,722		
Sum	15720	7130	3390	
Requested	17,530	8,400	16,600	
% covered	90%	85%	20%	

Bold: Input since the October 2007 RRB.

Steps 1, 2, 3: 90%, 85%, 20% covered

(In red new pledges/payments since last RRB)

Table 3: The state of funding of the restoration of the forward RPC system.

FUNDING Countries	Contributions kCHF	Comments
Belgium	420	Likely to use its Step 3 funds for RPC system
China	500	
India	800	Request made. News in Oct.
Iran		Discussing. Request made in Oct06 RRB was for 800 kCHF
Korea	522	Korea -405 kCHF
Pakistan	1250	

Bold: Input since the October 2007 RRB.

RE - Phase 1 upslope: funding now ~3.3 MCHF.

Detailed cost estimate, participation and sharing will be presented to the Oct 08 RRB



Completion of Low Luminosity Detector

Reminder from October 2007 (RRB25)

LHC Schedule: May 2007 Memo from the DG

“Engineering run at injection energy, originally foreseen at end this year (2007), shall not take place.”

LHCC: CMS has chosen to move to a more conservative (less parallel) installation schedule & undo some of the complexity of v35 schedule.

Situation Today

CMS closure now expected at the end of June (instead of autumn last year)

Extra time has been used (amongst other things) to:

- carry out installation with reduced risk (following a more natural sequence)

- introduce several trial tests, again to lower risks and anticipate future problems

Lowering operation was extended to reduce risks to operations in UX

Overcosts of gantry crane contract and extension of rental period (40 kCHF/mo)

Extended use of manpower has incurred extra costs (manpower runs at ~ 300 kCHF/mo).



Completion of Low Luminosity Detector

Reminder from October 2007 (RRB25)

“The October 2008 RRB, in one year’s time and after the completion of the low-luminosity detector, will be an appropriate moment to present an update of the financial position of CMS (first presented in October 2006 RRB, CERN-RRB-2006-105) and to make any necessary adjustments.”

The update will take account of the shift of the LHC startup with respect to what was expected in October 2006.



Conclusions on Funding

The completion of the low-luminosity detector is imminent, CMS again urgently requests all the Funding Agencies that have not yet made commitments with respect to the October 2006 Global Financial Plan to do so as soon as possible, at least for the Steps 1 and 2 and to the restoration of the Phase 1 of the RE system.

The construction, installation, and commissioning of the low-luminosity CMS detector is now very close to being completed.

CMS is very grateful to all the Funding Agencies for the support provided over the long construction period.



Spares

Table 2
CERN-RRB-2006-105

	PhDs	MoU Funding 2002	CTC1 RRB15 Oct02	CTC2 RRB20 Apr05	Constr. Funding 2006	STEP 1 Low Lumi (Constr.)	STEP 2 DAQ (PhD)	STEP 3 Rest (PhD)	Total Design Lumi
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Austria	11	3,900	600	275	4,775	211	45	171	427
Belgium	27	5,000	870	300	6,170	272	111	420	803
Brazil	9				0	0	37	140	177
Bulgaria	5	600	0	0	600	26	21	78	125
CERN	72	85,200	13,500	4,800	103,500	4,569	297	1,119	5,984
China	13	4,315	500	300	5,115			<i>in kind RPC</i>	
Croatia	7	280	49	20	349	15	29	109	153
Cyprus	3	600	106	0	706	31	12	47	90
Estonia	2	90	16	6	112	5	8	31	44
Finland	12	5,000	870	300	6,170	272	49	187	508
France CEA	14	5,600	1,687	445	7,732	341	58	218	617
France IN2P3	38	19,700	2,000	2,000	23,700		2,000	0	2,000 <i>Pledg</i>
Germany BMBF	41	17,000	2,709	1,100	20,809	919	169	637	1,725
Germany DESY	5				0	0	2,000	0	2,000 <i>New</i>
Greece	17	5,000		0	5,000	221	70	264	555
Hungary	6	1,000	58	0	1,058	47	25	93	165
India	26	4,400	300	500	5,200			<i>in kind RPC</i>	
Iran	3	510	700	0	1,210			<i>in kind RPC</i>	
Ireland	1				0	0	4	16	20
Italy	181	55,000	8,927	4,000	67,927	2,998	746	2,813	6,557
Korea	12	1,315	500	147	1,962			<i>in kind RPC</i>	
Mexico	5				0	0	21	78	98
New Zealand	3				0	0	12	47	59
Pakistan	3	2,445	230	149	2,824			<i>in kind RPC</i>	
Poland	12	3,000		0	3,000	132	49	187	368
Portugal	5	2,000	300	140	2,440	108	21	78	206
RDMS	72	18,862	2,211	1,657	22,730	1,003	297	1,119	2,419
Serbia	3		450	0	450	20	12	47	79
Spain	34	6,000	1,350	450	7,800	344	140	528	1,013
Switzerland	30	86,500		200	86,700	0	124	466	590
Taipei	11	2,330	410	0	2,740	121	45	171	337
Turkey	18	1,000	58	0	1,058	47	74	280	401
UK	49	9,100	918	3,000	13,018	575	202	762	1,538
USA	418	104,320	12,800	1,868	118,988	5,252	1,722	6,497	13,471
(Sum	1,168	450,067	52,119	21,657	523,843	17,530	8,400	16,600	42,530
Requested			63,000	32,000					