CMS Status

CHIPP Plenary Meeting

PSI Oct 15-16, 2007

Werner Lustermann, ETH Zurich

- **Swiss Institutes in CMS**
- **HCAL at P5**
- **CMS at P5**
- **ECAL**
- **Tracker**
- **Muon Systems**
- **Physics Preparation**

Swiss Institutes in CMS

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A. Brett, D. Calafiori, L. Djambazov,
M. Dröge, C. Haller, G. Leshev, M. Milesi,
S. Zelepoukine + workshops at IPP

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C. Eggel (PSI/ETH),
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A. Schmidt

E. Alagöz (PSI/UniZH),
Rommerskirchen,
D. Tsirigkas,
L. Wilke (PSI/UniZH)

J. Rochet, S.Steiner

63	**Total**
38	Physisists
15	PhD students
10	Techn. / Eng.

HCAL End-cap at P5

Since Nov. 2006 the installation and completion of the CMS in the underground cavern UXC started

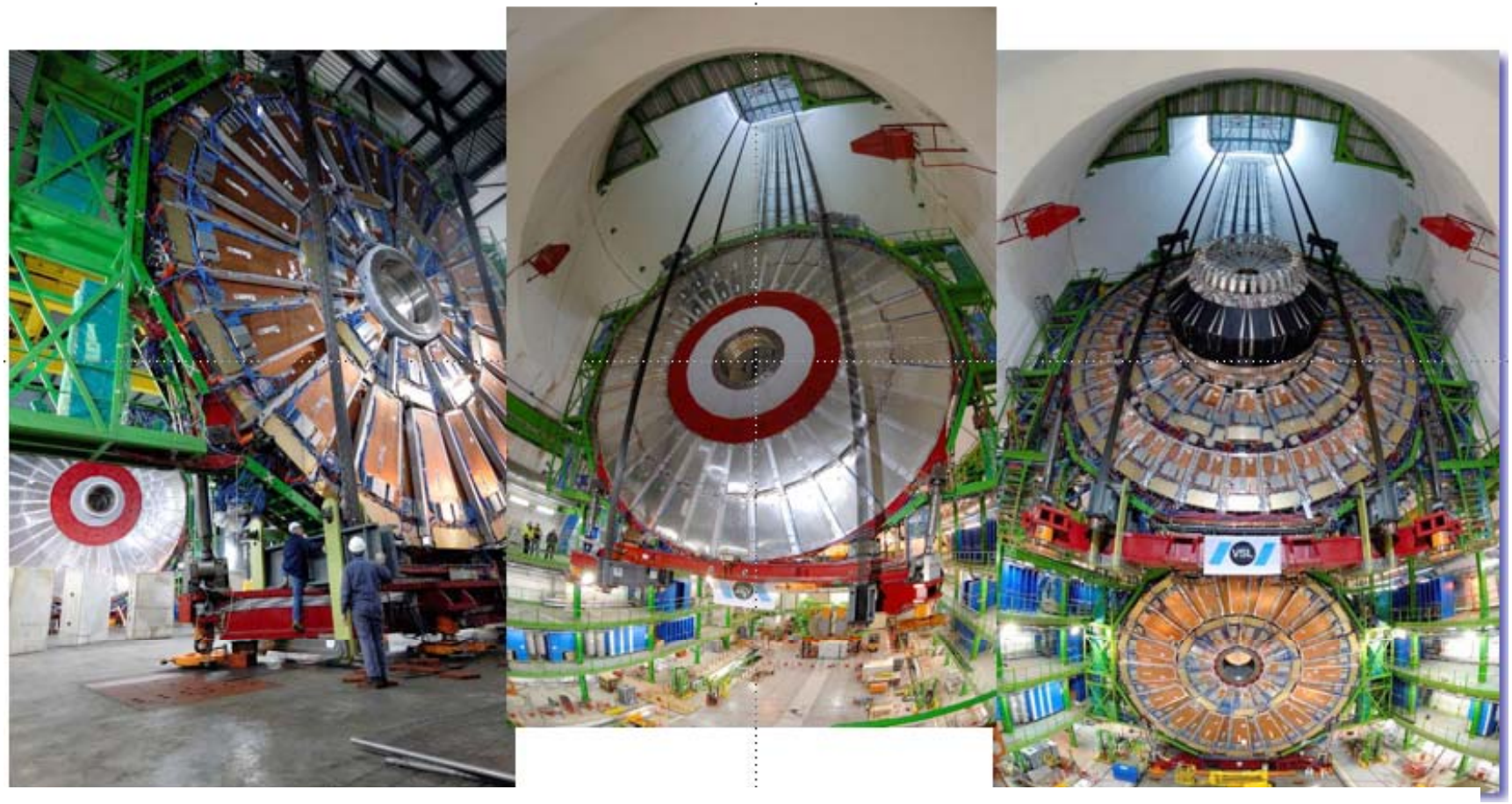
lowering of the HF (very forward HCAL), 2. Nov. 2006

HF tested at beam height with rotational shielding closed, Sept. 2007

HCAL barrel is installed, cabling and testing ongoing until Nov. 2007

First Endcap lowered

- During Dec. 2006 the first endcap was lowered, including CSC, RPC, and Hadron Endcap
- The detectors are fully cabled to the service cavern and available for global runs with cosmic muons



The first ECAL endcap +pre-shower detector are expected in March 2008

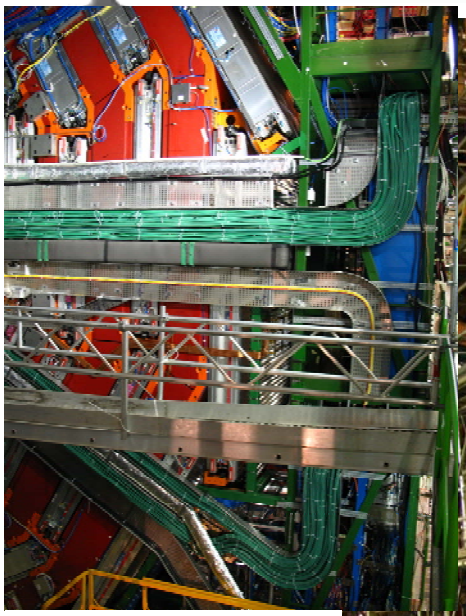
Central wheel lowered

- Lowering of the central wheel in Feb. 2007
- Cryogenics, vacuum, power, control and safety systems are connected
- Cooldown from Sept. to Nov. 2007
- Test at 4.5 K with 400 A

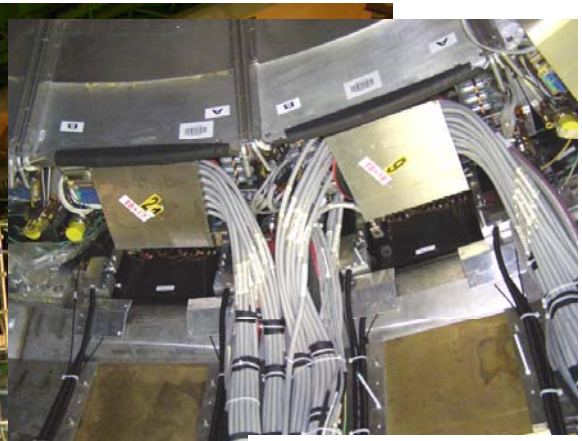
- End of March 2008 ready for operation

- All remaining parts, including the second end-cap will be lowered until the end of this year

P5 at present



Tracker cabling

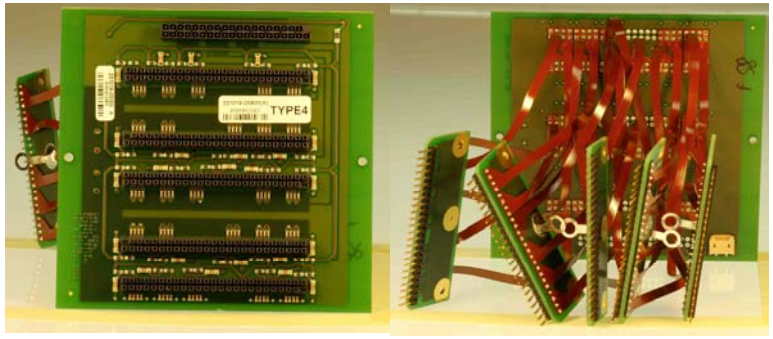


ECAL SM cabling

HF riser test

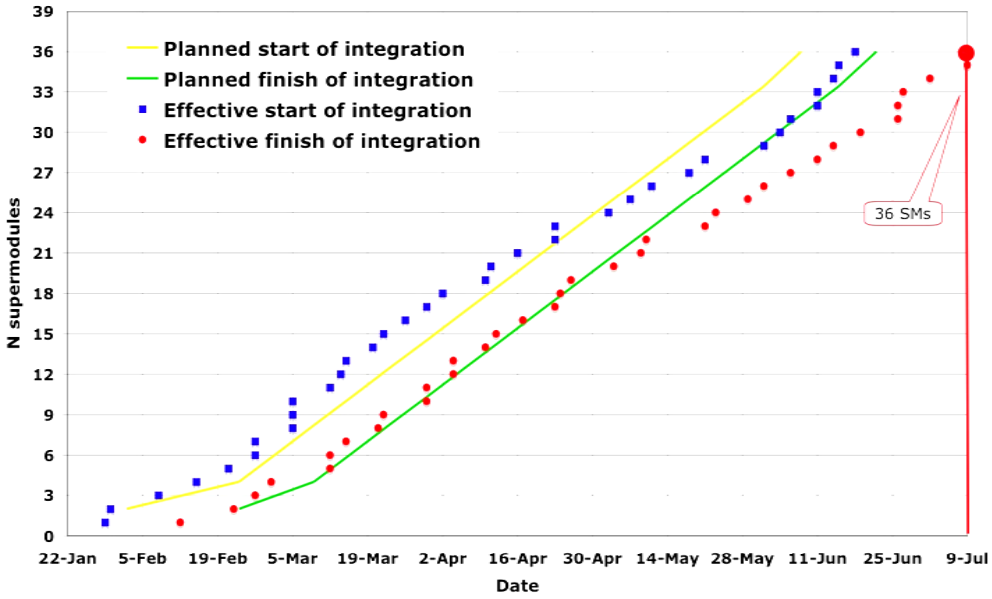
ECAL Barrel Construction

Due to various problems with the Kapton cables of the motherboards it was decided in Nov. 2006 to re-fabricate the necessary 2448 pieces

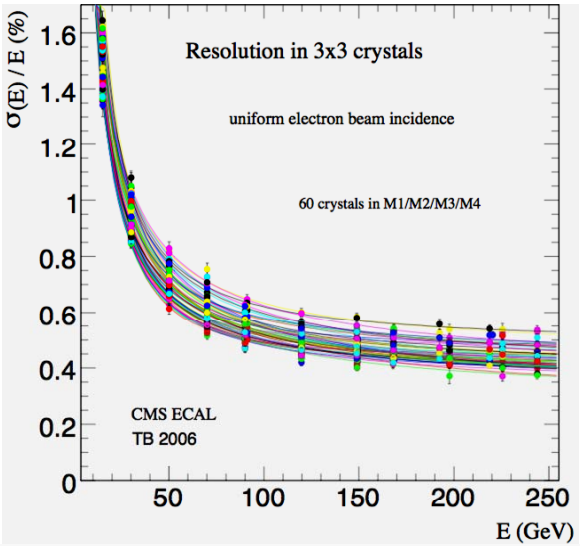


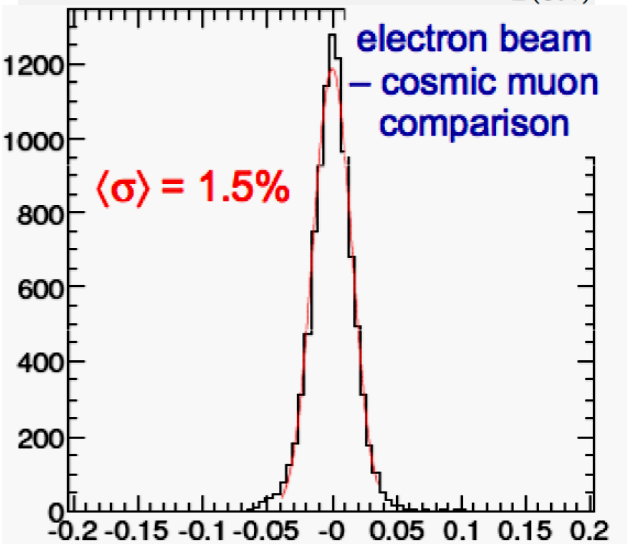
SM integration re-started in Feb. 2007.
24 + 2 already completed SMs had to be dismounted
36 SMs were completed on July 9, 2007

23 dead and 19 noisy channels out of 61200



ECAL Barrel Construction



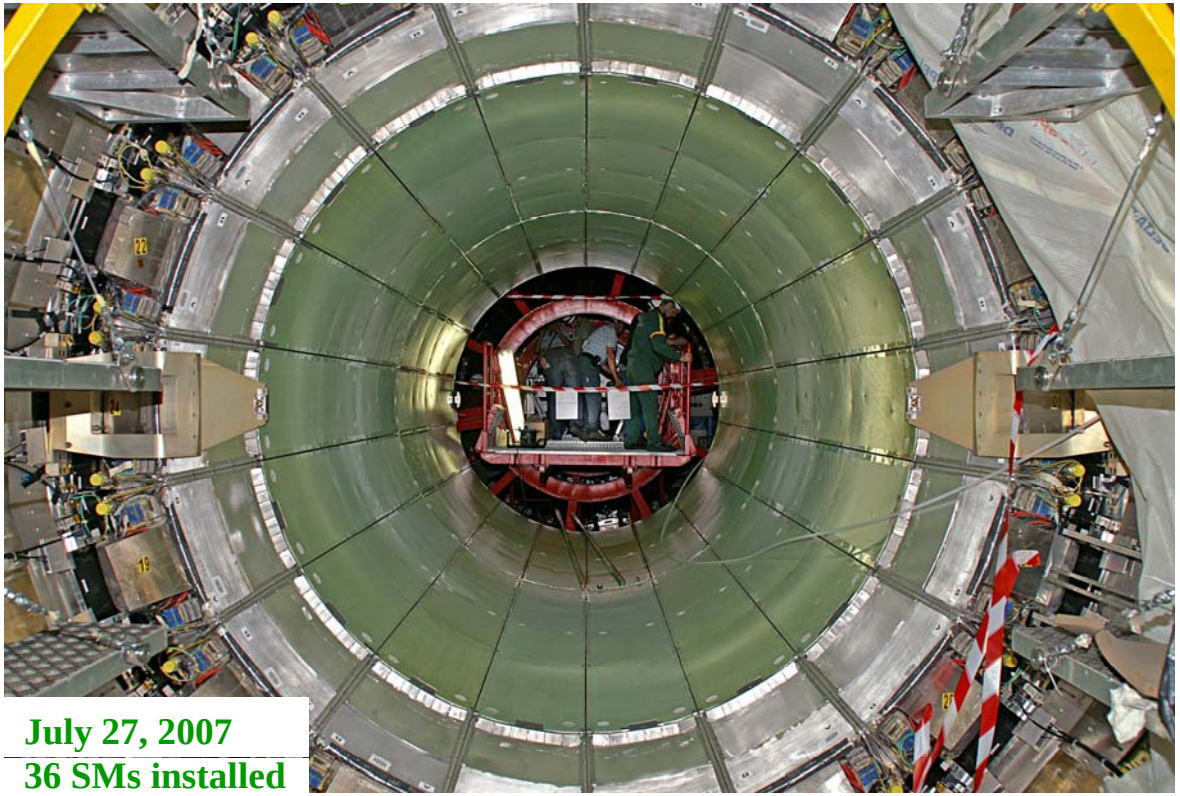


About 15000 crystals were calibrated with in an electron beam

All 61200 crystals were inter-calibrated using cosmic muons

Depending on eta the crystal to crystal calibration is (1.4 - 2.2) %

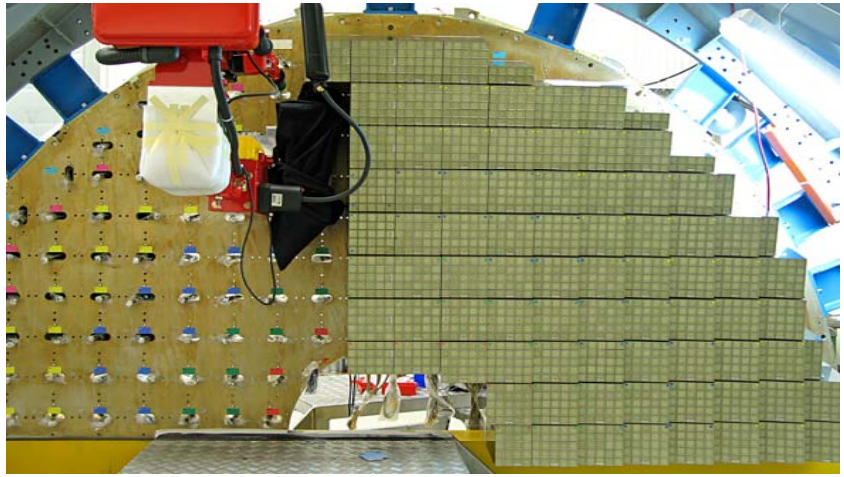
Electron beam and muon data agree to ~1.5%

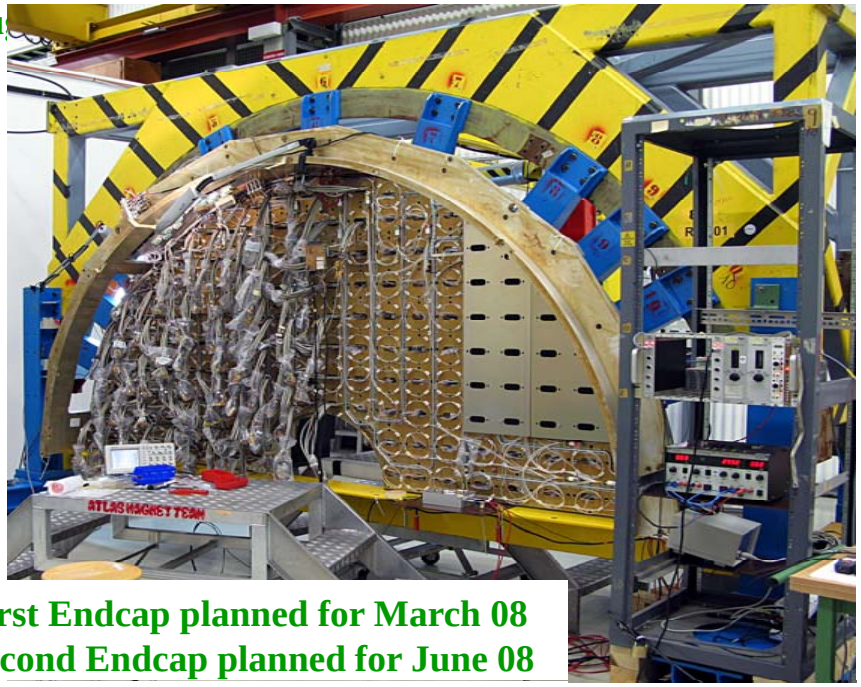


July 27, 2007
36 SMs installed

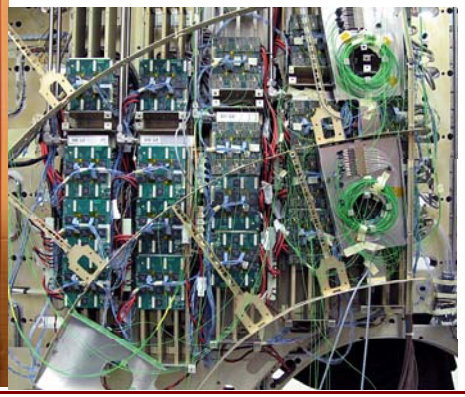
ECAL Endcap Construction

Mounting of Supercrystals on Dee started end of Au
(envisaged rate, 1 Quadrant / month)





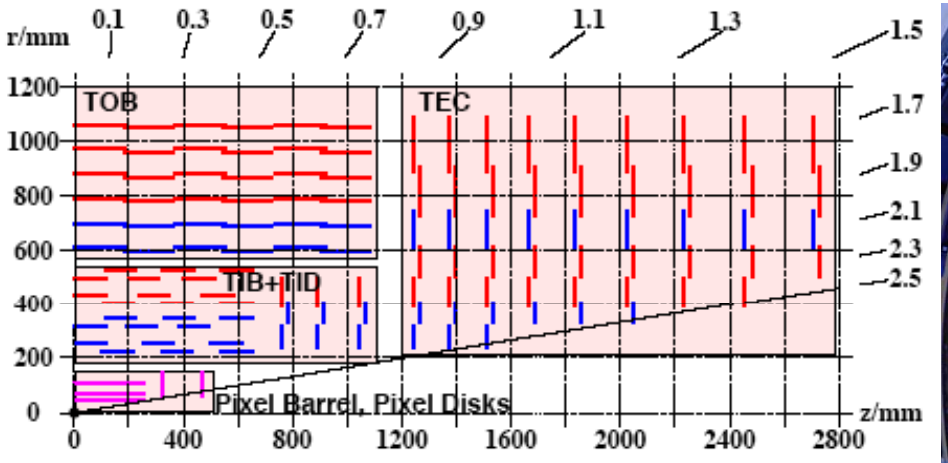
First Endcap planned for March 08
Second Endcap planned for June 08

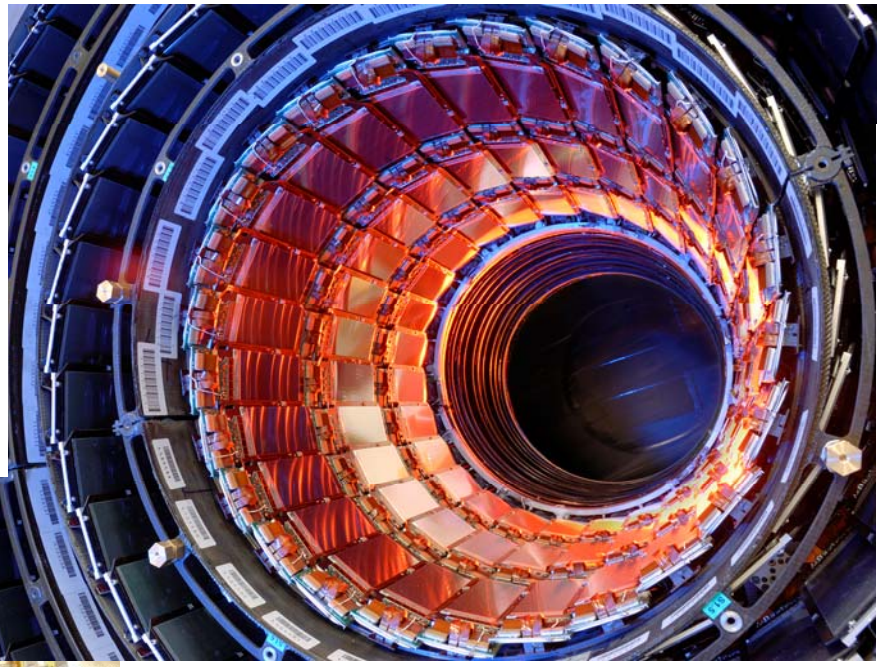


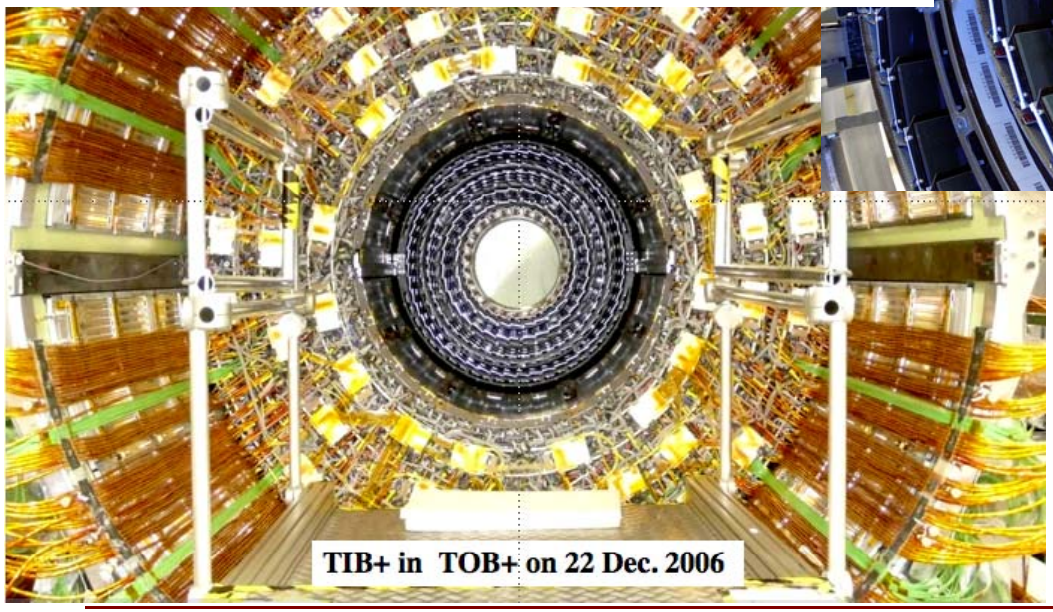
500 channel EE prototype (Dee 4) was built and during summer

It was operated in a test beam at CERN until beginning of Oct. 2007

Tracker







Tracker assembly finished in March 2007 (220 m^2, ~11 Mio. Channels)

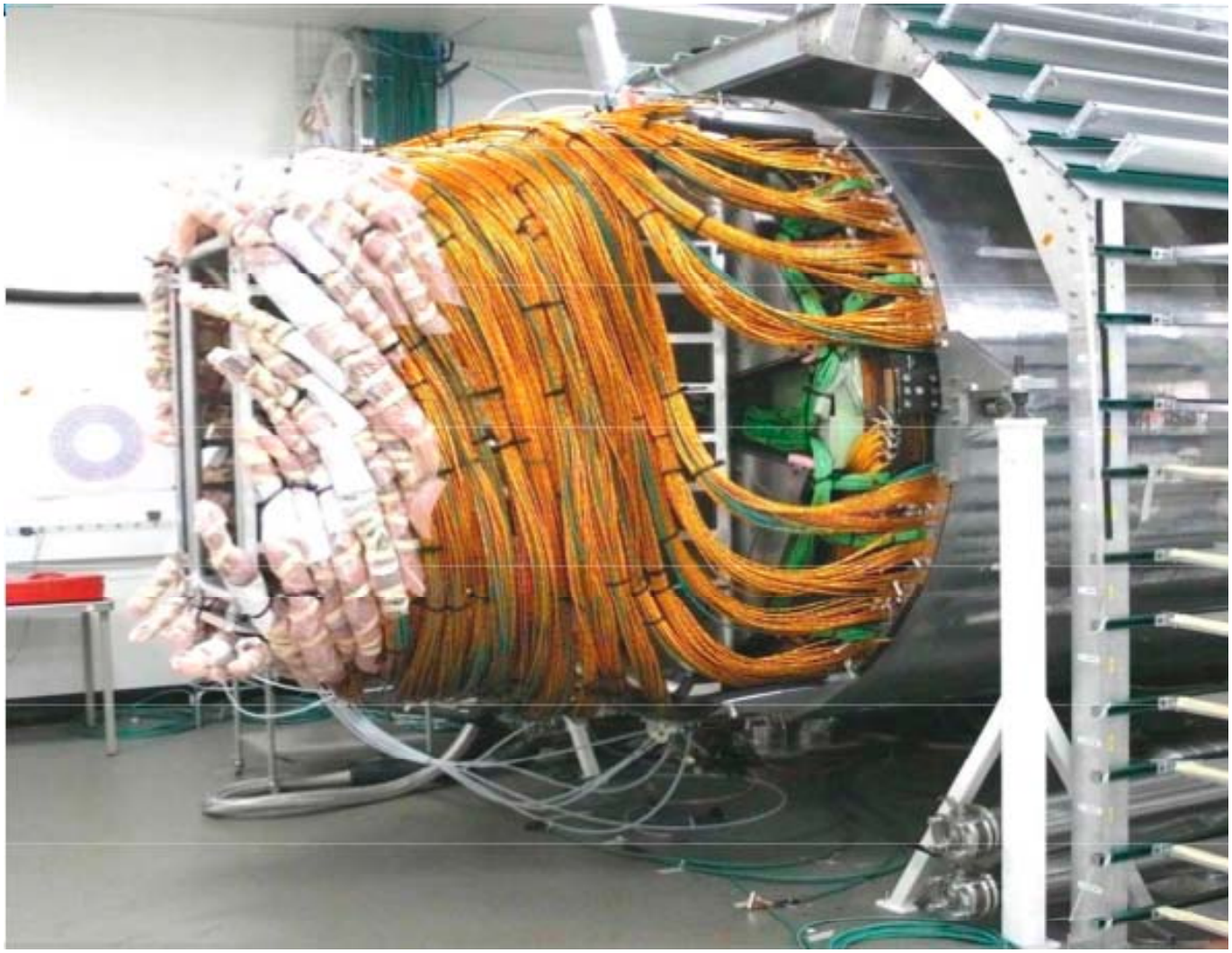
25 % were instrumented

5l million cosmic muons recorded during spring and summer 2007 at temperatures between -15 ºC and 20 ºC

Only a few per mille dead or noisy channels

S/N = 25:1

Tracker



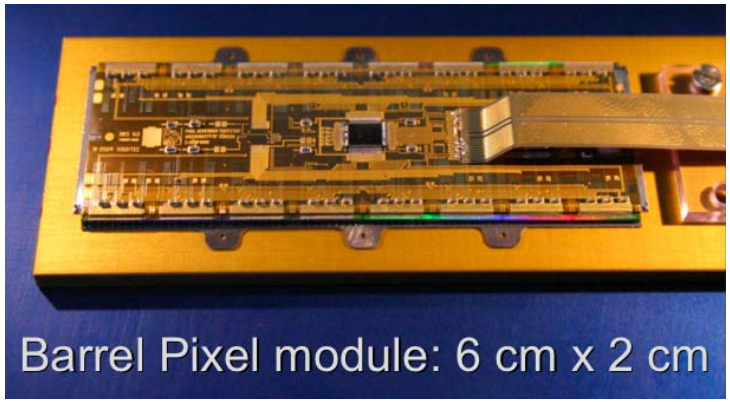
CMS Tracker is ready for installation in P5

Starting Nov. 2007 after completion of HCAL and EB cabling / piping

Radial clearance to ECAL ~1cm

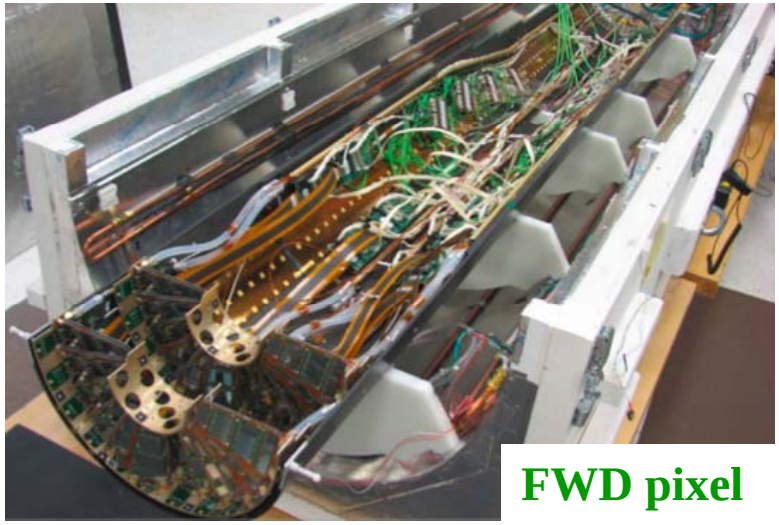
Pixel Detector

3 layers (4.4, 7.3 and 10.1) mm radius
~48 Mio pixels of 100x150 μm²



All parts for the 6 detector half shells + assembly tooling ready

First supply tube and half a barrel equipped with a few sensors will be delivered to CERN, for the CMS Dec. 07 global run.



FWD pixel

Barrel pixel supply tube

Pixel Detector

Barrel pixel support half shell

QuickTime™ and a
TIFF (LZW) decompressor
are needed to see this picture.

Special pixel detector installation rails had been designed and will be fabricated at PSI.

March 2008 installation of the complete detector

Cabling detail

QuickTime™ and a
TIFF (LZW) decompressor
are needed to see this picture.

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TIFF (LZW) decompressor
are needed to see this picture.

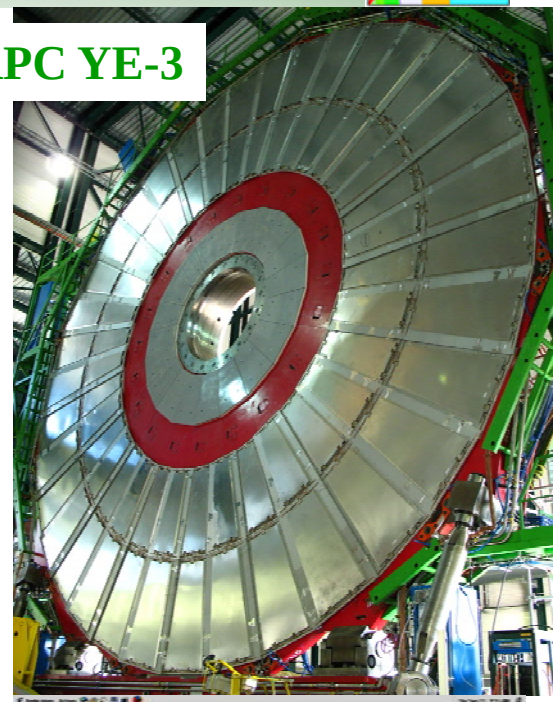
Muon systems

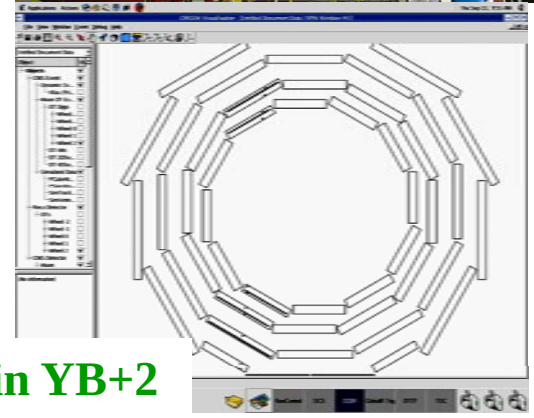
Resistive Plate Counters (RPC)
Installation of 432 Forward RPC chambers completed
All barrel RPCs tested and commissioned by Nov. 07

Cathode Strip Chambers (CSC)
Plus End:
all systems installed and cabled, expect muon triggers and data by end of Oct. 2007
Minus End:
all chambers installed, continuing testing and commissioning
Expect two months for completion underground

Drift Tubes (DT)
All but 8 out of 242 chambers are installed
Cabling, electronics installation, testing and commissioning ongoing

RPC YE-3





Cosmic in YB+2

Computing and Physics

- CMS computing moved from ORCA used for Physics TDR in 2006 to CMSSW
==> this is completed
- Computing Software and Analysis (CSA07) challenge (Sept. - Oct. 2007)
==> Do in detail what is needed in 2008 at a scale of 50%
==> i.e. 200 Mevt miss-calibrated / miss-aligned (for 10-100pb^{-1})
==> This includes the activities at Tier-0, Tier-1 and Tier-2 centers
- In parallel the Monte Carlo production will proceed (50 to 100 Million events per month)
- Test the so called "Express Line" at the CERN Analysis Facility (CAF)
- The results of the CSA07 test will be included in a new CMSSW release (V1_8_0) for the CMS global run in Dec. 2007
- The global run lessons will be included in CMSSW V2_0_0 beginning of next year

Three step plan for physics preparation

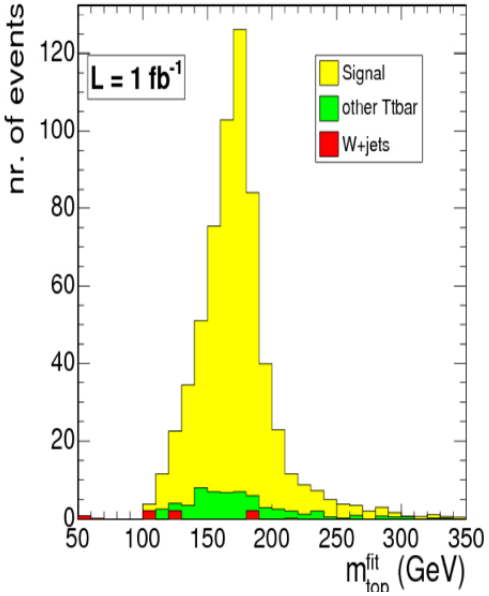
1) Up to 10 pb^{-1}
   detector synchronization, alignment, calibration
   trigger commissioning, measure jet and lepton rates
2) Up to 100 pb^{-1}: measure SM and start searches
   10^6 W $\rightarrow$ l n (l = e, μ); 2×10^5 Z$\rightarrow$ll (l = e, μ); 10^4 ttbar $\rightarrow \mu$+X
3) Up to 1000 pb^{-1}: Higgs discovery era, SUSY resonances up to a few TeV

SM Physics

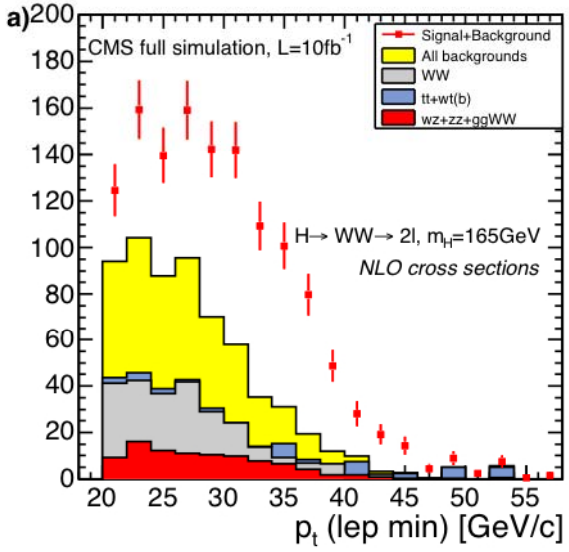
Assuming 1000 pb-1 a lot of interesting results could be obtained:

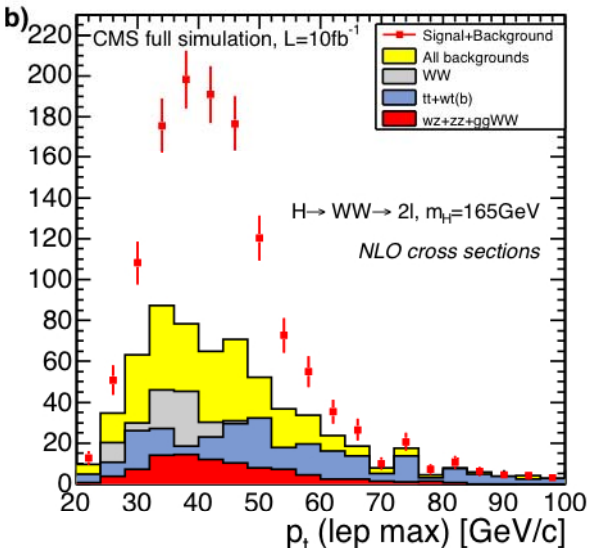
1) **Test QCD up to E_T=1 TeV**
2) **Precision measurement of W and Z parameters with ~1% stat. and 3 % system. Error**
3) **Several thousand clean ttbar events allow a cross section measurement to about 10% and a top mass measurement with (3 to 5) GeV precision**
4) **First Diboson cross section measurements pp → WZ and pp → ZZ**
5) **Maybe we see even a SM Higgs around 165 GeV**

ttbar → lνbWb



gg → H → WW → lνlν





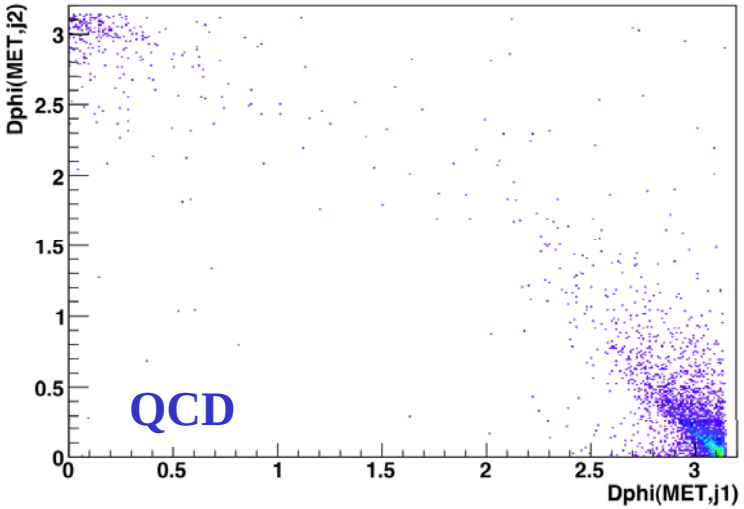
SUSY and BSM

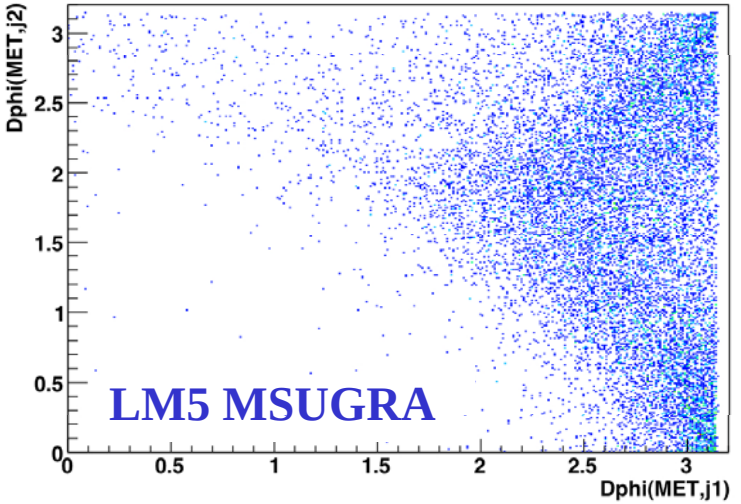
Four CMS SUSY and Beyond SM groups:
leptonic and hadronic SUSY; heavy stable charged particles; high mass resonances

main topics in Swiss institutes:

- **Finding alternatives to Missing Transverse Energy (MET), and ways to control it from data**
- **Studying multi-lepton + jet + MET final states**
- **Studying bb + jet + MET final states**
- **Studying heavy charged stable particle signatures**

Hadronic searches: jet + missing transverse energy (example: Dphi(MET, j2))



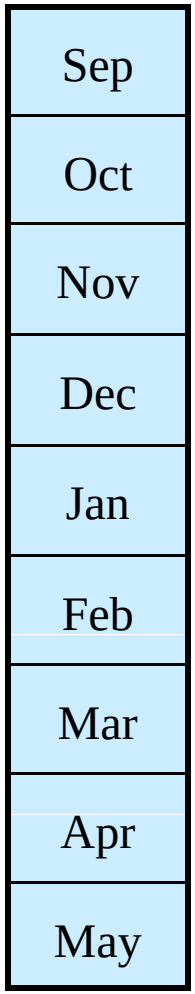


Search for alternatives to MET or ways to control from the data using:
Accoplanarity of 2 jets, hemisphere accoplanarity, event shapes (thrust, hemisphere masses, …)

CMS Schedule

1) Detector Installation, Commissioning & Operation

2) Preparation of Software, Computing & Physics Analysis



CSA07 S/w Release 1_6

Tracker Inserted

Test Magnet at low current

S/w Release 1_7 (HLT Validation)

2007 Physics Analyses Completed

Last Heavy Element Lowered

Tracker cabled

S/w Release 1_8 (Lessons of '07)

CMS Cosmic Run CCR_0T

(defined periods Dec-Mar)

Beam-pipe Closed and Baked-out

1 EE endcap Installed, Pixels installed

S/w Release 2_0 (CCR_4T, Production of startup MC samples)

Cosmic Run CCR_4T

MC Production for Startup

All LHC Expt Data Challenge: CSA08

Master Contingency

2nd ECAL Endcap Ready for Installation end Jun'08

T. Virdee, LHCC89, Sept. 2007

Summary / Outlook

CMS is on track for the startup of LHC in 2008

We would like to see the first pp-collisions at 14 TeV

Nevertheless we will take advantage of any delay, for whatever reason, in particular for the completion of the electromagnetic calorimeter endcaps

Acknowledgement:

It is a great pleasure to thank all the people who helped me with the preparation of this talk:

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M. Dittmar, G. Dissertori,
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Q. Ingram, P. Moortgat
F. Pauss, T. Virdee**