


***The ATLAS Experiment Entering Operation:  
Overview. Motivation and Status of the Project  
ICPP Istanbul, 27<sup>th</sup> October 2008***





The image features a composite background. At the top, a blue sky with white clouds and a range of snow-capped mountains. Below this, a large aerial photograph of the LHC tunnel in a green valley. A red line traces the path of the tunnel, with a circular callout highlighting the ATLAS detector. The detector is shown in a cutaway view, revealing its complex internal structure with blue and yellow components. In the foreground, a close-up view of the tunnel's interior shows the large, cylindrical superconducting magnets and the intricate wiring of the detector.

# **The Large Hadron Collider Project and ATLAS: *A Journey to Discover the Physics Shortly After the Big Bang***

***A dream becoming reality***  
***(Dedicated to the memory of Engin Arik and her colleagues  
with whom we shared this dream from the early 1990ies on)***



# History of the Universe

Physics at the LHC corresponds to conditions around here

**BIG BANG**

Inflation

t	$10^{-44}$	$10^{-37}$ s
T	$10^{32}$	$10^{28}$
E	$10^{19}$	$10^{15}$

possible dark matter relicts

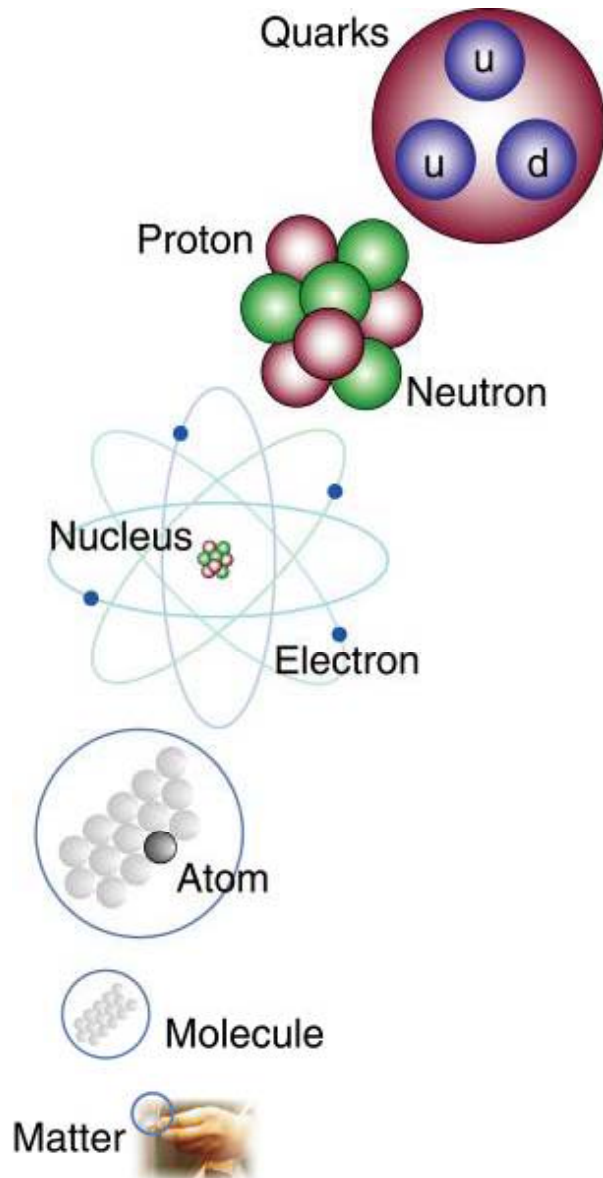
cosmic microwave radiation visible

**Key:**

W, Z bosons	meson	photon
quark	baryon	star
gluon	ion	galaxy
electron	atom	black hole
muon		
tau		
neutrino		

$10^{-10}$ s	$10^{-5}$ s	$10^2$ s	$3 \times 10^5$ y	$10^9$ y	Today
$10^{15}$	$10^{12}$	$10^9$	3000	15	$12 \times 10^9$ y (sec, yrs)
$10^2$	$10^{-1}$	$10^{-4}$	$3 \times 10^{-10}$	$10^{-12}$	2.7 (Kelvin)
					$2.3 \times 10^{-13}$ (GeV)

# The study of elementary particles and fields and their interactions



	matter particles			gauge particles	
	1st gen.	2nd gen.	3rd gen.		
Q U A R K	<i>u</i> <i>up</i>	<i>c</i> <i>charm</i>	<i>t</i> <i>top</i>	Strong Force	
	<i>d</i> <i>down</i>	<i>s</i> <i>strange</i>	<i>b</i> <i>bottom</i>	<i>g</i> x8 <i>Gluon</i>	
L E P T O N	<i>ν<sub>e</sub></i> <i>e neutrino</i>	<i>ν<sub>μ</sub></i> <i>μ neutrino</i>	<i>ν<sub>τ</sub></i> <i>τ neutrino</i>	Electro-Magnetic Force	
	<i>e</i> <i>electron</i>	<i>μ</i> <i>muon</i>	<i>τ</i> <i>tau</i>	<i>γ</i> <i>photon</i>	
				Weak Force	
				<i>W<sup>+</sup></i>	<i>W<sup>-</sup></i> <i>Z</i> <i>W bosons</i> <i>Z boson</i>
Scalar particle(s)				<i>H</i> ...	
				<i>Higgs</i>	

## Elements of the Standard Model

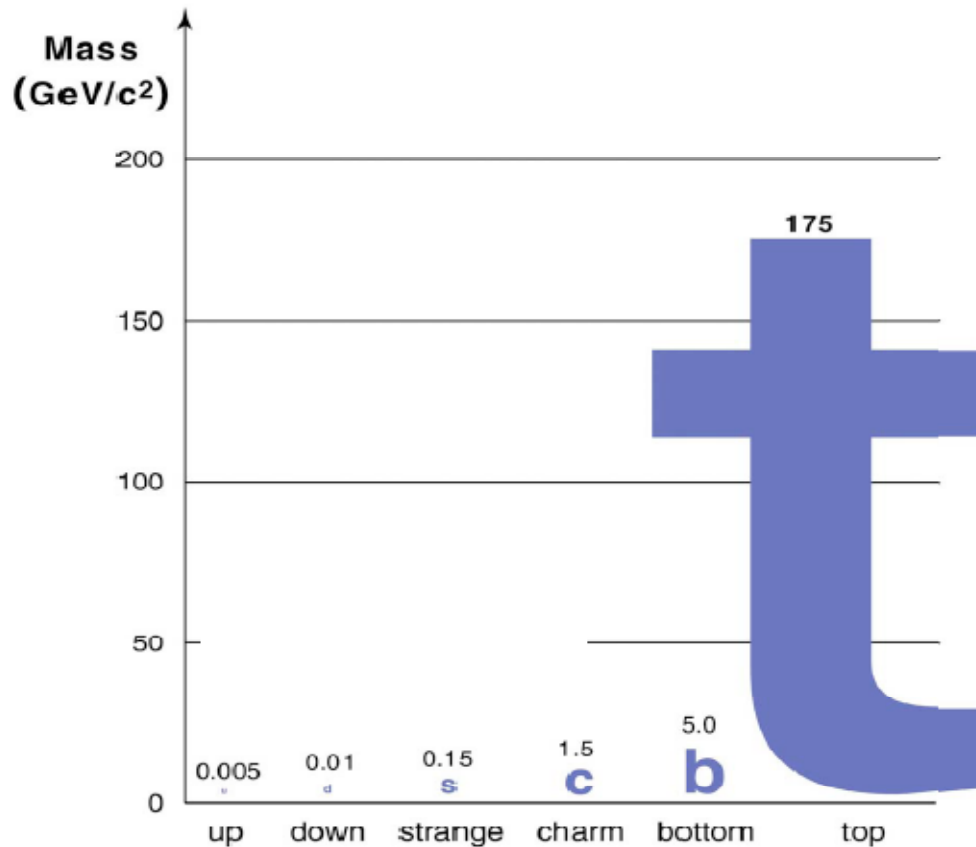


***A most basic question is why particles (and matter) have masses (and so different masses)***

**The mass mystery could be solved with the ‘Higgs mechanism’ which predicts the existence of a new elementary particle, the ‘Higgs’ particle (theory 1964, P. Higgs, R. Brout and F. Englert)**



**Peter Higgs**



**Quarks**

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P Jenni (CERN)

**The Higgs (H) particle has been searched for since decades at accelerators, but not yet found...  
The LHC will have sufficient energy to produce it for sure, if it exists**



**Francois Englert**

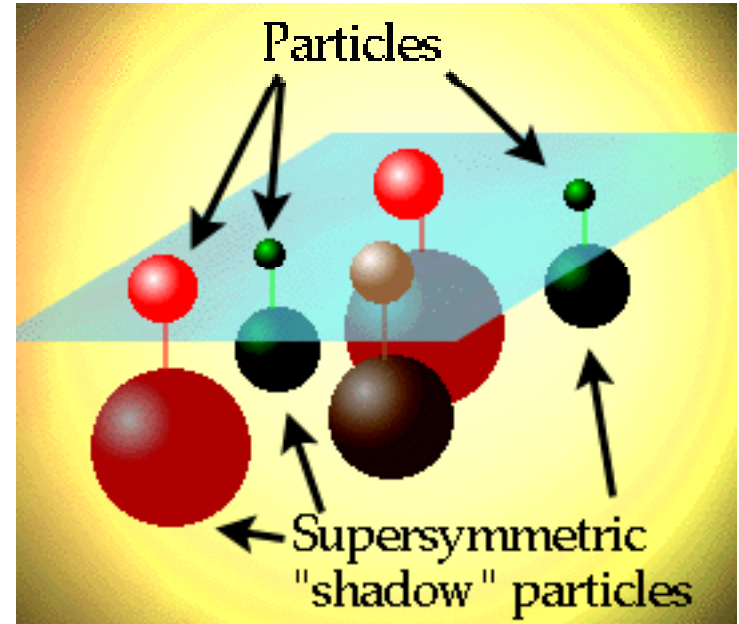
# Supersymmetry (SUSY)

Establishes a symmetry between fermions (matter) and bosons (forces):

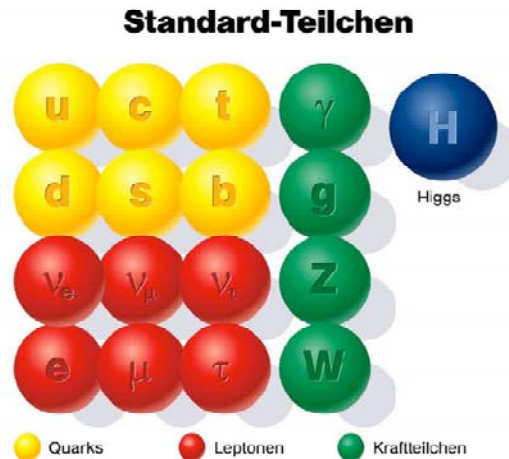
- Each particle  $p$  with spin  $s$  has a SUSY partner  $\tilde{p}$  with spin  $s - 1/2$

- Examples

$q$ ( $s=1/2$ )	$\rightarrow$	$\tilde{q}$ ( $s=0$ )	<b>squark</b>
$g$ ( $s=1$ )	$\rightarrow$	$\tilde{g}$ ( $s=1/2$ )	<b>gluino</b>

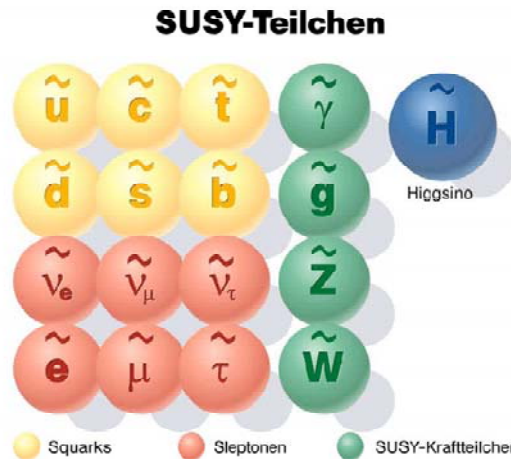


## Our known world



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## Maybe a new world?



LHC and ATLAS, Motivation and Status

## Motivation:

- **Unification** (fermions-bosons, matter-forces)
- **Solves some deep problems of the Standard Model**

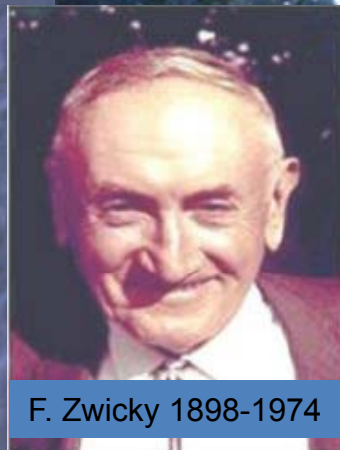


# Dark Matter in the Universe

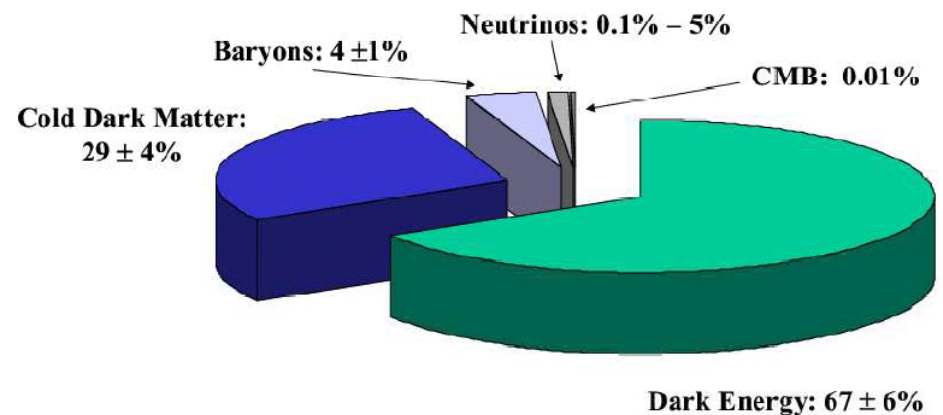
Astronomers say that most of the matter in the Universe is invisible Dark Matter

**'Supersymmetric' particles ?**

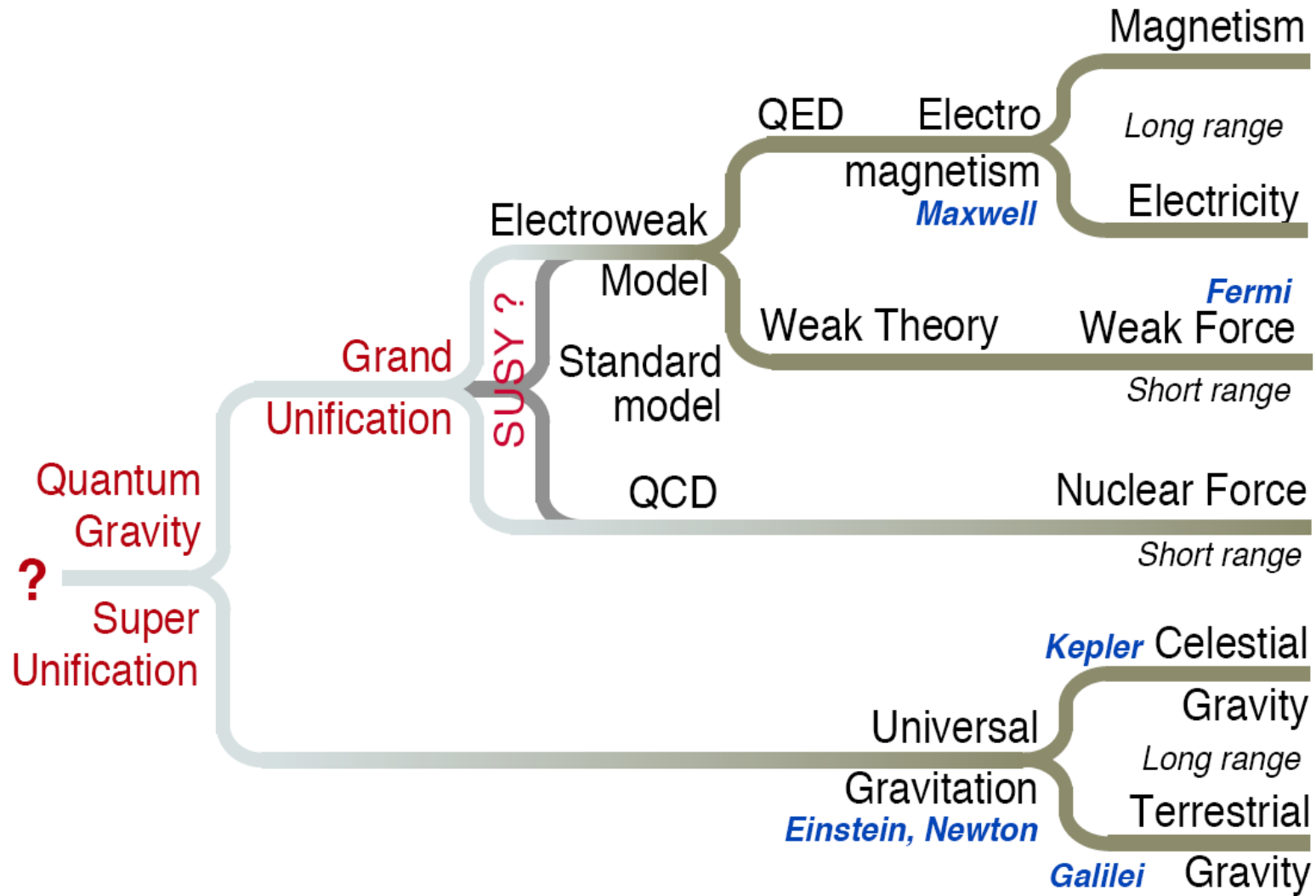
We shall look for them with the LHC



F. Zwicky 1898-1974



# Unification of Forces

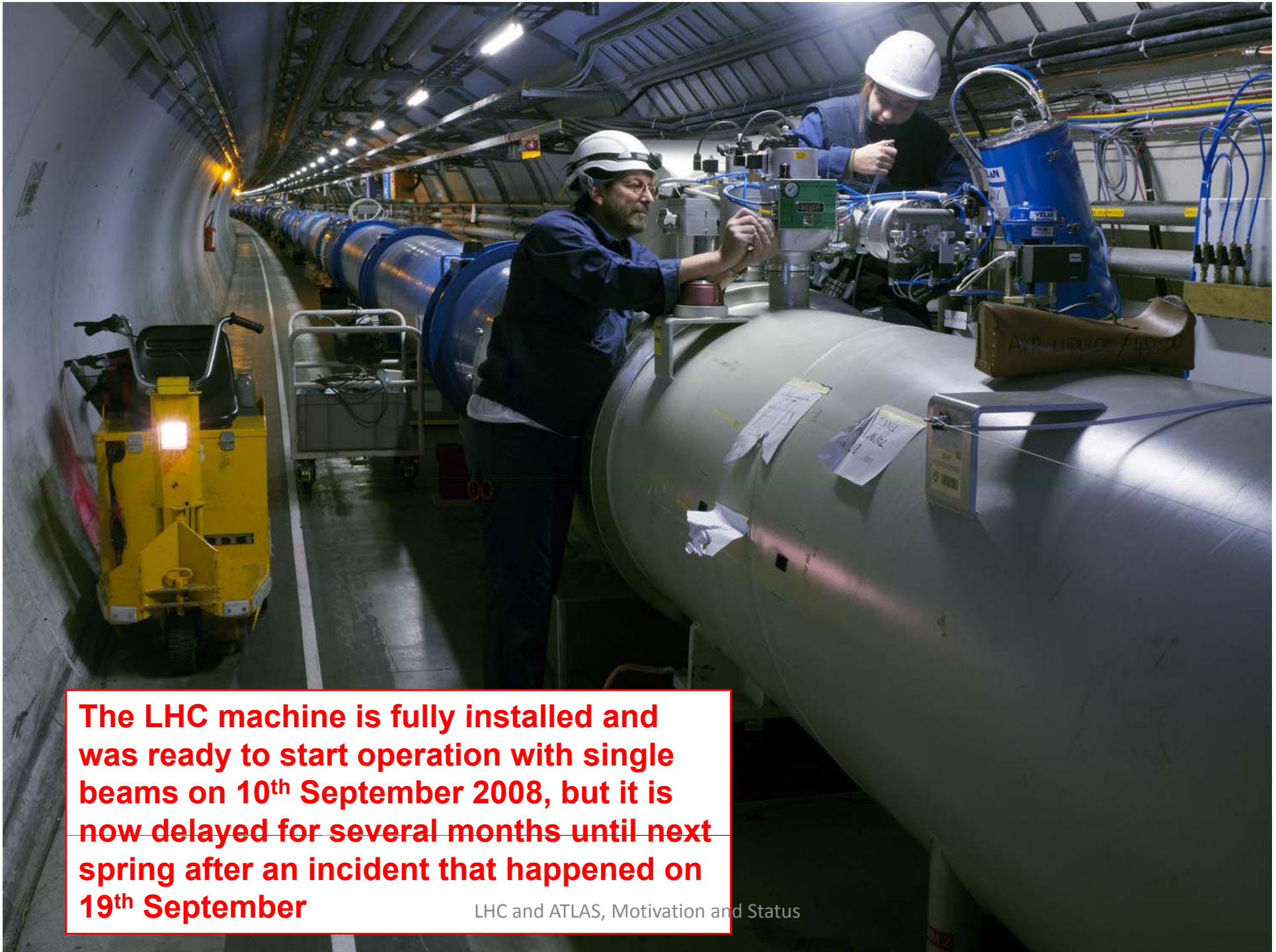




# *The LHC machine*

*The Large Hadron Collider is a 27 km long collider ring housed in a tunnel about 100 m underground near Geneva*





**The LHC machine is fully installed and was ready to start operation with single beams on 10<sup>th</sup> September 2008, but it is now delayed for several months until next spring after an incident that happened on 19<sup>th</sup> September**



- pp  $\sqrt{s} = 14 \text{ TeV}$   $L_{\text{design}} = 10^{34} \text{ cm}^{-2} \text{ s}^{-1}$  (after 2010)  
 $L_{\text{initial}} < \text{few} \times 10^{33} \text{ cm}^{-2} \text{ s}^{-1}$  (before)
- Note:  $\sqrt{s}$  is x7 Tevatron,  $L_{\text{design}}$  is x100 Tevatron
- Heavy ions (e.g. Pb-Pb at  $\sqrt{s} \sim 1000 \text{ TeV}$ )

First collisions:  
now expected in  
spring 2009

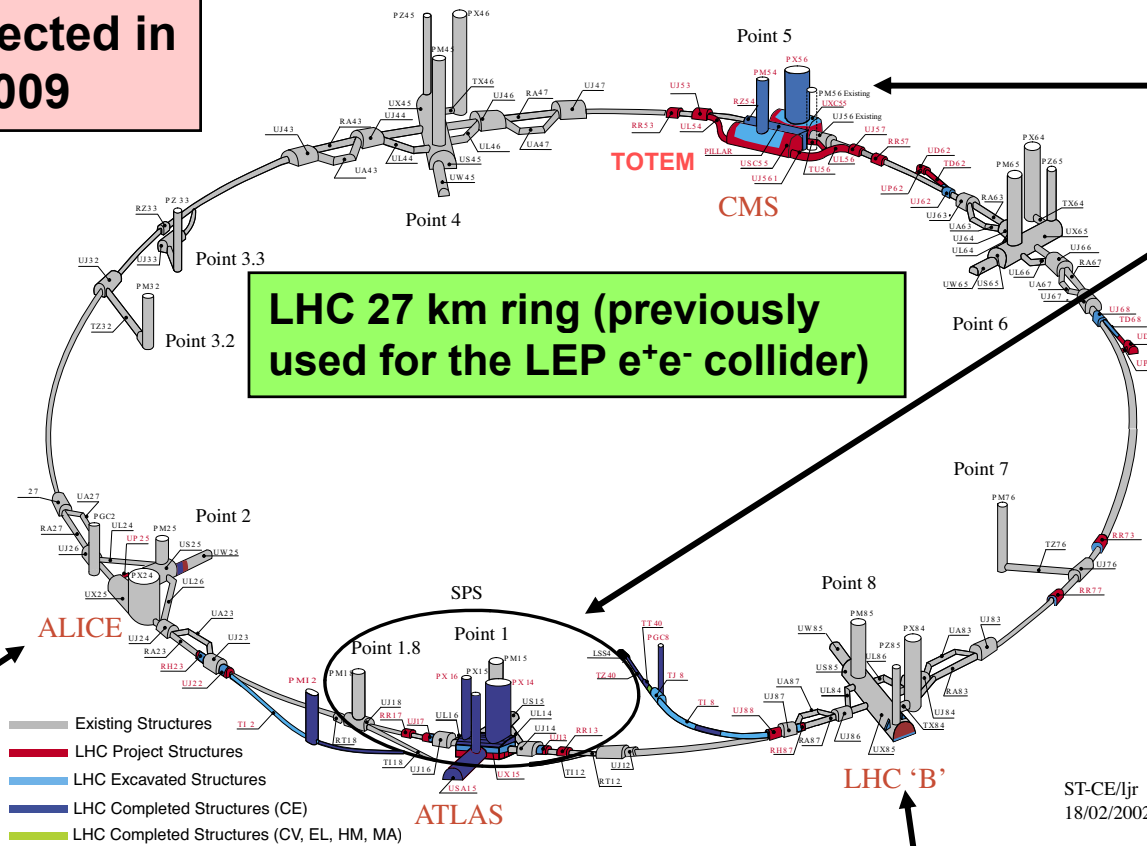
ATLAS and CMS :  
pp, general purpose

LHC 27 km ring (previously  
used for the LEP  $e^+e^-$  collider)

Today's topic:  
ATLAS

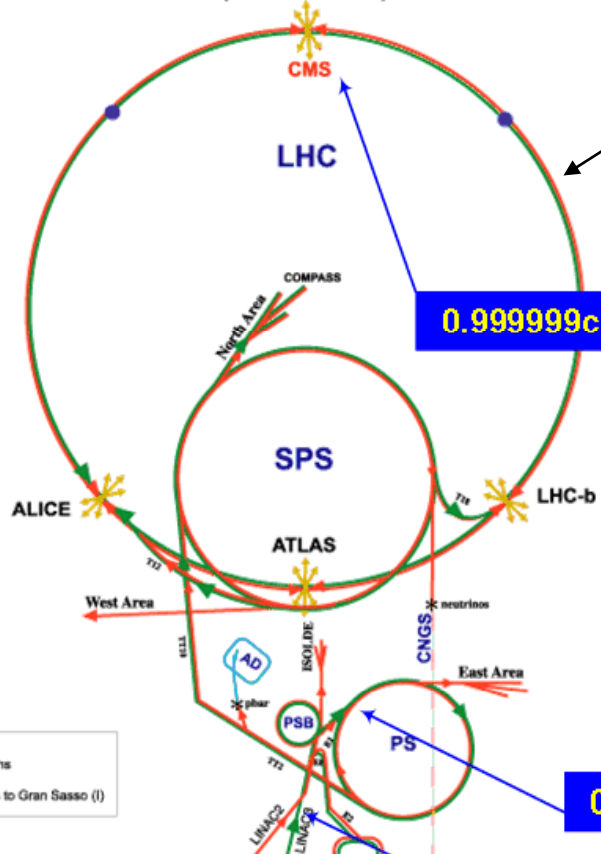
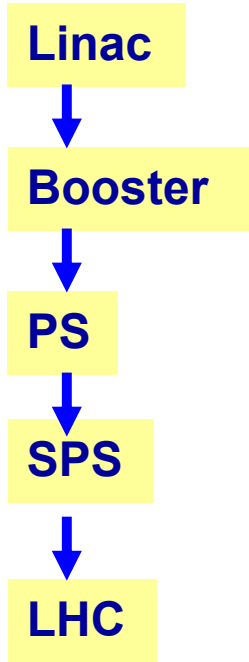
ALICE :  
ion-ion,  
p-ion

LHCb :  
pp, B-physics, CP-violation



# The full LHC accelerator complex

CERN Accelerators  
(not to scale)



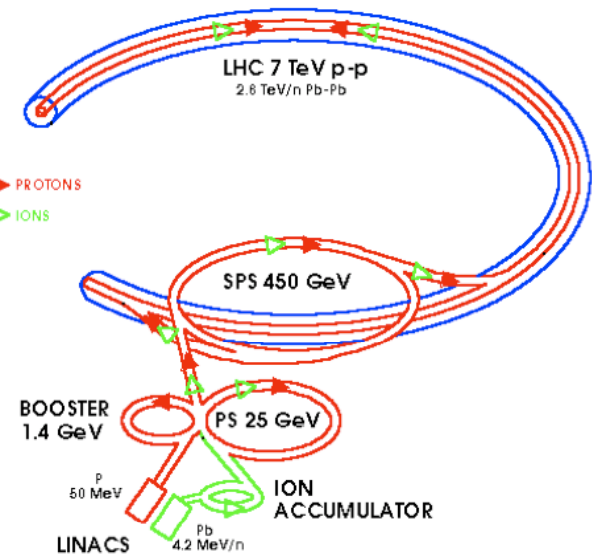
LHC ring is divided into 8 sectors

0.999999c by here

0.87c by here

0.3c by here

Start the protons out here



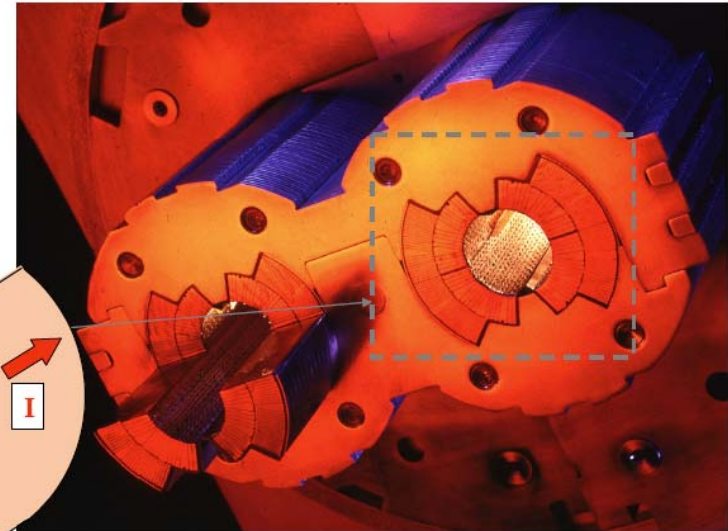
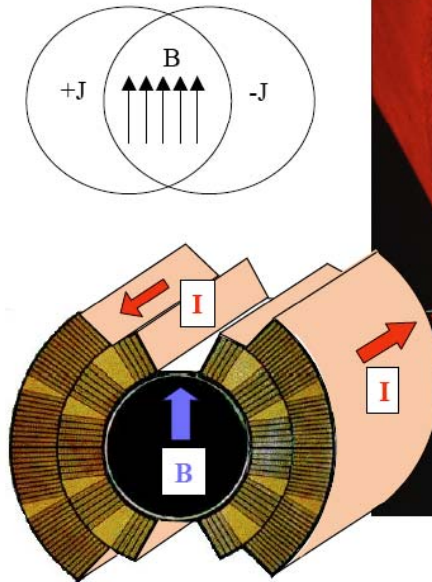
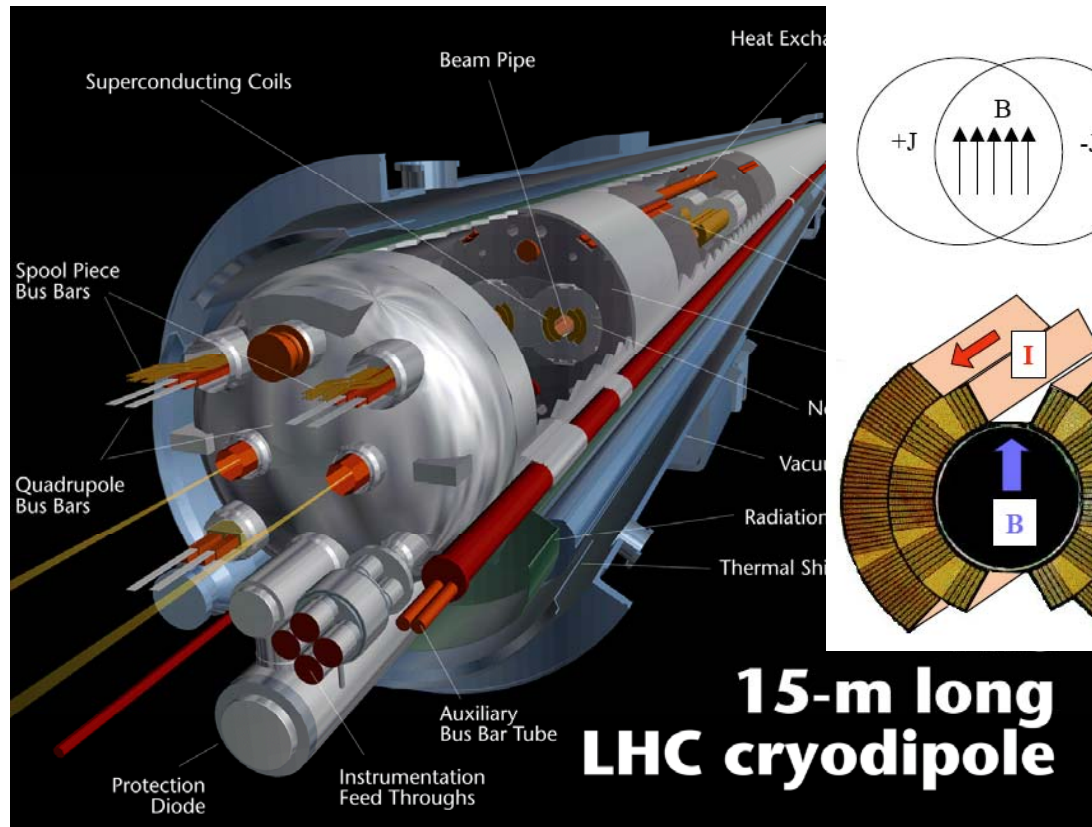
- LHC: Large Hadron Collider
- SPS: Super Proton Synchrotron
- AD: Antiproton Decelerator
- ISOLDE: Isotope Separator OnLine DEvice
- PSB: Proton Synchrotron Booster
- PS: Proton Synchrotron
- LINAC: LINear ACcelerator
- LEIR: Low Energy Ion Ring
- CNGS: Cern Neutrinos to Gran Sasso

Radolf LEY, PS Division, CERN, 02.09.96  
Revised and adapted by Antonella Del Rosso, ETT Div.,  
in collaboration with B. Desportes, SL Div., and  
D. Manglunki, PS Div. CERN, 23.05.01

> 50 years of CERN history still alive and operational



# LHC Accelerator Challenge: Dipole Magnets



**Magnetic Field for Dipoles**  
 $p \text{ (TeV)} = 0.3 \text{ B(T) R(km)}$

**For  $p = 7 \text{ TeV}$  and  $R = 4.3 \text{ km}$**   
 $\Rightarrow B = 8.4 \text{ T}$   
 $\Rightarrow \text{Current } 12 \text{ kA}$

**Coldest Ring in the Universe ?**

1.9 K (CMBR is about 2.7 K)

**LHC magnets are cooled with pressurized superfluid helium**

# ***Descent of the last dipole magnet, 26 April 2007***

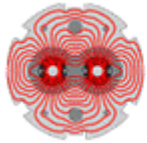


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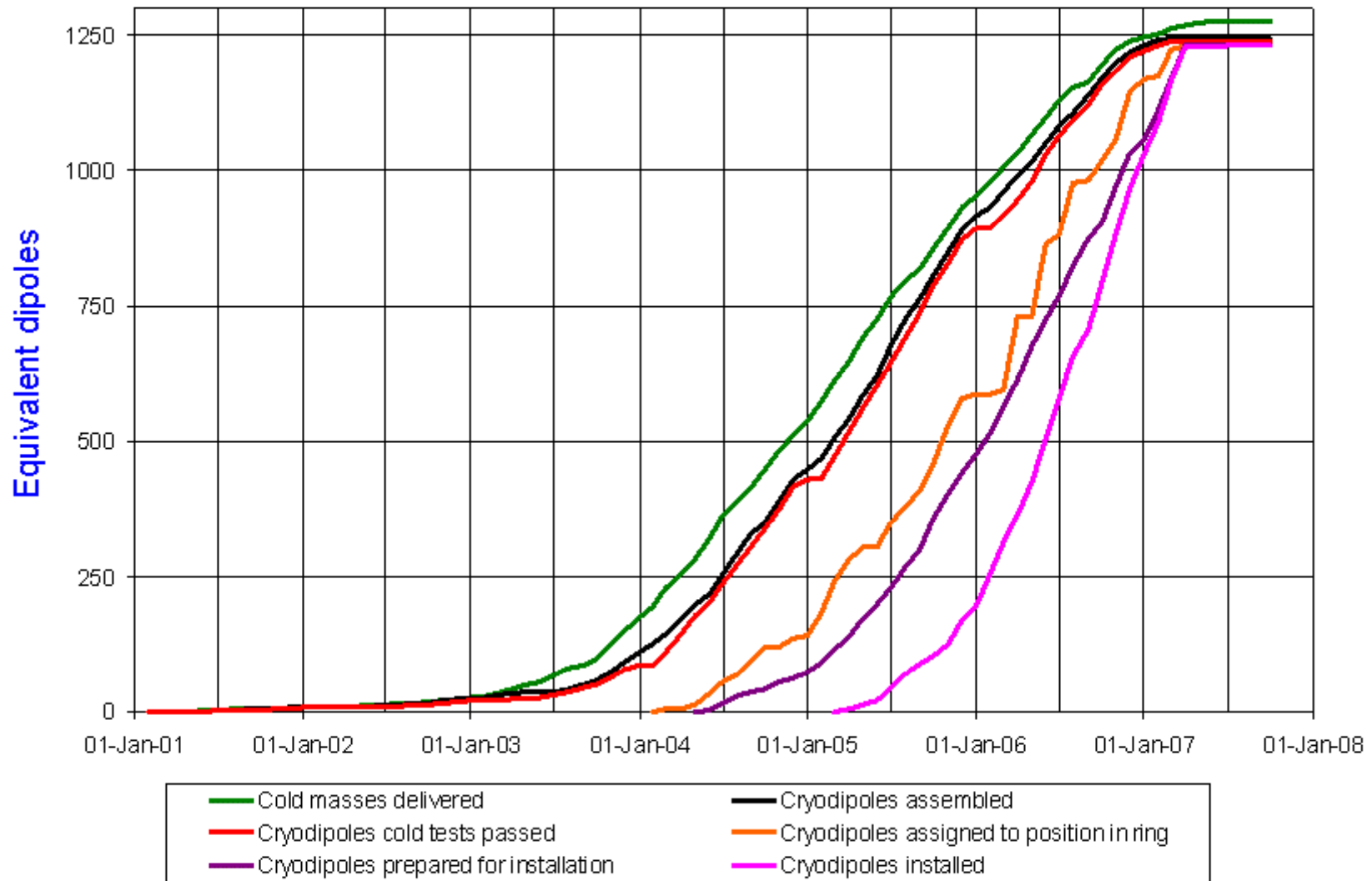


**30'000 km underground transports  
at a speed of 2 km/h!**

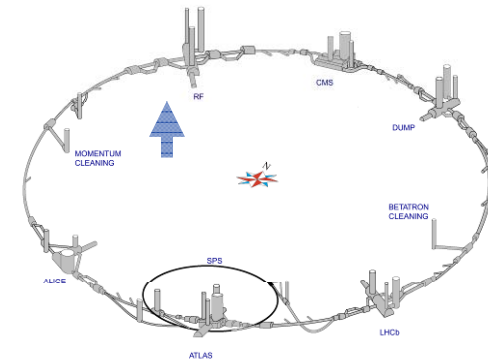
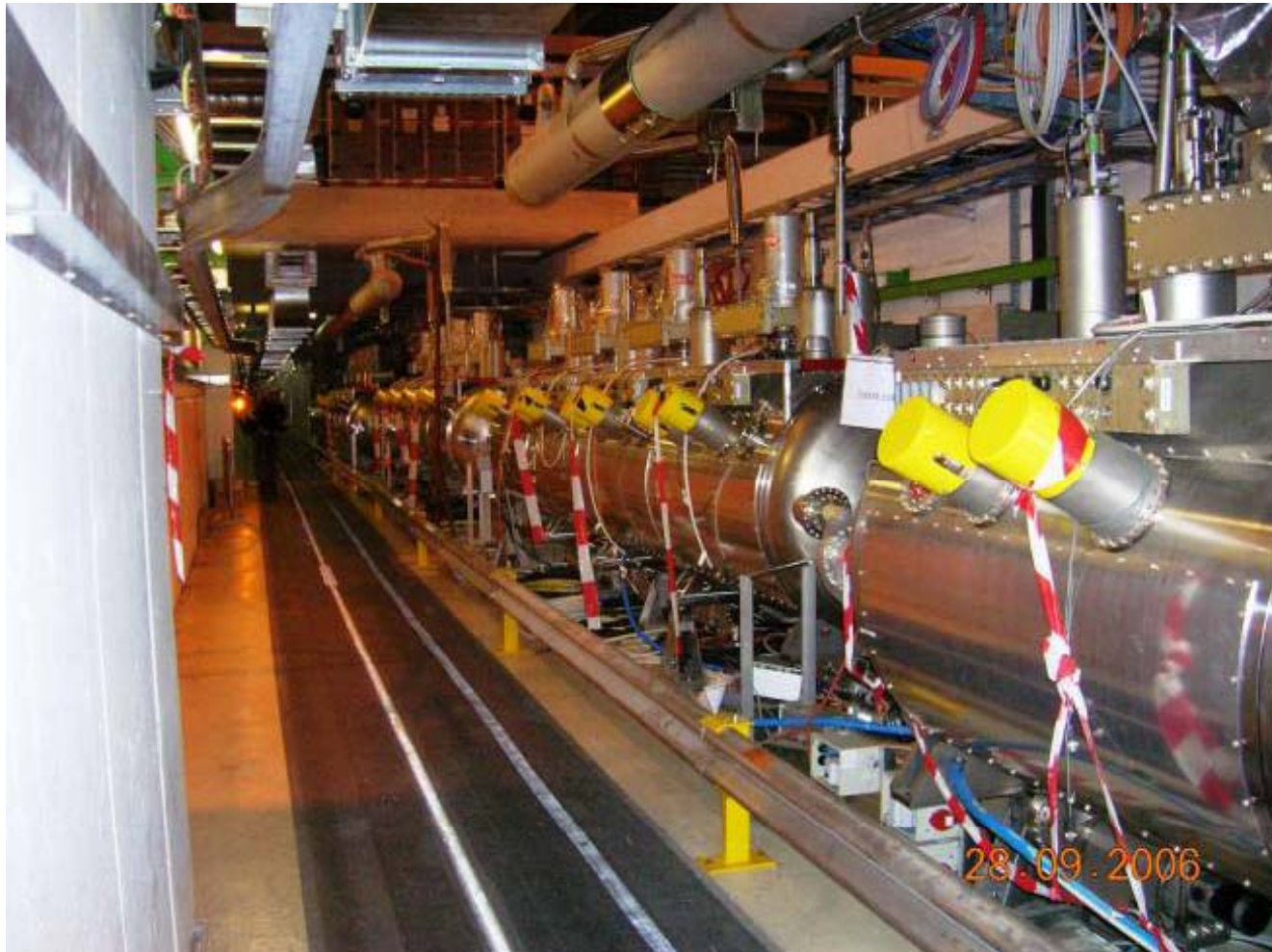




Cryodipole overview



# The particle beams are accelerated by superconducting Radio-Frequency (RF) cavities



Note: The acceleration is not such a big issue in pp colliders (unlike in  $e^+e^-$  colliders), because of the  $\sim 1/m^4$  behaviour of the synchrotron radiation energy losses [ $\sim E_{\text{beam}}^4/Rm^4$ ]

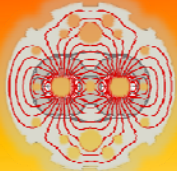
	LHC at 7 TeV	LEP at 100 GeV
Synchrotron radiation loss	6.7 keV/turn	3 GeV/turn
Peak accelerating voltage	16 MV/beam	3600 MV/beam



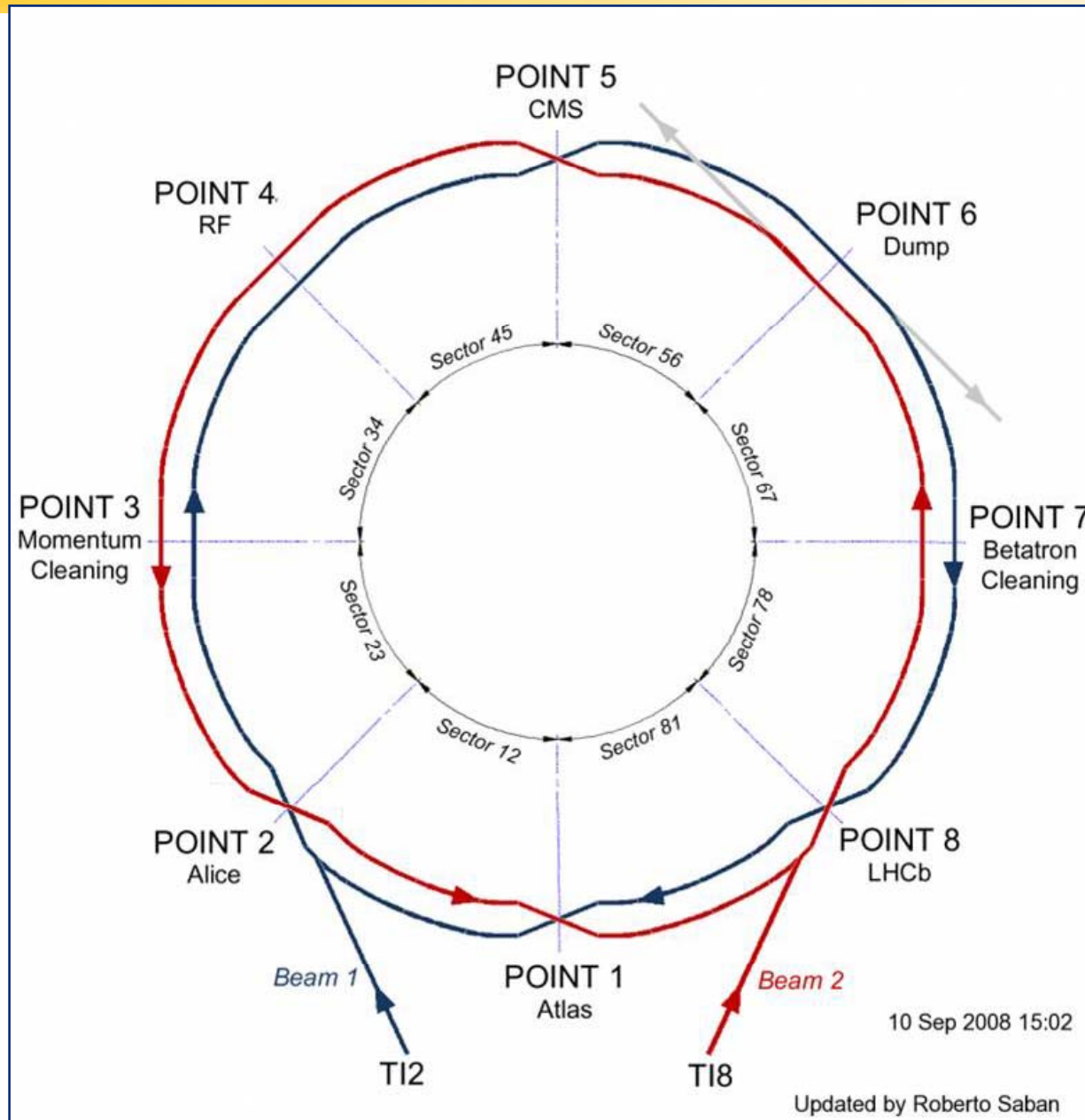
**Special quadrupole magnets ('Inner Triplets') are focussing the particle beams to reach highest densities ('luminosity') at their interaction point in the centre of the experiments**

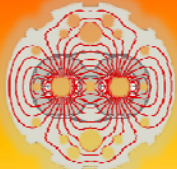




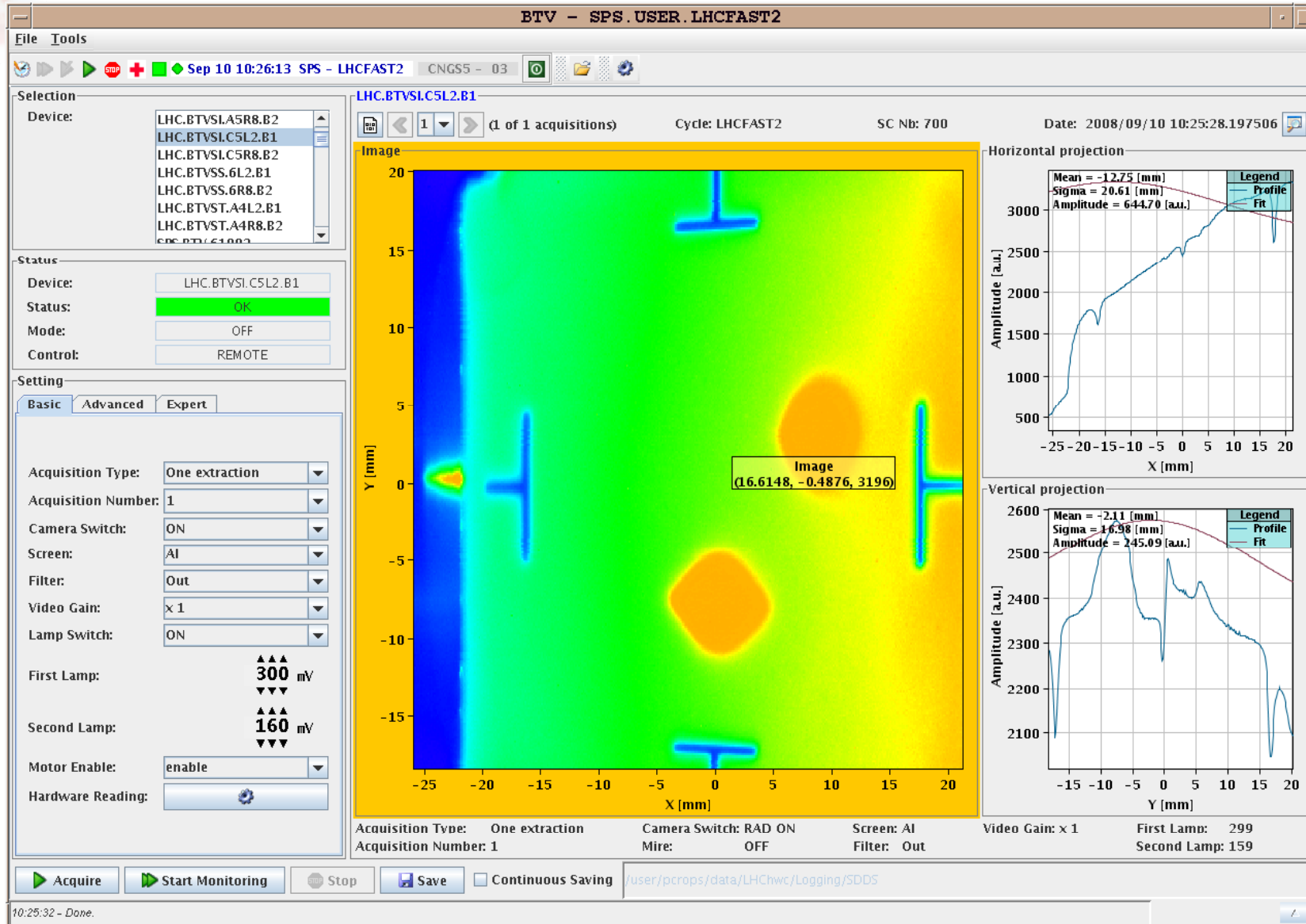


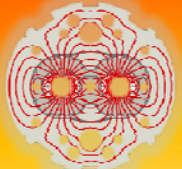
# LHC start-up on 10<sup>th</sup> September 2008



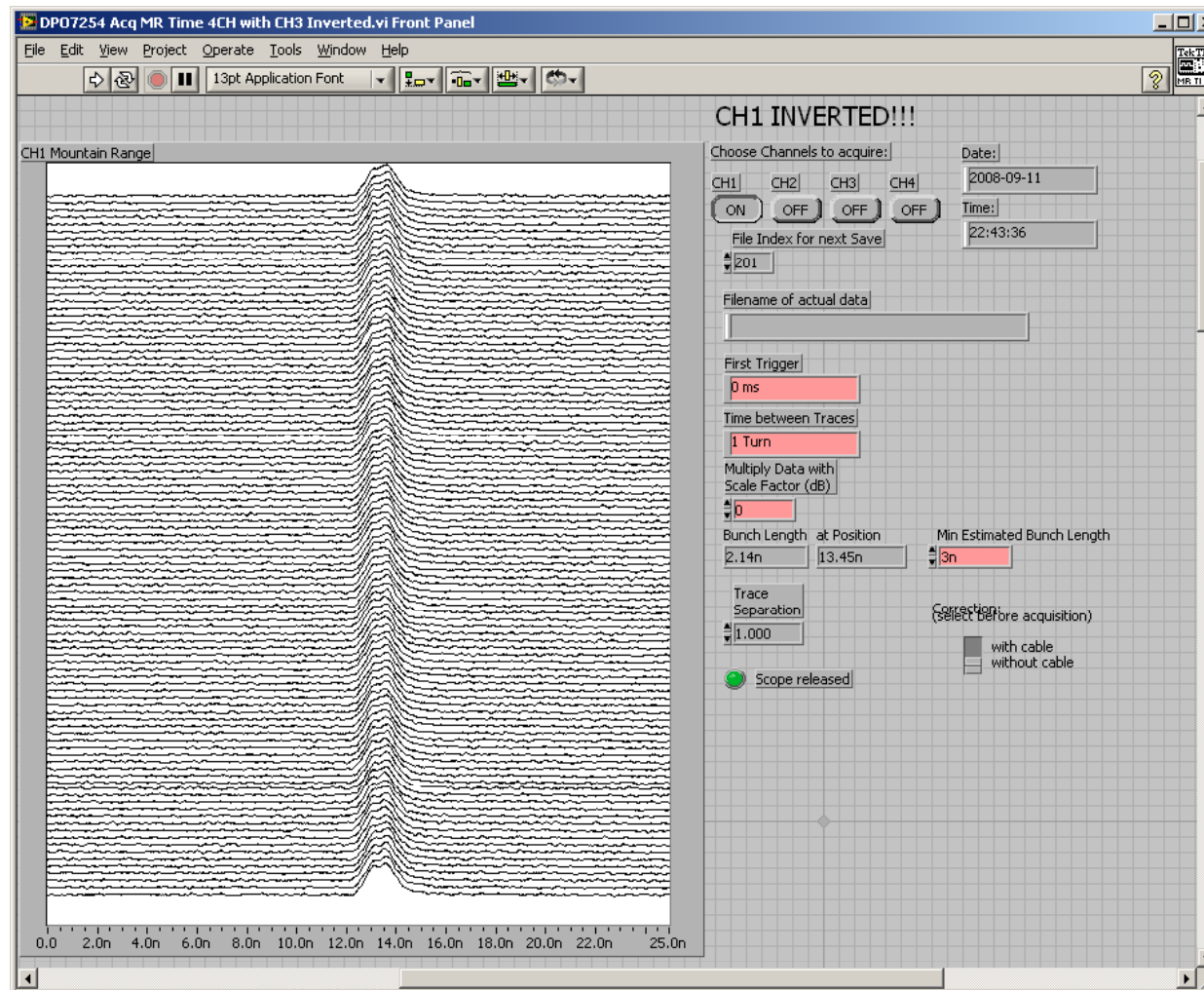


# Very first LHC beam on turns 1 and 2

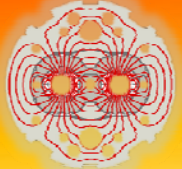




# Capture of the first LHC beam with optimum injection phasing, correct reference







## ***Transformer failure on 12<sup>th</sup> September***



- **At 23:30 on Friday a 12 MVA transformer at Point 8 failed.**
- **There is no spare unit but CMS has 2 similar transformers and a lot of over-capacity.**
- **The cryogenics at point 8 (7-8 and 8-1) was lost.**
- **The CMS transformer was installed on Saturday and Sunday.**

## *Incident on 19<sup>th</sup> September*

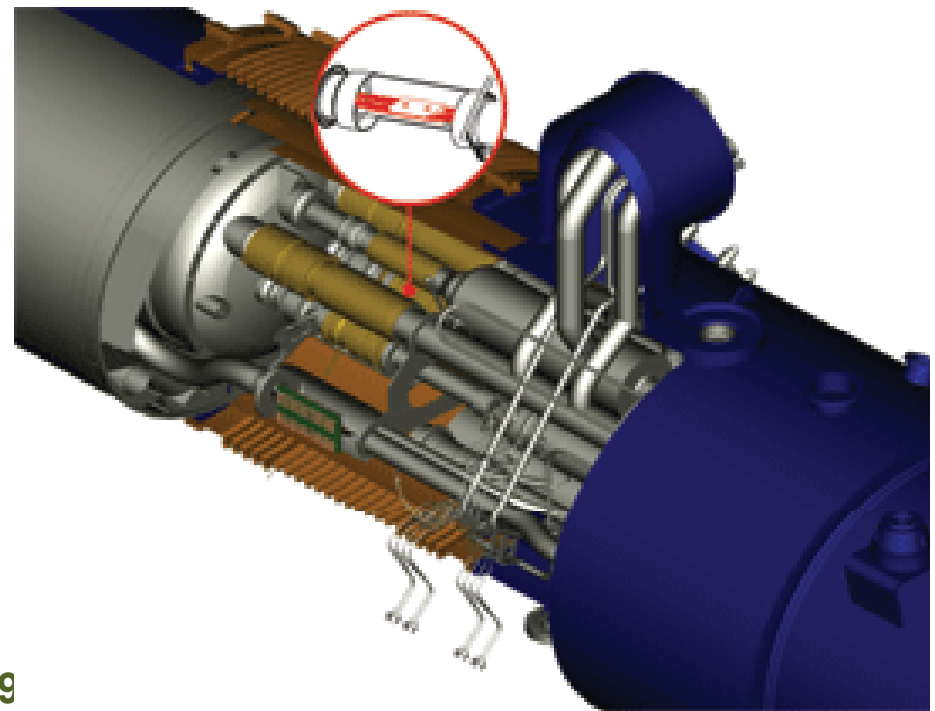
The LHC decided to use the few days of down-time to continue work on powering tests

During commissioning of the last main bend circuit to 5 TeV an incident occurred resulting in the triggering of quench heaters of about 100 magnets and a large He discharge into the tunnel

This resulted in mechanical damage in a part of this sector

**The cause was a faulty electrical connection between two magnets, and the repair work actions have now started, about 30 magnets will have to be replaced**

The exact start-up schedule is not yet known, it will be after the winter shut-down in spring (the ATLAS planning is to be ready in May 2009)



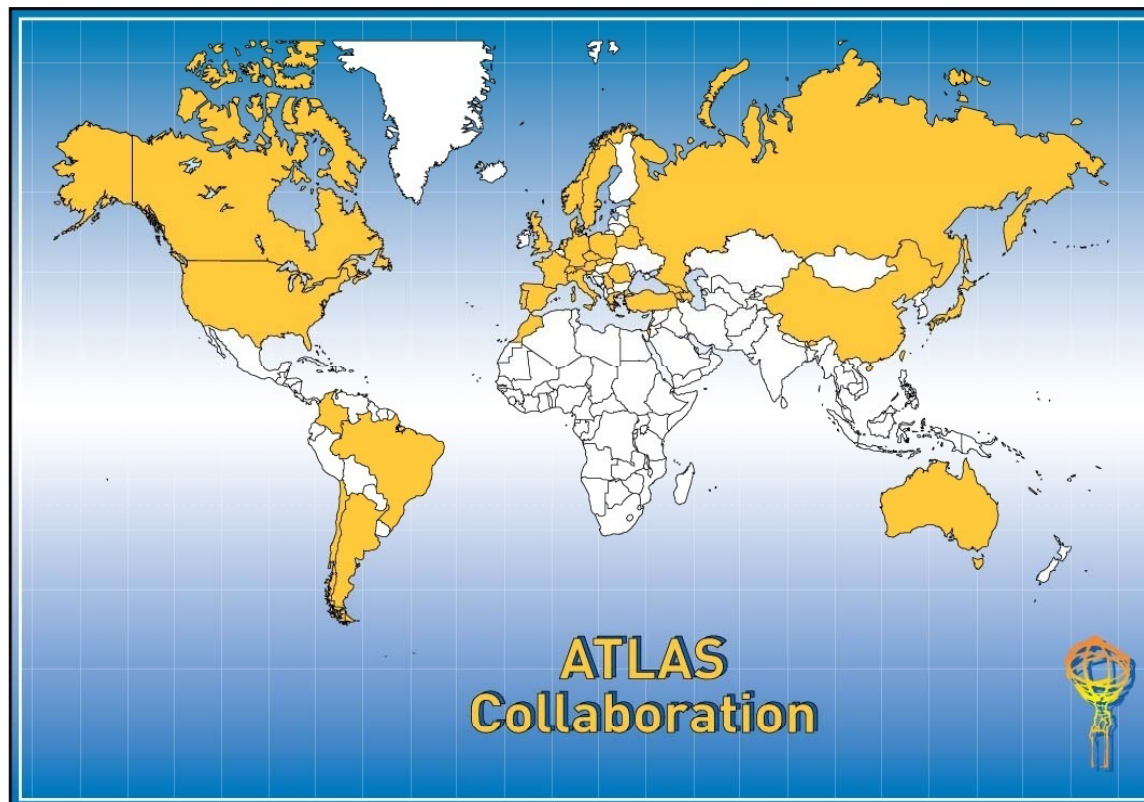


# ATLAS Collaboration

(Status July 2008)

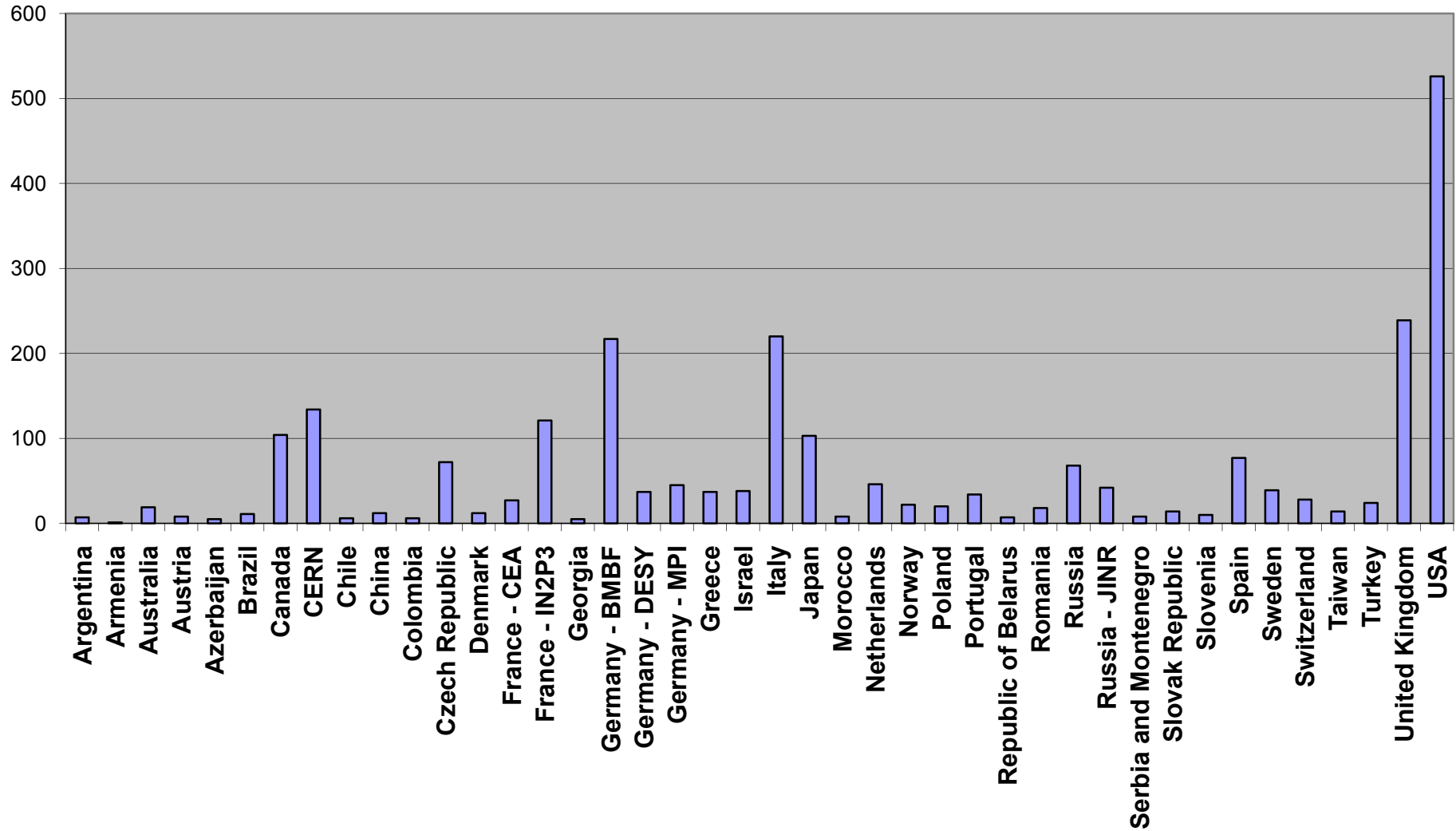
**37 Countries**  
**169 Institutions**  
**2500 Scientific Authors total**  
**(1800 with a PhD, for M&O share)**

**Engin Arik and her Bogazici University  
group joined officially ATLAS in  
June 1994**



Albany, Alberta, NIKHEF Amsterdam, **Ankara**, LAPP Annecy, Argonne NL, Arizona, UT Arlington, Athens, NTU Athens, Baku, IFAE Barcelona, Belgrade, Bergen, Berkeley LBL and UC, HU Berlin, Bern, Birmingham, UAN Bogota, Bologna, Bonn, Boston, Brandeis, Bratislava/SAS Kosice, Brookhaven NL, Buenos Aires, Bucharest, Cambridge, Carleton, Casablanca/Rabat, CERN, Chinese Cluster, Chicago, Chile, Clermont-Ferrand, Columbia, NBI Copenhagen, Cosenza, AGH UST Cracow, IFJ PAN Cracow, UT Dallas, DESY, Dortmund, TU Dresden, JINR Dubna, Duke, Frascati, Freiburg, Geneva, Genoa, Giessen, Glasgow, Göttingen, LPSC Grenoble, Technion Haifa, Hampton, Harvard, Heidelberg, Hiroshima, Hiroshima IT, Indiana, Innsbruck, Iowa SU, Irvine UC, **Istanbul Bogazici**, KEK, Kobe, Kyoto, Kyoto UE, Lancaster, UN La Plata, Lecce, Lisbon LIP, Liverpool, Ljubljana, QMW London, RHBNC London, UC London, Lund, UA Madrid, Mainz, Manchester, CPPM Marseille, Massachusetts, MIT, Melbourne, Michigan, Michigan SU, Milano, Minsk NAS, Minsk NCPHEP, Montreal, McGill Montreal, FIAN Moscow, ITEP Moscow, MEPHI Moscow, MSU Moscow, Munich LMU, MPI Munich, Nagasaki IAS, Nagoya, Naples, New Mexico, New York, Nijmegen, BINP Novosibirsk, Ohio SU, Okayama, Oklahoma, Oklahoma SU, Olomouc, Oregon, LAL Orsay, Osaka, Oslo, Oxford, Paris VI and VII, Pavia, Pennsylvania, Pisa, Pittsburgh, CAS Prague, CU Prague, TU Prague, IHEP Protvino, Regina, Ritsumeikan, UFRJ Rio de Janeiro, Rome I, Rome II, Rome III, Rutherford Appleton Laboratory, DAPNIA Saclay, Santa Cruz UC, Sheffield, Shinshu, Siegen, Simon Fraser Burnaby, SLAC, Southern Methodist Dallas, NPI Petersburg, Stockholm, KTH Stockholm, Stony Brook, Sydney, AS Taipei, Tbilisi, Tel Aviv, Thessaloniki, Tokyo ICEPP, Tokyo MU, Toronto, TRIUMF, Tsukuba, Tufts, Udine/ICTP, Uppsala, Urbana UI, Valencia, UBC Vancouver, Victoria, Washington, Weizmann Rehovot, FH Wiener Neustadt, Wisconsin, Wuppertal, Würzburg, Yale, Yerevan

## ATLAS Members per Funding Agency (including students)







ATLAS superimposed to the 5 floors of building 40

# ATLAS Detector

45 m

24 m

7000 Tons

Muon Detectors

Tile Calorimeter

Liquid Argon Calorimeter

Toroid Magnets

Solenoid Magnet

SCT Tracker

Pixel Detector

TRT Tracker

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***The underground cavern was finished in June 2003***





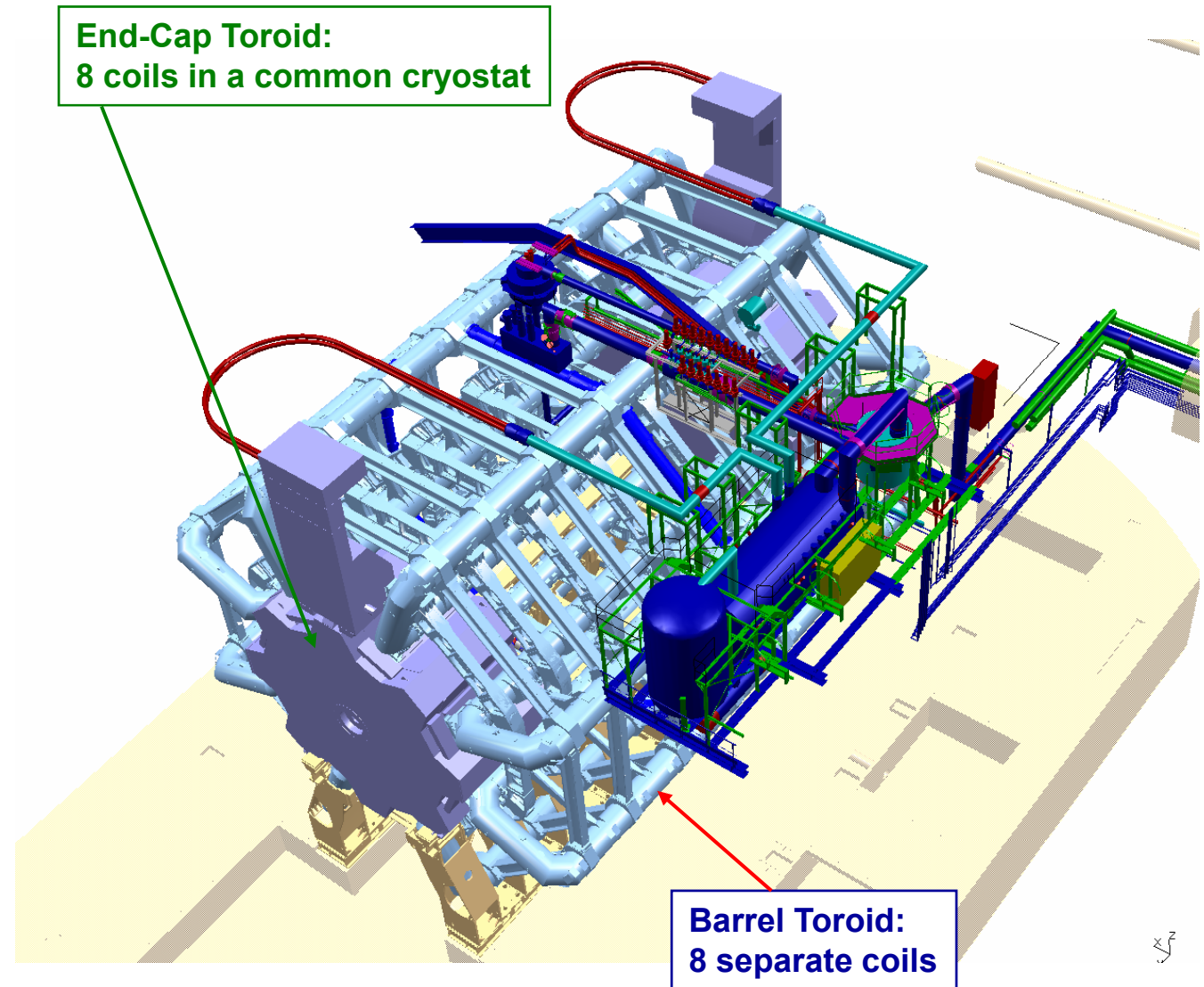
# Toroid system

## Barrel Toroid parameters

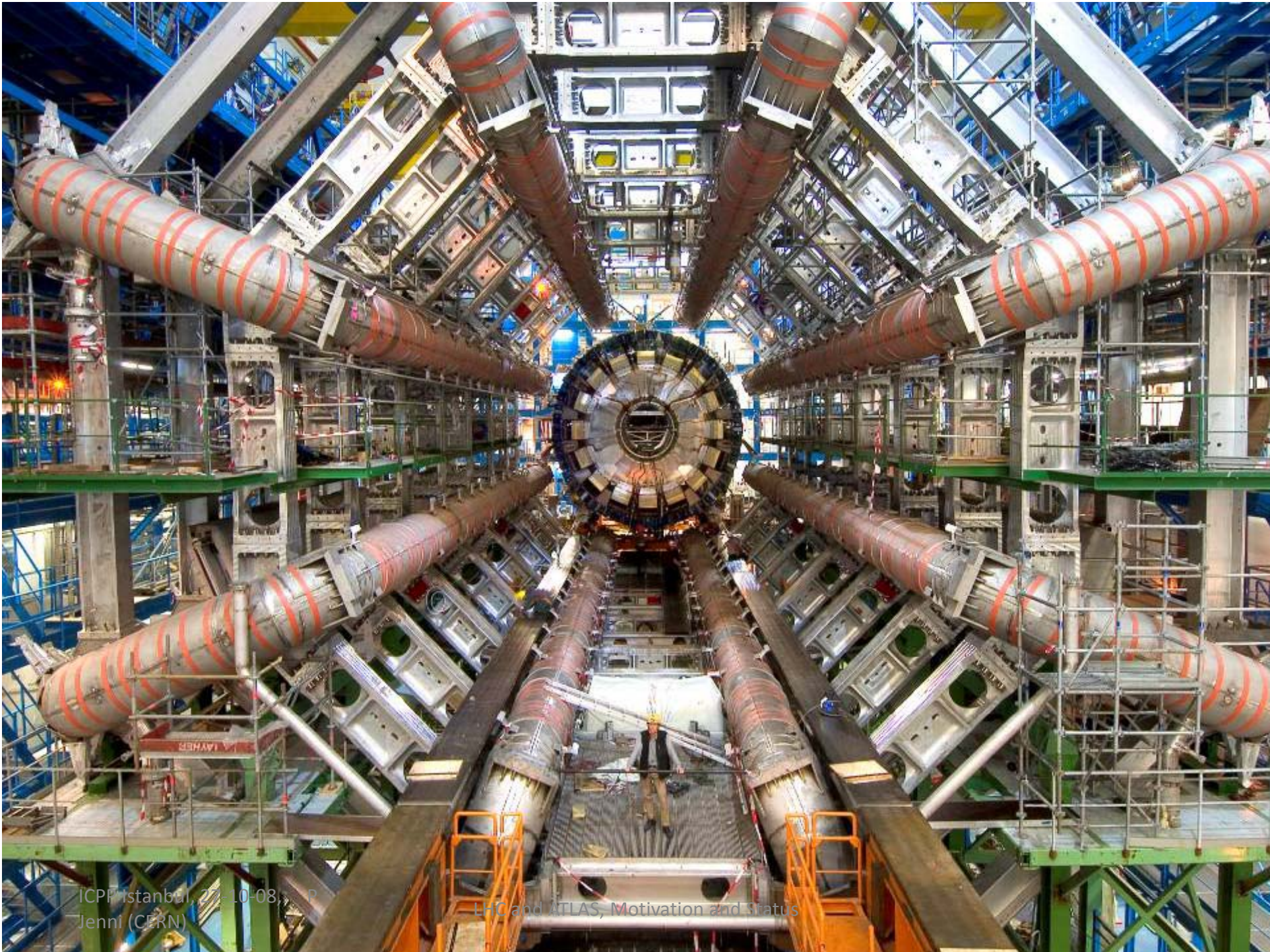
25.3 m length  
20.1 m outer diameter  
8 coils  
1.08 GJ stored energy  
370 tons cold mass  
830 tons weight  
4 T on superconductor  
56 km Al/NbTi/Cu conductor  
20.5 kA nominal current  
4.7 K working point

## End-Cap Toroid parameters

5.0 m axial length  
10.7 m outer diameter  
2x8 coils  
2x0.25 GJ stored energy  
2x160 tons cold mass  
2x240 tons weight  
4 T on superconductor  
2x13 km Al/NbTi/Cu conductor  
20.5 kA nominal current  
4.7 K working point







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LHC and ATLAS, Motivation and Status





## ***ATLAS End-cap Toroid installation***

**The transports and installations were major operations, involving also specialized firms**

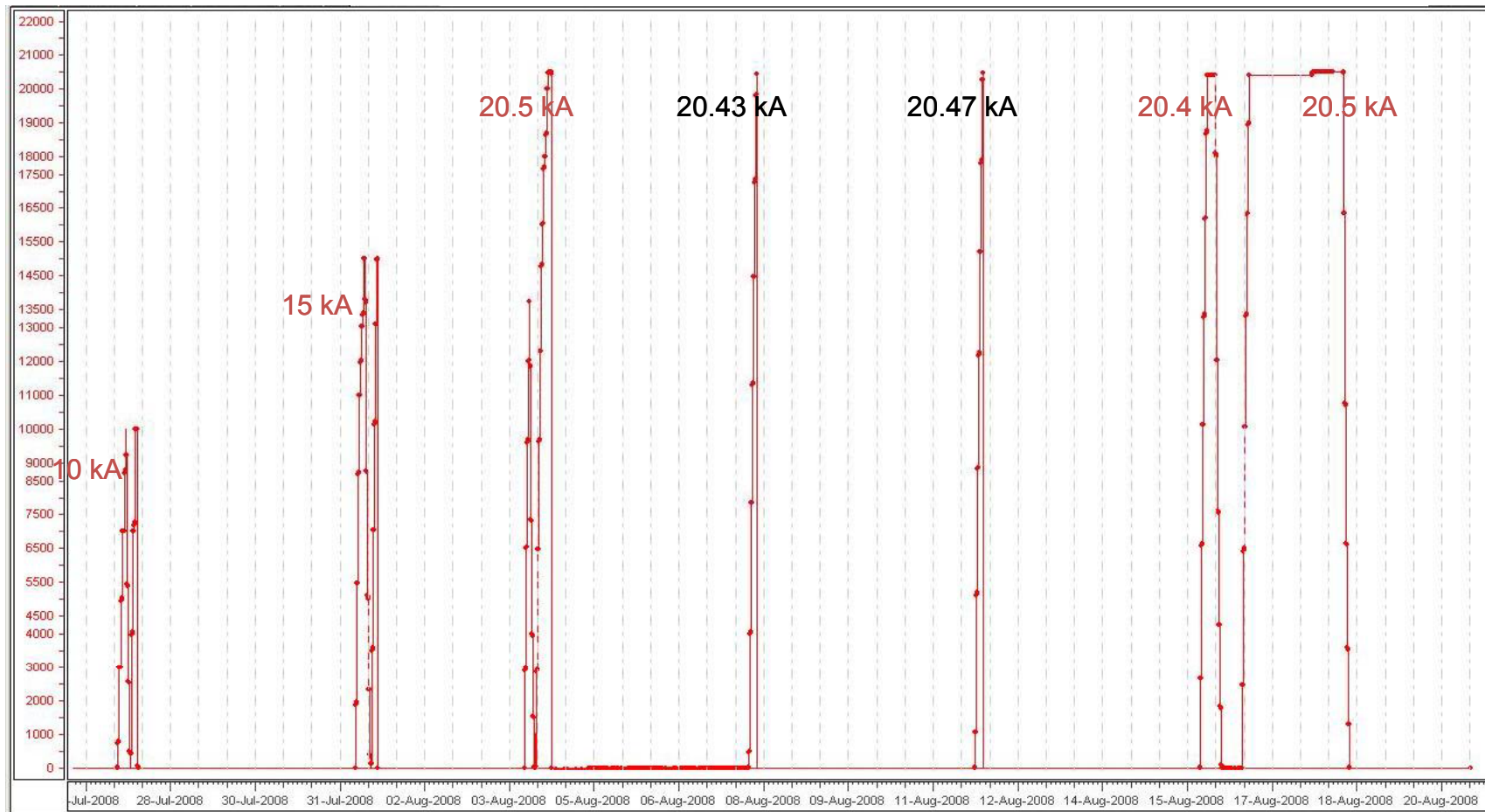
**The ECTs are 250 tons, 15 m high, 5 m wide**

**ECT-A was lowered on 13<sup>th</sup> June 2007, and  
ECT-C on 12<sup>th</sup> July 2007**





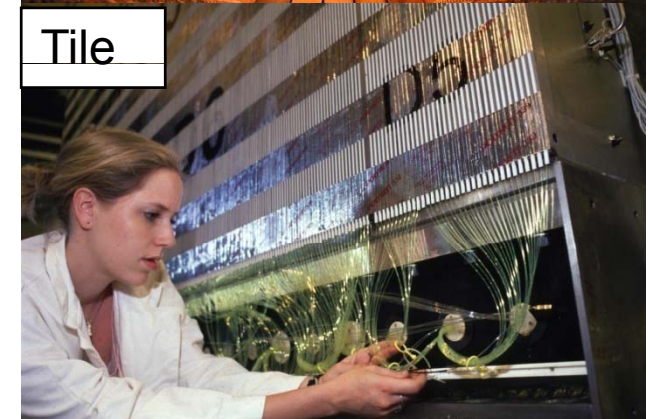
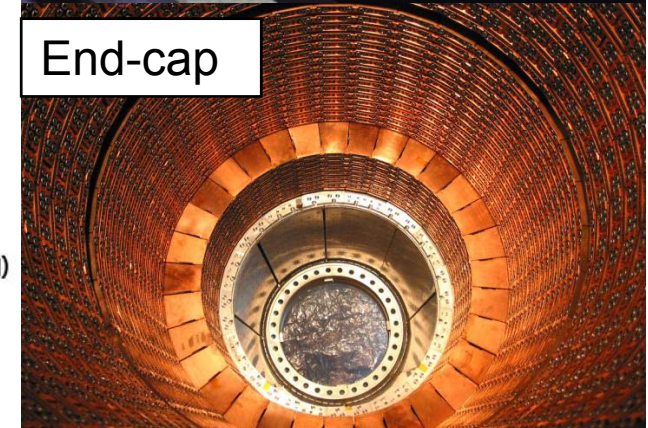
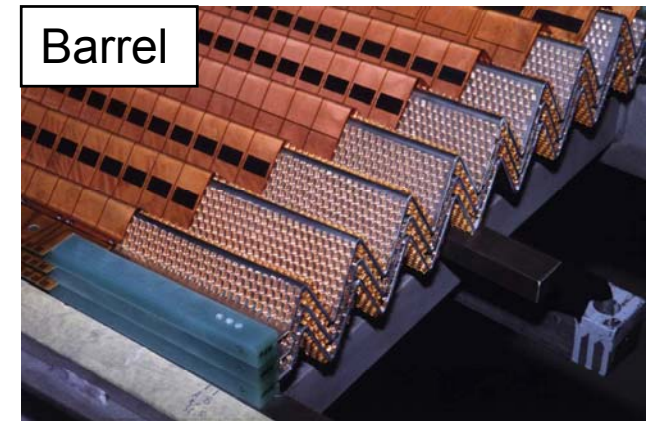
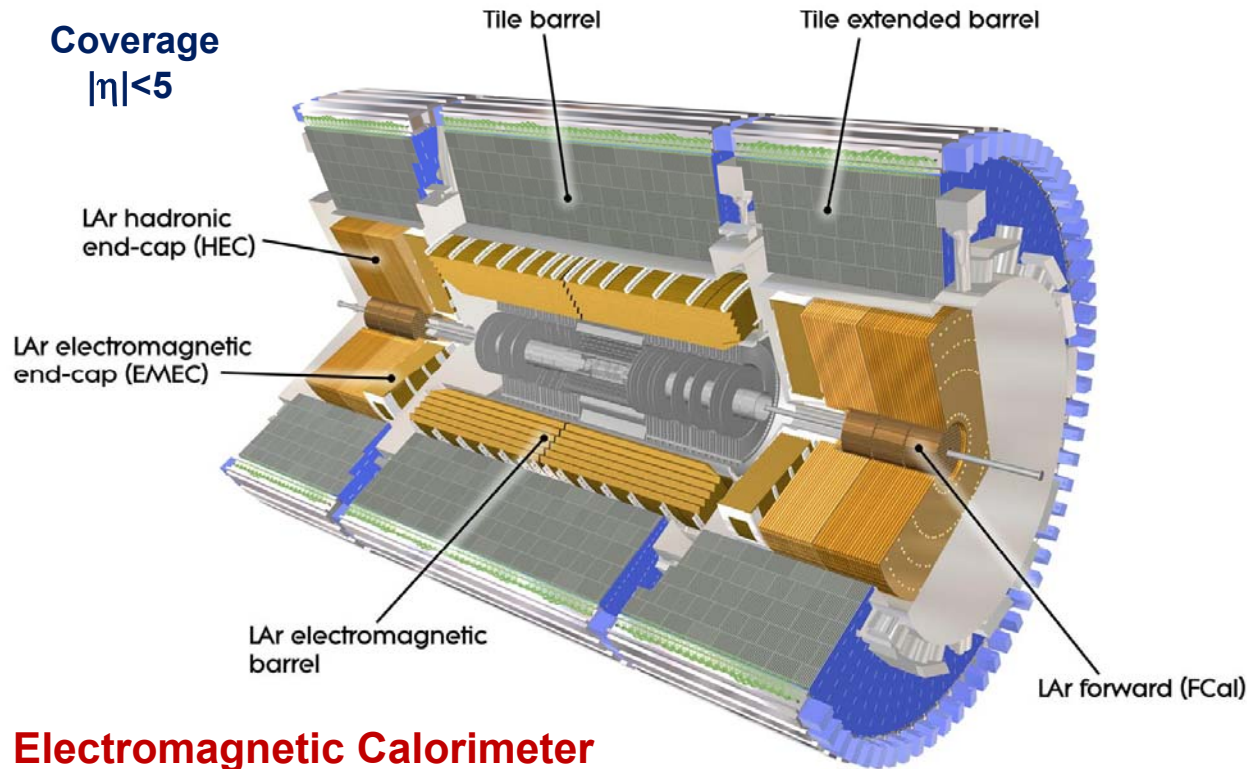
## ATLAS Toroid Commissioning Runs (27 July to 19 August 2008)



**Ramp-up of the current in 3 h10 min, slow dump in 2 h 40 min, fast dump in 2 min  
Recovery time after a fast dump (quench) is typically 100 hrs**

**Since then the full magnet system has been operated for weeks (including the central solenoid),  
only one more training quench occurred in ECT-A**

# Calorimetry



## Electromagnetic Calorimeter

barrel, end-cap: Pb-LAr

$\sim 10\%/\sqrt{E}$  energy resolution  $e/\gamma$

180'000 channels: longitudinal segmentation

## Hadron Calorimeter

barrel Iron-Tile, EC/Fwd Cu/W-LAr ( $\sim 20000$  channels)

$\sigma/E \sim 50\%/\sqrt{E} \oplus 0.03$  pion ( $10 \lambda$ )

## Trigger for $e/\gamma$ , jets, missing $E_T$ , etc

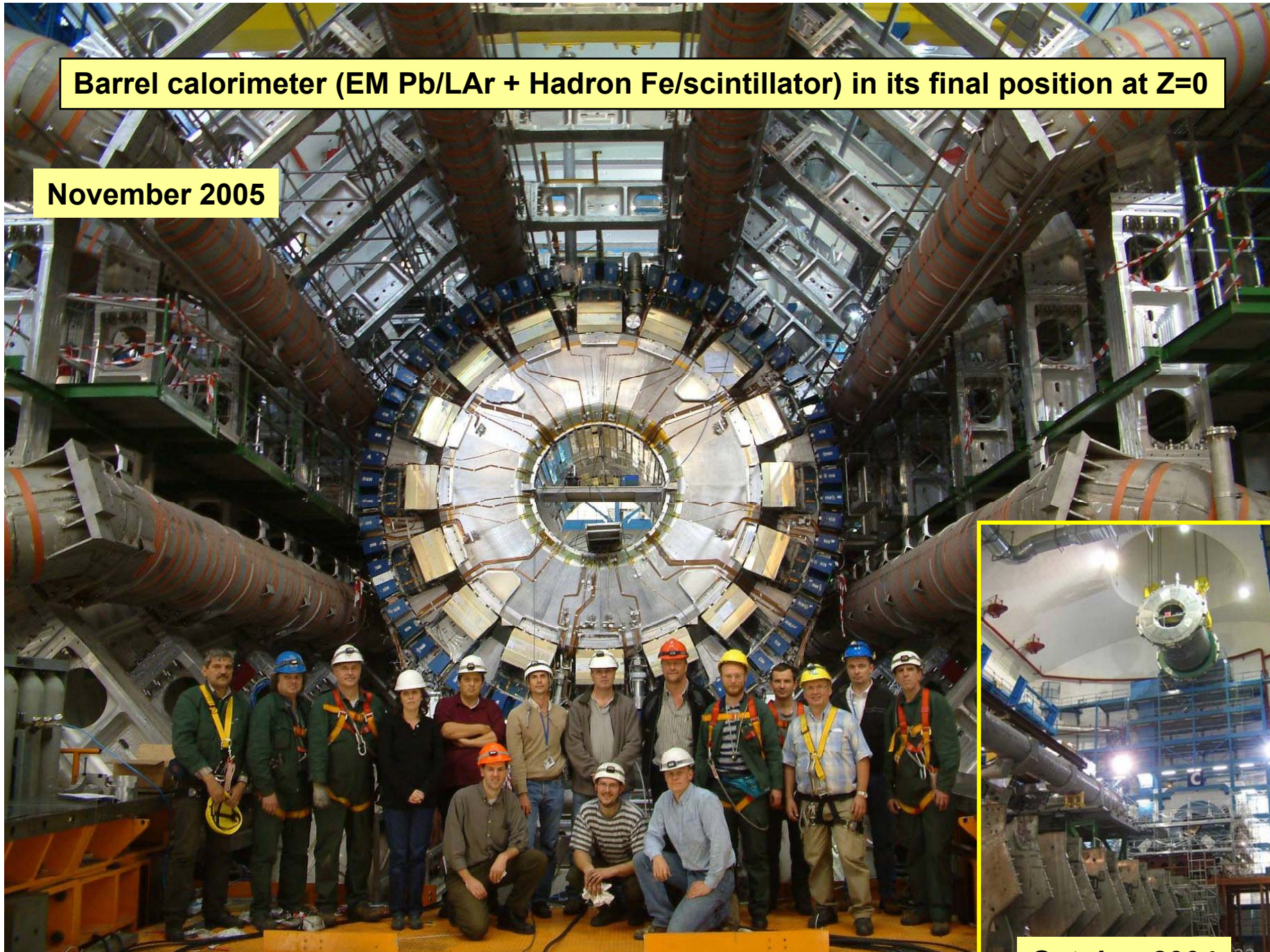
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LHC and ATLAS, Motivation and Status



**Barrel calorimeter (EM Pb/LAr + Hadron Fe/scintillator) in its final position at Z=0**

**November 2005**



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LHC and ATLAS, Motivation and Status



**October 2004**



# *Hardware Readiness: Liquid Argon Calorimeters*

## **Installation in the cavern**

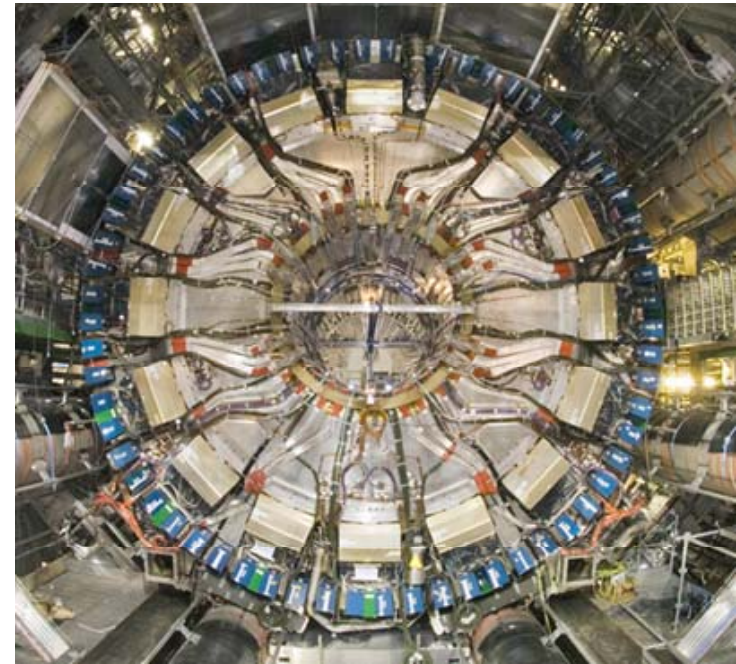
**Barrel in October 2004,  
End-caps by 2006**

## **Electronics equipment completed**

**Back-End May 2007**

**Front-End April 2008**

**(some refurbishment was needed)**



**Since May 2008**

**full calorimeter up, integrated in DAQ, slow control**

**in steady running mode**

**all channels read-out**

**~0.02 % dead (isolated) channels, plus 0.8% dead readout, including**

**1 of 8 HEC low voltage power supply off (need access for repair)**

**Commissioning on-going (cosmics and beam backgrounds)**

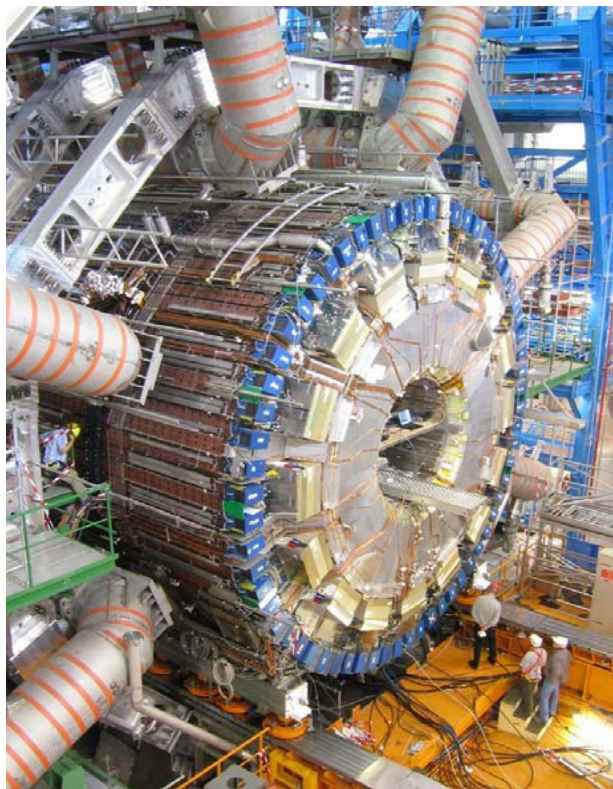
# Hardware Readiness: Tile Calorimeter

Installation in the cavern

Ext. Barrel C December 2004

Barrel October 2005

Ext. Barrel A May 2006

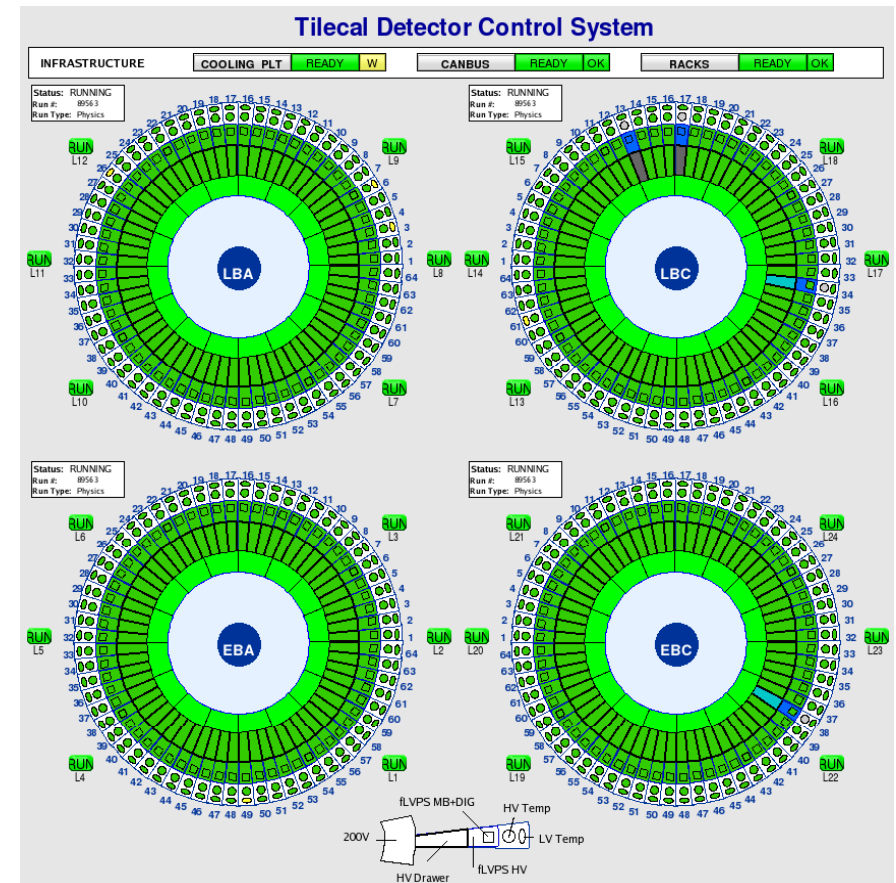


Electronics equipment completed May 2008

(some refurbishment was needed)

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LHC and ATLAS, Motivation and  
Status



full calorimeter up and running,  
integrated in DAQ

~10000 PMTs → 5000 cells

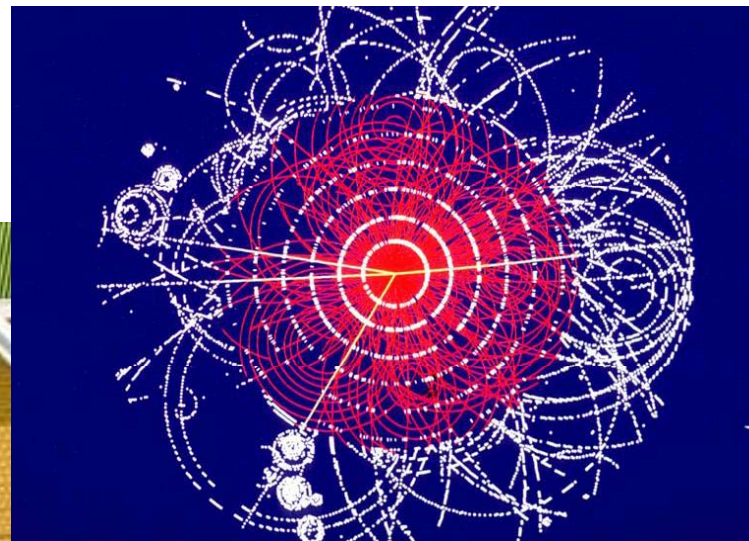
~0.2% dead (isolated) cells, and  
2 of 256 sectors off – power  
supply problem

will be repaired during shutdown  
with access

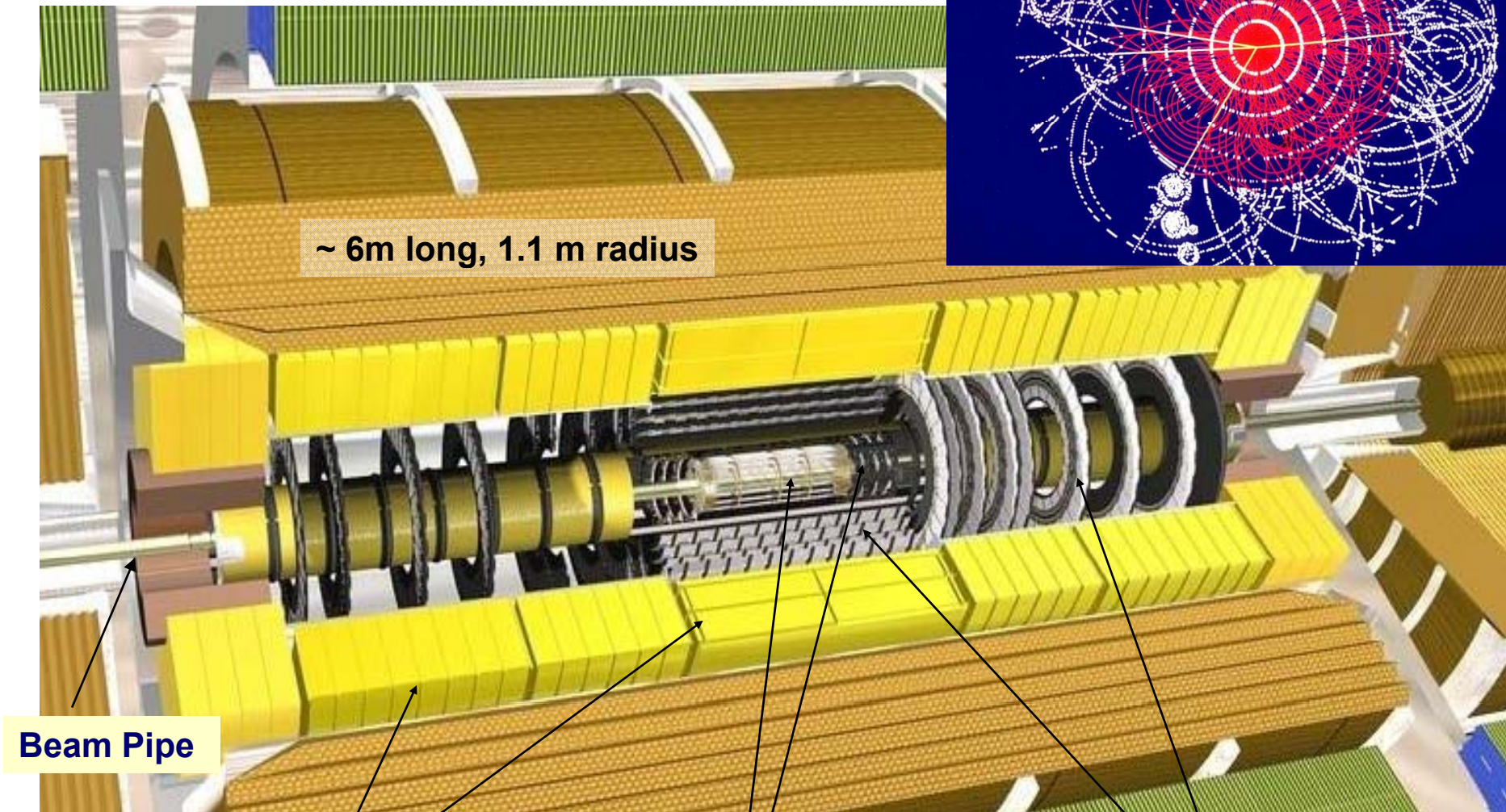


# ATLAS Tracking Detectors

2 Tesla solenoid  $\sigma/p_T \sim 5 \times 10^{-4} p_T \oplus 0.01$



~ 6m long, 1.1 m radius



Beam Pipe

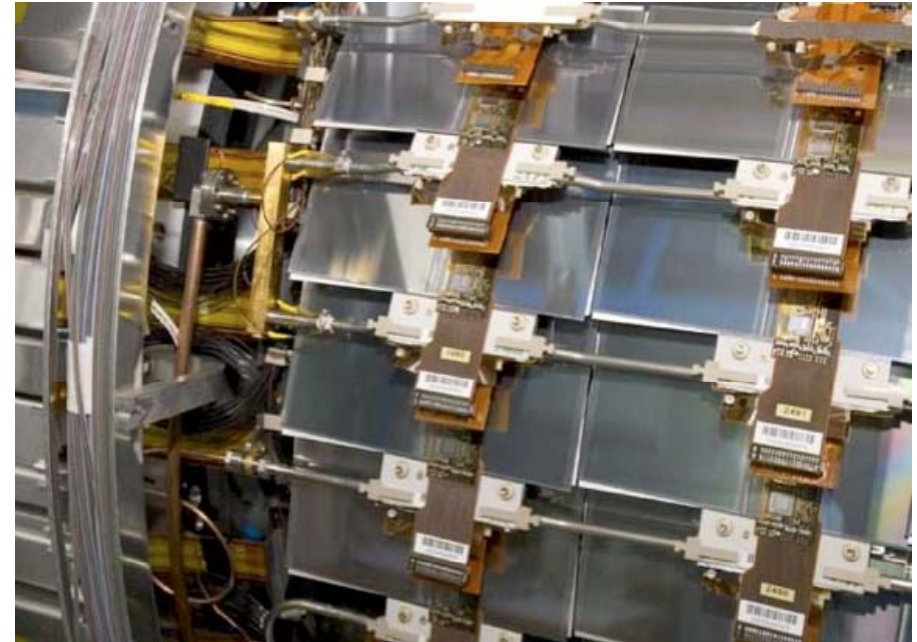
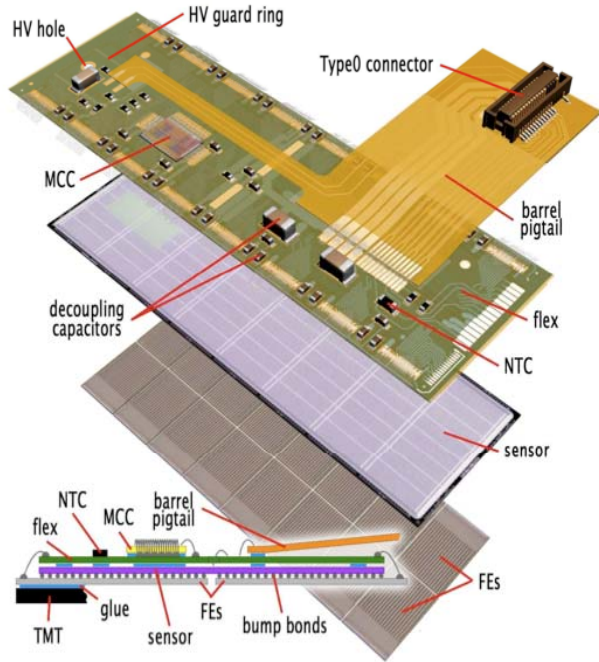
Transition Radiation Tracker (TRT)  
( $4 \times 10^5$  channels) with  $e/\pi$  separation

Pixels  
( $0.8 \times 10^8$  channels)

Si Strips Tracker (SCT)  
( $6 \times 10^6$  channels)

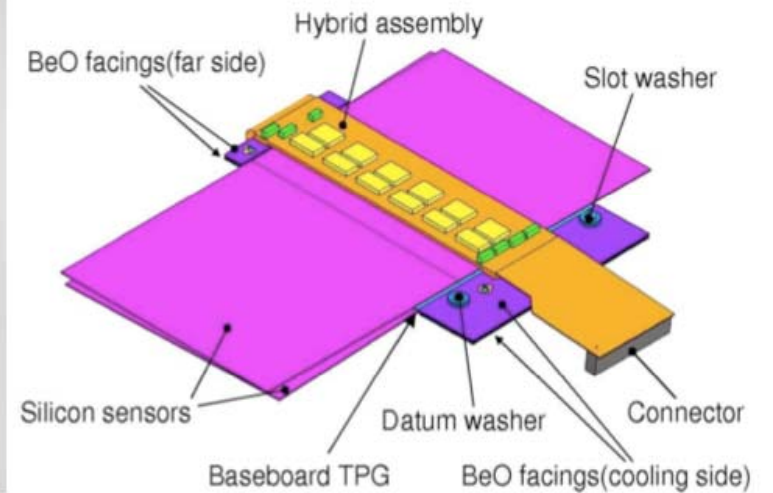
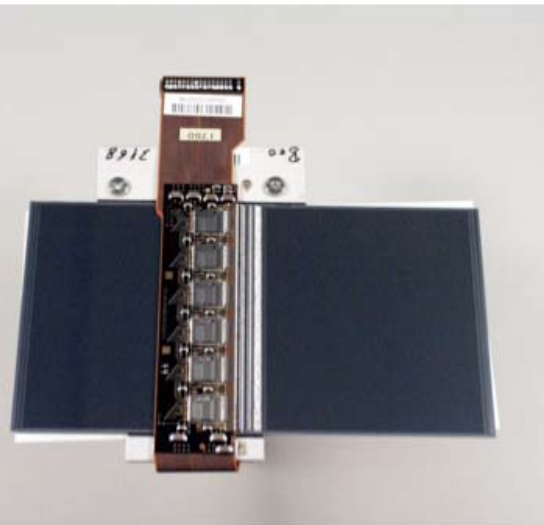
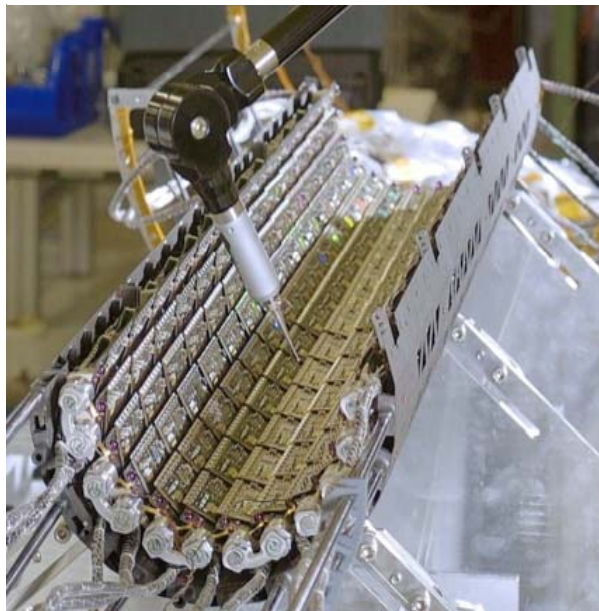


# Inner Detector Silicon-sensors



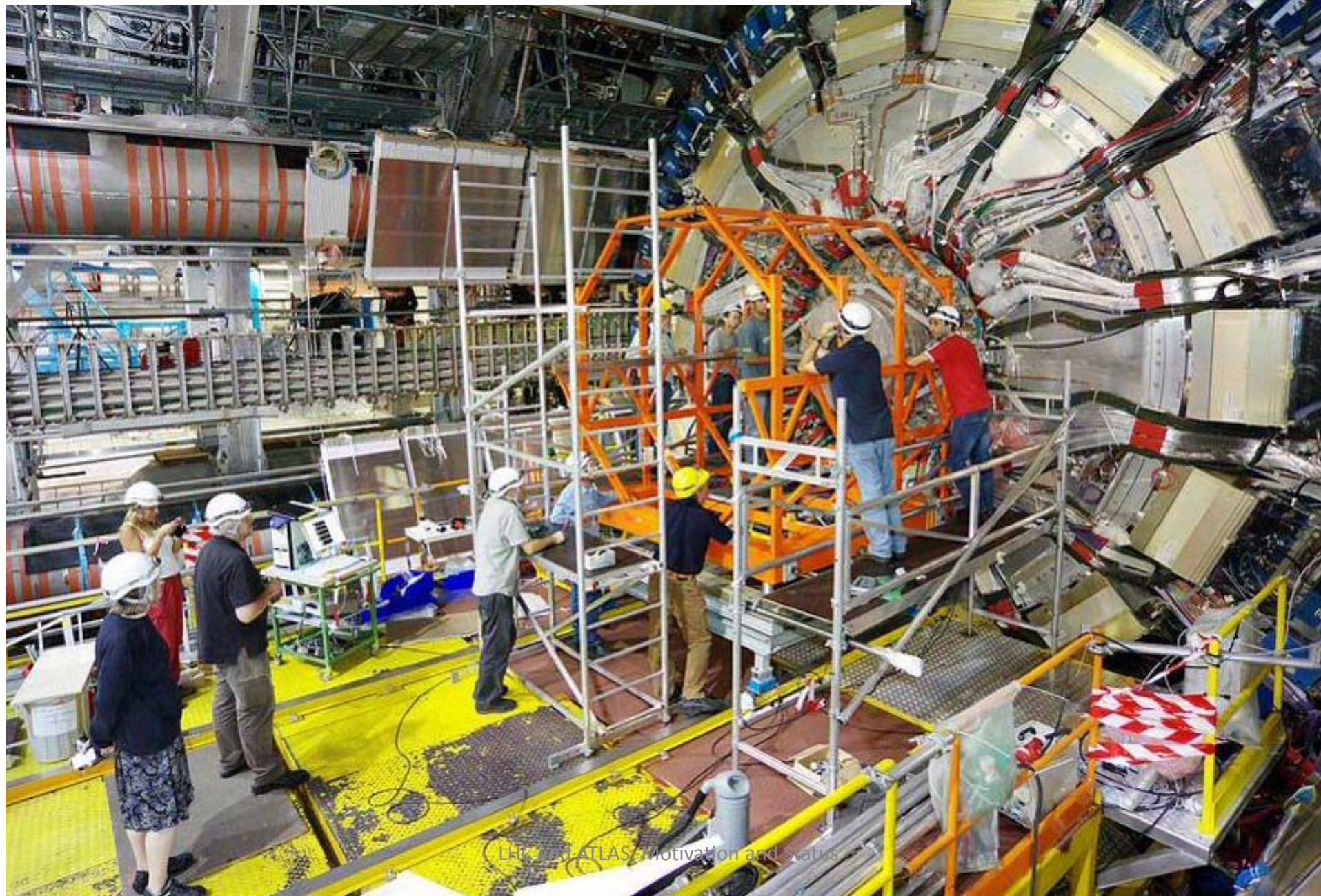
1744 Pixel modules, pixels  $50 \times 400 \mu\text{m}^2$

4088 SCT modules,  $80 \mu\text{m}$  micro-strips





***Installation of the ATLAS barrel tracker (Aug 2006)***





## ***Inner Detector hardware status***

**The critical path issue was the evaporative cooling system repair and cleaning of the plant, after a failure on 1<sup>st</sup> May 2008, which ended late July**

**Priority then given to Pixel operation**

- **First to safely bake-out the beam pipe (early August)**
- **Then to operate the full detector (for the first time)**

**By now we have gained considerable experience with the evaporative system and, more in general, with the environmental control**

- **Many more heater hours during last month than in the plant lifetime**
- **Operation is stable**

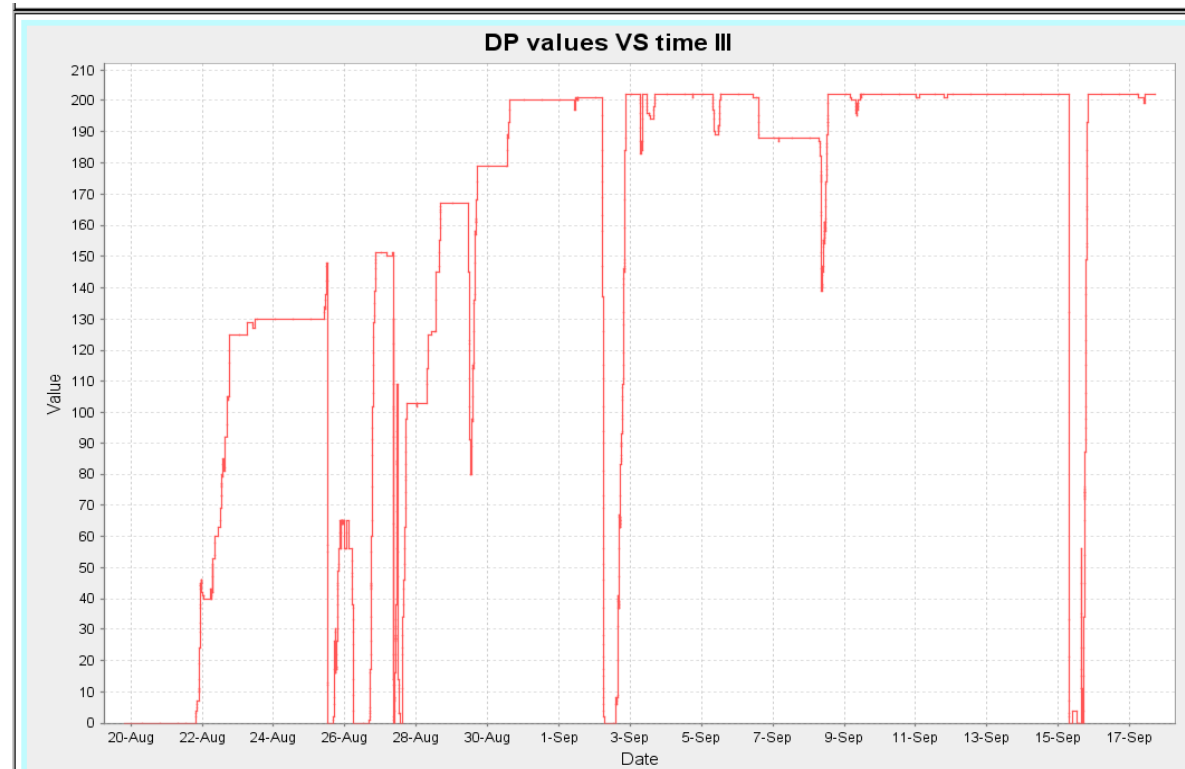
**All ID sub-detectors integrated in the ATLAS DAQ and took significant data**

**The TX plug-ins (opto-transmitter) remain an issue; they are dying at a significant rate**

- **Off-detector: they affect both SCT and Pixel**
- **A new production is now planned.**

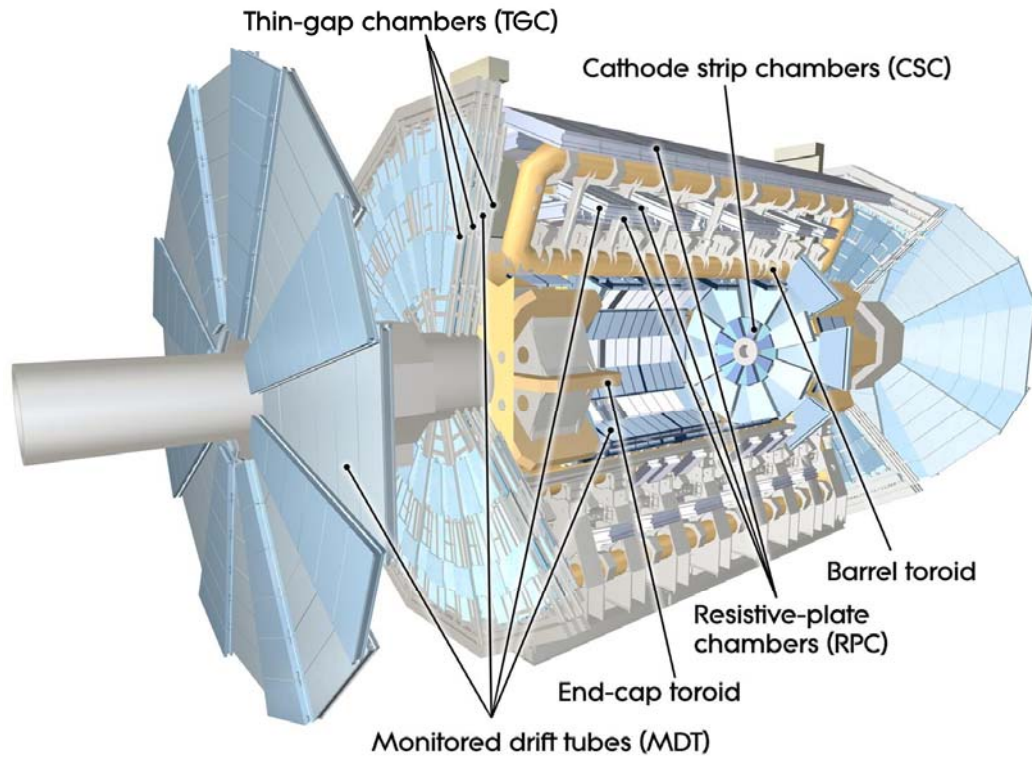


The evaporative cooling system has been an issue for ~ 2 years, now 202/204 loop on (we planned to leave 5 off for 2008: 3 in the Pixels (2.1% modules lost) and 2 in the SCT (0.9% modules lost))



**Overall:** **Pixels** >95% of the modules run stable  
**SCT** 99.8% barrel and 97.6% end-cap modules in operation  
**TRT** 98% read out (2% dead channels from assembly and installation)

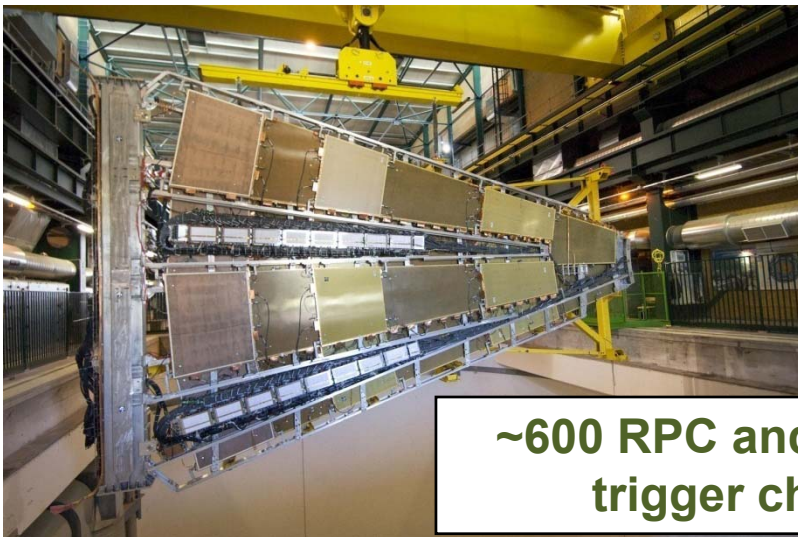
# Muon System



Stand-alone momentum resolution  
 $\Delta p_T/p_T < 10\%$  up to 1 TeV

2-6 Tm  $|\eta| < 1.3$  4-8 Tm  $1.6 < |\eta| < 2.7$

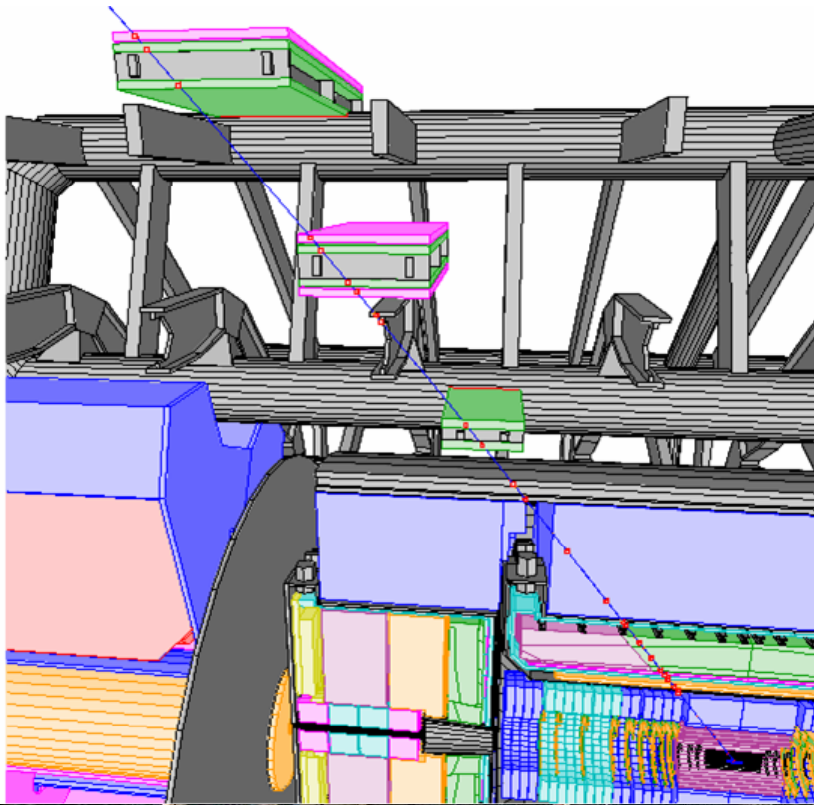
~1200 MDT precision chambers for track



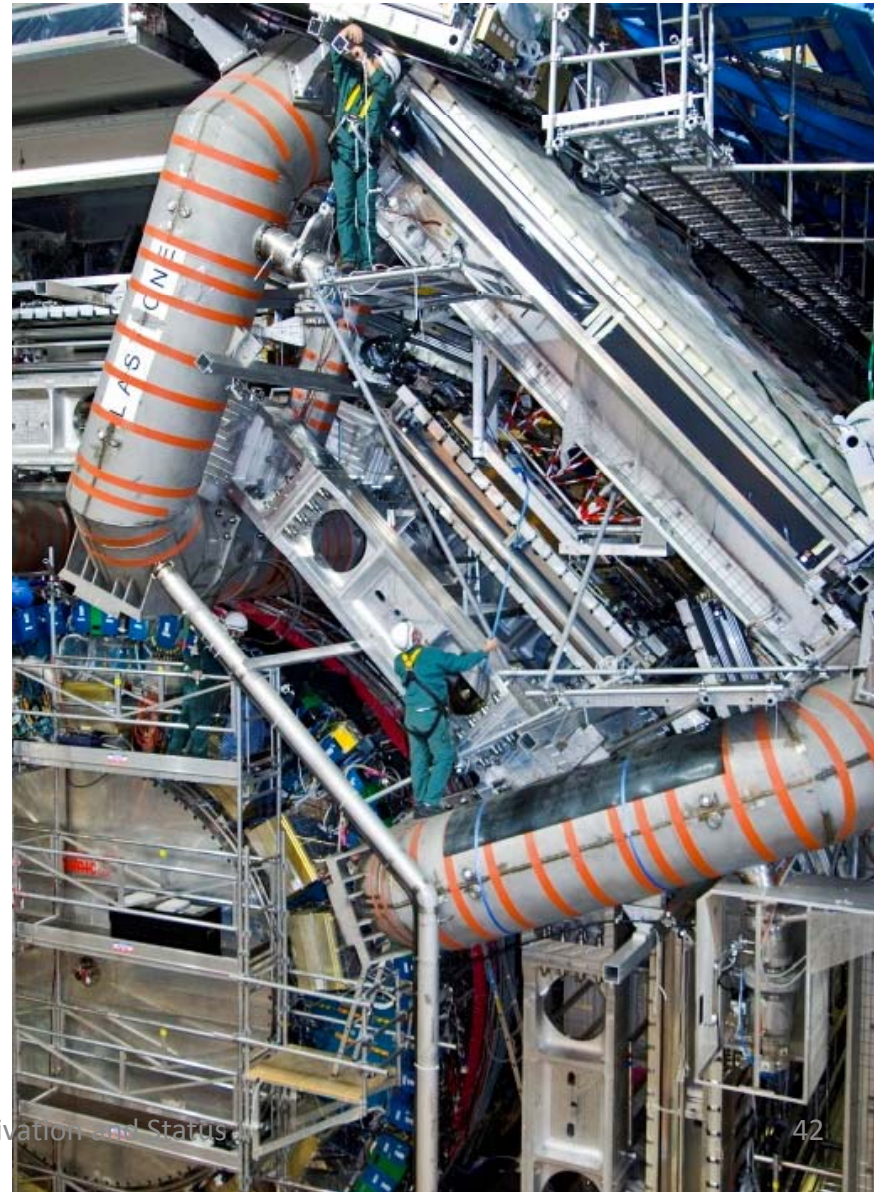
~600 RPC and ~3600 TGC trigger chambers







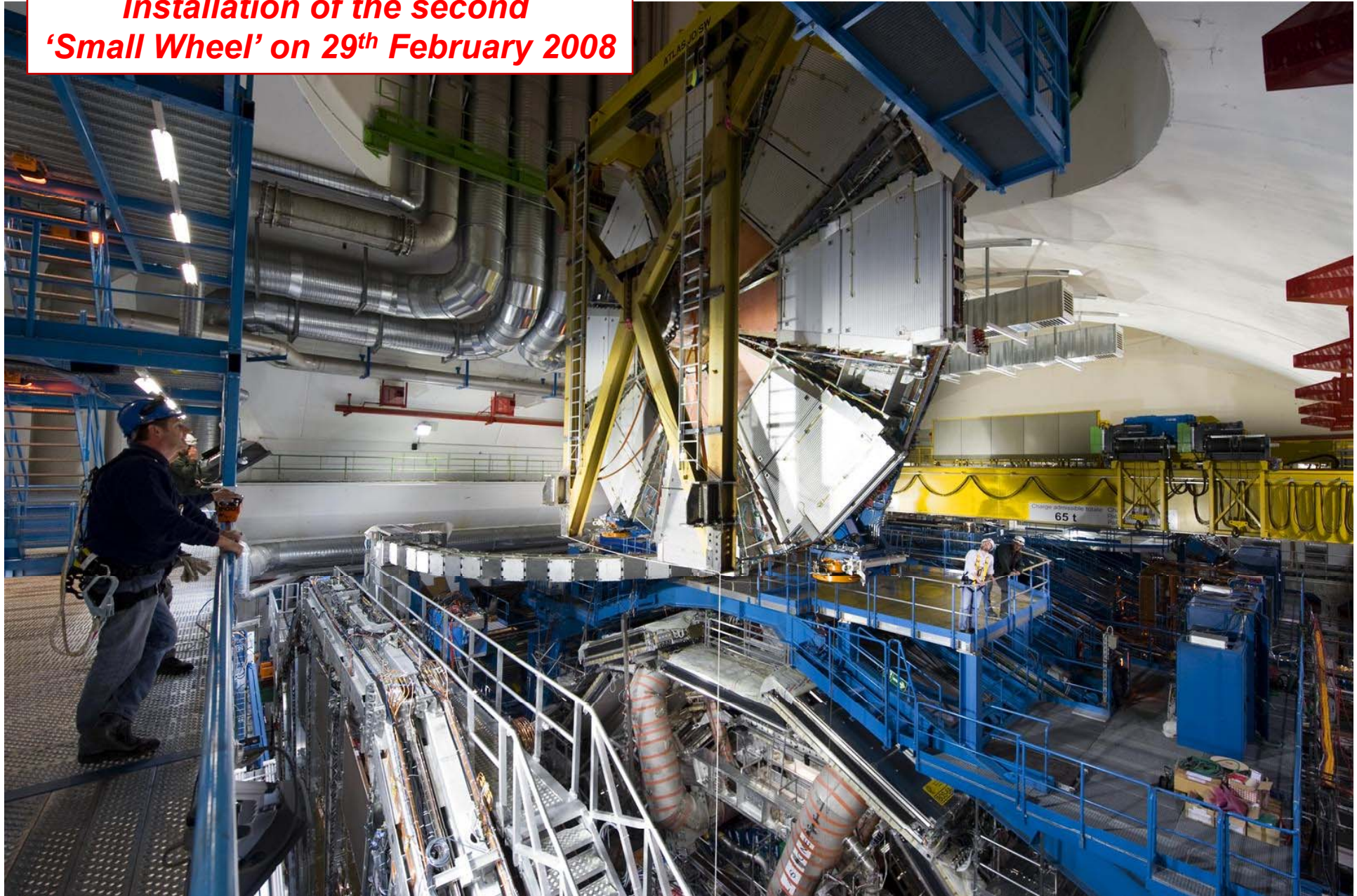
**Installation of barrel muon chambers  
(~ 700 stations)**



ICPP Istanbul, 27-10-08  
P Jenni (CERN)



***Installation of the second  
'Small Wheel' on 29<sup>th</sup> February 2008***





# Muon spectrometer hardware status

## MDT

Problematic chambers: < 1% (HV, read-out, gas)

## Alignment

99.7% of the barrel, 99% of the end-cap alignment lines are working

## RPC

- 16 sectors fully commissioned
- 3 sectors under final timing adjustments
- 2 sectors affected by missing CAEN HV
- 1 not ready (noise on clock propagation)

## TGC

All wheels on both sides ready for operation (need some HV for TGC on Small Wheel due to HV failure and shortage of spares)

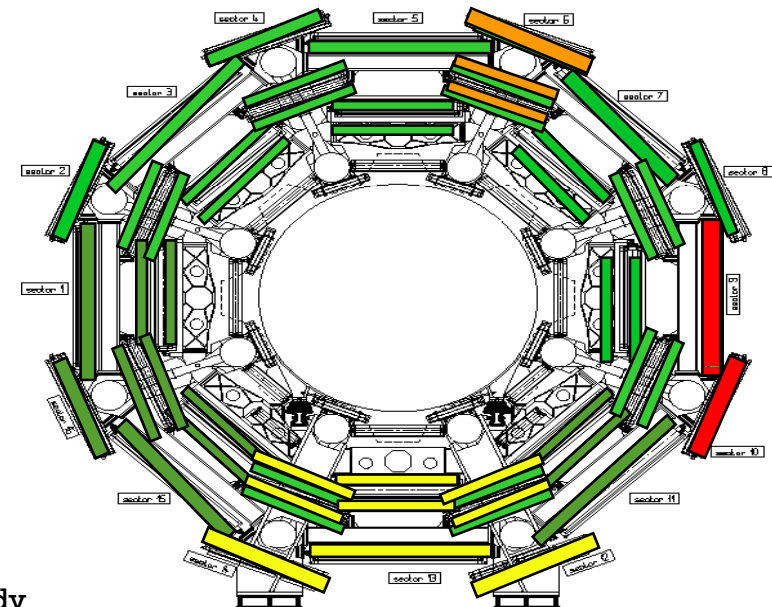
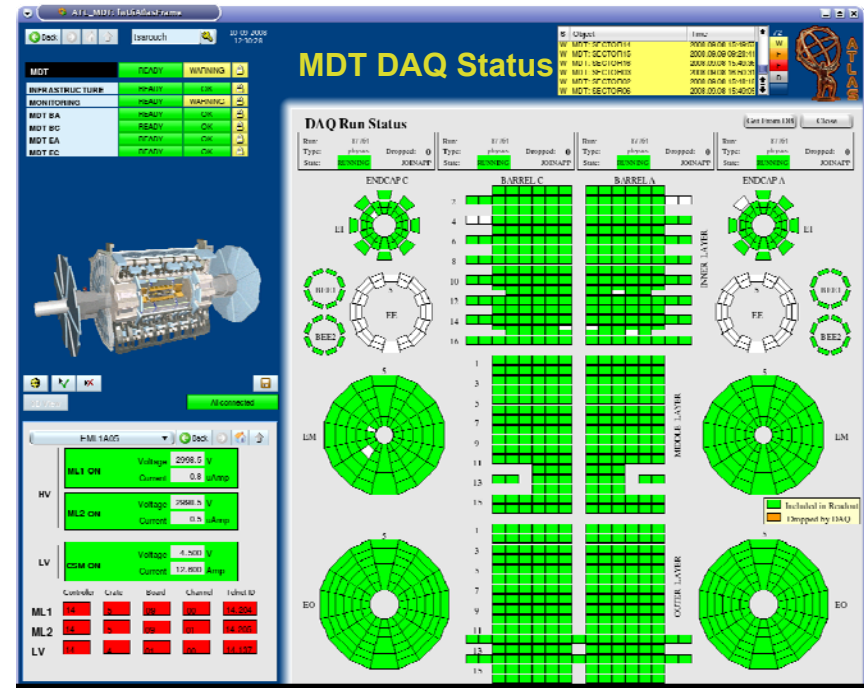
## CSC

Chambers work, but read-out limitation being worked on

11/10/2008, P

Jenni (CERN)

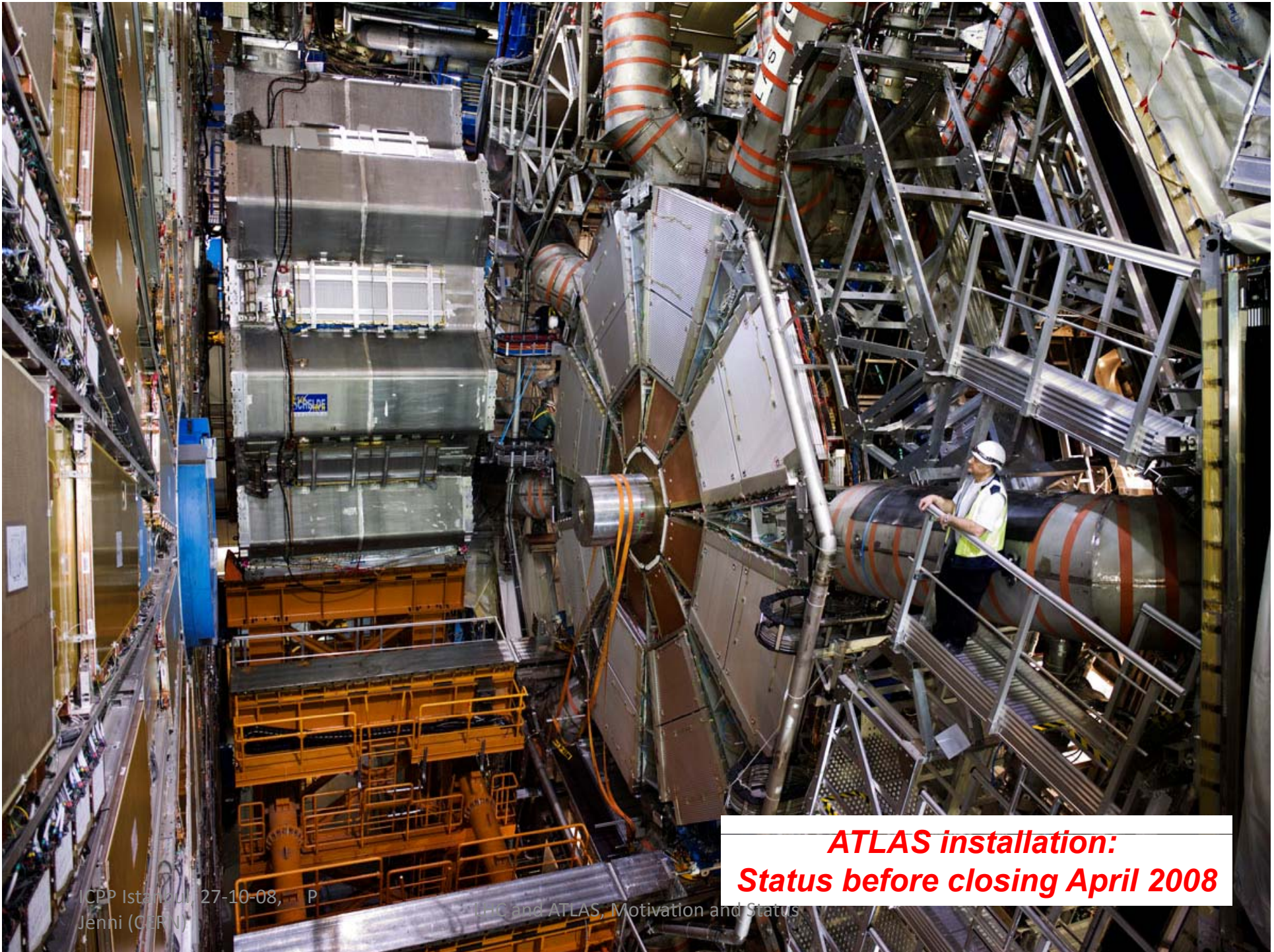
LHC and ATLAS Motivation and Status



Ready  
Missing timing adjustment  
Noise on clock propagation  
Missing CAEN boards

RPC



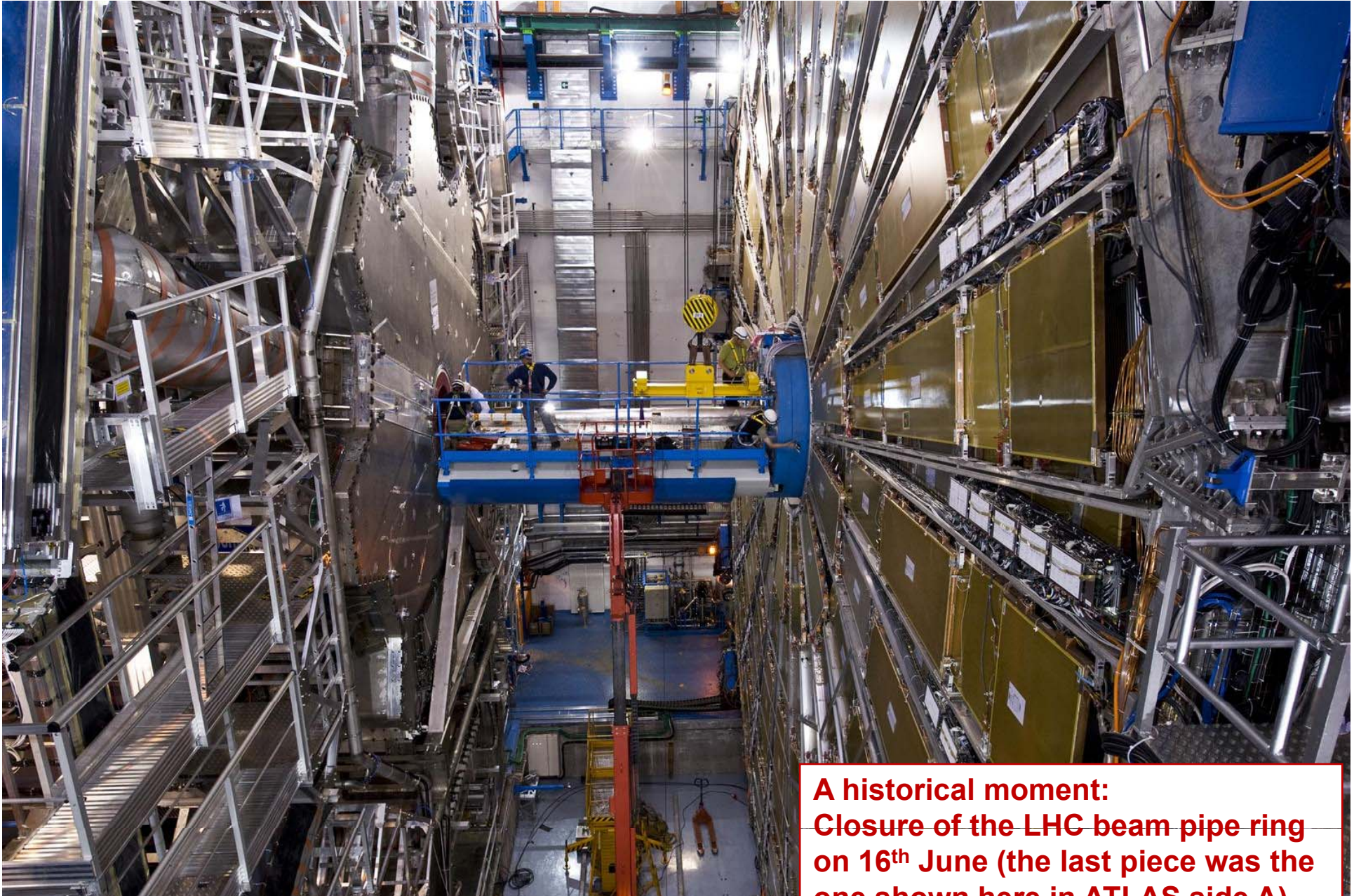


***ATLAS installation:  
Status before closing April 2008***

ICPP Istanbul, 27-10-08, P  
Jenni (CERN)

ATLAS and ATLAS, Motivation and Status





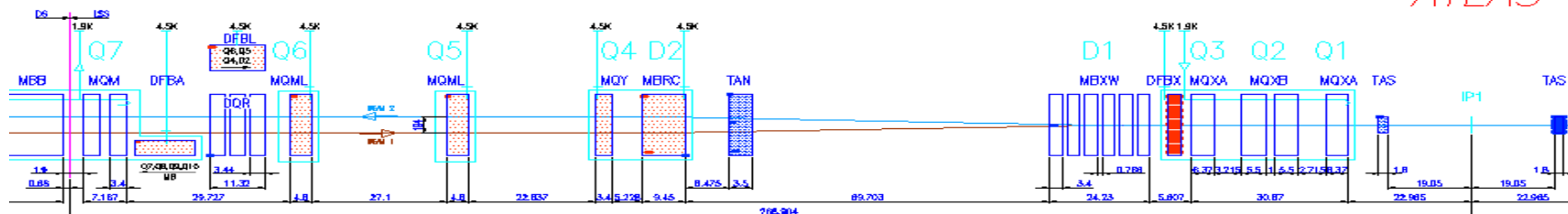
**A historical moment:  
Closure of the LHC beam pipe ring  
on 16<sup>th</sup> June (the last piece was the  
one shown here in ATLAS side A)**

ICPP Istanbul, 27-10-08,  
P Jenni (CERN)

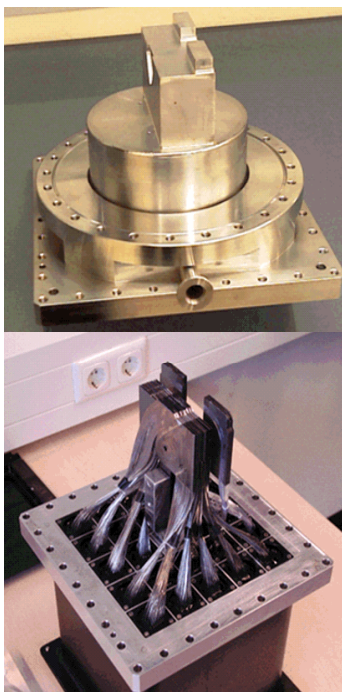


# Forward Detectors

ATLAS



ALFA at 240 m

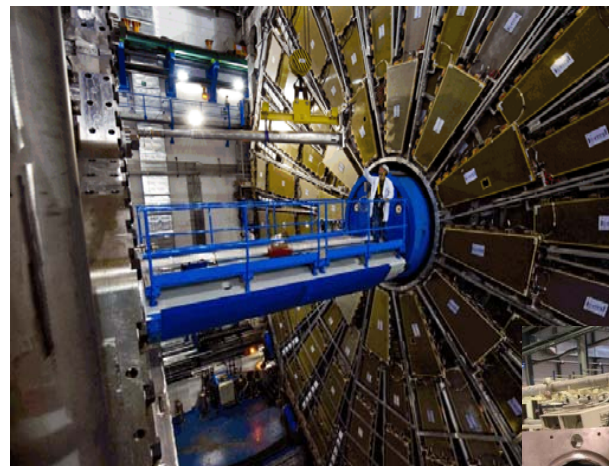


ZDC at 140 m



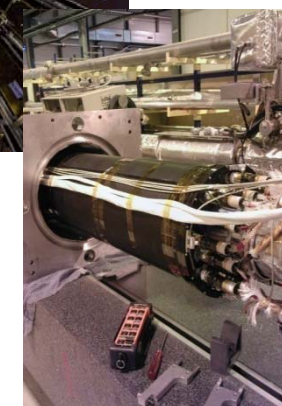
Zero Degree Calorimeter

LUCID at 17 m



Luminosity Cerenkov Integrating Detector

(Phase I detector is operational)



Absolute Luminosity for ATLAS

(Plus an internal Lol for future Forward Proton detectors at 220 and 420 m)



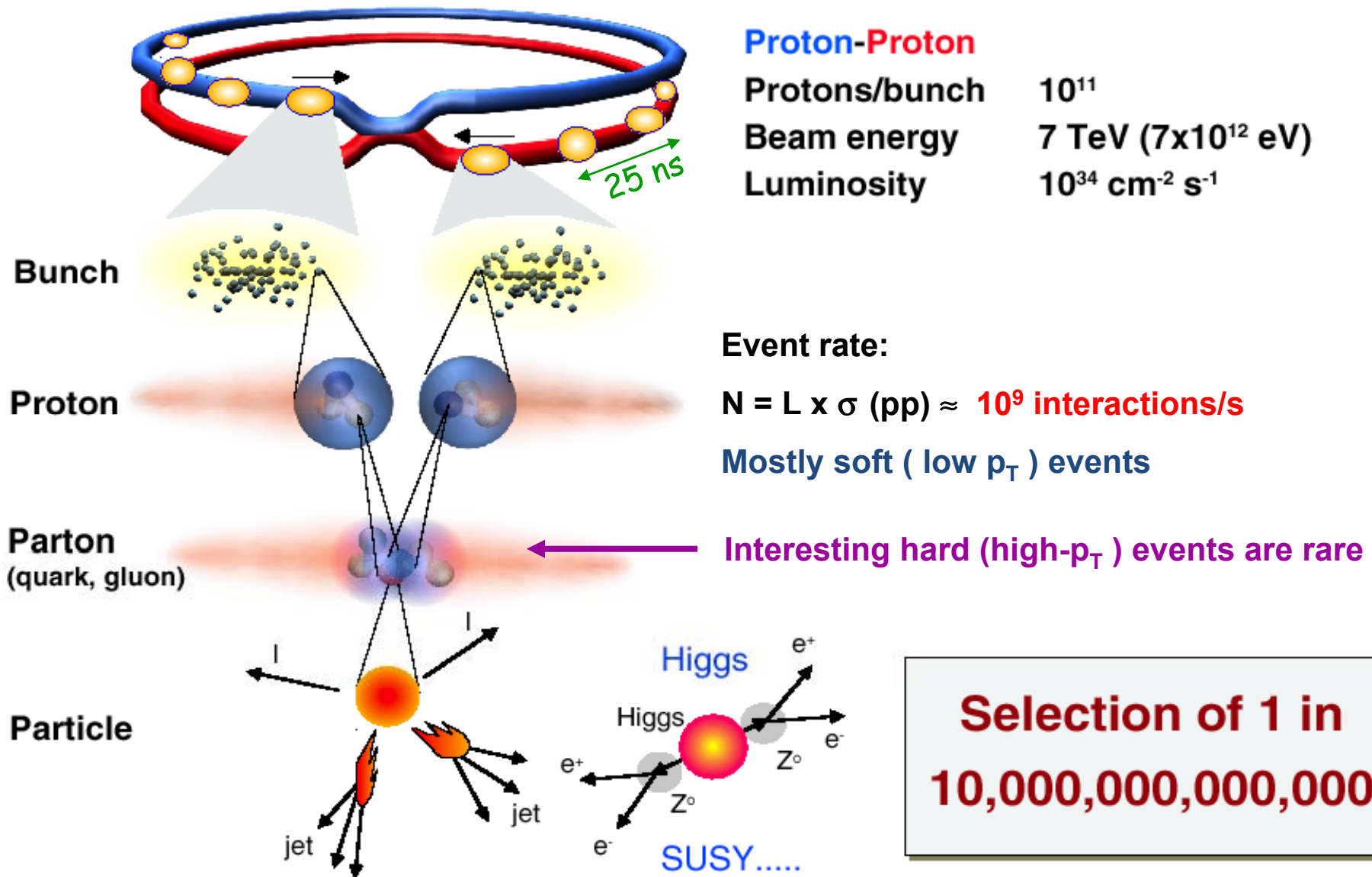


**The installation of the inner part of the forward shielding completed the configuration for the 2008 run**

**Note also the TGC 'Big Wheel' and MDT 'End Wall' chamber planes**

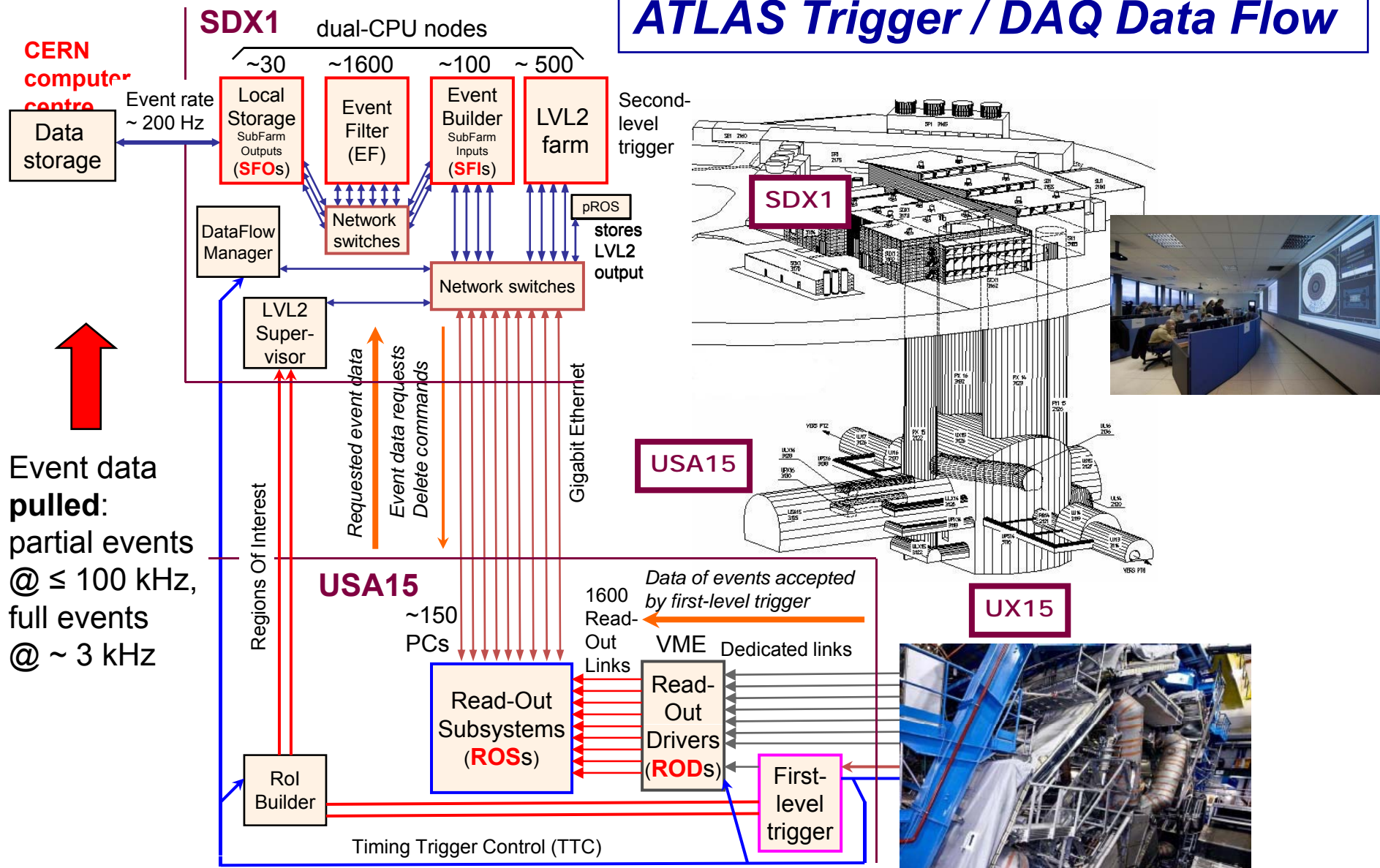
ICPP Istanbul, 27-10-08,  
P Jenni (CERN)

# Collisions at LHC





# ATLAS Trigger / DAQ Data Flow



Event data pulled:  
partial events @  $\leq 100$  kHz,  
full events @  $\sim 3$  kHz

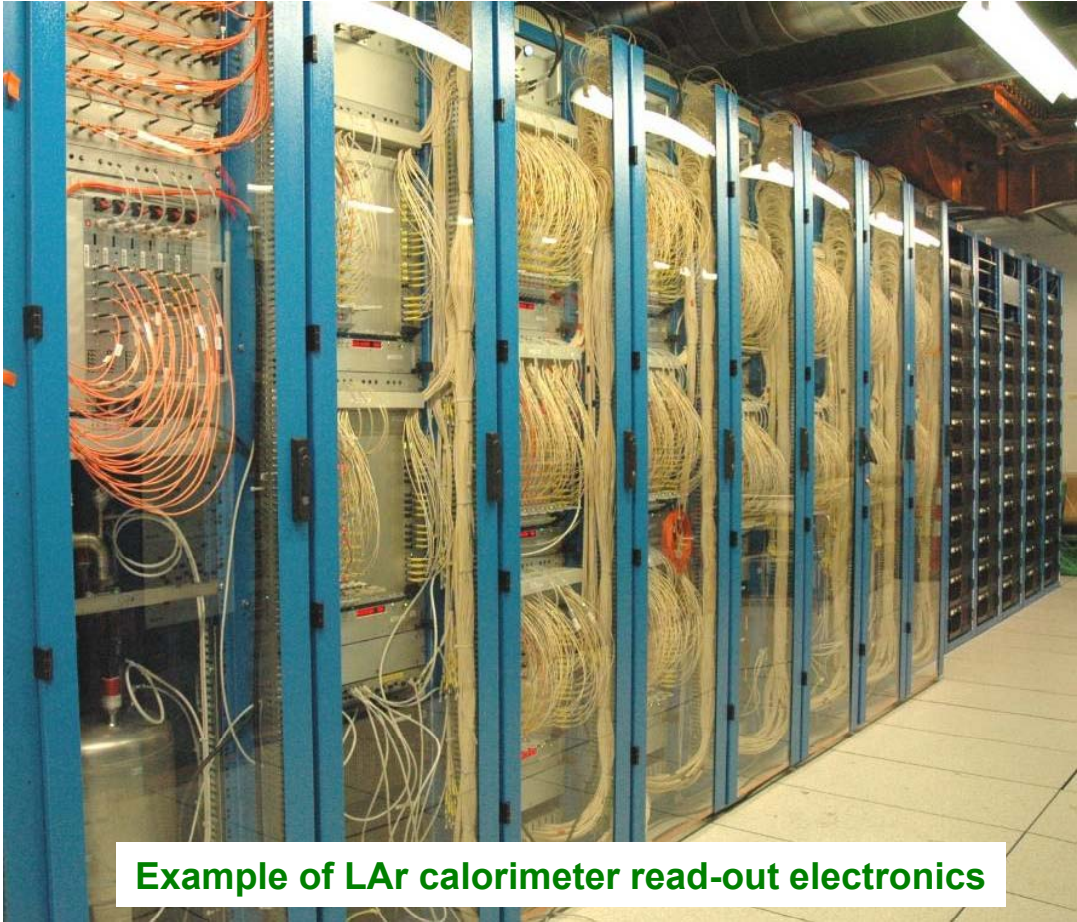
Event data pushed @  $\leq 100$  kHz,  
1600 fragments of  $\sim 1$  kByte each



The read-out electronics, trigger, DAQ and detector control systems have been brought into operation gradually over the past years, along with the detector commissioning with cosmics



Example of Level-1 Trigger electronics



Example of LAr calorimeter read-out electronics

In total about 300 racks with electronics in the underground counting rooms





## HLT Farms

Final size for max L1 rate (*TDR*)

~ 500 PCs for L2 + ~ 1800 PCs for EF  
(multi-core technology)

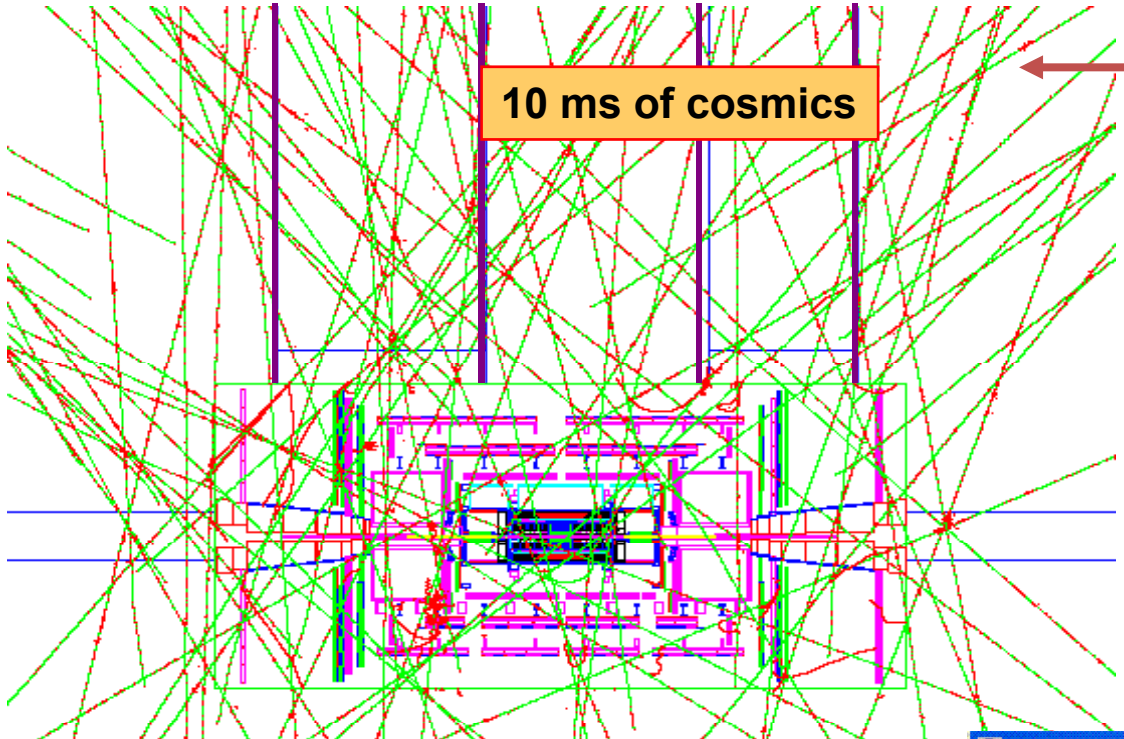
**For 2008** : 850 PCs installed  
total of 27 XPU racks = 35% of final  
system

(1 rack = 31 PCs)  
(XPU = can be connected to L2 or EF)

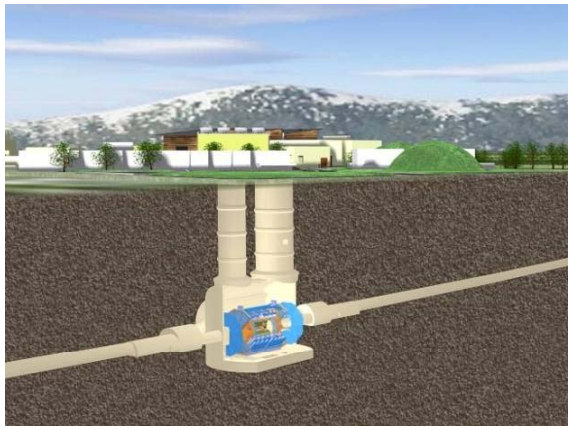
- x 8 cores
- CPU: 2 x Intel Harpertown quad-core 2.5 GHz
- RAM: 2 GB / core, i.e. 16 GB

**Final system** : total of 17 L2 + 62 EF racks  
of which 28 (of 79) racks as XPU





Simulated cosmic flux in the ATLAS cavern

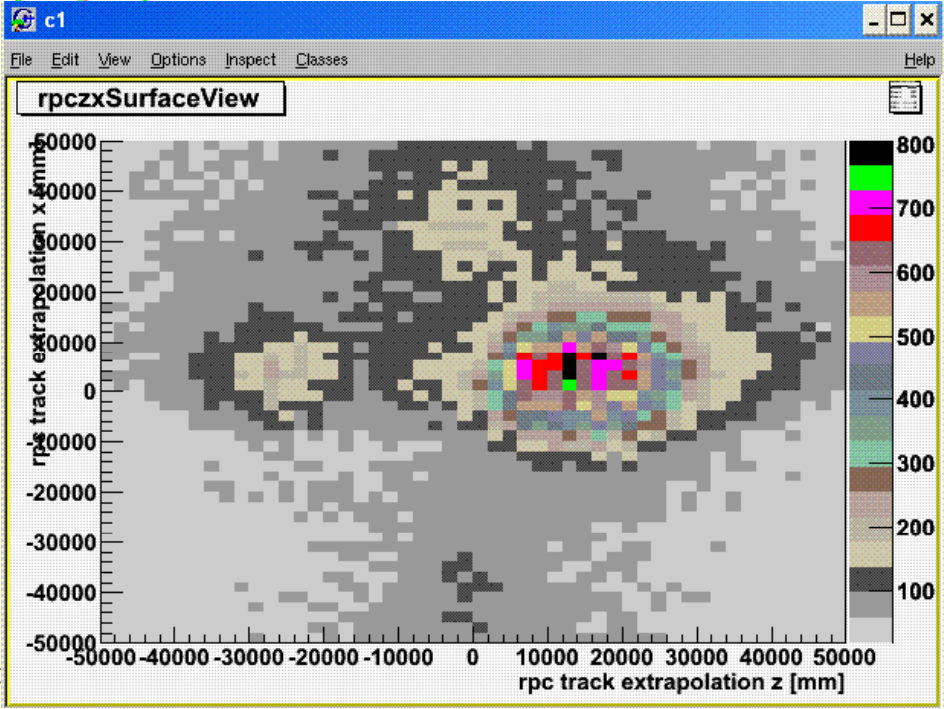


Cosmics data:



Muon impact points extrapolated to surface as measured by Muon Trigger chambers (RPC)

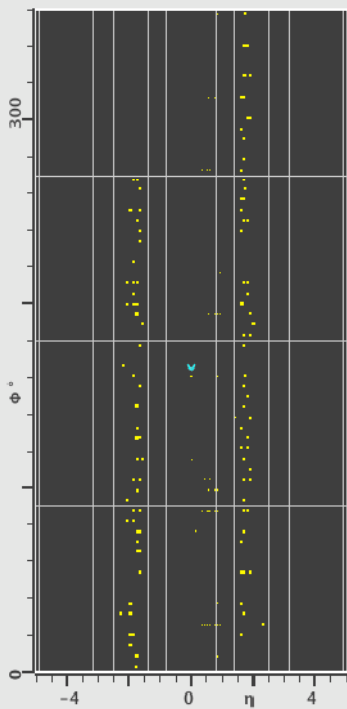
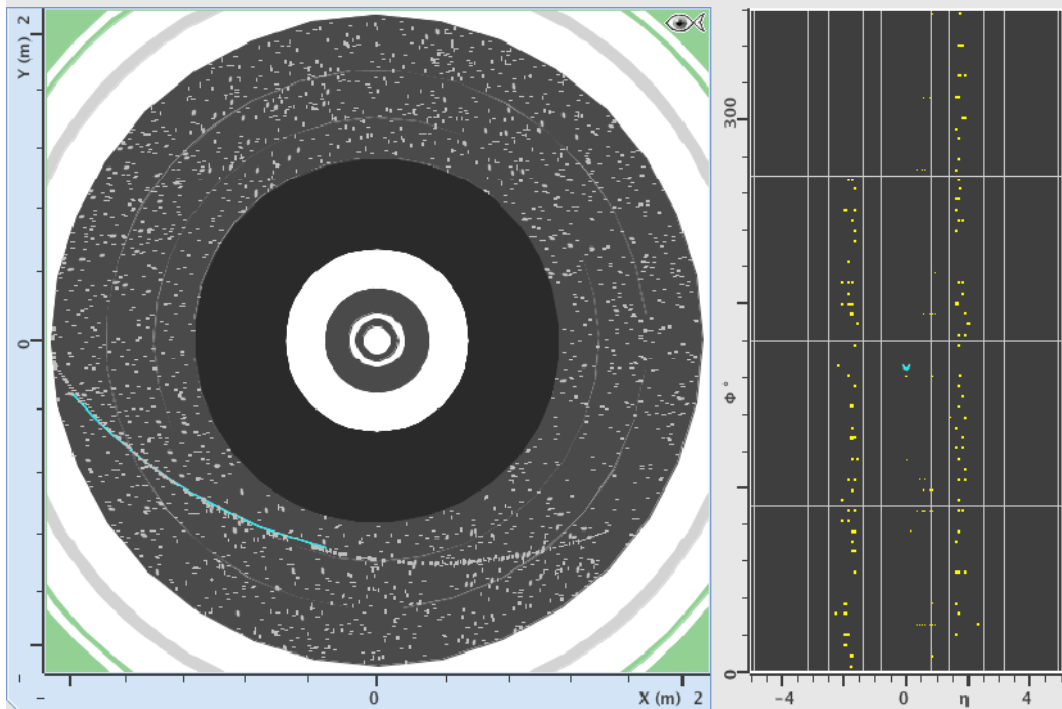
Rate ~100 m below ground: ~ O(10 Hz)



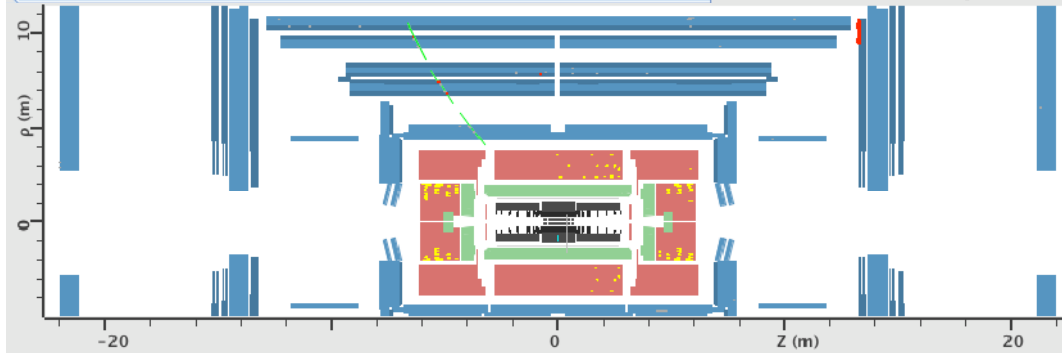
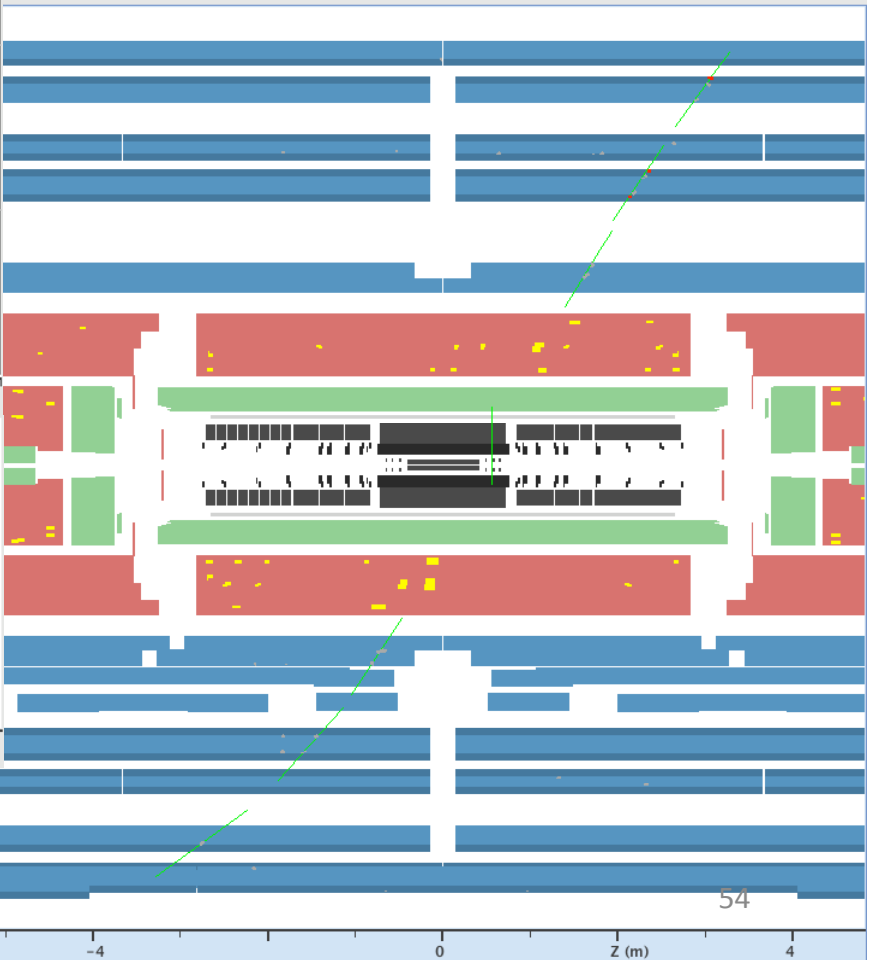


## Example cosmic events with magnets on

ATLAS 2008-08-23 12:13:41 CEST event:jiveXML\_83633\_780513 run:83633 ev:780513 Atlantis



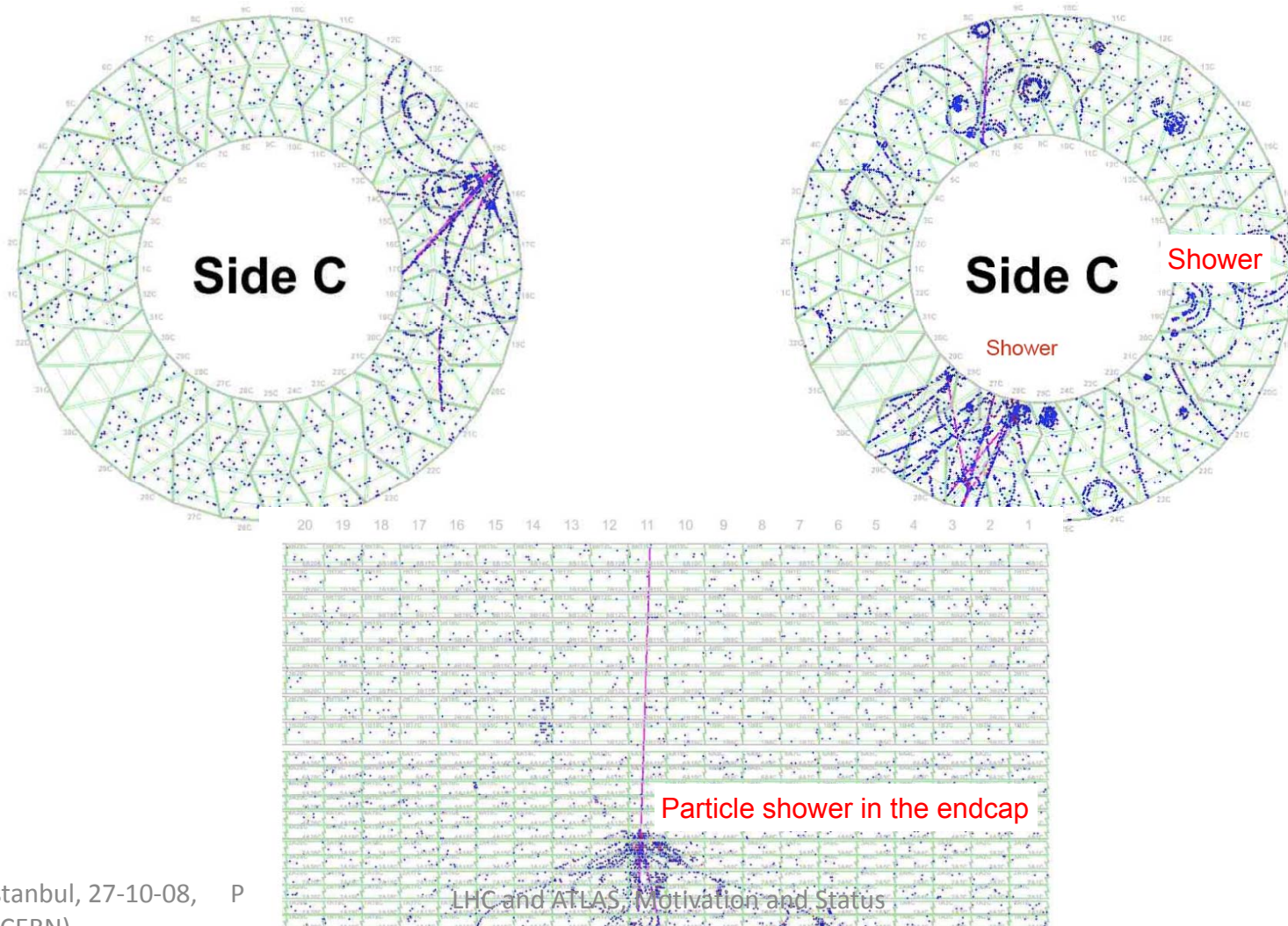
2008-08-16 16:47:40 CEST event:jiveXML\_82056\_14224 run:82056 ev:14224 Atlantis



## ***Cosmics showers/interactions in the TRT with solenoid on***

**Fully commissioned and inside ATLAS partition since long**

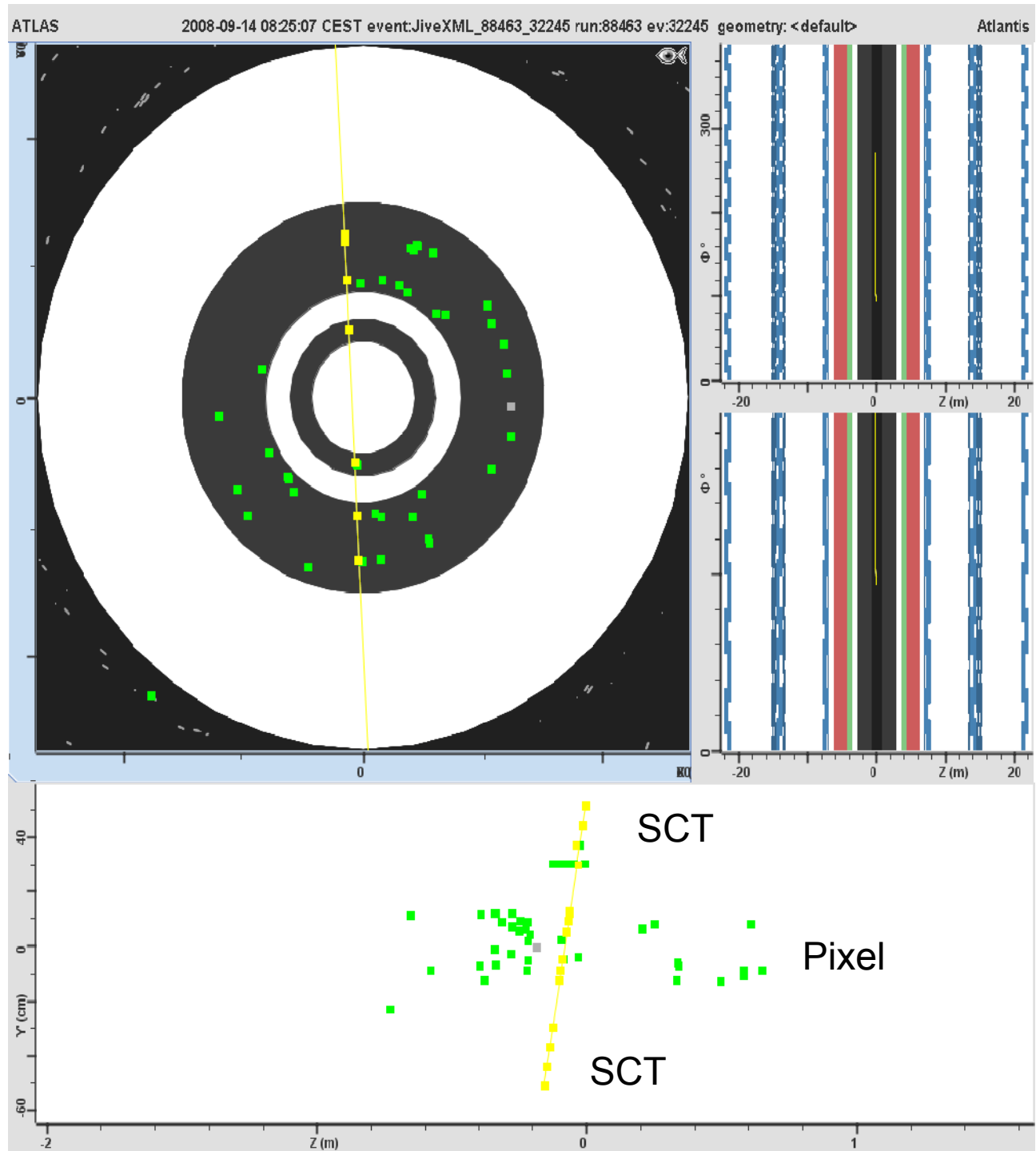
**(Xe is in since few weeks → results shown are with Ar/CO<sub>2</sub>/O<sub>2</sub>; 70/27/3%)**





# Cosmics in Pixel and SCT

Event with 7 Pixel hits (overlapping L2 modules) and 16 SCT hits



## Full Dress Rehearsal (FDR)

Played data through the computing system just as for real data from the LHC

- started at point 1, as though real data
- processed data at CERN Tier-0, various calibration & data quality steps
- shipped out to the Tier-1s and Tier-2s for physics analysis

Complementary to “milestone runs” which test the real detector, but only with cosmic rays

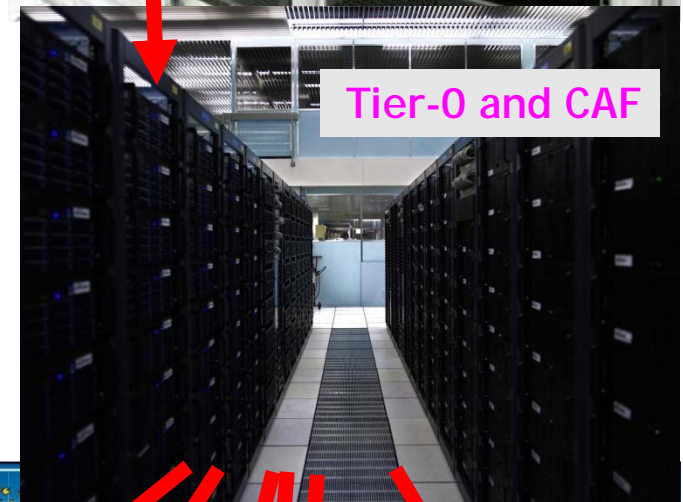
Two “FDR runs”  
(February and June-July)

Were a vital preparation for processing and analysing the first LHC data

ATLAS output disk (point-1)



Tier-0 and CAF



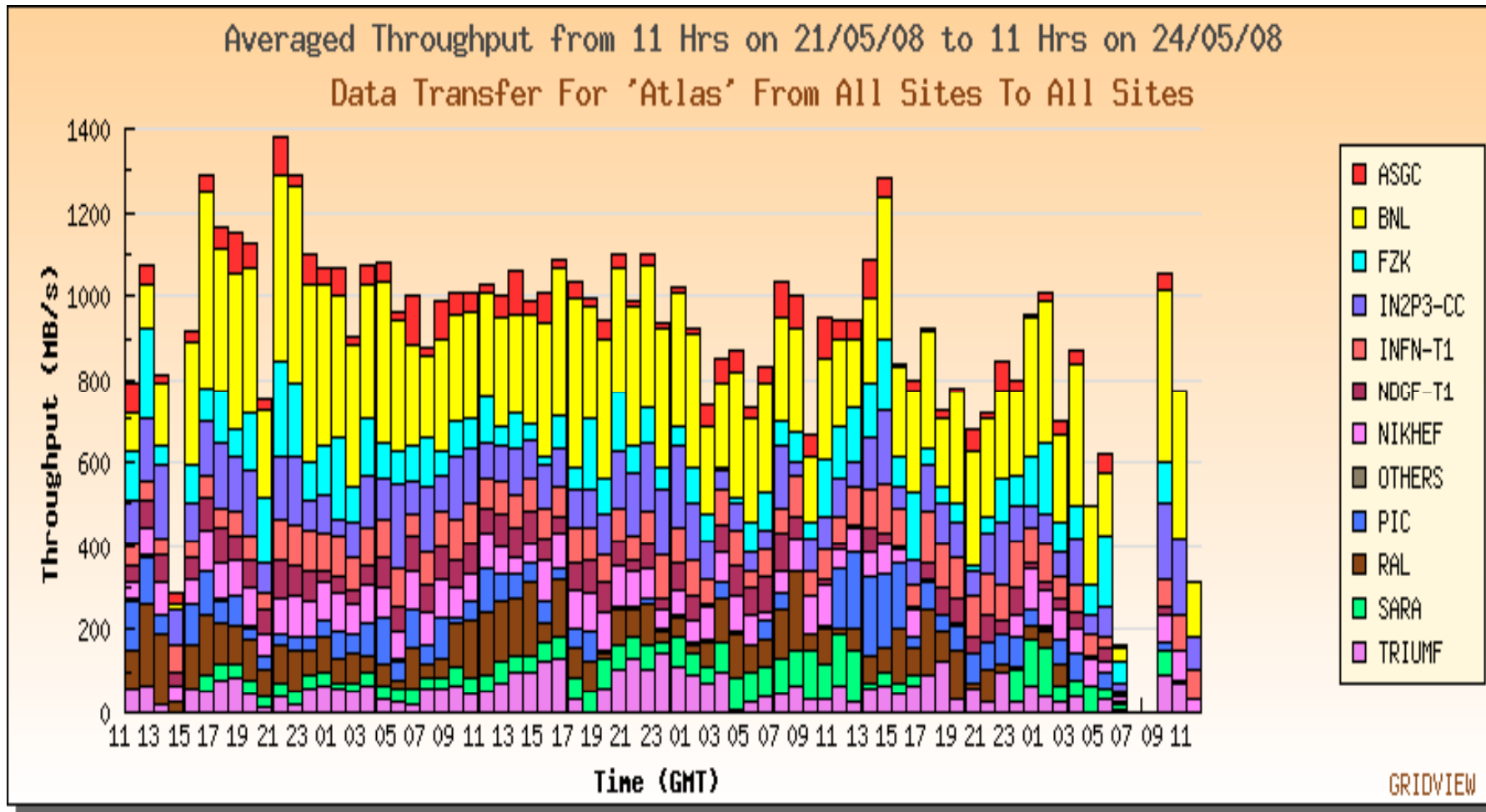


## wLCG Grid: Tier-0 and the 10 ATLAS Tier-1s



# ATLAS during the Common Computing Readiness Challenge CCRC Phase 2

Data transfer Tier0--> Tiers-1



Nominal peak level (~1 GB/s) sustained over 3 days





***Excitement in the ATLAS Detector Control Room:  
The first LHC event on 10<sup>th</sup> September 2008***

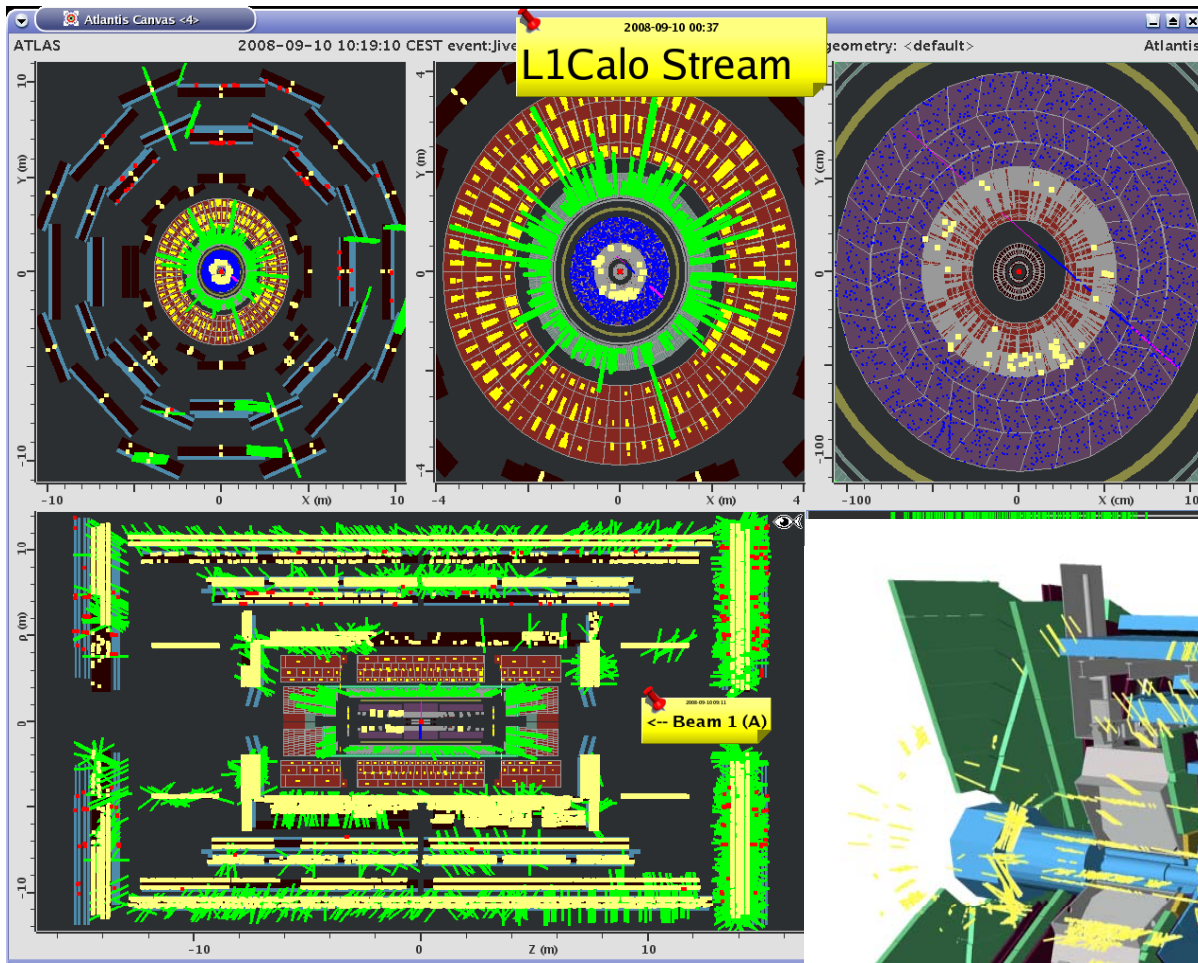
ICPP Istanbul, 27-10-08,  
P Jenni (CERN)





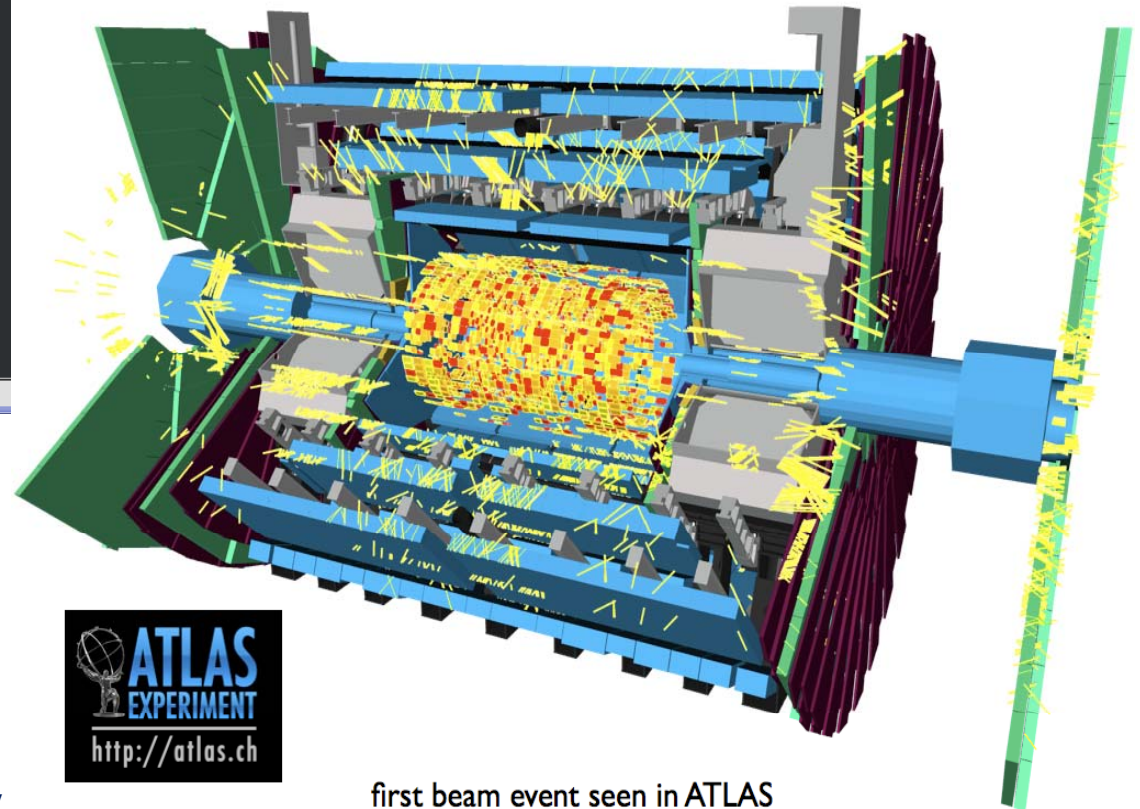
***... as well as in the ATLAS Tier-0 and Data Quality Control Rooms:  
Reconstruction follow-up and analysis of the first LHC events***





Online display

ICPP Istanbul, 27-10-08,  
P Jenni (CERN)



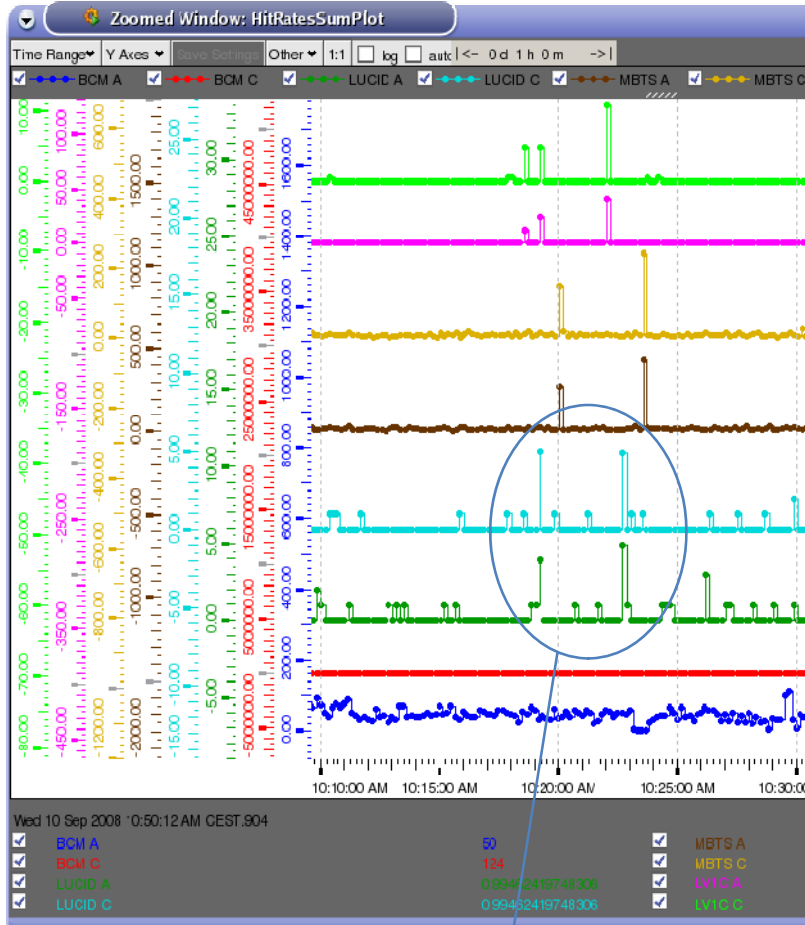
first beam event seen in ATLAS

Offline display

LHC and ATLAS, Motivation and Status

The very first beam-splash  
event from the LHC in ATLAS  
on 10:19, 10<sup>th</sup> September  
2008

# First hits in the LUCID detectors on Sep. 10<sup>th</sup> !

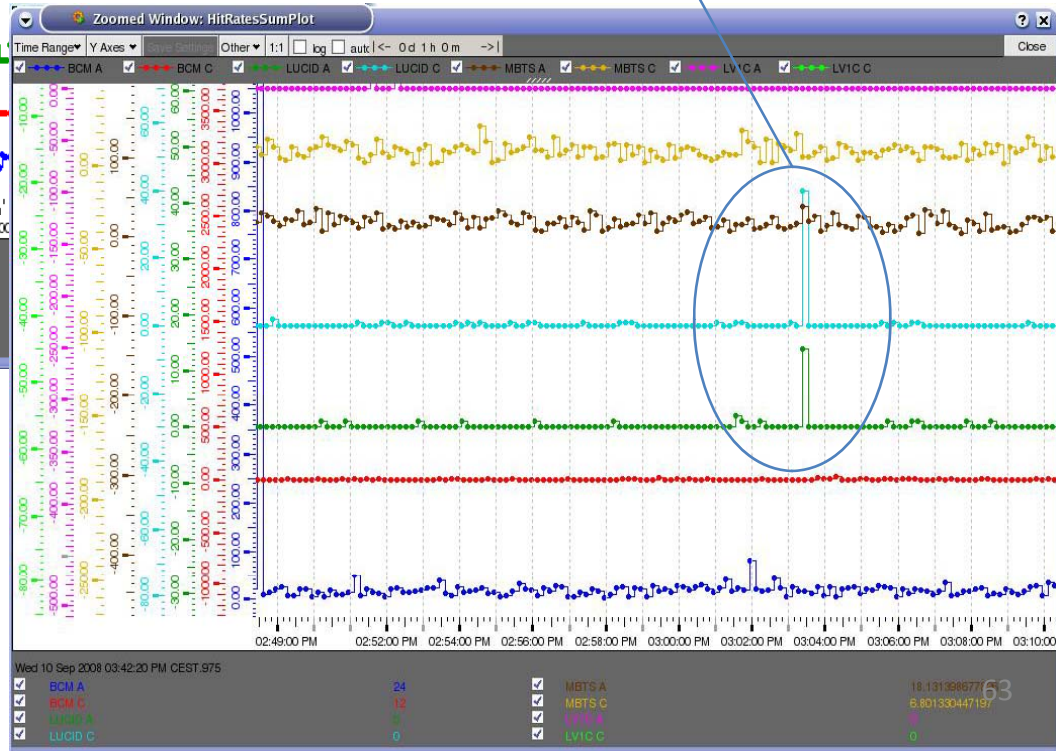


LV1C

MBTS



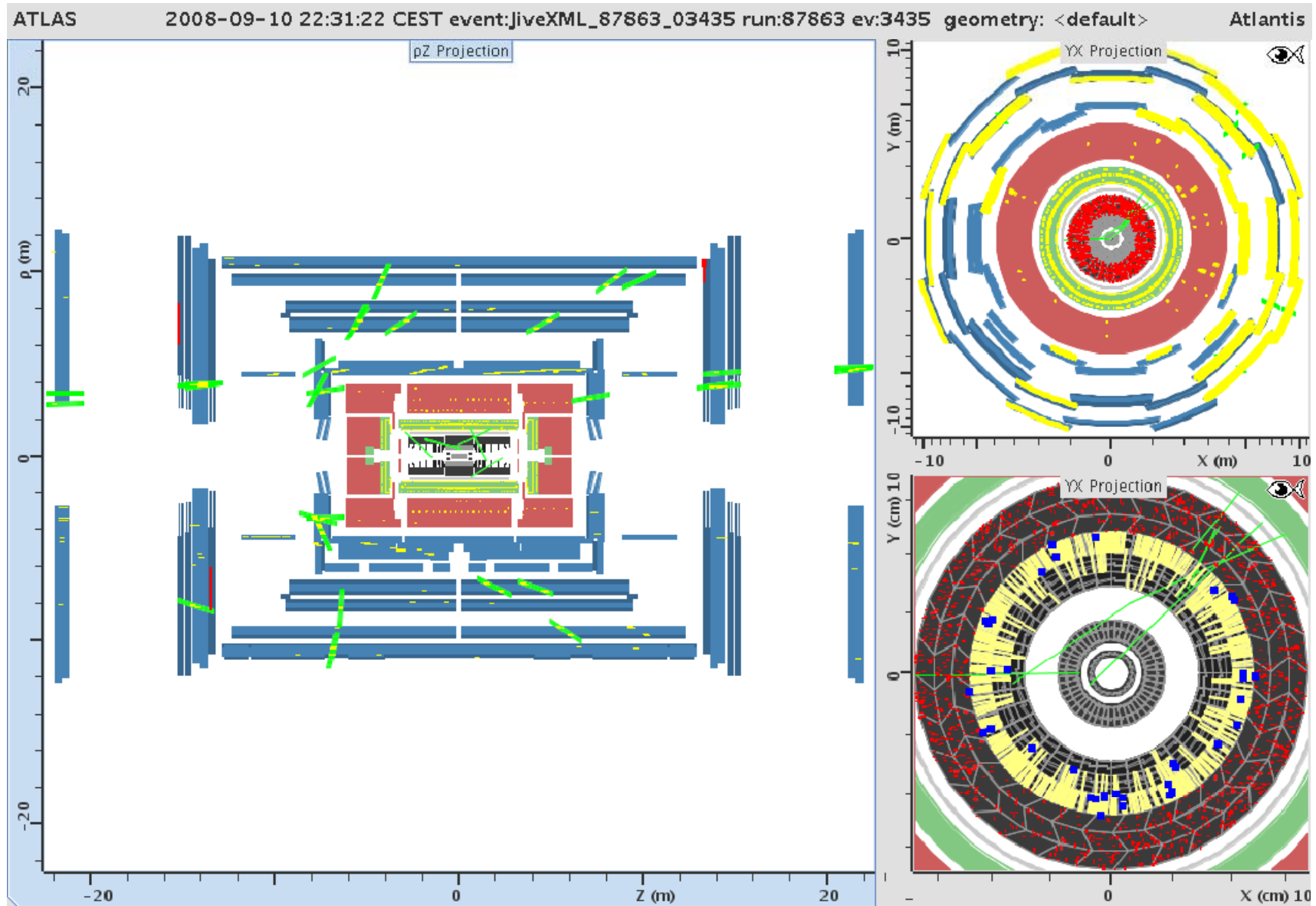
LUCID with beam 2



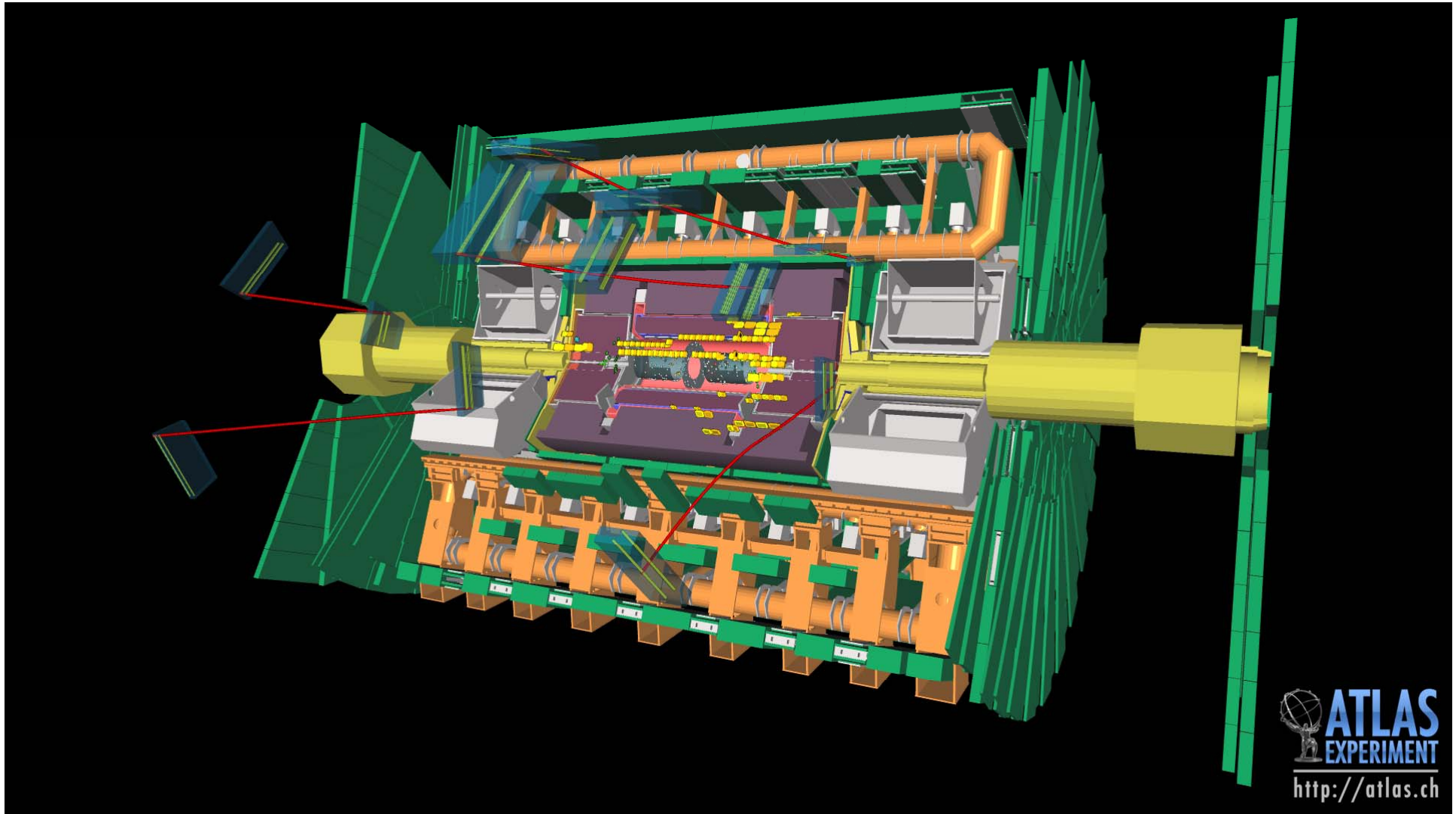
Lucid with beam 1



# A busy beam-halo event with tracks bent in the Toroids from the start-up day (offline)



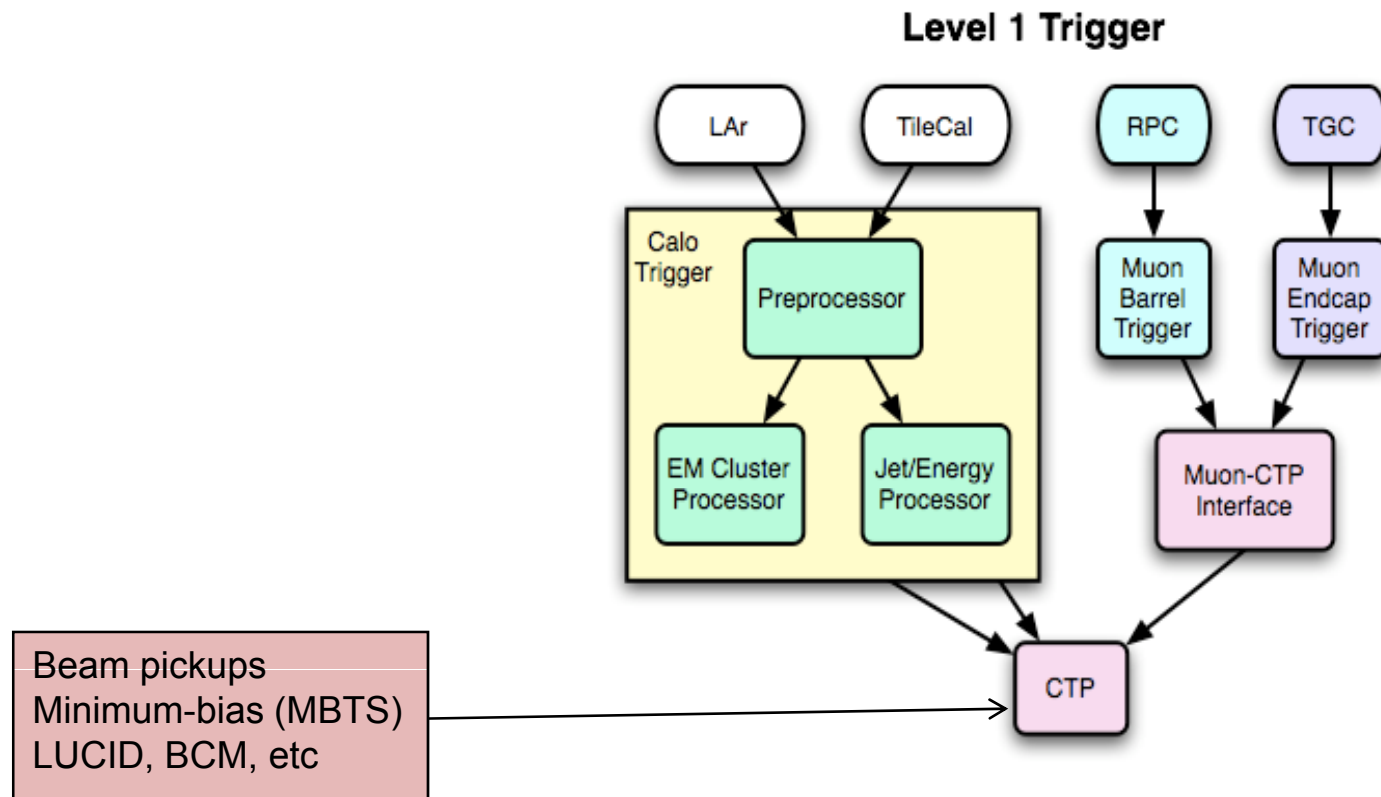
## Another beam-halo event





# LVL1 System

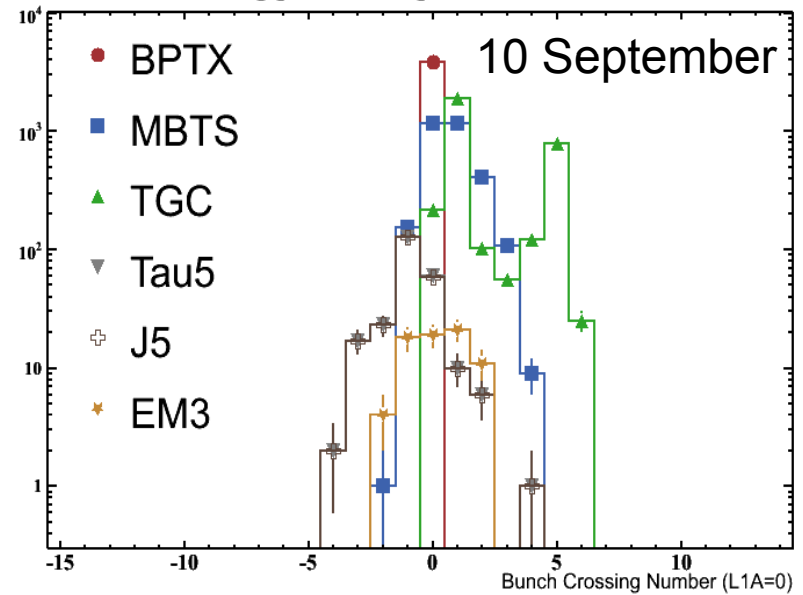
- **System is fully installed**
  - Still large programme of work to be done to commission it with beam
    - Much work done with cosmic rays, test pulses, etc
    - Already made good start with single beam, starting on 10<sup>th</sup> September
    - Some aspects of commissioning can only be done with collision data
      - E.g. detailed time alignment of barrel muon trigger



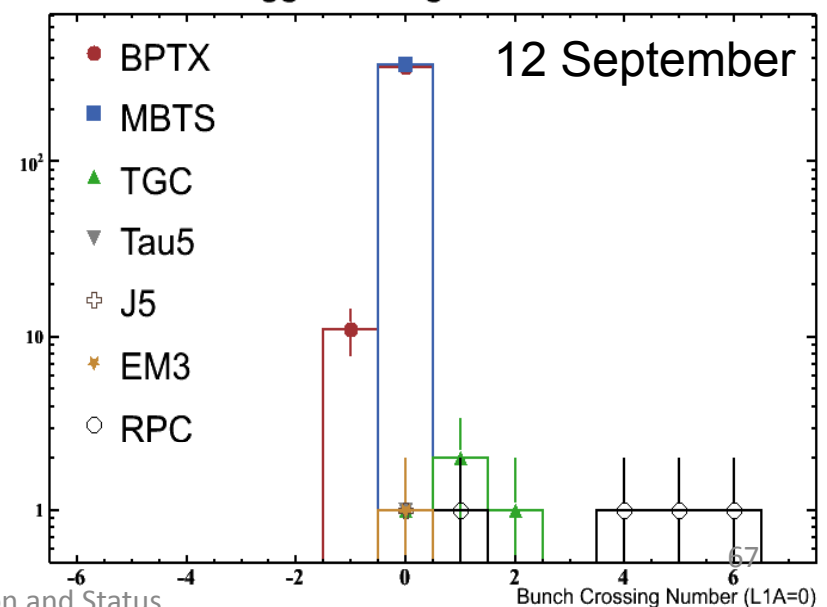
## Timing-in the trigger

- Experiment timing currently based on beam-pickup (“BPTX”) reference
  - First task of LVL1 central trigger team on 10<sup>th</sup> September was to commission the beam pickups
- Times of arrival of other triggers are being adjusted to match
  - Plots show evolution from 10 to 12 September
  - Timing-in now for down-stream side for single beam to have similar timing to collisions
- Each LVL1 sub-system also needs to be timed in internally
  - L1-calo, L1-RPC, L1-TGC, MBTS, etc

Relative Trigger Timing in Run 87863



Relative Trigger Timing in Run 88128



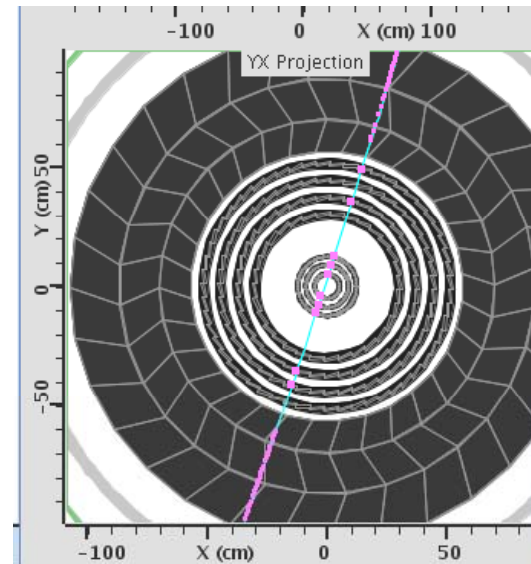
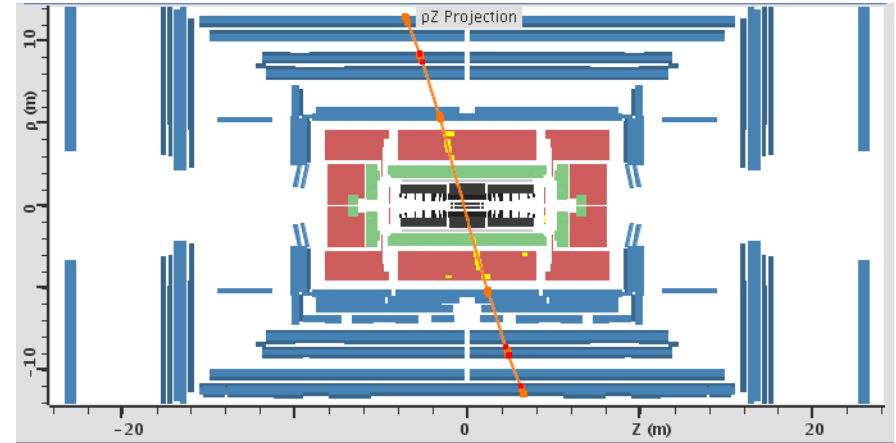
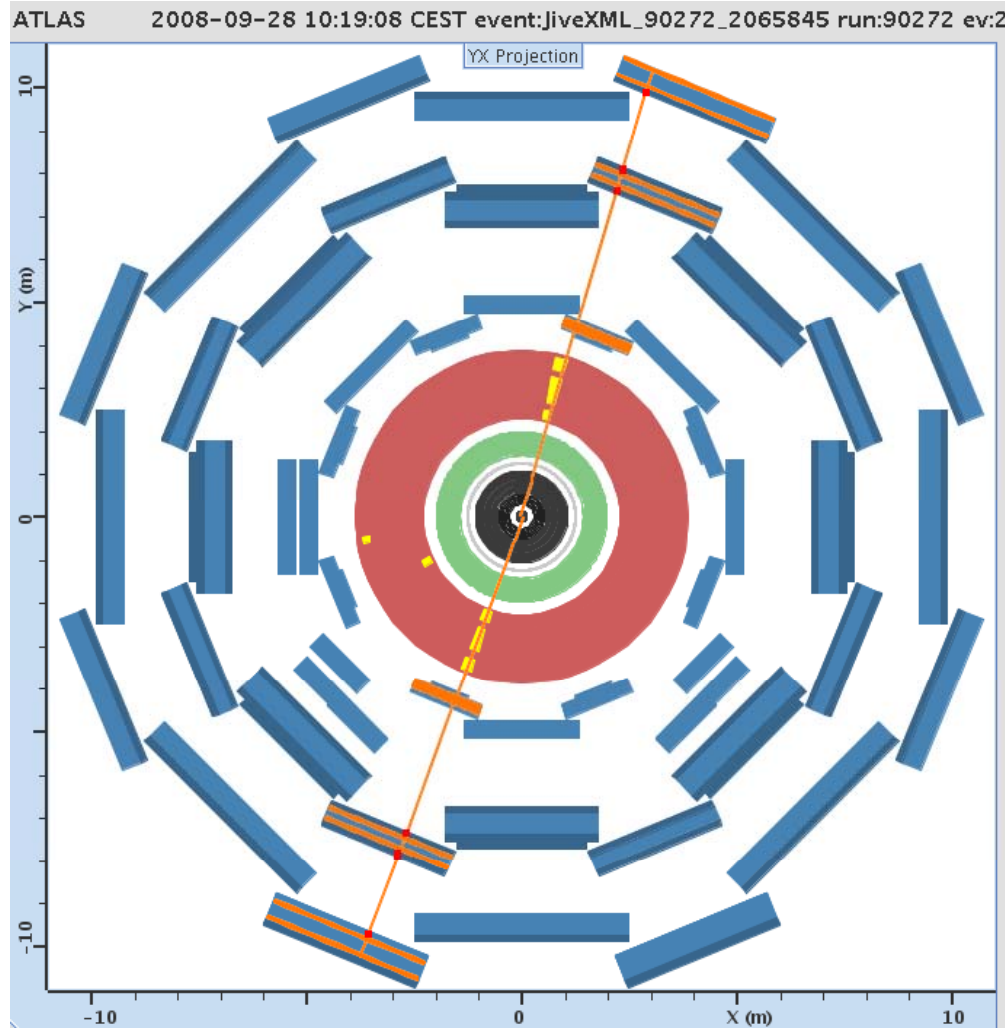


# ATLAS shutdown planning winter 2008/2009 (Schedule Version 10.1)

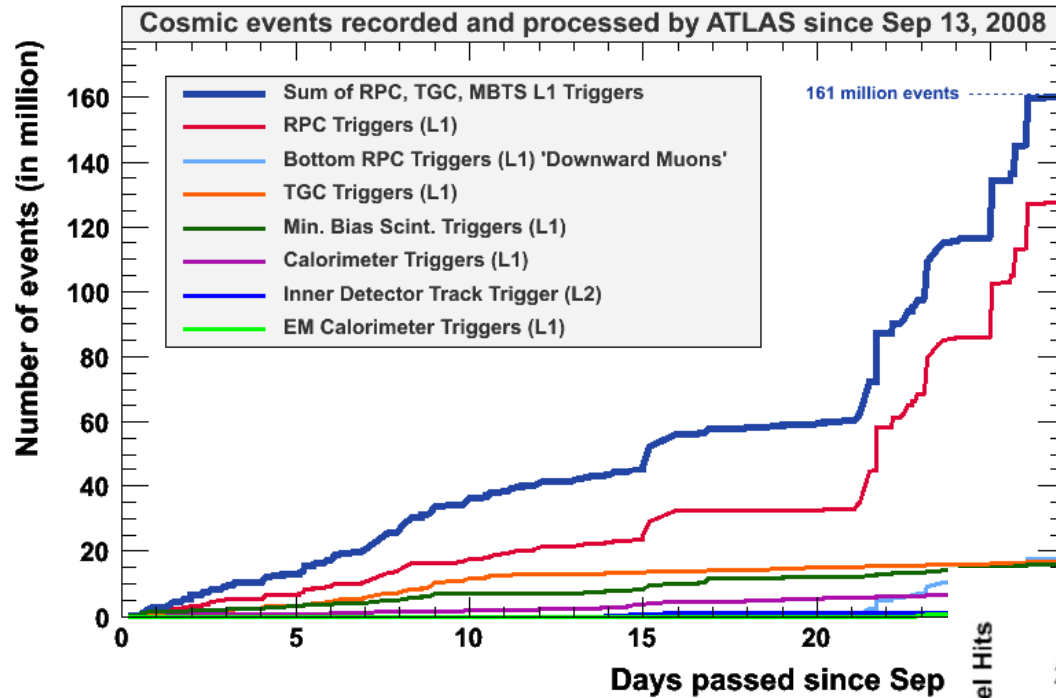
	Oct '08				Nov '08				Dec '08				Jan '09					Feb '09				Mar '09				April '09					
	40	41	42	43	44	45	46	47	48	49	50	51	52	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	
<b>Side C</b>	BW, EO, Lucid in commissioning mode		BW-C open for fibers repair		BW-C in garage position, no n-pentane																	Forward C in commissioning mode									
	no n-pentane		JF to surface		ECT-C out																			ECT-C in		JF in		BW-C in			
	Lucid + EO fix																														
<b>Barrel</b>	SW-TGC-A commissioning		open barrel C		Calos C electronics repair					close barrel C				All barrel in commissioning mode																	
	All barrel in commissioning mode		ID commissioning + RPC 12-13-14 trigger		Commissioning of individual systems																	All barrel in commissioning mode									
	SW-TGC-C commissioning		open barrel A		Calos A electronics repair					close barrel A				Fix barrel muon chambers + SW TGC																	
<b>Side A</b>	Lucid + EO fix		JF to surface		ECT-A out		BW-A in garage position, no n-pentane																	ECT-A in		JF in		BW-A open for fibers repair		BW-A in	
	BW, EO, Lucid in commissioning mode																														
<b>Magnets</b>	Toroids + Sol on		Sol on		Magnets off + yearly maintenance																	Magnets on									
<b>HS</b>	restricted access		repairs / maintenance activities																	restricted access											

**Extensive cosmics data collection with the full detector has ended on 20<sup>th</sup> October, the detector is now being opened for maintenance work, to be fully ready again in May 2009**

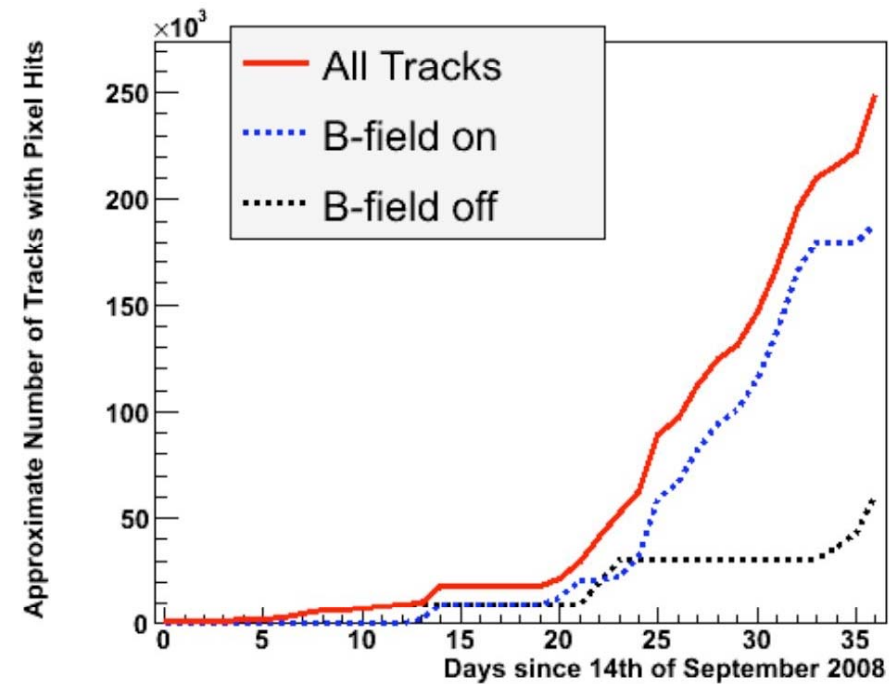
## *A nice cosmic muon through the whole detector...*







*A huge amount of cosmic ray triggers are recorded, in total (left) as well as giving tracks also in the smallest-volume detector, the Pixels (below)*



***The real content of the ATLAS status and preparation for the physics is to come in the following talks by ATLAS colleagues....***

***Daniel Froidevaux, CERN***

***Pauline Gagnon, Indiana***

***Jochen Schieck, Munich MPI***

***Michael Flowerdew, Liverpool***

***Christine Kourkoumelis, Athens***

***Rachid Mazini, Toronto***

***Daniel Levin, Michigan***

***Jean-Francois Marchand, LAPP***

***Simonetta Gentile, Roma I***

***Janet Dietrich, Freiburg***

***Christina Potter, London RHBNC***

***Muge Karagoz Unel, Oxford***

***Gokhan Unel, Irvine UC***

***Veysi Erkcan Ozcan, London UC***

***Victor Maleev, Petersburg NPI***

***Grant Gorfine, Wuppertal***

***Edward Moyses, Massachusetts***

***ATLAS TRT detectors: performance with first data***

***Women and Physics***

***Early top physics in ATLAS***

***Rediscovering SM physics with ATLAS***

***Search for Higgs bosons at LHC***

***Search for the VBF Higgs-->tau-tau decays with the ATLAS Detector at LHC***

***Diboson physics studies in the ATLAS experiment***

***Search for the SM Higgs decays to gamma-gamma decays in ATLAS***

***MSSM neutral Higgs searches***

***The reach of the ATLAS experiment in SUSY parameter space***

***Searching for new physics in events with three leptons in ATLAS***

***Search for low scale gravity signatures in ATLAS***

***Prospects for quark searches and their impact to Higgs searches in ATLAS***

***Vector Boson Scattering at ATLAS***

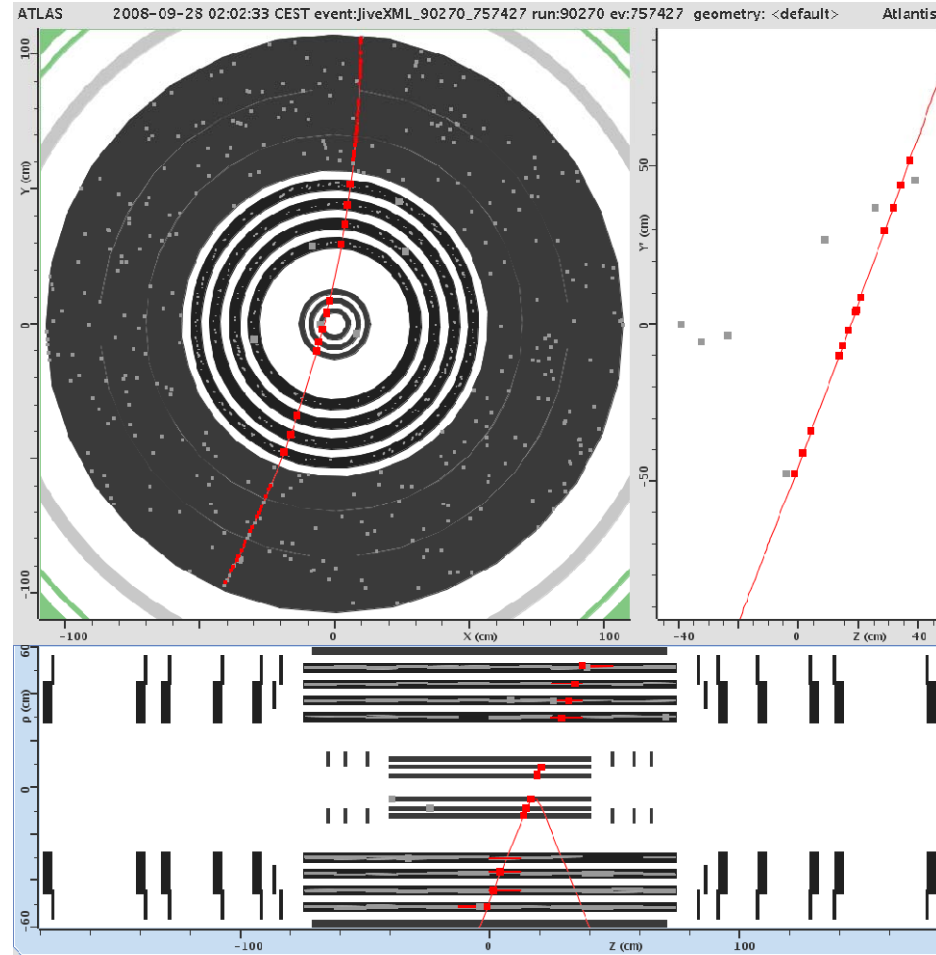
***Electron and Photon Reconstruction and Identification with the ATLAS***

***B tagging performance in ATLAS***

***Muon Identification for the ATLAS Experiment***



*A tribute to our Turkish  
Colleagues who worked  
on the Inner Detector, in  
particular the TRT*



Engin ARIK



İskender HİKMET



Özgen Berkol Doğan



Mustafa FİDAN



Engin ABAT



F. Şenel BOYDAĞ

***Engin pioneered the Turkish involvement in ATLAS, as she has more generally Turkish involvement in CERN, and this will for sure remain!***



**14<sup>th</sup> August 2008: Signature of a Cooperation Agreement between President O Cakiroglu of the Turkish Atomic Energy Authority and CERN-DG R Aymar**



**21<sup>st</sup> October 2008: HE Minister Mehmet Güler taking part in the LHC inauguration and visiting the ATLAS experiment**