current status of
LHC , ATLAS

- LHC & ATLAS overview

  [by M. Ishino ICEPP]

- LVL1 Endcap-Muon Trigger Electronics

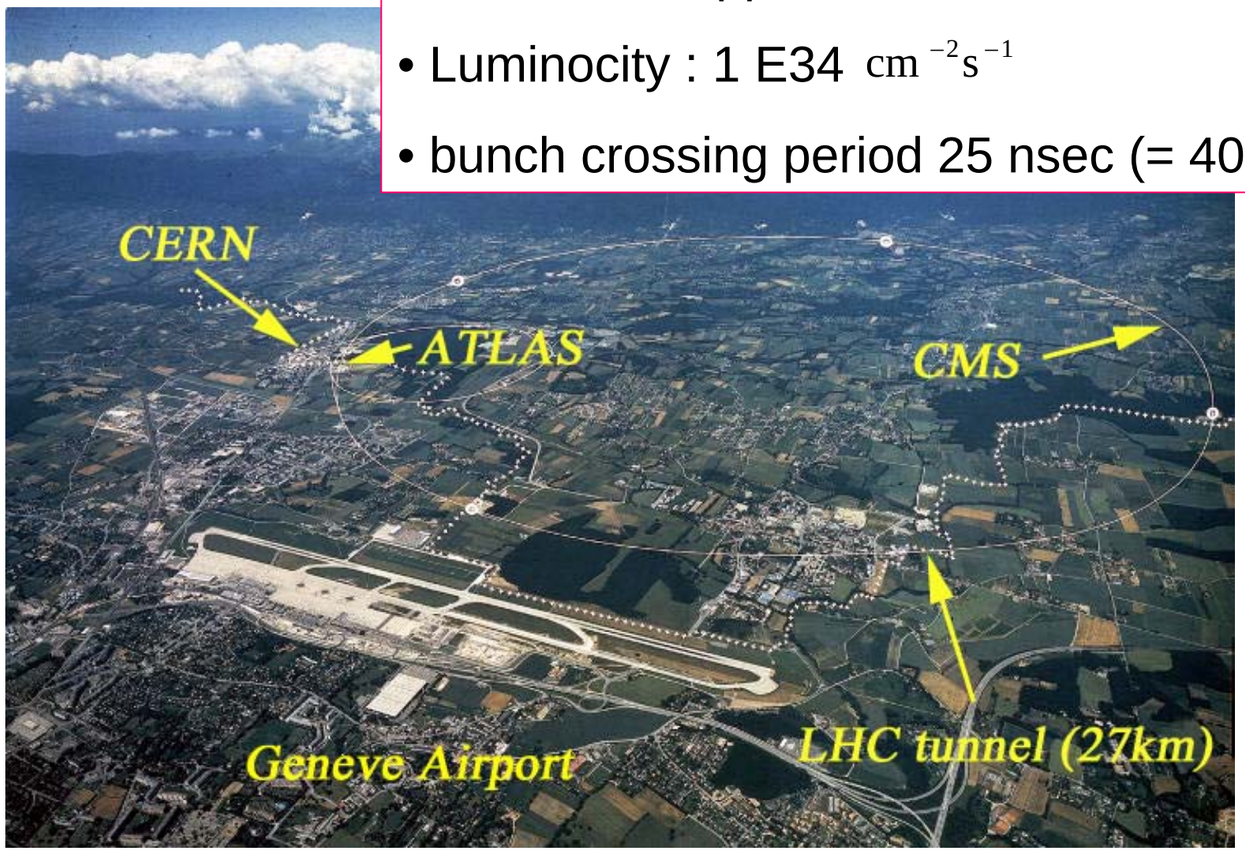
  [by K. Shibuya ICEPP]

as a background movie for coffee break

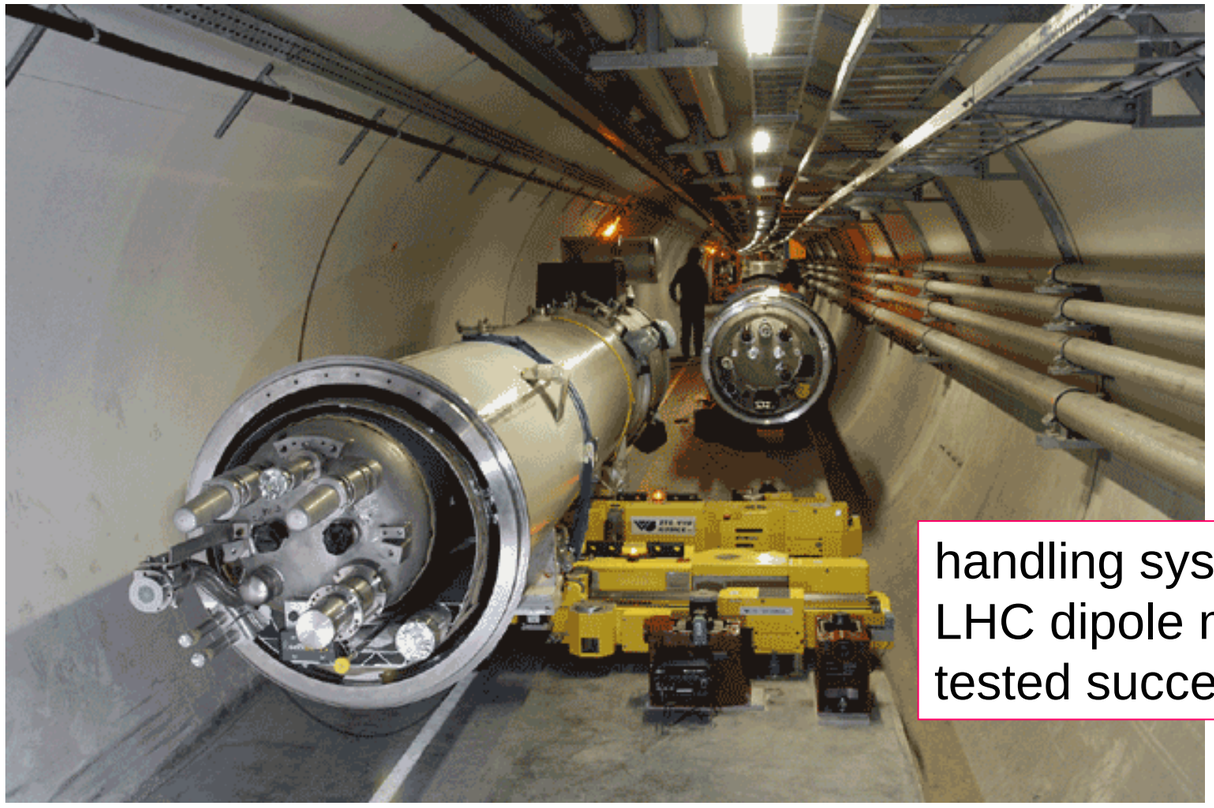
ATLAS Installation Video (~ 10 min.)

LHC @ CERN

- LHC 14 TeV pp collider
- Luminocity : 1 E34 $\mathrm{cm}^{-2}\mathrm{s}^{-1}$
- bunch crossing period 25 nsec (= 40MHz)

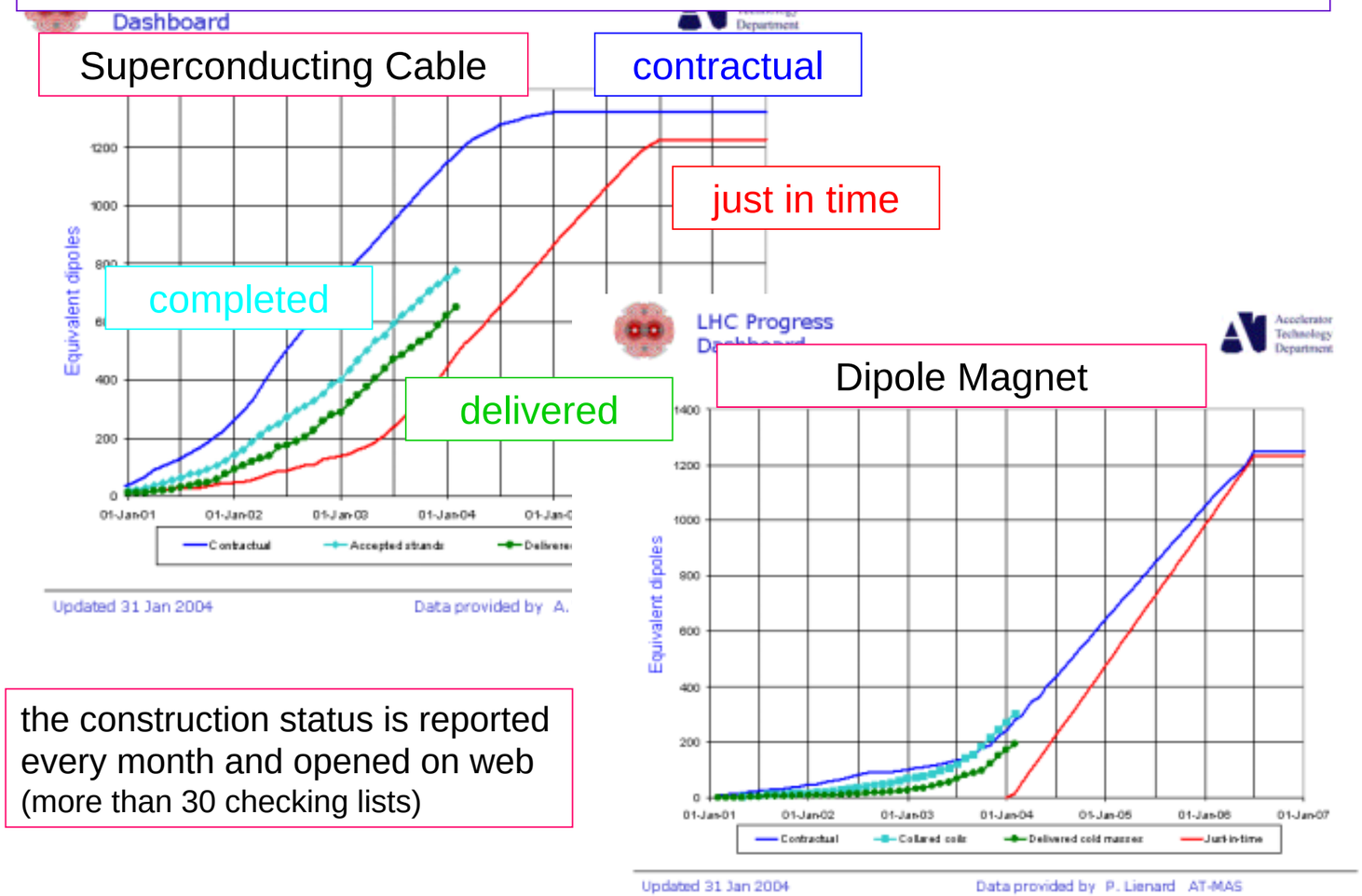


LHC magnet installation (test) on 27th Jan. 2004



handling system of the LHC dipole magnets was tested successfully

progress of construction of LHC



the construction status is reported every month and opened on web
(more than 30 checking lists)

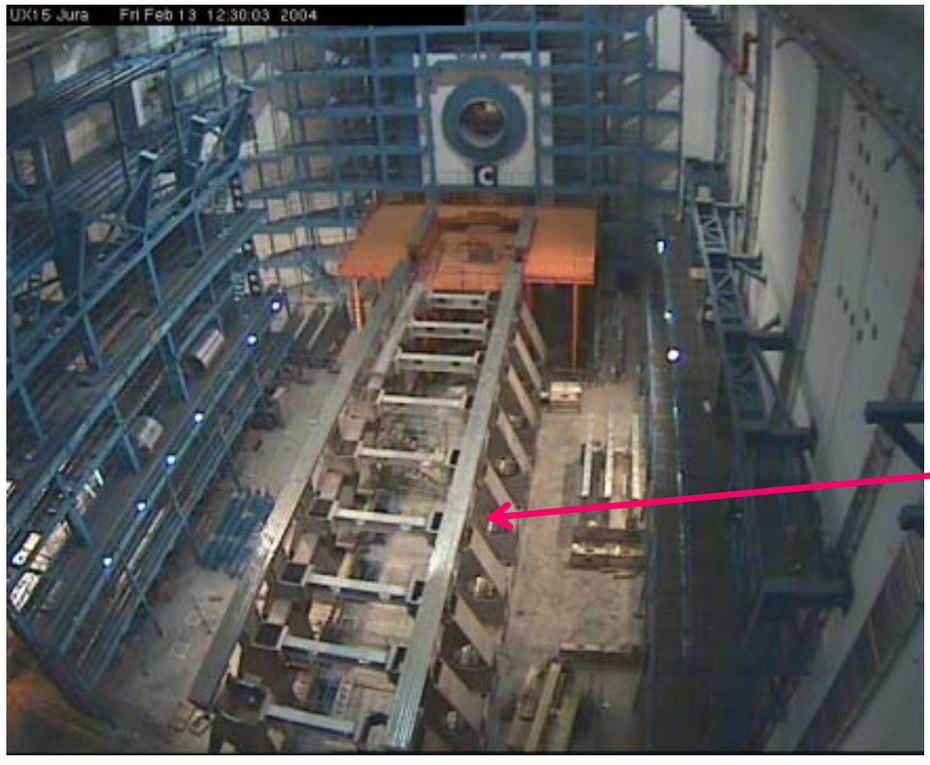
LHC schedule (ver. Dec. 2002) LHC-PM-PS-01 ver.4

- 2004 Q1 : start installation of dipole magnet
- 2006 Q1 : start beam injection (partially)
- 2006 Q3 : completion of LHC
- 2006 Q4 : start refrigeration of dipole magnet
- 2007 Q2 : 1st injection & commissioning (with beam)
- 2007 Q3 : 1st Physics Run

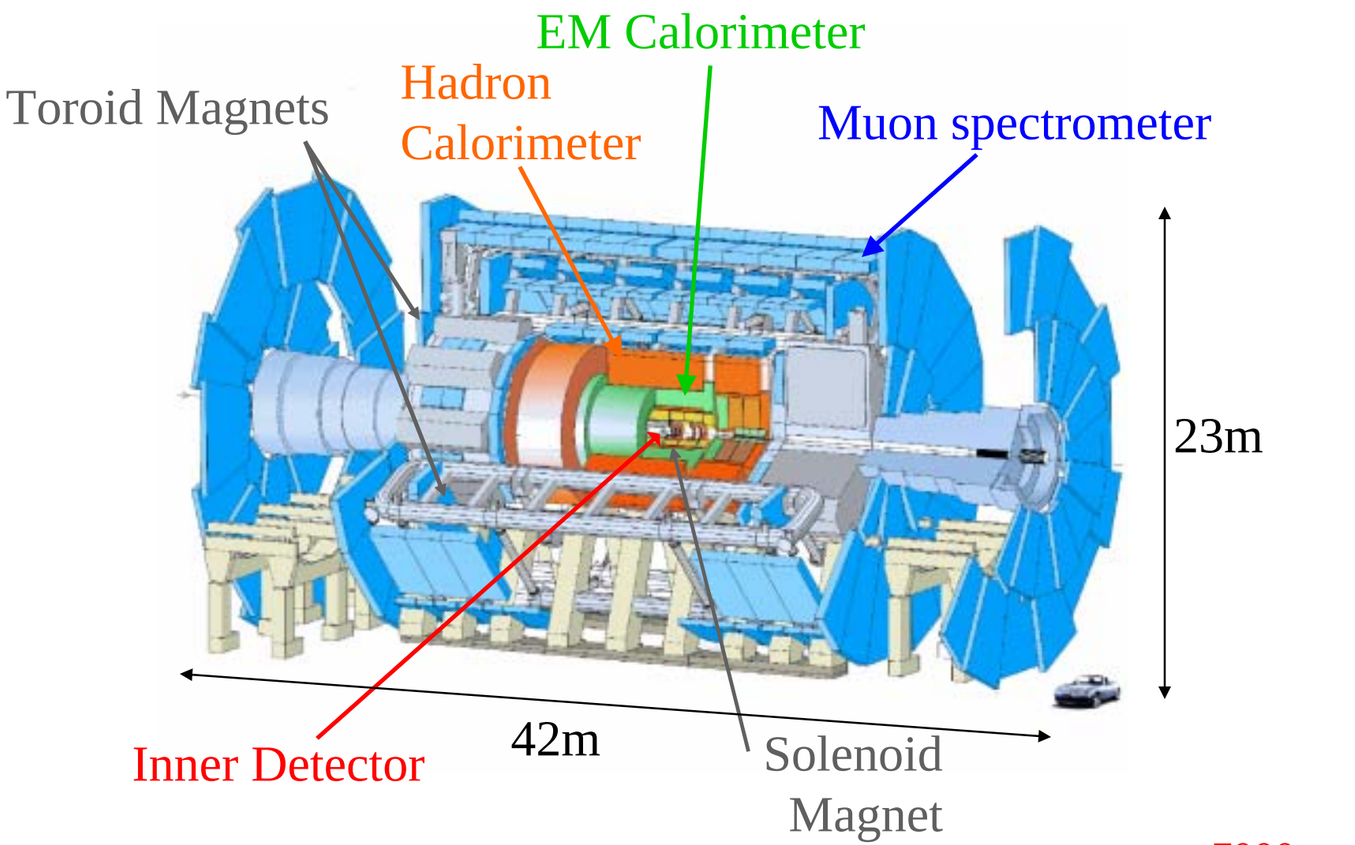
- collect ~10 fb^{-1} /exp (2.$10^{33}$$cm^{-2}$ s^{-1}) by early 2008
- collect 200-300 fb^{-1} /exp (3.4-10.$10^{33}$$cm^{-2}$ s^{-1}) in 5-6 yrs

200x : discovery of Higgs Boson , xxx , yyy

ATLAS Pit on 13.Feb.2004



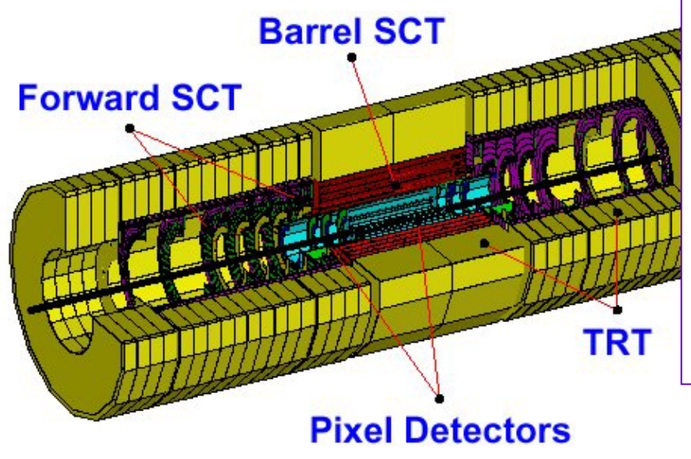
ATLAS



7000ton

Inner Detector

- Pixels : 50 μm ✕300 μm (3 layers per track)
- SCT : 80 μm Si strip, 12.8 cm long (4 layers per track)
- TRT : 4 mm ϕ straw tubes (36 straws per track)



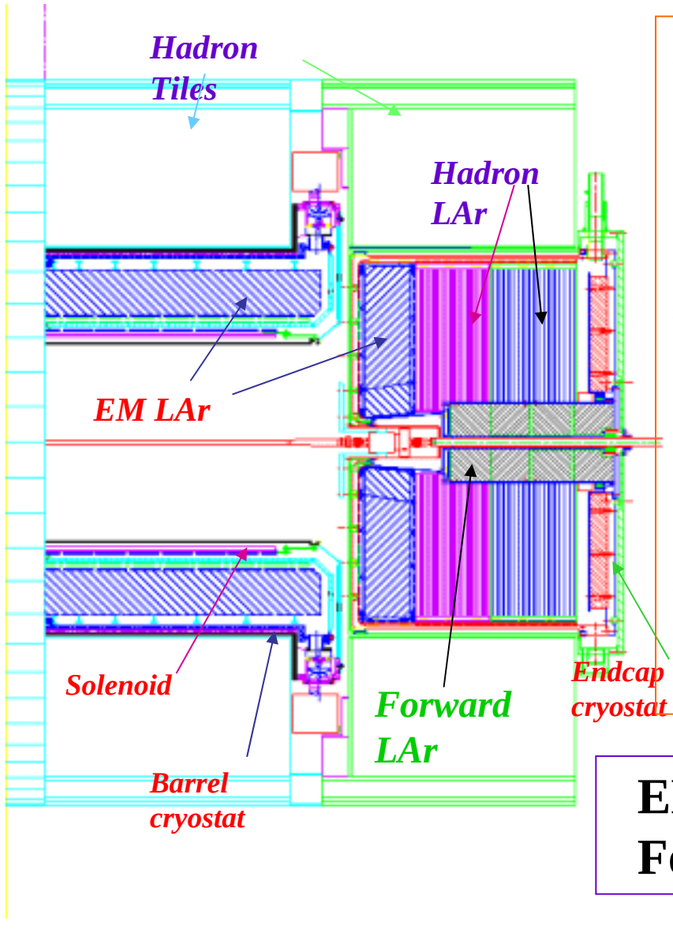
- ~2% of Pt resolution at 20GeV
- impact parameter res. $d_0 < 20$ μm
  (> 5GeV/c) vtx tag , b-tag , ..
- electron ID with TR photon
  - 3% of eff. for Pion (at the th. level of 90% electron eff.) for 5GeV

SCT barrel system test

First 4 Endcap TRT were delivered to CERN

Two of the SCT barrel support structures

Calorimeter



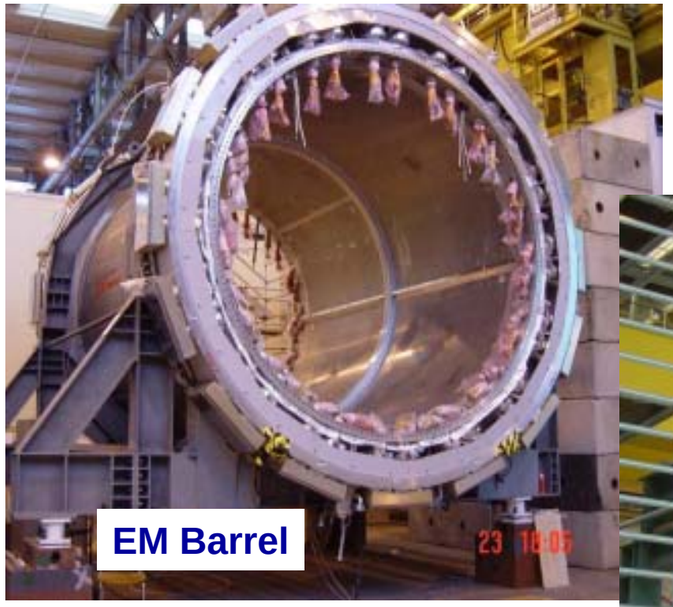
- EM (< 2% @ 50 GeV)
  - liq. Ar 21-36X_0

    (0.003 x 0.1 , 0.025 x 0.025 (0.05))
- Hadron (8% @ 100 GeV)
  - Scinti / Fe Sampling (0.1 x 0.1)
  - liq. Ar Sampling ~10λ (0.2 x 0.1)
- Forward (8% @ 300 GeV)
  - LAr Sampling 9λ (0.2 x 0.2)

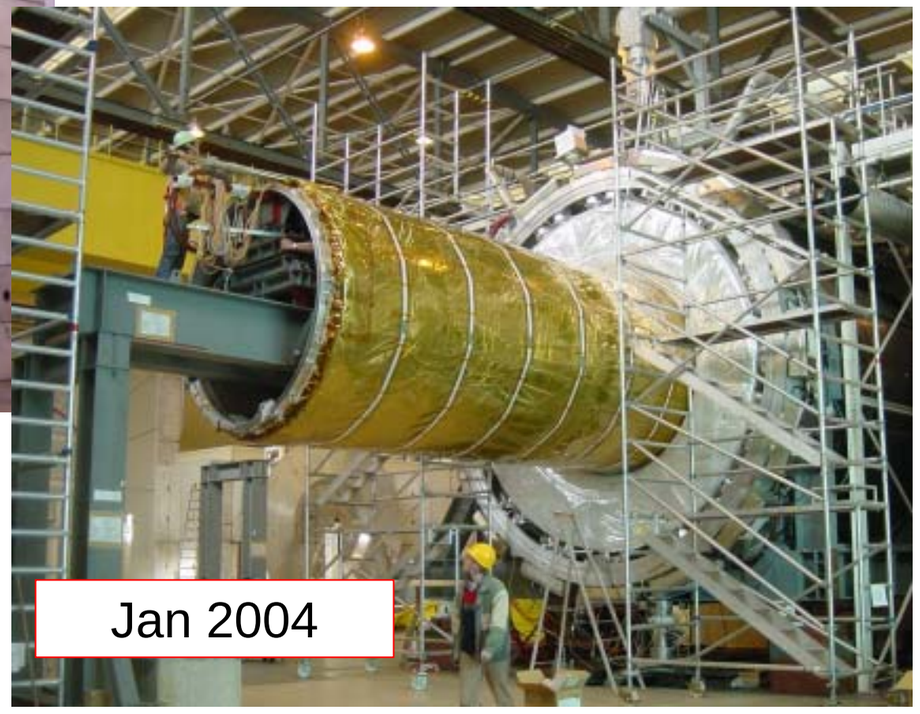
EM /HAD: $|\eta| < 3.2$
Forward : $3.1 < |\eta| < 4.9$

important for missing ET

LAr Calorimeter (EM Barrel)



mechanical & cryogenic
Integration with Solenoid Magnet



Tile Calorimeter

Pre assemble on surface (DONE)

disassemble (DONE)

Re-assemble in underground

Muon Spectrometer

Muon part is the HEART of ATLAS

because ...

– standalone momentum measurement

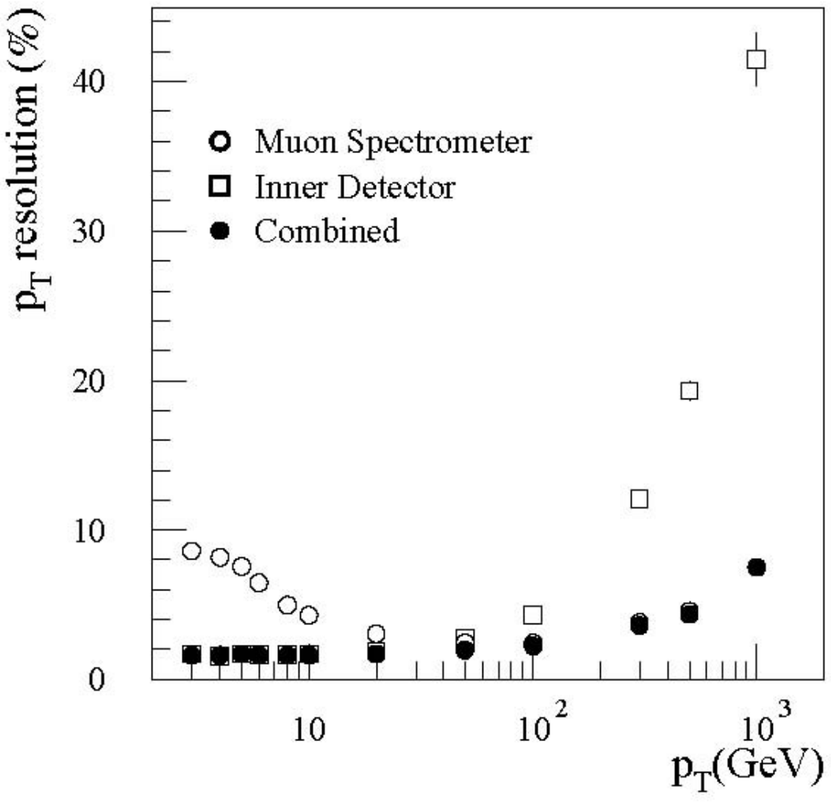
- bending power of the air-core SC toroid magnet

  ~ 3 T·m for Barrel / ~ 7 T·m for Endcap

– gives Trigger signal to ATLAS-DAQ system

We , ICEPP team is playing an important role also for this Muon Trigger detector, electronics and software

momentum resolution
muon standalone vs combined

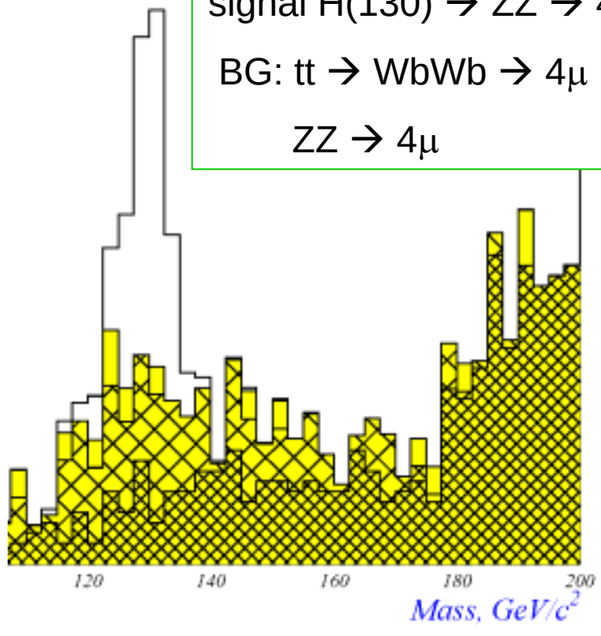


H → 4μ analysis with standalone muon system

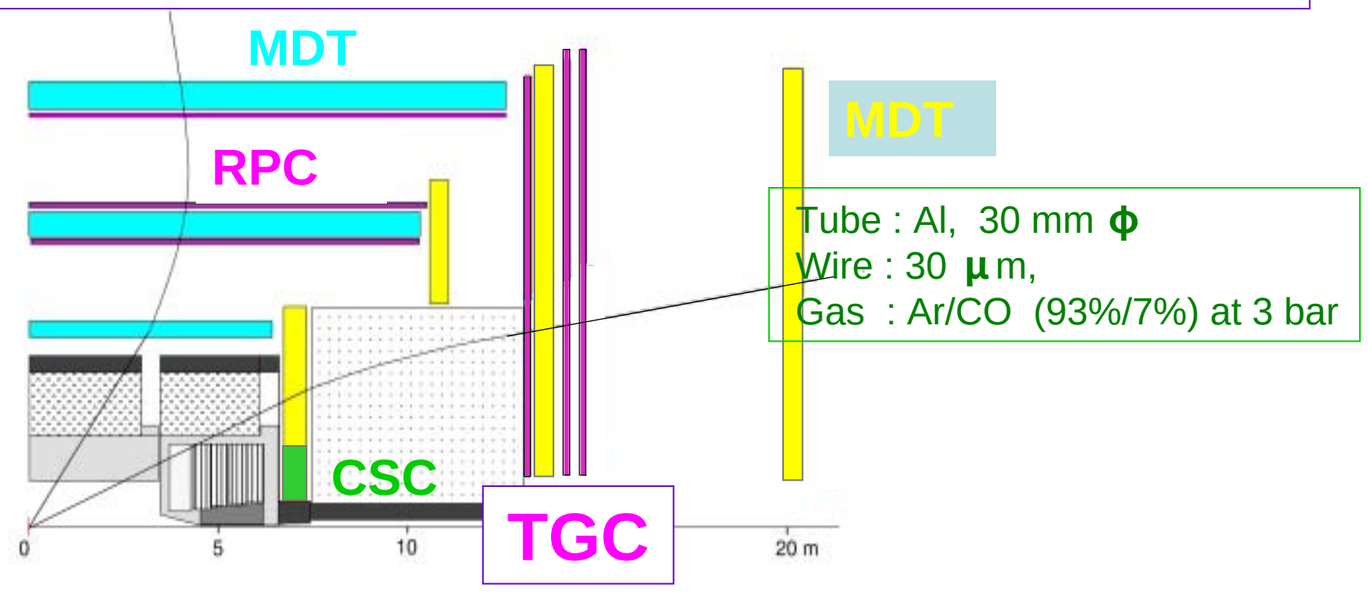
signal H(130) → ZZ → 4μ

BG: tt → WbWb → 4μ

ZZ → 4μ



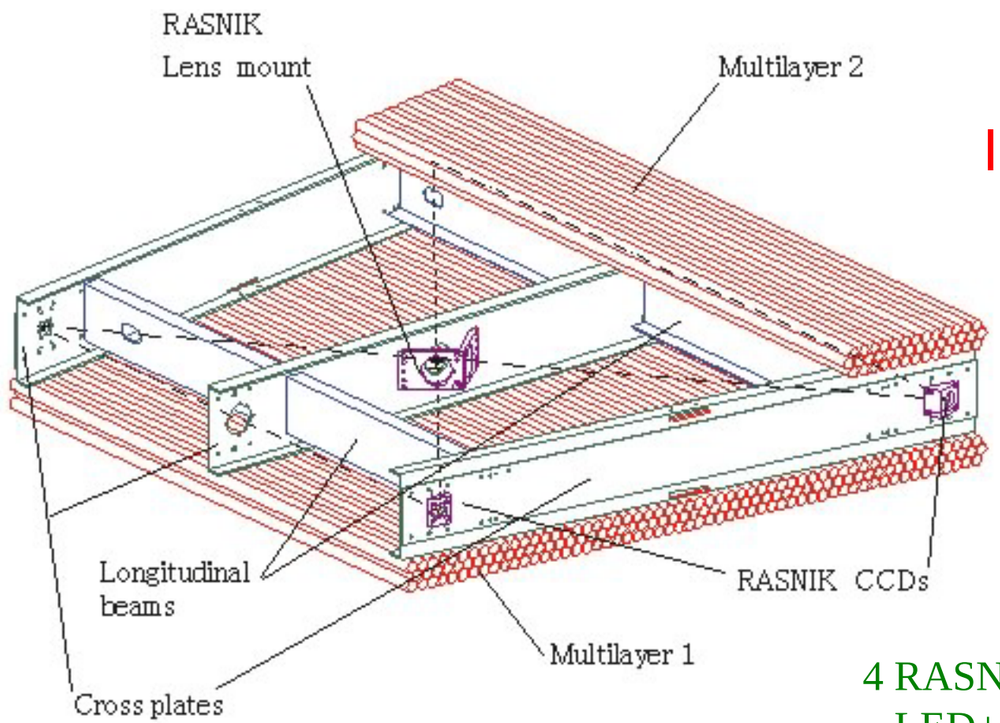
muon spectrometer system



TGC (Endcap) & RPC (Barrel) : Trigger Chamber

MDT & CSC (Forward Region) : Precision Chamber

alignment system for MDT



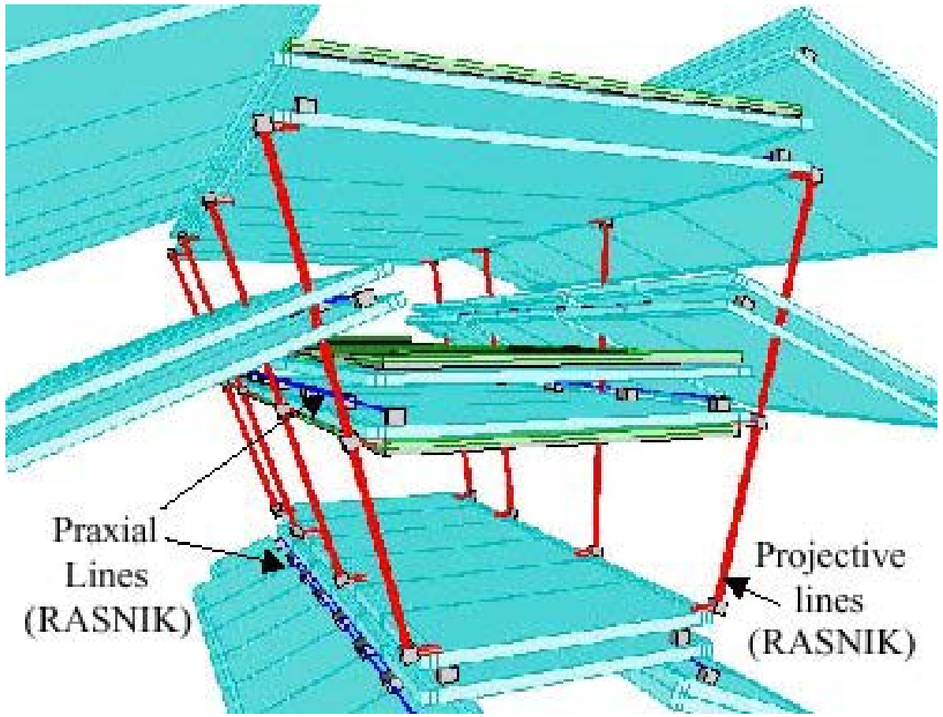
In-plane alignment

4 RASNIKs (3D position monitor,
LED+MASK+LENS+CCD)

→ monitor the cross plates

→ ~10 μm accuracy

alignment system for MDT

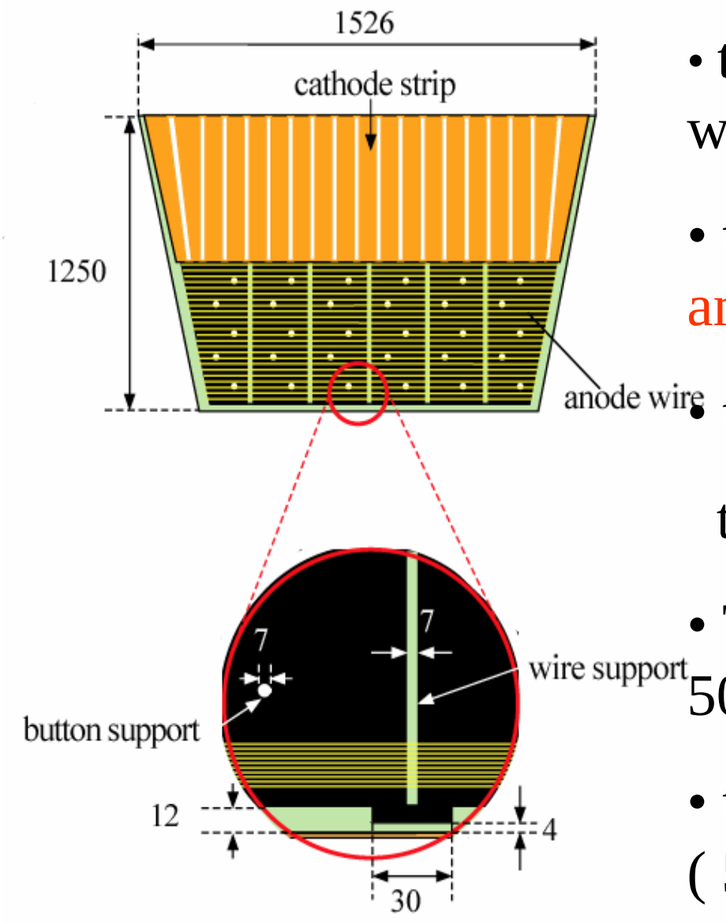


relative position
between chambers

~20 μm accuracy

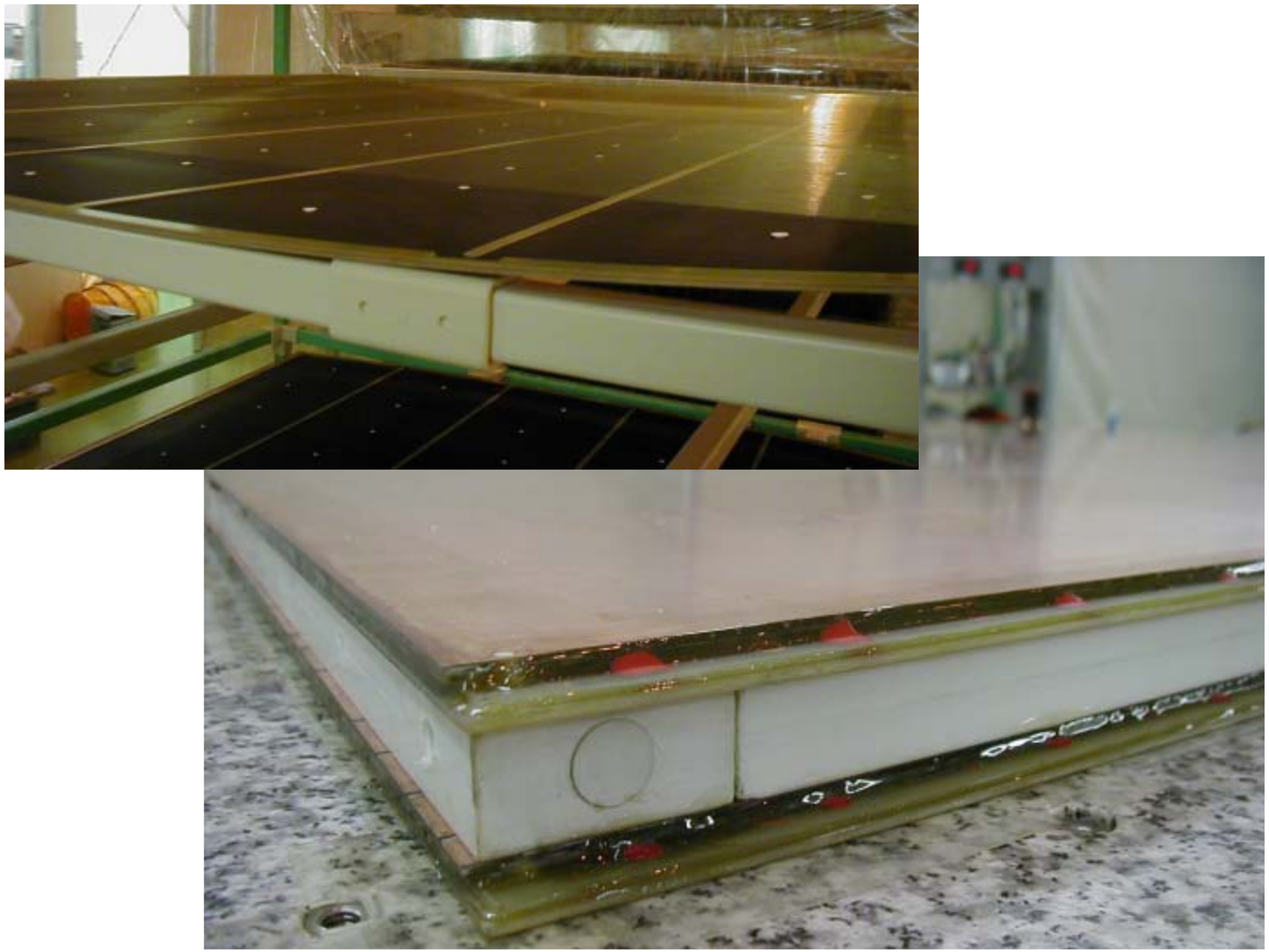
RASNIK (LED+MASK+LENS+CCD)

The basic property of TGC



- the basic structure is like MWPC with graphite cathode
- the signal is read from both anode wire and cathode strip
- the wire spacing is 1.8 mm

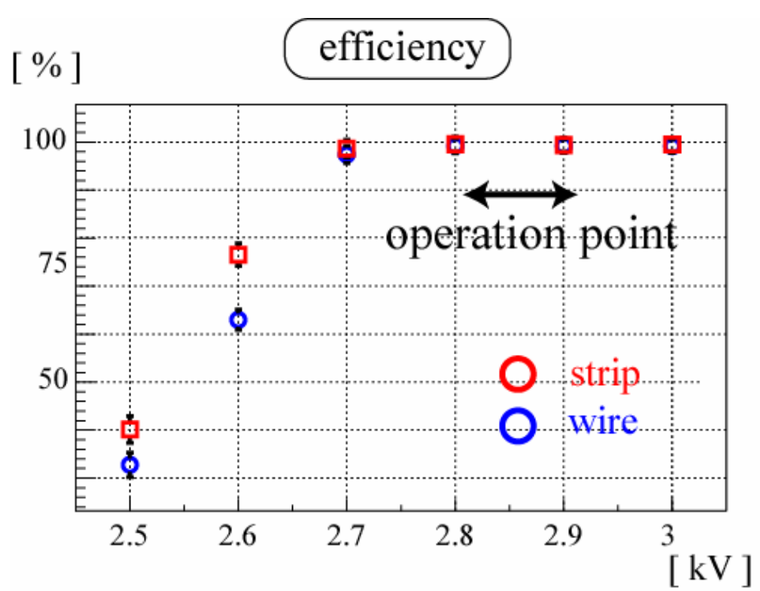
  the gap between a / c is 1.4 mm
- The diameter of tungsten wire is 50 micron
- the gas is CO2 and n-Pentane (55 : 45)

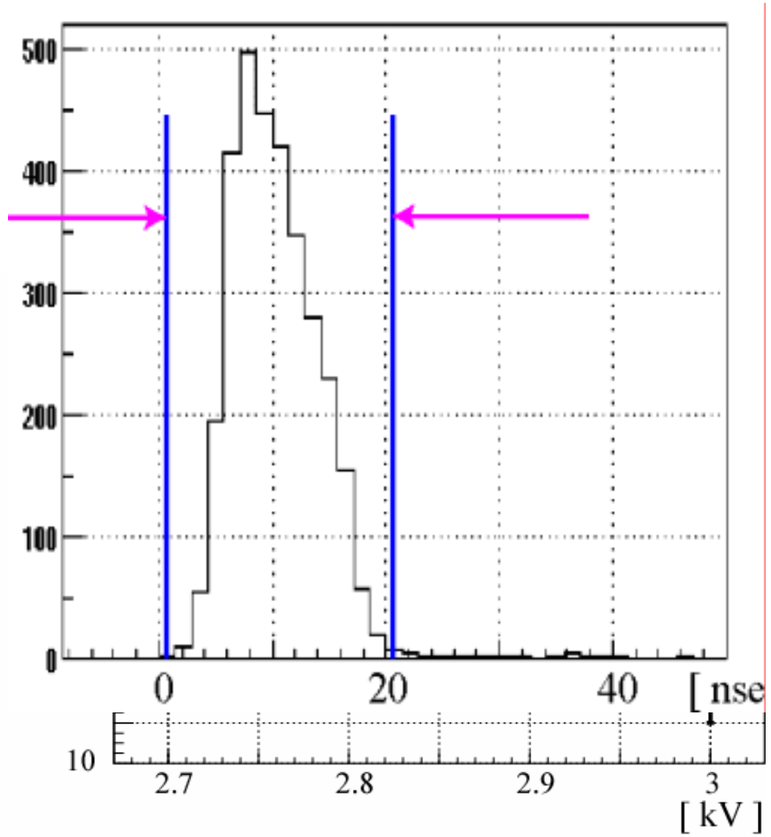


basic property of TGC with MIP

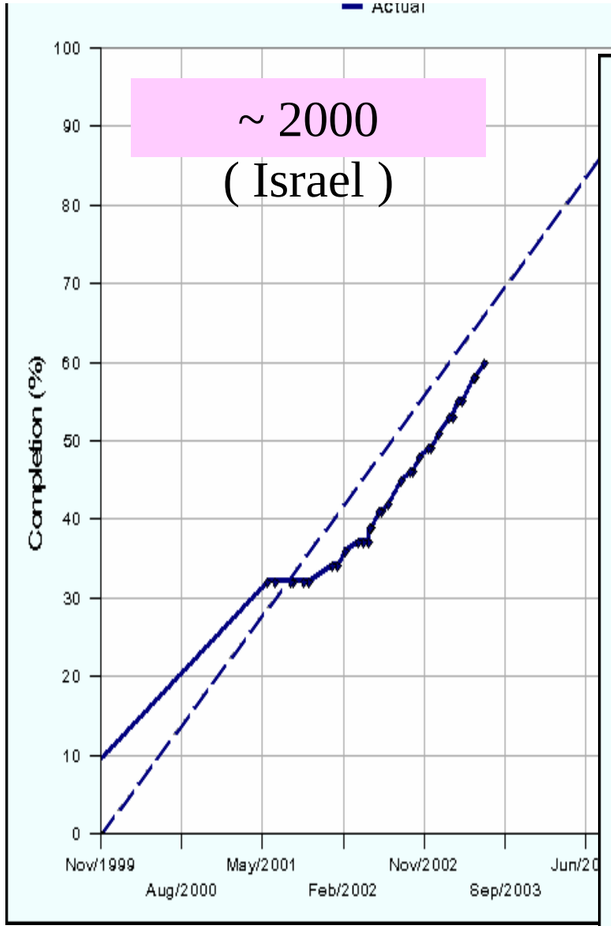
time jitter [Definition]

→ minimum time window for getting efficiency of 98 %

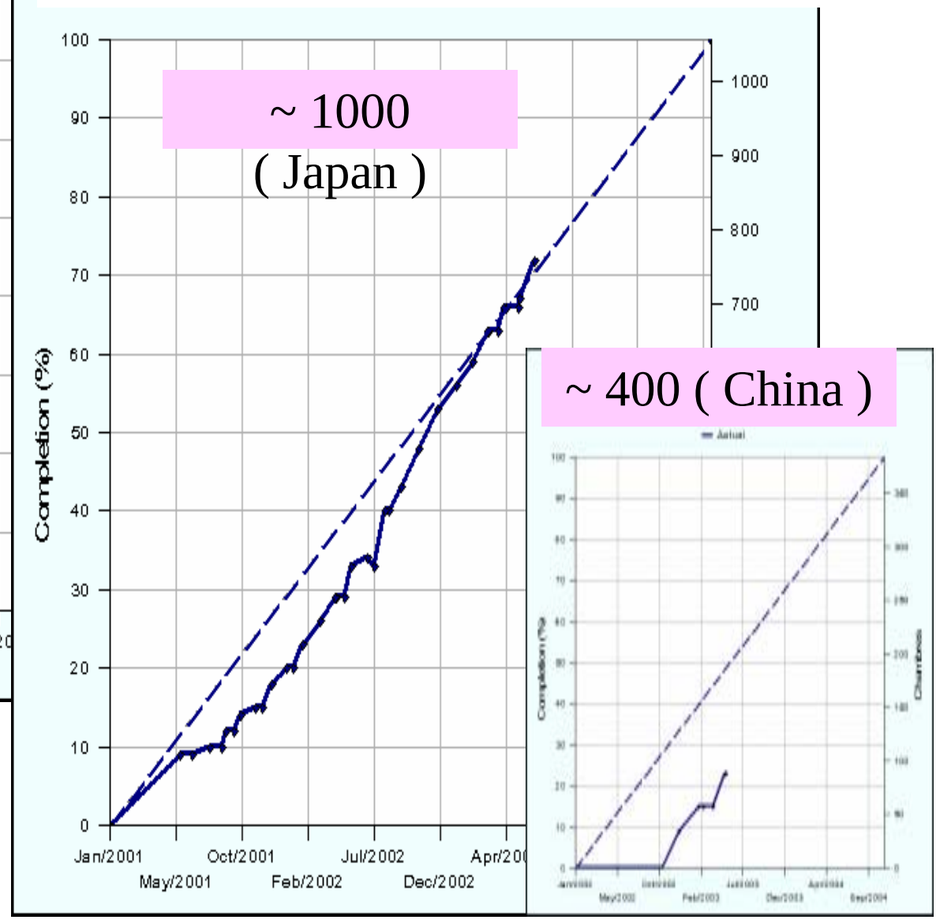




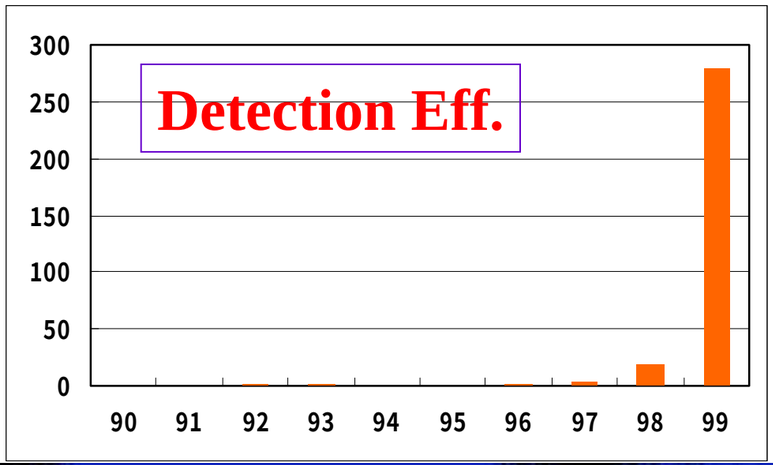
construction status

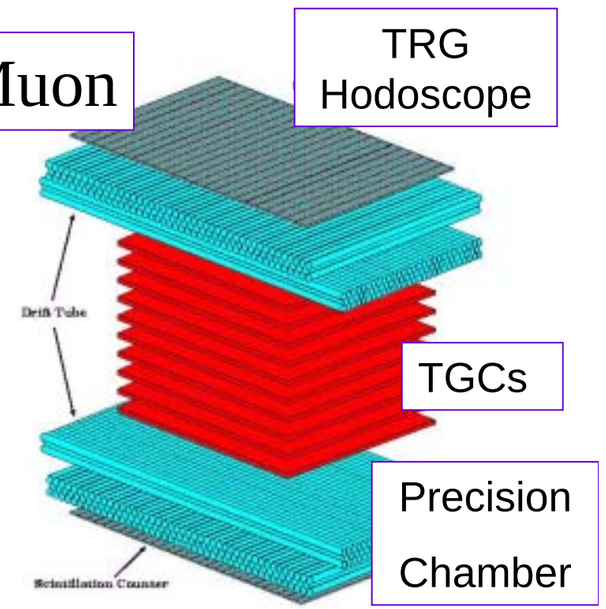


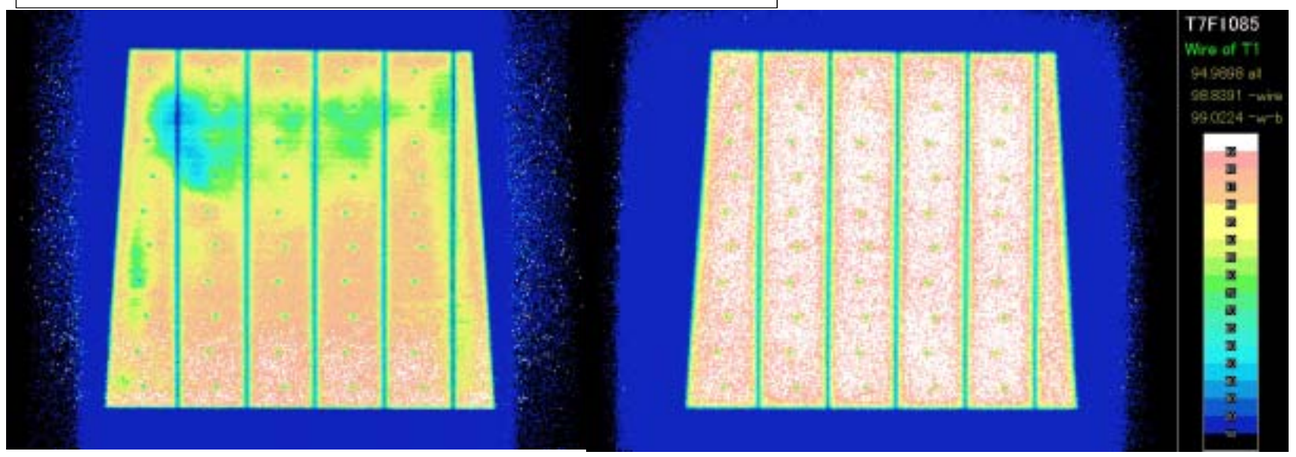
Until Aug. 03, 65 % of total has completed



Efficiency check with cosmic Muon







TGCs at CERN

30 % of total chambers were delivered to CERN. 23rd Feb.

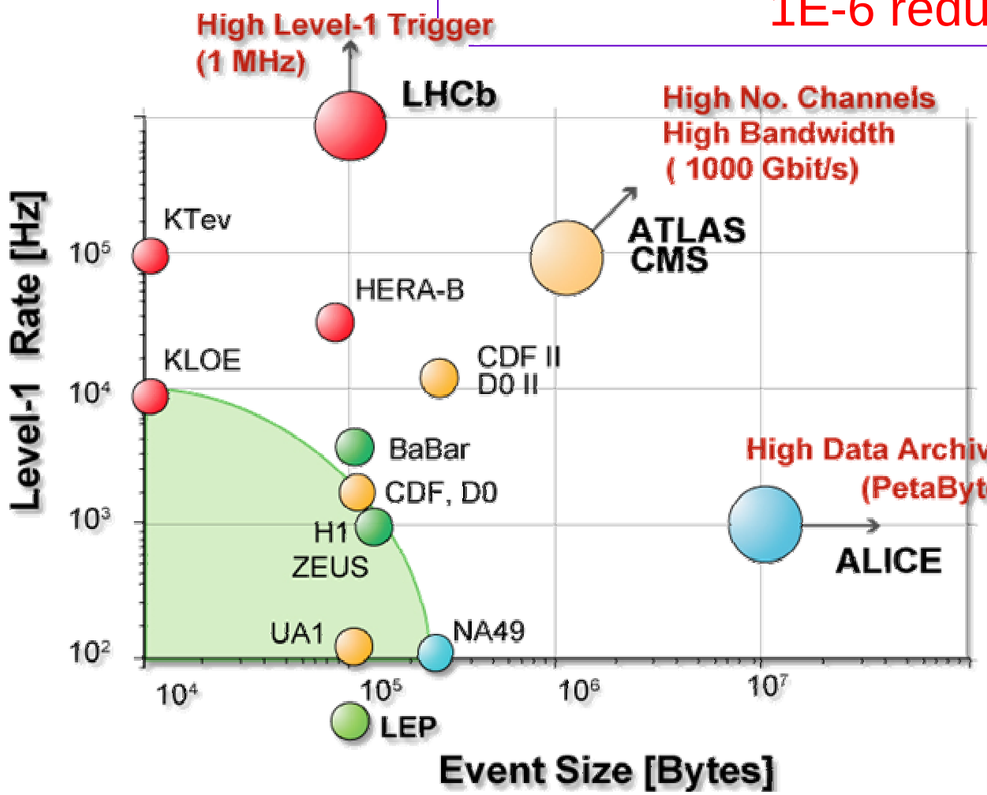
04’ more 20% will be arrived

Some basic tests are going on before installation

Trigger & DAQ

40 MHz Bunch Crossing → ~ 100 Hz

1E-6 reduction



Selection	Rate (Hz)
B-physics	~60
Electron	~20
Photon	~20
Muon	~15
Jet	~25
Jet + E_T^{miss}	~20
Total	**~160**

Computing in LHC era

- all the data cannot be handled at CERN anymore
- need extra computing power & storage outside of CERN
  (~ 6 National Center , ICEPP will be one of those)
- GRID Computing Model
  - roughly saying, World Wide Batch job system
- Spring 2004, the model will be tested with simulation data.
  The analysis chain (evt. gen → simulation → reconstruction → physics analysis) will be carried out on Grid base
- Network Band-width becomes more and more important resource

まとめ

- 2002 に計画を立てなおし、それを死守すべく 加速器、検出器の建設は進行中である
- Standalone でも reasonable な momentum resolution を持った ATLAS は素晴らしいデザインである
- TGC はμトリガーチェンバーとしてその大きな役割を果たすべく周到な準備が進行中である
- 国際戦争に勝利 (物理データの解析) 計算機の運用に関する R & D が進行中。2004 年の目玉はGrid Base での初の解析練習 Data Challenge を行うことである。

backup slides

ARCHITECTURE