Drift Chamber construction for ATLAS*

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CERN and the Technology Transfer in Greece
Amphitheatre N.C.S.R. "DEMOKRITOS",
Athens 14-11-2003

*supported by the GGET-Micromechanics and Microelectronics program

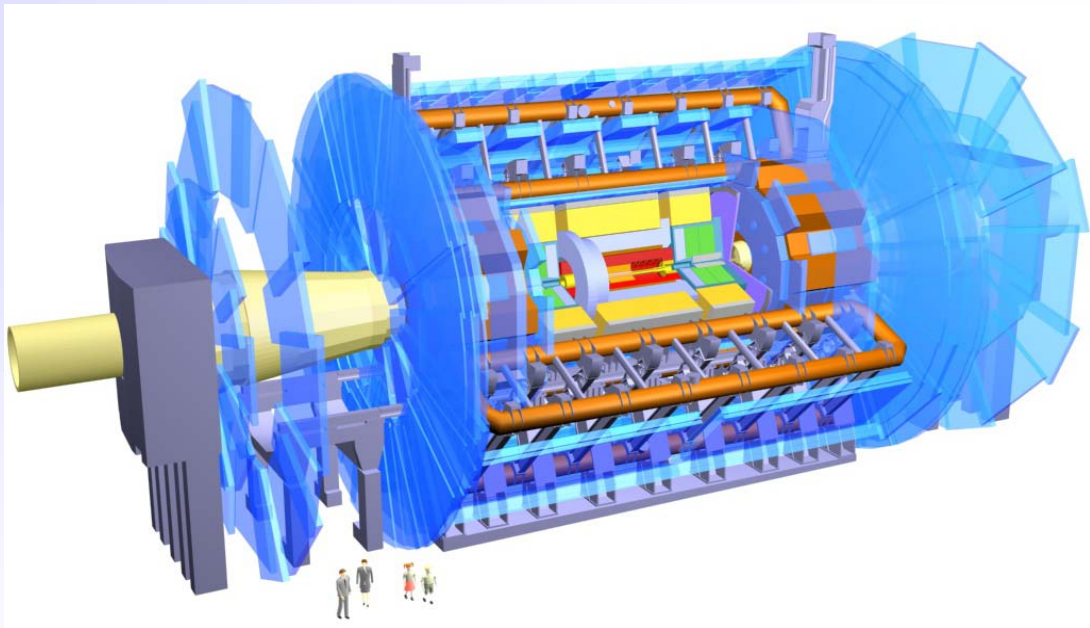
Outline

- *The Project*
- *The Laboratory Infrastructure created*
- *The Present Status of the Project*
- *Future perspectives of the Laboratory*

The project

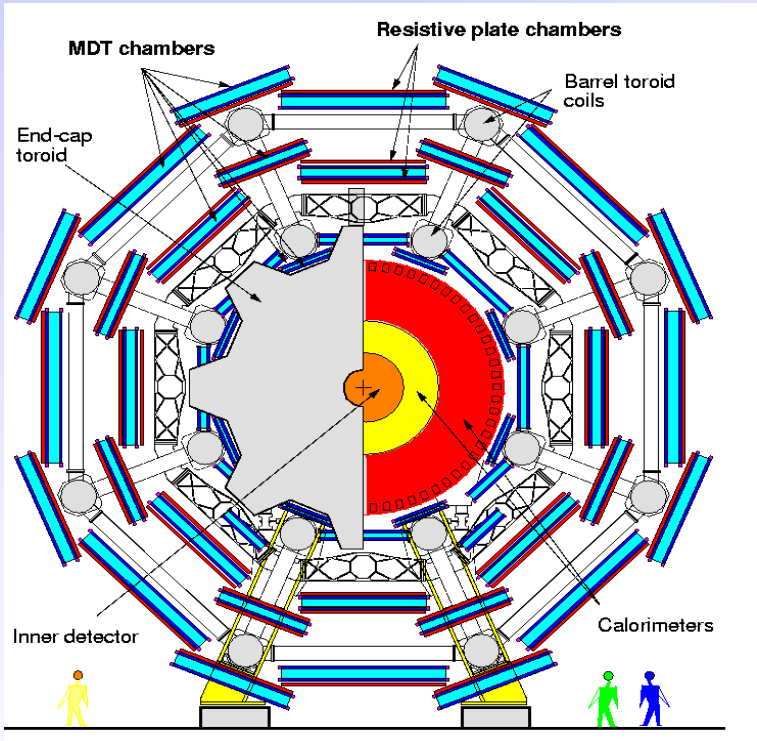
• Construction and test of all 128 BIS chambers in Greece

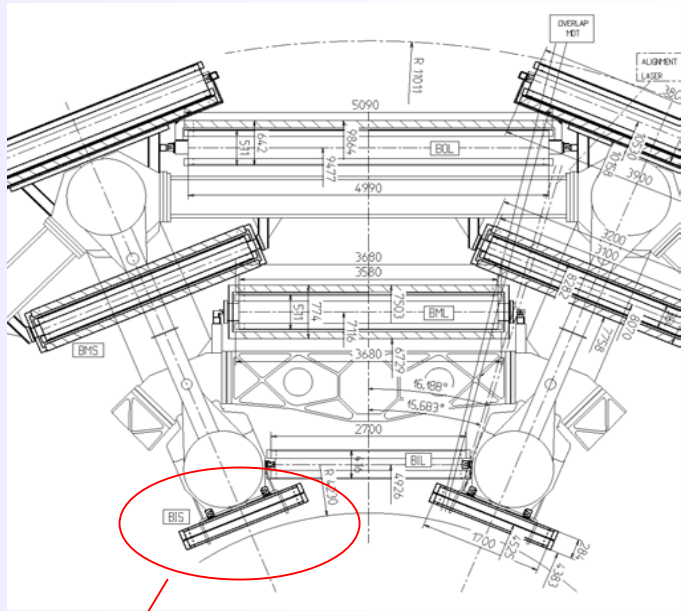
(10% of the Muon Tracking System)



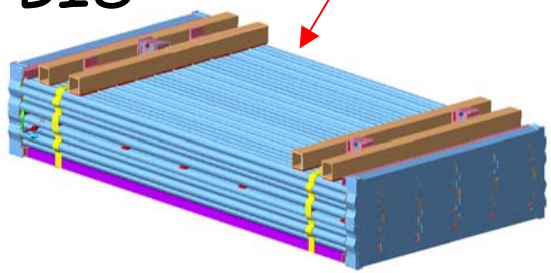
•Departments of Physics & Engineering

The Greek chambers (BIS) in the ATLAS Muon Spectrometer





BIS

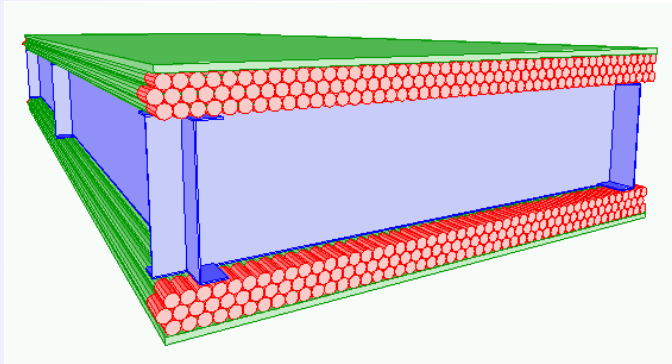


1700x90x30mm^3
240 Al tubes

Monitored Drift Tube Chambers (MDT)

•Individual detectors with high spatial resolution (drift tubes)

•Individual chambers: Precision in Construction (wire positions in a chamber less than 20 μm deviations from nominal positions)



Principle:

- Keep deformations of a chamber to a minimum (chamber design)

-Tubes arranged in Multilayers,

-Multilayers separated by a structure

-Chamber deformations (gravity and temperature) should follow individual tube deformation

•Monitor of deformations in a single chamber (inplane alignment system)

•Monitor of chamber position in the ATLAS detector

- Projective alignment

-Axial Proximity (praxial)

-Reference alignment

BIS Chamber specifications

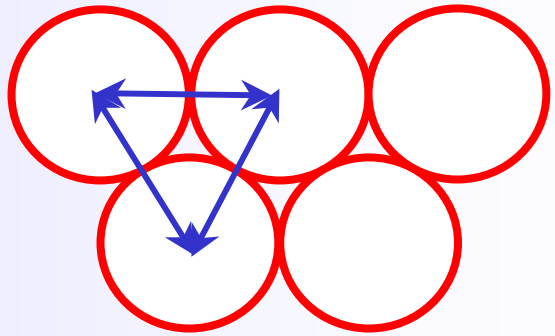
Support beams

Multilayer 1

Cross strips

Multilayer 2

wire positions in a chamber < 20 μm
deviations from nominal positions



30.035±0.02 mm at 20°C

Precision in construction of a few microns for sizes of several m^2 (2-10m^2)

- Assembly Procedure
- Quality Assurance/ Quality Control (QA/QC)

ATLAS Group of the Aristotle University of Thessaloniki

Physics Dept

Ch. Petridou

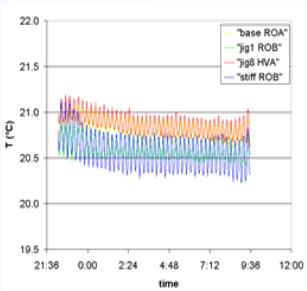
- T. Liolios
- M. Manolopoulou
- S. Dedousis
- M. Chardalas
- E. Savvidis
- D. Sampsonidis
- K. Ypsilantis
- T. Lagouri
- A. Krepouri
- C. Lamboudis
- K. Bachas
- K. Economou
- K. Filippousis

Engineering Dept.

- **K. Bouzakis**
- I. Tsiafis
- P. Paschalias
- Z. Indos

The infrastructure – Clean Room

- Clean Room (56 m^2) of controlled temperature and humidity, class 50000,

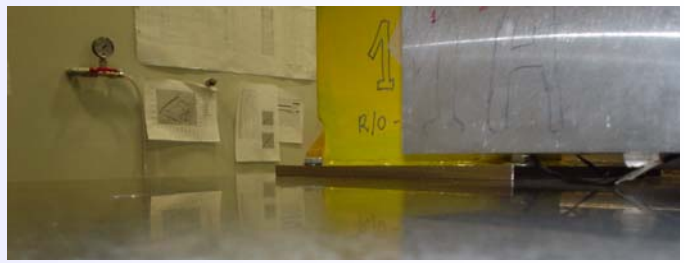


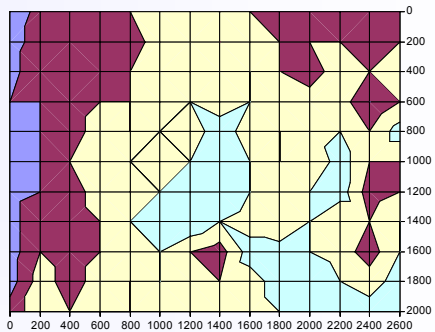
Temperature ±0.5°C
Humidity ±5%

The infrastructure – Granite table

- Granite table (2200x2700x400 mm^3, 7 ton)

surface flatness better than ±3 μm

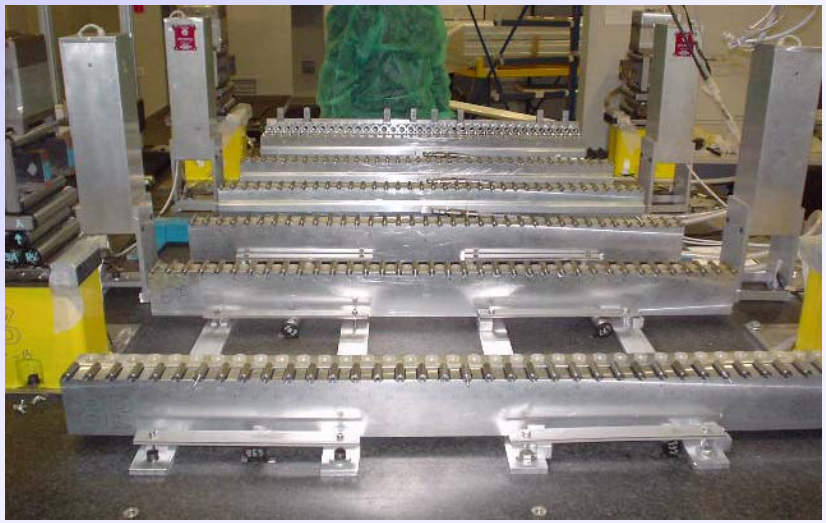




Granite Table Mapping
Flatness<±3μm

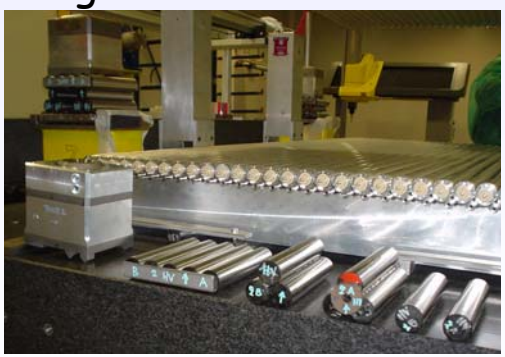
The infrastructure – Precision tools

- Precision tools for construction of detectors of maximum size 2000x1000x500mm³

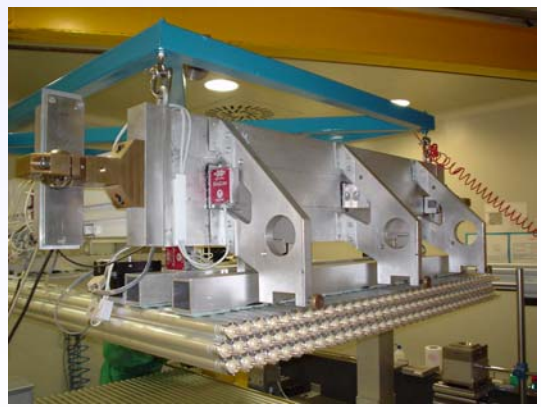


Set of jigs (made in the Clean Room rms <5 μm)

Height Blocks

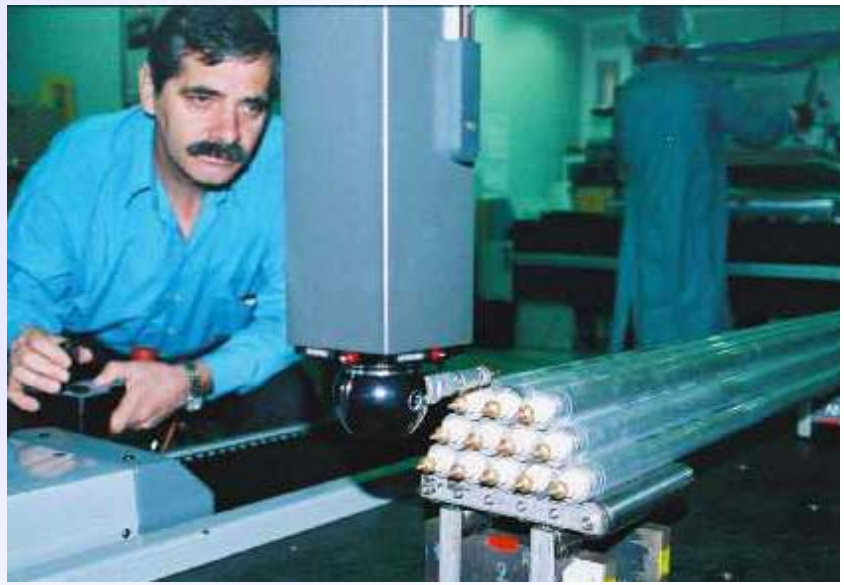


Stiffback

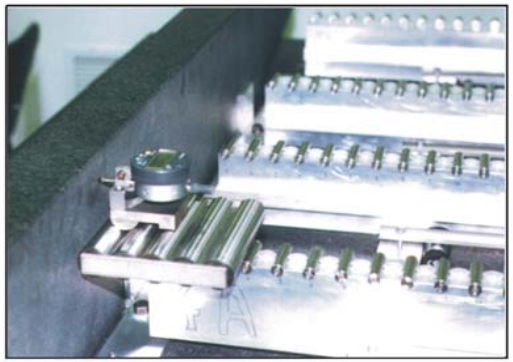


The infrastructure – CMM

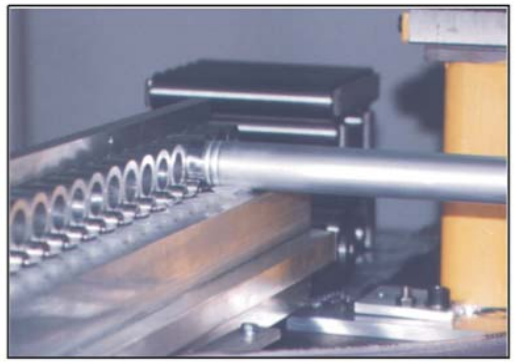
- 3-D measuring machine CMM with precision of ±3μm for objects of maximum size 1800x1000x500 mm^3



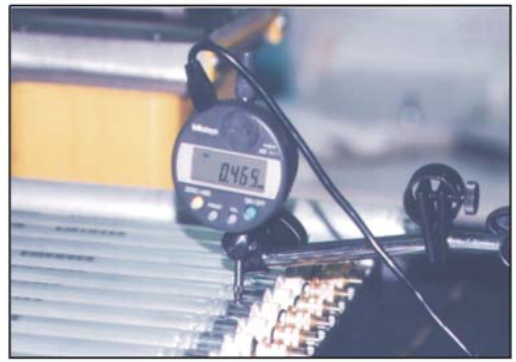
BIS assembly procedure



1. All jigs aligned

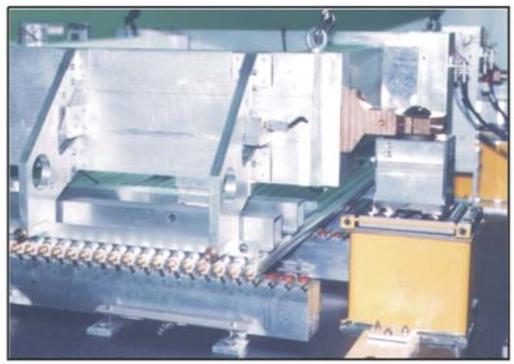


2. Tube positioning template on jigs

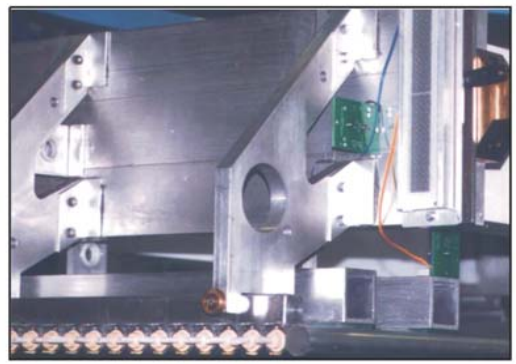


3. Tube height control (mitutoyo measurements)

4.Gluing



5. Support beams on L1



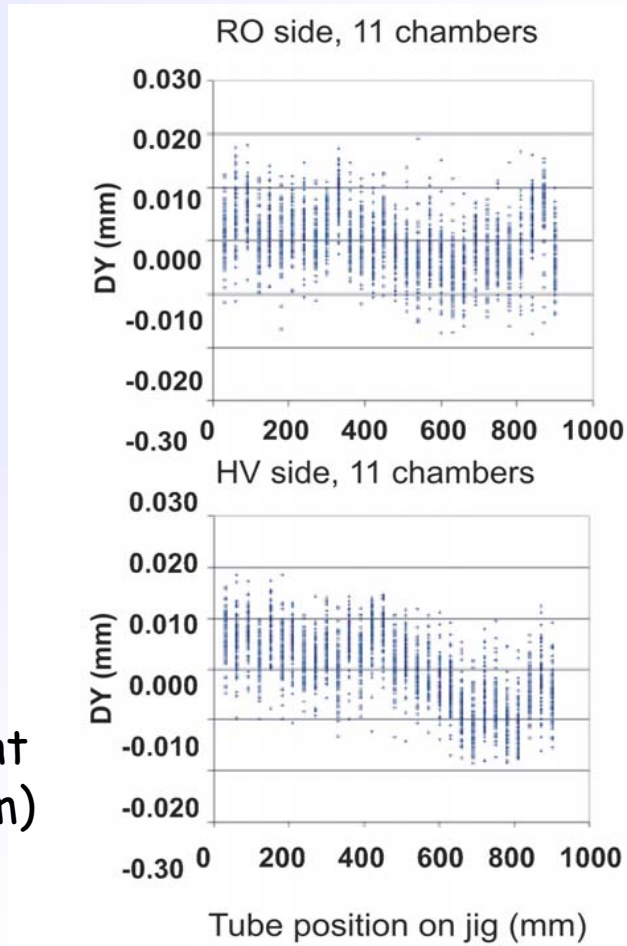
6. Control relative layer position

demo

BIS assembly QA/QC

Endplug height measurements with mechanical feeler

Control tube position on jigs

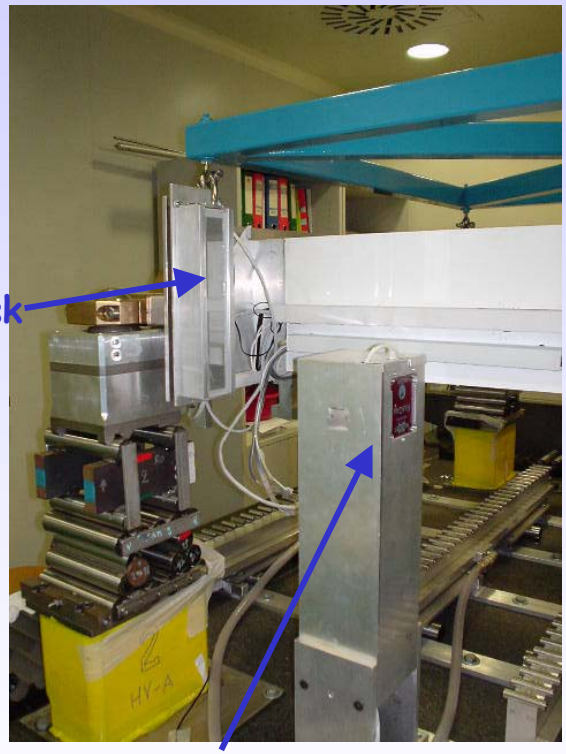


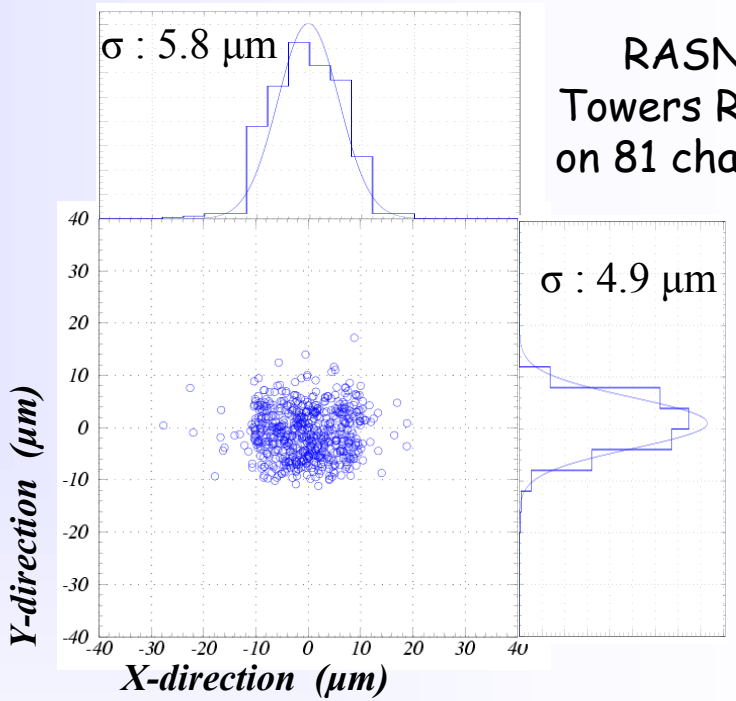
The pattern seen is inherent in jig construction (rms<5μm)

All tubes within ±20 μm

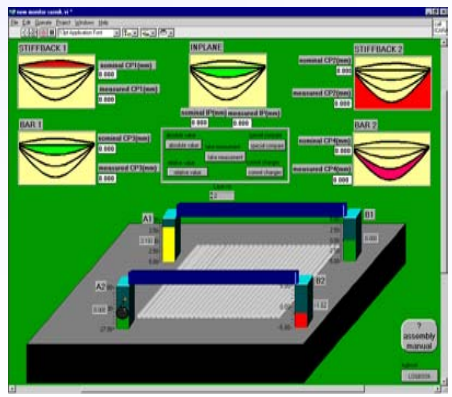
BIS assembly QA/QC

- The relative layer position of each tube layer is controlled to better than ±10 μm





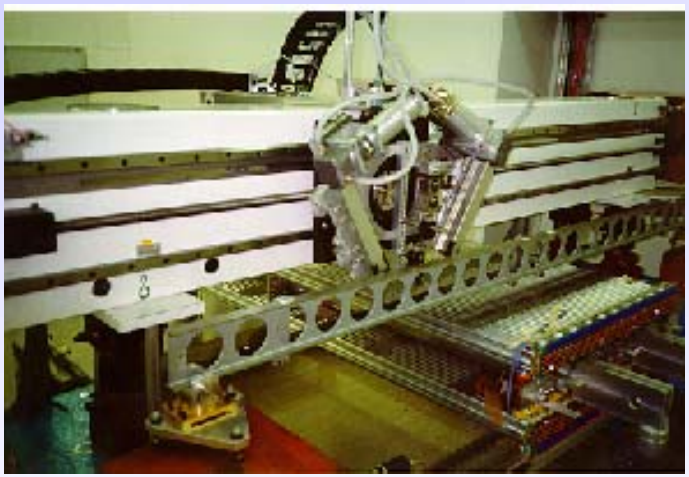
RASNIK Towers Results on 81 chambers



Online QA/QC, Data login by operator

BIS QA/QC - X-tomograph

10 BIS Chambers have been scanned so far and were found well within the specifications



Chamber Designed Parameter

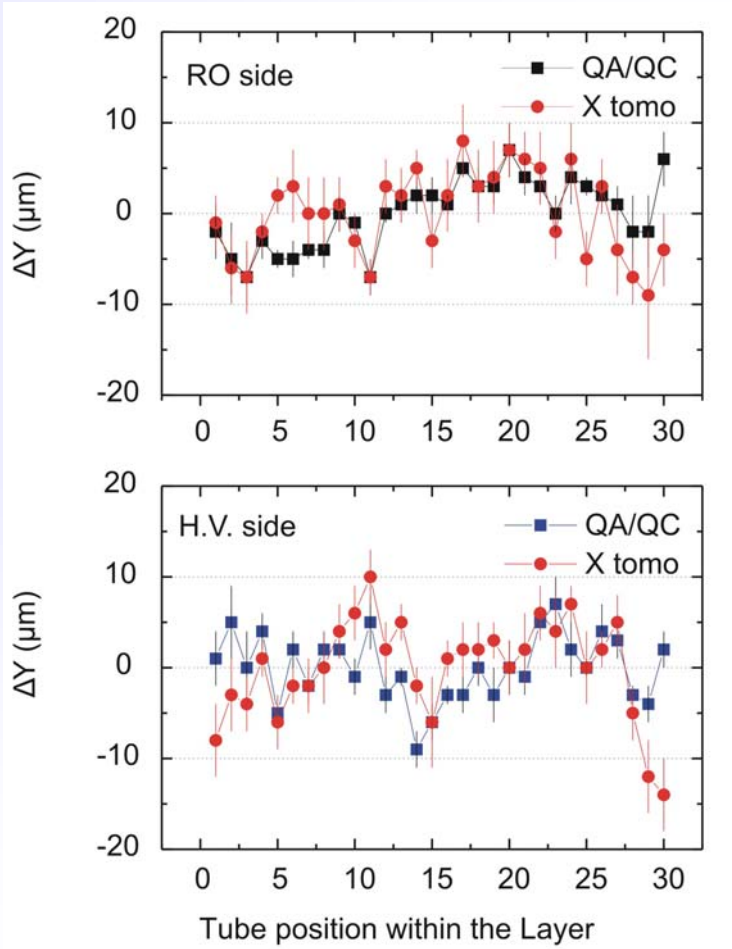
Z-wire pitch : 30.035 mm

Measured : 30.036 ± 0.003 mm

Y-Layer distance : 26.011 mm

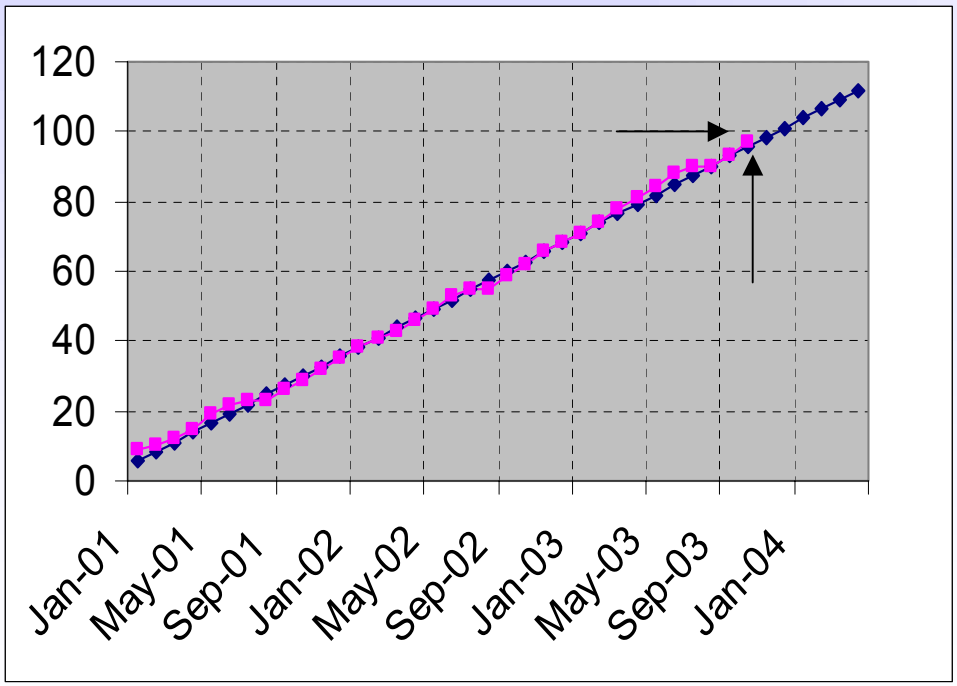
Measured : 26.014 ± 0.010 mm

On line Quality Assurance & X-Tomograph Results in excellent agreement!



BIS Production Status

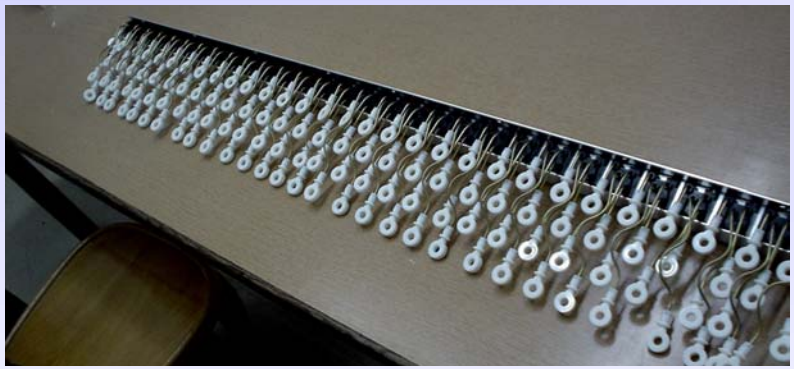
- 97 chambers produced
- 78 chambers transported to CERN



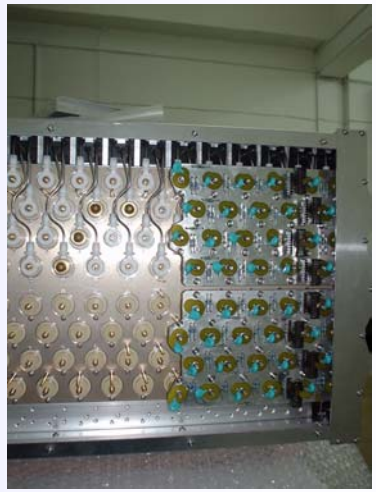
BIS Integration at AUTH

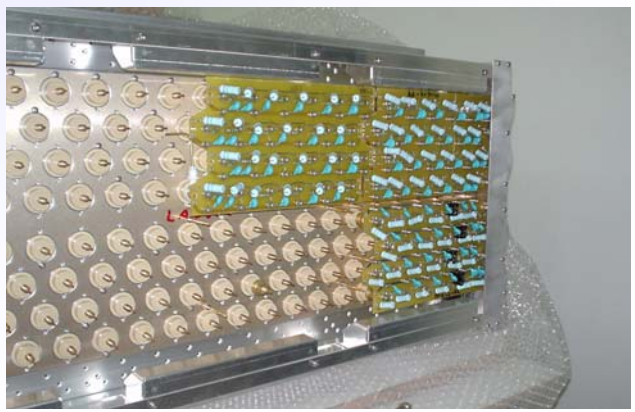
- 34 BIS will be equipped and tested at AUTH

- Gas System

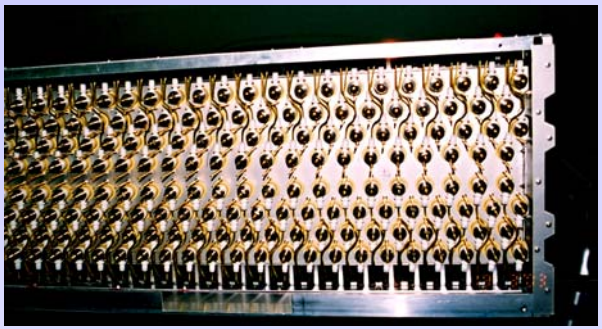


- Faraday Cages + Electronics



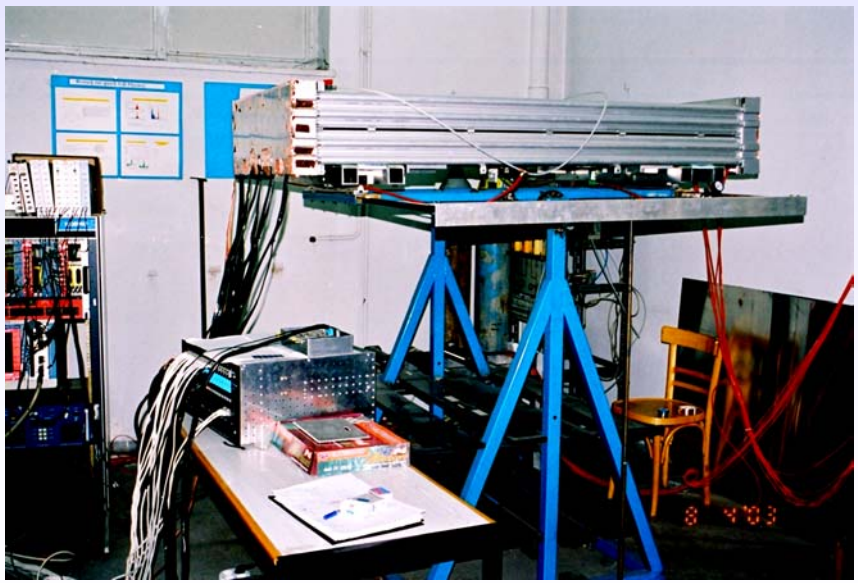


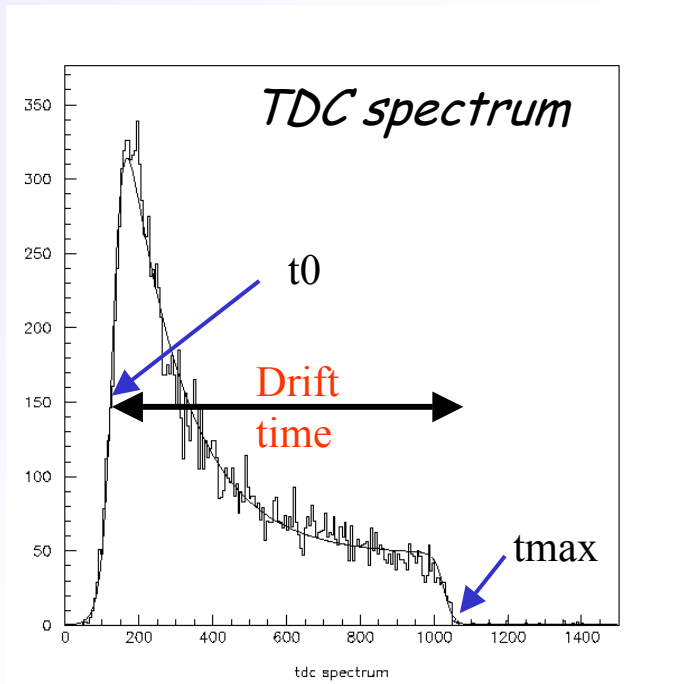
AUTh - The Cosmic ray test stand



Chamber Integration

BIS chamber with the trigger hodoscope

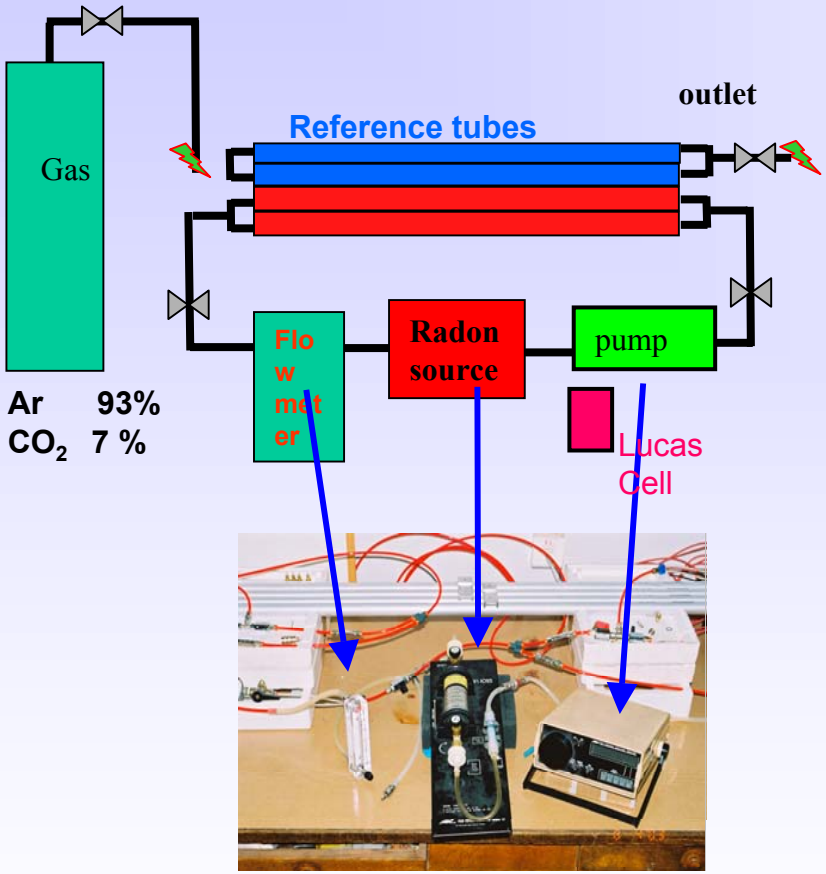




Greek Industries involved in the project

Rombis LTD	Clean Room Construction
Aeroclima SA	Climatisation of the Clean Room
Orfanidis SA	Precision Tools for the construction
METKA SA	Frames for the Chamber transportation
Alchrom SA	Aluminion sheets and chromatization
Dromeas SA	Faraday Cage Prototypes
Sclavos Laser SA	Faraday Cages Production

Aging Studies for the MDTs using a-particles



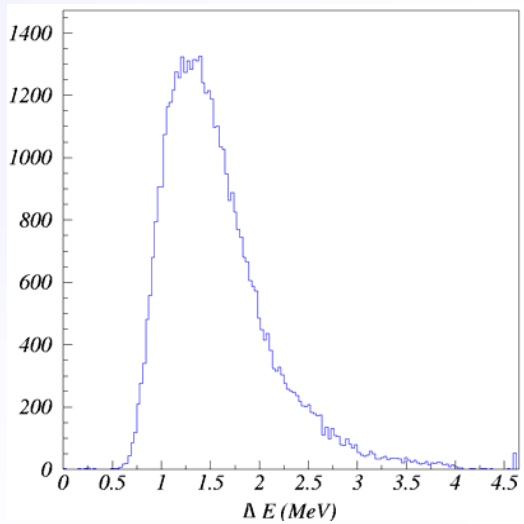
Goals

- Measure the ionization that an a produces in MDTs
- Study the aging effects on the MDTs due to the collected charge to the wire

How

- Use a-particles to irradiate the MDTs.
- Use of a radioactive gas (Radon) in order to enrich the tube gas and irradiate the MDTs internally.

Energy deposited in a MDT from alpha particles with mean energy of 6.4 MeV

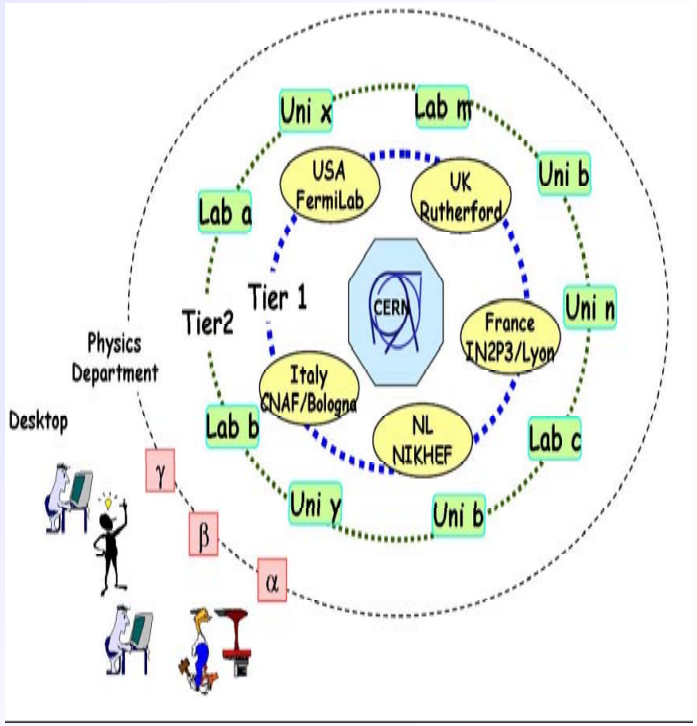


Grid

The laboratory is involved in the creation and operation of a GRID based computational center that will participate in the data analysis for the ATLAS experiment.

A pilot testbed consisted 5 worker nodes with 1 TB storage has already been installed

Currently the testbed is connected through our local crossgrid site to the common crossgrid and datagrid testbed



Schematic of the GRID project realization

What did we gain ?

A new Laboratory established which has the capability to construct and test Particle Physics detectors equipped with:

- design and QA/QC capabilities
  - AUTOCAD drawing office
  - 3D CMM
  - Rasnik systems
- infrastructure to perform cosmic ray tests
- fast trigger capabilities and modern DAQ systems
- detector control systems
- online monitoring software
- offline analysis tools

The AIM for the future of the laboratory

Maintain the infrastructure

Participate to particle detector construction and test projects

Keep minimum personnel (faculty and technical personnel) in order to:

a) continuously educate undergraduate and graduate students and new personnel

b) improve techniques and keep them up to date

Participate to EU projects in collaboration with other European and around the world laboratories

Summary

- The three Greek Institutes in ATLAS, in close collaboration, have constructed 97 BIS Muon chambers (2/3 completed)

- The accumulated infrastructure and knowhow places them among the European Particle Detector Laboratories with construction and test facilities. These installations should be maintained and further developed.

- The groups have also created testbed sites for GRID Technology (CrossGrid project) and they are part of the HellasGrid project under development.

- Primary goal of the teams: LHC Physics topics with muons in the final state. They are currently developing software tools like: -low p_T muon reconstruction for b-tagging (SM & MSSM Higgs)

  -quality control tools for the muon tracking by reconstructing the $Z \rightarrow \mu\mu$ mass