

Status Report on GR-BIS ATLAS Chambers

Theodoros Alexopoulos
on behalf of the Greek ATLAS Team

2005 Workshop on
Recent Advances in Particle Physics and Cosmology
ARISTOTLE UNIVERSITY OF THESSALONIKI
21-24 April 2005

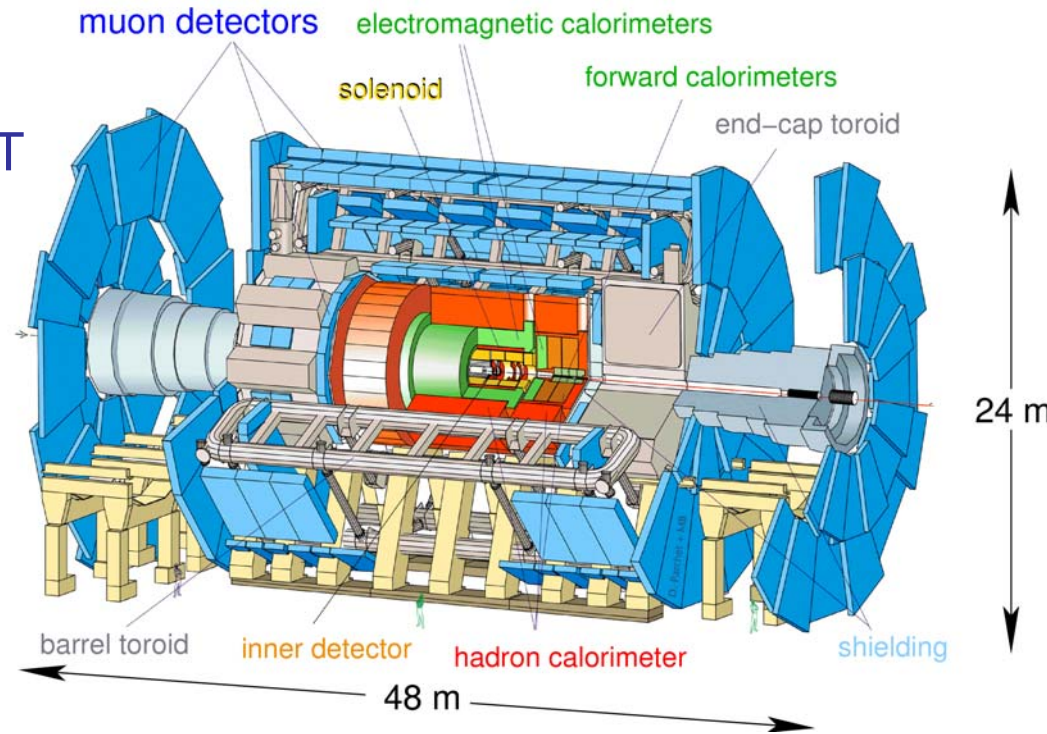
The ATLAS Muon Spectrometer



ATLAS at LHC: multi-purpose detector to search for Higgs and new physics

Muon Spectrometer:

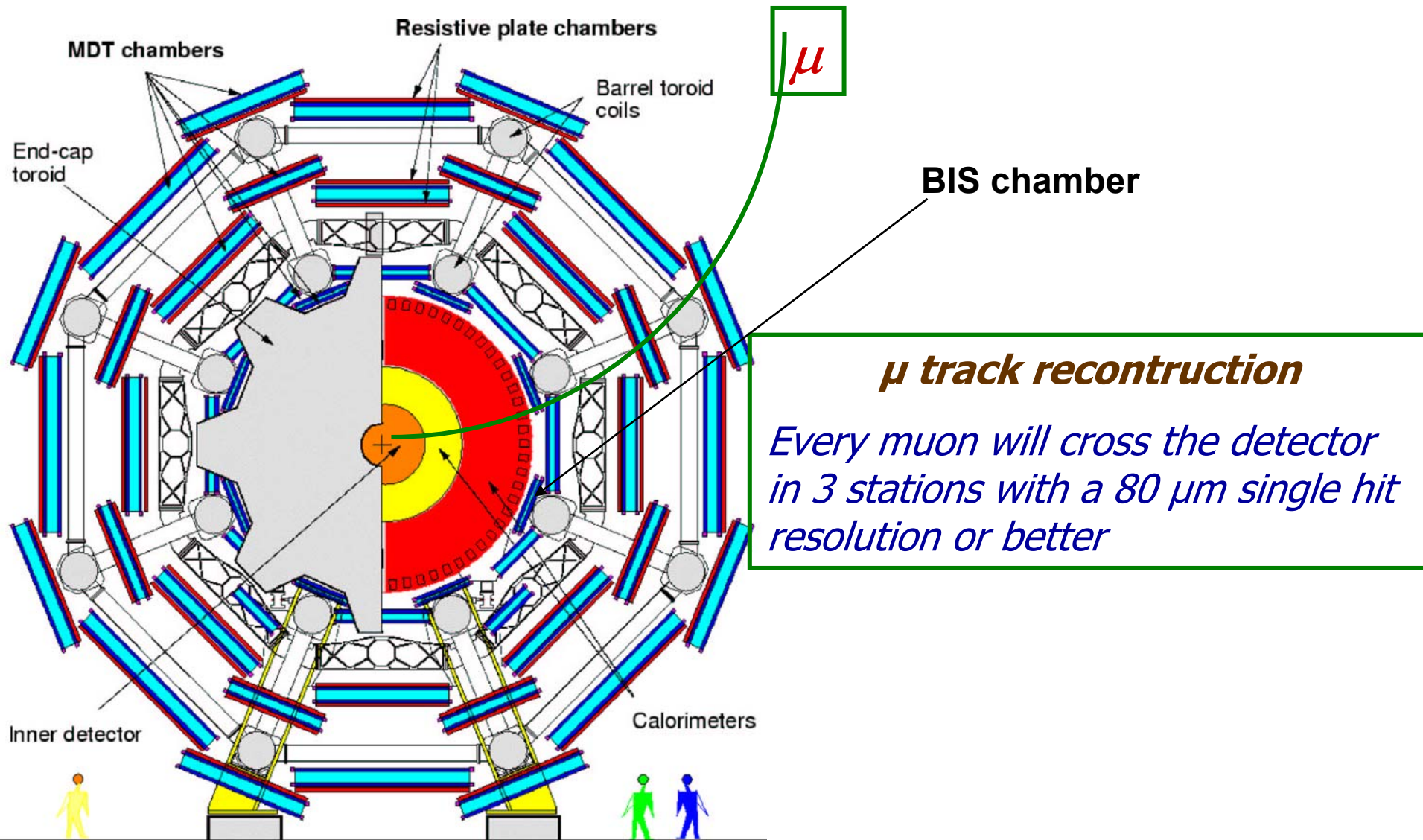
- toroidal magnetic field: $\langle B \rangle = 0.4 \text{ T}$
 $\Rightarrow$ high p_t -resolution independent of the polar angle
- size defined by large lever arm to allow high stand-alone precision
- air-core coils to minimise the multiple scattering
- 3 detector stations
 - cylindrical in barrel
 - wheels in end caps
- coverage: $|\eta| < 2.7$



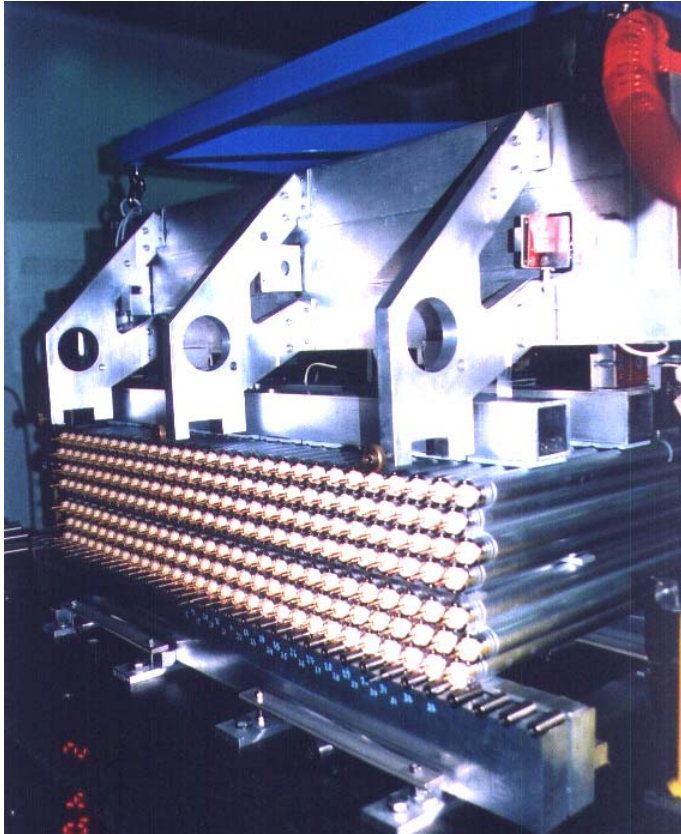
used technologies:

- fast trigger chambers:
TGC, RPC
- high resolution tracking
detectors: **MDT**, CSC

MDT (Monitored Drift Tubes) Chambers

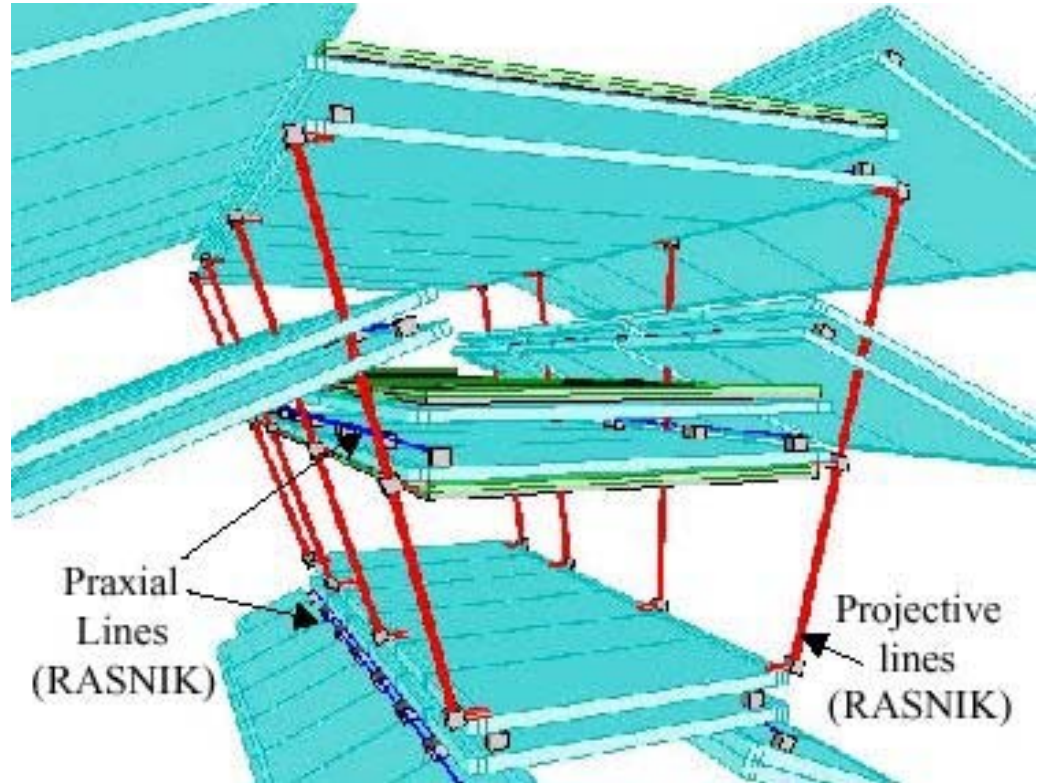


The Challenge



Precision in construction

(control detector deformations $< 20\mu\text{m RMS}$)



Precision in alignment

(monitoring the detector position $< 40\mu\text{m RMS}$)
Chamber deformations monitored with in-plane alignment

The Greek ATLAS Muon Team

3 Institutions

University of Athens (UoA)

National Technical University of Athens (NTUA)

Aristotle Univeristy of Thessaloniki (AUTH)

UoA

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- **P. Ioannou**
- **D. Fassouliotis**
- **I. Hatziantonaki**
- **K. Nikolopoulos**
- **D. Pappas**
- **D. Agriogiannis**

- **A. Dimakopoulou**
- **P. Kremizis**
- **K. Razakias**
- **K. Hormovas**

NTUA

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- **A. Filippas**
- **E. Gazis**
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- **E. Katsoufis**
- **T. Papadopoulou**
- **E. Fokitis**
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- **S. Dedousis**
- **M. Chardalas**
- **D. Sampsonidis**
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- **A. Krepouri**
- **C. Lamboudis**
- **K. Economou**
- **K. Filippousis**

Created a Production
Line for BIS chambers
construction
through Greece



AUTH
Final Assembly

NTUA
QAssurance-QControl

UoA
Construction of tubes

**Created a Production
Line for BIS chambers
construction
through Greece**

To CERN

AUTH

**NTUA
UoA**

AUTH

Final Assembly

NTUA

QAssurance-QControl

UoA

Construction of tubes

The Greek Muon Chambers (BIS)

112 (90 BIS30 + 22 BIS36) Chambers

- **University of Athens (UoA)**

Tube wiring/assembly (30,000 tubes finished December 2003)



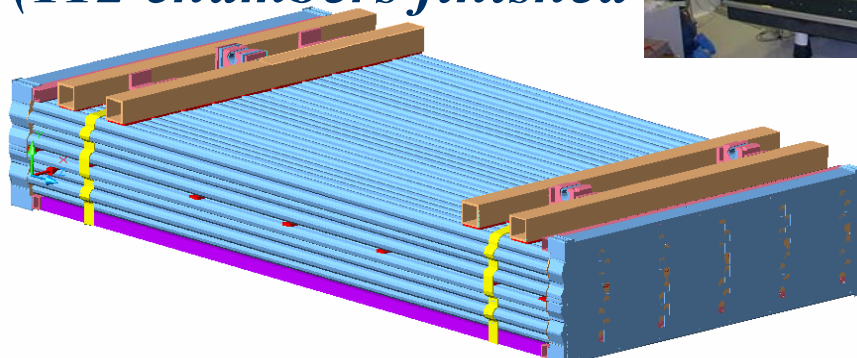
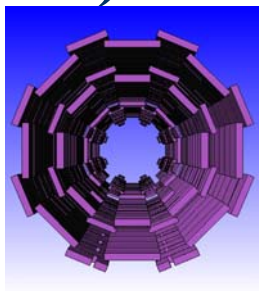
- **National Technical University of Athens (NTUA)**

*Quality Assurance/Quality Control of tubes
GL, WT, WP, LC (30,000 tubes finished March 2004)*

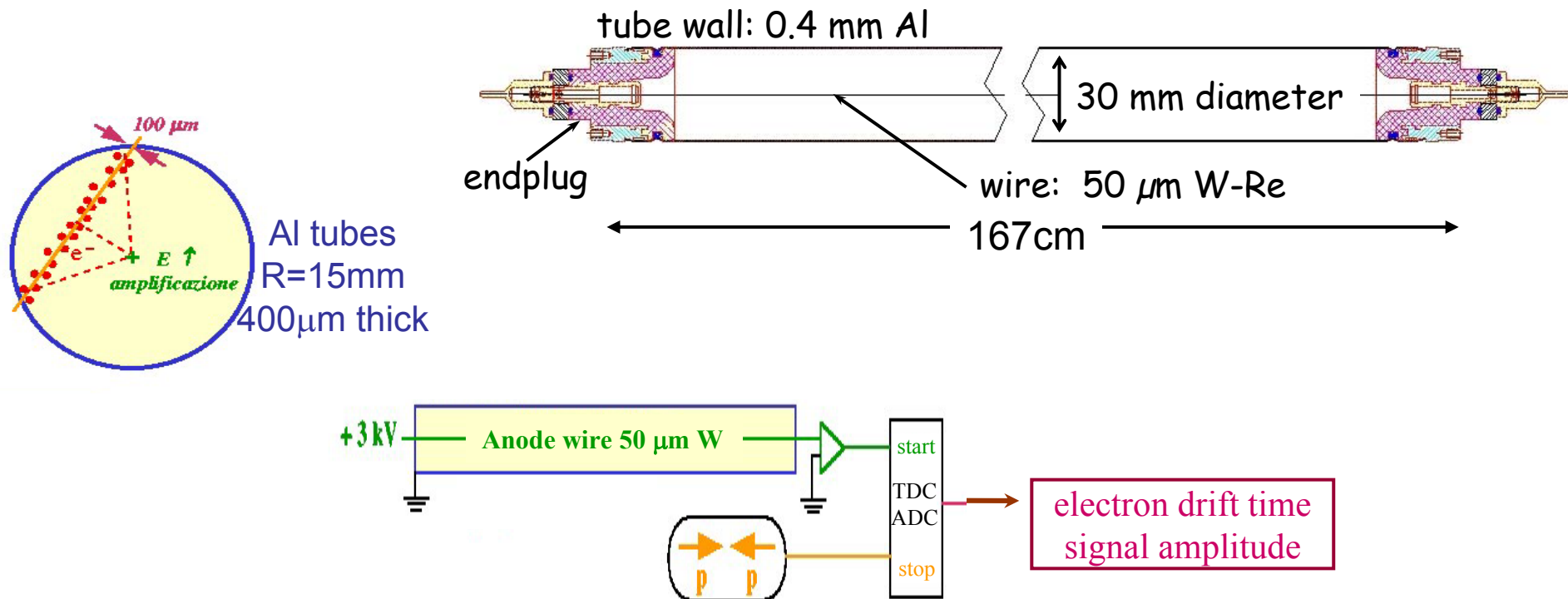


- **University of Thessaloniki (AUTH)**

Chamber assembly (112 chambers finished April 2004)



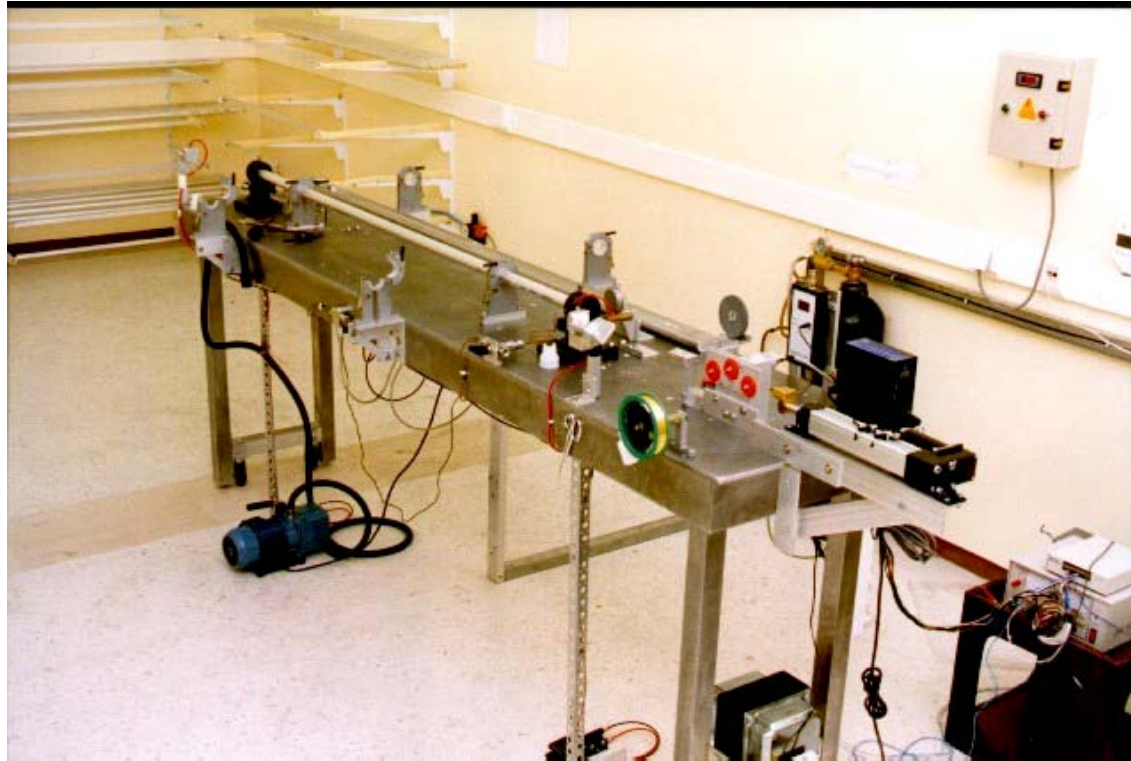
MDT (Monitored Drift Tube)



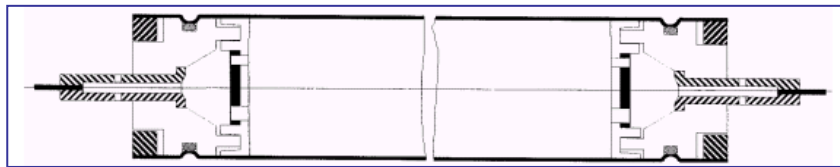
- Gas mixture: Ar-CO₂ 93-7%
- Absolute pressure 3 bar
- Gain 2×10^4 (HV=3080 V)
- Discriminator threshold:
20 primary e

Max drift time 700 ns
Single point resolution $\sim 80 \mu\text{m}$

UoA - The tube assembly facility

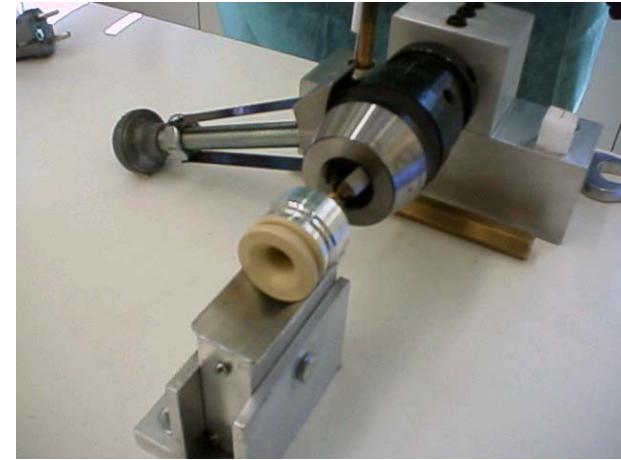


The Wiring table at UoA



MDT tube with the endplugs and the wire

Tooling for crimping the copper pin of the endplug



Tooling for crimping the wire

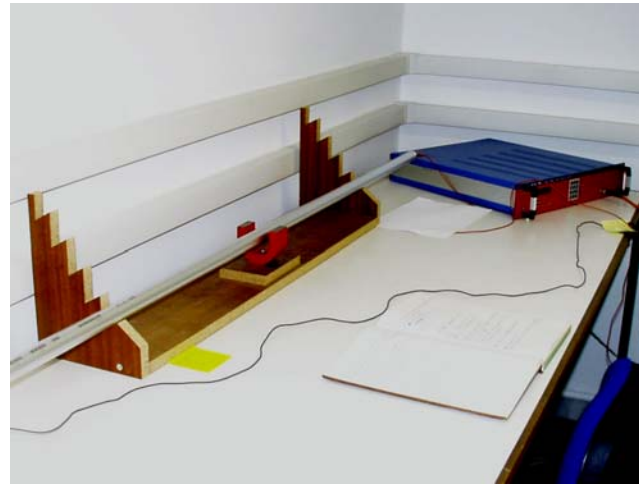


NTUA -The QA/QC MDT Facility

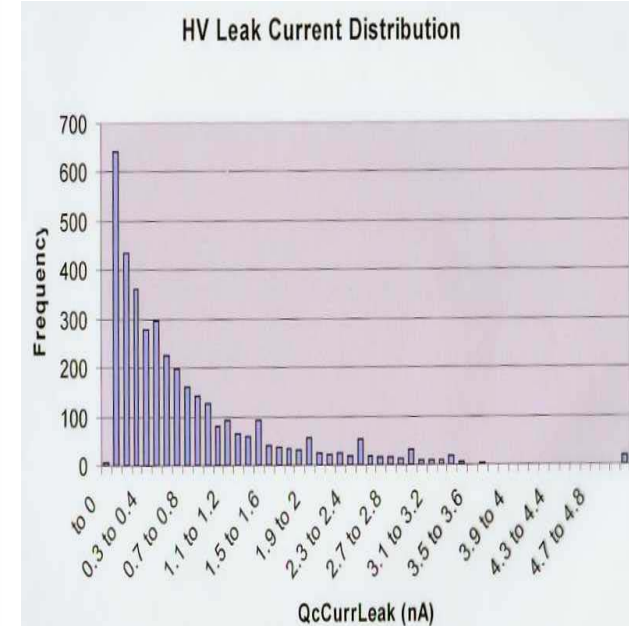
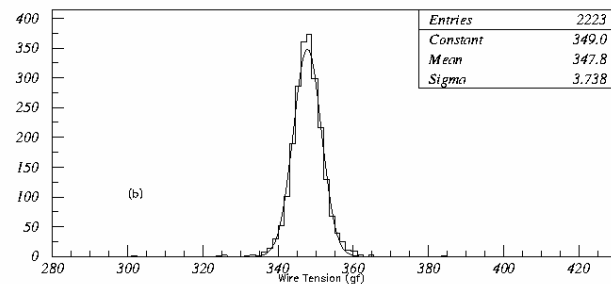
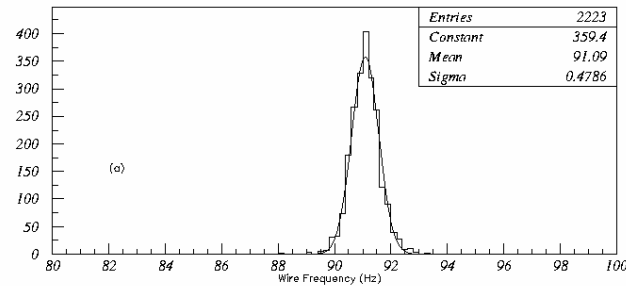
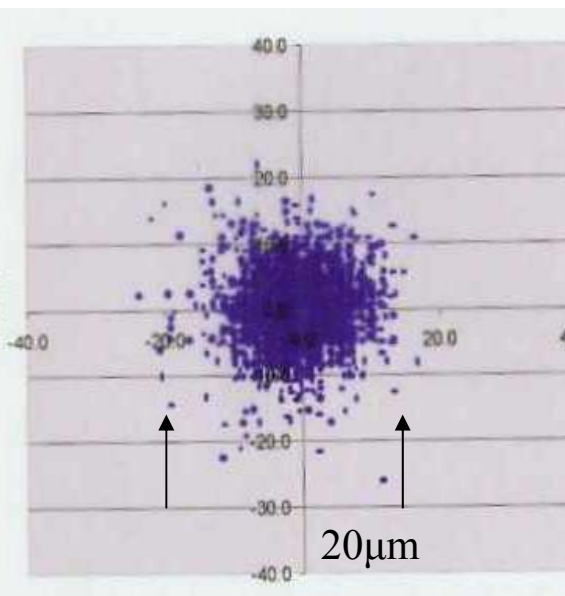
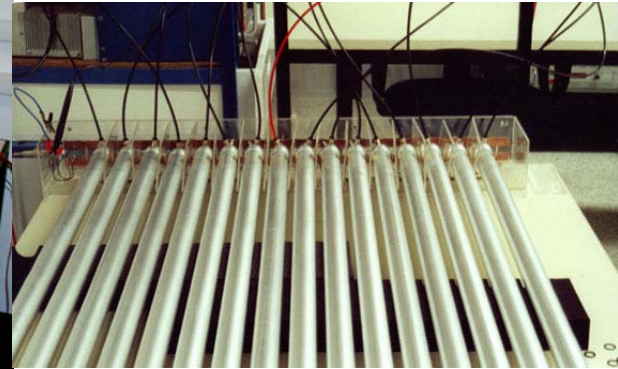
Wire position measurement



Wire tension measurement

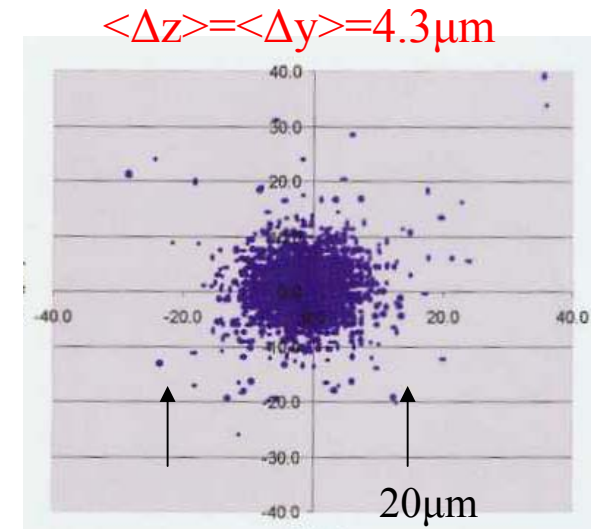
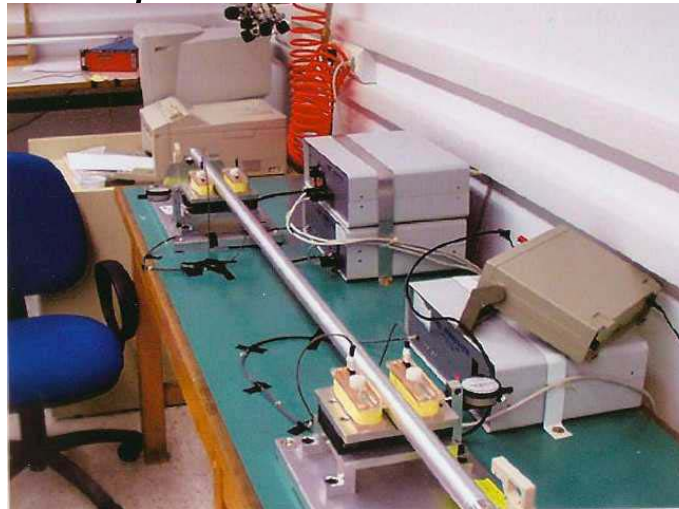
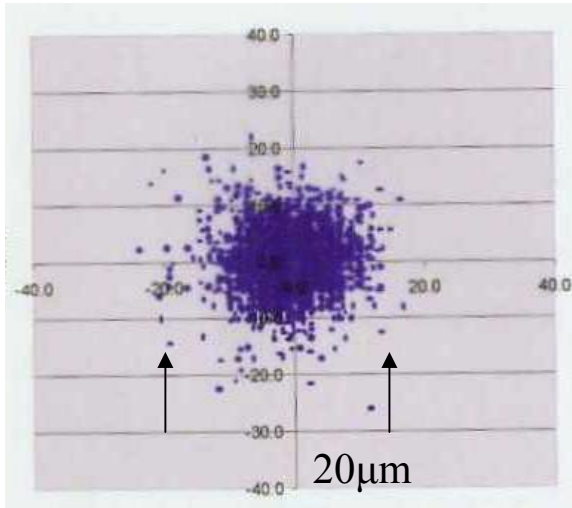


Dark Current meas.



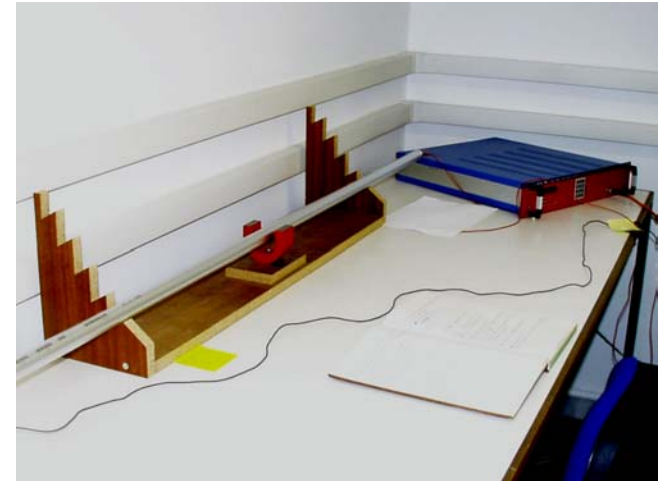
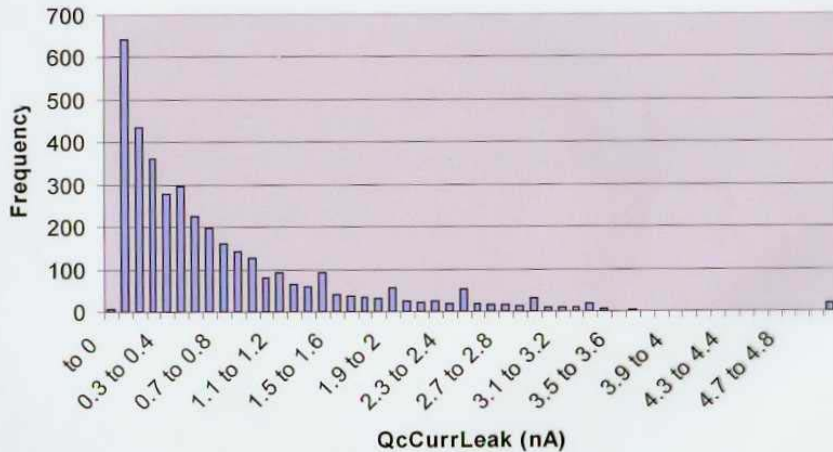
NTUA -The QA/QC MDT Facility

Wire position measurement



Dark Current and Wire Tension Measurements

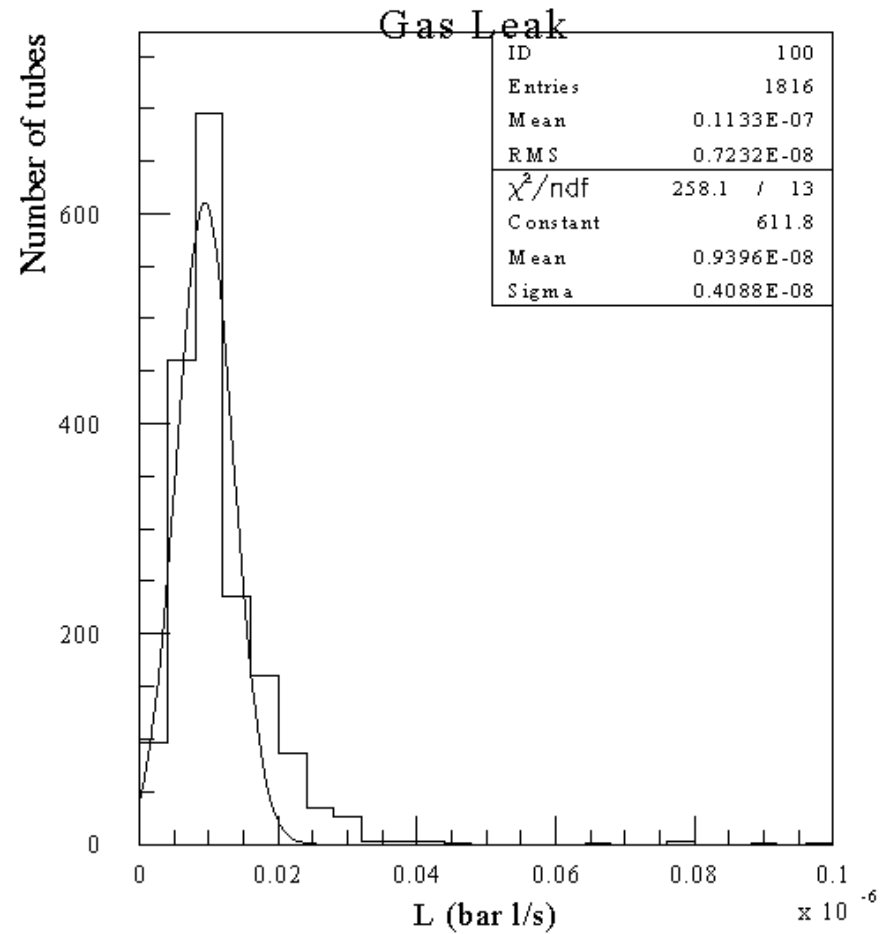
HV Leak Current Distribution



NTUA -The QA/QC MDT Facility



Gas Leak Test set-up



AUTH - MDT Chamber construction

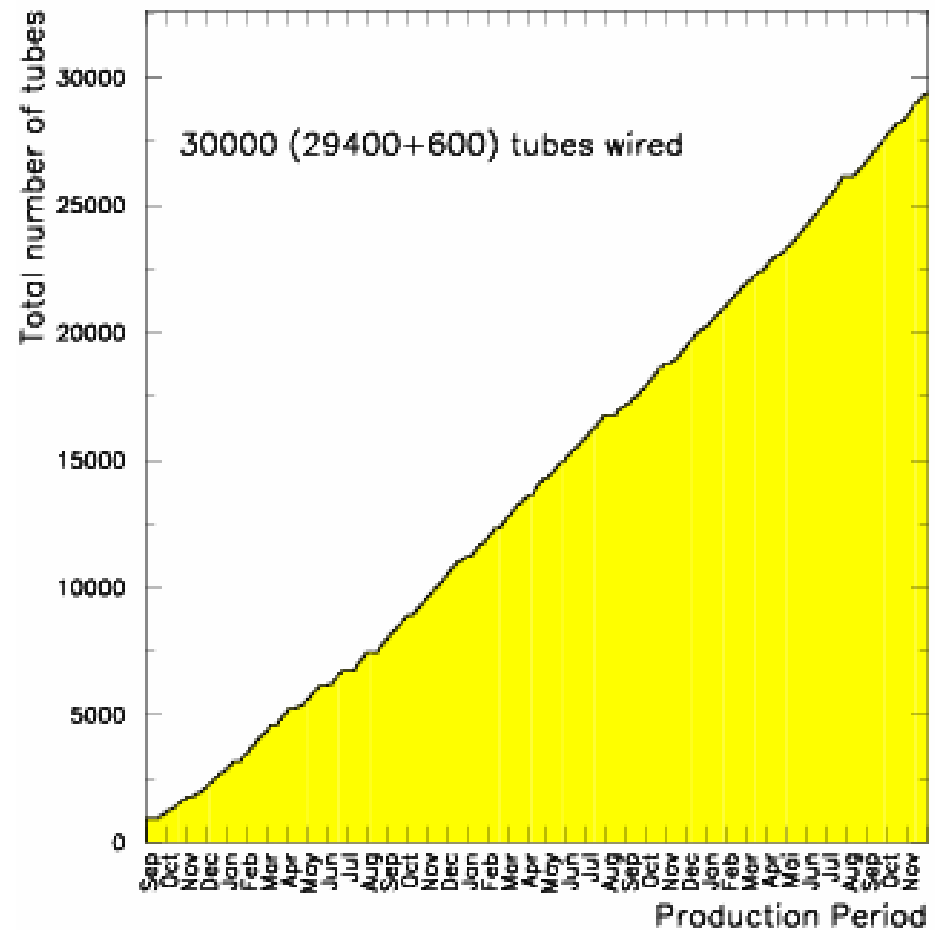
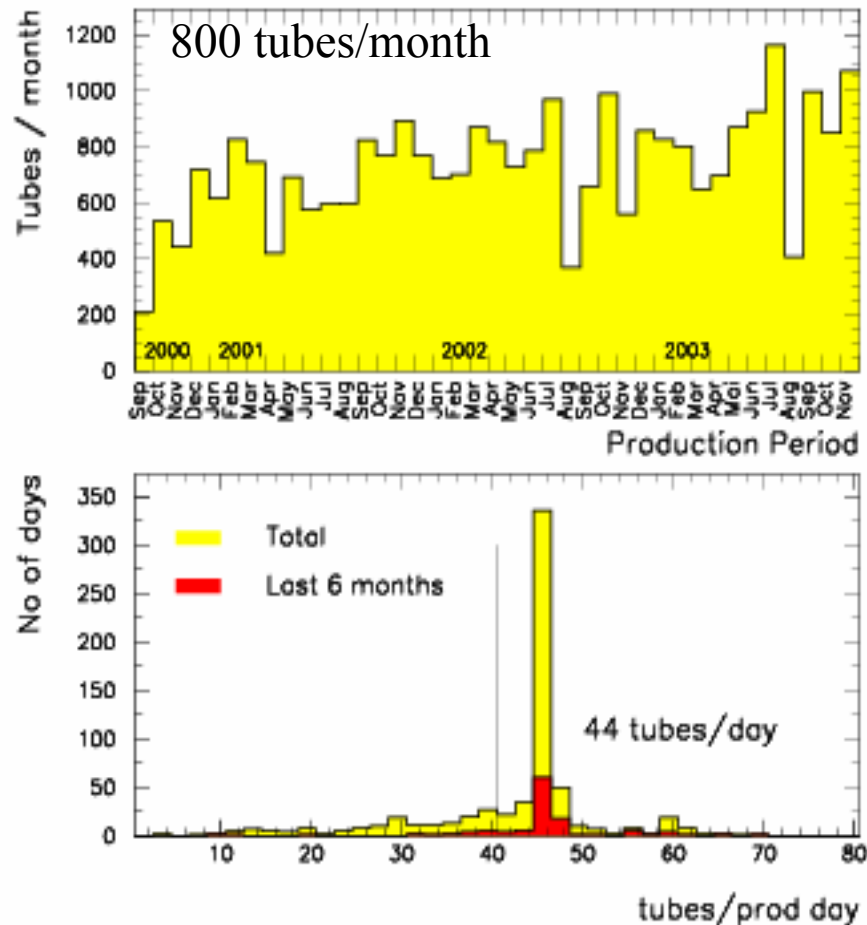
Clean room

Temperature $\pm 0.5^{\circ}\text{C}$ Humidity $\pm 5\%$



Tube and chamber production

4 years of continuous production: 30000 tubes assembled



Tube QA/QC results

Category	Number of tubes	Percentage (%)
Total	28700	100.00
Good	28455	99.15
Crimping	25	0.08
Wire broken	11	0.04
Length finished	10	0.04
Leak current	13	0.04
Gas leak	108	0.38
Wire location	20	0.07
Wire tension	58	0.20

...providing the services

Preparatory Activities at the institutes

- ✓ Prepare Gas Bars
(4/chamber, 120 tubes/Bar, 3 O-rings/tube)
- ✓ Test Gas Bars
- ✓ Prepare Piping for Gas Bar connection
- ✓ Prepare B Field sensor cables
- ✓ Prepare Alignment cables
- ✓ Prepare Temperature cables
- ✓ Order Read-Out cables
- ✓ Label all cables

...providing the services

the procedure

➤ Stage 1 (Blg 184 : equip with gas bars, FC's, HH's+MECCA
109 chambers at CERN, test for gas leak OK)
STARTED March 2004 – **Almost FINISHED** (but 3 chambers)

- ✓ **Glue T Sensors**
- ✓ **Glue B Field platforms/sensors/cables**
- ✓ **Glue alignment platforms/cables**
- ✓ **Install mezzanines+covers on Faraday cages**
- ✓ **Install RO cabling**

➤ Stage 2 **NOW HALF_FINISHED**

Noise test **NOW**

Cosmic Ray test **NOW**

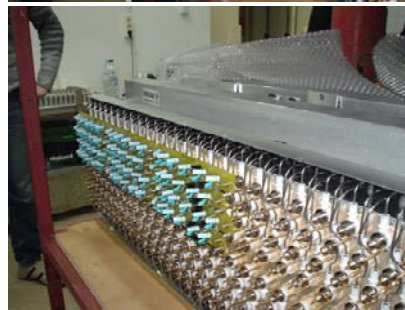
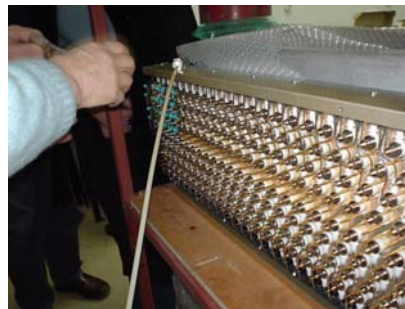
Database **NOW**

...providing the services



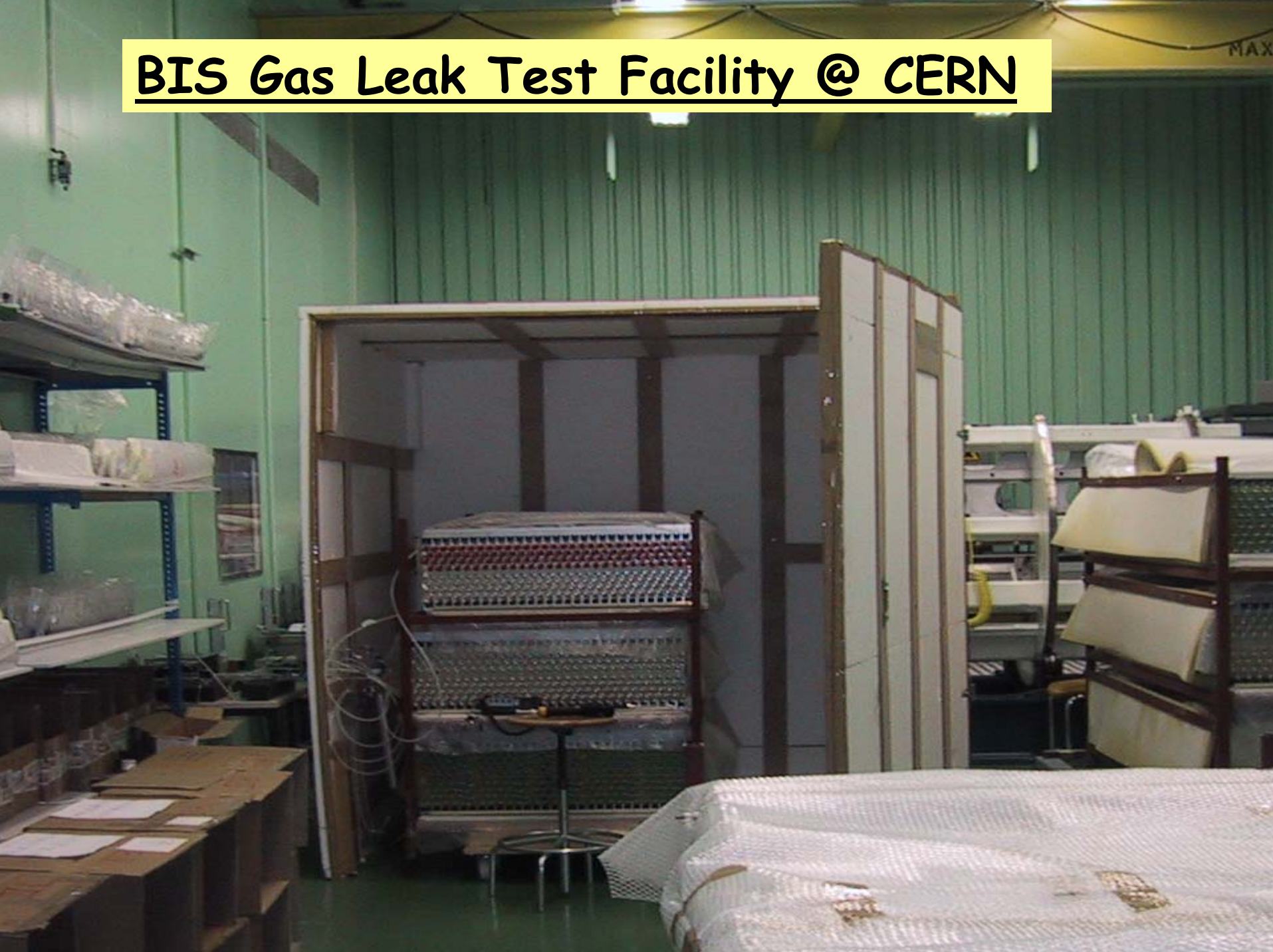


Integration At CERN





BIS Gas Leak Test Facility @ CERN

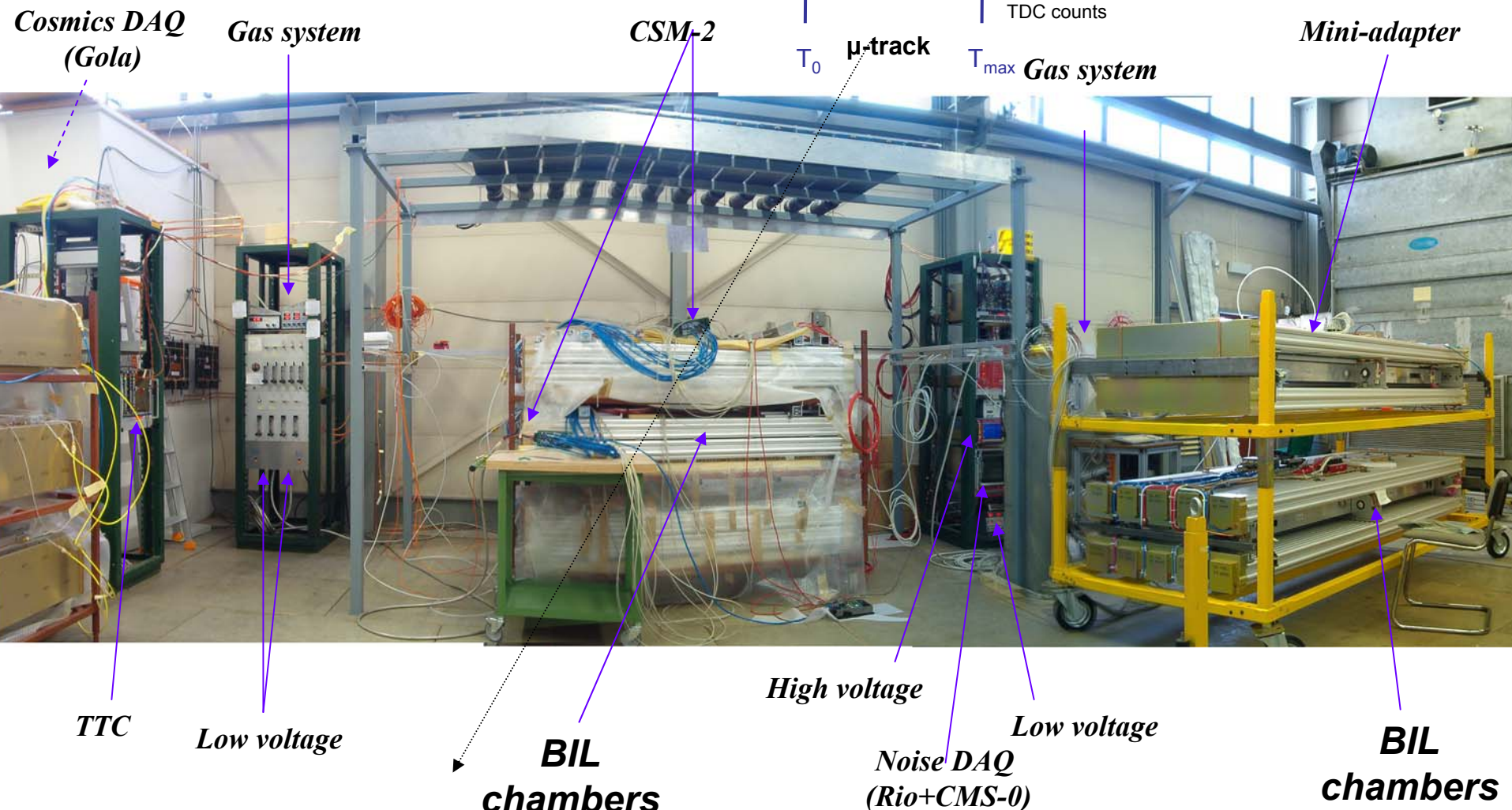
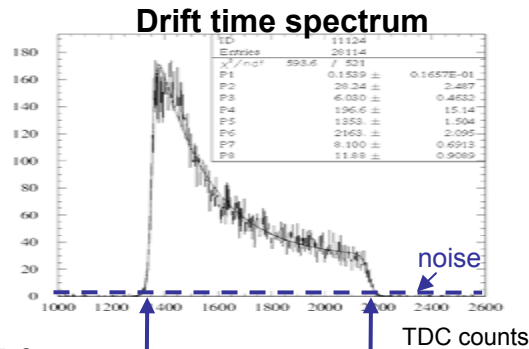


ALL 112 CHAMBERS @ CERN

Test facilities shared with BIL team



Noise & Cosmic test Facility @ CERN



Summary of the Action Items

Step	ACTION	MEASURE	ATLAS LIMIT
1	Gas distribution system	Leak rate	2×10^{-8} bar•l/s per tube 1 mbar/day per chamber
3	Electronics	Noise rate	1 kHz per tube
4	Cosmics data	Performance	

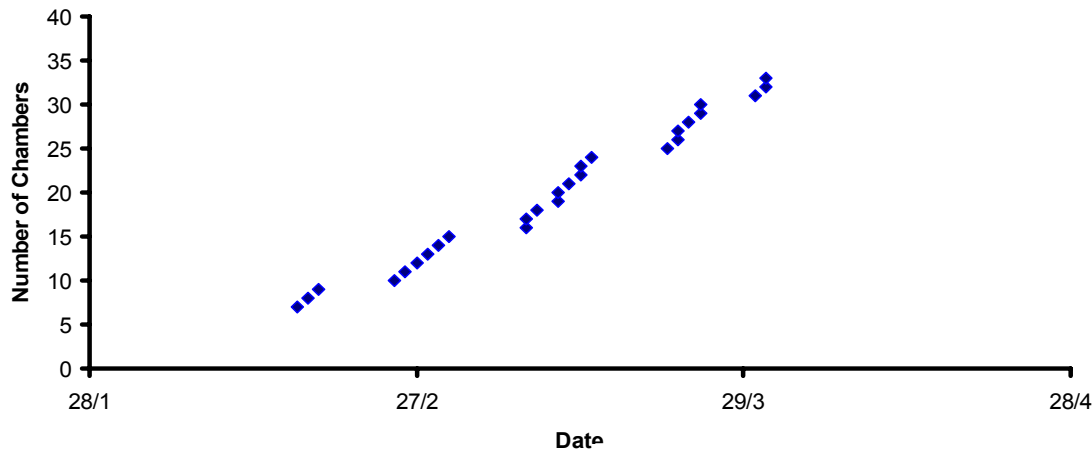
BIS in bt.283 Status

- BIS services integration:
100 chambers Completed out of 112 chambers
- Commissioning:
45 Chambers ready for Installation
 - Gas Leak test
 - Noise Test
 - Cosmics test

Production - Integration Status

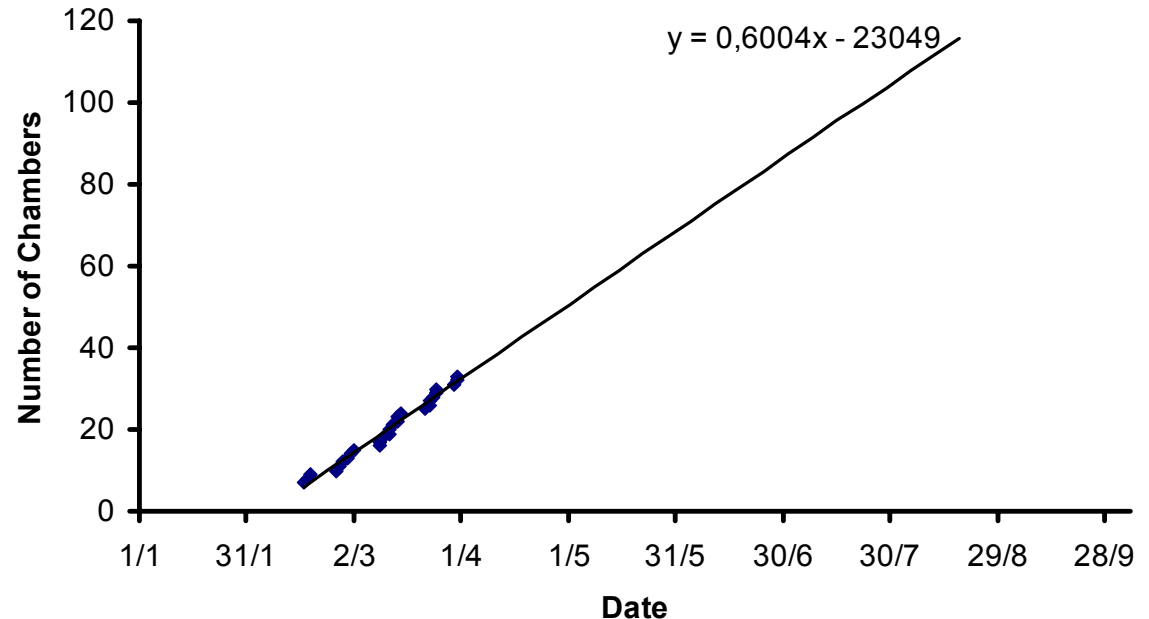
- Integrated Chambers with mezz. Cards : 45
- Integrated Chambers w/o mezz.cards : 55
- Bare Chambers : 3
- Chambers with FC and gas bars : 9
- TOTAL 112 Chambers

Commissioning plan in bt.283



BIS Chambers passing Cosmics test in bt.283

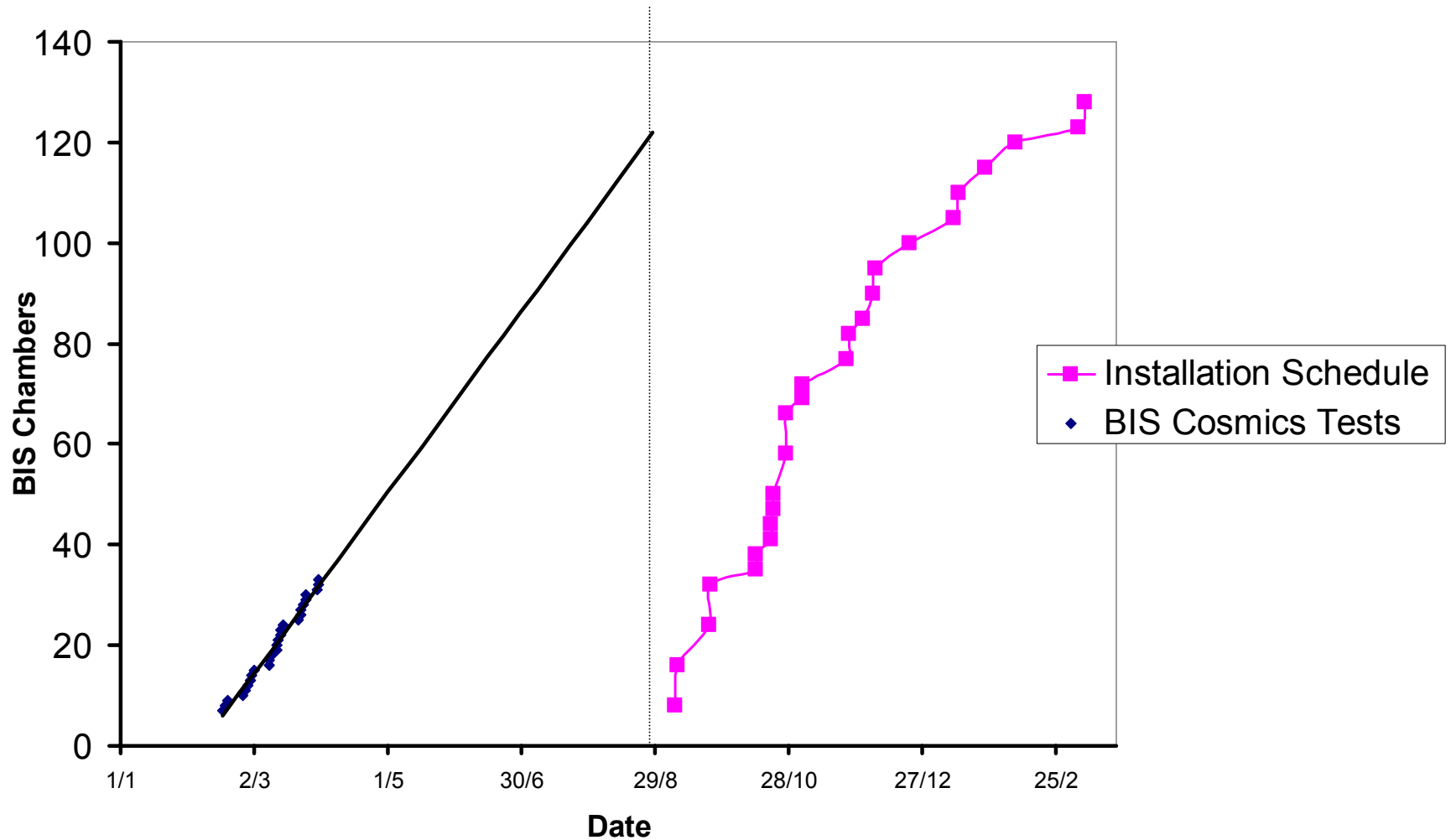
112 chambers
fully tested by
11 Aug. 2005



Remaining Action Items

- HV cables testing and installation
- Gas line modifications in sectors 12 and 14
- Mezzanine cards and RO cables for $112-45=67$ chambers
- Chambers to be filled up to 3bars
- DB matters

Commissioning and Installation



Conclusions

- *A Greek Collaboration can participate & contribute to a very big scale experiment!*
- **All BIS chambers will be ready for installation on time.**
- **Estimates are realistic, based on previous performance.**