Construction and Test of a Full Prototype Drift-Tube Chamber for the Upgrade of the ATLAS Muon Spectrometer at High LHC Luminosities

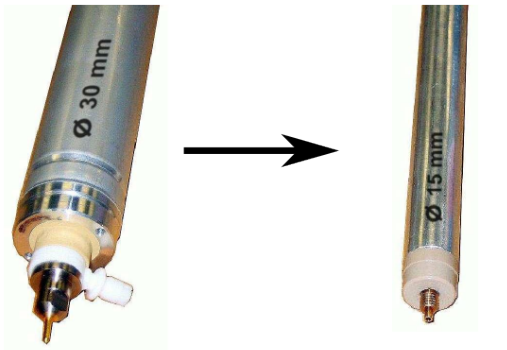
B. Bittner, J.Dubbert, O. Kortner, H. Kroha, A. Manfredini, S. Ott, R. Richter, P. Schwegler, D. Zanzi, O. Biebel, A. Engl, R. Hertenberger, A. Zibell

How to improve the rate capability of drift tubes?

Reduce the tube diameter!

ATLAS MDT: ⌀ 30 mm

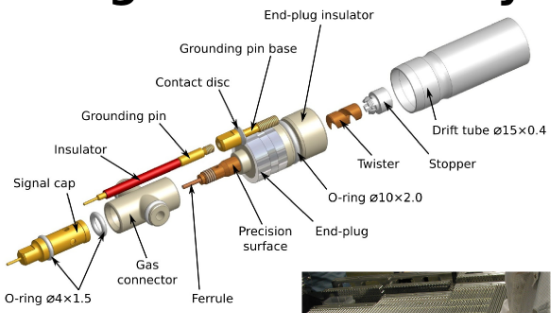
sMDT: ⌀ 15 mm

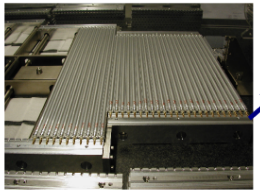


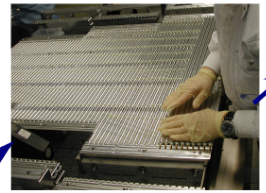
Advantages of smaller drift tubes: The highlights

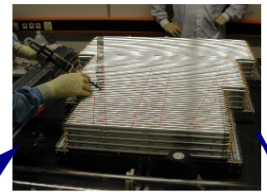
- 7.8× lower occupancy
- 8/16× less space charge for gammas and charged hadrons.
- Higher granularity: Twice the number of tube layers possible
- Easy to integrate into the existing systems.

Design and Assembly

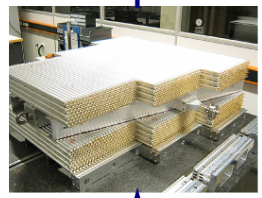


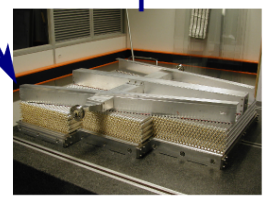


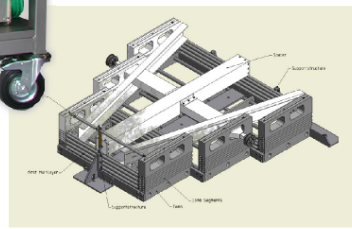


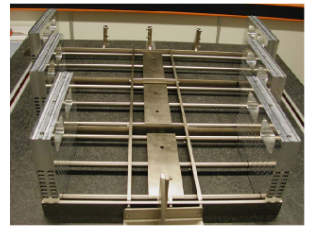


Method allows positioning of wires with 20 µm precision

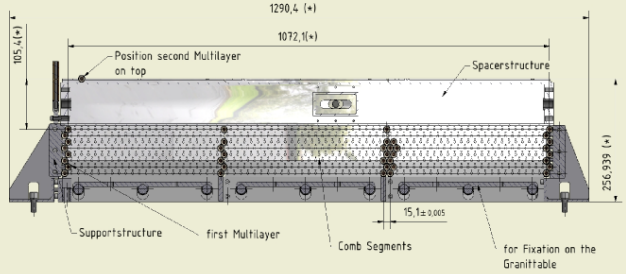








Precision assembly jigging



Construction and Test of a Full Prototype Drift-Tube Chamber for the Upgrade of the ATLAS Muon Spectrometer at High LHC Luminosities

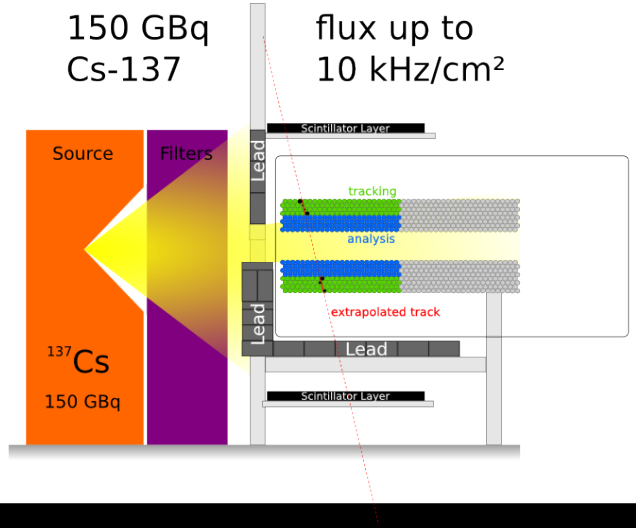
B. Bittner, J.Dubbert, O. Kortner, H. Kroha, A. Manfredini, S. Ott, R. Richter, P. Schwegler, D. Zanzi, O. Biebel, A. Engl, R. Hertenberger, A. Zibell

2011 Measurements at High Background Rates

Gamma Irradiation Facility, CERN

150 GBq
Cs-137

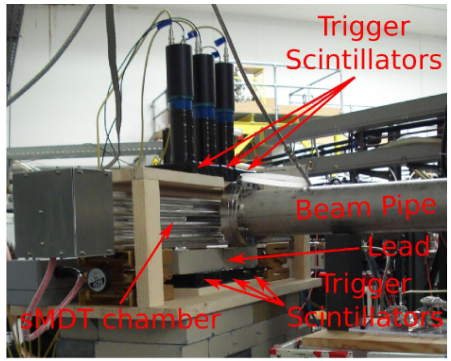
flux up to
10 kHz/cm²



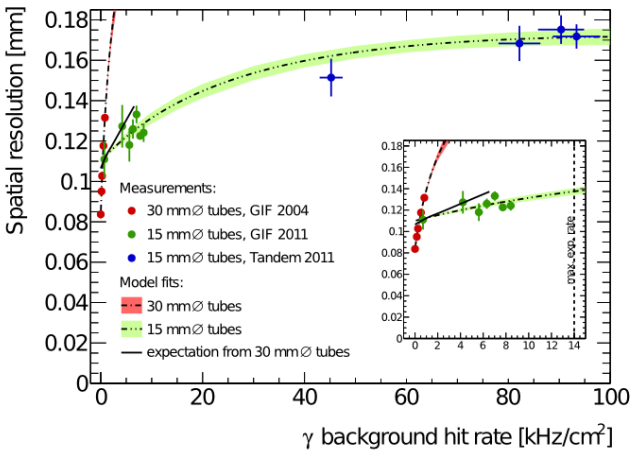
Munich MLL Tandem Accelerator

20 MeV
protons

flux up to
>100 kHz/cm²



Results: Spatial resolution



Conclusions

- Successful construction of a full protoype chamber
- Validation of the assembly procedure (1 chamber/week)

Up to the highest expected rates:

- Efficiency: >70% (single tube) >99% (8-layer chamber)
- Resolution: <140 µm (single tube) <50 µm (8-layer chamber)

⇒ Fullfill all requirements for HL-LHC

Results: Efficiency