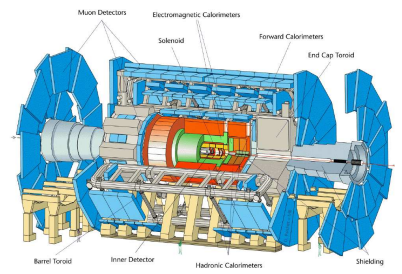




# Integration, Commissioning and Installation of Monitored Drift Tube Chambers for the ATLAS Barrel Muon Spectrometer



J. Dubbert<sup>a</sup>, M. Groh<sup>a</sup>, O. Kortner<sup>a</sup>, H. Kroha<sup>a</sup>, J. v. Loeben<sup>a</sup>, R. Richter<sup>a</sup>, J. Schmalzer<sup>a</sup>, H. v. d. Schmitt<sup>a</sup>, O. Biebel<sup>b</sup>, D. Merkl<sup>b</sup>, F. Rauscher<sup>b</sup>, and A. Staude<sup>b</sup>

<sup>a</sup>Max-Planck-Institut für Physik, Föhringer Ring 6, D-80805 München, Germany

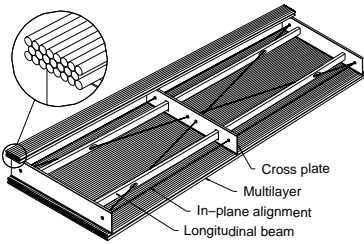
<sup>b</sup>Ludwig-Maximilians-Universität München, Am Coulombwall 1, D-85748 Garching, Germany

## Abstract

The ATLAS experiment at the Large Hadron Collider (LHC) at CERN is currently being assembled to be ready to take data in 2007. Its muon spectrometer is designed to achieve a momentum resolution better than 10% at 1 TeV. In the barrel part, a toroidal air-core magnet is instrumented with three layers of Monitored Drift Tube (MDT) chambers for precision tracking. The Max-Planck-Institut für Physik and the Ludwig-Maximilians-University in Munich have built 88 (BOS) MDT chambers for the outermost barrel region. We report on our experience with the tests of the MDTs, their integration with the Resistive Plate trigger chambers and the installation of the muon stations in the experiment. First results of their commissioning in the ATLAS detector will be presented.

## Monitored Drift Tube (MDT) Chambers

- 2 multilayers of 3 drift tube layers, aluminum support
- BOS Chamber size: 5–8 m<sup>2</sup>
- 20 μm mechanical precision
- 50 μm resolution



- Monitored...**
- Optical systems to monitor chamber geometry

- Optical chamber-to-chamber alignment

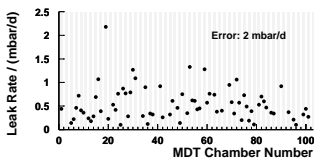
## Test of MDT Chambers after Shipment to CERN

A set of measurements ensures proper operation of the MDT

- Leak rate measurement
- HV test
- Noise test (with/without HV)
- Cosmic ray test after integration

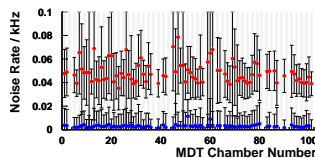
## Results

### Leak Test



Allowed leak rate: 7 mbar/d

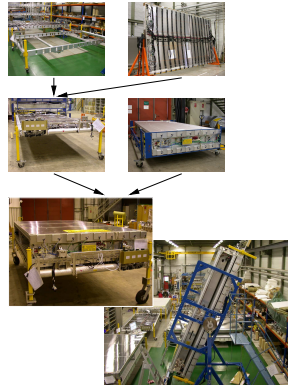
### Noise Test



Allowed noise rate: 5 KHz with HV

**All 88 BOS MDTs passed all tests without failure**

## Integration of Muon Stations



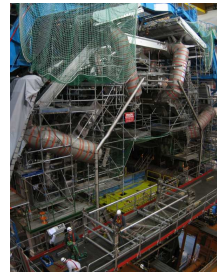
- MDT and RPC combined to muon station (weight: 1 t)
- Precise mechanical adjustment: 0.5 mm
- Additional sensors (B-field, chamber-to-chamber alignment)
- Sag compensation (chamber bent to follow wire sag)

**88 BOS MDT stations integrated**

## Installation in ATLAS

Stations are inserted into installation frame, supported on 2 cranes, rotated to appropriate angle, and slid onto rails in the detector.

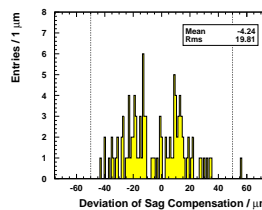
- Start of installation: Feb. 2006
- End of installation: May 2006



- Rate: Up to 4 stations / day
- Required precision of mechanical positioning: 1 mm

**84 of 88 BOS MDT stations installed**

## Commissioning after Installation



- Pressure check
- HV test
- Verification of sag compensation (see left)
- Check of alignment systems

**All installed BOS stations ok**

- Cosmic ray runs as soon as final services connected (work in progress)
- BOS stations will participate in data taking during magnet system test in June 2006