

# Installation and Commissioning of ATLAS MDT Chambers at CERN

D. Merkl, O. Biebel, F. Fiedler, R. Hertenberger, P. Klemm, A. Mlynek, T. Müller, T. Nunnemann, F. Rauscher, D. Schaile, H. Steffens, R. Ströhmer, A. Varga, J. Dubbert, M. Groh, O. Kortner, H. Kroha, J. v. Loeben, R. Richter, and J. Schmalzer<sup>a</sup>  
<sup>a</sup> MPI München

All 88 monitored drift tube (MDT) chambers for the outer layer of the ATLAS Muon Spectrometer (called BOS or BOF MDT-chambers), built in collaboration with the Max-Planck-Institute for Physics and the JINR Dubna, have been commissioned and calibrated [1,2] in the ATLAS cosmic ray measurement facility of the Ludwig-Maximilians-University (LMU) Munich until end of 2005. These MDT chambers were transported to CERN and were tested and commissioned again to demonstrate their functionality in the Muonspectrometer of ATLAS. The MDT chambers were integrated with the trigger chambers (RPC=Resistive Plate Chambers) and were tested together in a cosmic ray test facility at CERN [3]. Afterwards they were transported to the ATLAS Muonspectrometer (Fig. 1, 2, 3) and installed on rails attached on the Toroid Magnetic coils. They are positioned within mm precision on the rails (Fig. 4).



Fig. 1: Muon station in the right angle at the ATLAS Muonspectrometer with cranes  
 Fig. 2: View from the ground of the ATLAS cavern installation frame above the ATLAS pit



Fig. 3: Muon station on the rails in the ATLAS Muonspectrometer  
 Fig. 4: Positioning of the Muon station on the rails in the ATLAS Muonspectrometer

After the installation, the 88 Munich MDT chambers were successfully tested concerning their high voltage stability and gas tightness without any failure. The connection of cables and gas is ongoing. November 2006, the ATLAS Barrel Toroid coils were tested and reached full magnetic field. During the timeperiod with and without magnetic field, 13 muon station (including 4 Munich MDT chambers) were running and data taking with cosmic muons. It was used to test the performance of MDT and RPC chambers, the read-out hard- and software, the online monitoring, the alignment etc. The data is used for testing the offline software (e.g. muon track reconstruction) and the calibration software. Fig. 5 shows the drift time spectra of one MDT chamber with (red) and

without magnetic field and the expected time difference of  $\approx 20\text{ns}$  between the two spectra.

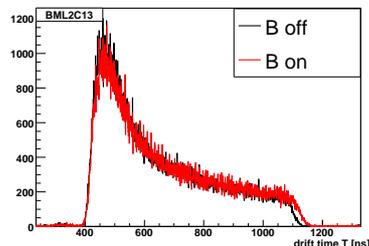


Fig. 5: Drift time spectrum with (red) and without magnetic field,  $\Delta T_{max} \approx 20\text{ns}$  as computed

Fig. 6 presents the reconstructed track of a measured cosmic muon with a momentum  $p \approx 18 \text{ GeV}/c$  going through 4 muon station in the ATLAS Barrel Muonspectrometer during the magnetic field test.

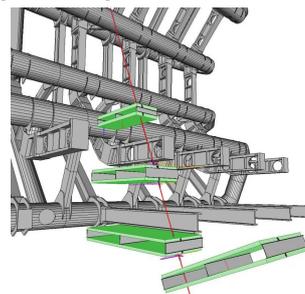


Fig. 6: Reconstructed track of cosmic muon ( $p \approx 18 \text{ GeV}/c$ )

During 2006, about 85 % of the muon stations in the ATLAS Muonspectrometer (Barrel, Fig. 7) and one big wheel (endcap with trigger chambers Fig. 8) were installed. The commissioning of the complete ATLAS Muonspectrometer should be finished until October 2007 and LHC will start at the end of 2007.

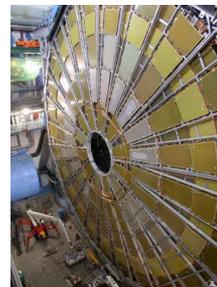
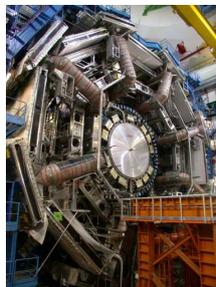


Fig. 7: Current installation status of the ATLAS Barrel Muonspectrometer  
 Fig. 8: Big Wheel (Trigger status) of the ATLAS Barrel chambers TGC

## References

- [1] F. Rauscher *et al.* Annual report 2004, p. 83
- [2] D. Merkl *et al.* Annual report 2004, p. 82
- [3] D. Merkl *et al.* Annual report 2005, p. 78