

Commissioning and Integration of ATLAS MDT Chambers at CERN

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All 88 monitored drift tube (MDT) chambers for the outer layer of the ATLAS Muon Spectrometer, built in collaboration with the Max-Planck-Institute for Physics and the JINR Dubna, have been commissioned and calibrated ([1]) in the ATLAS cosmic ray measurement facility of the Ludwig-Maximilians-University (LMU) Munich ([2]) until end of 2005.

80 of these 88 finished chambers were transported to CERN and had to be tested and commissioned again to demonstrate their functionality in the Muon spectrometer of ATLAS. No damage due to the transport was found. Already 74 of these MDT chambers passed the leak test with leak rates, Fig. 1, below the allowed rate for this commissioning test with $10\times$ ATLAS leak rate (ATLAS leak rate: 2×10^{-8} bar/l-s per tube [3]).

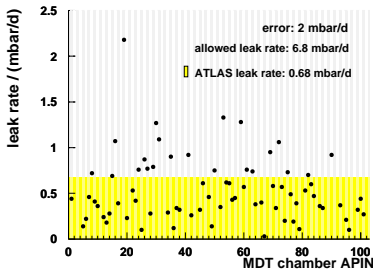


Fig. 1: Leak rates for the tested chambers at CERN, limit: $10\times$ ATLAS leak rate of 0.68 mbar/d

The following test of the MDT chambers was the noise test with an effective threshold of -50mV. The 74 tested chambers had noise rates below the ATLAS noise limit of 5kHz/tube, Fig. 2.

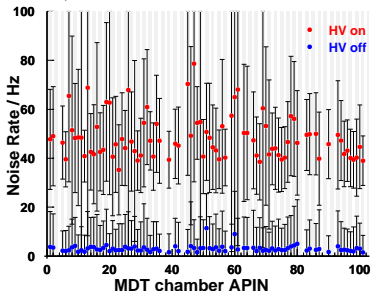


Fig. 2: Noise rates for the tested chambers at CERN, with high voltage (HV) to identify “dead” channels and without HV to measure only the electronic noise

After the successful MDT chamber tests, the chambers got additional sensors like survey targets, alignment sensors and magnetic field sensors whose functionality were tested afterwards. 61 of the tested chambers were integrated with the RPC trigger chambers. The stations for the outer layer of the ATLAS muon spectrometer, the BOS stations, (BOS= Barrel Outer Small) are the most complicated ones due to a common support frame which has

to be mounted outside the magnetic coils of ATLAS. The RPC trigger chamber, Fig. 3, is first built in the common support, Fig. 4. After this time-consuming procedure, the MDT chamber, Fig. 6, has to be carefully mounted and adjusted on top of the common support, Fig. 5.



Fig. 3: RPC

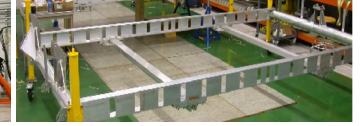


Fig. 4: Common support frame



Fig. 5: RPC in the common support

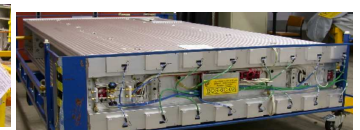


Fig. 6: MDT chamber

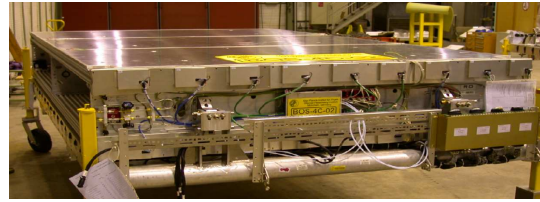


Fig. 7: Completed BOS station

On a special rotator (Fig. 8), the completed BOS stations were rotated at the right ATLAS angle and then aligned and sag-adjusted. During the sag adjustment, the drift tubes got the same sag as the wires, Fig. 9.



Fig. 8: Station on Rotator

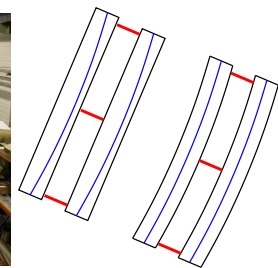


Fig. 9: Sag adjustment

The 61 BOS stations were tested in the cosmic ray test stand at CERN. All these MDT chambers passed this test without any failure. At the beginning of 2006, all 88 MDT chambers will be tested and integrated. The installation of the BOS stations will start in February 2006.

References

- [1] F. Rauscher *et al.*, Annual report 2004, p. 83
- [2] T. Trefzger *et al.*, Annual report 1999, p. 106
- [3] R. Hertenberger *et al.*, Annual report 2003, p. 89