# First Results at the Cosmic Ray Telescope

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One of the tasks of the LMU-ATLAS-group is the commissioning and calibration of 88 drift tube chambers of the ATLAS muon spectrometer. A cosmic ray telescope will provide the accuracy to perform this task. With this telescope we will test each chamber, weather it is operational and we will calibrate the wire positions in the chambers. Furthermore we will gain experience with the long term stability of the chambers including the internal and external alignment systems.

For the measurement of the wire position, the chamber to be tested is put between two reference chambers, which were measured at the x-ray tomograph at CERN. With the help of the reference chambers, the track of the muon is reconstructed. This track is extrapolated to the chamber we want to measure, and compared with the measurement in the tested chamber. A systematic deviation shows a displaced wire. The cosmic ray test stand, and the achievable measurement precisions were described in [2].

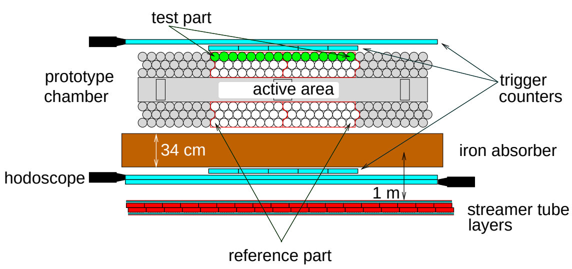


Fig. 1: A preliminary version of the test stand

In order to experience the technical problems before the start of the series production of the chambers, and because we wanted to confirm the Monte-Carlo studies, we built a preliminary version of the telescope as shown in fig. 1. We had one prototype chamber, which was artificially divided into reference part, with which we reconstructed the tracks, and a test part. We looked at the track residuals for the tubes in the test part, which is

$$residuum = d(track,\ wire) - r_{drift}, \tag{1}$$

where $d(track,\ wire)$ is the distance of the reconstructed track from the wire in the test part, and $r_{drift}$ is the measured drift radius there. The width of this distribution corresponds to the measurement precision for the wire positions. Figure 2 shows this distribution for the test stand data, and a Monte Carlo [3] simulation of this setup. Comparing the widths of the distributions we observe no statistically significant difference which means, that the data agree with the Monte Carlo.

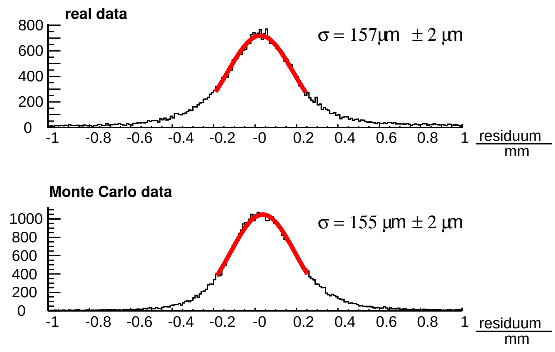


Fig. 2: Residuum distribution without any cuts.

An important feature of the telescope is also the possibility to harden the spectrum of cosmic ray muons by a multiple-scattering-cut. This can be achieved by comparing the position measurement of streamer tubes below the iron absorber with the extrapolated track from the drift tube chamber. As an example we required a multiple scattering angle of less than 9 mrad. The residual distributions after this cut also agree within the statistical errors (see fig. 3). The resolution has improved with the cut as expected.

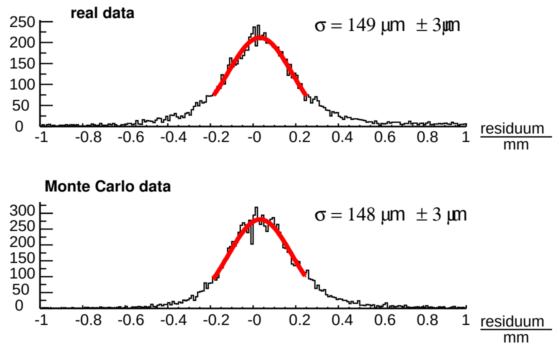


Fig. 3: Residuum distribution without any cuts.

In summary a first telescope set-up has successfully been taken into operation. A full GEANT based simulation models our data with the expected accuracy. The set-up was operated over periods longer than the anticipated measurement periods for the test chambers and no significant instability was observed. The final system will allow us to control such instabilities by better monitoring facilities for temperature, the gas system, and the alignment of multilayers and chambers.

The effect of the streamer tube cut was shown. This effect is expected to be more beneficial in the final set-up, because of the larger distance and more matter between the test and the reference part which increases track deviations arising from multiple scattering.

## References


[1] F. Rauscher, diploma thesis, LMU München, 2001
[2] T. Trefzger *et al.*, Jahresbericht 1999, p. 106
[3] Oliver Kortner, ATL-MUON-2000-021, MTGEANT-4 - The Munich Test-Stand Simulation Programme