Pulser Test of ATLAS Muon Chambers

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Final electronics have to be installed at some of the already calibrated BOS chambers. Therefore a simple test – the pulser test – is needed to check whether all electronics channels of the chambers are still working after mounting the electronics.

18 mezzanine cards are to be mounted on each chamber. Each of these cards is divided into 24 read-out channels. For the pulser test rectangle pulses of 5 V are sent to the HV-connector of the chamber and the output of all 432 channels is monitored.
So far this test has been developed and performed at the cosmic ray facility of the LMU. But it will be applied to the calibrated chambers stored in Eching, soon.

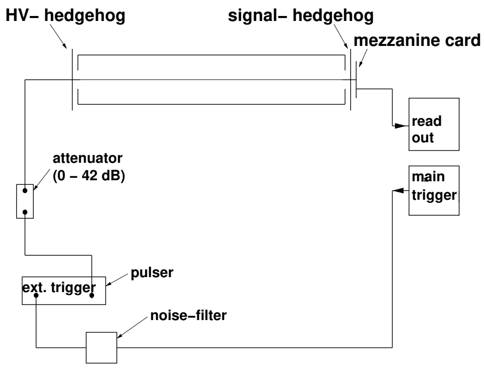

Fig. 1: Setup for the pulser test

The setup of the pulser test is illustrated in figure 1. A given number of trigger signals is sent to the HV side of the chamber. The signals pass the noise filter, which is set to eliminate interfering signals. The main trigger then initiates a 5 V rectangle pulse at the pulse generator (pulser). An attenuator is applied to reduce the pulse's amplitude by up to 42 dB. At 40 dB only 0.01 % of the signal amplitude is still applied to the chamber. At the read-out (RO) side of the chamber the measured pulses are counted and analyzed.
Figure 2 shows an attenuation curve for channel 1 (at mezzanine card 1) of chamber BOS_3A_02. 10000 main trigger signals were applied to each channel. The number of pulse counts (hits) remains stable up to an attenuation of about 30 dB. After this threshold, the curve is declining quickly but does not drop to zero at once, as one would expect if there was no electronic noise. At 42 dB no signal is observed anymore.

The curve was fitted with an error function and a threshold value was determined at 90 % of the number of main trigger signals. For this channel, the threshold is located at an attenuation of about 34 dB. All remaining channels show comparable threshold values, as can be seen in figure 3. All of them are located between 29 dB and 39 dB corresponding to the internal threshold of the read-out mezzanine card of about 42 $mV \pm 6$ mV.

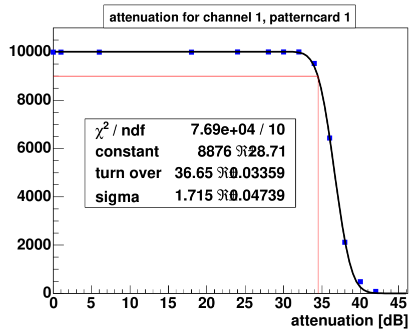

Fig. 2: Attenuation for mezzanine card 1, channel 1, BOS_3A_02.

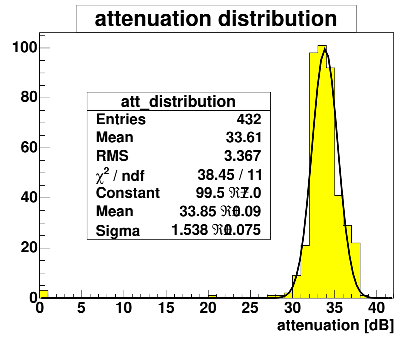

Fig. 3: Attenuation distribution for all channels of chamber BOS_3A_02.

At the few chambers with disconnected tubes – i.e. the sense wire in the tube is electrically insulated from the read-out electronics – the cross-talk between single tubes can be studied. For this purpose the chamber is pulsed and the attenuation curve for the disconnected tube, which is expected to show no signal at all, is determined. The curve is represented in figure 4. The observed cross-talk between the disconnected tube and the surrounding tubes amounts to about 35 % at 0 dB attenuation. The cross-talk hits already disappear at an attenuation of 6 dB. It is, therefore, negligible compared to the typical signal amplitude of 300 mV in the read-out mezzanine card. So the pulser test is useful to investigate the read-out electronics with simple means.

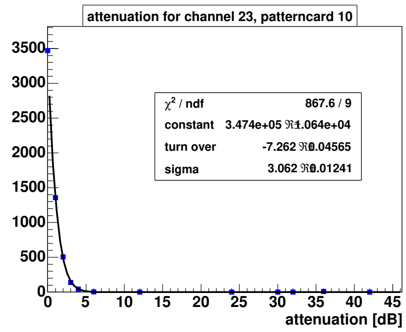

Fig. 4: Attenuation curve for disconnected channel 23, mezzanine card 10 (ML1, L1, T44), BOS_1C_06.