First beam test of the Frankfurt prototype for the CBM-TRD

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As one of the key components in the CBM experiment, the Transition Radiation Detector (TRD) will play a significant role in the particle identification. A fast detector with double sided readout chambers [1] and a ALICE type of detector with both drift and amplification regions were designed for the circumstance of high particle rates. We propose to build a fast detector with an amplification region only. Simulation studies combining dE/dx and transition radiation show that such a simple detector can fulfill the requirement of particle identification [2]. If such design can be realized and verified by more sophiscated studies and beam tests, it will noticeably reduce the cost and simplify the construction.

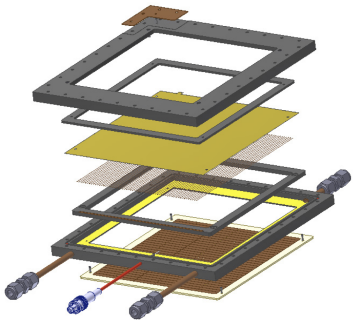

Figure 1: Sketch of the readout chamber

The IKF group in Frankfurt participated in the beam test in Novermber 2010 at CERN and tested its two prototype detectors. Both detectors are equipped with a readout chamber, which has an amplification region of 1 cm. A sketch of the readout chamber is shown in Fig. 1. The chamber size is 15×15 cm^2 and it is enclosed by an aluminized kapton foil and a simple PCB for the charge sensitive readout.

Inside the readout chamber a plane of anode wires is located in the centre for gas amplification. The pitch between anode wires is 5 mm for one chamber and 2.5 mm for the other. The anode wires are made of Au plated W, 20 μm in diameter. Rectangular pads with a conservative size of 5×50 mm^2 are chosen to read out particle-induced signals. In the beam test, eight neighbouring pads in the middle column grouped together from each chamber are read out by the 8-channel SPADIC chip, developed to be a self-triggered pulse amplification and digitization ASIC [3]. The radiator is a sandwich construction of Rohacell HF71 foam and polypropylene fibres. Figure2 displays one of the prototype detectors during the beam test.

The setup of the Frankfurt prototypes can be found in the overview of this CERN beam test [4]. Both detectors were tested at beam momenta of 2, 3, 4 and 5 GeV/c respectively.

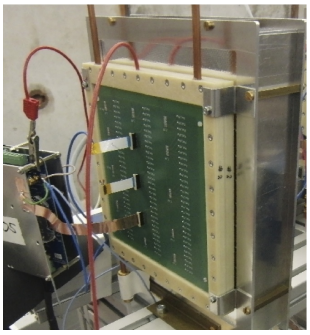

Figure 2: Prototype detector in the beam tests

Two gas mixtures were used in the test: Xe-CO_2 and Ar-CO_2, with a ratio of 80:20 in both cases. Figure3 shows a very preliminary result of the integrated ADC spectra from pions (blue line) and electrons (red line) separately. Here the data was collected by the chamber of 2.5 mm wire pitch at the beam momentum of 5 GeV/c and with the gas mixture of Xe-CO_2.

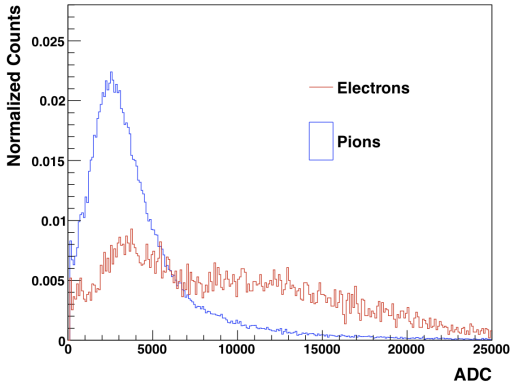

Figure 3: Integrated ADC spectra from pions (blue line) and electrons (red line)

References

[1] M. Klein-Bösing *et al*, Nucl. Instrum. Meth. **A 585** (2008) 83

[2] P. Reichelt *et al.*, *Study on electron-pion discrimination with the CBM Transition Radiation Detector*, this report

[3] T. Armbruster *et al*, *CBM-TRD readout with the SPADIC amplifier / digitizer chip*, this report

[4] D. Emschermann and C. Bergmann, *First common beam test of the CBM STS, RICH and TRD subsystems at the CERN Proton Synchrotron*, this report