Beam tests with an ALICE TRD supermodule

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The Transition Radiation Detector (TRD) of the ALICE experiment at LHC is designed to provide electron/pion identification and tracking of all charged particles [1]. The TRD will supplement the TPC electron/pion identification by a pion rejection factor of the order of 100 at momenta above 1 GeV/c, allowing precision measurements of quarkonia. Sophisticated on-detector electronics [2] is designed to trigger on high-momentum electrons and on jets. The project is now in the production stage, with 2 supermodules installed in the ALICE setup and a few more being prepared for installation before the LHC startup in spring 2008.

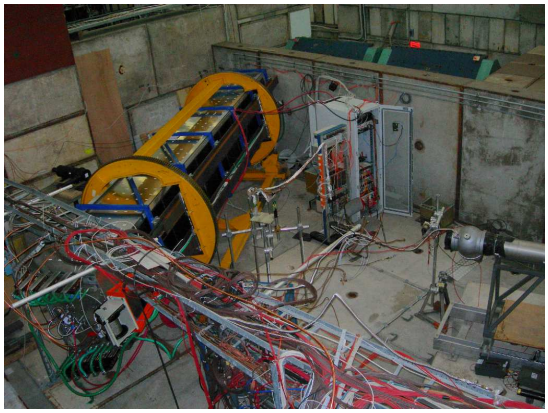

Figure 1: The TRD supermodule installed at the T10 beamline at CERN PS.

A first beam test of a final supermodule (SM) of TRD was performed at the CERN PS accelerator in November 2007, with the aim to provide reference distributions for our particle identification methods [3] as well as to check the overall detector performance. Measurements were carried out in an electron/pion beam with momenta of 1 to 6 GeV/c. Fig. 1 shows a picture of the setup at the beamline. Besides the TRD supermodule, the setup was comprising of: beam trigger scintillators, a Pb-glass calorimeter and a Cherenkov detector for e/π identification and two Si-strip detectors for position reference. The final readout chain of the TRD was used to read 1 stack of the 5 of the SM, both with and without zero suppression.

In Fig. 2 we present the measured average signals as a function of drift time for pions and electrons, for the momentum of 4 GeV/c. The detector signal is spread over about 2 μs. The peak at small drift times originates form the amplification region, while the plateau is from the drift region. For the electrons, the contribution of TR, which is preferentially absorbed at the entrance of the detector (corresponding to large drift times), is evident.

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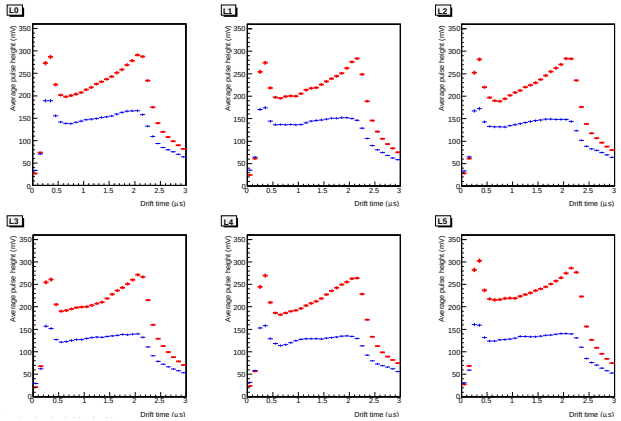

Figure 2: Average pulse heights for the 6 layers, sampled in time bins of 100 ns, for electrons (thicker symbols) and pions of 4 GeV/c.

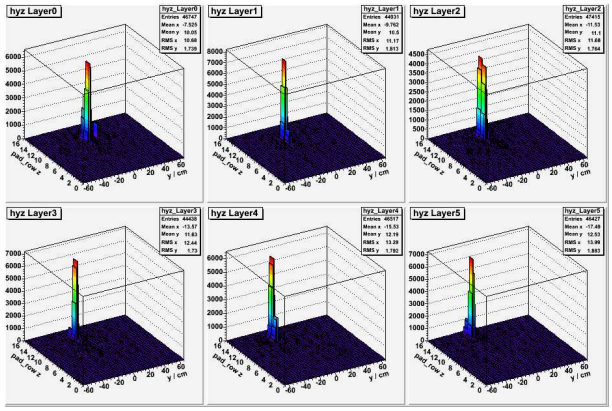

Figure 3: Tracklet distribution over the 6 layers.

In Fig. 3 we illustrate tracklet (track segment within one chamber, reconstructed on-line) performance for the six layers of the TRD. Plotted is the distribution of the found tracklets over the area of the chambers, reflecting the position of the beam incidence.

Data analysis is in progress to estimate the performance for e/π separation and for tracking. The experience during the beamtime will help improve the performance of the detector and of the data readout chain.

References

[1] ALICE Transition Radiation Detector Technical Design Report, ALICE TDR 9, CERN/LHCC 2001-021.

[2] V. Angelov, NIM A 563 (2006) 317.

[3] C. Adler et al., NIM A 552 (2005) 364;
A. Bercuci et al., this Report.