# Test of Münster CBM TRD prototypes at the CERN PS/T9 beam line *

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The Münster real-size CBM TRD prototypes [1] of $59 \times 59$ cm$^2$ shown in Fig. 1 are derived from the design of the ALICE TRD modules. An amplification region of 3.5+3.5 mm is combined with a 5 mm drift section leading an active gas volume thickness of 12 mm. Signals are induced on rectangular pads of 7.125 mm width, respectively, to allow for charge collection on 3 adjacent pads. This design corresponds to the smallest module size next to the beam-pipe, required for 12% of the total CBM TRD area, and is scalable to 1 m$^2$-size detector modules.

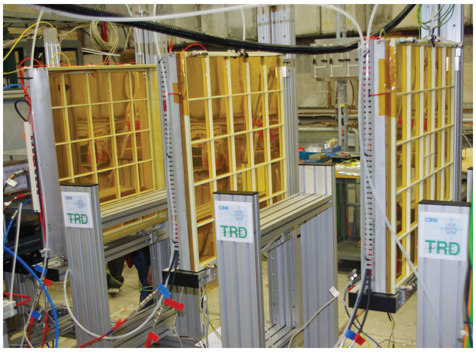


Figure 1: Münster TRD protoypes in the CBM beam test.

Various radiator types were investigated on these 3 TRD prototypes during the common CBM beam test [2] in 2012. The read-out was performed with the SPADIC v0.3 / Susibo [3], SPADICv1.0 [4] and FASP [5] front-ends. The setup was entirely EPICS controlled, allowing for online monitoring of the HV settings, gas flow and inclusion of these values in the DAQ stream. First results of the ongoing analysis are shown in Figure 2. One important aspect of radiator choice is to match of the TR-emission spectrum with respect to the absorption spectrum of the detector. For a detailed investigation, we have built different radiator types: regular foil and irregular foam, fiber and sandwiches. Ideally, a radiator should yield an optimal TR-performance, while keeping the material budget as low as possible. While this consideration favors regular foil radiators, they usually require a significant external support frame to keep the foils stretched and in position. This additional frame material is avoided in our first micro-structured self-supporting radiators (Kshort, K, K++). First results using self-supporting radiators type K (Fig. 3) are promising and comparable to the classical radiator type B with the same properties made from the identical material.

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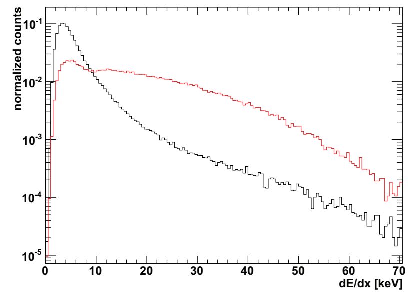


Figure 2: ADC spectra for $\pi$ (black) and $e$ (red), integrated and calibrated, on the 2nd TRD operated with Xe/$CO_2$ (80:20) gas in combination with 350 foil layer micro-structured self-supporting radiator (K++) at 3 GeV/c.

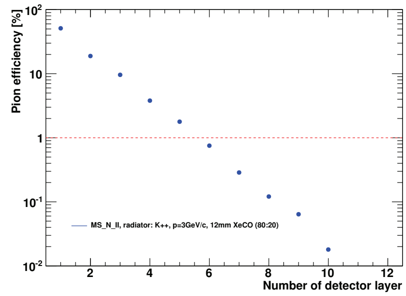


Figure 3: Extrapolated pion efficiency for a TRD consisting of up to 10 layers for micro-structured self-supporting radiator (K++). The dashed line indicates the design goal of 1% $\pi$ efficiency, at 90% $e$ efficiency which is reached in this configuration with 6 layers.

## References

[1] D. Emschermann et al. "Development and CbmRoot implementation of the Münster CBM TRD prototypes 2012", CBM Progress Report 2012

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[3] T. Armbruster et al.,"CBM-TRD readout with the SPADIC amplifier / digitizer chip", CBM Progress Report 2010

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[5] V. Catanescu et al., "Front End Electronics for High Counting Rate TRD using a prototype ASIC", CBM Progress Report 2009