Two-dimension position sensitive Transition Radiation Detector in beam-tests using new Fast Analog Signal Processor (FASP)

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The new two-dimension position sensitive TRD prototype architecture for CBM experiment developed by us is based on diagonally split rectangular pads of the read-out electrode [1]. The choice of triangular-pad geometry allows for position determination in both coordinates: across and along the pads, respectively. The TRD prototype used in the present tests has a readout electrode of 25 μm thickness kapton foil having on both sides evaporated Al/Cr layers with the mentioned pad structure.

The first version of the prototype was built with an anode-cathode distance of 3 mm (DSTRD-V1) and a readout electrode with a double sided pad structure [2, 3] similar with small size double sided TRD prototype which showed that such a geometry preserves the performance up to 2x10^5 part.$\cdot$cm$^{-2}\cdot$s^{-1} counting rate. In order to improve the charge sharing between the pads for position reconstruction, the second version was built with a 4 mm anode-cathode distance (DSTRD-V2).

Both detectors were tested with the 5.9 keV X-ray ^{55}Fe source using both the anode and pad signal, respectively. 80% Ar + 20% CO_2 gas mixture was flushed trough the counter. For pad signal processing we used the new FEE - Fast Analog signal Processor (FASP) [4] developed in our group. It has 8 input/output channels and can provide two type of outputs: a fast output with a semi-Gaussian shape (Fig.1, blue line) and a flat top output (Fig. 1, red line) [5].

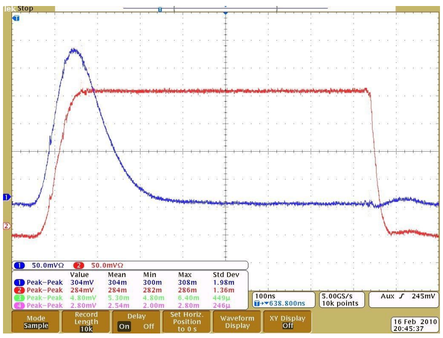

Figure 1: Fast output (blue line) and flat top output (red line) of the Fast Analog signal Processor (FASP)

The obtained pulse height spectrum (10% energy resolution in sigma) for the pad signal of DSTRD-V2, processed by the FASP fast output is presented in Fig. 2 (left). The applied anode voltage was 1750V. The right side of Fig. 2 shows the obtained pulse height spectrum (10.4% energy resolution in sigma) for the flat-top output and 1800 V anode voltage. Both FASP outputs were digitized with an AD811 converter, the fast output via a main amplifier with 300 ns shaping time, the flat top output directly.

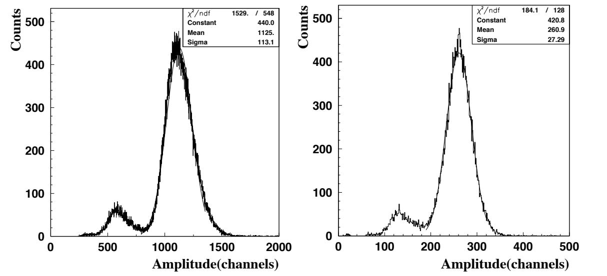

Figure 2: Pulse height spectrum of the (FASP) fast output, anode voltage 1750 V (left side), as well as of the flat-top output (right side), anode voltage 1800V

The detectors were tested with electron and pion beam of 1 - 5 GeV/c momenta at the T10 beam line of the CERN PS accelerator in a joint measurement campaign of the CBM Collaboration. The signals delivered by 16 triangular pads were processed by the FASP using the flat top output. They were digitized by a 32 channels peak sensing Mesytec ADC (MADC-32).

Figure 3 shows the pulse height distributions of electrons and pions for 2 GeV/c momentum, a gas mixture of 80% Xe + 20% CO_2 and operating the DSTRD-V1 counter with 1700 V anode voltage. A detailed analysis is in progress.

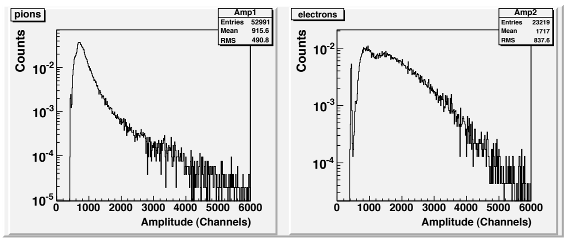

Figure 3: Pulse height distributions of electrons and pions for 2 GeV/c momentum

References

[1] D. Bartoş *et al.*, *CBM Progress Report 2009*, Darmstadt 2010, p. 31

[2] M. Petrovici *et al.*, Nucl. Instrum. Meth. **A 579** (2007) 961

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

[4] V. Cătănescu *et al.*, *CBM Progress Report 2009*, Darmstadt 2010, p. 47

[5] A. Caragheorgheopol *et al.*, *Front-end electronics for high counting rate TRD*, this report