Two-dimensional MWPC prototype for CBM TRD*

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Introduction

The signal induced on a segmented conductive electrode is used in a large number of MWPC applications for position information. Additionally, the firing anode can be used for orthogonal position information at an increased operational cost. The draw back of such procedure is the poor localization along the wire and the impossibility to operate in conditions of high local occupancies and counting rates. In the current report the performance of an innovative geometry of the read-out electrode is presented. The $2D$ information can be extracted in high fluxes without additional anode read-out channels.

The TRD MWPC for CBM

The TRD developed in Bucharest for the CBM experiment [1] is characterized by a $4\ mm$ drift and a $2 \times 4\ mm$ amplification regions and wire pitches of $1.5\ mm$ for the cathode and $3\ mm$ for the anode wires (see Fig. 1 left). The conductive electrode is segmented in triangular shaped pads of $7.3 \times 27.7\ mm^2$ and $0.2\ mm$ spacing arranged as in Fig. 1 right with respect to the anode wires.

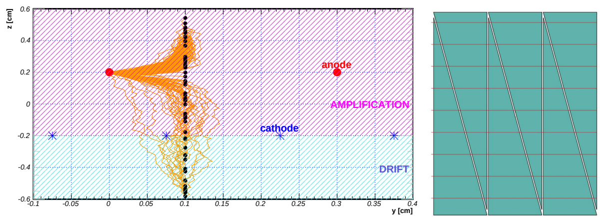

Figure 1: Active volumes (drift, amplification) and elements (anode, cathode wires and the pad plane structure) as well as signal formation in the TRD as simulated in Garfield++ [2].

The Local Anode Identification method

Due to varying cross section of pads with respect to anode wires in our current set-up and localization of the induced signal the Pad Response Function (PRF) varies with the position of firing anode wire along the pads. Thus one can build an Anode Response Function (ARF) for anode identification. In Fig. 2 left the method is tested using an uniform illumination of the TRD detector with a ^{55}Fe source. For each PRF value nine maxima are found corresponding to the anodes covered by a pad-row. Each local maxim is fitted and the mean and sigma parameters of the Gaussian distribution are extracted (see markers on Fig. 2 left and the sin interpolation). A very good separation between each curve is obtained for the whole pad height.

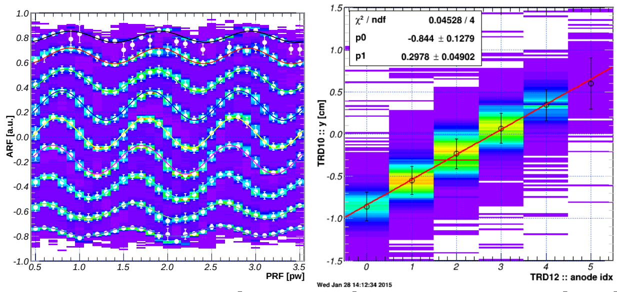

Figure 2: ARF correlations with PRF as measured with TRD prototype for a uniform illumination with ^{55}Fe (left) and with the position measurement by a reference TRD for MIPs (right) respectively. The slope of the fit ($p1$) gives the measured distance beteen anodes in cm.

In November 2014, the TRD prototype operated with Xe/CO_2 $(80/20)$ was tested with MIPs at CERN-PS. To estimate the resolution of the ARF method a reference position sensitive TRD was mounted orthogonal to it. The reference detector was operated in the rectangular shaped pads geometry for good position resolution across pads. The correlation between position measurements in the reference detector and anode identification by ARF is shown in Fig. 2 right. The measured distance of $2.98 \pm 0.05\ mm$ between anode wires corresponds to the designed pitch of $3\ mm$. The measurement across pads is performed for the time being using the parring of triangular pads. A resolution of $\approx\ 500\ \mu m$ is obtained for ^{55}Fe position scan operated with Ar/CO_2 $(80/20)$ and FASP v0.1 [3] FEE.

Conclusions

It was demonstrated that the usage of a varying PRF along pads can provide good local anode identification. The method opens the possibility of using reduced *effective* pad geometries with implications in position resolution at constant read-out costs and experimental material budgets.

References

[1] M. Tarzila et al., CBM Progress Report (2012) 80.

[2] Garfield++ http://garfieldpp.web.cern.ch/garfieldpp

[3] V. Catanescu, CBM 10^{th} Collaboration Meeting Dresden, Sept 25-28, 2007

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