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2D Interleaved Readouts for MPGDs

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Coarsely segmented (pitch > 1 mm) zigzag-shaped anode strip arrays have been shown to have considerable advantages over similarly pitched straight strip arrays for standard planar MPGDs, including GEM, Micromegas, and micro-RWELL detectors. Once the geometric parameters of the zigzag are precisely tuned for a specific detector application, the spatial resolution remains high and approximately flat for very large pitches, up to 3.3 mm or more. Additionally, the response of the optimized zigzags along the measured coordinate and in the orthogonal direction are highly uniform without the need for differential non-linearity corrections. We extend the enhanced charge sharing characteristic of the zigzags to the case of a 2D readout by employing anode structures that are interleaved along two distinct directions. This allows for the possibility to choose arbitrary coordinate axes suitable for particular detector applications. As in the 1D case, the segmentation of the 2D anodes can also be large to minimize the channel count and save considerably on the readout electronics. Thus, to achieve the desired position resolution and uniformity of response, we rigorously optimize the basic geometric parameters of various 2D interleaved anode shapes with the goal of minimizing the channel count while maintaining the detector performance. A variety of 2D interleaved readout patterns coupled to GEM, micro-RWELL, and Micromegas detectors were evaluated at a beam test and in the lab using a highly collimated X-ray source for this purpose. In addition to providing a survey of the geometric parameters of the anode structure, various 2D readouts were studied with angles other than 90 deg. between the coordinate axes. Results will be presented at the conference that demonstrate the viability of such 2D interleaved readouts with an emphasis on the spatial resolution and the uniformity of response along each coordinate.

Collaboration

EIC at BNL

Primary authors: KISELEV, Alexander (Brookhaven National Laboratory); AZMOUN, Bob (Brookhaven National Laboratory); WOODY, Craig (Brookhaven National Lab)

Presenter: KISELEV, Alexander (Brookhaven National Laboratory)

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