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Novel zigzag and diamond pattern for Micromegas and Gas-based detector

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Gas-based detectors Micromegas are used in many high energy physics experiments to track charged particles. They can cover large areas with homogeneous gain, providing spatial resolution from millimeter to tenth of millimeter.
Micromegas can be read along one projection with strips (1D) or two projections with pads interconnected (2D), but the resolution highly depend of the density (pitch) of the pattern.
In the worse case, a particle hit a single pattern providing a resolution of pitch/$\sqrt{12}$.
To reduce this dependency, novel "zigzag" 1D pattern and "diamond" 2D pattern are tested and optimized to obtain the best resolution regardless of the pitch, in the context of the Electron-Ion Collider R&D on detectors.

Tested using a proton beam at Fermilab Test Beam Facility, zigzag and diamond geometries have been successfully characterized with Micromegas, showing $150\mu m$ 1D spatial resolution with a pitch of $2mm$.
Identical readout have been tested with other gaseous detectors (μRWell, GEM) for a complete comparison.
For Micromegas, the zigzag pattern have been tested on a full scale prototype of 40x40cm^2 with a pitch from 1 to $3mm$.

In this presentation, it will be shown that zigzag and diamond patterns are efficient geometry for Micromegas and other gaseous detectors, compatible with future large detectors. Details on the characterization, detectors and technologies used will be discussed.

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