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Resistive High Granularity Micromegas for Future Detectors

This contribution presents recent advancements in single-stage pixelised resistive Micromegas detectors for precision tracking and muon system applications in future collider experiments. These detectors combine high-rate capability, excellent spatial and timing resolution, and robust spark protection, making them well-suited for operation in demanding experimental environments.

The detectors, featuring pad-based readout with mm²-scale granularity, have demonstrated stable operation at particle rates up to 10 MHz/cm², achieving spatial resolutions below 100 µm and timing resolutions under 10 ns. These performance parameters can be tuned to match specific experimental requirements, from high-precision tracking to more cost-effective solutions with reduced granularity, such as those foreseen for FCC-ee.

More specifically, for low- to medium-rate environments, detectors with capacitive charge-sharing anodes allowing a reduction in the number of readout channels while preserving adequate precision, are explored. For high-rate scenarios, robust resistive layouts with fast charge evacuation, ensuring discharge stability and efficiency, are under testing. The resistive protection is implemented through different schemes and integration strategies, tailored to optimise performance under various conditions.

More recently, together with small and medium-size prototypes, detectors with active areas up to 40 × 50 cm² have been realised and tested, validating the concept in terms of uniformity, robustness, and rate performance across increasing detector sizes. The results demonstrate the scalability of the technology toward large-area coverage, a key requirement for future high-energy physics experiments.

Secondary track

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