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High-Rate Capable Floating Strip Micromegas Detector

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We report on the development of novel discharge insensitive floating strip Micromegas (MICRO-MEsh GASeous) detectors, fit for use in high-energy muon spectrometers. The suitability of these detectors for particle tracking is shown in high-background environments and at very high particle fluxes up to 60MHz/cm^2.
Measurement and simulation of the microscopic discharge behavior demonstrate the excellent discharge tolerance. A floating strip Micromegas with an active area of 48cm x 50cm with 1920 copper anode strips exhibits in 120GeV pion beams a spatial resolution of 50µm at detection efficiencies above 95%. Pulse height, spatial resolution and detection efficiency are homogeneous over the detector. Reconstruction of particle track inclination in a single detector plane is discussed, optimum angular resolutions below 5° are observed. Systematic deviations of this µTPC-method are fully understood.
The reconstruction capabilities for minimum ionizing muons are investigated under intense background irradiation of 550kHz 20MeV protons. An influence on the performance is only observed for temporally and spatially coincident muon and background signals.
A 6.4cm x 6.4cm floating strip Micromegas doublet with low material budget is investigated in highly ionizing proton and carbon ion beams at particle rates between 2MHz and 2GHz. Stable operation up to the highest rates is observed, spatial resolution, detection efficiencies, the multi-hit and high-rate capability will be discussed.

Summary

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