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Design and Performance of a Triple-GEM Hodoscope for Cosmic Muon Tracking

Thursday, 3 December 2026 15:00 (30 minutes)

We report on the design and operational characterization of a atmospheric cosmic-ray muon telescope employing two 10×10 cm^2 NA64-type triple-GEM detectors combined with a plastic scintillator coincidental trigger system readout via NIM electronics. Signal processing and data acquisition across the 1024 detector channels are performed synchronously with the trigger logic signal using the RD51 Scalable Readout System (SRS) equipped with the front-end ASIC VMM3a. Optimal operating conditions yield detection efficiencies up to 90% and a time resolution of 9.9 ± 0.4 ns. Angular distributions of the atmospheric muon flux measured under laboratory and open-sky conditions in Bogotá D.C., Colombia (2600 m a.s.l.), were reconstructed. Upon acceptance and efficiency corrections, preliminar measurements of the flux exhibits a zenith dependence modulated by $\cos^n\theta$ ($n = 2.13 \pm 0.5$) and vertical intensity $I_0 = 260$ m^{-2} s^{-1} sr^{-1}. Fluctuations observed in the angular distribution are attributed to acceptance correction errors under high electronic noise levels, along with clock distribution instabilities in the Clock and Trigger Fanout (CTF) board. Nevertheless, the physical parameters remain in agreement with historical measurements, confirming the feasibility of VMM3a–SRS integrated hodoscopes for atmospheric muon tracking.

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