

Performance of triple-GEM detectors for the ME0 system of the CMS Phase-2 Upgrade

The High-Luminosity LHC will deliver proton-proton collisions at 5-7.5 times the nominal LHC luminosity, with an expected number of 140-200 pp-interactions per bunch crossing. To maintain the performance of muon triggering and reconstruction under high-rate background, the forward part of the Muon spectrometer of the CMS experiment will be upgraded with Gas Electron Multiplier (GEM) detectors. The ME0 station will consist of stacks of six triple-GEM detectors, designed to extend the muon system pseudo-rapidity coverage up to $|\eta| < 2.8$. The operating environment for ME0 will be characterized by extremely high rates, estimated from simulation studies to reach approximately 150 kHz/cm². To ensure the ME0 system performs effectively in this challenging environment, a detailed study of its rate capability and timing performance is critical. This talk provides an overview of the ME0 project and its current status. In particular, we present the integration of a final-design prototype for a six-layer ME0 stack, along with performance measurements for muon segment reconstruction efficiency and timing. We report on measurements conducted using cosmic rays as well as rate capability tests under high-rate gamma background conditions at the CERN Gamma Irradiation Facility (GIF++). Our results confirm that the ME0 design meets the Phase-2 CMS muon system upgrade requirements.

Workshop topics

Detector systems

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