

Performance studies of large-area triple-GEM prototypes for future upgrades of the CMS forward muon system

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The RPC muon system of the CMS detector at the CERN LHC remains uninstrumented in the pseudorapidity region $1.6 < |\eta| < 2.4$. An ongoing project aims at covering the region of the muon endcaps with large-area triple-GEM detectors whose features are suited to enhance muon tracking and preserve triggering capabilities for the CMS detector upgrade. The design and assembling of small (10cm×10cm) and full-size trapezoidal (1m×0.5m) triple-GEM prototypes will be described. The prototypes have been tested with soft x-rays and with a pion/muon test beam at the CERN SPS. Results from measurements with different experimental set-up on detector resolution and efficiency as well as timing performance will be reported. Preliminary simulation results will be discussed, related to studies on performance variations of the expected muon tracks reconstruction and trigger performance for different upgraded muon system scenarios with several physics processes. Micro-Pattern Gas Detectors (MPGDs) are the detector technology of choice for simultaneously providing precision tracking and fast trigger information. They can be designed with sufficiently fine segmentation to cope with the hostile environment at a high-luminosity LHC and are being considered for a CMS high-eta muon upgrade. Several Triple Gas Electron Multiplier (GEM) prototypes have been built for this project with conventional construction techniques over the last two years. Here we report on a novel design and construction technique for a small Triple-GEM detector prototype. This method uses a purely mechanical way to stretch GEM foils in situ and does not require spacer frames or gluing, making it potentially very interesting for large-scale, cost-effective industrial production of GEM detectors. We will present details of the detector assembly procedure and results of preliminary performance tests of the resulting detector prototype.

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