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Large-Scale Production and Implementation of the CMS ME0 GEM Detector for HL-LHC

Abstract

As part of the CMS detector upgrades for High-Luminosity LHC operations, the muon system is being enhanced with the innovative Muon Endcap (ME0) detector, which entered large-scale production in 2024. This new six-layer detector station extends the muon system's pseudo-rapidity reach to $|\eta| = 2.8$, representing a significant improvement over the current $|\eta| = 2.4$ limit and opening new possibilities for forward physics measurements.

The ME0 architecture features 18 detector stacks per endcap, each incorporating six triple-layer gas electron multiplier (GEM) chambers. This configuration delivers up to six additional measurement points per muon track, substantially advancing muon identification capabilities, spatial precision, and first-level trigger robustness.

Production coordination across multiple international facilities ensures both manufacturing scalability and adherence to delivery schedules. This presentation examines the ME0 detector architecture, manufacturing methodology, quality control protocols, and current production achievements, highlighting its critical contribution to CMS muon system performance in the HL-LHC era.