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## Upgrade of the CMS muon system with triple-GEM detectors

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After 5 year of R&D on Gas Electron Multiplier (GEM) technology, the CMS GEM Collaboration proposed to instrument the vacant high eta region of the CMS muon system with large triple-GEM detectors, a technology able to sustain the harsh environment at the High-Luminosity LHC while operating for 20 years. New large size (990 x 440-220 mm<sup>2</sup>) triple-foil GEM detectors were developed, equipped with a new readout system. Combining triggering and tracking functions, the new GEM chambers will improve the performance of the CMS muon trigger and will also improve the muon identification and track reconstruction. With the addition of new detectors in the forward region ( $1.5 < \eta < 2.2$ ) the CMS muon spectrometer will recover its originally planned redundancy. Developing and testing several small and full size prototypes with different geometries yielded progressive improvement in assembly technique. These prototypes have been tested using radiation sources, cosmic rays, and test beams at CERN and Fermilab. The results show that these triple-GEM detectors fully satisfy the requirements for use in the forward region of the CMS muon system at HL-LHC. An additional station proposed in conjunction of the CMS forward calorimeter upgrade will extend the muon acceptance up to  $|\eta| < 3.0$ . We report on the status of the CMS GEM upgrade, including its expected impact on the performance of the CMS experiment, and the architecture of the GEM detectors and readout. We also present results of test beam measurements made in 2014 using the latest generation of chambers, including some with new readout electronics using the VFAT2 front-end chip and optical readout based on the micro-TCA standard.

**Primary author:** Prof. DAVIES, Gavin (Imperial College London)

**Presenter:** Dr DORNEY, Brian (European Organization for Nuclear Research (CERN))

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