Contribution ID: **162** Type: **Poster**

Upgrades of the CMS muon detectors: from Run-3 towards HL-LHC

Monday, 15 July 2019 19:40 (20 minutes)

The present CMS muon system consists of three different detector technologies: drift tubes (DT) and cathode strip chambers (CSC) are used in the barrel and end-cap regions of the spectrometer as offline tracking and triggering devices, whereas resistive plate chambers (RPC) are installed both in barrel and end-caps and are exploited mostly in the trigger. In order to cope with the challenging conditions of increasing luminosity expected at HL-LHC, several upgrades of the muon detectors and trigger system are planned. In the case of DT and CSC, the electronics will be upgraded to handle higher rates, but there is no plan to replace the existing DT, CSC and RPC chambers. Therefore, accelerated ageing tests are being performed to assess the performance stability of all muon detectors under conditions which exceed, by one order of magnitude, the design specifications. New micro-pattern gas detectors will be added to improve the performance in the forward region, more critical in terms of rates and characterized by a less uniform magnetic field. Large-area triple-foil gas electron multiplier (GEM) detectors are being already installed during the second LHC long shutdown covering the pseudo-rapidity (η) region $1.6 < |\eta| < 2.4$. They will allow to control the rate of background triggers while preserving high trigger efficiency for low transverse momentum muons. For the HL-LHC operation the muon forward region will also be enhanced with another large area GEM based station, called GE2/1, and with two new generation RPC stations, called RE3/1 and RE4/1, having low resistivity electrodes. These detectors will combine tracking and triggering capabilities and can stand particle rates up to few kHz/cm2. In addition to take advantage of the pixel tracking coverage extension a new detector, ME0 station, behind the new forward calorimeter, covering up to $|\eta| = 2.8$. We present results about the expected performance stability of the existing muon detectors at HL-LHC. Moreover, we report on the outcome of simulation-based studies which describe the impact of the muon upgrades to the trigger and the reconstruction of muon physics objects.

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Session Classification: Wine & Cheese Poster Session

Track Classification: Detector R&D and Data Handling