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Upgrades and aging of the CMS muon system (12' + 3')

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The present CMS muon system operates three different detector types: in the barrel drift tubes (DT) and resistive plate chambers (RPC), along with cathode strip chambers (CSC) and another set of RPCs in the forward regions. In order to cope with increasingly challenging conditions various upgrades are planned to the trigger and muon systems.

In view of the operating conditions at HL-LHC, it is vital to asses the detector performance for high luminosity. New irradiation tests had to be performed to ensure that the muon detectors will survive the harsher conditions and operate reliably. The new CERN GIF++ (Gamma Irradiation Facility) allowed to perform aging tests of these large muon detectors. We present results in terms of system performance under large backgrounds and after accumulating charge through an accelerated test to simulate the expected dose.

New detectors will be added to improve the performance in the critical forward region: large-area triple-foil gas electron multiplier (GEM) detectors will already be installed in LS2 in the pseudo-rapidity region 1.6 < eta < 2.4, aiming at suppressing the rate of background triggers while maintaining high trigger efficiency for low transverse momentum muons. For the HL-LHC operation the muon forward region should 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 $|\eta| = 3$.

To continue triggering with the current performance in Run-2, the Level-1 Trigger will have to undergo a significant re-organisation, going from a subsystem-centric view in which hits in the DT, the CSC, and the RPC were treated separately to a merged treatment at the track-finding level.

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