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Longevity Studies of the CMS Muon System for HL-LHC

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During the upcoming years of the High Luminosity Large Hadron Collider (HL-LHC) program, the CMS Muon spectrometer will face challenging conditions. The existing detectors, which consist of Drift Tubes (DT), Resistive Plate Chambers (RPC), and Cathode Strip Chambers (CSC), as well as recently installed Gas Electron Multiplier (GEM) stations, will need to sustain an instantaneous luminosity of up to $5 - 7 \cdot 10^{34}$ $\mathrm{cm}^{-2}\mathrm{s}^{-1}$, resulting in increased pile-up, and about 10 times the expected LHC integrated luminosity. To cope with the high rate environment and maintain good performance, additional GEM stations and improved RPC (iRPC) detectors will be installed in the innermost region of the forward muon spectrometer. The CMS muon system upgrade program includes, together with the substitution of the on-detector and backend electronics of the existing detectors, accelerated irradiation studies performed at the CERN Gamma Irradiation Facility (GIF++) or with specific X-ray sources, in order to certify the detector performance for 10 years of operation under the harsh HL-LHC conditions. Furthermore, since RPCs and CSCs use gases with a global warming potential (GWP), ongoing efforts are being made to find new eco-friendly gas mixtures, as part of the CERN-wide program to phase out fluorinated greenhouse gases. This report presents the status of the CMS Muon system longevity studies, along with actions taken to reduce detector aging and minimize greenhouse gas consumption.

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