

Longevity study of CMS Muon Detector facing the High Luminosity LHC phase

Wednesday 3 July 2024 14:39 (1 minute)

The forthcoming High Luminosity LHC (HL-LHC) program presents a formidable challenge for the constituent elements of the CMS Muon Detector. Current systems, encompassing Drift Tubes (DT), Resistive Plate Chambers (RPC), and Cathode Strip Chambers (CSC), are tasked with operating under conditions of 5 times higher instantaneous luminosity than originally designed, demanding endurance for approximately 10 times the anticipated LHC integrated luminosity. Addressing the high-rate environment while preserving optimal performance, requires the incorporation of additional Gas Electron Multiplier (GEM) and improved Resistive Plate Chamber (iRPC) detectors in the innermost region of the CMS forward muon spectrometer. The performance of all subdetectors must ensure sustained operation in such extreme conditions. To meet these challenges, accelerated irradiation studies have been conducted across all muon systems, usually carried out at the CERN Gamma Irradiation Facility (GIF++). This presentation will provide an overview of the latest study results on the longevity of CMS Muon Detector systems after around 10 years of operation and following the extensive integrated charge exposure at GIF++. Furthermore, a preliminary overview of the detector's longevity during operation with ecologically friendly gas mixtures will be provided.

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Session Classification: Poster Session