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Highlights on Searches for Environmentally Friendly Gases in the CMS RPC System

The Resistive Plate Chambers (RPC) of the CMS experiment operate with a gas mixture composed of 95.2% $C_2H_2F_4$, a greenhouse gas with high Global-Warming Potential (GWP). In recent years, several eco-friendly alternatives, such as hydrofluoroolefins (HFOs), have been investigated to identify sustainable replacements that preserve the detector performance. Another promising approach is to partially substitute $C_2H_2F_4$ with CO_2, potentially reducing the GWP of the mixture by 30–40%. These studies are being carried out at the CERN Gamma Irradiation Facility (GIF++), which replicates the conditions expected during the High-Luminosity Phase-2 data taking at the Large Hadron Collider (HL-LHC), using an 11.5 TBq gamma source and a muon beam. This contribution presents updated results on the performance of two 1.4 mm gap RPC chambers operating with various eco-gas and CO_2-based mixtures under high-rate gamma irradiation. In addition, it highlights the latest results in aging studies, providing a deeper insight into the long-term behavior and stability of these alternative gas mixtures for the future of the RPC.

Secondary track

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