

Performance of new CO₂ based mixture in CMS Improved Resistive Plate Chambers in HL-LHC environment

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Resistive Plate Chamber (RPC) detectors in the Compact Muon Solenoid (CMS) experiment operate with a gas mixture comprised of 95.2% of C₂H₂F₄, that provides a high number of ion-electron pairs, 4.5% of iC₄H₁₀, that ensures the suppression of photon-feedback effects and 0.3% of SF₆, used as an electron quencher to further operate the detector in streamer-free mode. C₂H₂F₄ is known to be a Greenhouse gas with a global warming potential (GWP) of 1430. Several ECO-friendly alternatives to C₂H₂F₄ have been studied in the last few years. In this context, one short-mid term approach for the next years of the Large Hadron Collider (LHC) operation could be to focus on reducing the GWP of the RPC gas mixture by adding CO₂ in the place of C₂H₂F₄. The studies are done at CERN Gamma Irradiation Facility (GIF++) in the North Area of SPS, where a 13.6TBq radiation source and a muon beam from SPS are used to mimic the conditions of Phase-II of LHC. This work will present the performance of a 1.4mm gap RPC chamber with two different CO₂ based mixtures (30% and 40%) with a high gamma background, as well as the perspectives to start the aging campaign for the best mixture.

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