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Fluoride production in CMS Resistive Plate Chambers (RPC) and long-term aging studies

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The Resistive Plate Chambers (RPC) are gaseous detectors widely used in the muon trigger systems of LHC experiments. Gas mixtures based on HydroFluoroCarbon (HFC) components are generally used. The pollutants produced in the gas under high electrical discharge may accelerate the detectors aging, in particular the Fluorine ions (F-) produced in connection with Hydrogen Fluoride (HF) may damage the inner detector surface due to its high chemical reactivity. Dedicated measurements to estimate the HF production rate has been performed at the CERN Gamma Irradiation Facility (GIF++) operating a spare CMS-RPC detector at different background gamma rate and with different gas volumes changes. The HF trapped inside the detector gas volume has been also estimated. The HF deposited on the inner bakelite surface has been estimated operating the detector with pure Argon. The HF study results will be presented. In addition, in view of High Luminosity LHC (HL-LHC) period, a dedicated aging study is ongoing at GIF++, where few spare CMS-RPC detectors are exposed to an intense gamma radiation to estimate the impact of HL-LHC conditions, in order to confirm that the CMS-RPC system will survive to the harsher background rate expected at HL-LHC. The main detectors parameters (currents, rate, resistivity, etc.) are under monitoring as a function of the accumulated charge, and the performance studied with muon beam. After having collected a significant amount of the total irradiation preliminary results will be presented.

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