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Characterization of new RPC eco-friendly gas mixtures at GIF++

The Resistive Plate Chamber (RPC) is a parallel plate, gaseous detector with a wide range of applications in physics experiments at e.g. the CERN LHC collider and future, beyond LHC facilities.

In order to operate the detector in avalanche mode, the standard RPC gas mixture is based on $C_2H_2F_4$, which is characterized by a high Global Warming Potential (GWP) and therefore considered greenhouse gas (GHG). Recent European regulations demand the reduction of the GHG emissions and new alternatives have to be found.

The quest for a suitable eco-friendly gas is a multi-parameter problem that has to take into account several aspects: flammability, toxicity, handling hazards and matching with the available on-board detectors electronics. An interesting eco-friendly replacement gas has been identified in the form of HFO-1234ze and several groups have already characterized it for RPCs with different layouts.

A crucial point to be evaluated is the long term behaviour with eco-friendly gas mixtures under irradiation. For this reason, a collaboration among ALICE, ATLAS, CMS, CERN EP-DT and groups working at experiments beyond colliders was set up to investigate the performance of RPCs with eco-friendly based gas mixture under irradiation .

Several RPC detectors with different layouts have been tested at the CERN Gamma Irradiation Facility (GIF++), which provides an intense gamma source allowing to simulate the LHC experiments background radiation.

The RPC performance with eco-frienldy gas mixtures is being studied at GIF++ for different gamma rates. The detector longevity and the Hydrogen Fluoride (HF) production rate are under study as well and are evaluated as a function of the integrated RPC charge.

The long term program of the Collaboration and preliminary results on the detector performance and longevity will be reported in this talk.

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