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Characterization of Glass Multigap RPC Detector with alternative gas to R134a and SF6

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Glass Multigap Resistive Plate Chamber (MRPC) detectors are primarily used for their excellent time resolution properties in High Energy Physics and Tomography application. Typically, they are operated with a freon-based gas mixture containing C₂H₂F₄ (R134a) and SF₆, both greenhouse gases (GHG) with high global warming potential.

This study focuses on the construction and characterization of new prototypes of 4-gap glass MRPC detectors, along with their performance evaluation. The construction employs an alternative method for spacer placement, using one-side glued circular spacers, making the construction process easier.

The detector's performances with alternative gas mixtures will be presented. Initially, a partial substitution of the R134a with CO₂ and HFO will be considered, followed using NOVEC 4710 as an SF₆ alternative. The detectors are characterized with cosmic muons to evaluate efficiency, current, streamer probability, prompt charge, and cluster size.

Finally, the time resolution of the different gas mixture will be analyzed, using the combination of two MRPC and the PETIROC 2A front-end ASIC.

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