

## Workshop on Advanced Radiation Detector and Instrumentation in Nuclear and Particle Physics (Online)



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### In Search of an Eco-friendly Gas Mixture for Avalanche Mode Operation of RPC

*Tuesday, 26 October 2021 10:50 (20 minutes)*

The standard gas mixture for avalanche mode operation of Resistive Plate Chamber is prepared using a major proportion of R134a along with a small amount of  $i\text{-C}_4\text{H}_{10}$  as a photon quenching component. In addition, a minute amount of  $\text{SF}_6$  is used for streamer suppression. Both of the R134a and  $\text{SF}_6$  gases are known for their large global warming potential which casts harmful effect on the environment. In this work, we have proposed an eco-friendly gas mixture of Ar (5%):  $\text{CO}_2$  (60%):  $\text{N}_2$  (35%) for operating RPCs in avalanche mode and qualified the mixture with numerical simulation. Using a hydrodynamic model, developed by us, the detector efficiency and streamer probability for the proposed mixture have been simulated to study its suitability. To validate the numerical model, the simulated results using the standard gas mixture of R134a (95.2%):  $i\text{-C}_4\text{H}_{10}$  (4.5%):  $\text{SF}_6$  (0.3%) have been compared with the available experimental data of the same. To show the efficacy of the proposed gas mixture, the simulated efficiency and streamer probability have been compared to that of the standard gas mixture and other eco-friendly hydrofluoro-olefin (HFO1234ze)-based potential replacements. Addition of  $\text{SF}_6$  by a small amount and lowering of electronic threshold have been investigated as possible means to reduce the observed streamer probability for the proposed gas mixture.

#### What is your experiment?

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