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New gas mixtures for Resistive Plate Chambers operated in avalanche mode

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RPCs are widely used in the present LHC experiments, with gas mixtures usually made out of C2H2F4/i-C4H10/SF6 (the “standard mixture”). RPCs assure a nice overall performance, with efficiencies greater than 95%, time resolution of the ns order, and rate capability reaching 1kHz/cm2.
However, the standard mixture presents some drawbacks. As a first point, RPCs reach maximum efficiency at voltages greater than 9 kV, implying complex and expensive hardware. Moreover, HF is produced during operation and this may damage them. Finally, the standard mixture is close to the flammability, so all necessary cautions must be taken.
To overcome these problems, it was pointed out that a change in gas pressure would have an immediate effect on the RPCs operating voltage. In principle, operating RPCs at a pressure half of the atmospheric one, for instance, would result in reducing by a factor approximately two the operating voltage. This would overcome these three drawbacks, at least partially.
Since this is not a practical option, the idea is that adding He to the standard mixture would mimick a reduction in the total pressure, since this gas takes part only partially to the avalanche process. In this talk we will report on a series of tests made out using RPCs filled with the standard mixture to which increasing fractions of He were added. Plots about efficiency, time resolution, charge and all other relevant quantities are reported. The results are quite promising and demonstrate the validity of this approach, opening an original path for testing and optimizing a new set of gas mixtures.

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