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Progress Towards a Large-Area, Ultra-Low-Gas-Consumption RPC Detector

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Large Resistive Plate Chamber (RPC) systems have their roots in High Energy Physics (HEP) experiments at European Organization for Nuclear Research (CERN): ATLAS, CMS, ALICE, where hundred of square meters of both trigger and timing detectors, have been deployed. These devices operate with complex gas systems, equipped with re-circulation and purification units, which require the addition of quantities of fresh gas of the order of 6 $cm^3/min/m^2$, creating logistical, technical and financial problems. Recently, new EU legislation for the progressive phasing out of the main gas used on RPCs, Tetrafluoroethane C2H2F4, due to its high Global Warming Power (GWP) 1430, has further increased the pressure on these systems. This poses problems for existing experiments but especially for new ones where current solutions will most likely not be allowed.

In this communication, we present a new concept in the construction of RPCs which allows to operate the detector in a ultra-low gas flow regime. In this construction, the glass stack (sensitive part of the detector) is encapsulated in a tight polypropylene plastic box, which presents an excellent water vapor blocking properties as well as a good blocking to atmospheric gases. A detector module with almost 2 m^2 was operated for more than one month with a gas flow of less than 1 $cm^3/min/m^2$ in stable conditions.

The applications of this technology in high energy physics as well as in cosmic rays experiences are discussed. In particular, results are presented concerning a cosmic ray telescope equipped with four of such planes, for the precise monitoring of cosmic rays flux, but also with the capability to perform muon tomography are presented.

Collaboration

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