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Developmental Studies on the Performance Enhancement of Gas-Tight Resistive Plate Chambers (RPCs) for Muography Applications

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Muon-based radiography, also known as “muography”, is an application of particle physics based on muons naturally produced from cosmic rays in the upper atmosphere. Muography determines the average density of an object by measuring the muon flux passing through it and comparing it with a reference flux through the unobstructed sky.

In this talk, we report on the status of our development of a portable muon hodoscope built using glass-RPC detectors with an active area of $16\text{ cm} \times 16\text{ cm}$, featuring a readout strip with a pitch of 1.0 cm and a strip width of 0.9 cm. The goal of this project is to use this detector for muography applications in confined locations (e.g. underground tunnels or cramped rooms), with complex logistics that are common for field work in archaeology, cultural heritage studies and geophysics. Therefore, some of the most important design considerations are portability, compactness, low weight, low cost, autonomy and versatility.

As RPCs are gas detectors, leaks are a concern in confined spaces; moreover, we need to minimize refills. This leads to emphasis on assessing and minimizing the dependence on time of the detector performance metrics on timescales of hours, days, weeks or months. Thus, in this talk, we present our studies on the long-term stability of these detectors, covering aspects such as efficiency, time response, and gas stability, in addition to some preliminary results from an absorption muography study conducted with various objects to assess the feasibility and performance of the current version of the detector.

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