Performance testing of gas-tight portable RPC for muography application

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Muography is a technique used for scanning by analysis of muon interactions with a target object. The interactions occur through various mechanisms, with absorption and multiple coulomb interaction being the most prominent ones. Important applications of muography include anomaly detection for maritime security, monitoring of volcanic activity, scanning of monuments and artefacts to safeguard our heritage, etc. Muography provides non-destructive sub-surface imaging technique with high penetration power.

The accuracy of muography scans depend on several factors, with some of the important parameters being the tracking system geometry, the efficiency and position resolution of the muon tracking detector system. To address these factors, our study proposes the use of a gas-tight portable RPC detector for muon detection, offering a cost-effective solution with high efficiency and position resolution that can be scaled to a large area. Our portable RPC detector prototypes are currently undergoing testing for long-term operation to ensure gas stability, which directly affects RPC performance. These tests are critical to ensure the performance of the detector in the field environment. It is being developed for non-destructive inspection of relatively small volumes, such as archaeological artefacts, where conventional radiography methods are not feasible.

The portable RPC is currently tested with he same gas mixture as the CMS experiment at CERN and a 1D readout with a strip width and pitch of 0.9 cm and 1.0 cm, respectively. The electrodes are thin glass plates, each measuring 1.1 mm thick, coated with a thin layer of conductive paint, and placed inside an aluminium chamber with a 1 mm gap between parallel electrode plates,These detectors have been tested for various properties, such as the I-V curve (which gives information about the working voltage), efficiency with respect to the trigger from plastic scintillators, time response, and long term operation. To investigate the gas stability, performances are compared between gas-flow and sealed operations.