

Muon radiography of the Puy de Dôme by the TOMUVOL collaboration: status and prospects.

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Muons are elementary particles analogous to the electron but 200 times heavier. They are produced in the interaction of cosmic rays with the earth's atmosphere. High energy (above a few hundred GeV) atmospheric muons can travel through kilometres of rock. Therefore, they are a natural probe for scanning density distributions within large structures, like mountains or volcanoes.

TOMUVOL (TOMographie MUonique des VOLcans) is a French interdisciplinary collaboration of particle physicists and volcanologists. It aims to develop instruments and methods for a complete 3D muon tomography of volcanoes with high resolution (down to 10 mrad) and large scale tracking detectors. The ultimate goal is the construction and validation of an autonomous and portable radiographic device for volcano tomography, which can be used for studying their internal structure and monitoring active volcanoes. For these purposes, the project benefits from a reference site used as testbed: the Puy de Dôme (alt. 1464 m a.s.l.), an extinct 11000 years old volcanic dome in the Massif Central, south-central France. It has a remarkable composite structure with two domes originating from two subsequent eruptions, which occurred within a short time interval. Hence it is expected to exhibit an interesting and contrasted density structure.

We report on past and forecoming campaigns of radiographic measurements at the flank of the Puy de Dôme using prototypes detectors made of Glass Resistive Plate Chambers (GRPCs). First, the detectors used as well as the ongoing technical upgrades will be detailed. Secondly, we'll discuss the analysis and simulation tools developed for the radiographic reconstruction of the integrated density profiles. The first radiographic images of the volcano inner structure obtained through muon tomography are in agreement with standard geophysical measurements and show the outstanding potential of this novel imaging technique.