

Requirements for a survey system of active volcanoes based on muon radiography

jeudi 19 avril 2012 18:10 (20 minutes)

Muon imagery techniques, that use cosmic-ray muons generated in the upper atmosphere, are currently intensively being developed by several international groups to probe the internal structures of volcanic edifices to depths up to several kilometers. These techniques may be used to construct precise 3D models of rock density distribution, and, even more, its variation with time, within active volcanoes. The development and validation of this innovative imaging method are currently being pursued by the multidisciplinary TOMUVOL collaboration that involves both particle and astroparticle physicists, volcanologists and geophysicists. The next step of the project concerns the application of muon tomography to the monitoring of active volcanoes, when validated on the experimental site, the Puy de Dôme volcano (Massif Central, France).

To achieve this goal, the main challenge is the design, development and construction of a mobile instrument platform. Monitoring volcanoes using muon tomography is challenging, since it requires using cutting-edge particle physics detectors, previously used mostly in the laboratory, in harsh environments. The field muon telescope system has to be transportable, autonomous in energy and connected via a two-way communication channel (remote control of the system and data transmission). The definition of the specifications will constrain the project in all the technical aspects: the gas systems (for GRPC detectors), the design of the detectors, the autonomy in energy, the communication and data transmission, the instrument mobility and portability, the operation centre, the adaptation to local conditions, the design of the instrument platform prototype.

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Classification de Session: Technical developments for muon and neutrino imaging

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