

Prototype water Cherenkov detector measurements for muon tomography applications

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Muography is an imaging technique based on the detection of muons produced naturally in the atmosphere with applications in Volcanology, Archaeology, Civil Engineering, Homeland Security etc. Various types of background impact absorption tomography measurements at high zenithal detection angles. Trackers combined with Cherenkov detectors have been proposed as means for better background rejection especially for low energy muons and electrons.

Gaseous or water Cherenkov detectors are viable candidates for this. The first provides better energy discrimination while the latter seems more promising for operating outdoors, where most muon absorption tomography experiments take place. Detector stability can become an issue under varying and sometimes extreme weather conditions like the ones encountered around volcanoes for example.

We developed an innovative Cherenkov prototype in the IP2I-Lyon (CNRS-IN2P3, University Lyon-1) within the MEGAMu project funded by the ANR. The original aspects of this detector are two-fold : a fibers-based light collection system and an opto-electronics readout chain identical to the one used for the scintillator trackers. The interesting feature is the uniqueness of the readout chain for tracker and Cherenkov detectors that making it perfectly suited for field experiments with simple trigger and synchronisation schemes.

We present results of the first prototype designed and build in IP2I, installed in-between an hodoscope made out of muon detection matrices. We will describe the DAQ chain and the overall experimental setup. We will present results on the characterisation of the detector's response to muon tracks and the comparison with a dedicated simulation based on GEANT4 implementing the exact experimental geometry with a primitive simulated version of the Cherenkov detector prototype. Perspectives on the next phase of building a large Cherenkov detector of 1 m3 volume to be coupled with a muon telescope in the field are discussed.

Collaboration

Role of Submitter

The presenter will be selected later by the Collaboration

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