Contribution ID: **65** Type: **Poster**

A new detector to muon tomography for glaciers melting monitoring

Wednesday 6 September 2023 10:10 (10 minutes)

We present a design project for a muon tomography detector aiming to the monitoring of glacier thickness. The glacier melting process is not completely understood and is considered a hot topic in view of the global warming.
Muon Tomography is a widely used technique, employed to perform imaging of the inner structure of large objects, as volcanoes, container, and pyramids. This technique takes advantages of the muon flux reaching Earth surface ($\sim 70\ \mathrm{m}^{-2}\mathrm{s}^{-1}\mathrm{sr}^{-1}$). In case of glaciers, thanks to the different density of ice and rock, a directional flux measurement provides information on the bedrock-ice interface depth.

The goal of our project is the development of a detector able to measure the glacier thickness with short exposure time, and with a real time data taking and processing, in order to perform studies of the seasonal behavior, and the glacier melting trend through the years. The detector will also be operable in open-sky and be replicable. The foreseen design of the detector is based on scintillation fibers disposed organized in layers, and read by SiPMs driven by FERS boards (A5202), developed by CAEN s.p.a., that both supply and read the detectors.

In this contribution, we will show the results of a set of simulations aimed to optimize the detector design, and the foreseen performances of the designed detector. The angular resolution of the reconstructed muon tracks will be shown considering different configuration of the detector, together with a study of the dependence of the angular resolution with respect to the direction of the incoming particle. We will present also the result of the tests on the read-out chain, that are performed in collaboration with CAEN s.p.a.. Finally, we will present also the results of a full simulation that includes the detector and the profile of a real mountain.

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Session Classification: Poster Session I

Track Classification: Applications in Security & Environmental Imaging