Mt. Vesuvius

One of the most dangerous active volcanoes, located in the south of Italy near the city of Naples, with more than half a million people living in its high-hazard zone.

Over time, Mt. Vesuvius has undergone drastic changes in morphology due to its activity. Recent eruptions in its last period of activity caused the collapse of its caldera and the formation of the current crater. The summit cone is believed to have a layered structure of materials with different densities, which MURAVES aims to study.

MURAVES @ Mt. Vesuvius

The 3 MURAVES telescopes are housed inside a container located 1500m away from the crater summit. The electric power is supplied by a solar panel system on the container roof connected to an array of batteries.

4 concrete platforms and lead walls, for 3 detector configurations pointing towards Mt. Vesuvius and 1 collecting open-sky reference data.

Simulation chain

Performing a full Monte Carlo simulations chain for the MURAVES experiment and comparing the resulting data is essential in order to image a target and explore the different impacts of experimental limitations.

Measurement principle and initial datasets

The experiment aims at mapping the mean density of the matter crossed by muons in the traversal of the volcano, through the measurement of the muon flux that reaches the detector as a function of zenith (θ) and azimuth (φ). Its ratio with the muon flux measured in reference data (i.e. with the muon tracker pointing to open sky in the opposite direction) gives a muon transmission map:

$$T_{exp}(\theta, \phi) = \frac{N_{meas}}{N_{meas}} \cdot \frac{N_{real}}{N_{real}} = \frac{\int_{E_{min}}^{\infty} N_{\mu}(E) dE}{\int_{E_{0}}^{\infty} N_{\mu}(E) dE}$$

Preliminary analysis based on initial datasets (1-2 months of exposure time) from 2 out of 3 telescopes, each operated at two different working points corresponding to 2 SiPM temperature settings.

The measured flux obtained from these datasets is consistent with the expected muon flux evaluated using the PUMAS muon transport code.

Preliminary results

The visible cone was divided into 3 regions, further subdivided in left and right parts in order to measure possible asymmetries between the slopes of the volcano. A measurement of the density asymmetry (\(\rho_{right}/\rho_{left}\)) is obtained, indicating density asymmetry variations between different layers. More data are being accumulated, and a thorough assessment of possible biases is ongoing.

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References