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Tuning parametric models of the atmospheric muon flux in MUPAGE to data from the KM3NeT detector

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The muons produced by cosmic ray interactions in the upper atmosphere constitute the main background for underwater neutrino detectors such as KM3NeT (the Cubic Kilometre Neutrino Telescope), which is currently being deployed in the Mediterranean Sea at two distinct locations. Situated at different depths, the KM3NeT/ARCA and KM3NeT/ORCA detectors experience a different flux of muons, and thus are uniquely positioned to study their evolution and propagation from cosmic ray showers. It is imperative to the main physics goals of the experiment that the atmospheric muon background is modelled correctly, which aids in benchmarking and understanding the detector response to the constant flux of these particles.

In this study, the data from the KM3NeT/ORCA detector is used and compared with the Monte Carlo prediction from the MUPAGE (MUons from PArametric formulas: a fast GEnerator for neutrino telescopes) software package, which generates the energy spectrum, lateral distribution, and muon multiplicity of muon bundles according to a specific parametrisation. This parametrisation consists of many free parameters which can be tuned such that simulated physical observables in the detector agree with those measured in data. In this way, improvements to the data-Monte Carlo agreement are achieved by quantitatively comparing the level of agreement between simulated and measured observables in the KM3NeT detector.

Keywords

atmospheric muon background, KM3NeT; ORCA; ARCA; DU; Detection Unit; muon; neutrino; CR; Cosmic Ray; air shower; simulation; MUPAGE; Mediterranean Sea; underwater neutrino telescope; PMT; DOM

Collaboration

KM3NeT

other Collaboration

Subcategory

Experimental Results

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