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Comparison of the measured atmospheric muon rate with Monte Carlo simulations and sensitivity study for detection of prompt atmospheric muons with KM3NeT

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The KM3NeT Collaboration has successfully deployed the first detection units of the next generation undersea neutrino telescopes in the Mediterranean Sea at the two sites in Italy and in France. The data sample collected between December 2016 and January 2020 has been used to measure the atmospheric muon rate at two different depths under the sea level: 3.5 km with KM3NeT/ARCA and 2.5 km with KM3NeT/ORCA . Atmospheric muons represent an abundant signal in a neutrino telescope and can be used to test the reliability of the Monte Carlo simulation chain and to study the physics of extensive air showers caused by highly-energetic primary nuclei impinging the Earth's atmosphere. At energies above PeV the contribution from prompt muons, created right after the first interaction in the shower, is expected to become dominant, however its existence was not yet experimentally confirmed. In this contribution data collected with the first detection units of KM3NeT are compared to Monte Carlo simulations based on MUPAGE and CORSIKA codes. The main features of the simulation and reconstruction chains are discussed and presented. Additionally, sensitivities of both KM3NeT/ARCA and KM3NeT/ORCA to the prompt muon component are derived using CORSIKA code.

Keywords

CORSIKA; 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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