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Surface muons in IceTop

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IceTop, the surface component of the IceCube detector, has been used to measure the energy spectrum of cosmic rays from 1.6 PeV to 1.3 EeV. It was recently shown that the recorded data can also be used to measure the average density of GeV muons in the shower front at large radial distances (> 300 m) from the shower axis. The analysis is based on fitting the single muon peak in charge histograms build over many events. The single muon peak is theoretically well understood and stands out above the electromagnetic background at large distances. Since the analysis can be done in several radial intervals, we effectively extract the average muon lateral distribution function from data (μ -LDF). The amplitude of the μ -LDF is connected to the average mass of cosmic rays.

We will present the measurement of the μ -LDF for cosmic rays with energies from 1.6 PeV and to about 0.1 EeV and compare it to proton and iron simulations. By combining the μ -LDF with complementary mass-sensitive observables, we expect to significantly reduce systematic uncertainties in the inferred mass composition of cosmic rays due to theoretical uncertainties in hadronic interaction models.

Collaboration

IceCube

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