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Measuring the Muon Production Depth in Cosmic Ray Air Showers with IceTop

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IceTop, the surface component of the IceCube Neutrino Observatory, detects air showers initiated by cosmic ray nuclei and gamma rays. The ground level muons are correlated with the energy and mass of the primary particle. This correlation is enhanced by resolving those muons which are produced early in the shower. The muon production depth (MPD) is reconstructed as a function of muon arrival time at ground level and distance from the shower core. This technique is most efficient when there are numerous muons that can be separated from the electromagnetic component of the shower. We use CORSIKA simulations to study the ability of IceTop to reconstruct the MPD distribution as a function of the shower's impact point, energy, and zenith angle. We explore the improvement of the measurement of the primary particle energy and mass that the reconstructed MPD can provide.

Collaboration

IceCube

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