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Zenith-Angle-Corrected Energy Estimation for Cosmic Rays Above 1 PeV

The LHAASO-KM2A can precisely measure the shower sizes of both electromagnetic particles and muon content in cosmic-ray air showers. In this study, we present a method for estimating the energy of primary cosmic rays over a broad zenith angle range (0°–40°) with a consistent zenith-angle correction. This wide range zenith angle enhances cosmic-ray measurement statistics by significantly increasing the number of detected events. We report both the bias and energy resolution of our technique, with the bias found to be less than 5%. The all-particle energy spectrum derived from this method aligns expected energy spectrum. We further assess the systematic uncertainties arising from high-energy hadronic interaction models like QGSJETII-04, EPOS-LHC, and SIBYLL-2.3d on our energy estimation, covering energy from 1 PeV upward. This approach improves the high-energy spectrum reconstruction, primarily due to enhanced event statistics enabled by zenith-angle corrections.

Collaboration(s)

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