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Validation of Atmospheric Neutrino Flux via Cosmic Ray Muon Spin Polarization Detector (CRmuSR)

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Atmospheric neutrinos (ATNs) are widely studied in the context of neutrino oscillation parameter measurements due to a wide range of propagation baselines and neutrino energies. Determining parameters such as θ_{23} and Δm^2_{32} relies on precise experimental measurements of the atmospheric neutrino flux. The theoretical prediction of ATN flux significantly influences the accuracy of these results. Since ATNs are produced either through the production or decay of cosmic ray muons (atmospheric muons), cosmic ray muons serve as an ideal probe to investigate the production mechanisms of ATNs. By detecting the polarization of cosmic ray muons, we can extract the ratio of their parent particles, such as the K/π ratio. To achieve this, the research group at Sun Yat-Sen University (SYSU) has developed a novel detector system called the Cosmic-Ray Muon Spin Polarization Detector (CRmuSR). CRmuSR employs a modular design to reconstruct the momentum direction of cosmic ray muons and the spatial distribution of Michel electrons. With a time resolution superior to 2ns, the CRmuSR system offers high precision. Additionally, the modular design makes CRmuSR easily deployable as an array, potentially aiding future atmospheric neutrino experiments to investigate the ATN production process within an acceptable period.

Collaboration(s)

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