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Machine Learning-Based Trajectory Reconstruction for Cosmic Ray Analysis in the ISS-CREAM Experiment

The Cosmic Ray Energetics And Mass for the International Space Station (ISS-CREAM) experiment was designed to study high-energy cosmic rays on the ISS. The primary scientific goals of ISS-CREAM are to explore the origin, acceleration mechanisms, and propagation of cosmic rays with charges ranging from Z = 1 to Z = 26 in the energy range of approximately 10^{12} to 10^{15} eV. The instrument consists of a silicon charge detector (SCD) for charge measurements, a sampling tungsten/scintillator calorimeter (CAL) including a carbon target for energy measurement and high-energy triggering, top/bottom counting detectors for low-energy event triggering, and a boronated scintillator detector for electron-hadron separation. The hit position of an incident cosmic ray on the SCD is determined by backtracking from the CAL. Therefore, trajectory reconstruction from the CAL is crucial for obtaining the charge of cosmic rays. In this study, a Convolutional Neural Network (CNN) was developed and trained to reconstruct the cosmic-ray trajectories using two-dimensional projected hit information from the CAL. Using this machine learning method, cosmic-ray trajectories were reconstructed, and their hit positions on the SCD were determined. This presentation will discuss the trajectory reconstruction for the ISS-CREAM experiment using the CNN method.

Collaboration(s)

ISS-CREAM

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