Contribution ID: **952** Type: **Poster**

MC study of Bayesian unfolding for energy spectra of five mass groups using the Tibet AS gamma experiment

To investigate the mechanism responsible for the steepening beyond the knee, it is necessary to measure the energy spectra of individual nuclear elements. The Tibet ASγ experiment is designed specifically to observe the shower maximum around the energy of the knee. It employs a high-density air-shower array (Tibet-III) to measure the charged particles, designated by the sum of charged particle density Σρ, and a muon detector array to measure the total muon number ΣNμ. In this contribution, we report a Monte Carlo study for reconstructing the energy spectra of proton, Helium, Carbon group, Silicon group and Iron group assuming an observation by the Tibet AS gamma experiment.We applied a multidimensional unfolding method based on the Bayes' theorem to the two-dimensional distribution of Σρ and ΣNμ, and found that it is possible to determine the fluxes of individual nuclei. We also estimated the systematic uncertainties arising from the algorithm, choice of hadronic interaction models and composition models. We found that the choice of hadronic interaction models dominates the uncertainty to be +2%/-16% in P flux and +25%/-9% in Fe flux at 10^{6.37}GeV.

Collaboration(s)

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Session Classification: PO-1

Track Classification: Cosmic-Ray Indirect