Sensitivity of the Tibet hybrid experiment (Tibet-III + MD) for primary proton spectrum between 30 TeV and a few hundreds of TeV's

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What is this contribution about? This presentation is about the observational study of the chemical composition of cosmic rays in the "knee" region. In the Tibet ASγ experiment, we are currently measuring proton spectrum in the range of tens to hundreds of TeV.

What is it relevant/interesting? It is important to clarify the chemical composition of cosmic rays over wide energy range covering the "knee" for the study of cosmic-ray origin and propagation. Recent direct observations have revealed spectral fine structure of light nuclei up to about 10 TeV, and various ground-based air shower experiments have reported the proton spectrum beyond several hundred TeV including the knee. However, their results do not agree with each other at present. On the other hand, an intermediate energy between the direct observations and the ground-based observations is one of the regions where further observations are expected. We aim to clarify the proton spectrum in this energy range using Tibet-III in which the location at 4300 m above sea level leads to high detection efficiency and energy resolution.

What have we done? We have developed a proton spectrum measurement method using the Tibet-III air shower array and MD detector of the Tibet ASγ experiment. In this method, protons were selected using the difference in the number of muons in the air shower. The systematic error of the measurement was evaluated by Monte Carlo simulation.

What is the result? MC simulations of air showers were performed assuming two nuclear interaction models (Sibyll 2.3c+FLUKA and QGSjet-II-04+FLUKA) and two chemical composition spectrum (Shibata model (Heavy dominant) and Gaisser-fit model (Helium dominant)), and detector responses were calculated by Geant4. It is found that proton events can be sorted with 90% purity by a cutline depending on the number of muons, and the systematic error among these models is up to ±36%.