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Potential measurement of the primary cosmic-ray proton spectrum between 40 TeV and a few hundred TeV with the Tibet hybrid experiment (Tibet-III + MD)

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We are observing extensive air showers using the Tibet-III air shower array and the underground water-Cherenkov Muon Detector array (MD) to measure the chemical composition of cosmic rays around the knee energy region. We have developed a method to select air showers induced by primary protons with the energy between 40 TeV and 630 TeV by using the number of muons detected by the MD in each shower. The detector's sensitivity for primary proton spectra was evaluated by Monte Carlo simulations assuming different primary cosmic ray composition models and interaction models. Using the number of muons detected by the MD, it was found that the protons could be selected with 90% purity. The systematic errors including the model uncertainty is sufficient to study the shape of proton spectra. We will also report results from the analysis of observed data with the new method.

Collaboration name

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