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Optimization of gamma-ray energy estimation for the ALPAQUITA experiment

The ALPACA experiment, a new air-shower array in Bolivia to observe cosmic rays and gamma rays in the energy range between TeV to PeV, aims to survey PeVatron candidates in the southern sky, including the Galactic Center. The ALPAQUITA experiment, a prototype of ALPACA, has 97 scintillation detectors with an area of 1 m^2 and began data taking in April 2023.

In the ALPACA collaboration, the lateral distribution of air showers is used for the energy reconstruction of gamma rays. The lateral distribution is fitted using the NKG function, and the obtained function is used to determine the particle number density Sx at a distance x from the shower core. Then, energy is parameterized as a function of Sx and the zenith angle, which enables us to determine gamma-ray energies. In this presentation, we conducted Monte Carlo simulations of gamma-ray showers and formulated energy in the range of $x = 20 \sim 70$ m. We then evaluated the accuracy of energy determination and energy resolution using each function and selected the optimal Sx.

Collaboration(s)

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