

New methods to reconstruct X_{\max} and the energy of gamma-ray air showers with high accuracy in large wide-field observatories

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A new method to reconstruct the slant depth of the maximum of the longitudinal profile (X_{\max}) of high-energy showers initiated by gamma-rays as well as their energy (E_0) are presented. The method were developed for gamma rays with energies ranging from a few hundred GeV to around 10 TeV. An estimator of X_{\max} is obtained, event-by-event, from its correlation with the distribution of the particles' arrival time at the ground, or the signal at the ground for lower energies. An estimator of E_0 is obtained, event-by-event, using a parametrization that has as inputs the total measured energy at the ground, the amount of energy contained in a region near to the shower core and the estimated X_{\max} . Resolutions about 40 (20) g/cm² and about 30(20)% for, respectively, X_{\max} and E_0 at 1 (10) TeV energies are obtained, considering vertical showers. The obtained results are auspicious and can lead to the opening of new physics avenues for large wide field-of-view gamma-ray observatories. The dependence of the resolutions with experimental conditions is discussed.

Keywords

Very high energy gamma-ray; Wide-field observatory; Energy reconstruction

Collaboration

other Collaboration

Subcategory

Experimental Methods & Instrumentation

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