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A CORSIKA study on the influence of muon detector thresholds on the separability of primary cosmic rays at highest energies

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The precise determination of the number of muons in extensive air showers is a key issue for being able to separate showers that have been initiated by different primary particles. In the context of the planned upgrade of the Pierre Auger Observatory to improve muon detection capabilities, we have analyzed CORSIKA shower simulations at energies above 10^{18} eV to quantify expectations on the separability of primary particles. We find that an improved separation power, described in terms of the "merit factor", is achieved if muons at lowest energies are rejected, i.e. the detector energy threshold is set to ~ 1 GeV. In order to gain insight into the underlying physics of this surprising result, we have investigated shower-to-shower fluctuations and Poisson statistics driving the separability. Further, we have studied the characteristics of the particles preceding the muons in the shower development.

Collaboration

– not specified –

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