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Estimation of the invisible energy with the data collected by the Pierre Auger Observatory

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The determination of the primary energy of extensive air showers using the fluorescence technique requires an estimation of the energy carried away by particles that do not deposit all their energy in the atmosphere. This estimation is typically made using Monte Carlo simulations and thus depends on the assumed primary particle mass and on model predictions for neutrino and muon production.

In this work we review the method that the Pierre Auger Collaboration uses to obtain the invisible energy directly from hybrid events measured simultaneously with the fluorescence and the surface detectors of the Pierre Auger Observatory. As a corroboration of these results, a new method for the determination of the invisible energy using an independent dataset is also presented.
Both methods are based on the correlation of the invisible energy with the muon content of air showers and agree within systematic uncertainties, giving an estimation of the invisible energy that removes possible systematic uncertainties related to differences between the available high energy hadronic interaction models and data.

Presentation type

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