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Measurements of the Longitudinal Shower Development with the Pierre Auger Observatory

In this work we explain how the Pierre Auger Observatory measures and reconstructs the longitudinal development of air showers. The measurement of the energy deposit in the atmosphere by the detection of the emitted fluorescence light is going to be briefly reviewed and the reconstruction procedure is going to be explained in details. The two main outputs of this analysis are: a) the depth in which the shower reaches its maximum (X_{\max}) and b) the shower energy.

In this work we concentrate on the analysis techniques developed with the aim to evaluate the unbiased X_{\max} distributions. We show how using measured events it is possible to determine the depth ranges in which the detectors are able to measure an unbiased X_{\max} distribution. Using this analysis method we managed to obtain unbiased data without the use of shower and detector simulations. Another important point we are going to present in this work is how the detector resolution have been calculated and how they are taken into account in our final results. The analysis procedure explained here is a fundamental step in the composition studies and in the measurements of the proton-air cross section published by the Pierre Auger Collaboration.

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