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Abstract

The profile of the longitudinal development of showers produced by ultra-high energy cosmic rays carries information related to the interaction properties of the primary particles with atmospheric nuclei. In this work, we present the first measurement of the average shower profile in traversed atmospheric depth at the Pierre Auger Observatory. The shapes of profiles are well reproduced by the Gaisser-Hillas parametrization within the range studied, for $E>10^{17.8}$ eV . A detailed analysis of the systematic uncertainties is performed using ten years of data and a full detector simulation. The average shape is quantified using two variables related to the width and asymmetry of the profile, and the results are compared with predictions of hadronic interaction models for different primary particles.