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Measurement of the TeV atmospheric muon charge ratio with the full OPERA data set

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The OPERA detector, designed to search for muon- to tau-neutrino oscillations in direct appearance mode, is located in the underground Gran Sasso laboratory, a privileged location to study TeV-scale cosmic rays. Given the large rock depth and the detector's wide acceptance, the apparatus was used to measure the atmospheric muon charge ratio in the TeV energy region. The muon charge ratio, defined as the number of positive over negative charged muons, provides an understanding of the mechanism of multiparticle production in the atmosphere in kinematic regions not accessible to accelerators, as well as information on the primary cosmic ray composition.

We present the results obtained with the full statistics collected by OPERA from 2008 to 2012. The combination of two data sets with opposite magnet polarities allows minimizing systematic uncertainties and reaching an accurate determination of the muon charge ratio. Relevant parameters on the composition of primary cosmic rays and the associated kaon production in the forward fragmentation region are obtained.

Summary

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