Title

Detection and analysis of atmospheric muons using the ALICE detector at the LHC

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Abstract

ALICE is a general purpose experiment designed to investigate nucleus-nucleus collisions at the CERN Large Hadron Collider (LHC). Located 52 meters underground, with 28 meters of overburden rock, it has also been used to detect the muonic component of the extensive air showers produced by cosmic-ray interactions in the upper atmosphere. A program of cosmic-ray data taking, with specific triggers for atmospheric muons, was started in 2010 in periods when there is no beam circulating in the LHC. Several million events have been recorded to date. The large size and excellent tracking capability of the ALICE Time Projection Chamber are exploited to detect and reconstruct these muons.

In this talk the analysis of the multiplicity distribution of the atmospheric muons detected by ALICE between 2010 and 2013 is presented, along with the comparison with Monte Carlo simulations. Special emphasis is given to the study of high multiplicity events containing more than 100 reconstructed muons. The comprehension of the frequency of these events was an unsolved problem since the pioneering studies performed by ALEPH and DELPHI experiments at LEP. In our work the ALICE measurements show that such high multiplicity events demand primary cosmic rays with energy above 10^{16} eV. Their frequency can be successfully described by assuming a heavy mass composition of primary cosmic rays above this energy and using the most recent interaction models to describe the development of the air shower resulting from the primary interaction.