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Recent astroparticle physics results from ALICE-LHC at CERN

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Abstract
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ALICE is one of four large experiments at the CERN Large Hadron Collider. Located 52 meters underground with 28 meters of overburden rock, it has also been used to detect atmospheric muons produced by cosmic-ray interactions in the upper atmosphere. We present the multiplicity distribution of muons for these cosmic-ray events and their comparison with Monte Carlo simulation. This analysis exploits the large size and excellent tracking capability of the ALICE Time Projection Chamber. Special emphasis is given to the study of high multiplicity events containing more than 100 reconstructed muons and corresponding to a muon areal density larger than 5.9 m-2. Similar high muon multiplicity events have been studied in previous underground experiments such as ALEPH and DELPHI at LEP. While these experiments were able to reproduce the measured muon multiplicity distribution with Monte Carlo simulation at low and intermediate multiplicities, they failed to reproduce the frequency of the highest multiplicity events.
We demonstrate that the high muon multiplicity events observed in ALICE stem from primary cosmic rays with energies above 1016 eV. The frequency of these events can be successfully described by assuming a heavy mass composition of primary cosmic rays in this energy range and using the most recent hadronic interaction models to simulate the development of the resulting air showers. This observation narrows the scope to alternative, more exotic, production mechanisms for these events.

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