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# Strange hadron production in high-multiplicity hadronic collisions with cosmic ray monte carlo simulations for atmospheric air showers and beyond: simulation study

In this paper, we conduct a Monte Carlo simulation study to investigate the production of strange and multi-strange hadrons in high-multiplicity proton-proton collisions. Our objective is to refine and validate the hadronic interaction models crucial for air shower simulations such as EPOS, QGSJET, SIBYLL, and PYTHIA. These models play a pivotal role in predicting the propagation of extensive air showers in the atmosphere and comparing them with experimental data from cosmic ray observatories such as high-multiplicity proton-proton collisions in the ALICE experiment. In the case of (K0S) mesons, at low multiplicity classes, we found that EPOS and PYTHIA can show a better prediction of the data than QGSJET and SIBYLL, while QGSJET exhibits favourable predictions at higher multiplicity classes. On the other hand, when looking at ($\Lambda$) baryons, the EPOS model is the only model that shows the best comparison to data. In addition, We employ the Tsallis distribution to extract the effective temperature (Teff) and the non-extensivity parameter (q).

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