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Simulation study of cosmogenic particles and their correlations obtained at ground level

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Study of particle showers produced in the atmosphere due to the interactions of primary cosmic particles have provided a natural laboratory of physics of standard model and beyond standard model. While the showers encompass the physics of strong, weak and and electromagnetic interactions, the very first interactions are strong interactions producing hadronic showers which introduce the largest uncertainty in the estimates of particle yields. In this work, we made comprehensive study of air shower simulations using various combinations of hadronic models and particle transport code of CORSIKA package. The hadronic particles mostly pions and kaons decay to muons which are the most abundant charged particles at the Earth. We start with primary proton and alpha distributions as power law which are scaled to match the measured flux in balloon experiments at the top of atmosphere. The shower simulation includes production, transport and decays of secondaries upto the ground level. We provide a way to validate the simulation results using the ground based measurements namely, single and multiple muon yields and their charge ratios as a function of zenith angle and momentum. This provides a basis for comparisons amoung the six model combinations used in this study. We then use the best model to quantitatively predict the absolute and relative yields of various particles at ground level as well as their correlations with primaries and with each other.

Session

Astroparticle Physics and Cosmology

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