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Mean shower depth and interaction characteristics

The mean depth of shower is used for studying interconnection between shower longitudinal profile and hadronic interaction characteristics. The equations for the shower originated by high energy proton in the atmosphere are written and, within certain simplifications, solved for the case of logarithmically decreasing interaction length of hadrons in air.
The obtained expression explicitely splits into center of gravity of the purely electromagnetic cascade at the primary proton energy and modification of that by hadronic cascading and provides transparent view of the way in which hadronic interaction characteristics determine the longitudinal shower development.
Results of calculations for two hadronic generators QGSJETII-04 and EPOS-LHC
are compared with values obtained from shower simulations with use of CORSIKA.

Primary author: KHEYN, Lev (SINP MSU)

Presenter: KHEYN, Lev (SINP MSU)

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