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Estimation of the composition of the primary cosmic ray particles by measurements of the cosmic ray muon component

The primary cosmic ray particles constitute 85% protons, 12% helium, 3% iron, and heavier elements. They interact with the Earth's atmosphere, producing secondary particles known as Extensive Air Showers (EAS). Among the particles produced in EAS are pions and kaons, which subsequently decay into muons. Cosmic ray muons form the main part of cosmic ray particles that reach on the earth's surface. The lateral distribution of cosmic ray muon coincidences is often used to model and understand the development of the EAS in the earth's atmosphere. In this work, the lateral distribution of cosmic ray muons was investigated using two-fold coincidences. Four detectors were positioned at two-fold coincidence separated at regular intervals. The coincidence rate was between these detector stations was measured. The measured data was compared with Monte Carlo (MC) simulations of EAS. The EPOS and GHEISHA models were used for high and low-energy particle interactions respectively. The analyses indicate the following composition of primary cosmic ray: protons (81±0.01) %, helium (10±0.04) %, and iron and heavier elements (9±5.88) %. The knowledge gained from the lateral distribution of cosmic ray muons is essential for the understanding of the interaction of cosmic ray particles and the development of extensive air showers. Furthermore, this information enhances our understanding of the chemical composition of primary cosmic ray particles.

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