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Hybrid method for identifying mass groups of primary cosmic rays in the joint operation of IACTs and wide angle Cherenkov timing arrays

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The mass composition of cosmic rays in the hundreds of TeV energy range is purely measured and uncertain, because primary cosmic rays measurements on satellites requires a large area of detectors, but energy is too low for application of methods developed for EAS measurements. In this paper we consider a possibility to use the hybrid method originally aimed to gamma hadron separation in TAIGA experimrnt, to distinguish the diffrent mass groups among cosmic rays in the energy range 100 TeV- 500 TeV. The international gamma-observatory TAIGA (Tunka Advanced Instrument for cosmic rays and Gamma-Astronomy) is intended for ultra high energy gamma-ray astronomy (>30 TeV). It aims at combining the cost-effective timing-array technique with IACTs, allowing to reach a total area up to a few square kilometers and strong suppressing hadron background because of a very precise angular resolution (order of 0.1 degrees at the energy >100 TeV). Hybrid operation of both of these techniques can lead to a relatively cheap way of development of a large area array.

We analyze Hillas's parameters of images produced by different nuclei in IACT together with known arrival direction and shower core position, measured by Hiscore timing arrays. We show that hybrid method can be very effective for this task.

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