A STUDY OF THE CAPABILITY OF THE LHAASO EXPERIMENT TO SEPARATE PRIMARY MASS GROUPS SAMPLES

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THE DETECTOR

The Large High Altitude Air Shower Observatory (LHAASO) will be built in the Sichuan Province (China) at 4410 m a.s.l.

The experiment will be made by four detectors

1) KM2A
   - 5635 1 m^2 plastic scintillators, located on a triangular grid with 15m spacing
   - 1221 36 m^2 water cherenkov μ detectors, located on a triangular grid with 30m spacing
2) WCDA
   - 300x300 m^2 water Cherenkov detector
3) WFCTA
   - 24 wide field of view Cherenkov (and Fluorescence) telescopes
4) SCDA
   - 452 close packed burst detectors

Due to its very large coverage both for the electromagnetic ($5x10^3$ $m^2/10^6$ m^2= $5x10^{-3}$) and muon ($5x10^4$ $m^2/10^6$ m^2 = $5x10^{-2}$) EAS components LHAASO will be a very high resolution experiment

THE SIMULATION

CORSIKA

QGSJet II-04 (E > 200 GeV)

FLUKA (E < 200 GeV)

Electromagnetic component simulated with EGS4

No thinning

Energy threshold:

3 MeV (e & γ), 100 MeV (μ & hadrons)

Simulation performed for:

H, He, C and Fe primary particles

at fixed energies

10^{15}, $5x10^{15}$, 10^{16}, $5x10^{16}$, 10^{17}, $5x10^{17}$ eV

and vertical direction (θ=0°)

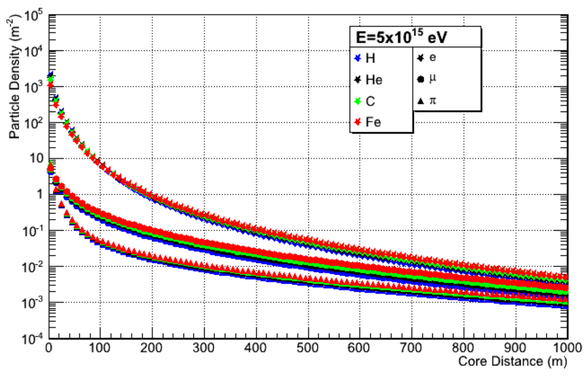
No detector simulation has been considered in the present work.

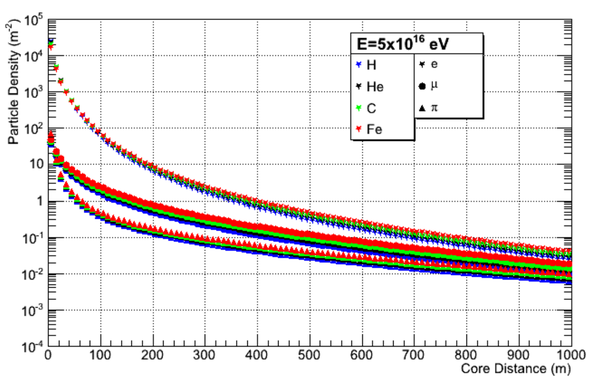
RESULTS

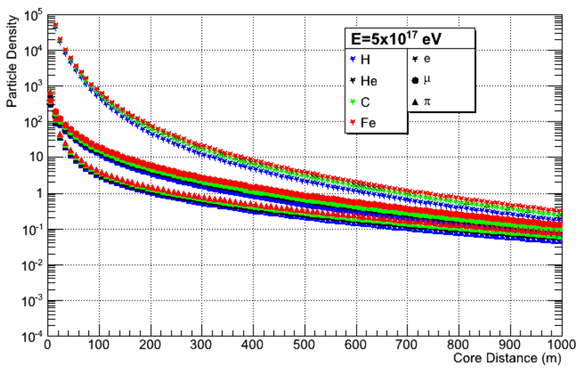
$e^{\pm}$, μ and π lateral distribution have been obtained at different energies.

$e^{\pm}$ density < 1 particle m^{-2} at ~200 m for $5x10^{15}$ eV and ~400 m for $5x10^{16}$ eV → radius containing the detectors fired in an event

For $5x10^{17}$ eV $e^{\pm}$ density > 10^4 particles m^{-2} (detector saturation) at 50 m from the shower core



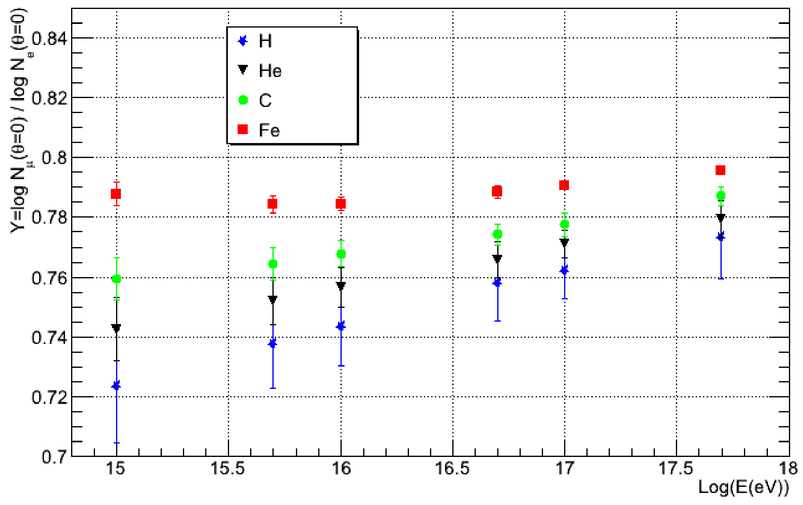




MASS GROUPS SEPARATION

A first attempt to evaluate the possibility of separating events in samples generated by different mass groups can be obtained studying the ratio between the total muon and electron numbers at observation level:

$$Y = \frac{LogN_{\mu}(\vartheta = 0)}{LogN_{e}(\vartheta = 0)}$$



Using this first, simple approach a clear separation between light and heavy primaries is expected.

Deeper investigations using all detectors included in the LHAASO experiment will be pursued to separate more than two mass groups.

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