

Cosmic ray mass composition at the *knee* using azimuthal fluctuations of air shower particles detected at ground by the KASCADE experiment

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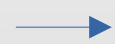


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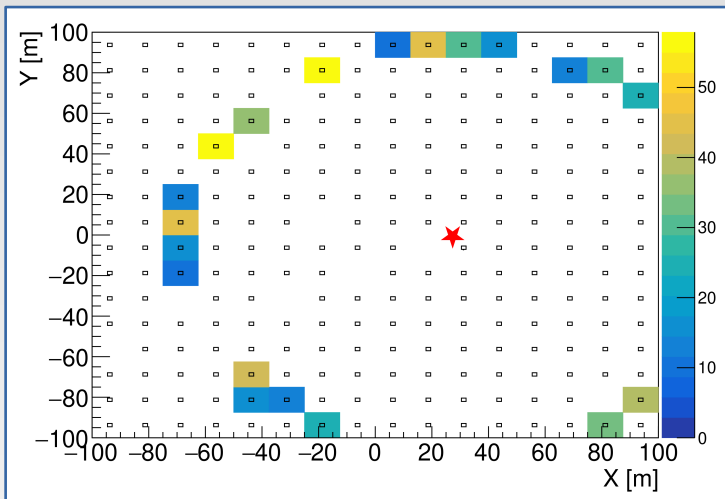
The LCm observable from EAS at PeV

- The LCm observable, $LCm = \log(C_k)$ [R. Conceição, *et.al.*, JCAP 10, 086 (2022)]

$$C_k = \frac{2}{n_k(n_k - 1)} \frac{1}{\langle S_k \rangle} \sum_{i=1}^{n_k-1} \sum_{j=i+1}^{n_k} (S_{ik} - S_{jk})^2$$



Accounts for the non-uniformity in the signal induced in detectors at a given distance from the shower axis in vertical showers.



The energy deposited in in e/ γ -detectors located in the radial range $r_k = [100 - 110]$ m of the 252-detector array of the KASCADE experiment.

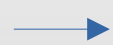


The KASCADE experiment @ KIT Germany.

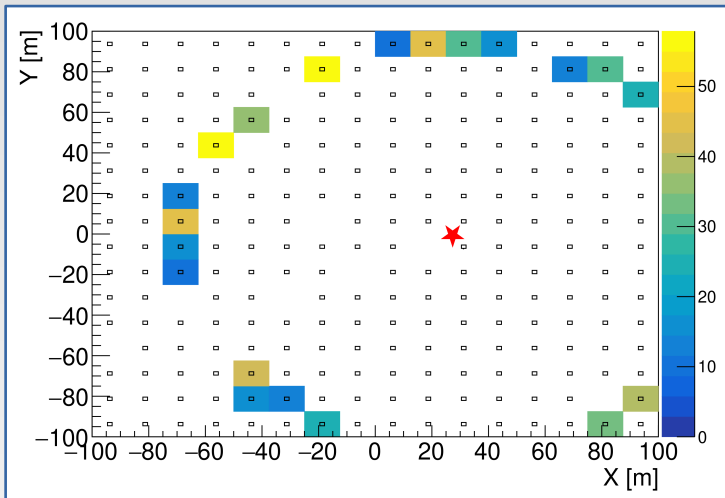
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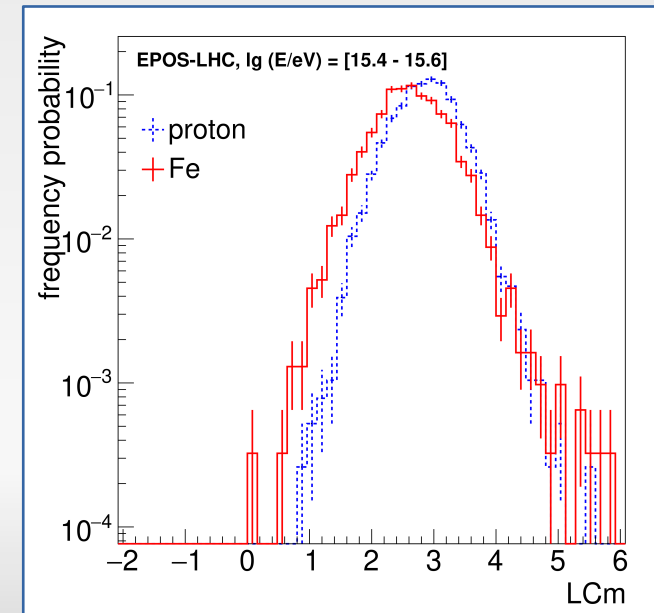
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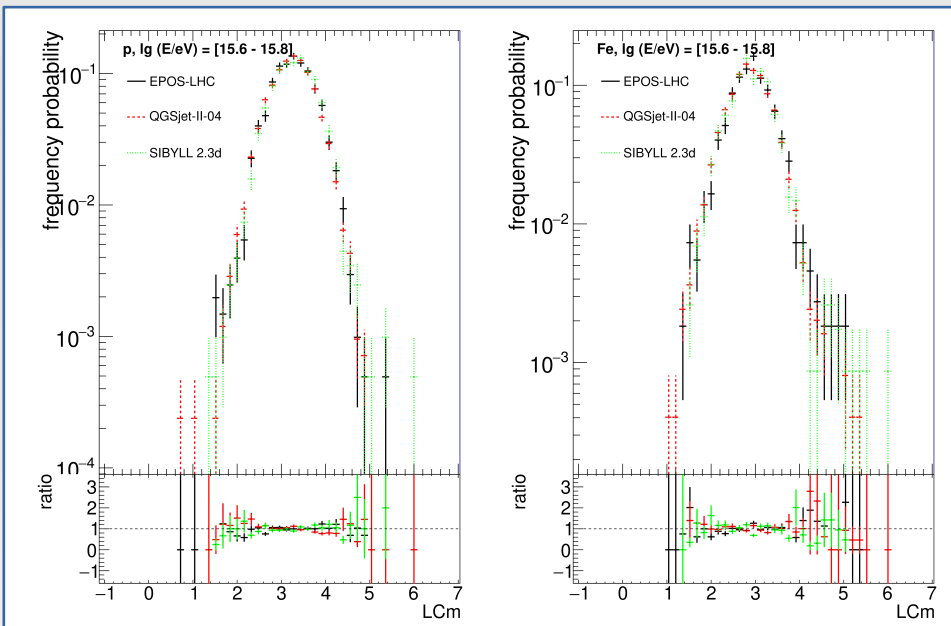
- LCm distributions from Monte Carlo simulations of KASCADE array (CORSIKA + CRES(GEANT 3) + KRETA)

- EPOS-LHC, QGSjet-II-04, SIBYLL 2.3d and FLUKA ($E_{lab} < 200$ GeV)
- (p, He, C, Si, and Fe)
- $\lg(E/eV) = [15.0 - 16.0]$ with intervals of $\lg(E/eV) = 0.2$
- $\gamma = -2.7$
- $\theta = [0^\circ - 20^\circ]$ and $\phi = [0^\circ - 360^\circ]$
- $10^3 - 10^4$ events / primary species / model in each energy interval



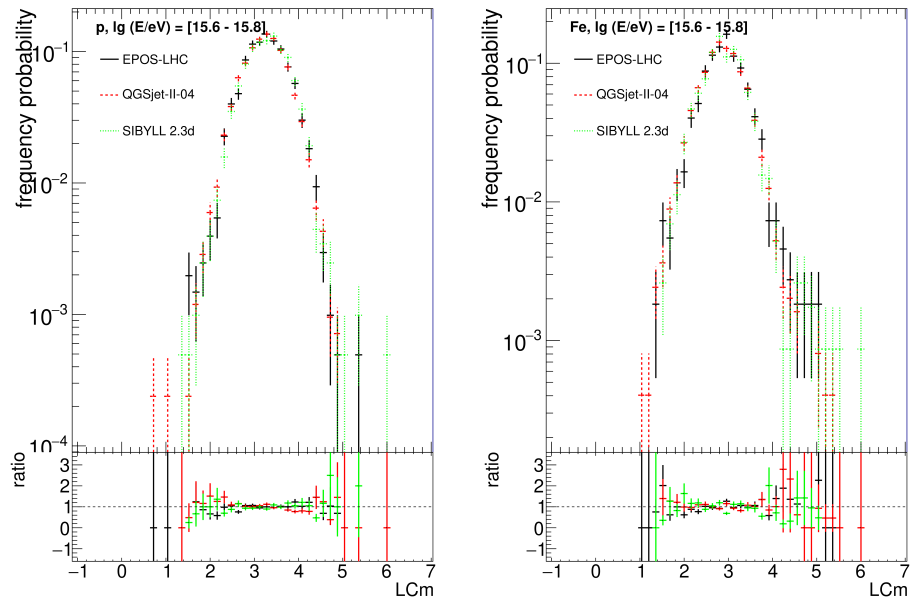
The LCm observable from EAS at PeV

- LCm dependence on hadronic interaction models



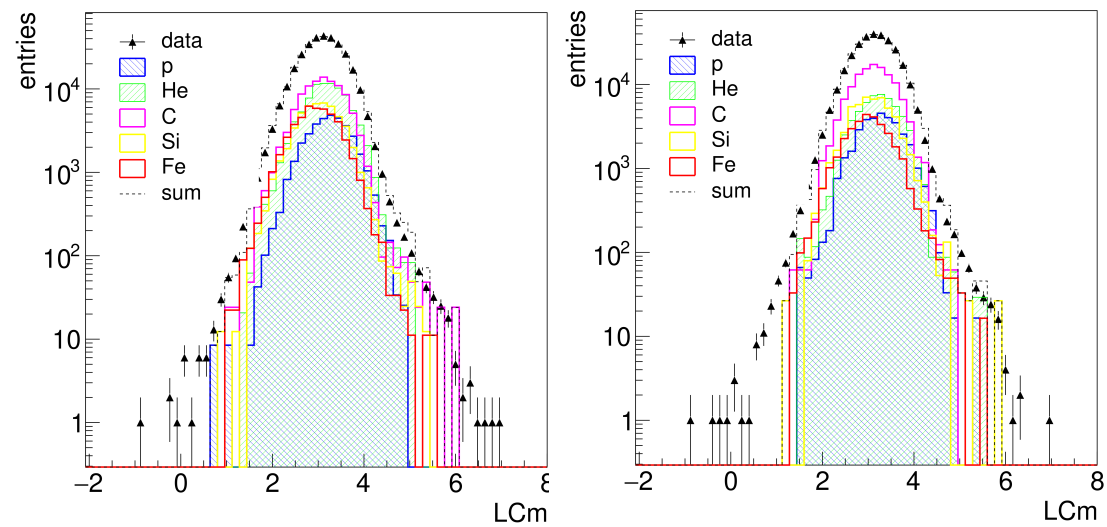
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- Fitting experimental LCm distributions with MC predictions

QGSjet-II-04 $\lg(E/eV) = [15.6 - 15.8]$ EPOS-LHC



Mass composition around the *knee*

