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New insights from old cosmic rays:

A novel analysis of archival KASCADE data

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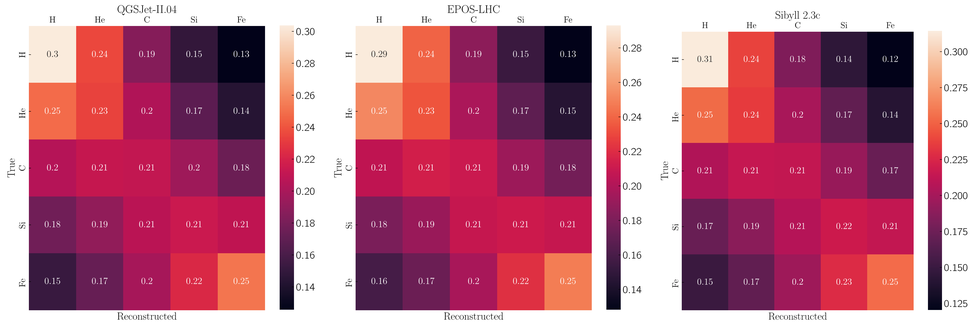
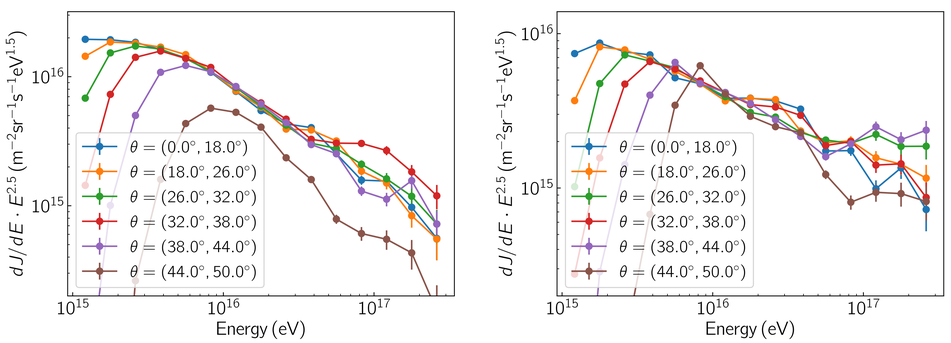
Method



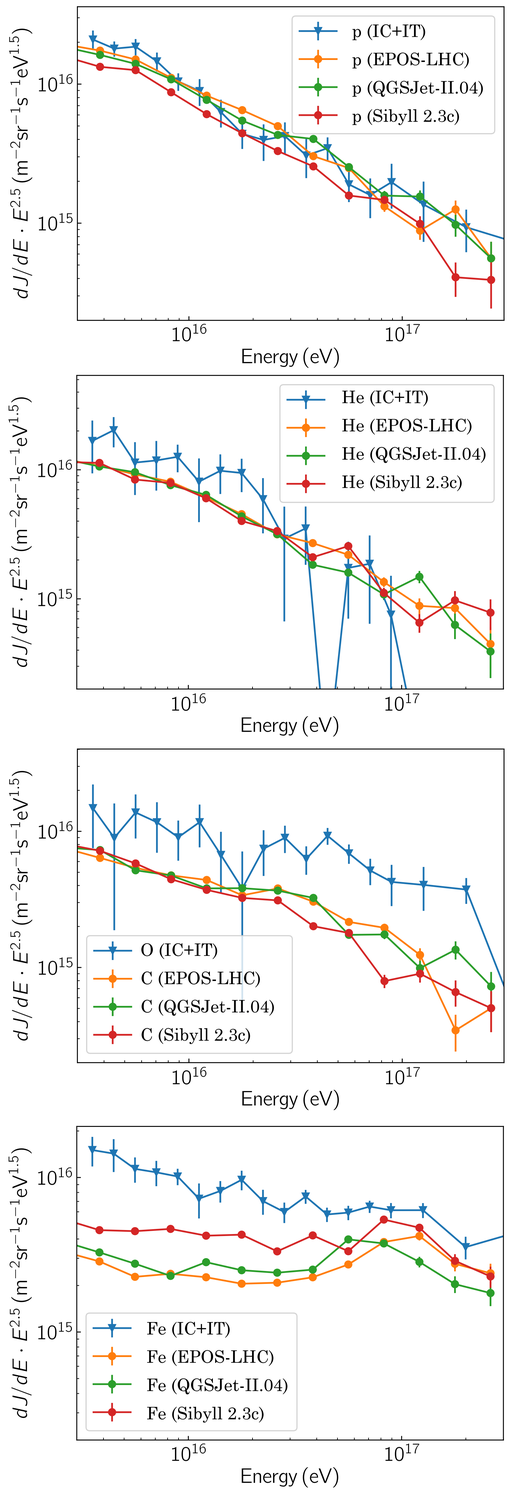
- KASCADE data from KCDC
- Random forest
  - Input: energy E; shower core coordinates (x, y); arrival direction (θ, ϕ); muon and electron numbers $\log_{10} N_\mu$, $\log_{10} N_e$; and shower age s
  - Output: primary particle: *H*, *He*, *C*, *Si*, *Fe*
- Modern hadronic models: QGSJet-II.04, EPOS-LHC and Sibyll 2.3c

Zenith angle systematics

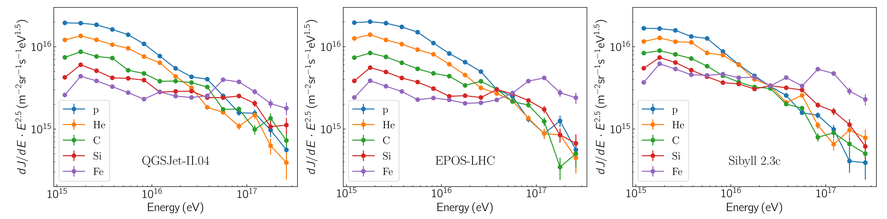


- Zenith bands are selected in order to obtain equal exposure for each curve
- Zenith angle cut might be accurately pushed from $18°$ to $\mathcal{O}(30°)$
- Thereby increasing the exposure by a factor $\simeq 3$

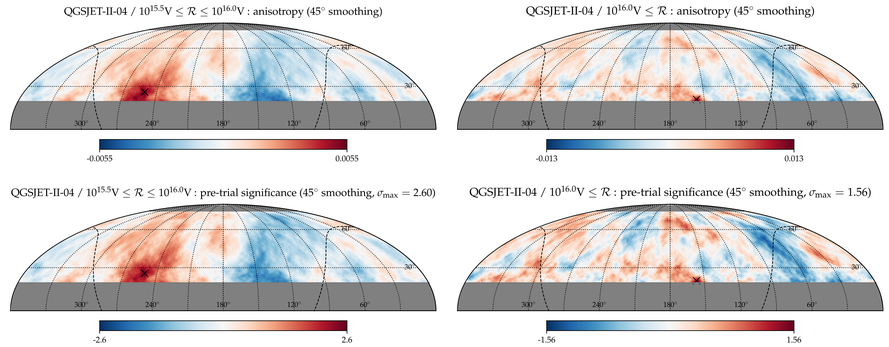
Comparison with IceCube & IceTop



Spectra by different hadronic models

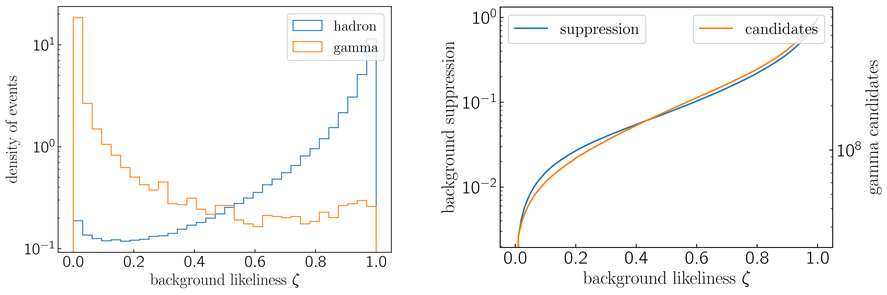


Anisotropy study



- Analisys the anisotropy of CR arrival direction in terms of rigidity for the first time
- We do not find strong evidence for large-scale anisotropies and place 90% C.L. UL on the dipole amplitude

Towards search for PeV photons



- Novel mass composition analysis based on archival data of the KASCADE
- Reconstruction of large-scale anisotropy of CRs as function of rigidity
- Room for improvement using station responses and KASCADE-Grande data
- Final goal: search for photons
- Software used in outreach and partly published in Jupyter Hub at IAP KIT