Contribution ID: **528** Type: **Talk**

Adjustments to Model Predictions of Depth of Shower Maximum and Signals at Ground Level using Hybrid Events of the Pierre Auger

Wednesday 14 July 2021 19:12 (12 minutes)

‘We present a new method to explore simple ad-hoc adjustments to the predictions of hadronic interaction models to improve their consistency with observed two-dimensional distributions of the depth of shower maximum, Xmax, and signal at ground level, as a function of zenith angle. The method relies on the assumption that the mass composition is the same at all zenith angles, while the atmospheric shower development and attenuation depend on composition in a correlated way. In the present work, for each of the three leading LHC-tuned hadronic interaction models, we allow a global shift ΔXmax of the predicted shower maximum, which is the same for every mass and energy, and a rescaling R_Had of the hadronic component at ground level which depends on the zenith angle.

We apply the analysis to 2297 events reconstructed by both fluorescence and surface detectors at the Pierre Auger Observatory with energies 10^18.5-10^19.0 eV. Given the modeling assumptions made in this analysis, the best fit reaches its optimum value when shifting the Xmax predictions of hadronic interaction models to deeper values and increasing the hadronic signal at both extreme zenith angles. The resulting change in the composition towards heavier primaries alleviates the previously identified model deficit in the hadronic signal (commonly called the muon deficit), but does not remove it. Because of the size of the required corrections ΔXmax and R_Had and the large number of events in the sample, the statistical significance of the corrections is large, greater than 5σ_stat even for the combination of experimental systematic shifts within 1σ_sys that are the most favorable for the models.

Keywords

Cosmic rays; mass composition; models of hadronic interactions; signal in surface detectors; depth of air-shower maximum

Collaboration

Auger

other Collaboration

Subcategory

Experimental Results

Primary author: Dr VÍCHA, Jakub (Institute of Physics of Czech Academy of Sciences)

Presenter: Dr VÍCHA, Jakub (Institute of Physics of Czech Academy of Sciences)

Session Classification: Discussion

Track Classification: Scientific Field: CRI | Cosmic Ray Indirect