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UHE Composition Measurement by Stereo HiRes Experiment

P. Sokolsky, Y. Fedorova and the Hires Collaboration
High Energy Astrophysics Institute, University of Utah, Salt Lake City, Utah 84112,USA
Presenter: C.C.H. Jui (ps@cosmic.utah.edu), usa-sokolsky-P-abs2-he14-poster

We present an update on the composition of Ultra High Energy Cosmic Rays (UHECR) as studied with the High Resolution Fly's Eye cosmic ray observatory (HiRes). Elongation rate and X*max* distribution results will be shown for our updated stereo data. Simulated data using the QGSJet01 and SIBYLL 2.1 hadronic interaction models will be used to predict elongation rates and X*max* distribution widths in the UHECR regime. These CORSIKA-generated EAS were incorporated directly into a detailed atmospheric and detector Monte Carlo.

1. Introduction

The distribution of positions of shower maxima (X*max*) in the atmosphere has been shown to be sensitive to the composition of cosmic rays. The rate of change of X*max* with the log of the energy of the primary energy, dX*max*/dlog(E.), is known as the elongation rate. Previous experiments [1,2] (stereo Fly's Eye, HiRes prototype-MIA) have shown evidence for an elongation rate of 80-90 gm/cm^2 in the energy rage from 10^{17} to $10^{18.5}$ eV. The HiRes experiment has published results on the elongation rate and Xmax distribution above 10^{18} eV, based on a limited subset of all available stereo data[3]. We will present an update on these distributions.

2. Methods

Data were collected in stereo from November 1999 to September 2004. For most events hourly atmospheric parameters are available and were used during reconstruction. If no measurement existed in the database, the events were reconstructed with the average atmospheric description. Periods during which the optical depth measurement was larger than 0.12, the operators' comments suggested bad weather, or the steerable lasers indicated that the aperture was cloudy were discarded. When the same cuts used on the data were applied to the Monte Carlo, the resolution was 30 gm/cm^2 in X*max* and 13% in energy. Results will be presented on comparison of the measured elongation rate and X*max* distributions to predictions from simulated data using the QGSJet and SIBYLL hadronic interaction models for Fe and p compositions.

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References

[1] D.J. Bird et. al., Ap. J. 424, 491 (1994); D. J. Bird et. al., Phys. Rev. D 47, 1919 (1993).
[2] T. Abu-Zayyad et. al., Phys. Rev. Lett. 84, 4276 (2000); T. Abu-Zayyad et al., Ap. J. 557, 686(2001).
[3] T. Abu-Zayyad et al., Ap. J. 622, 910 (2005).