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A Three-Point Cosmic Ray Anisotropy Method JOHN HAGUE, BERNARD BECKER, MICHAEL GOLD, JOHN MATTHEWS, U. New Mexico — The two-point angular correlation function is a traditional method used to search for deviations from expectations. In this paper we develop and explore a new three-point (shape-strength) method with the intended application being the search for deviations from isotropy in the highest energy cosmic rays. We compare the sensitivity of two-point and shape-strength methods for a variety of Monte-Carlo simulated (mock data) anisotropic signals. Studies are done with anisotropic source signals diluted by an isotropic background. Type I and II errors for rejecting the hypothesis of isotropic cosmic ray arrival directions are evaluated for four different event sample sizes: 27, 40, 60 and 80 events consistent with near term data expectations from the Pierre Auger Observatory. In all cases the ability to reject the isotropic hypothesis improves with event size and with the fraction of anisotropic signal. While ~ 80 event data sets should be sufficient for reliable identification of anisotropy in cases of rather extreme (highly anisotropic) data, much larger data sets are suggested for reliable identification of more subtle anisotropies. The shape-strength method consistently performs better than the two point correlation. Applying these methods to the 27 events above 57 EeV published by the Pierre Auger Observatory we find a 3 probability of isotropy using the two-point method and 0.2% probability using the shape-strength method.

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