

A Feldman-Cousins Likelihood Analysis of Soudan 2 Data for Atmospheric Neutrino Oscillations

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A bin-free Feldman-Cousins style likelihood analysis has been carried out on Soudan 2 atmospheric neutrino data. Reference is given to a full description of the statistical methods used.

A likelihood analysis scheme has been developed for the determination of neutrino oscillation parameters from atmospheric neutrino data using the Feldman-Cousins prescription [1]. The features that distinguish this analysis are;

1. the data are used without binning,
2. background events are fully integrated into the formalism
3. pdfs for the likelihood function are calculated by gaussian smearing of Monte Carlo and background data,
4. nuisance parameters (background fractions and data normalization) are determined in an integrated manner,
5. systematic errors in calibration, fluxes and cross-sections are incorporated in the Feldman-Cousins analysis and
6. the Feldman-Cousins scheme gives proper coverage for the 90% confidence region determination

and for the discrimination against the no oscillation hypothesis.

The resultant 90% confidence levels on the oscillation parameters were shown and it was demonstrated that the data agreed with the expected sensitivity of the data and that not using the full Feldman-Cousins procedure would have seriously underestimated the allowed region.

Full details of the analysis are given in reference [2], including the full mathematical formalism.

References

- [1] G.J.Feldman and R.D. Cousins, Phys. Rev. D**57**,3873 (1998).
- [2] M. Sanchez *et al*, Phys ReV D**68**, to be published, and hep-ex/0307069