Validation of parameter estimation in 3+1-flavor long-baseline neutrino oscillations at NOvA

Scientific Achievement

<u>Demonstration</u> of the Feldman-Cousins (FC) approach in a covariance matrix-based fit framework using the 3+1-flavor sterile neutrino oscillations model

Significance and Impact

We have extended the previous 3-flavor, extrapolation-based NOvA analyses to a 3+1-flavor model, introducing 4 additional free oscillation parameters. Results of our study indicate the paramount importance of the FC approach in order to obtain maximally precise measurement of sterile neutrino parameters

Research Details

- 110K NERSC hours for test, <u>full run in July</u> 2019
- <u>5x faster</u> than current method of systematic uncertainty handling
- Over 500 pseudo-experiments are computed at each point in parameter space to determine the empirical statistical distribution
- <u>This is a new approach to parameter estimation within NOvA, enabling higher dimensions to be incorporated into calculations.</u>
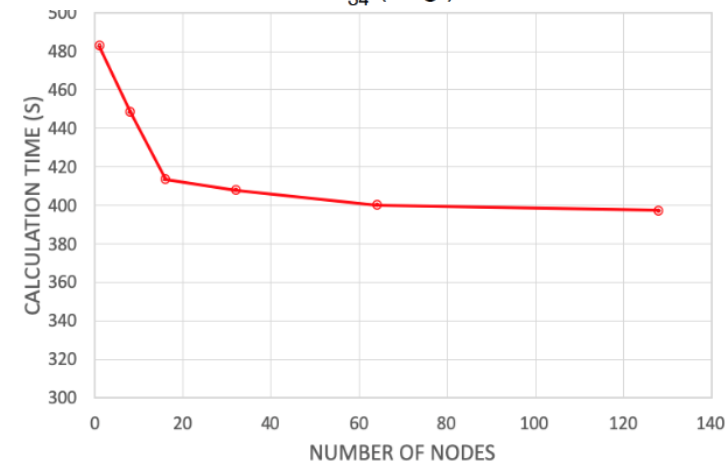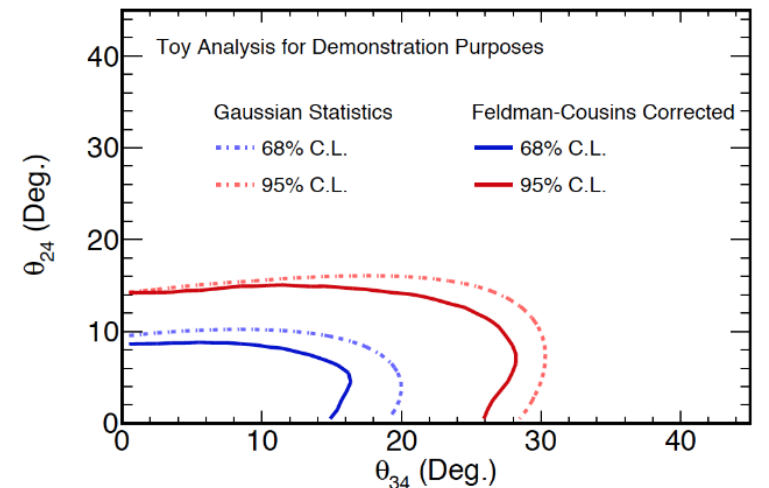
Toy Demonstration of FC approach in a 3+1-flavor covariance matrix fit: (Top) Effect of the FC approach on selected intervals of fixed confidence level; (Bottom) Calculation time as a function of number of nodes used.