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Accelerating Calculation of Confidence Intervals for NOvA's Neutrino Oscillation Parameter Estimation with Supercomputers

NOvA is a world-leading long-baseline neutrino oscillation experiment. Probes of neutrino and antineutrino oscillations in the NuMI beam enable precise measurements of the atmospheric oscillation parameters, determination of the mass ordering, and constraints for the CP-violating phase. Additionally, NOvA is probing sterile neutrino mixing and setting stringent constraints on sterile model parameters.

Constructing statistically correct confidence intervals is challenging. NOvA follows the computationally-expensive Feldman-Cousins (FC) prescription to ensure correct statistical coverage with test-statistics distributions constructed empirically, requiring generation and fitting of $\mathcal{O}(10^6)$ pseudo-experiments. In this poster, we present techniques and tools developed by the NOvA and the DOE SciDAC-4 "HEP Data Analytics on HPC" collaborations to leverage the power of supercomputers to determine NOvA's FC-constructed confidence intervals. This new framework reduces the time necessary to produce statistically robust results from several months down to a few days.

Mini-abstract

NOvA uses supercomputers to produce neutrino oscillation results over 50 times faster than before.

Experiment/Collaboration

NOvA, SciDAC-4

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