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Searches for New Physics in the Short Baseline Neutrino Program at Fermilab with SBNfit

SBNfit is a software framework designed for the purpose of performing simultaneous fits across data from multiple, correlated distributions. Although extremely modular and generic, an ideal application is the searches for new physics at the Short Baseline Neutrino (SBN) experimental program at Fermilab. SBN comprises three experiments: MicroBooNE, SBND, and ICARUS, each of which can perform measurements of neutrino event rates at a distinct distance from the neutrino source in the Fermilab Booster Neutrino Beamline. Since each detector shares the same neutrino flux and argon cross-sections, these measurements are highly correlated. These correlations can be further exploited to reduce systematic uncertainties by performing multiple side-by-side channel fits, allowing us to ask deeper questions about the underlying physics behind our observations. We explore this with a case study of how a muon neutrino sample can be used to constrain backgrounds in electron neutrino appearance studies.

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