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GUNDAM: a pioneering universal tool for long-baseline neutrino oscillation experiments

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Long baseline neutrino experiments are moving toward precision measurements of the oscillation parameters; namely the CP violation phase, the mass ordering or the octant of θ_{23}. This means systematic uncertainties must be reduced to few percent level, especially those related to neutrino interactions. This is usually done by using near detector data to constrain theoretical models. As a result, statistical analyses for neutrino interaction model tuning and neutrino cross-section measurements now involve near a thousand nuisance parameters with increasingly more complex functions for propagating systematic errors. In addition, combined experiment analyses carried out recently have revealed the crucial need for developing common software tools for achieving the next world leading measurements of oscillation parameters. In the context of the upgrade of the near detectors of T2K, we designed a pioneering open-source tool called GUNDAM, standing for Generalized and Unified Neutrino Data Analysis Methods. Its ambition is to provide a universal software suite for performing any statistical analysis. Its unique structure allows physicists to compose their own analysis without editing the source code i.e., only using a set of configuration files and inputs. The T2K collaboration is now using GUNDAM as its main frequentist fitter for performing model tuning and cross-section analyses at the near detector. This poster presents the main features and design of GUNDAM, as well as its most recent achievements with T2K data. Upcoming functionalities will be advertised, such as Bayesian MCMC engine or the perspective of performing a full oscillation analysis, using simultaneously the near and the far detector data.

Poster prize

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