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GNA: new framework for statistical data analysis

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Measurement of the physical parameters is usually done by fitting a numerical experiment model to the data. High precision experiments require detailed models with a large number of uncertain parameters. The models should be computationally efficient. In the same time they should be flexible enough since the analysis preparation requires a lot of testing.

We are solving these problems by introducing the GNA framework. The computational model in GNA is represented by a directed acyclic graph. Each node is an operation on an array (matrix multiplication, reweighting or even cross section calculation) implemented in C++ for efficiency. The model is then assembled by connecting the nodes, outputs to inputs. The assembly is done within Python. Such an approach enables the user to build complex but flexible and efficient lazy evaluated models. GNA offers tools for handling large number of parameters with uncertainties and correlations, fitting and statistical analysis.

GNA states for "global neutrino analysis" and is originally developed for the application for the neutrino physics for the data analysis of such experiments as Daya Bay, JUNO and NOvA.

Primary authors: Ms FATKINA, Anna (JINR); Mr TRESKOV, Konstantin (JINR)

Co-authors: Dr NAUMOV, Dmitry (JINR); Dr GONCHAR, Maxim (JINR)

Presenter: Ms FATKINA, Anna (JINR)

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