Joint fits with CAFAna

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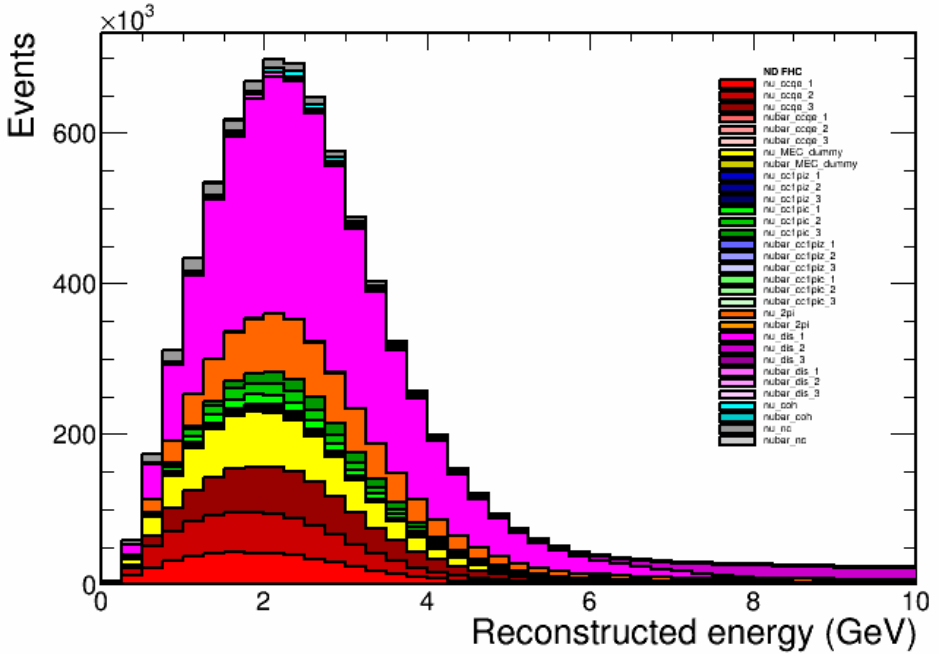
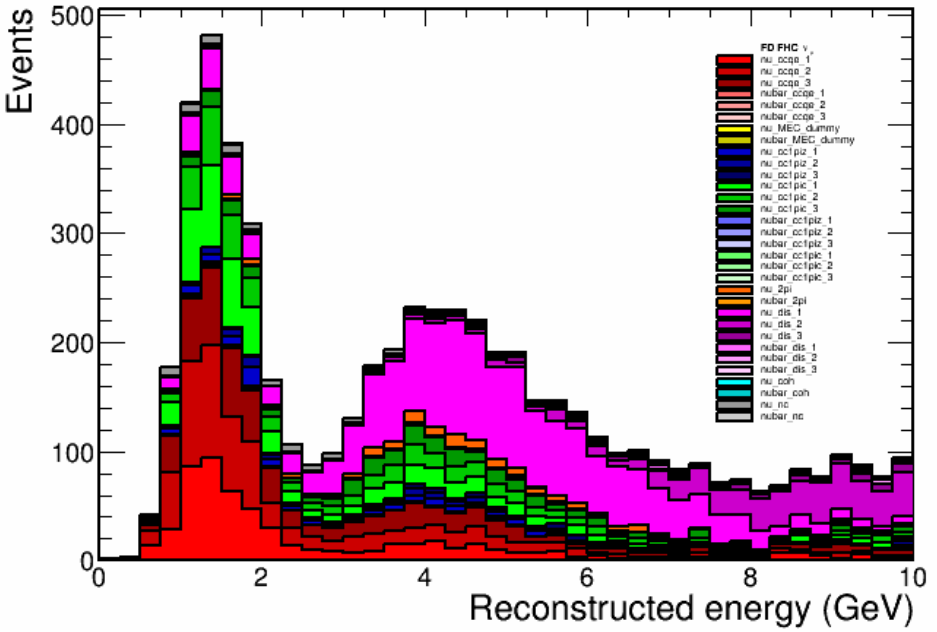
ND+LBL meeting
5 May, 2017

Goals & Progress

- Goal: use NOvA's CAFAna framework for DUNE
- Added functionality to perform ND+FD joint fits over all FHC+RHC samples
- Integrated NDTF outputs into CAFAna – using FGT files, flux and XS covariance matrices, FD MVASelection files
- In progress:
  - Add ND detector systematics, run with many ND configurations
  - With help of MSU group, generate fake data samples with NEUT or NuWro

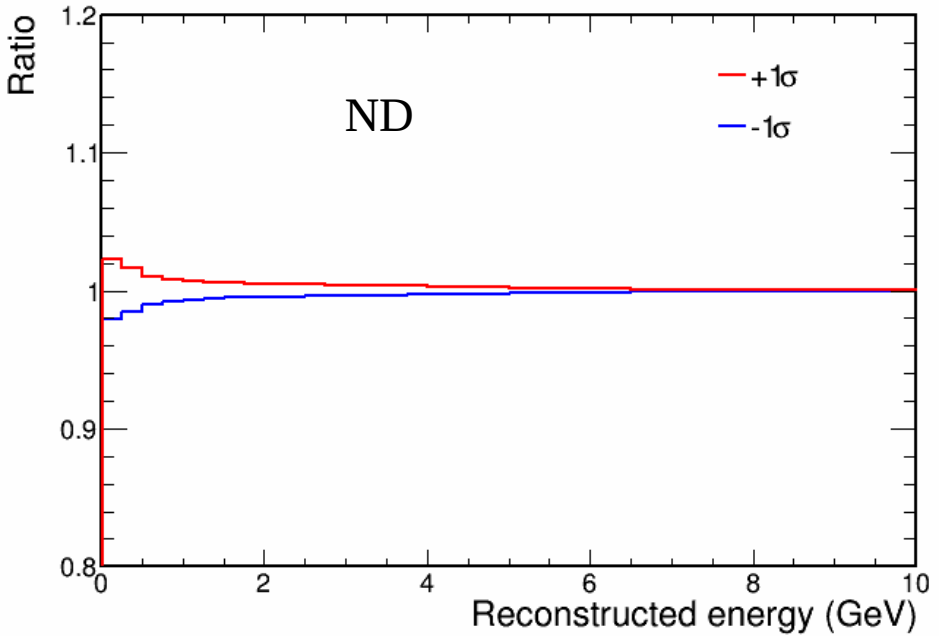
Sample examples

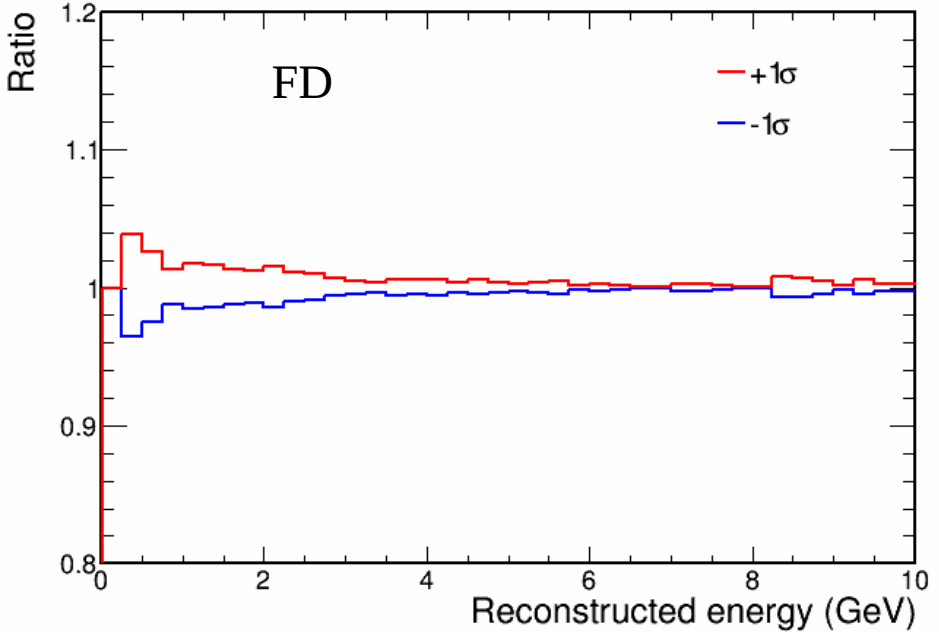




- FHC ν_μ selected events at ND (left) and FD (right)\
- Divided into categories based on XS uncertainties used by NDTF

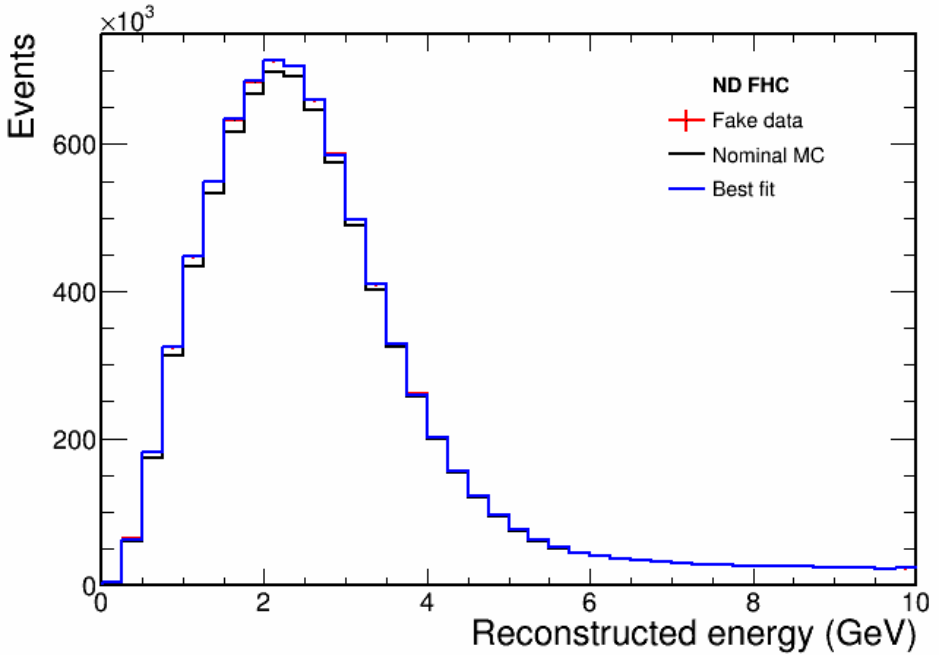
Effect of XS systematics: low-Q^2 CCQE shown

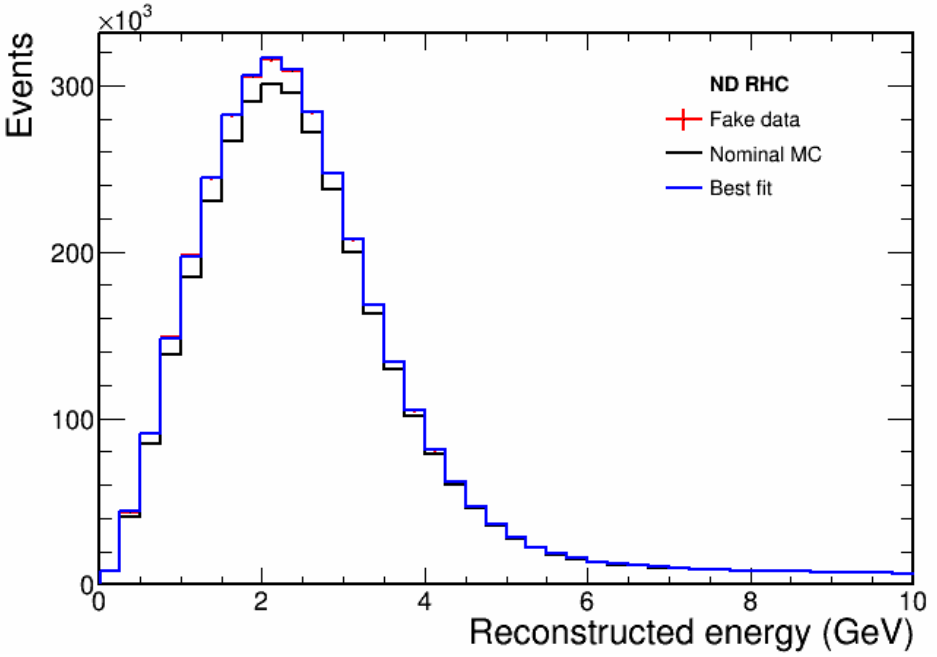




- Have these plots for 32 systematics and 6 samples
- Easy to turn on and off parameters in the fit

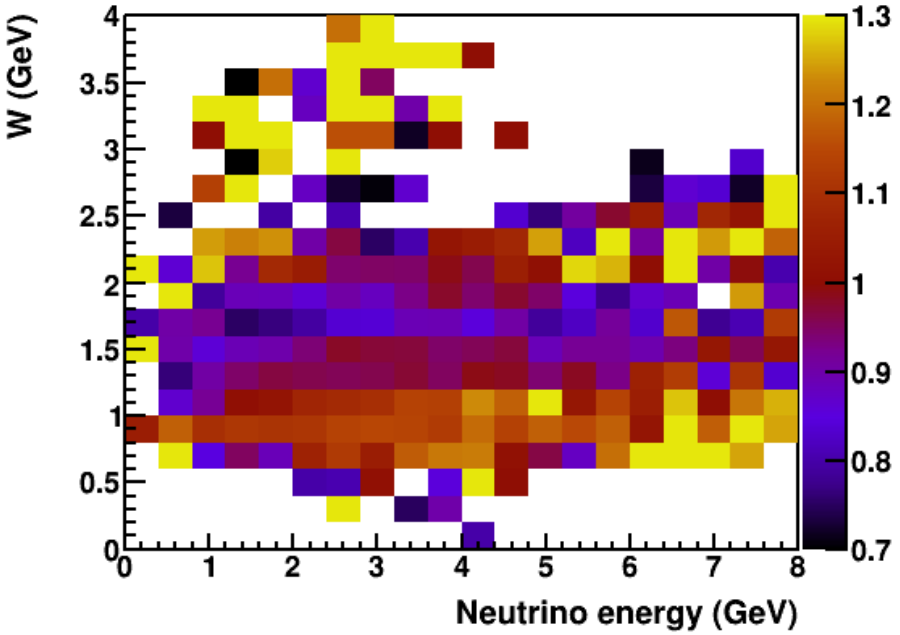
Fit sanity checks

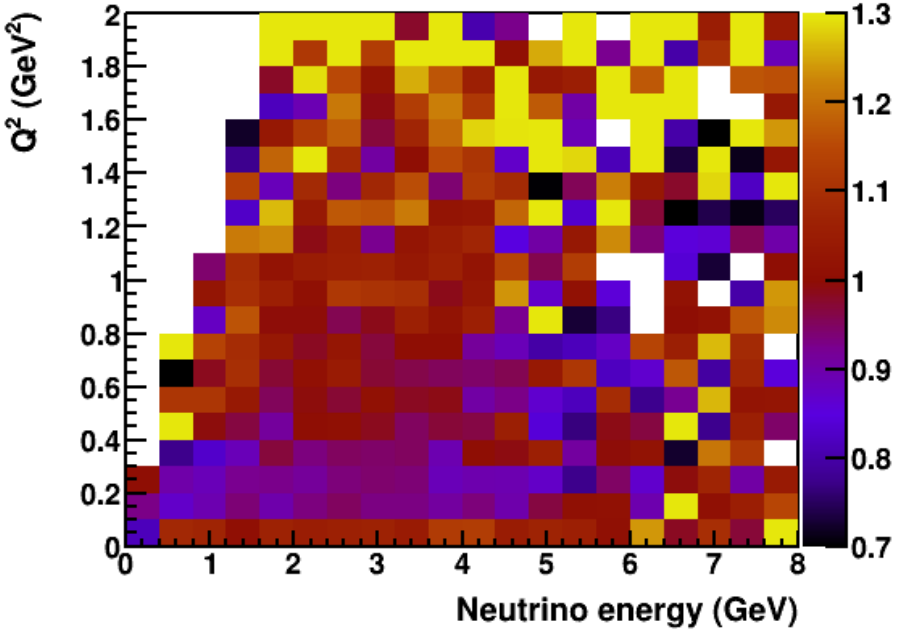




- Can vary XS parameters and fit them out

Use of other generators for fake data





- Shown is NEUT/GENIE ratio
- Limited in what kinematics we use by what is available in FD files
- Also have NuWro available
- Runs fine, but there is still 1 bug I can't figure out