

## Ifit Status

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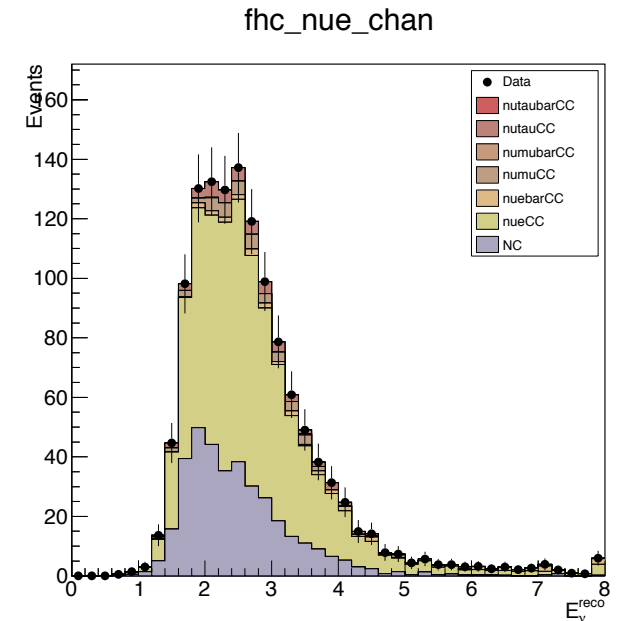
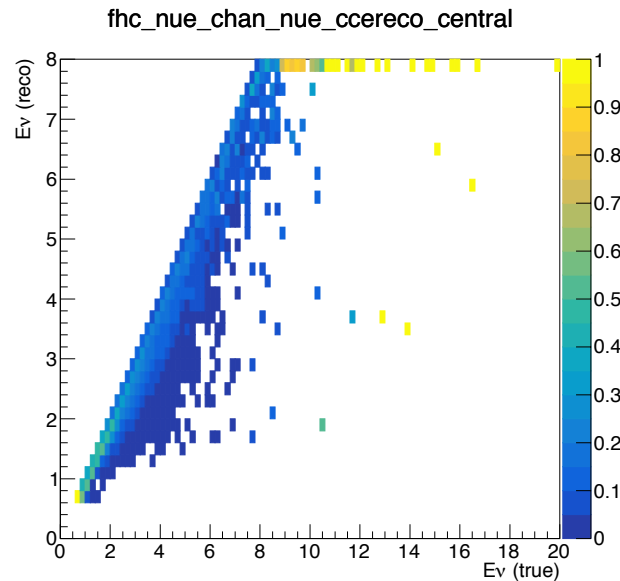
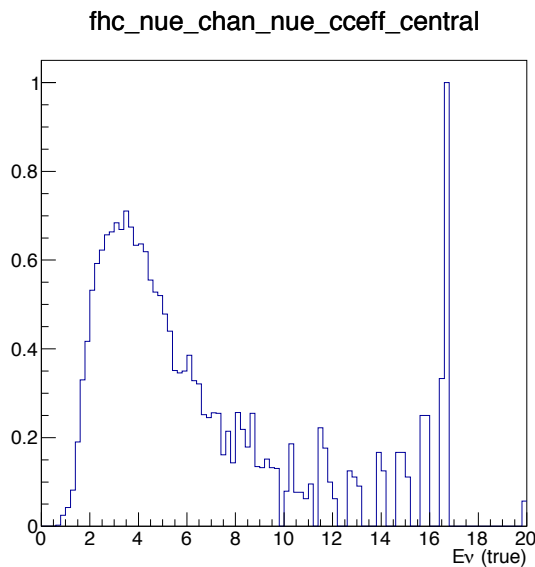
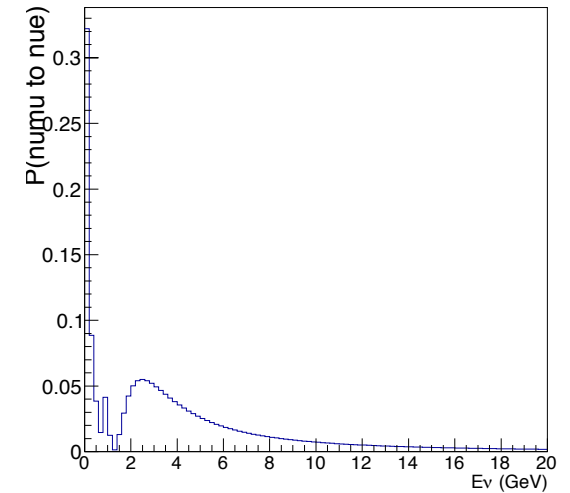
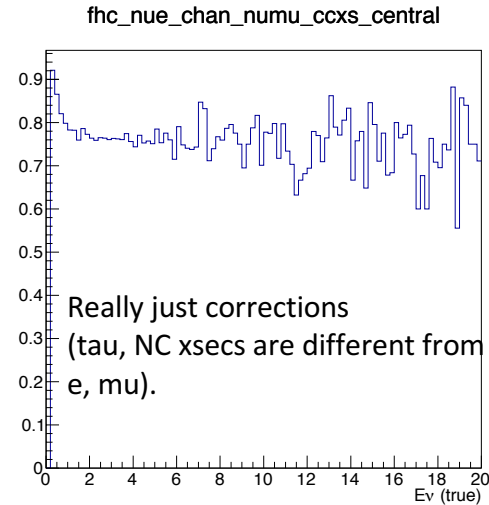
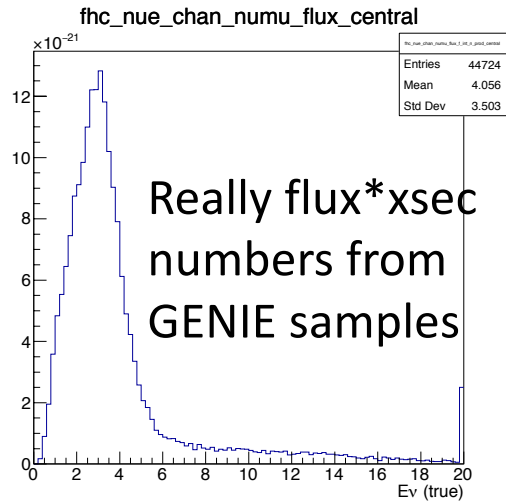
DUNE Joint LBL/ND Software Meeting

May 5, 2017

# lfit features

- Separate code that runs fit and prepares inputs
  - Fit code:
    - compute  $\text{flux} \times \text{cross-section} \times \text{osc-prob} \times \text{eff} \times \text{ereco}$
    - Osc probs computed with Prob3++
    - apply systematic uncertainties
    - Calculate  $-2\ln L$ , run fit
  - Input code: histograms of flux, cross section, eff, ereco, systematics  
Most physics-specific stuff is in here. Fit code can remain general.  
Ideal for extensibility to exotic models, many channels/detectors, etc.
- Code checked into dunelbl repository: lfit.C, lfit.h, prep1.C

# $\nu_e$ CC Channel: Flux, Xsec, Osc, Eff, Eereco

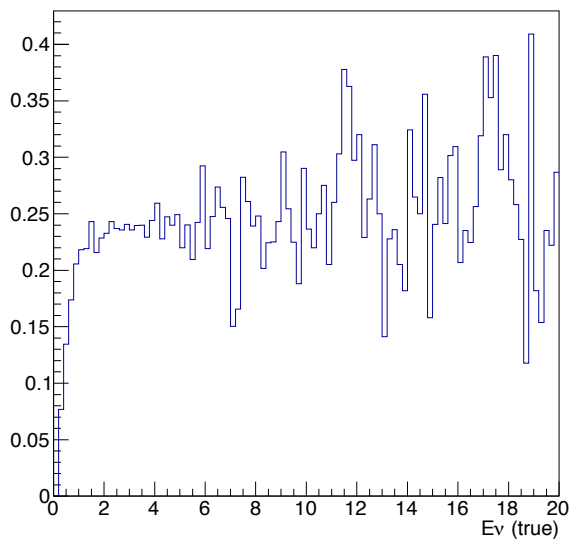


# NC Contribution in $\nu_e$ CC

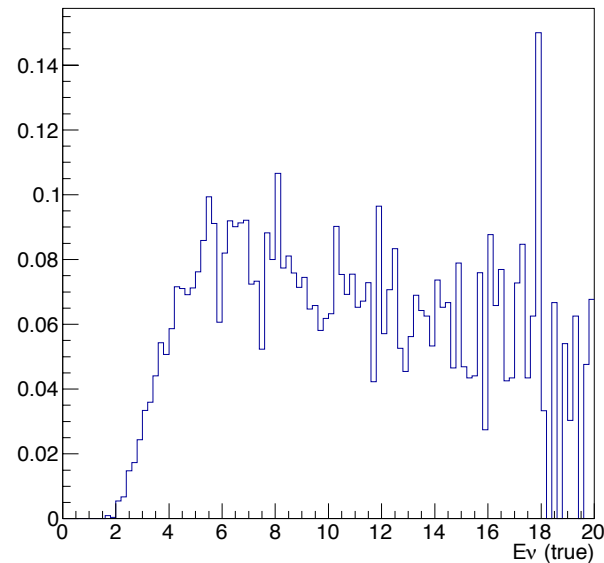
Fitter does not assume that NC cross sections are the same for all neutrino species, but you can specify that when preparing inputs. (future: allow for steriles in the fit)

Really a ratio of NC to CC cross section

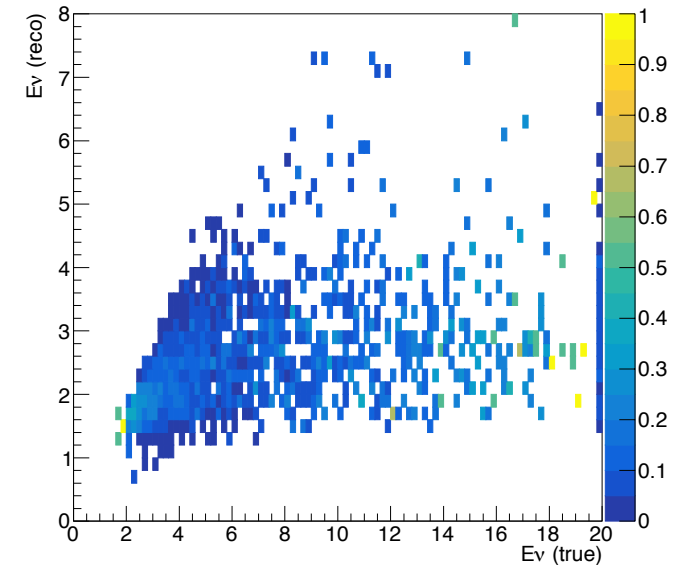
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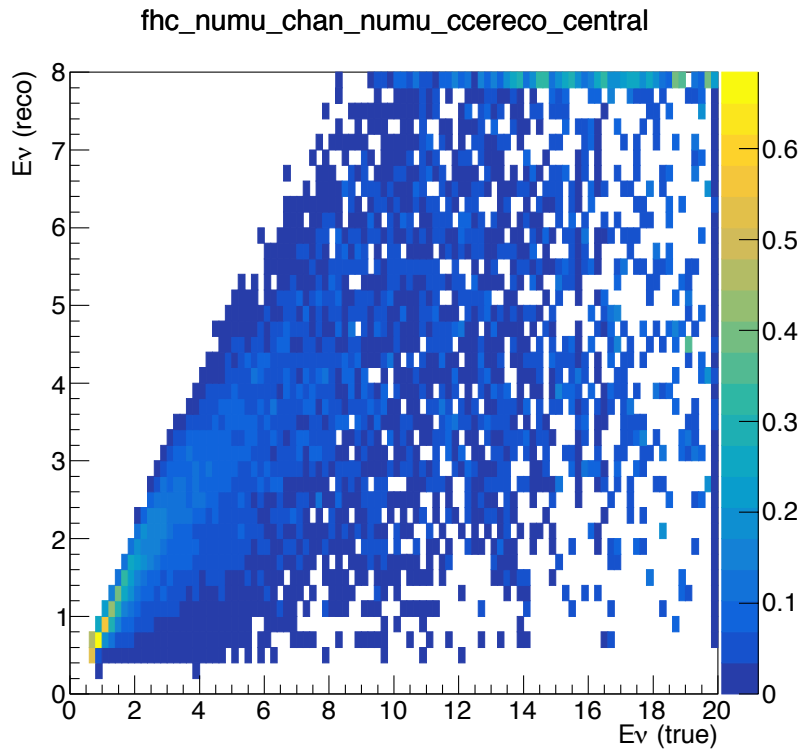
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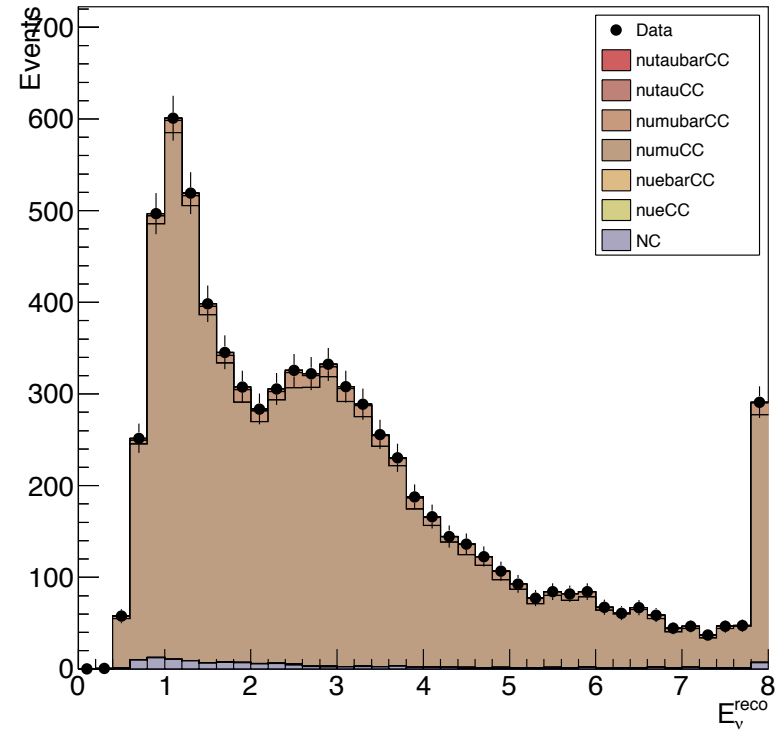
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# $\nu_{\mu}$ CC Channel

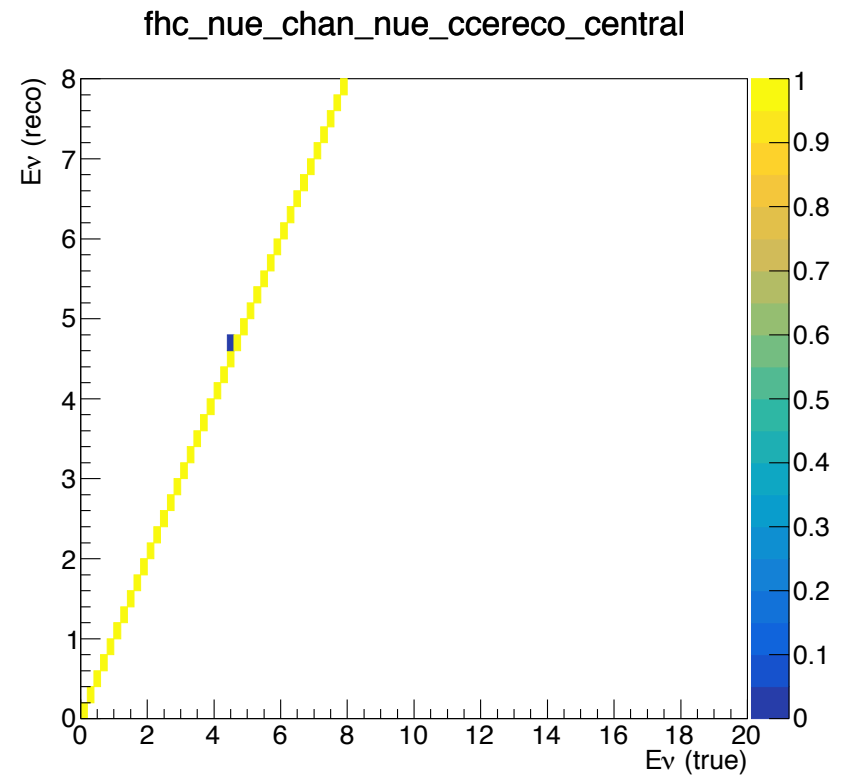
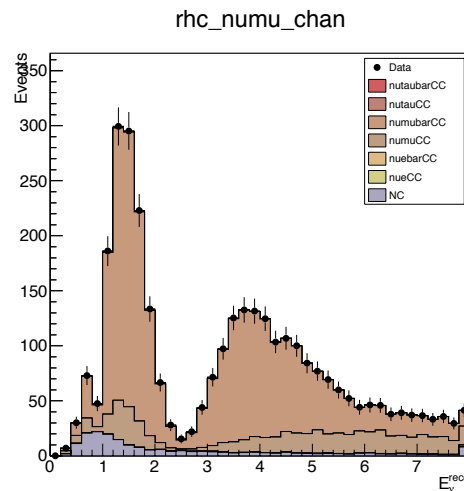
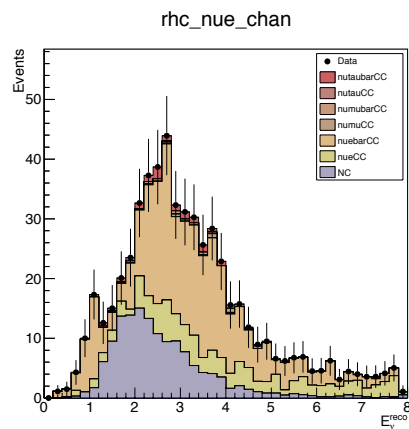
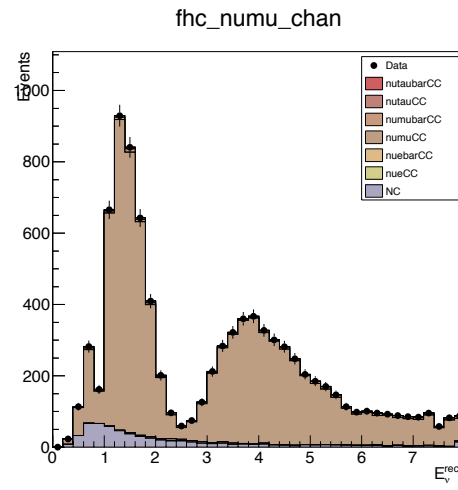
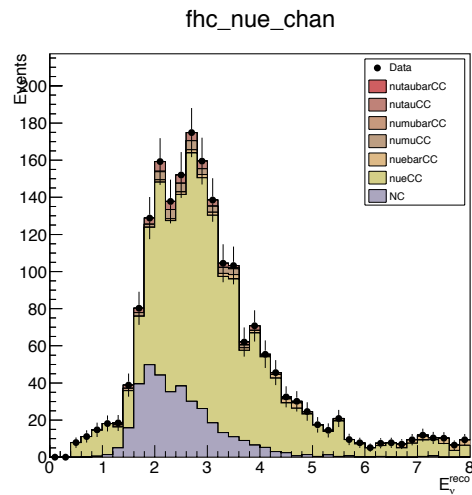


fhc\_numu\_chan



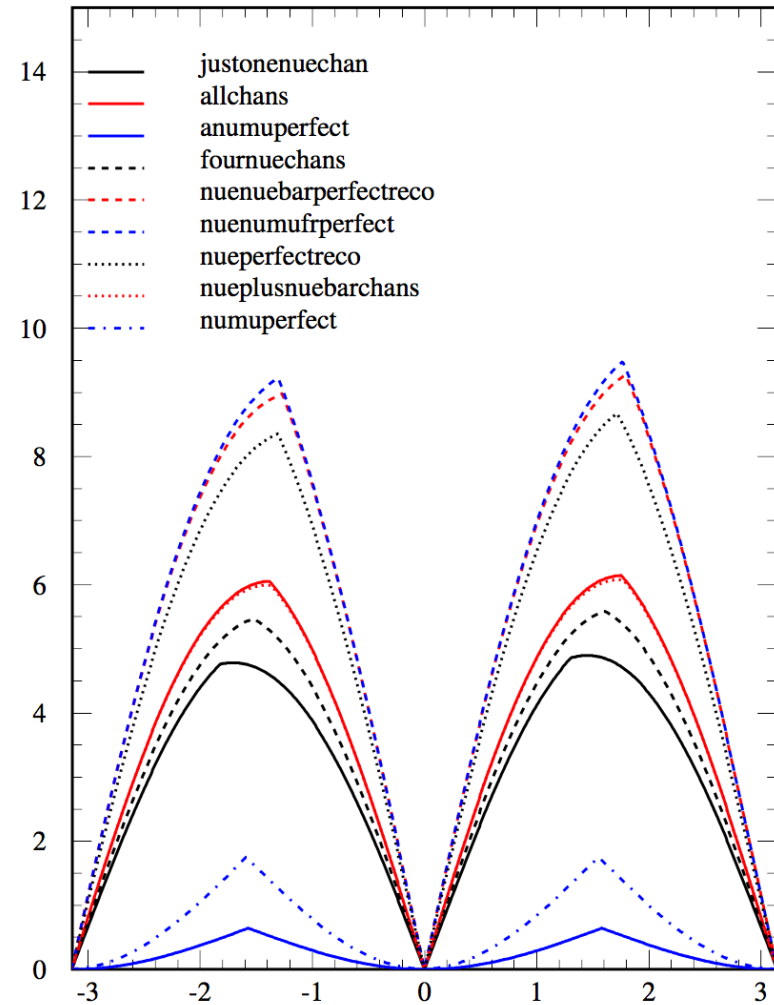
# Perfect Channels as a test

100% efficiency, perfectereco



No systematics!

40 kt fiducial mass  
3.75 (FHC) + 3.75 (RHC) MW-years  
Normal hierarchy  
 $\sin^2\theta_{12} = 0.30428$   
 $\sin^2\theta_{13} = 0.02172$   
 $\sin^2\theta_{23} = 0.45$   
 $\Delta m^2_{12} = 7.5 \times 10^{-5}$   
 $\Delta m^2_{13} = 2.457 \times 10^{-3}$



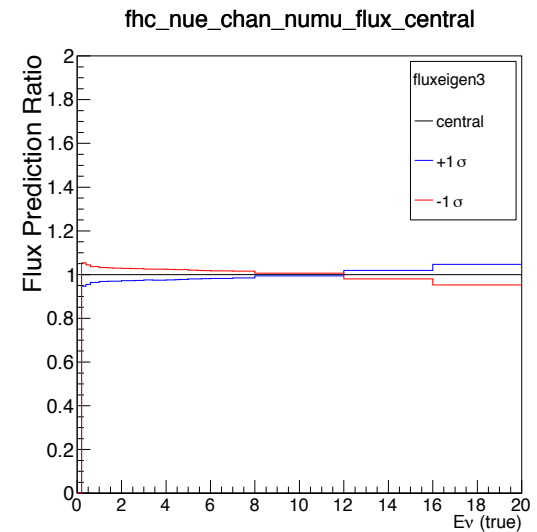
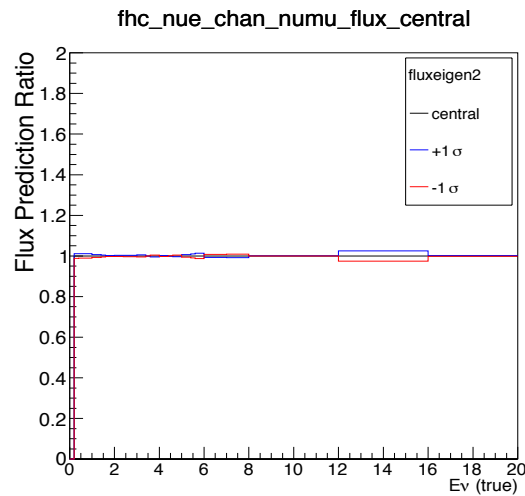
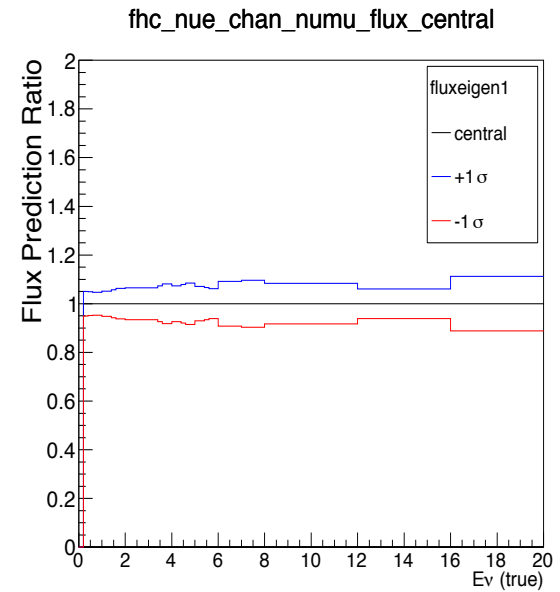
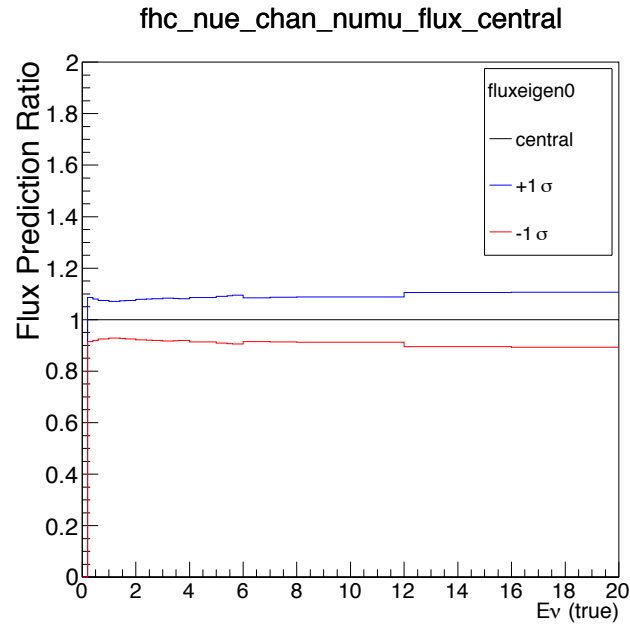
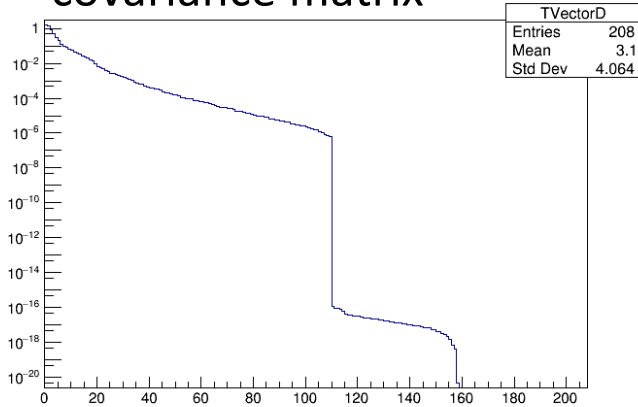




# Diagonalization of Flux Uncertainty Matrix

Goal: find an independent basis, reduce dimensionality, and provide for easier (1D) inspection

Eigenvalues of beam covariance matrix



# Moving Forwards

- Still debugging FD channels and  $\delta_{CP}$  scan
- Obtained FGT and GArTPC Task Force Files and looking into reading them in. I think I have enough info from the branches
- Some debugging to do of the delta CP scan
- Make a mass hierarchy sensitivity plot
- Test the systematic fits
- Write a Markov Chain integrator (copy ideas from mclimit)
- Do near-far fit
- Add Atmospheric