

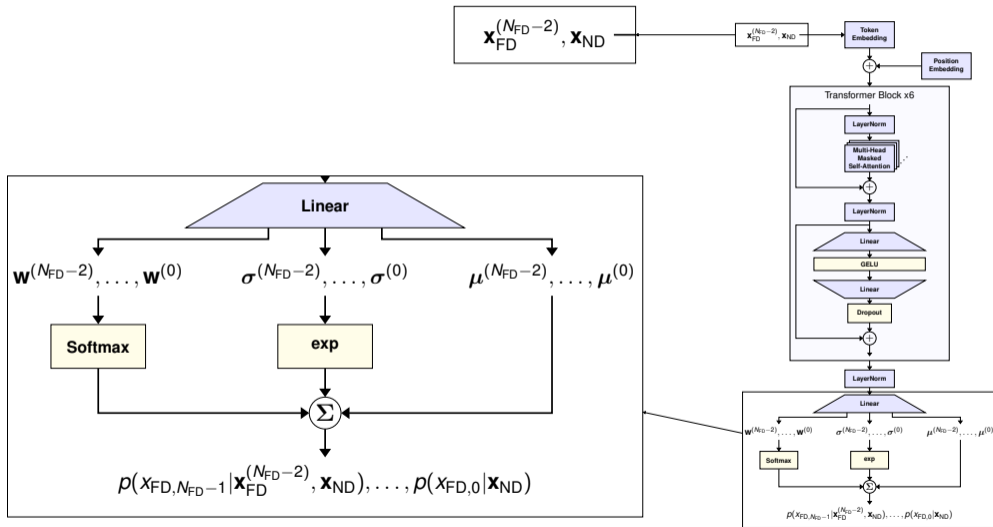
# Near to Far Model Update

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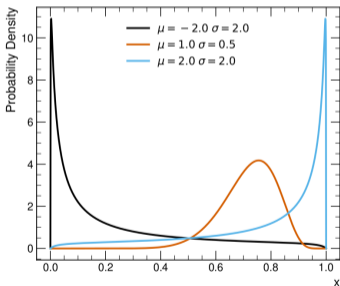
Alex Wilkinson

29 November 2024

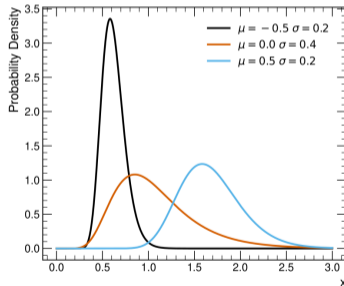
# The Model



- ▶ Predicted conditional probability distributions are a weighted sum of Gaussian
  - Currently using 64 Gaussians
- ▶ The Gaussians are transformed using a change of variables so that they are more appropriate for the FD variables

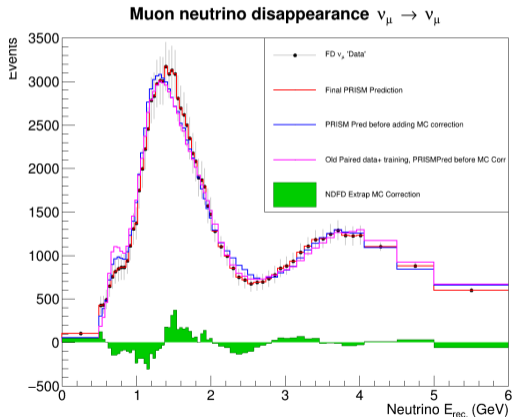


(a)  $y = (1 + e^{-x})^{-1}$

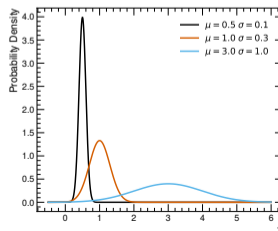
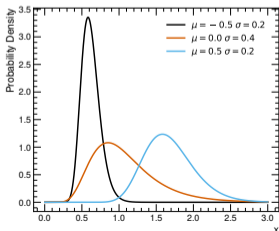


(b)  $y = e^x$

- ▶ Trained with muon resimulated paired data:

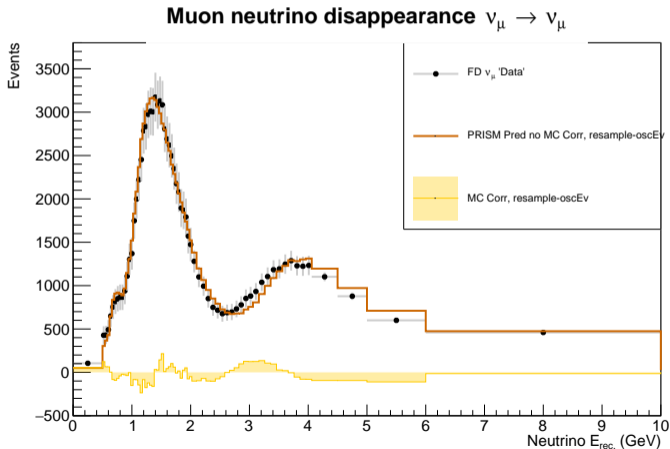


- ▶ We tried a few things to have the model do a more accurate detector effects correction for the PRISM pred
- ▶ Most of these focused on resampling the data during training
  - Dataset is made with the ND beam flux
  - Can resample to other fluxes during training by selecting the training data with a **true neutrino energy** closest to a true neutrino energy randomly sampled from a histogram
- ▶ Also considered removing the log-normal change of variables for the FD reco energy Gaussian mixtures:



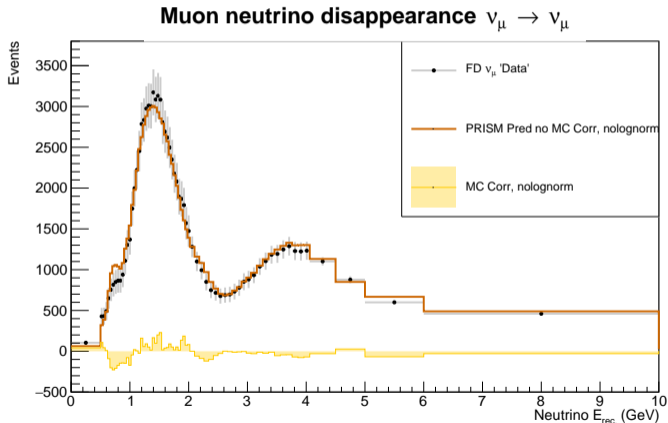
# Resample to Oscillated Flux

- Resample with NuFIT 4 oscillated flux histogram i.e. the target of the linear combination:



# Remove the log-norm Transformation

- ▶ Gaussian mixture instead of log-normal mixture:



- ▶ The following results in bad PRISM preds:
  - Resample to uniform true neutrino energy
  - Resample to the combined true neutrino energy of all ND detector positions
  - Resample to FD oscillated **reconstructed** neutrino energy
- ▶ Both the no log-norm and the oscillated flux resample are helpful
- ▶ Currently making new CAFS for:
  - No log-norm again (have made some minor model improvements since the last one)
  - No log-norm and resampling to oscillated flux