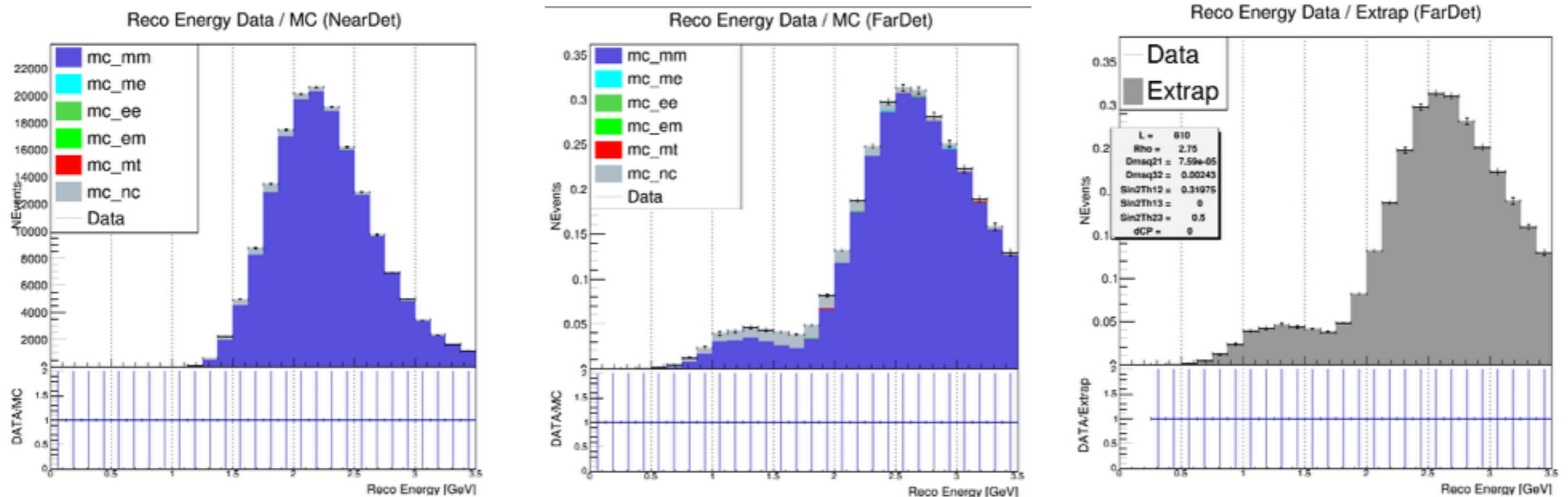


FNEPpackage

The Grid Edition

Have now tested FNEPpackage over the whole fileset
(excluding FD Data and cosmics)



After a few pre-processing steps,
takes 7(3) seconds to run a full Numu(Nue) extrapolation

Run on grid using Satish's submit_nova_art.py script

```
# Job and project options
--jobname kmatera_fnepackage_numu_job_mc
--defname prod_pid_FA14-12-29_nd_genie_nonswap_postshutdown
--njobs 304
--files_per_job 0
--opportunistic
--print_jobsub

# novasoft options
-c fnespectrumprodjob_mc.fcl
--testrel /nova/app/users/kmatera/tagDev
--tag development

# Copy-back: options for built-in runNovaSAM.py .
# Advanced usage can replace this block with the --copyOutScript option
--dest /nova/ana/users/kmatera/FNEPackage_Grid/numu_huge_nd_mc
--copyOut
--runDirs
--outTier out1:fnespectrumprod_art
--histTier fnespectrumprod_hist

# Name of your project/jobs, be creative
# SAM dataset definition, defines files to be processed
# Number of jobs to run
# Maximum number of files to be processed by each job
# Run in opportunistic mode, i.e. steal non-NOvA nodes, optional
# Print jobsub submission block, good for records

# Job fcl for nova executable
# Path to test release, optional
# Tagged release of novasoft to use

# Output directory
# Copy back output to --dest location
# Sort output by run number
# Extension for ART-ROOT output stream out1
# Extension for hist (TFileService) output
```

Note that both out tiers shown above *must* be included

Remember to change this from mc → data when appropriate!

And make certain that you've chosen the right numu/nue template in each!

Remember to run on PID-level files when using the Numu/Nue templates

We run over five MC(DATA) file sets for this test

FD MC FLUXSWAP:	prod_pid_FA15-01-12_fd_genie_fhc_fluxswap :	1499 FILES
FD MC NONSWAP:	prod_pid_FA15-01-12_fd_genie_fhc_nonswap :	1497 FILES
FD MC TAUSWAP:	prod_pid_FA15-01-12_fd_genie_fhc_tau :	1499 FILES
ND MC (POST SD):	prod_pid_FA14-12-29_nd_genie_nonswap_postshutdown	7598 FILES
ND MC (PRE SD):	prod_pid_FA14-12-29_nd_genie_nonswap_preshutdown_downsampled	7598 FILES
ND DATA (POST SD):	prod_pid_FA14-12-29_nd_numi_fullgain_goodruns:	1544 FILES
FD DATA:	prod_pid_FA14-10-28_fd_numi_fa_goodruns:	87955 FILES!
FD COSMICS:	???	???

 = have not included yet

550 jobs @ 25 files per job

Longest job time was ~10 hours (ND MC)

Final size of all output Hist files:

Nonswap:	2.107 GB		1491 out files		vs 1497 input files		AVG FILE SIZE = 1.41 MB
Fluxswap:	2.110 GB		1498 out files		vs 1499 input files		AVG FILE SIZE = 1.41 MB
Tauswap:	2.065 GB		1499 out files		vs 1499 input files		AVG FILE SIZE = 1.38 MB
ND MC:	17.914 GB		7598 out files		vs 7598 input files		AVG FILE SIZE = 2.36 MB
ND DATA:	3.833 GB		1544 out files		vs 1544 input files		AVG FILE SIZE = 2.48 MB

ART files are ~50-60% the size of Hist files

New option for accepting Hist files in “list of files.txt” format

FNEUseProdHistFileLists: 1 ← Enable “list of files.txt” option by setting this = 1

FNEProdHistFileLists:

```
{  
  fd_nonswap: "/nova/app/users/kmatera/tagDev/FNEWorkspace_numu_grid/numu_nonswap_hist_list.txt"  
  fd_fluxswap: "/nova/app/users/kmatera/tagDev/FNEWorkspace_numu_grid/numu_fluxswap_hist_list.txt"  
  fd_tauswap: "/nova/app/users/kmatera/tagDev/FNEWorkspace_numu_grid/numu_tauswap_hist_list.txt"  
  nd_mc: "/nova/app/users/kmatera/tagDev/FNEWorkspace_numu_grid/numu_nd_mc_hist_list.txt"  
  nd_data: "/nova/app/users/kmatera/tagDev/FNEWorkspace_numu_grid/numu_nd_data_hist_list.txt"  
}
```

Each file contains a list of filenames;

debug records (e.g., num events loaded) are recorded by **list name**

For small collections of files, can still drop them into ProdFileFolder,
and disable “list of files.txt” option

FNEProdFileFolder: "FNEWorkspace_numu_grid/FNEProdHistFiles_nonqe"

FNEAnaFileFolder: "FNEWorkspace_numu_grid/FNEAnaHistFiles"

Loading all Hist files the first time is rather time-consuming

Loading spectra from TObject file 13630 / 13630 (100 %) Time Elapsed (min): 181.9 / Est Time Rem (min): 0 (0 %)

Num events loaded:	Events	EventsPassed	GoodSpills
[nd][mc_mm]:	42543020	/ 1012827	/ 15196000
[nd][mc_me]:	0	/ 0	/ 0
[nd][mc_ee]:	784177	/ 883	/ 15196000
[nd][mc_em]:	0	/ 0	/ 0
[nd][mc_mt]:	0	/ 0	/ 0
[nd][mc_nc]:	11062918	/ 26604	/ 15196000
[nd][data]:	14291663	/ 242998	/ 3310732
[fd][mc_mm]:	619963	/ 168868	/ 1491000
[fd][mc_me]:	590735	/ 7657	/ 1498000
[fd][mc_ee]:	12603	/ 236	/ 1491000
[fd][mc_em]:	12999	/ 2421	/ 1498000
[fd][mc_mt]:	168678	/ 9964	/ 1499000
[fd][mc_nc]:	892953	/ 11850	/ 4488000
[fd][data]:	0	/ 0	/ 0

Loading complete!

Total time (min): 182

Total files (#) : 13630

We run through all these events with
`fnespectrumanajob_mc.fcl`, apply basic kNumu cut;
Drops size to 200 MB, load time to 70 seconds

Loading complete!

Total time (min) : 1.15 ~ 68 seconds
Total files (#) : 1
Total events checked : 1484308
Total events saved : 1484308

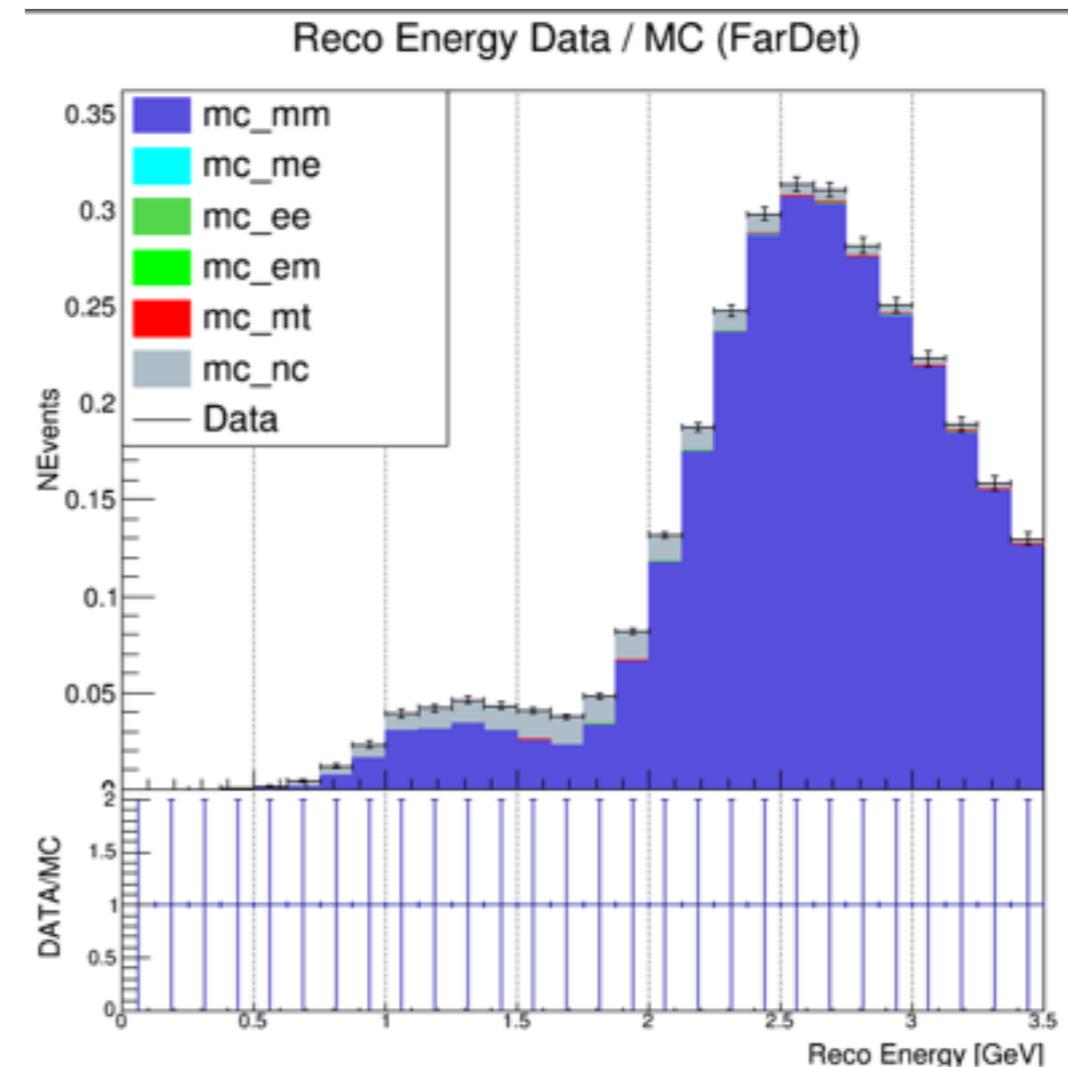
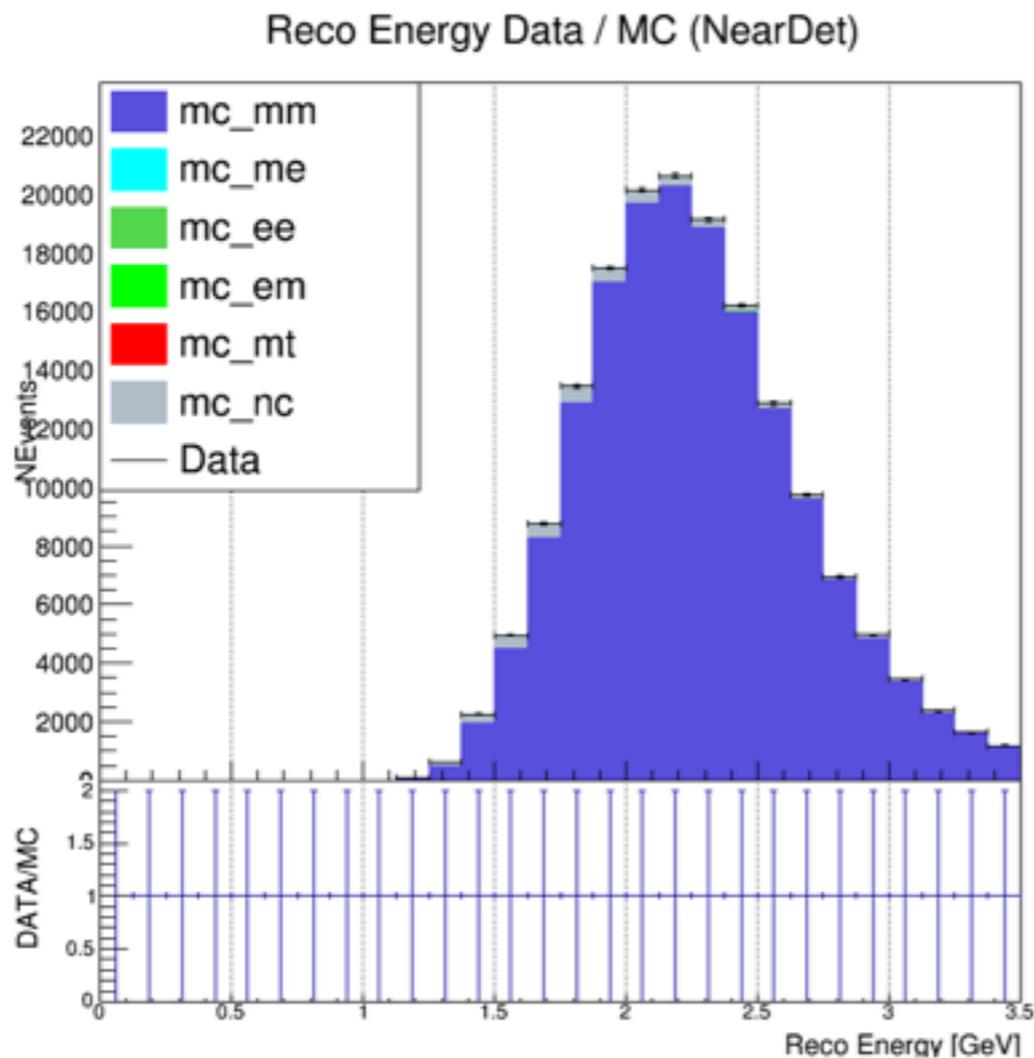
By default, files are always trimmed
by `keep_lo/hi` values and saved

Can disable this by changing the following parameters to 0 in the
FNESpectrumAna.fcl file:

```
FNESaveARTObjects: 0  
FNESaveHistObjects: 0
```

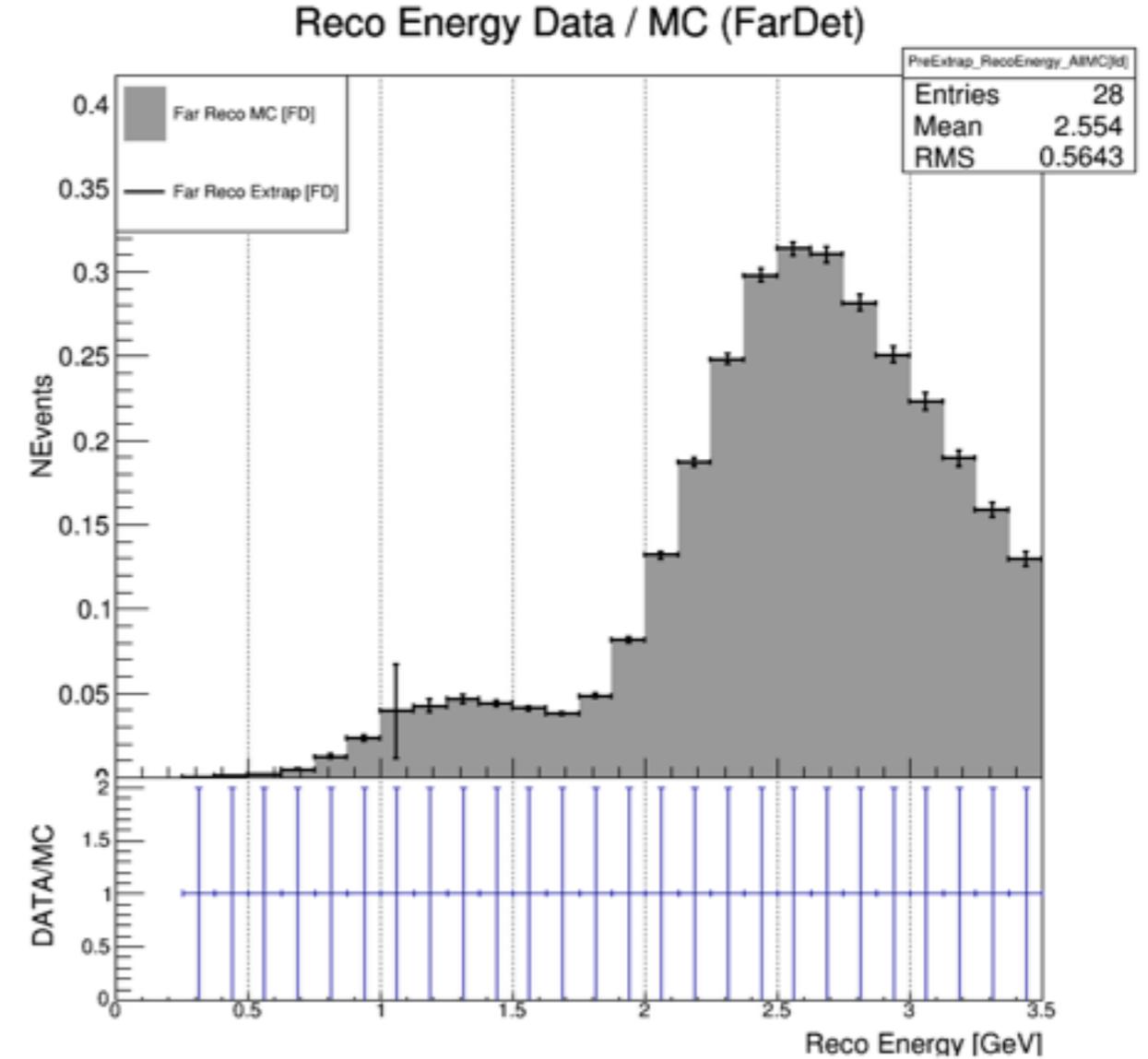
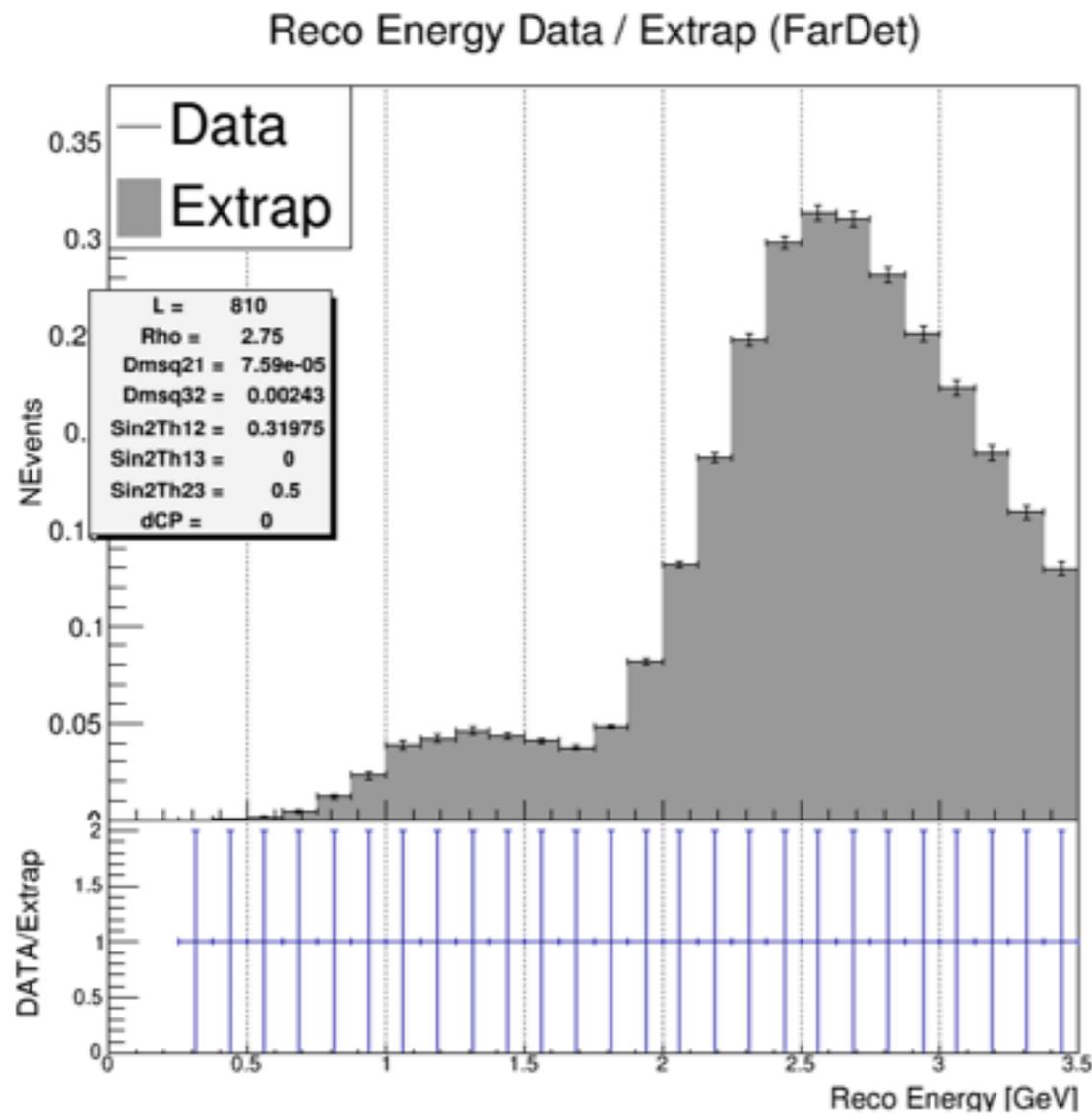
For the rest of this presentation, we use the “trimmed” file
(only keep events which pass the basic `kNumu` cuts)

Numu !QE selection cuts applied; scaled to POT=1E20
MC 1 to 1



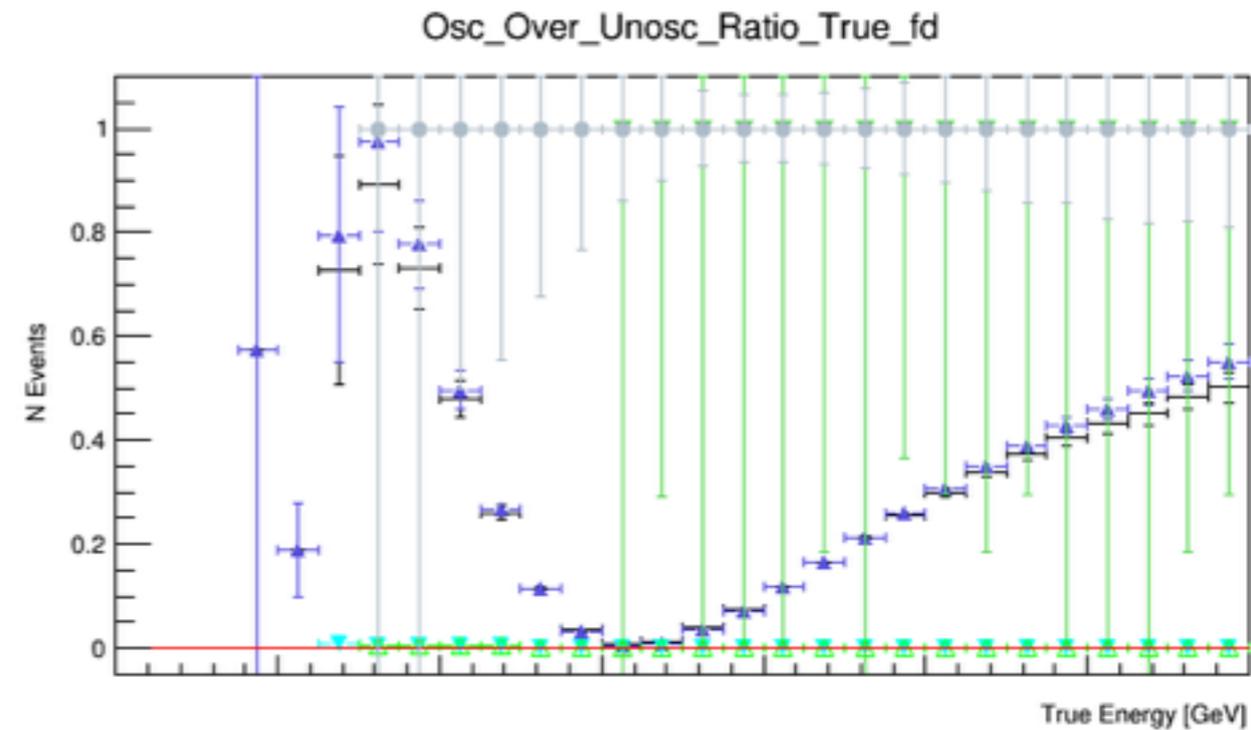
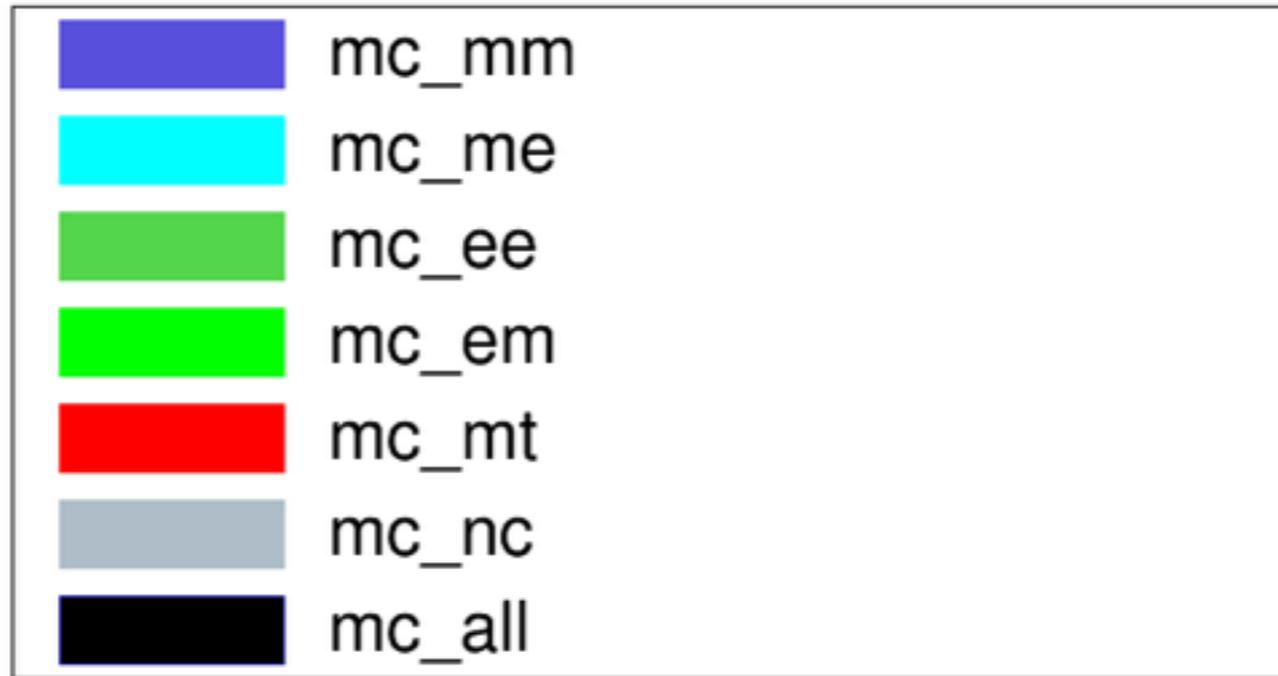
Reconstructed Near/Far energy spectra
for selected events (reminder: scaled)

Numu !QE selection cuts applied; scaled to POT=1E20 MC 1 to 1

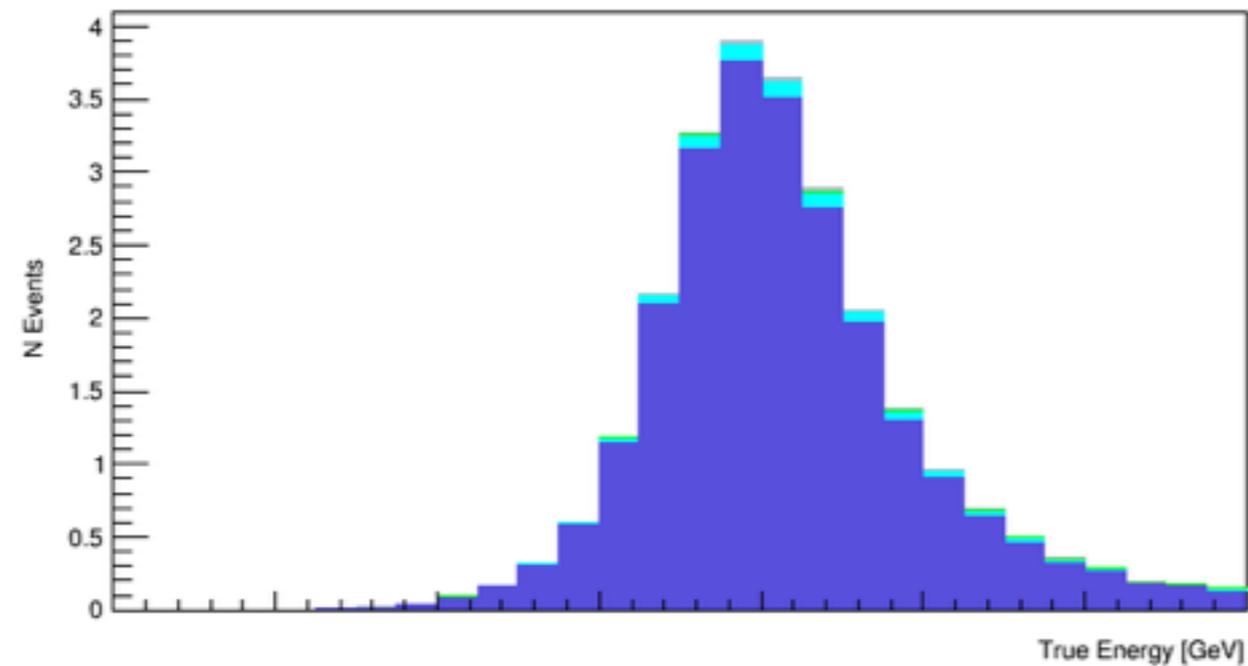


Best-fit extrapolated FD reco energy spectrum vs data

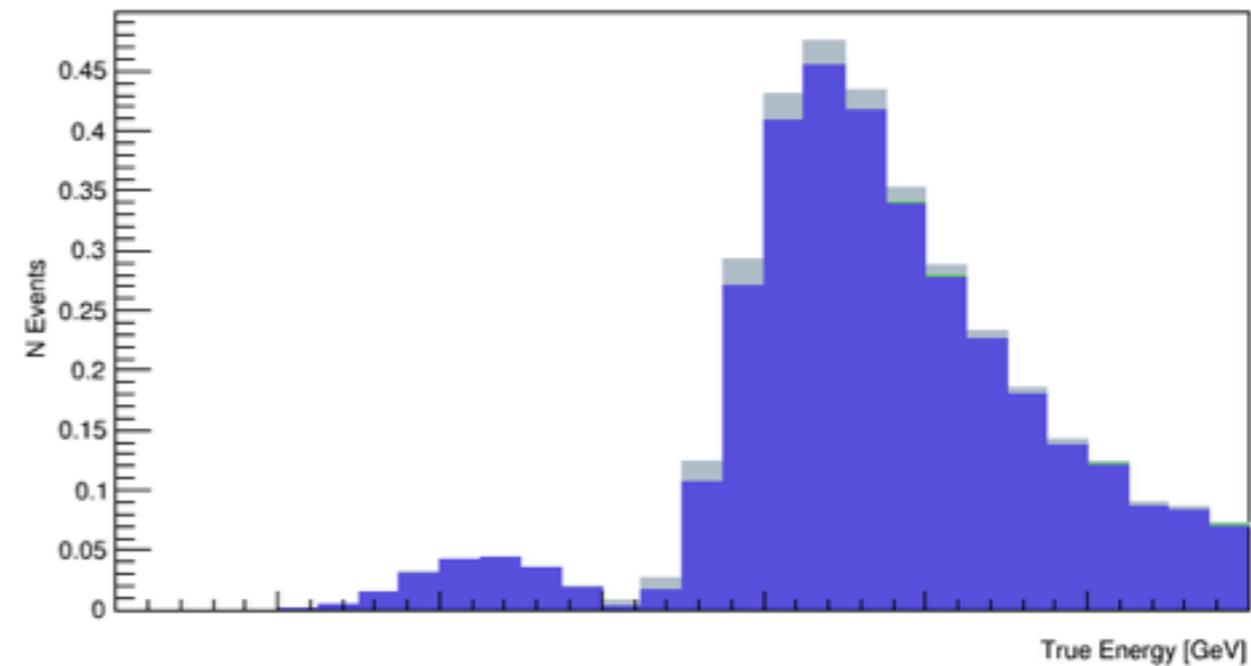
Oscillated Energy Spectra (True)



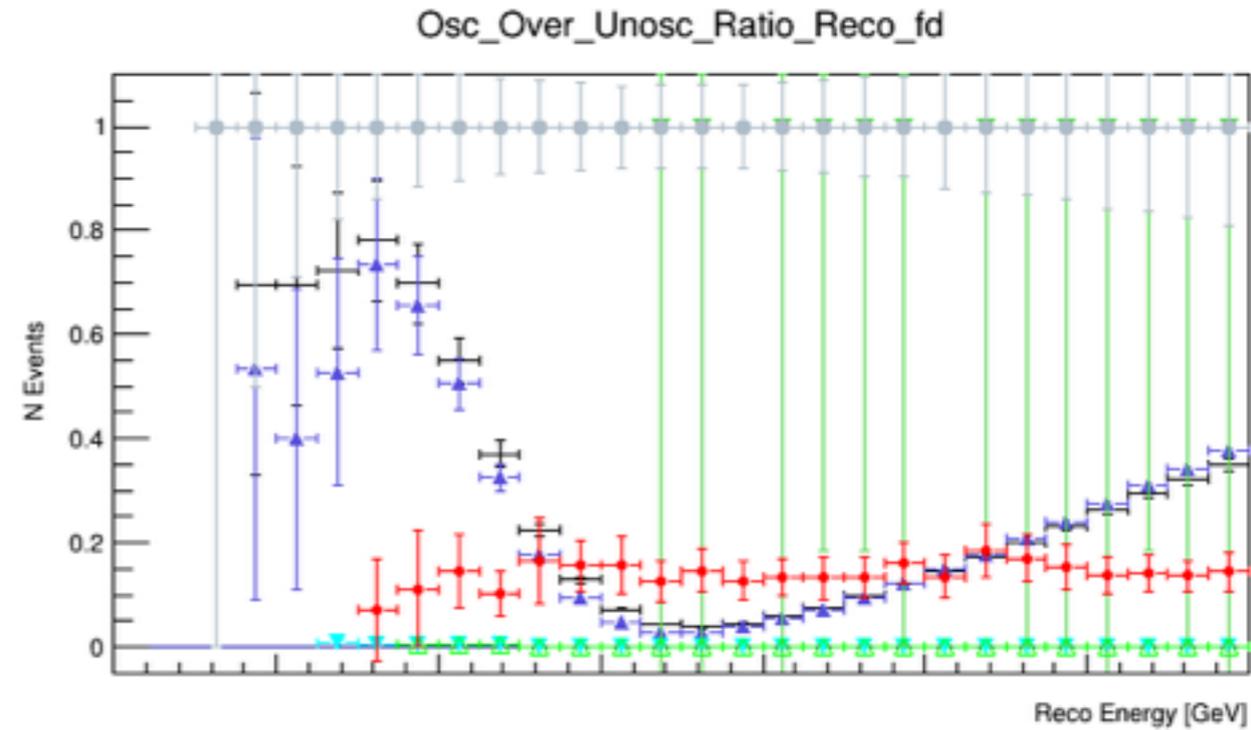
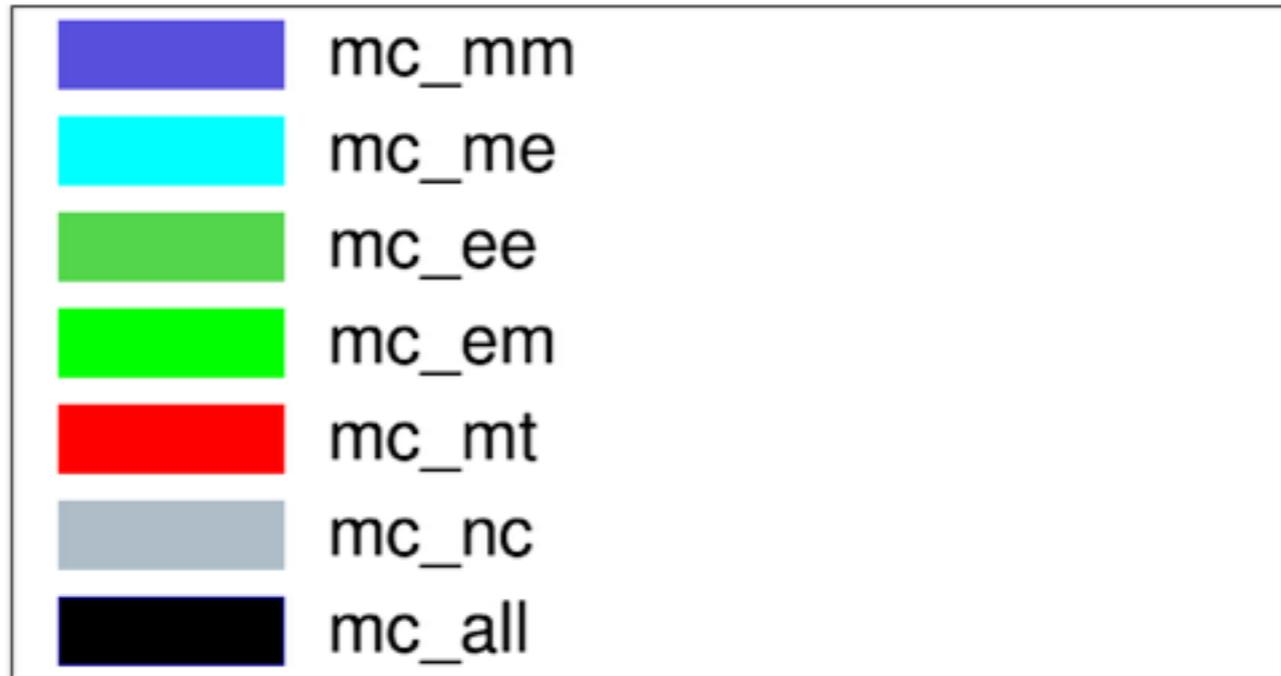
Unoscillated_True_fd



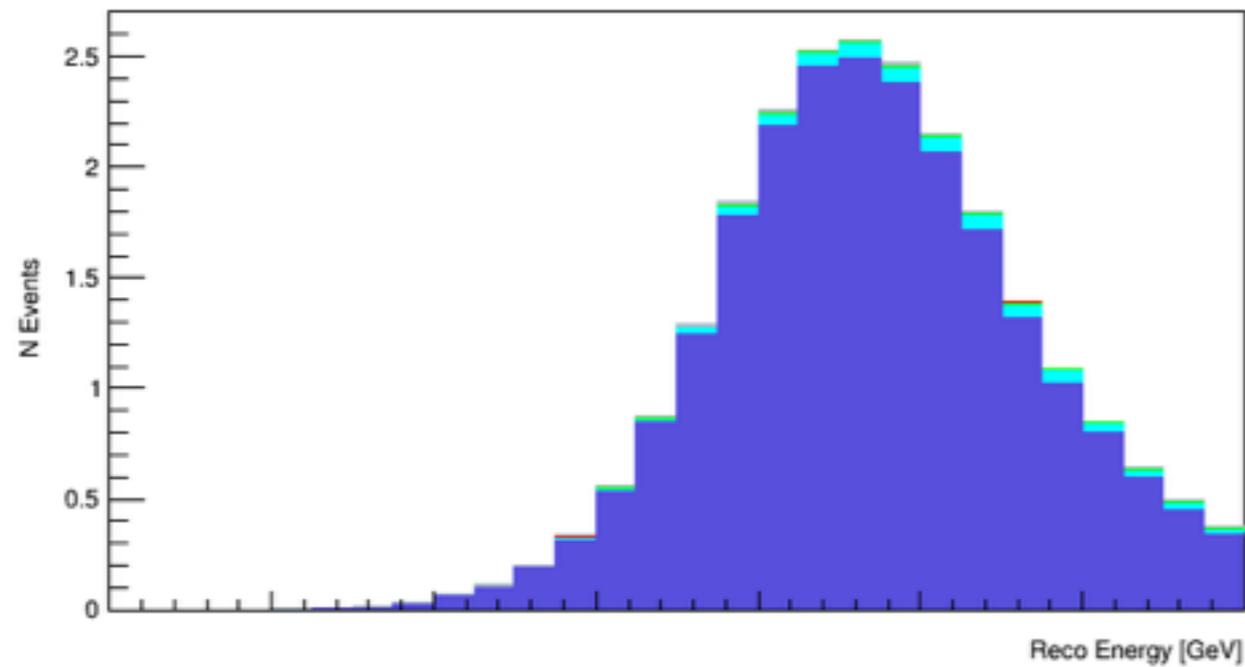
Oscillated_True_fd



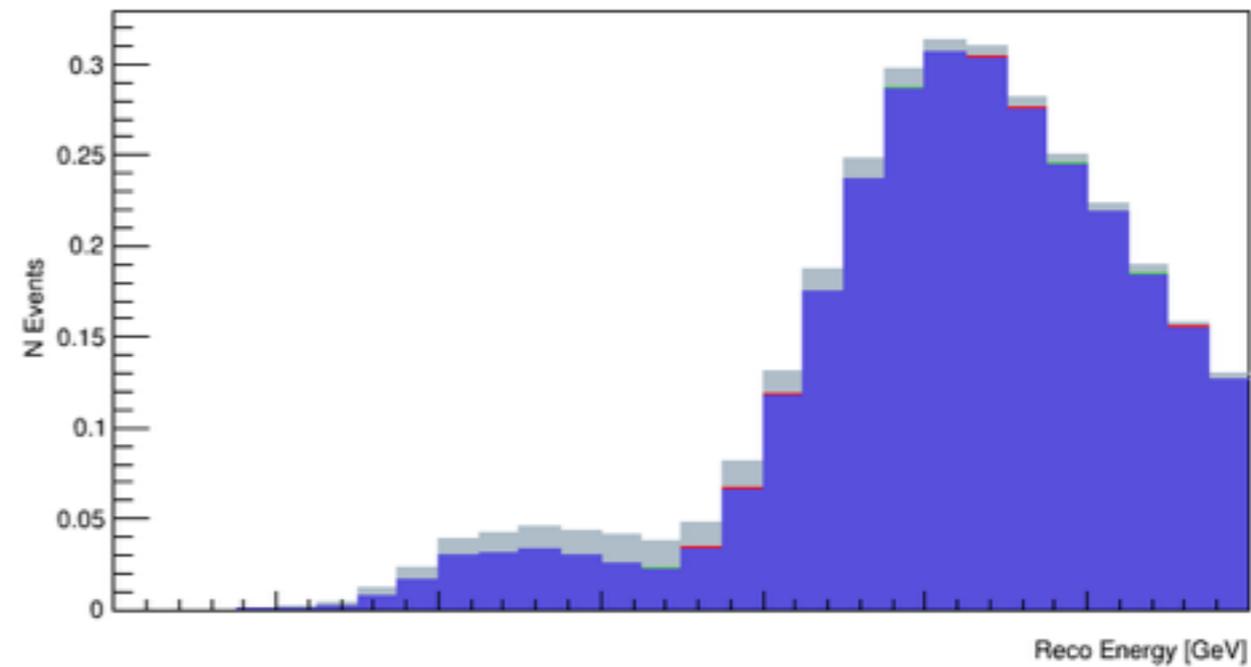
Oscillated Energy Spectra (Reco)



Unoscillated_Reco_fd

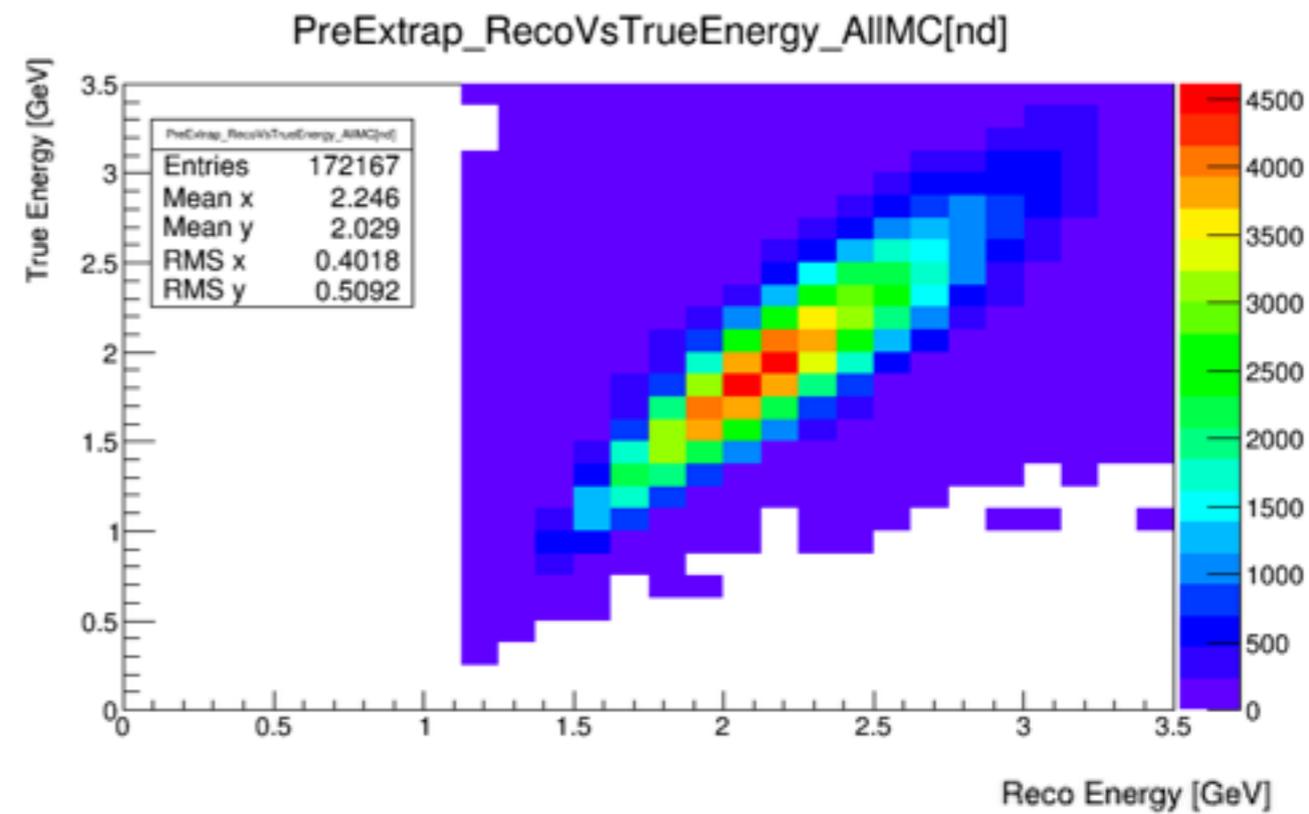
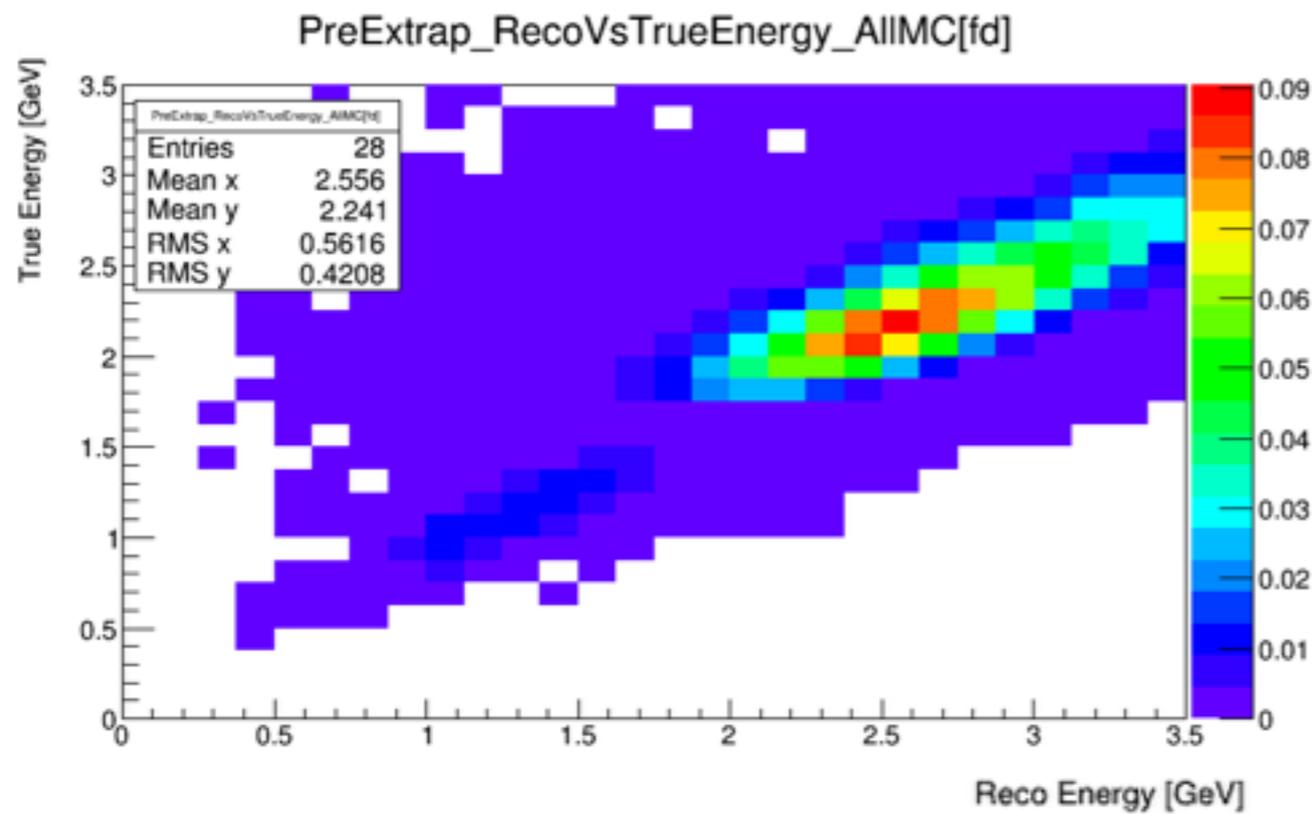


Oscillated_Reco_fd

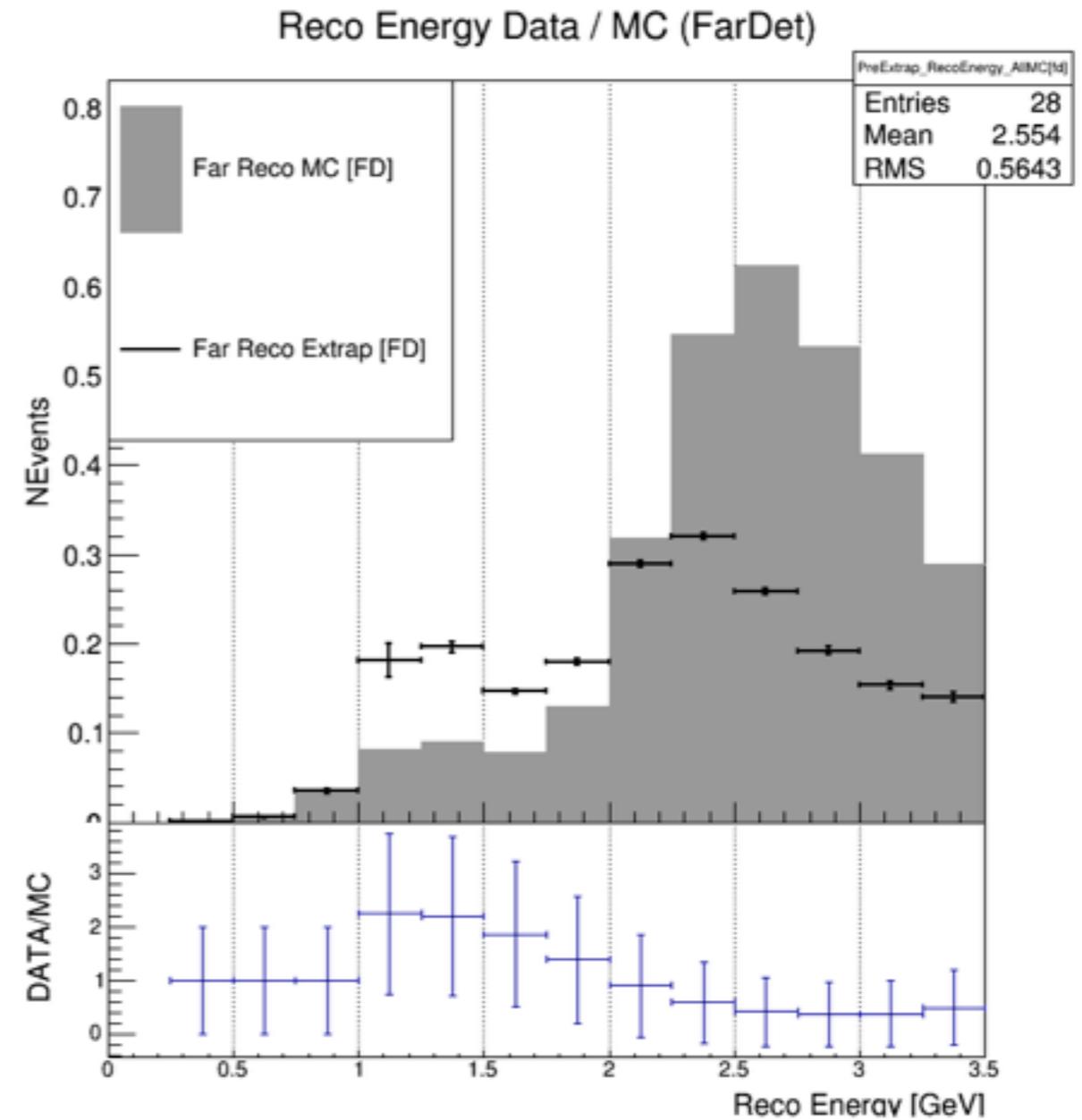
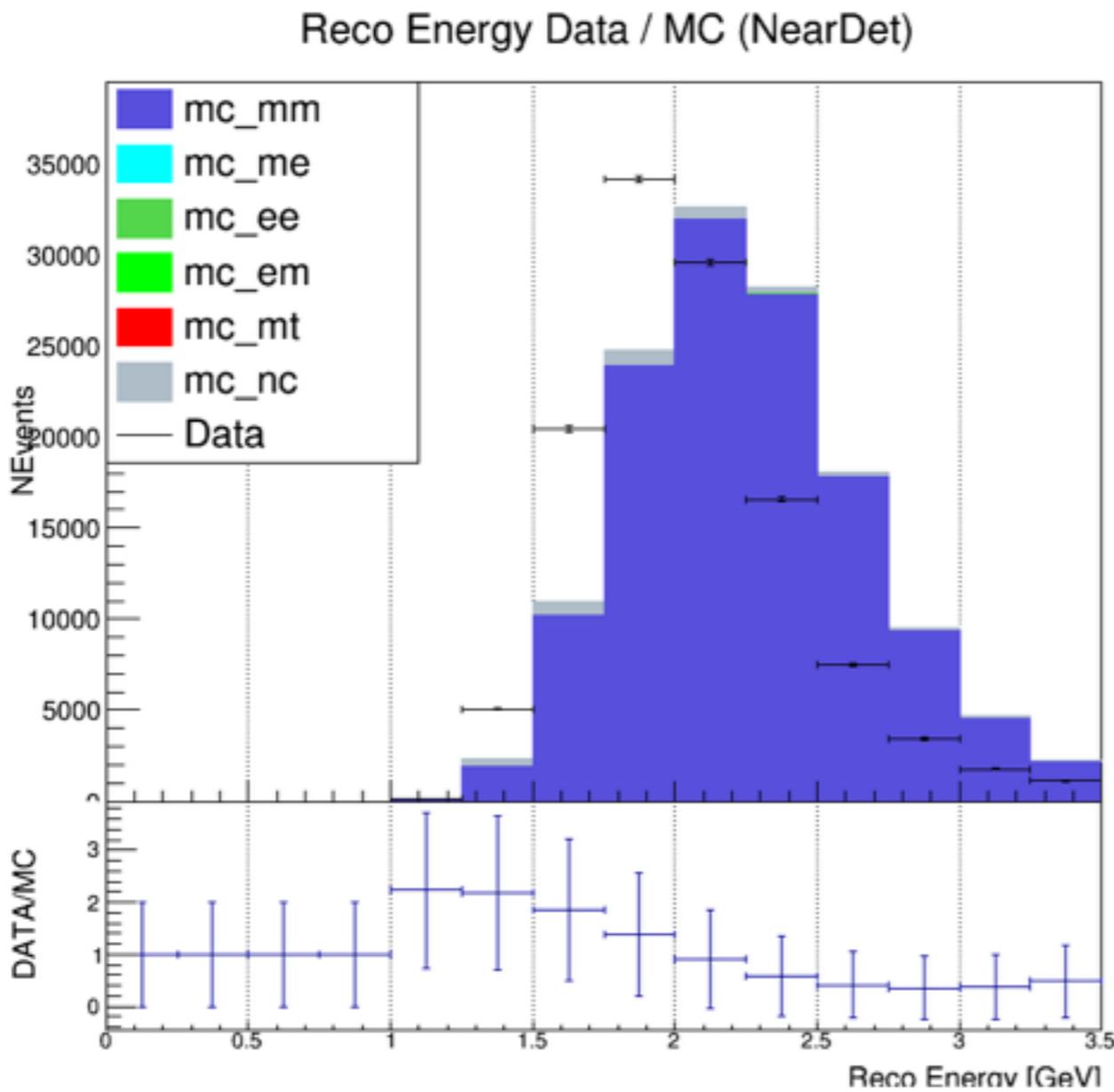


True vs Reco E

(all passing MC events, weighted by osc. prob.)



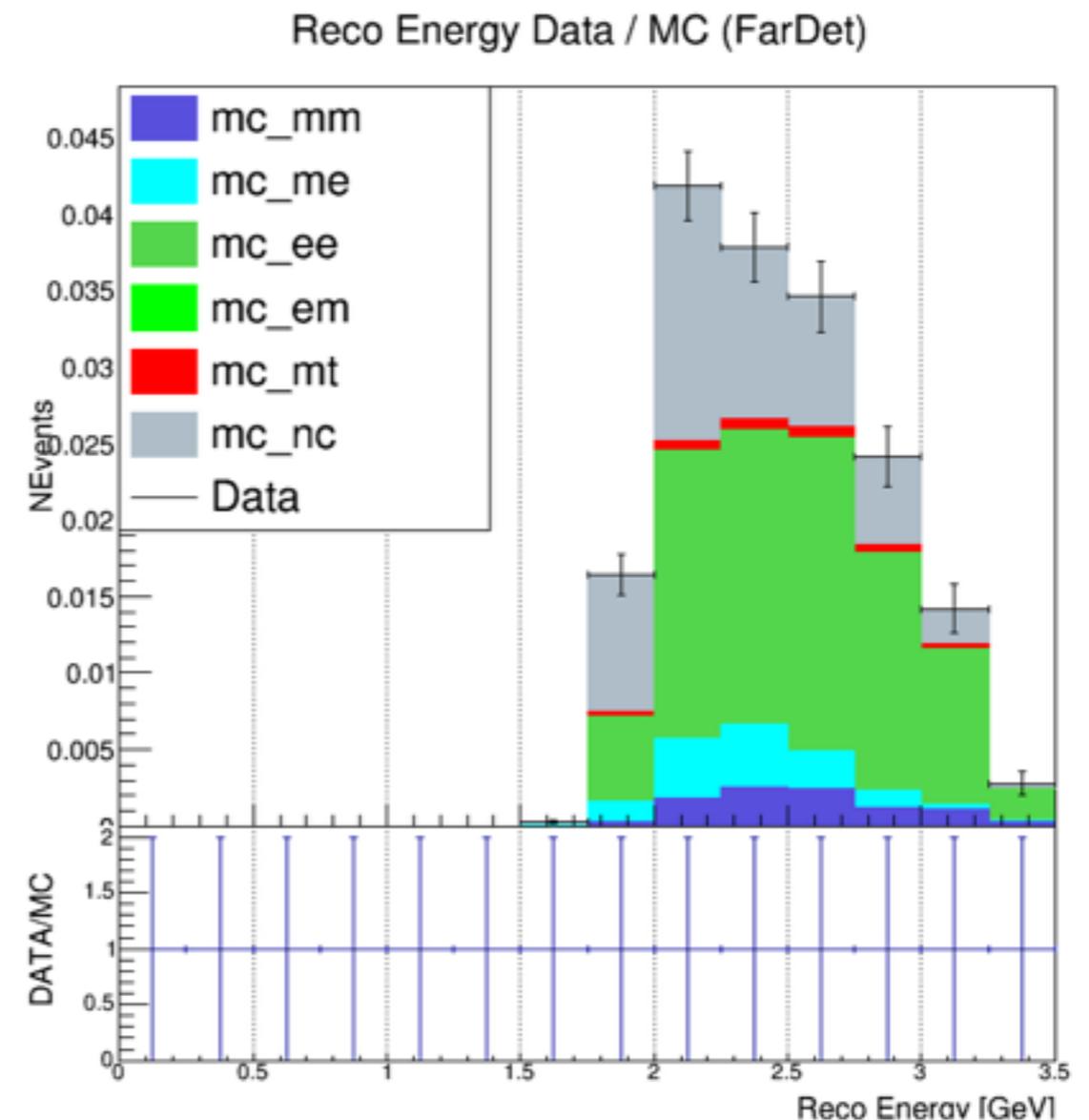
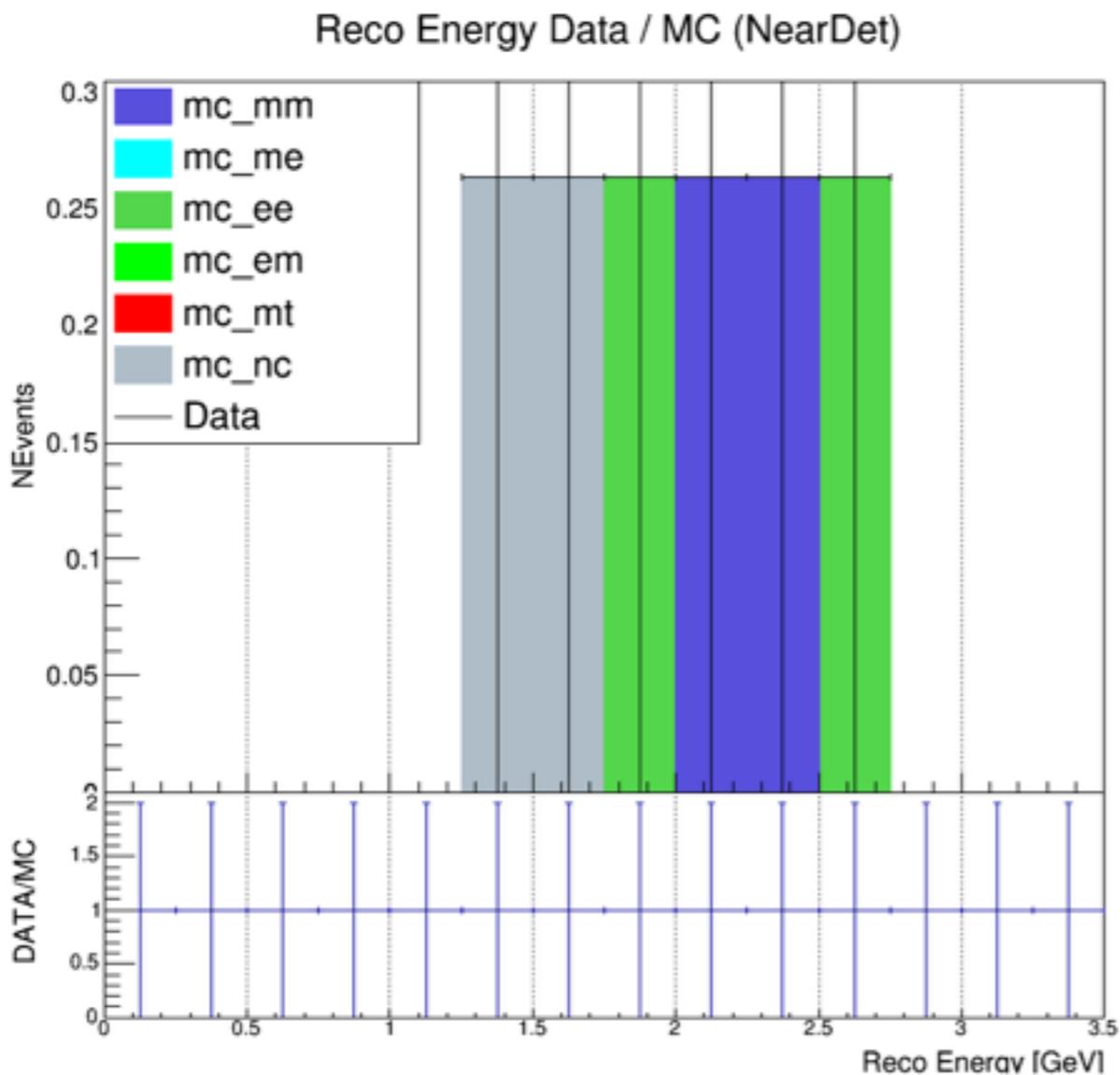
Numu !QE selection cuts applied; FD scaled to POT=1E20
 ND DATA is data & FD DATA is MC



Reconstructed Near/Far energy spectra
 for selected events (reminder: scaled)

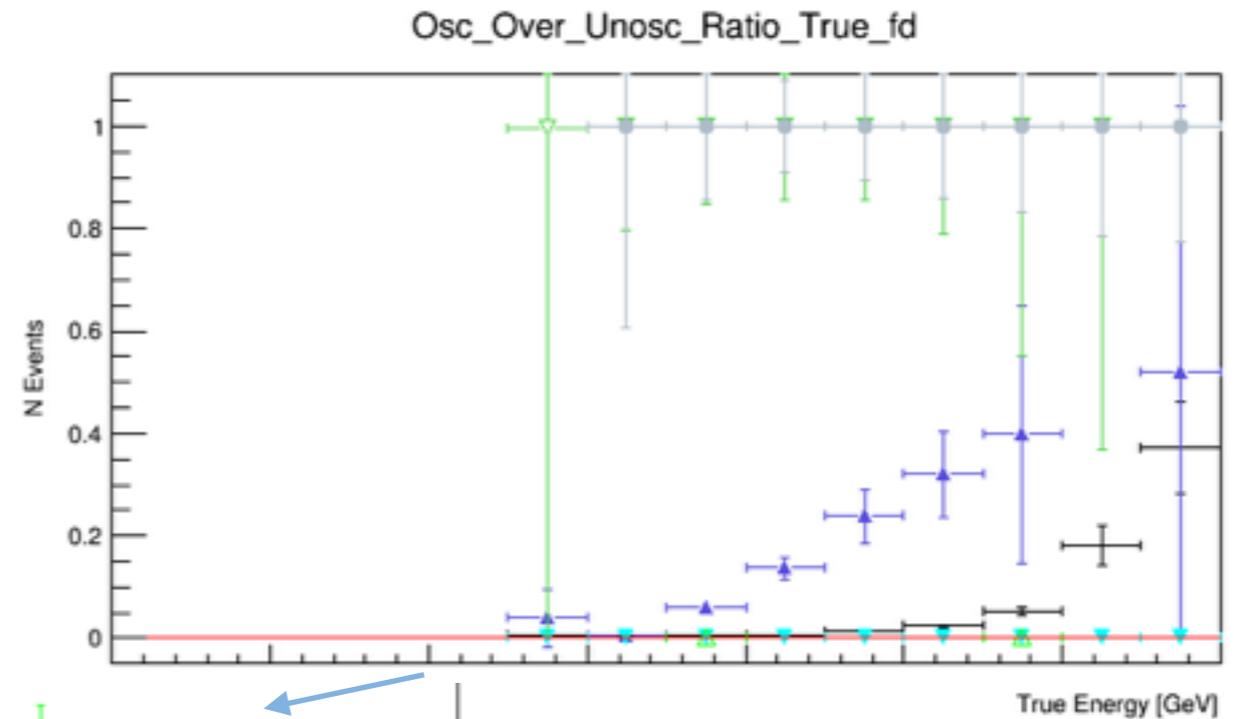
Now we look at the same plots for
Nue LID selection

Nue LID selection cuts applied; scaled to POT=1E20
MC 1 to 1

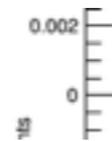


Reconstructed Near/Far energy spectra
for selected events (reminder: scaled)

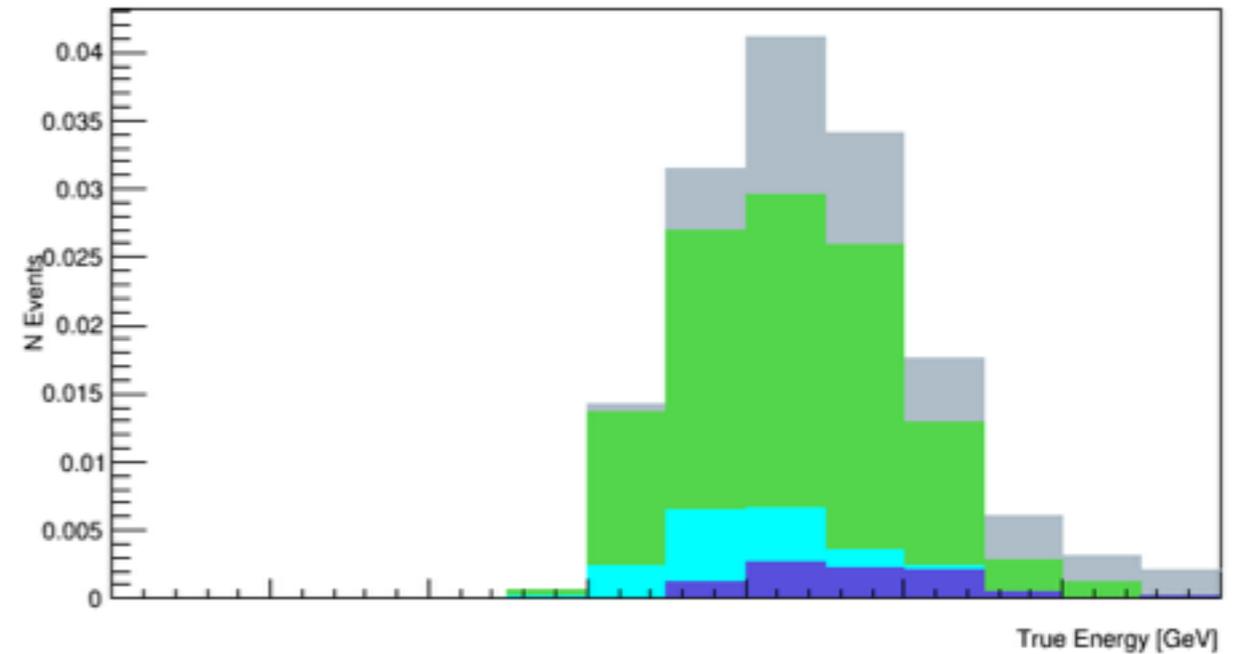
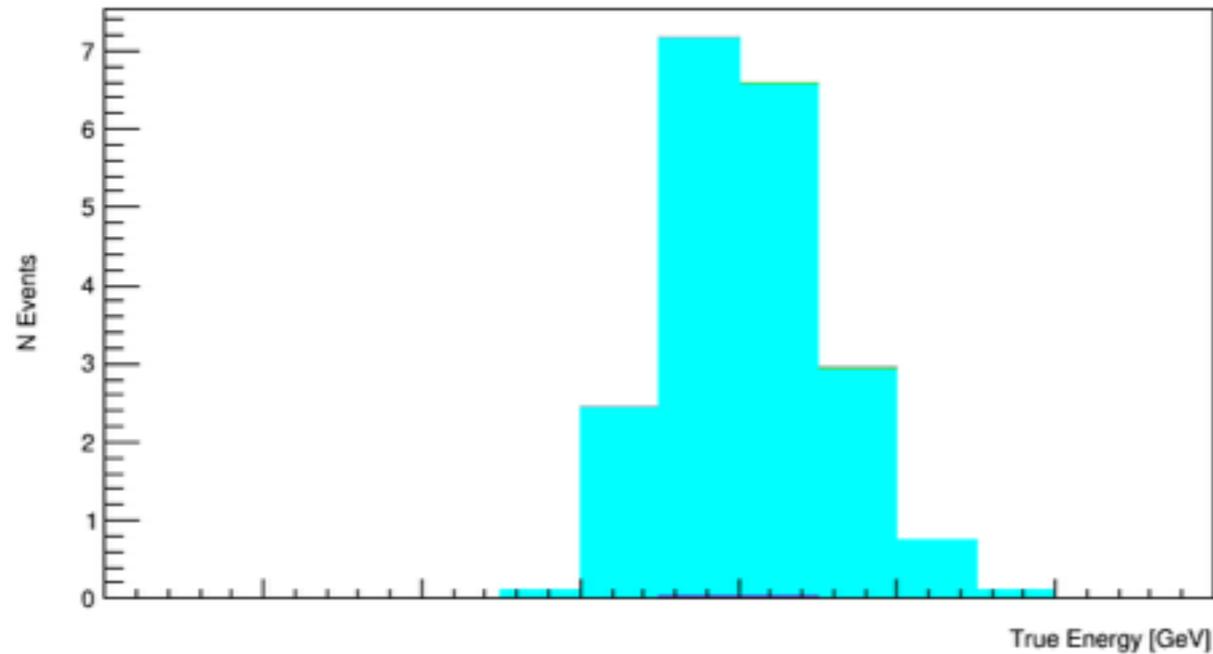
Oscillated Energy Spectra (True)



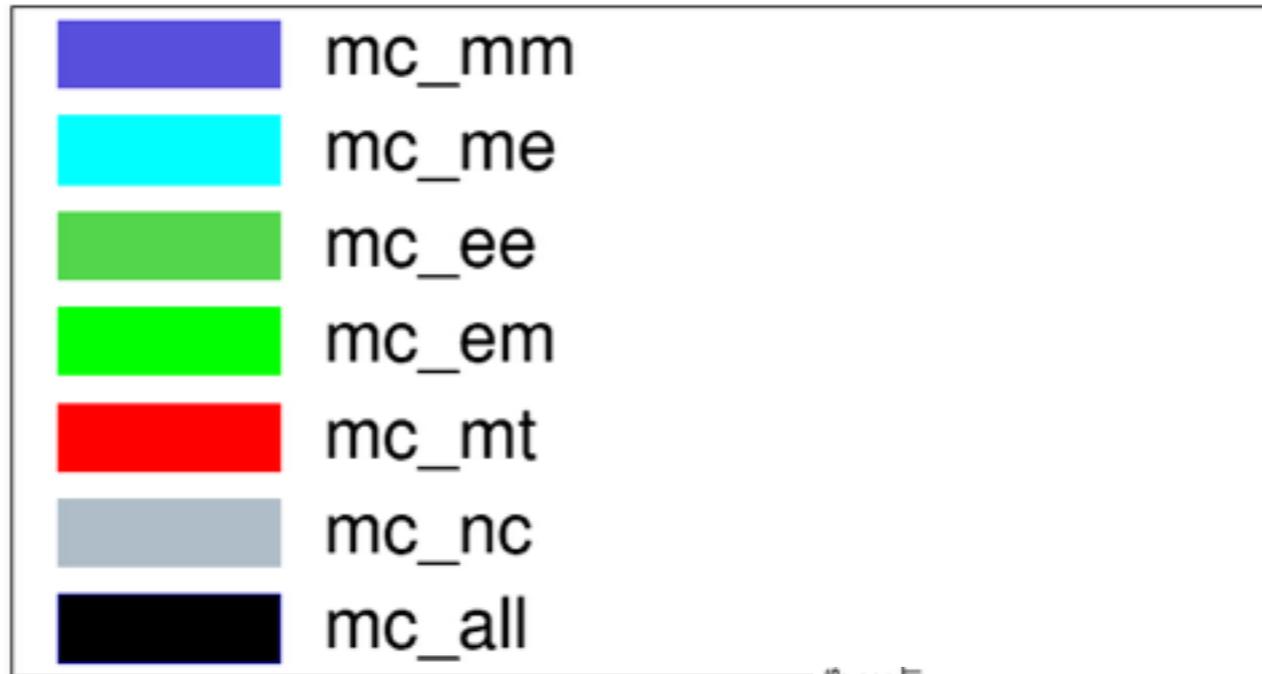
Unoscillated_True_fd



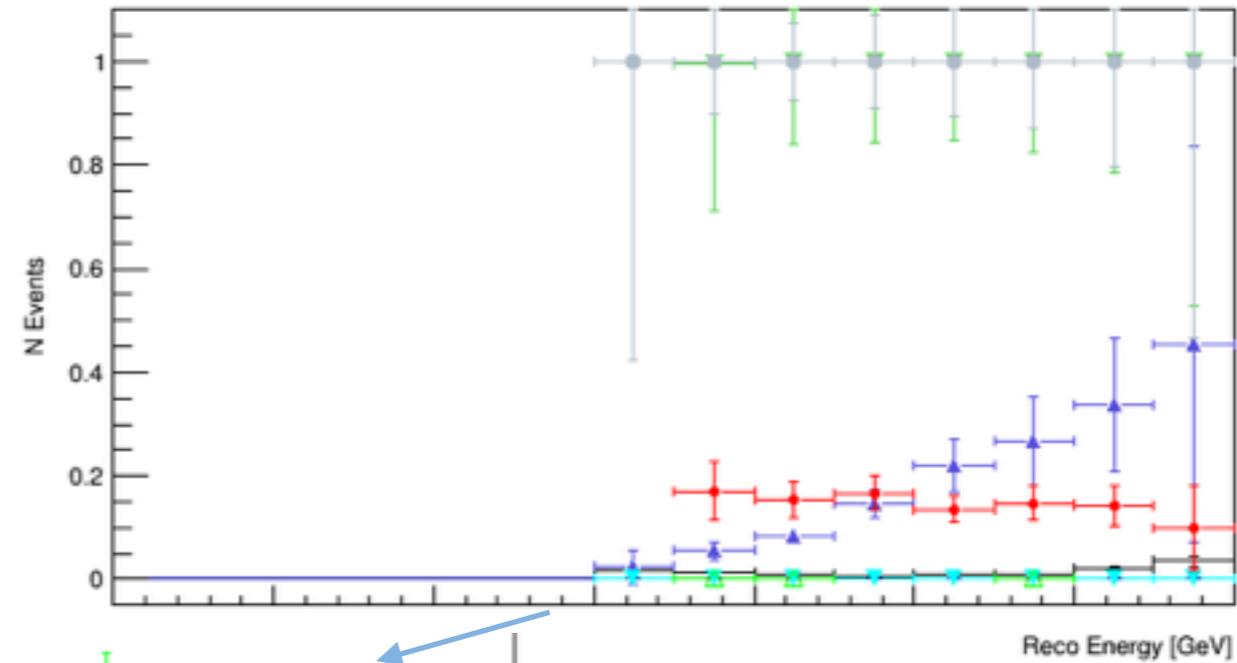
Oscillated_True_fd



Oscillated Energy Spectra (Reco)

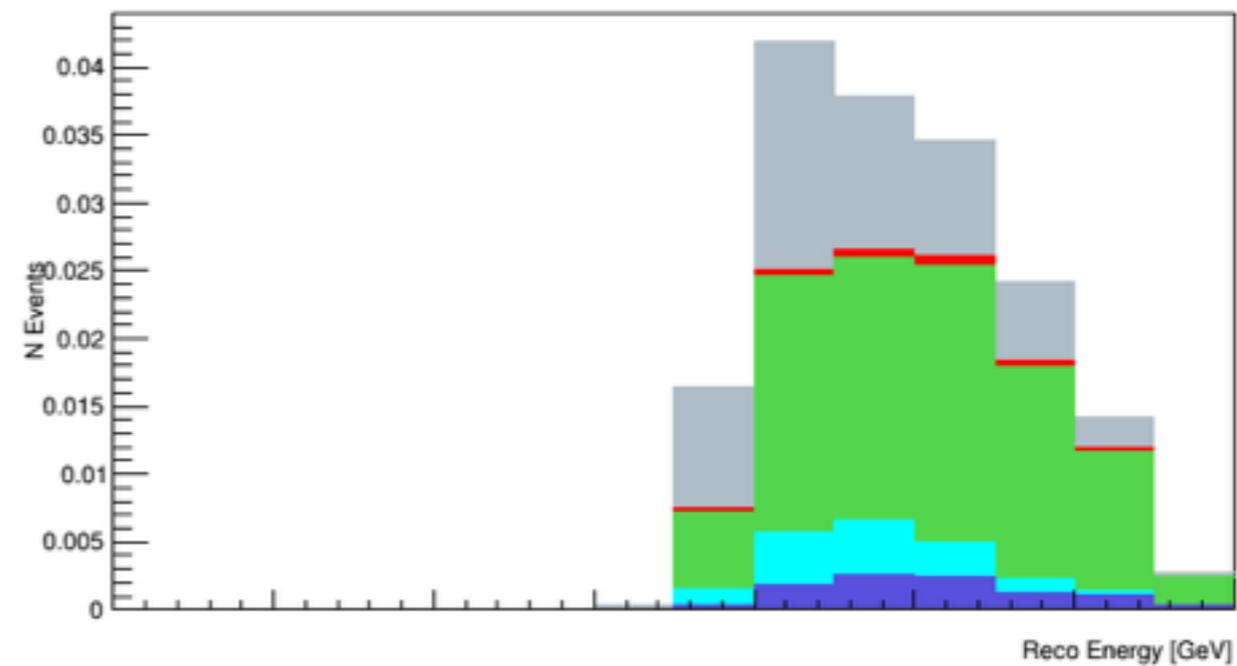
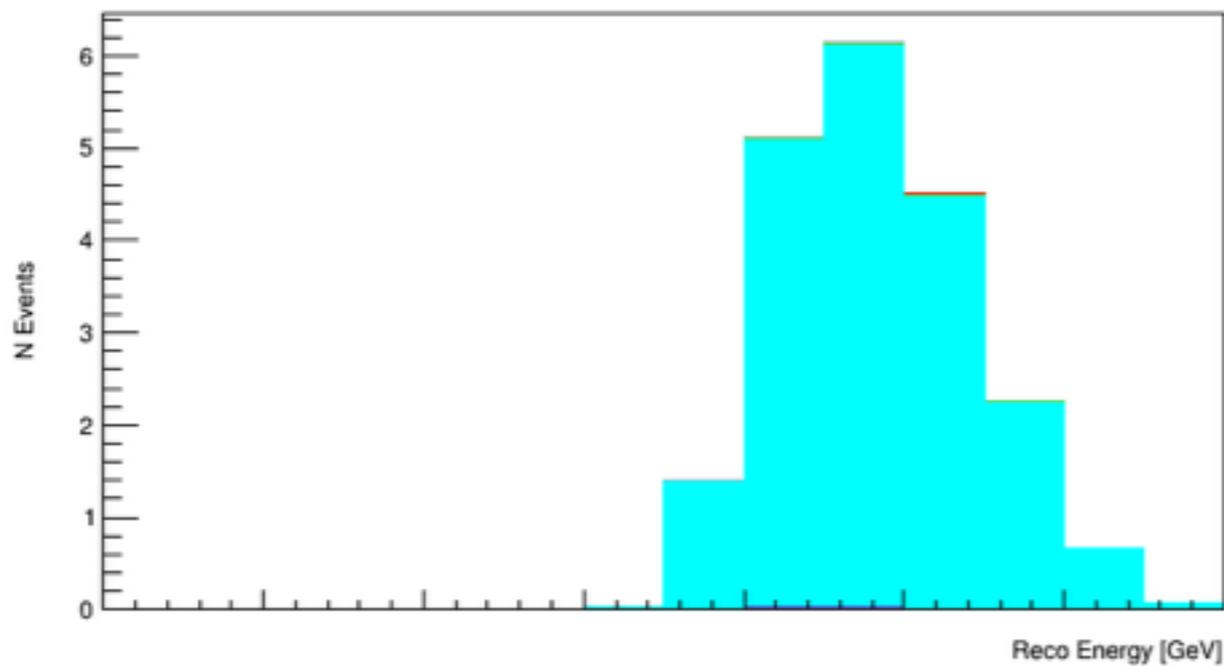


Osc_Over_Unosc_Ratio_Reco_fd



Unoscillated_Reco_fd

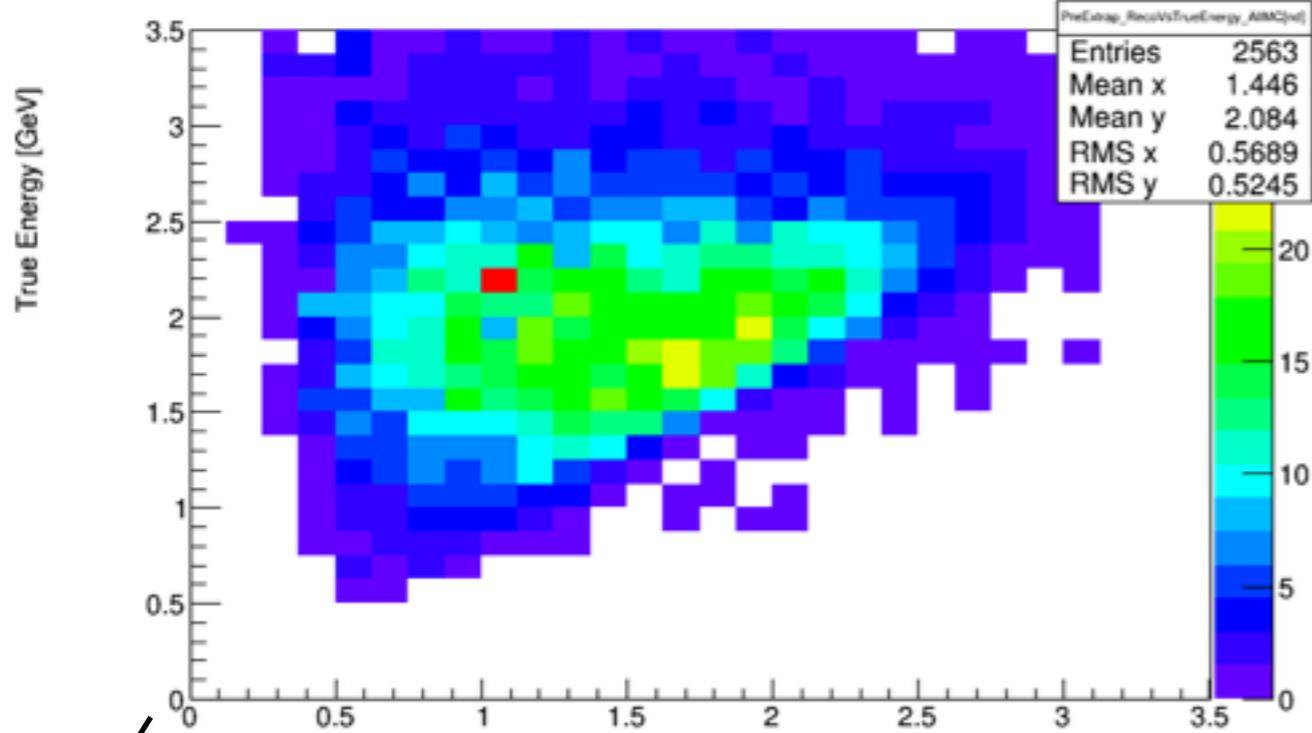
Oscillated_Reco_fd



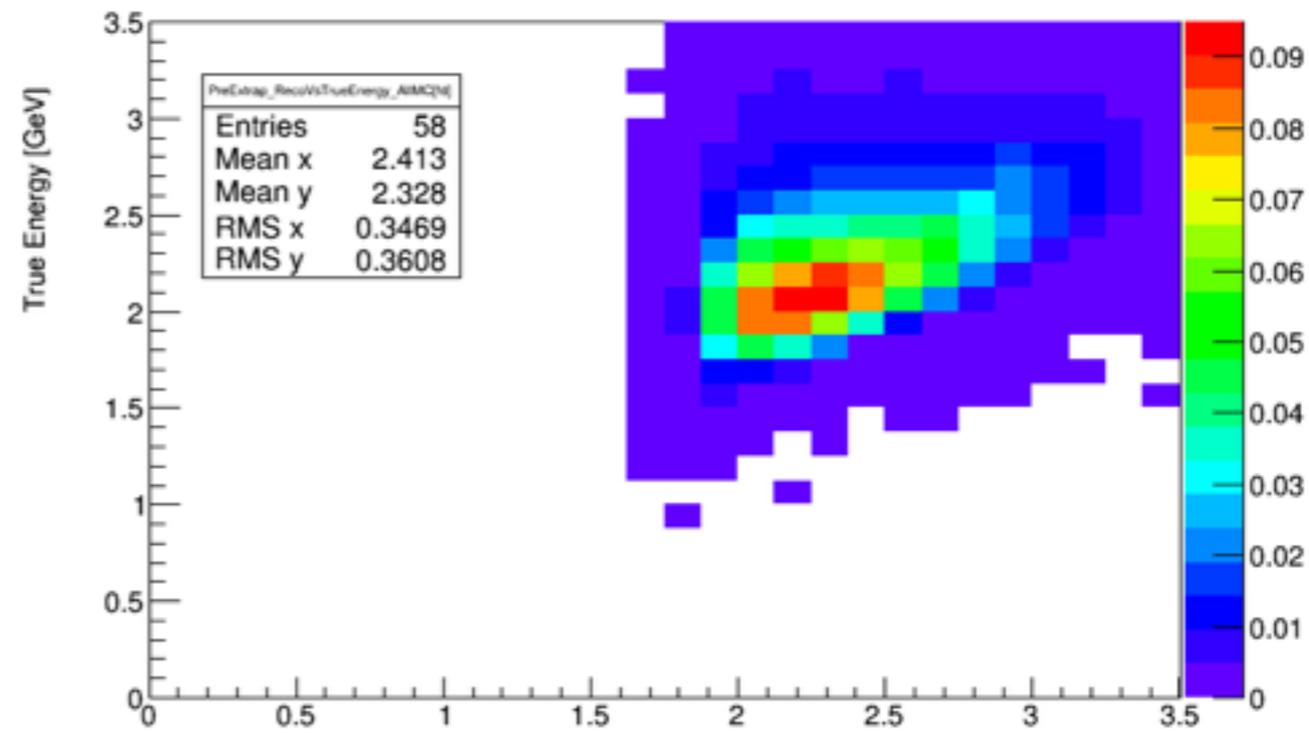
True vs Reco E

(all passing MC events, weighted by osc. prob.)

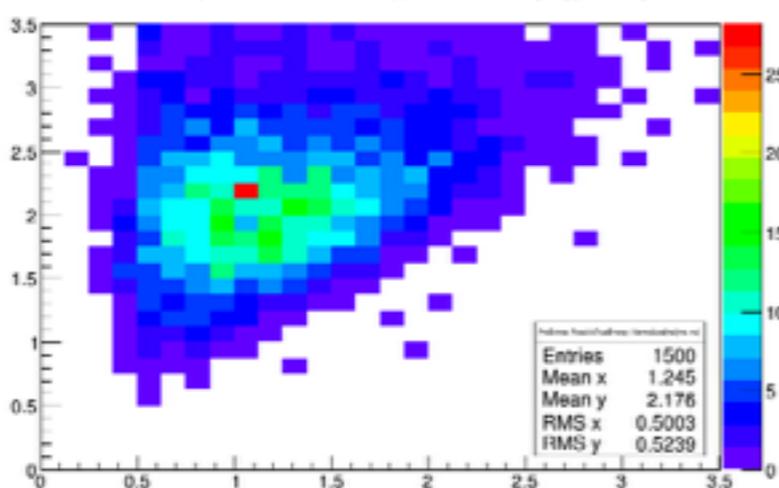
PreExtrap_RecoVsTrueEnergy_AllMC[nd]



PreExtrap_RecoVsTrueEnergy_AllMC[fd]

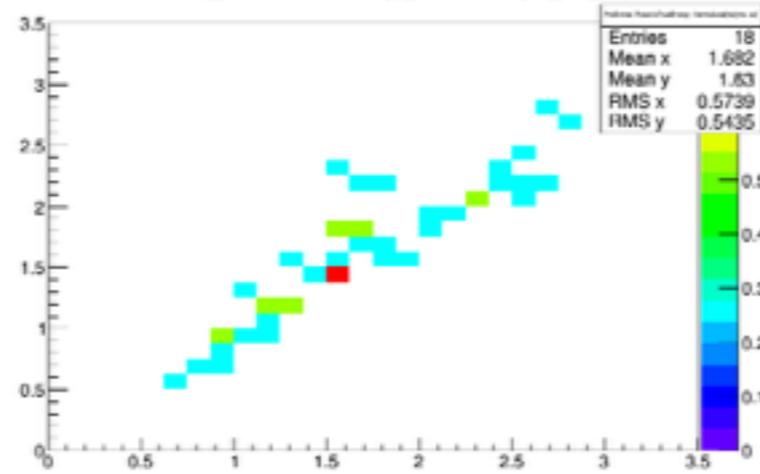


PreExtrap_RecoVsTrueEnergy_Normalized[nd][mc_nc]

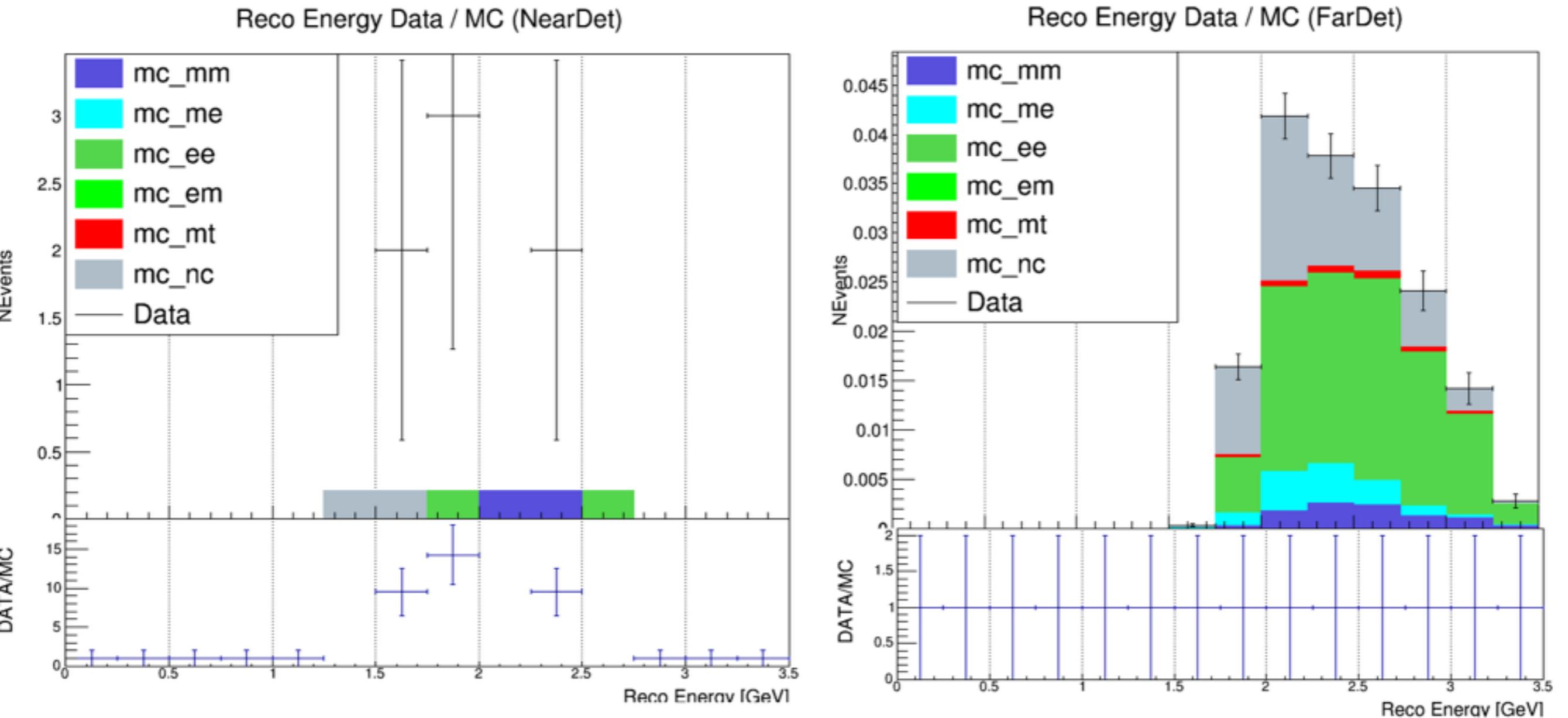


Reco Energy [GeV]

PreExtrap_RecoVsTrueEnergy_Normalized[nd][mc_ee]



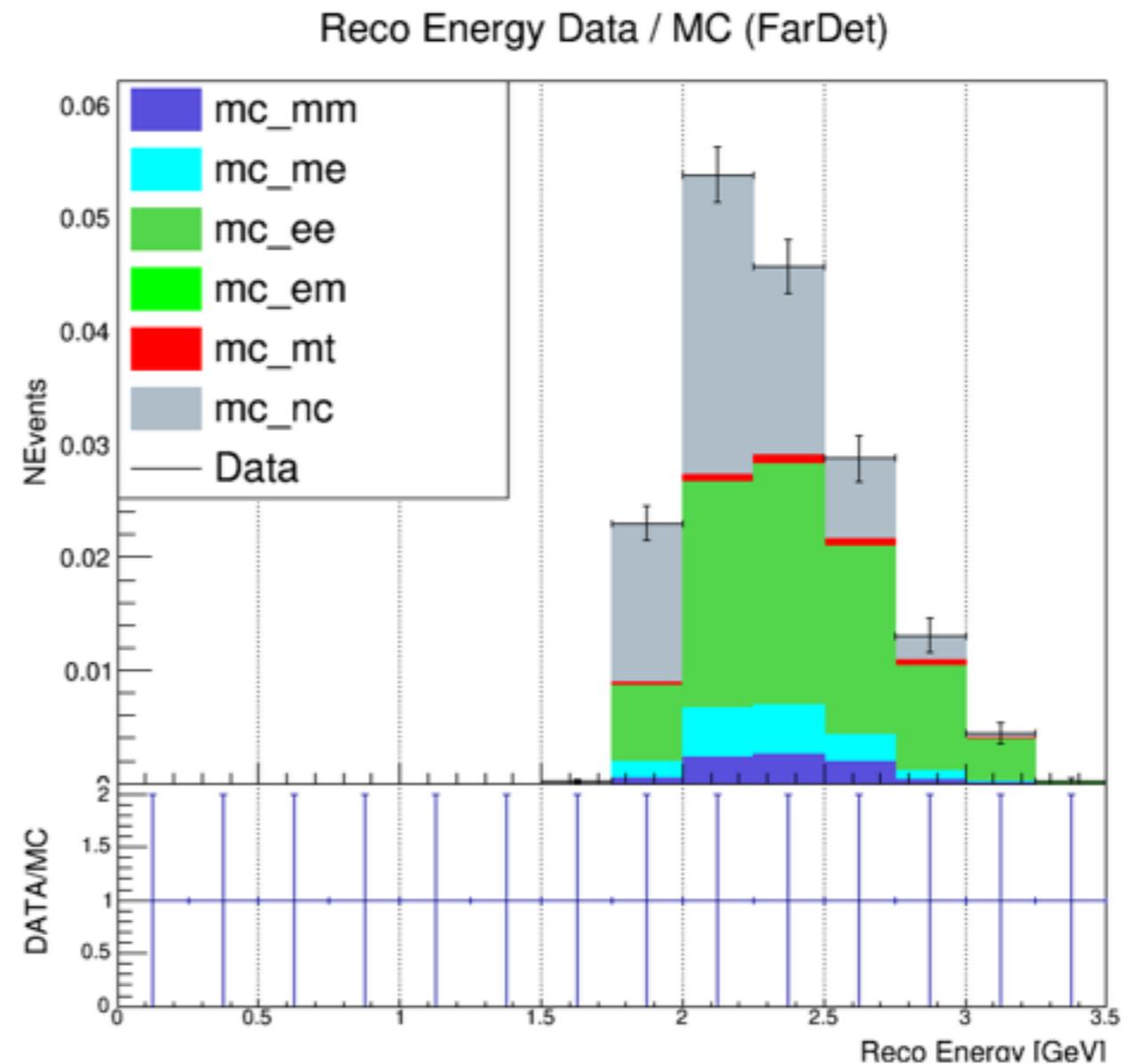
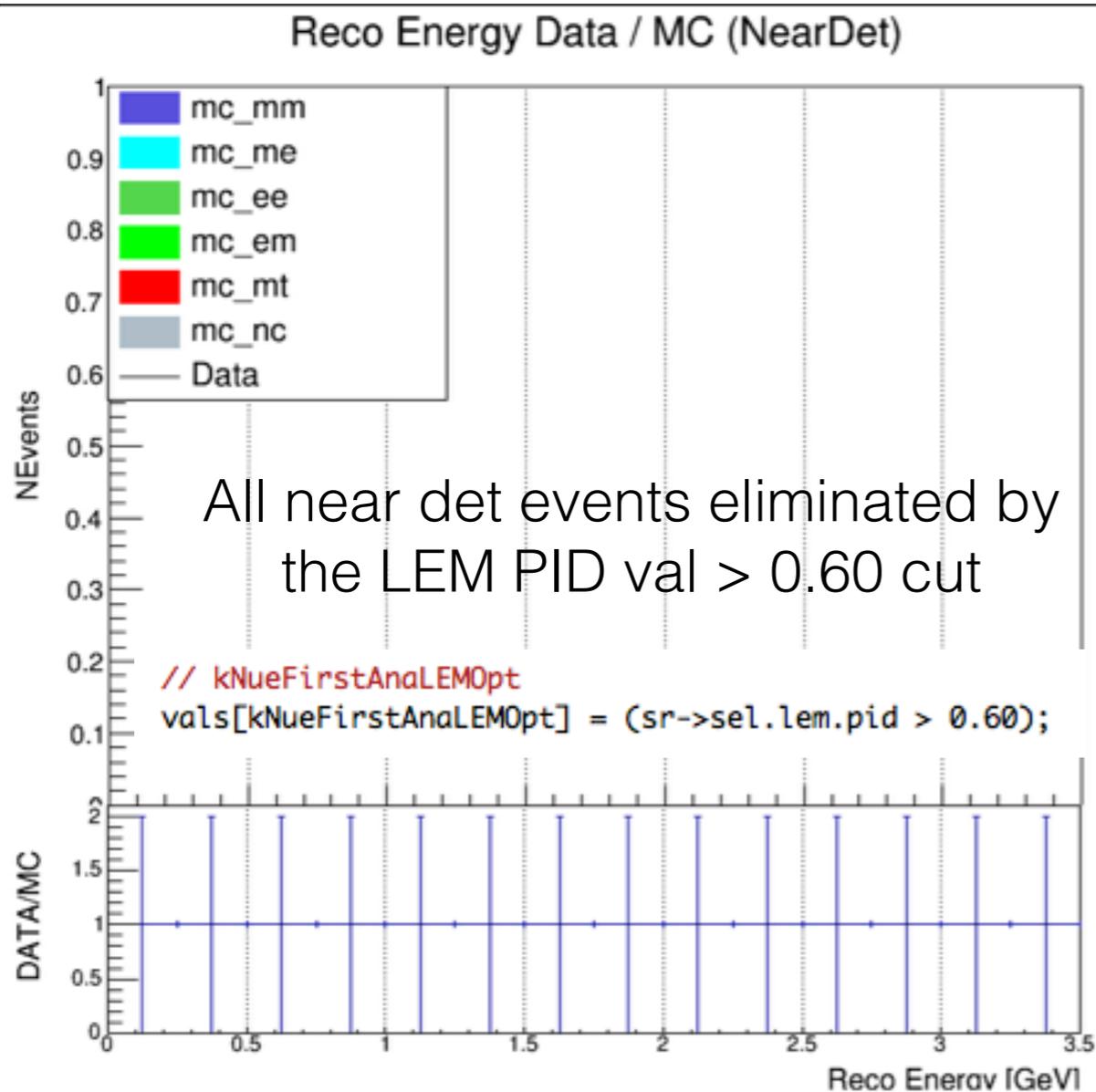
Nue LID selection cuts applied; FD scaled to POT=1E20
ND DATA is data & FD DATA is MC



Reconstructed Near/Far energy spectra
for selected events (reminder: scaled)

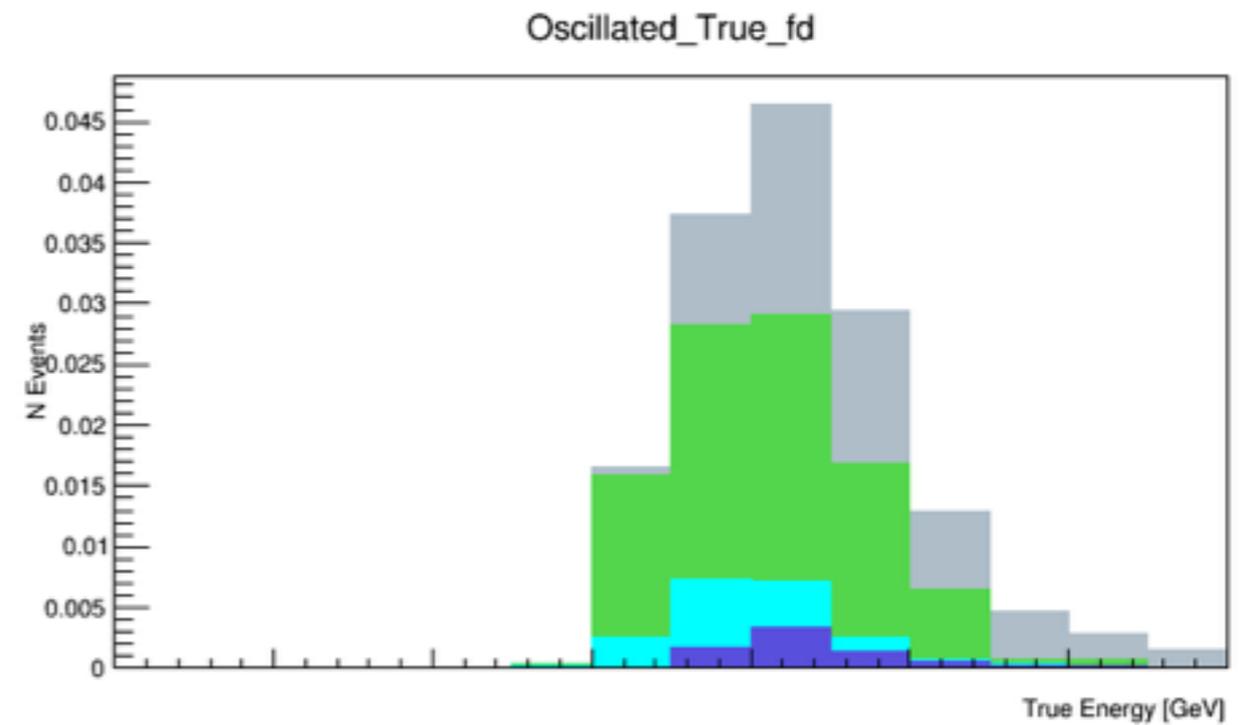
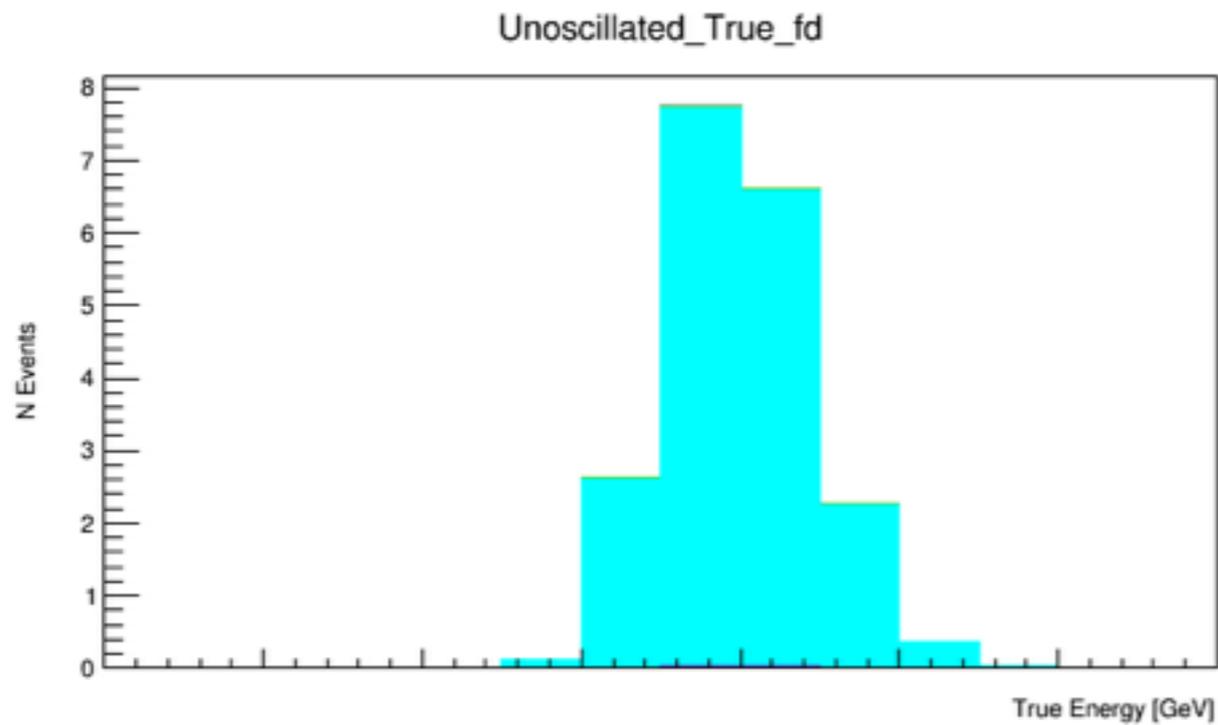
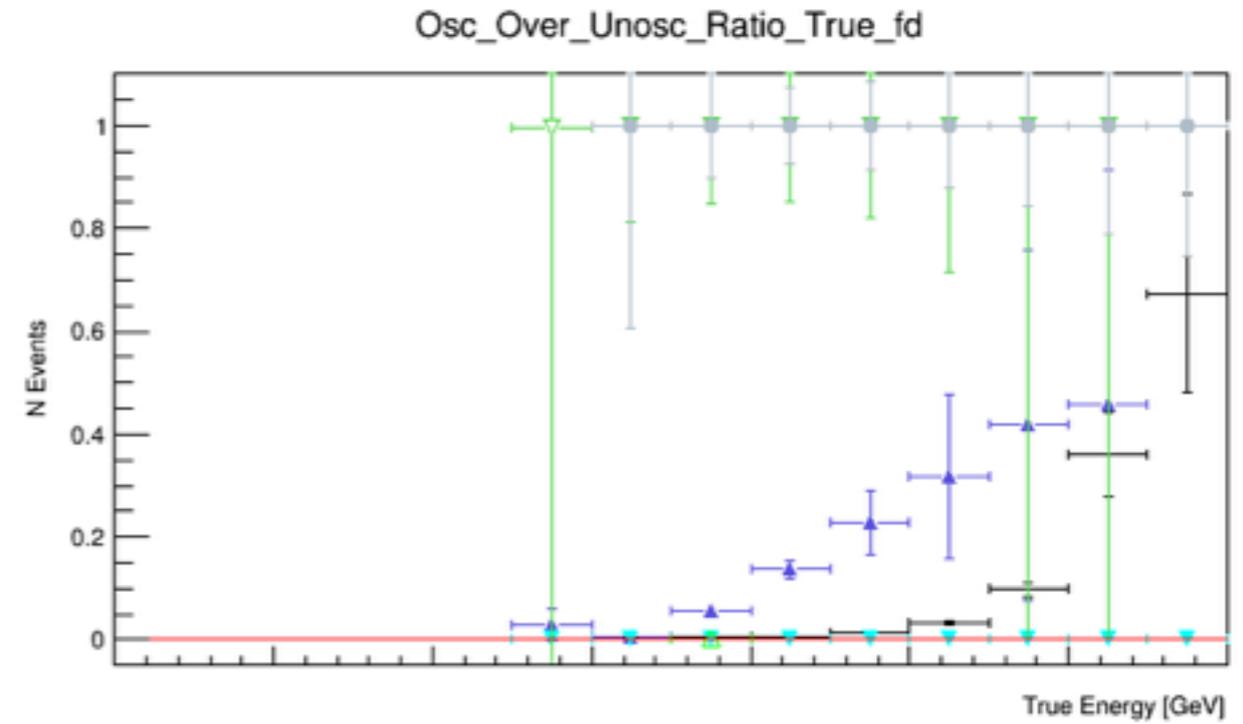
And the same plots for
Nue LEM selection

Nue LEM selection cuts applied; scaled to POT=1E20 MC 1 to 1

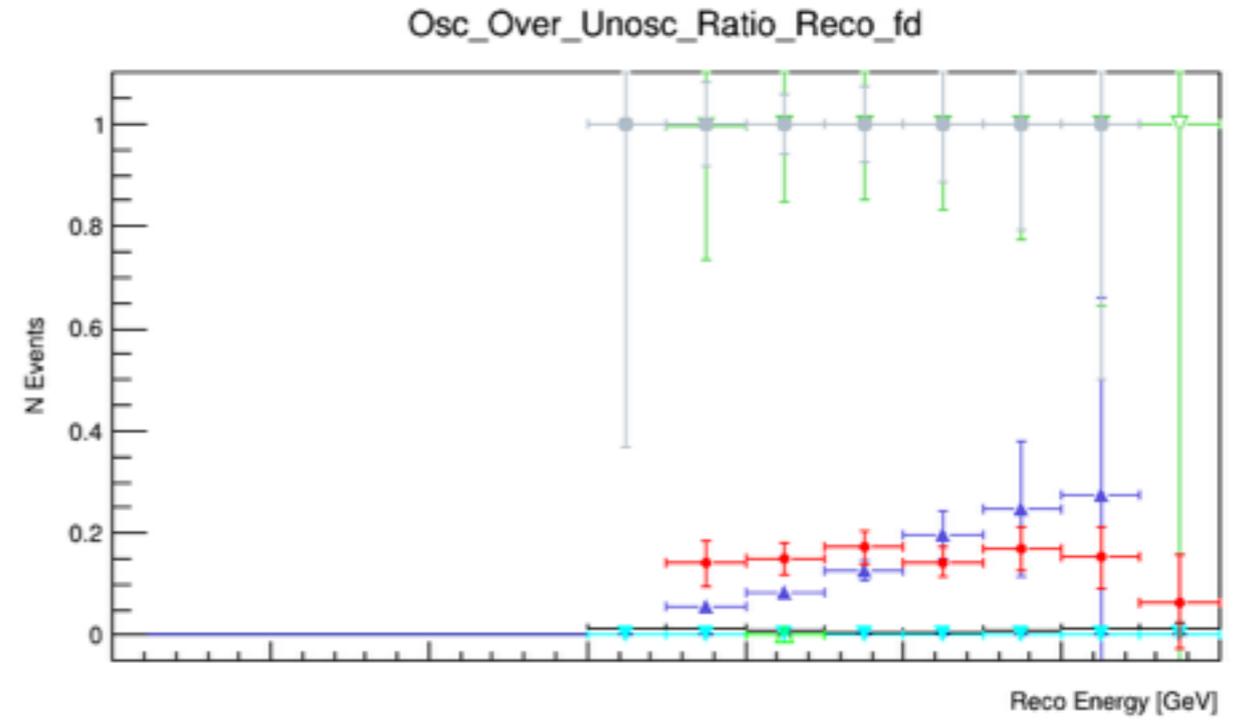


Reconstructed Near/Far energy spectra for selected events (reminder: scaled)

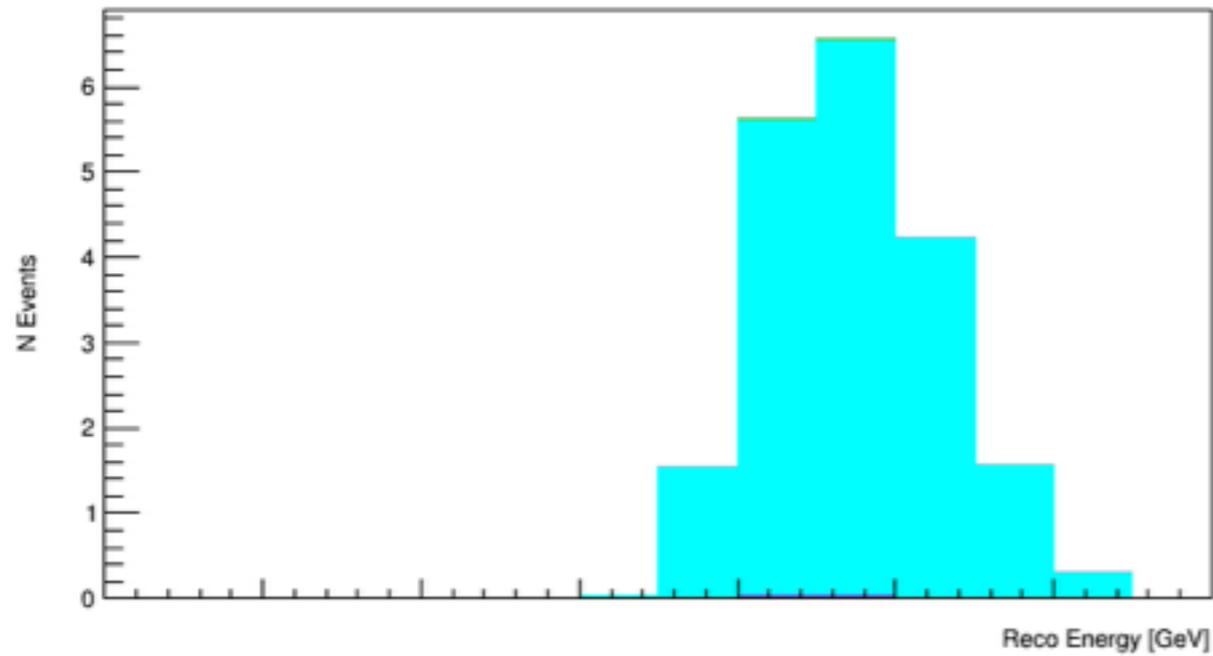
Oscillated Energy Spectra (True)



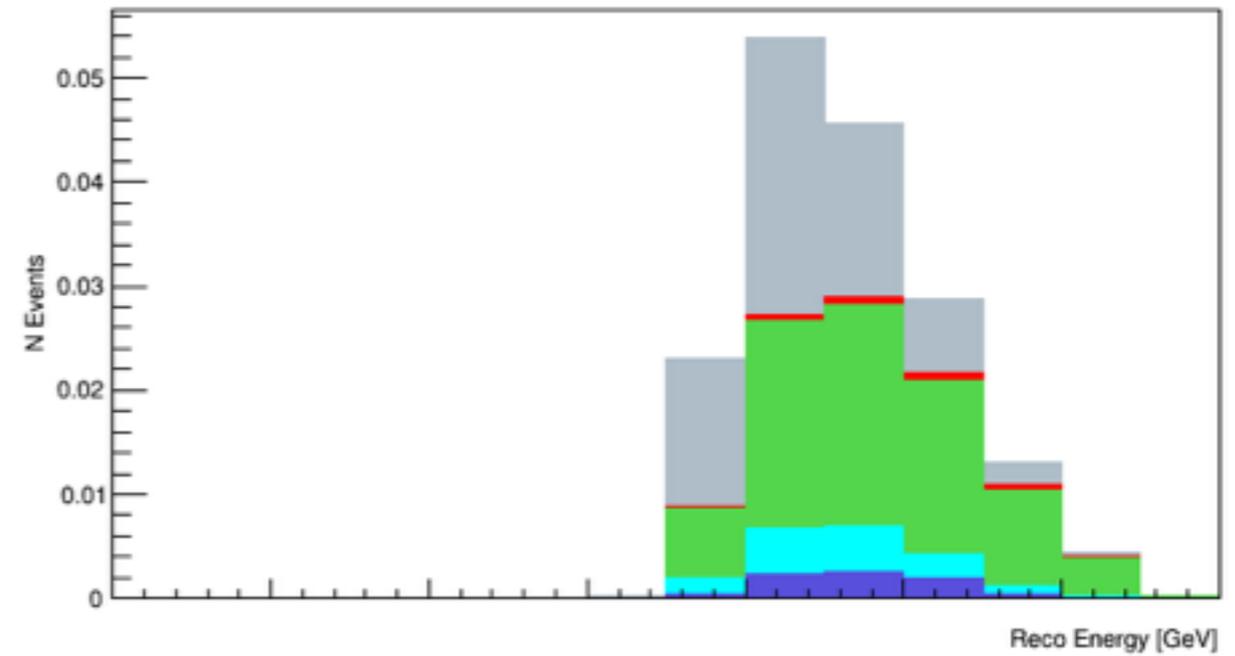
Oscillated Energy Spectra (Reco)



Unoscillated_Reco_fd



Oscillated_Reco_fd



Going into next week

Shifts plus extrapolation:

Look through CAFAna Extrap docs

Check that we follow same basic steps for good comparisons

Include cosmics / anti-neutrinos:

Anti-neutrinos a very easy feature to add

Cosmics for FD spectra

"Detecting the Invisible: Hunting Neutrinos"



May 30th, Chicago Science Fest
222 W. Merchandise Mart Plaza, 12th Floor,
Chicago, IL, 60654, United States

Suggestions / comments / things that would be good to
present?