ncgamma analysis tools

MC

NEUT

skdetsim

lowfit

make_ntuple

T2KReWeight

Scrape

data

lowfit

make_ntuple

Scrape

optimization

Systematic Errors

σ_{NCQE}

Corina Nantais
Group meeting
27 April 2017

How to proceed with MC: new code and new computer

Huang-san	my improvements	status
NEUT 5.1.4.2	NEUT 5.3.2	done, not tested
11a nominal flux, 11b v3.2 tuning	13 a nominal flux, 13a v1.1 tuning	not done
SterileAna	Prob3++	done, not tested
Alex T2KReWeight ~v1p17 (no NCQE)	T2KReWeight v1r27p2 (no NCQE)	started
neutrino only	neutrino and antineutrino	done, simple tests

NEUT 5.3.2

change NEUTROOT environment variable in skenv_py.csh

check out from svn
https://kmcvs.icrr.u-tokyo.ac.jp/svn/rlsep/neut/tags/neut_5.3.2/

can compare to old copy of /neut_5.3.2 used with Huang-san

these 2 files were since updated by Huang-san:
nudeex_n.F
nudeex_p.F

other files from modified 5.1.4.2 (must update svn and t2k.org instructions)
mk_num.sh
mk_nue.sh
mk_nmb.sh
go_submit.csh
neut_num.card
neut_nue.card
neut_nmb.card
mk_flux.list.sh

Move to 13a flux?


```
~@sukap001[174]_% ls /disk01/sklb/OLD/flux/
flux10a  flux10a_2  flux10a_root  flux11a  flux13a  sk  sk_nd5
~@sukap001[175]_% 
```

- flux13a/sk_nd5/root/ is empty, and there is nothing else?
- come back to this, 11a for now

3e5 NEUT 5.3.2 events of each of numu, nue, numubar

- neutfiles have a size, but 17 MB instead of 18 MB from Jan 17
- err/ are size 0, and are empty
- out/ looks ok

- can't really test until process everything
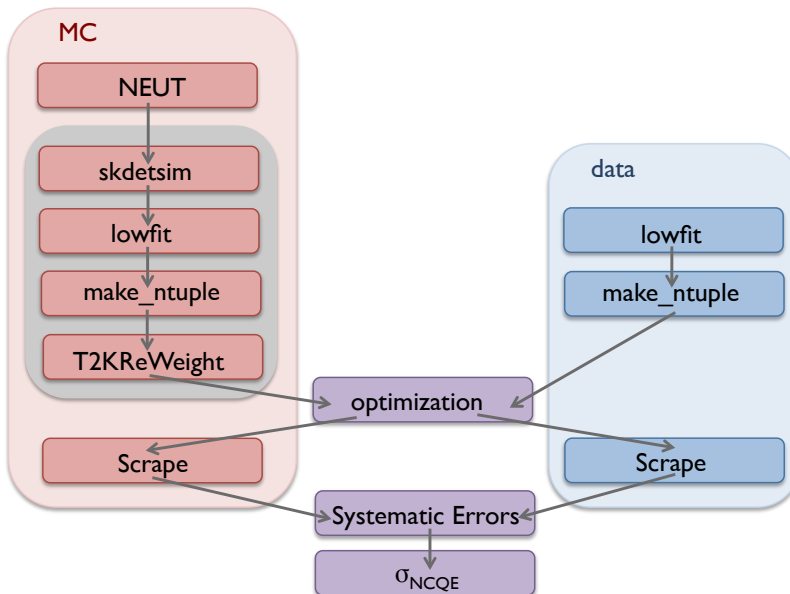
skip neut_select

- no neut_select for now (because I was having trouble with it before)
- it's just to save time

SterileAna

- simple oscillation program
- adapted from somewhere, probably an early T2K numu analysis
- calculates oscillation probability for CC events
- basic oscillation calculations based on equations in MINOS sterile papers
- only pieces used were the python scrape tools which created the limited ntuples, SterileScrapper.py and SterileSel.py in ncgamma/Processing/
- I also found Sterile in these 3 places:
1) ncgamma/Processing/ScrapeLE.py
   gSystem.Load("…/ncgamma/SterileAna/lib/libSterileAna.so")
2) ncgamma/SelectionFigures/SterileSel.py
3) SystematicErrors/SysError.py
   gSystem.Load("…/ncgamma.SterileAna.lib/libSterileAna.so")

- Alex doesn't remember why 1–3 need to load the compiled library. Comment it out and see what breaks

Comment it out and see what breaks

Change #1

Comment out

.../ncgamma/Processing/ScrapeLE.py

#gSystem.Load("$HOME/svntest/SterileAna/lib/libSterileAna.so")

#osc = SterileOsc()

#osc.CalcPMNS()

   #if iscc:

   # posc = osc.VacuumProbPDG(mctree.ipnu[0], iscc, int(scrape.treevars["appeared"][0]), mctree.pnu[0])

$ ./runscrape.csh

ncgamma.data.ontiming.root	ncgamma.xsec_prefit.ankowski.nosel.root
ngamma.data.ontiming.nosel.root	ncgamma.niwg.ankowski.root
ncgamma.data.offtiming.nosel.root	ncgamma.xsec_prefit.ankowskit.root
ncgamma.data.wideting.nosel.root	ncgamma.flux_prefit.ankowski.root

Change #2

Remove

.../ncgamma/SelectionFigures/SterileSel.py

Comment out

.../ncgamma/SelectionFigures/SelectionPlots.py

#from SterileSel import *

Comment it out and see what breaks

Nothing broke. Just did without adjusting for oscillation, I guess.

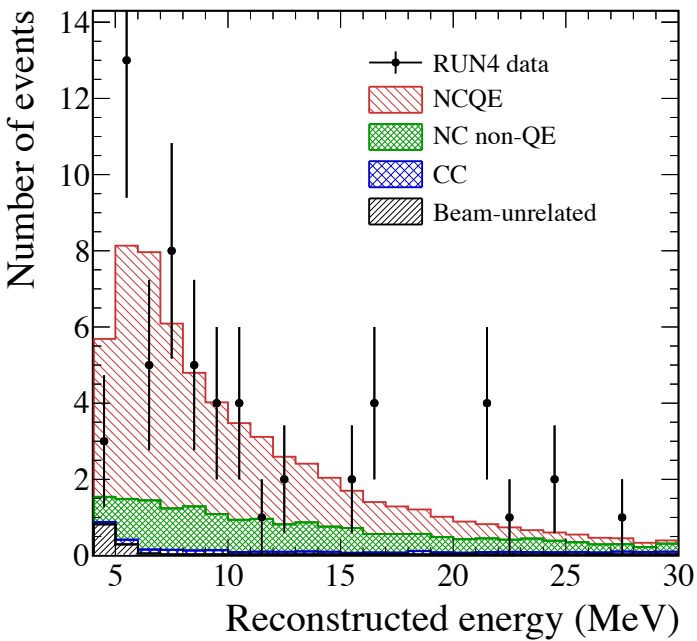Not surprised MC looks different, especially CC. See next 5 slides for examples.

Note that I looked at plots after Change #1 and Change #2.

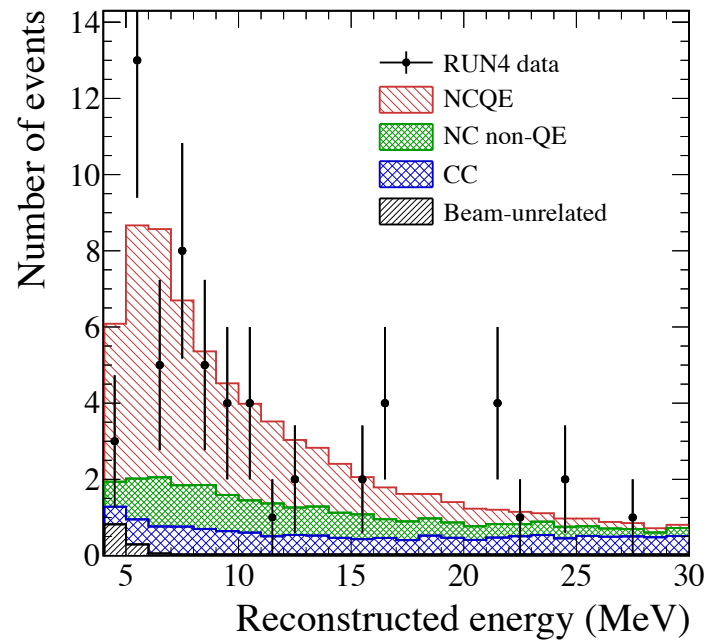Then undid Change #2, to see only Change #1.
Plots looked the same as the previous. So Change #2 had no effect?

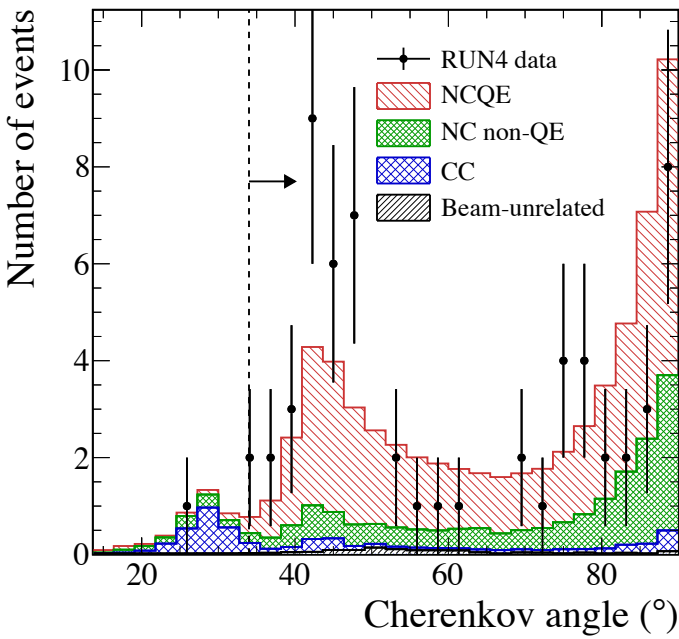MC looks different, especially CC

erec

original

Changes #1 & #2
Change #1
(plots look the same)

angle

original

Changes #1 & #2
Change #1
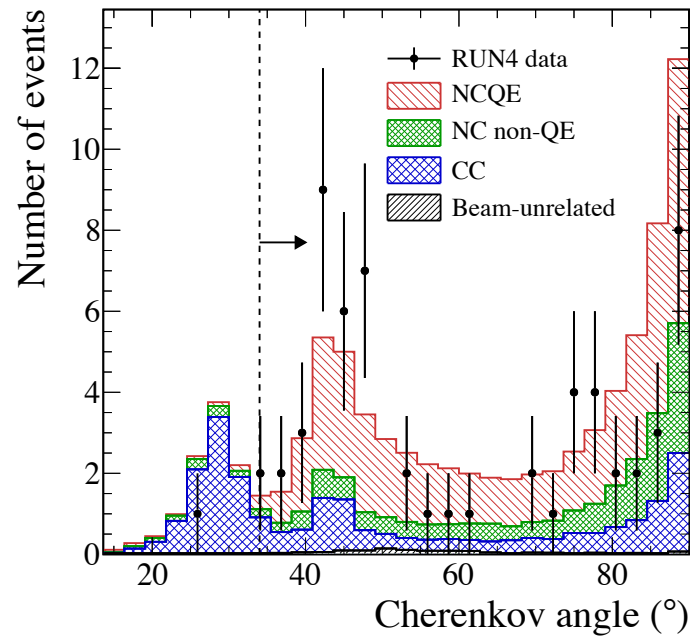(plots look the same)

dwall_both

MC looks different, especially CC
(Note different scale)
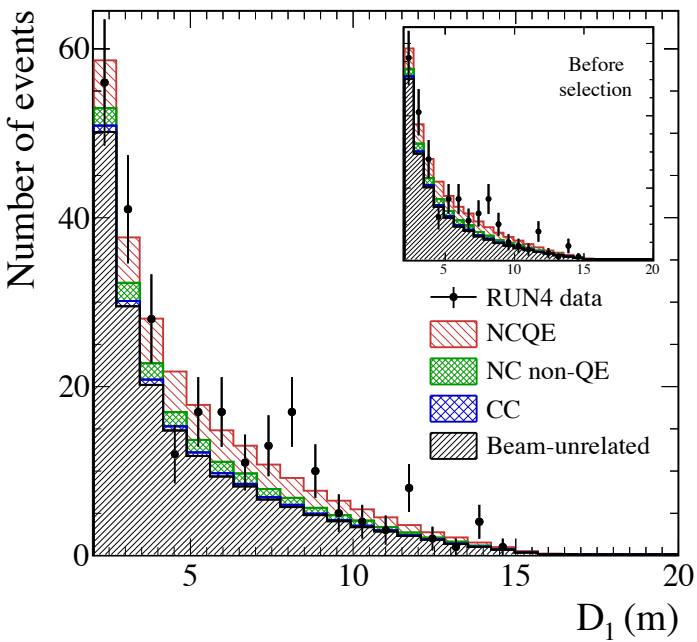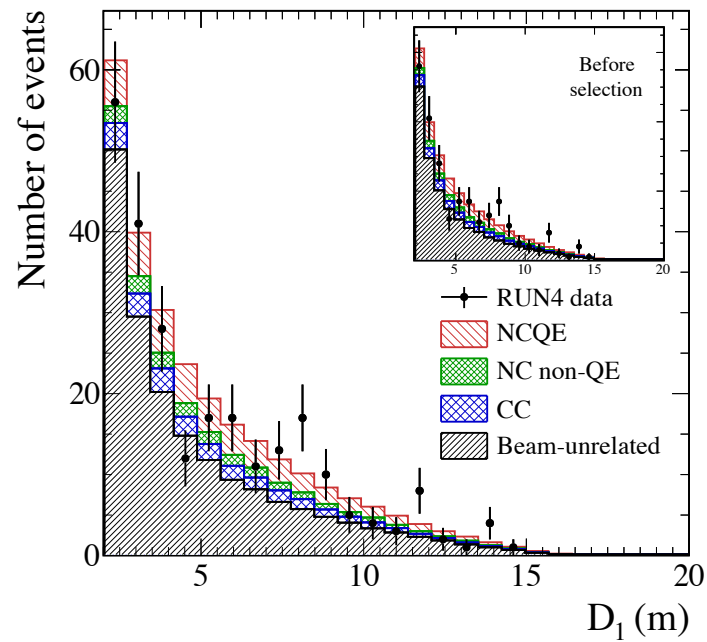
original

Changes #1 & #2
Change #1
(plots look the same)

effwall_both

MC looks different, especially CC
(Note different scale)
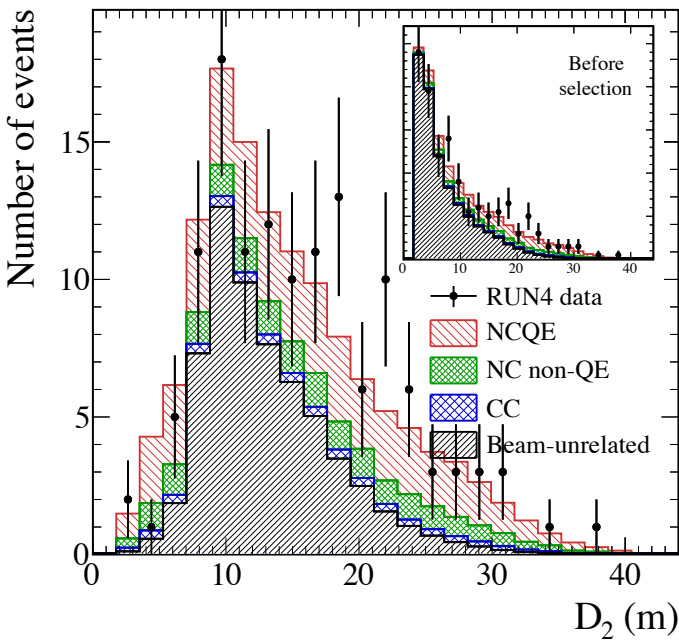
original

Changes #1 & #2
Change #1
(plots look the same)
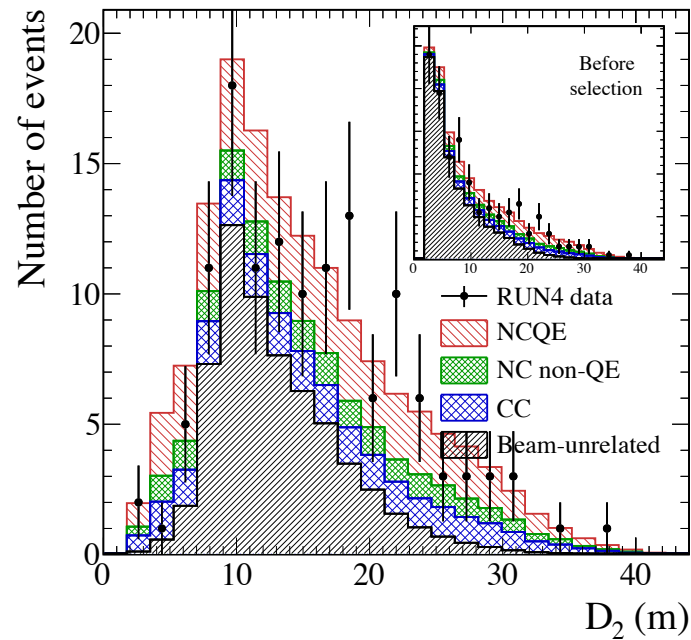
ovaq_both

MC looks different, especially CC
(Note different scale)

original
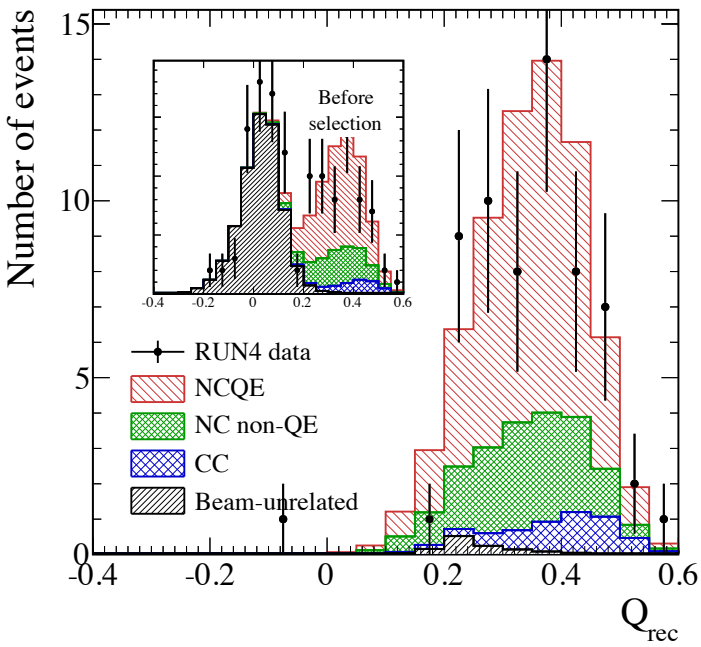
Changes #1 & #2
Change #1
(plots look the same)
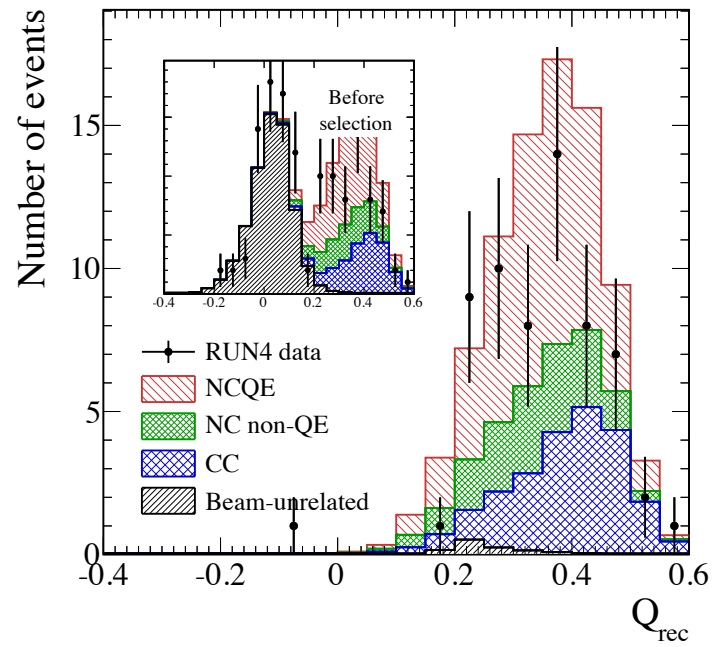
Comment it out and see what breaks

Change #2 only (no Change#1) – haven't tried yet

Change #3 – haven't tried yet

Comment out

…/ncgamma/SystematicErrors/SysError.py

    #gSystem.Load("…/ncgamma/SterileAna/lib/SterileAna.so")

    …

Use Prob3++

- Change #1 will need to be rewritten with Prob3++

- .so is a shared object, root

- look for osc

Xiaoyue

- "If you're looking for the regular Prob3++, it's here on sukap"
/home/skofl/sklib_gcc4.8.5/atmpd_16c/src/analysis/Prob3++/

→ there are .py files there

- "to set up all the paths and libraries"
source /home/sklb/software/setup.csh

- we use g77 and 14c
/home/skofl/sklib_g77/atmpd_14c/src/analysis/Prob3++

first, learn a bit about SterileAna

ncgamma/SterileAna/SterileAna/SterileOsc.cc

- CalcPMNS
- VacuumProbPDG
- VacuumProb

SterileOsc.cc

```cpp
Double_t SterileOsc::VacuumProbPDG(int inu, bool isCC,  bool appeared, Double_t pnu, Double_t length) const
{
    if (isCC) {
        if (appeared)
            return VacuumProb(mu, e, pnu);
        else if (abs(inu) == 14)
            return VacuumProb(mu, mu, pnu);
        else if (abs(inu) == 12)
            return VacuumProb(e, e, pnu);
        else
            return 1;
    }
    else {
        if (appeared)
            return 0;
        else if (abs(inu) == 14)
            return 1. - VacuumProb(mu, s, pnu);
        else if (abs(inu) == 12)
            return 1. - VacuumProb(e, s, pnu);
        else
            return 1.;
    }
}
```

```cpp
Double_t SterileOsc::VacuumProb(Nu_t a, Nu_t b, Double_t energy, Double_t length, bool eave) const
{
    if (length < 0) length = Ldef;

    Double_t LoE = 1.26693281 * length / energy;

    Double_t dms[5][5];
    dms[4][3] = dm43;
    dms[4][2] = dm43+dm32;
    dms[4][1] = dm43+dm32+dm21;
    dms[3][2] = dm32;
    dms[3][1] = dm32+dm21;
    dms[2][1] = dm21;

    Double_t sinsq;
    Double_t sin2m;
```

```cpp
    Double_t prob = 0, pinc;
    complex<Double_t> M;
    if (a == b) prob += 1;

    for (int j = 1; j <= 4; j++) {
        for (int i = j+1; i <= 4; i++) {
            double phase = dms[i][j]*LoE;
            //if (dms[i][j] <= 1.0) {
            //if (phase >= 6.28318530718 && eave) {
            if (phase >= 7.0685 && eave) {
                sinsq = 0.5;
                sin2m = 0;
            }
            else {
                sinsq = pow(sin(phase),2);
                sin2m = sin(2.*phase);
            }

            M = conj(U[a][i])*U[b][i]*U[a][j]*conj(U[b][j]);
            pinc = -4.*real(M)*sinsq + 2*imag(M)*sin2m;
            prob += pinc;
        }
    }

    return prob;
}
```

19

ncgamma/Proecssing/ScrapeLE.py

- posc
- replace VacuumProbPDG with Prob3++ probability

```python
if options.mcmode:
    scrape.SetVar('pnu', mctree.pnu[0])
    scrape.SetVar('inu', mctree.ipnu[0])
    scrape.SetVar('mode', abs(mctree.mode))
    iscc = is_cc(mctree)
    scrape.SetVar('isCC', iscc)
    isqe = is_qe(mctree)
    scrape.SetVar('isQE', isqe)
    scrape.SetVar('onePi0', one_pi0(mctree))
    scrape.SetVar('onePipm', one_pipm(mctree))
    posc = 1.
    if iscc:
        posc = osc.VacuumProbPDG(mctree.ipnu[0], iscc, int(scrape.treevars["appeared"][0]), mctree.pnu[0])
    scrape.SetVar('t2kposc', posc)
```

Prob3++ README

```
20130125

Prob3++ is an Engine for computing three-flavor neutrino oscillation
probabilities. The main library libThreeProb.a can be used
to externally call routines to compute said probabilities.

////// Library Version
    This document is valid for library version
     v2.10
```

Prob3++ README

```
//////////////////
 Python Wrapper

 - A simple python wrapper for just the BargerPropagator class is provided
in the py_wrapper.c. It has been written under ctypes, instead of something
more fancy, because cytpes is bundled (and should therefore be present) in
all pthon distributions.

 To use the shared library must be used:

 >make shared

 Be sure that the Prob3++ directory is included in your LD_LIBRARY_PATH, or install
the shared library into some directory that is.


 To run the test script, you may have to change the path to the python executable
at the top of the file: simpleLinear.py . This script requires pyroot.
```

- source /home/sklb/software/setup.csh
- it is gcc and 16c…

```tcsh
#!/bin/tcsh -f

if (-e /home/skofl/sklib_gcc4.8.5/skofl_16c/env.csh) then
    source /home/skofl/sklib_gcc4.8.5/skofl_16c/env.csh
endif

if (-e /home/skofl/sklib_gcc4.8.5/atmpd_16c/env.csh) then
    source /home/skofl/sklib_gcc4.8.5/atmpd_16c/env.csh
endif

#setenv CVSROOT :ext:anoncvs@repo.nd280.org:/home/trt2kmgr/ND280Repository
setenv CVSROOT :ext:anoncvs@repo.nd280.org:/home/trt2kmgr/T2KRepository
setenv CVS_RSH ssh
unset CVS_SERVER

#setenv PATH /home/xiaoyue/.local/bin:$PATH

setenv CERNLIB /home/skofl/sklib_gcc4.8.5/cern/2005
```

- /home/skofl/sklib_gcc4.8.5/skofl_16c/env.csh

```
setenv CC "gcc"
setenv CXX "g++"
setenv CPP "/lib/cpp"
setenv FC "gfortran"
setenv SKOFL_ROOT /home/skofl/sklib_gcc4.8.5/skofl_16c
setenv CERN /home/skofl/sklib_gcc4.8.5/cern
setenv CERN_LEVEL 2005
setenv CERN_ROOT /home/skofl/sklib_gcc4.8.5/cern/2005
setenv ROOTSYS /home/skofl/sklib_gcc4.8.5/root_v5.28.00h
setenv NEUT_ROOT /home/skofl/sklib_gcc4.8.5/neut_5.3.6
setenv ATMPD_ROOT /home/skofl/sklib_gcc4.8.5/atmpd_16c
set path = ( $SKOFL_ROOT/bin $ATMPD_ROOT/bin $ROOTSYS/bin $CERN_ROOT/bin $path )
if ($?LD_LIBRARY_PATH) then
 setenv LD_LIBRARY_PATH $SKOFL_ROOT/lib:`/home/skofl/sklib_gcc4.8.5/root_v5.28.00h/bin/root-config --libdir`:$LD_L\
IBRARY_PATH
else
 setenv LD_LIBRARY_PATH $SKOFL_ROOT/lib:`/home/skofl/sklib_gcc4.8.5/root_v5.28.00h/bin/root-config --libdir`
endif
```

also, NEUT 5.3.6 instead of NEUT 5.3.2

local copy of Prob3++

- don't want to "make shared" in skofl directory
- cp –r /home/sklib_g77_atmpd_14c/src/analysis/Prob3++
- make shared
- libThreeProb.so was created

- change skenv_py.csh LD_LIBRARY_PATH to this copy of Prob3++

```
#setenv LD_LIBRARY_PATH "$SKOFL_ROOT/lib:/home/cnantais/ncgamma/SterileAna/lib:`$ROOTSYS/bin/root-config --libdir`:$LD_L\
IBRARY_PATH"
#if ($?LD_LIBRARY_PATH) then
# setenv LD_LIBRARY_PATH  $SKOFL_ROOT/lib:`$ROOTSYS/bin/root-config --libdir`:$LD_LIBRARY_PATH
#else
# setenv LD_LIBRARY_PATH  $SKOFL_ROOT/lib:`$ROOTSYS/bin/root-config --libdir`
#endif
setenv LD_LIBRARY_PATH "$SKOFL_ROOT/lib:/home/cnantais/ncgamma/Prob3++/lib:`$ROOTSYS/bin/root-config --libdir`:$LD_LIBRA\
RY_PATH"
```

ran Prob3++ example
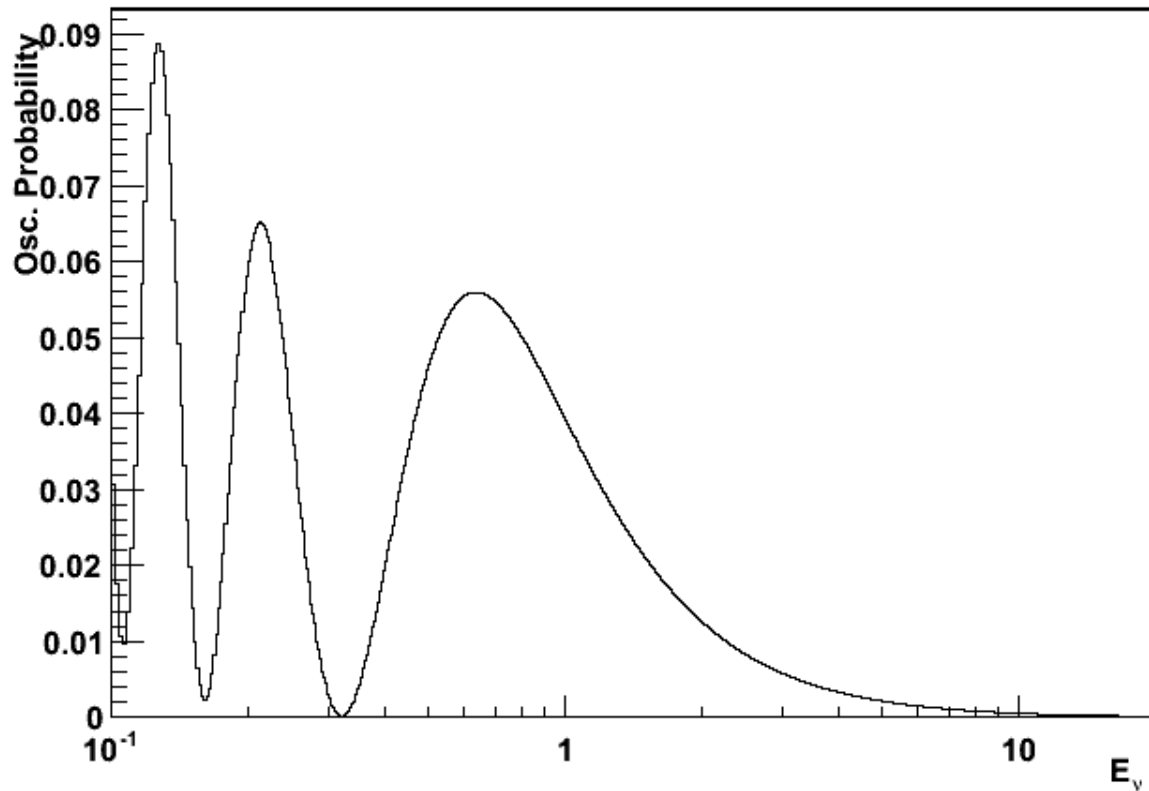
- cp Prob3++/BargerPropagator.py Processing/.

ScrapeLE.py

```
#gSystem.Load("$HOME/ncgamma/SterileAna/lib/libSterileAna.so")
#osc = SterileOsc()
#osc.CalcPMNS()

from BargerPropagator import *

# Get the Propagator
b = BargerPropagator()

# Define the oscillation parameters
x12    = 0.825
x13    = 0.10
x23    = 1.0
m21    = 7.9e-5
mAtm   = 2.5e-3
delta  = 0.

# ks: 0 - sin2(2q) variables
# ks: 1 - sin2( q) variables
ks     = 0
```

oscillation parameters from Prob3++ example

actually, posc might have to be 1-b.GetProb()
from SterileOsc.cc

```
posc = 1.
if iscc:
    #posc = osc.VacuumProbPDG(mctree.ipnu[0], iscc, int(scrape.treevars["appeared"][0]), mctree.pnu[0])

    if mctree.ipnu[0] > 0:      nutype = 1 #neutrino
    else:                       nutype = -1 #antineutrino

    energy = mctree.pnu[0] #neutrino energy
    b.SetMNS( x12, x13, x23, m21, mAtm, delta, energy, ks, nutype )
    b.propagateLinear( 1 , 295.0 , 2.6 ) #2.6 g/cm^3 was the default

    if mctree.ipnu[0] == 12:    nuflav = 2 #electron
    else:                       nuflav = 1 #muon

    posc = b.GetProb(nuflav,nuflav) #(nuin, nuout) so prob that it doesn't change, I think
scrape.SetVar('t2kposc', posc)
```

oscillation parameters

from Trevor:

Δm^2_{21} = 7.53e-5

Δm^2_{32} = 2.5e-3

$\sin^2\theta_{12}$ = 0.304

$\sin^2\theta_{13}$ = 0.0219

$\sin^2\theta_{23}$ = 0.5

BasePath = 1100 km

Density = 3.0 g/cm3

Table 14.1: The best-fit values and 3σ allowed ranges of the 3-neutrino oscillation parameters, derived from a global fit of the current neutrino oscillation data (from [60]). For the Dirac phase δ we give the best fit value and the 2σ allowed ranges; at 3σ no physical values of δ are disfavored. The values (values in brackets) correspond to $m_1 < m_2 < m_3$ ($m_3 < m_1 < m_2$). The definition of Δm^2 used is: $\Delta m^2 = m_3^2 - (m_2^2 + m_1^2)/2$. Thus, $\Delta m^2 = \Delta m_{31}^2 - \Delta m_{21}^2/2 > 0$, if $m_1 < m_2 < m_3$, and $\Delta m^2 = \Delta m_{32}^2 + \Delta m_{21}^2/2 < 0$ for $m_3 < m_1 < m_2$.

Parameter	best-fit	3σ
Δm^2_{21} [10^{-5} eV ^{2}]	7.37	$6.93 - 7.97$
$|\Delta m^2|$ [10^{-3} eV ^{2}]	2.50 (2.46)	$2.37 - 2.63$ ($2.33 - 2.60$)
$\sin^2\theta_{12}$	0.297	$0.250 - 0.354$
$\sin^2\theta_{23}$, $\Delta m^2 > 0$	0.437	$0.379 - 0.616$
$\sin^2\theta_{23}$, $\Delta m^2 < 0$	0.569	$0.383 - 0.637$
$\sin^2\theta_{13}$, $\Delta m^2 > 0$	0.0214	$0.0185 - 0.0246$
$\sin^2\theta_{13}$, $\Delta m^2 < 0$	0.0218	$0.0186 - 0.0248$
δ/π	1.35 (1.32)	$(0.92 - 1.99)$
		$((0.83 - 1.99))$

rpp2016-rev-neutrino-mixing.pdf
14. NEUTRINO MASS, MIXING, AND OSCILLATIONS
[60] F. Capozzi et al., arXiv:1601.07777

```python
from BargerPropagator import *

# Get the Propagator
b = BargerPropagator()

# Define the oscillation parameters
x12     = 0.297
x13     = 0.0214
x23     = 0.437
m21     = 7.37e-5
mAtm    = 2.50e-3
delta   = 0.

# ks: 0 - sin2(2q) variables
# ks: 1 - sin2( q) variables
ks      = 1
```

actually, posc might have to be 1-b.GetProb()
from SterileOsc.cc

```python
        if iscc:
            #posc = osc.VacuumProbPDG(mctree.ipnu[0], iscc, int(scrape.treevars["appeared"][0]), mctree.pnu[0])

            if mctree.ipnu[0] > 0:      nutype = 1 #neutrino
            else:                       nutype = -1 #antineutrino

            energy = mctree.pnu[0] #neutrino energy
            b.SetMNS( x12, x13, x23, m21, mAtm, delta, energy, ks, nutype )
            b.propagateLinear( nutype, 295.0, 3.0 ) #3.0 g/cm^3

            # 1:e 2:mu 3:tau  -1:e_bar -2:mu_bar -3:tau_bar
            if ipnu == 12:    nuflav = 1 #nue
            elif ipnu < 0:    nuflav = -2 #numubar
            else:             nuflav = 2 #numu

            posc = b.GetProb(nuflav,nuflav) #(nuin, nuout)
        scrape.SetVar('t2kposc', posc)
```

ncgamma/Processing/ScrapeLE.py

- testosc.py works well

just need to check:

1) mctree.ipnu[0] as neutrino neutrino type
   12 → nue
   <0 → numubar
   else → numu

2) mctree.pnu[0] as neutrino energy, must be in GeV for Prob3++

ncgamma/SystematicErrors/SysError.py

Change #3

search for osc, like Change #1

cp Prob3++/BargerPropagator.py SystematicErrors/.

ncgamma/SystematicErrors/SysError.py

```python
#gSystem.Load("/home/cnantais/ncgamma/SterileAna/lib/libSterileAna.so")

#
# Initialize some objects
#
rand = TRandom3()
#osc = SterileOsc()
#osc.CalcPMNS()

from BargerPropagator import *

# Get the Propagator
b = BargerPropagator()

# Define the oscillation parameters
x12     = 0.297
x13     = 0.0214
x23     = 0.437
m21     = 7.37e-5
mAtm    = 2.50e-3
delta   = 0.

# ks: 0 - sin2(2q) variables
# ks: 1 - sin2( q) variables
ks      = 1
```

comment out SterileAna.so
add Prob3++

33

ncgamma/SystematicErrors/SysError.py

```python
if tree.inu == 14:
    f = "numu"
elif tree.inu == -14:
    f = "numubar"
elif tree.inu == 12:
    f = "nue"
else:
    print "Flavor unrecognized:", tree.inu

pion = False
if tree.mode > 30 and tree.mode < 35: pion = True

#posc = osc.VacuumProbPDG(tree.inu, tree.isCC, tree.appeared, tree.pnu)

if tree.inu > 0:      nutype = 1 #neutrino
else:                 nutype = -1 #antineutrino

energy = tree.pnu #neutrino energy
b.SetMNS( x12, x13, x23, m21, mAtm, delta, energy, ks, nutype )
b.propagateLinear( nutype, 295.0, 3.0 ) #3.0 g/cm^3

# 1:e 2:mu 3:tau  -1:e_bar -2:mu_bar -3:tau_bar
if tree.inu == 12:        nuflav = 1   #nue
elif tree.inu == -14:     nuflav = -2 #numubar
else:                     nuflav = 2   #numu

posc = b.GetProb(nuflav,nuflav) #(nuin, nuout)

# Weights, on the other hand, are different
for (x,r), tree in trees.items():
    key = (x,r,c,f)
    # weight[0] already included in weight
    #wgt = scale1*tree.weight1 + scale2*tree.weight2 + scale3*tree.weight3 + scale4*tree.weight4
    wgt = scale4*tree.weight4
    wgt *= posc
```

actually, posc might have to be 1-b.GetProb()
from SterileOsc.cc

ncgamma/SystematicErrors/SysError.py

just need to check:

1) tree.inu as neutrino type
   12 → nue
   -14 → numubar
   14 → numu

2) tree.pnu as neutrino energy, must be in GeV for Prob3++

Also noticed in SysError.py

```python
# from OscError.py
cur_dm   = rand.Gaus(1., 0.035)  # 3.5% shift
cur_sn   = abs(rand.Gaus(1., 1)) # 9.2% shift
thisB_ccqe   *= cur_dm * cur_sn
thisB_ccoth *= cur_dm * cur_sn
```

Huang-san told me to delete OscError.py back on 26 November 2015

Is it ok to leave this?
What are the 3.5% and 9.2% shifts?

SterileAna

I emailed Alex and Huang-san

In addition to SterileScrapper.py and SterileSel.py in …/ncgamma/Processing, I also see things related to SterileAna in the following 7 places:

1) …/ncgamma/Processing/ScrapeLE.py
   gSystem.Load("…/ncgamma/SterileAna/lib/SterileAna.so")
2) …/ncgamma/SelectionFigures/SterileSel.py
3) …/ncgamma/SystematicErrors/SysError.py
   gSystem.Load("…/ncgamma/SterileAna/lib/SterileAna.so")

4) …/ncgamma/SystematicErrors/OscError.py
   gSystem.Load("$HOME/ana/T2K/steriles/SterileAna/lib/SterileAna.so")
   Not right anyway. Deleted OscError.py
5-7) …/ncgamma/para/Calcmc.py and Calcoffbeam.py and fom_3para.py
   #from SterileSel import *
   #from SterileScrapper import SterileScrapper
   Commented out anyway. Deleted lines.

6

Remove the "Sterile" name

Processing/

- SterileSel.py

- SterileScrapper.py

- these are the scraper and selection definitions

- so they don't calculate oscillation probability?

- just change the name to drop Sterile

- (could do the same for SelectionFigures/SelectionPlots.py and SterileSel.py)

Remove "Sterile" in Processing/

- mv SterileSel.py Sel.py

- mv SterileScrapper.py Scrapper.py

- ScrapeLE.py

```
import sys
#from SterileSel import *
from Sel import *
#from SterileScrapper import SterileScrapper
from Scrapper import Scrapper
from math import sqrt
from ROOT import *
from os.path import join, exists, basename
from glob import glob


##
# Process Inputs
##


#scrape = SterileScrapper(options.mcmode, options.storeWeights)
scrape = Scrapper(options.mcmode, options.storeWeights)
```

- Scrapper.py
```
#class SterileScrapper:
class Scrapper:
```

Remove "Sterile" in SelectionFigures/

- mv SterileSel.py Sel.py

- SelectionPlots.py

```
#from SterileSel import *
from Sel import *
```

T2KReWeight

- have to rewrite some parts of the reweighting tools
- the original T2KReWeight tool uses the NC1pi data (ND280, and other experiments) to correct all the NC events. Alex modified the code not to reweight NCQE MC events by NC1pi data

T2KReWeight v1r27p2

Xiaoyue 03 April 2017

I have installed the latest version (http://www.t2k.org/asg/oagroup/tool/t2kreweight/installing/releaseinfo) of T2KReWeight on sukap. You can find it here:

/home/sklb/software/GlobalAnalysisTools/T2KReWeight_v1r27p2

To run it, SK library 16c needs to be linked. The setup file is

/home/sklb/software/GlobalAnalysisTools/T2KReWeight_v1r27p2/my_setup.csh

Is it ok to use 16c libraries with v1r27p2?
I'm supposed to use 14c libraries for ncgamma

OA group T2KReWeight Release Info

Tag	Description and main features	Date	NEUT	GENIE	JReWeight	NIWGReWeight	GEANTReWeight
v1r27p3	Patch the previous release for Summer 2017 OA. **Fixes from v1r27:** - 2p2h shape dial implemented with 3D(Enu, q0, q3) tables. Patched due to bugfix. - Improved and added validation scripts. **Updates from v1r27:** - Include modern SK spline generation script. - Updated BANFF spline app - Update NEUT to include alternate form factor work by Patrick Stowell. Patch 3 completed validation. - New Eb dial included, but is unstable and is biased in the forward region. **We advise against using it for uncertainties.** Note: "p1" also exists in CVS for both T2KReWeight and NIWGReWeight containing an additional set of SF–>RFG reweighting tables that were removed because they did not resolve the underlying issue of mixing event–by–event reweighting with binned reweighting. They were discarded wholesale from this version because we do not want anyone using a "new" version that is not better than the old version, and has not gone through as much validation as the previous iteration of tables.	Apr 4th 2017 (patch 3)	5.3.3 v1r27p1 (tarball) (this is also on SVN at revision 301)	2.10.0 (>=2.8.0)	v1r13	v1r23p2	v1r1
v1r27	New dials for 2017 OA. Major changes: – New 2p2h shape uncertainty dial – New Eb dial (supercedes 2014 and prior implementation) – Updated validation, spline file generation apps	Oct 14th 2016	5.3.3 Autumn 2016 (tarball)	2.10.0 (>=2.8.0)	v1r13	v1r23	v1r1

patch 3 on 04 April 2017

Xiaoyue emailed me about patch 2 on 03 April 2017

Should I use 2 or 3?

http://www.t2k.org/asg/oagroup/tool/t2kreweight/installing/releaseinfo

my_setup.csh

	my_setup.csh	ncgamma
CXX	g++	g++34
CPP	gcc -E	gcc34 -E
CC	gcc	gcc34
FC	gfortran	-
F77	gfortran	g77
ROOTSYS	/home/skofl/sklib_gcc4.8.2/root_v5.28.00h	/usr/local/sklib_g77/root_v5.28.00h/

specifics for T2KREWEIGHT, PATH, LD_LIBRARY_PATH OA analysis,
NEUT, JNuBeam, NIWG, and GEANT

don't see anything specific to 16c in
my_setup.csh?
but there is gcc, instead of g77

(usr/local/sklib_g77/ is a link to /home/skofl/sklib_g77/)

local copy of T2KReWeight v1r27p2

- cp –r /home/sklb/software/GlobalAnalysisTools/T2KReWeight_v1r27p2/ .

- source my_setup.csh
- ./configure

```
[~/ncgamma/T2KReWeight_v1r27p2@sukap001[341]_% ./configure
Name "main::CERN_ROOT" used only once: possible typo at ./configure line 371.
/home/sklb/software/GlobalAnalysisTools/T2KReWeight_v1r27p2/configure

Can not write out the Make.config file! at ./configure line 72.
~/ncgamma/T2KReWeight_v1r27p2@sukap001[342]_%
```

./configure

```
/home/cnantais/ncgamma/T2KReWeight_v1r27p2/configure


Your input configuration options were: (none)

The /home/cnantais/ncgamma/T2KReWeight_v1r27p2/make/Make.config file has been succesfully generated!
The following config options were set:
  T2KREWEIGHT_OPTION_ENABLE_GENIE=NO
  T2KREWEIGHT_OPTION_ENABLE_NEUT=NO
  T2KREWEIGHT_OPTION_ENABLE_JNUBEAM=NO
  T2KREWEIGHT_OPTION_ENABLE_NIWG=NO
  T2KREWEIGHT_OPTION_ENABLE_GEANT=NO
  T2KREWEIGHT_OPTION_ENABLE_OAANALYSIS=NO
  T2KREWEIGHT_OPTION_WITH_OAANALYSIS_LIB=
  T2KREWEIGHT_OPTION_ENABLE_DYLIBVERSION=YES
  T2KREWEIGHT_OPTION_WITH_CXX_DEBUG_FLAG=
  T2KREWEIGHT_OPTION_WITH_CXX_OPTIMIZ_FLAG=-O2
  T2KREWEIGHT_OPTION_WITH_PYTHIA6_LIB=
  T2KREWEIGHT_OPTION_WITH_LHAPDF_INC=
  T2KREWEIGHT_OPTION_WITH_LHAPDF_LIB=
  T2KREWEIGHT_OPTION_WITH_LIBXML2_INC=
  T2KREWEIGHT_OPTION_WITH_LIBXML2_LIB=
  T2KREWEIGHT_OPTION_WITH_LOG4CPP_INC=
  T2KREWEIGHT_OPTION_WITH_LOG4CPP_LIB=
  T2KREWEIGHT_OPTION_WITH_CERN=
  T2KREWEIGHT_OPTION_ENABLE_TRACKERFILE=NO
  T2KREWEIGHT_OPTION_ENABLE_PSYCHE=NO

*** To continue building T2KReWeight type: gmake

~/ncgamma/T2KReWeight_v1r27p2@sukap001[381]_%
```

gmake

- errors…

```
***** Compiling genWeights_SK_2016

g++ -g  -Wall -fPIC -Wno-write-strings  -O2   -Wno-strict-aliasing -ffriend-injection -c genWeights_SK_2016.cxx -I/usr/local/sklib_g77/root_v5.28.00h/i
nclude -I/home/cnantais/ncgamma/T2KReWeight_v1r27p2/src
genWeights_SK_2016.cxx:81:19: fatal error: BeRPA.h: No such file or directory
 #include "BeRPA.h"
                   ^
compilation terminated.
make[1]: *** [genWeights_SK_2016.exe] Error 1
make[1]: Leaving directory `/home/cnantais/ncgamma/T2KReWeight_v1r27p2/app'
```

default is all engines disabled, go back and enable some

Enable various engines

- ./configure --enable-niwg
  → works

- ./configure --enable-niwg --enable-jnubeam
  → works

- ./config.sh (niwg, jnubeam, oa)
  → works

- ./config.sh (neut, niwg, jnubeam, oa)
  → doesn't work, errors related to RooTrackerVtx
  emailed Xiaoyue

Xiaoyue 25 April 2017

- did not have trouble building with NEUT enabled
- I think RooTrackerVtx stuff is related to the ND
- try not enabling oaanalysis

- ./config.sh (neut, niwg, jnubeam)
  → works

Summary of building T2KReWeight v1r27p2

- ./configure → BeRPA
- ./configure --enable-niwg
- ./configure --enable-niwg --enable-jnubeam

- ./config.sh (niwg, jnubeam, oa)
- ./config.sh (neut, niwg, jnubeam, oa) → RooTrackerVtx
- ./config.sh (neut, niwg, jnubeam)

- ./config.sh (none) → BeRPA
- ./config.sh (niwg)
- ./config.sh (jnubeam) → BeRPA
- ./config.sh (niwg, jnubeam)
- ./config.sh (neut, niwg)
- ./config.sh (niwg, oa)
- ./config.sh (oa) → BeRPA
- ./config.sh (neut, niwg, oa) → RooTrackerVtx

Conclusions from building T2KReWeight v1r27p2

- enable NIWG, or else get an error with BeRPA
- enabling JNuBeam or not does not seem to have an effect
- enabling NEUT is ok, as long as OA analysis is not enabled
- enabling OA analysis is ok, as long as NEUT is not enabled
- enabling both NEUT and OA analysis with NIWG (and with or without JNuBeam), errors with RooTrackerVtx

- also asked Xiaoyue if I need to change my_setup.csh from NEUT 5.3.3 patch to NEUT 5.3.2 being used in ncgamma analysis

Xiaoyue 26 April

- I don't think we need oaanalysis if we only care about far detector stuff
- are you running on SK MC? no, ncgamma MC is different
- for my purposes, I only need NEUT, NIWG, JNuBeam, and GeReweight
- mentioned p3
- I think NEUT 5.3.2 is used by T2KReWeight v1r23. I don't know if the newer NEUT would work for you as different NEUT versions provide different dials. If not, we might have to install T2KReWeight v1r23

- ./config.sh (neut, niwg, jubeam, geant)
- should I install T2KReWeight v1r23 in my home directory?

OA group T2KReWeight Release Info

v1r23	Fixes to implementation for 2014/2015 nubar disappearance measurement. Includes: – Corrected pF/EB histograms – New |q3| cut dial – Executables for spline generation at ND280, SK Associated TN192v2.0 and TN193v1.1. List updated here	Jan 23rd, 2015	5.3.3 with minor fixes for print statements (tarball here)	N/A	v1r11	v1r19	v1r1
v1r21	2014/2015 oscillation analysis nubar disappearance measurement update includes: – New NEUT parameters for QE, 1pi models. Full list here and summarized in TNs192v1.0, 193v1.0 – NIWG2015 tuning parameters such as RPA, SF –> RFG corrections	Jan 7th, 2015	5.3.3 with minor fixes for print statements (tarball here)	N/A	v1r11	v1r17	v1r1
v1r19	2013 oscillation analysis + NCEL xsec measurement update includes: – New MAQE dial for NCEL events (NEUT) – 2013 BANFF systematic generation application and updated support for ND280 MC inputs Documentation forthcoming. NEUT version needs to be checked to be OK for the head.	Aug 28th, 2013	5.1.4.2_nd280	2.6.2	v1r7	v1r15	v1r1

v1r23 still needs NEUT 5.3.3?

Xiaoyue 27 April

- you can probably use v1r27
- the current T2K-SK MC was also generated using NEUT 5.3.2 with spectral function, but the latest NEUT provides newer tunings while keeping the default model the same as 5.3.2. Could confirm with NIWG (Kendall or Hayato-san)
- wouldn't be too bad to install your own T2KReWeight. NIWG, JNuBeam, and GeantReWeight don't take much space anyway.
- she will ask if she needs to update to patch 3 or v1r27

Rewrite T2KReWeight NCQE

- compare Alex version to v1r27p2
- ncgamma/T2KReWeight/

```
[~/ncgamma/T2KReWeight@sukap001[332]_% ls
BANFF.sh          NIWG.sh            genWeightsNC_NIWG.cxx
BANFF_PREFIT.sh   PrepareBanffNQS.py genWeights_2012a.cxx
FLUX_PREFIT.sh    XSEC_PREFIT.sh     genWeights_ncgamma.cxx
MAQE.sh           env.csh
Makefile          env.sh
```

env.csh

```csh
#!/bin/csh
setenv T2KREWEIGHT /home/ahimmel/ana/T2K/T2KReWeight/TestVer
setenv PATH $T2KREWEIGHT/app:$PATH
setenv LD_LIBRARY_PATH $T2KREWEIGHT/lib:$LD_LIBRARY_PATH
setenv JNUBEAM $T2KREWEIGHT/JReWeight
setenv NIWG $T2KREWEIGHT/NIWGReWeight
#setenv GEANTRW $T2KREWEIGHT/GeantReWeight
setenv NIWGREWEIGHT_INPUTS $NIWG/inputs
setenv JREWEIGHT_INPUTS $JNUBEAM/inputs
#setenv GEANTREWEIGHT_INPUTS $GEANTRW/inputs
#setenv NEUTROOT=/home/tmv23/working/NEUT/neut_5.1.4.2
setenv NEUTROOT /home/atmpd/neut/neut_5.1.4.2
#setenv NEUTROOT=/home/huangkx/t2k/alex/mc/neut/tags/5.1.4.2
#setenv GENIE=$HOME/t2k/GENIE
#setenv GENIELIB=$GENIE/lib
#setenv PYTHIA6 /usr/local/sklib_gcc412/pythia6/v6_424
#setenv LHAPATH $HOME/t2k/LHAPDF
#setenv LOG4CPP=/home/pablofer/LOG4/log4cpp/src
setenv NEUT_ROOT $NEUTROOT
setenv LD_LIBRARY_PATH $NEUT_ROOT/src/reweight:$NEUT_ROOT/lib:$LD_LIBRARY_PATH
```

JNUBEAM and NIWG are also in Alex's directory, do they also need modification?
doesn't have OAANALYSISLIBS, so maybe I don't need OA analysis?
GEANTRW is commented out so don't need?

Alex working with ~v1p17

```
[/home/ahimmel/ana/T2K/T2KReWeight@sukap001[356]_% ls
HEAD  TestVer  app  config_command  v1r15p1  v1r17  v1r17_od_wskdet
```

OA group T2KReWeight Release Info

v1r19	2013 oscillation analysis + NCEL xsec measurement update includes: – New MAQE dial for NCEL events (NEUT) – 2013 BANFF systematic generation application and updated support for ND280 MC inputs Documentation forthcoming. NEUT version needs to be checked to be OK for the head.	Aug 28th, 2013	5.1.4.2_nd280	2.6.2	v1r7	v1r15	v1r1
v1r17	2012 numu disappearance update includes: – New 1/MAQE^2 dial (NEUT) – Overall normalization dial for antineutrino interactions (NIWGReWeight) – W shape parameter only affects NC interactions (NIWGReWeight) – pF/EB have been modified based on true p,theta templates and validated (NIWGReWeight)	Oct 10th, 2012	5.1.4.2_nd280	2.6.2	v1r7	v1r15	v1r1
v1r15p1	– Bug fix: Allow user to specify SK file type (e.g. signal nue or not) for use in JReWeight (genWeights_2012a has been modified to check the SK file name)	May 21, 2012	5.1.4.2_nd280	2.6.2	v1r7	v1r11	v1r1
v1r15	– NIWG parameters used for 2012a review – NIWG New functionality: MiniBooNE 1pi Enu shape discrepancy parameter – NIWG Updates: pF, Eb, SF response modifications – app/genWeights_2011a.cxx: Updated with 1pi Enu shape and NEUT PDD parameter (if necessary) – Various fixes in GenieUtils	May 7, 2012	5.1.4.2_nd280	2.6.2	v1r7	v1r11	v1r1

tag, description, date, NEUT, GENIE, JReWeight, NIWGReWeight, GEANTReWeight

Compare TestVer to v1p27p2


```
/home/ahimmel/ana/T2K/T2KReWeight/TestVer@sukap001[360]_% ls
CVS          NIWGReWeight              VERSION  configure          lib    src
JReWeight    README                    app      env.sh             make
Makefile     T2KReWeight.xcworkspace   bin      example_scripts    neut
```