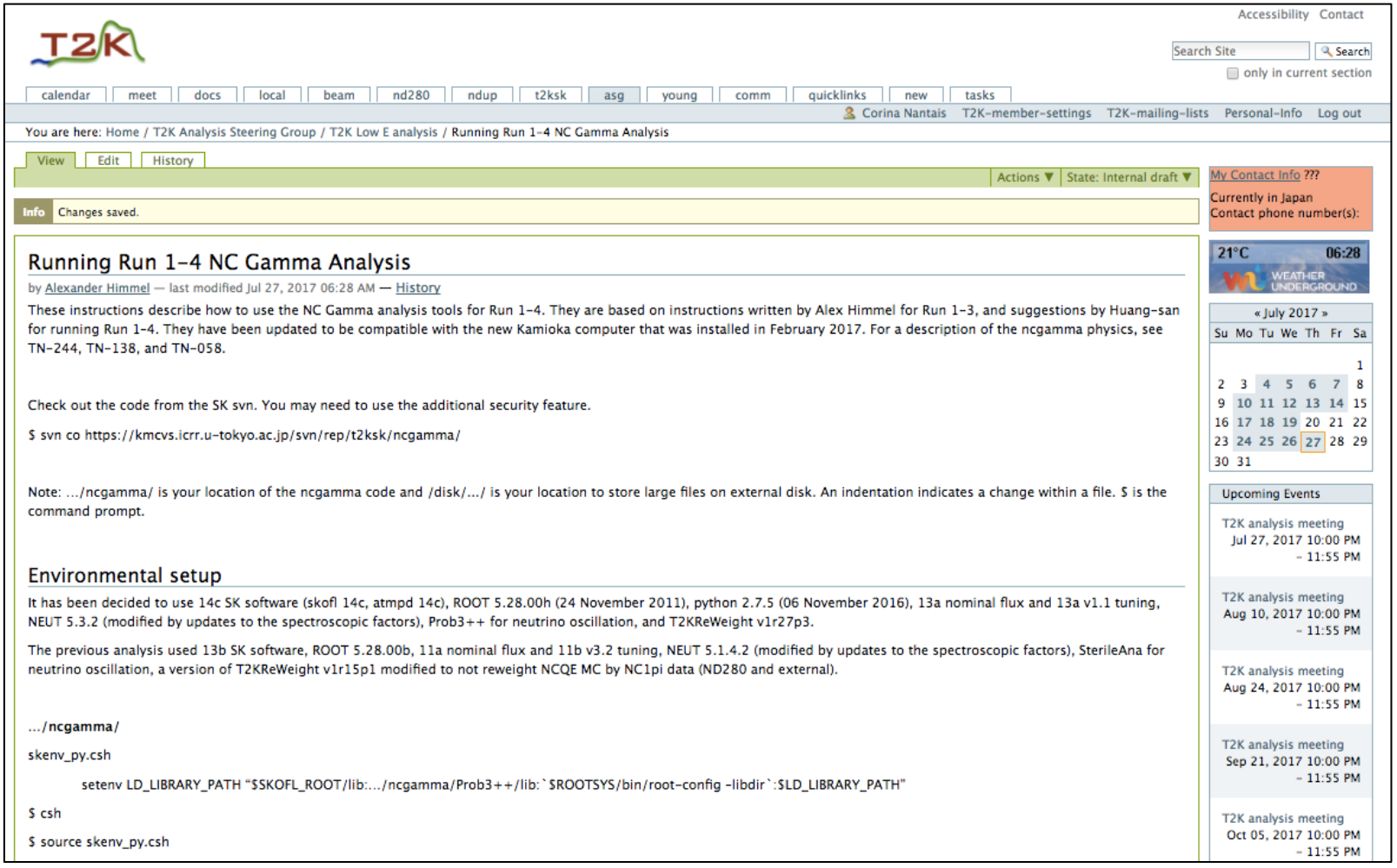
ncgamma analysis tools

Corina Nantais
local meeting
02 August 2017

Updated t2k.org running instructions

(will update svn afterwards)

- http://www.t2k.org/asg/lowe/run14-instructions



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T2K

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Running Run 1-4 NC Gamma Analysis

by Alexander Himmel — last modified Jul 27, 2017 06:28 AM — History

These instructions describe how to use the NC Gamma analysis tools for Run 1-4. They are based on instructions written by Alex Himmel for Run 1-3, and suggestions by Huang-san for running Run 1-4. They have been updated to be compatible with the new Kamioka computer that was installed in February 2017. For a description of the ncgamma physics, see TN-244, TN-138, and TN-058.

Check out the code from the SK svn. You may need to use the additional security feature.

$ svn co https://kmcvs.icrr.u-tokyo.ac.jp/svn/rep/t2ksk/ncgamma/

Note: .../ncgamma/ is your location of the ncgamma code and /disk/.../ is your location to store large files on external disk. An indentation indicates a change within a file. $ is the command prompt.

Environmental setup

It has been decided to use 14c SK software (skofl 14c, atmpd 14c), ROOT 5.28.00h (24 November 2011), python 2.7.5 (06 November 2016), 13a nominal flux and 13a v1.1 tuning, NEUT 5.3.2 (modified by updates to the spectroscopic factors), Prob3++ for neutrino oscillation, and T2KReWeight v1r27p3.

The previous analysis used 13b SK software, ROOT 5.28.00b, 11a nominal flux and 11b v3.2 tuning, NEUT 5.1.4.2 (modified by updates to the spectroscopic factors), SterileAna for neutrino oscillation, a version of T2KReWeight v1r15p1 modified to not reweight NCQE MC by NC1pi data (ND280 and external).

.../**ncgamma**/

skenv_py.csh

setenv LD_LIBRARY_PATH "$SKOFL_ROOT/lib:.../ncgamma/Prob3++/lib:`$ROOTSYS/bin/root-config -libdir`:$LD_LIBRARY_PATH"

$ csh

$ source skenv_py.csh

My Contact Info ???

Currently in Japan

Contact phone number(s):

21°C 06:28 WEATHER UNDERGROUND

« July 2017 »

Su	Mo	Tu	We	Th	Fr	Sa
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	31					

Upcoming Events

T2K analysis meeting
Jul 27, 2017 10:00 PM - 11:55 PM

T2K analysis meeting
Aug 10, 2017 10:00 PM - 11:55 PM

T2K analysis meeting
Aug 24, 2017 10:00 PM - 11:55 PM

T2K analysis meeting
Sep 21, 2017 10:00 PM - 11:55 PM

T2K analysis meeting
Oct 05, 2017 10:00 PM - 11:55 PM

Working on updating flux

11a nominal with v3.2 tuning → 13a nominal with v2.0 tuning

Relevant pieces of code:

- Processing/SelectNCGamma_data.py
- Processing/SelectNCGamma.py
- mc/(neut/neut_5.3.2/src/t2kflux_zbs/)mk_num.sh (nue, nmb)
- mc/(neut/neut_5.3.2/src/t2kflux_zbs/)mk_fluxlist.sh
- para/Calcmc.py
- Processing/Scrapper.py
- SystematicErrors/NominalXsec.py

Flux

- /SystematicErrors/beamweights/ → these are the flux histograms, on t2k.org

(SelectNCGamma_data.py, SelectNCGamma.py, para/Calcmc.py, Scrapper.py, NominalXsec.py)

- /disk01/sklb/OLD/flux → these are the nominal flux MC files

(mc/(neut/neut_5.3.2/src/t2kflux_zbs/)mk_num.sh (nue, nmb) and mk_fluxlist.sh)

SystematicErrors/beamweights/

old 11a nominal with v3.2 tuning

```
~/ncgamma/SystematicErrors/beamweights@sukap001[660]_% ls
FluxMean.gif
MeanFlux.C
run1-4
run4_full
sk_tuned11bv3.1_11anom_run1-run3c_neu2012.root
sk_tuned11bv3.1_11anom_run1.root
sk_tuned11bv3.1_11anom_run1_and_run2.root
sk_tuned11bv3.1_11anom_run2.root
sk_tuned11bv3.1_11anom_run3b.root
sk_tuned11bv3.1_11anom_run3b_and_run3c_neu2012.root
sk_tuned11bv3.1_11anom_run3c.root
sk_tuned11bv3.2_11anom_run1-run2.root
sk_tuned11bv3.2_11anom_run1-run3c.root
sk_tuned11bv3.2_11anom_run1-run3c_fine.root
sk_tuned11bv3.2_11anom_run1-run4_fine.root
sk_tuned11bv3.2_11anom_run1.root
sk_tuned11bv3.2_11anom_run2.root
sk_tuned11bv3.2_11anom_run3b-run3c.root
sk_tuned11bv3.2_11anom_run3b.root
sk_tuned11bv3.2_11anom_run3c.root
sk_tuned11bv3.2_11anom_run4.root
tuned11bv3.2
tuned11bv3.2.tar.gz
tuned11bv3.2_run4_full.tar.gz
```

t2k.org

- beam/NuFlux/fluxreleasesummarylink/
- TN-264
- flux_release_summary_v3p0.pdf (07 June 2017) - up to Run 8

- 13 a Tuning v2.0,used in 2017 OA

	Tuning v3	same as tuning v2	FLUKA2008	horn-off flux	
11b	Tuning v3.1	same as tuning v2	FLUKA2008	update NA61's Kaon result	2012a OA
	Tuning v3.2	same as tuning v2	FLUKA2008	bug fix in K^- tuning	2013a OA
13a	Nominal	No tuning	FLUKA2011		
	Tuning v1	Sec./Tert. π, K Out of target $n \rightarrow \pi$ prod.	FLUKA2011	use 2007+2009 π, $K^{\pm}$ and K^0_S NA61 thin target data	
	Tuning v1.1	same as v1	FLUKA2011	update calibration constant	$\bar{p}$ OA
	Tuning v2.0	same as v1	FLUKA2011	bug fix in production cross section tuning; back-applied to all T2K runs	2017 OA
Latest	http://www.t2k.org/beam/NuFlux/FluxRelease/13arelease kekcc: /gpfs/fs03/t2k/beam/mc/beamMC/13av2.0				

t2k.org

- binning definitions
- detector definitions
- flux definitions

flux_release_summary_v3p0.pdf
TN-264

The flux release tar files contain predicted neutrino fluxes for each sub-run and combined runs (FHC and RHC). Two energy binnings are provided:

Fine binning : 200 bins of 50 MeV from 0 to 10 GeV, then 1 GeV bins from 10 to 30 GeV.

Standard binning : 60 energy bins distributed as follow:

```
bins[60] = {0, 0.1, 0.2, 0.3, 0.4, 0.5, 0.6, 0.7, 0.8, 0.9, 1, 1.1,
1.2, 1.3, 1.4, 1.5, 1.6, 1.7, 1.8, 1.9, 2, 2.1, 2.2, 2.3, 2.4, 2.6,
2.8, 3, 3.2, 3.4, 3.6, 3.8, 4, 4.5, 5, 6, 7, 8, 9, 10, 11, 12, 13,
14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30}
```

For each sub-runs and detectors (SK, ND280 cargo “nd5”, ND280 magnet “nd6” and sand muon plane “nd13”) nominal fluxes (centered non-divergent proton beam profile, no tuning), real fluxes (data-driven beam profile, no tuning) and tuned fluxes (data-driven beam profile, interactions tuned) are provided as well as ratios to nominal fluxes, for the all neutrino types.

Run Name	Starting		Stopping		Horn current
	DAQ run	date	DAQ run	date	
Run 1	290031	Jan 23 23:21:31 2010	340142	Jun 26 07:00:19 2010	+250 kA
	2010 data up to summer shutdown				
Run 2	360088	Nov 18 12:15:37 2010	380030	Mar 11 04:58:26 2011	+250 kA
	From 2010 shutdown to 2011 earthquake				
Run 3a	390042	Dec 26 17:44:05 2011	410068	Mar 8 09:42:13 2012	0 kA
	Data with horns turned off				
Run 3b	410074	Mar 8 22:23:08 2012	410208	Mar 22 04:10:32 2012	+205 kA
	2012 data with horns at +205 kA				
Run 3c	420022	Apr 8 22:22:31 2012	430068	Jun 9 07:55:17 2012	+250 kA
	Nominal horn current until 2012 summer shutdown				
Run 4	440021	Oct 19 02:54:33 2012	490038	May 8 01:12:02 2013	+250 kA
	From 2012 after shutdown to 2013 hadron hall accident				
Run 5a	550131	May 21 21:57:37 2014	550244	May 29 00:11:28 2014	+250 kA
	2014 FHC data with MR 55 tune 1				
Run 5b	550245	May 29 00:12:07 2014	550281	Jun 3 07:00:23 2014	+250 kA
	560170	Jun 24 21:05:27 2014	560185	Jun 26 07:00:22 2014	+250 kA
	2014 FHC data with MR 55 tune 2 and MR 56				
Run 5c	560010	Jun 4 23:28:45 2014	560163	Jun 24 13:50:42 2014	-250 kA
	2014 RHC data up to summer shutdown				
Run 6a	580045	Nov 2 03:24:48 2014	580086	Nov 4 09:00:52 2014	+250 kA
	600012	Jan 12 23:49:57 2015	600032	Jan 16 10:00:11 2015	+250 kA
	610012	Feb 25 16:41:26 2015	610027	Feb 27 10:08:25 2015	+250 kA
	All FHC data of run 58-61				
Run 6b	580099	Nov 4 23:22:52 2014	580265	Nov 25 06:59:58 2014	-250 kA
	590004	Nov 29 22:17:30 2014	590152	Dec 22 06:52:44 2014	-250 kA
	RHC up to the end of run 59				
Run 6c	610034	Feb 27 19:44:32 2015	610099	Mar 12 12:57:01 2015	-250 kA
	2015 RHC data up to the beginning of the OTR drift				
Run 6d	610100	Mar 12 16:20:15 2015	610209	Apr 1 06:55:10 2015	-250 kA
	RHC data from OTR drift to end of run 61				
Run 6e	620016	May 8 23:48:20 2015	620111	May 20 07:00:02 2015	-250 kA
	630011	May 22 23:18:00 2015	630094	Jun 1 09:37:54 2015	-250 kA
	run 62 RHC data up to 2015 shutdown + run 63 RHC data				
Run 6f	630106	Jun 1 18:18:50 2015	630110	Jun 3 09:00:36 2015	+250 kA
	run 63 FHC data up to run 6 end				
Run 7a	660062	Feb 1 00:44:18 2016	660093	Feb 3 01:04:27 2016	+250 kA
	MR run 66 FHC data				
Run 7b	660100	Feb 3 23:10:23 2016	680150	May 18 06:15:59 2016	-250 kA
	All RHC data of run 7 (ie MR run 66-68 RHC data)				
Run 7c	680162	May 19 12:24:33 2016	680248	May 27 09:21:46 2016	+250 kA
	MR run 68 FHC data				
Run 8	700032	Oct 27 16:07:46 2016	740057	Apr 12 08:05:07 2017	+250 kA
	All MR Run 70-74 data				

Table 3 – **Runs subdivisions, starting and stopping date and MR run numbers and horn current mode**

flux_release_summary_v3p0.pdf
TN-264

T2K Run by FHC and RHC

- beam/NuFlux/FluxRelease/13arelease
- 13av2-tuned-fluxes-for-runs1-8-slides (Tom Apr 2017)

- tuned13av2.tar.gz.
- TN-217 will be updated
- 13av2 flux uncertainties will be released later → is that a problem? Emailed Tom

Content of the tuned13av2.tar.gz file

Example of tuned13av2/run7a/sk_tuned13av2_13anom_run7a_numode_fine.root

KEY: TH1D enu_sk_tuned13a_numu_ratio;1 13a tuning v2 flux/13a nominal flux
KEY: TH1D enu_sk_tuned13a_numub_ratio;1 13a tuning v2 flux/13a nominal flux
KEY: TH1D enu_sk_tuned13a_nue_ratio;1 13a tuning v2 flux/13a nominal flux
KEY: TH1D enu_sk_tuned13a_nueb_ratio;1 13a tuning v2 flux/13a nominal flux

Tuned/Nominal flux

KEY: TH1D enu_sk_13a_real_numu_ratio;1 real p beam profile flux (run7a)/13a nominal flux
KEY: TH1D enu_sk_13a_real_numub_ratio;1 real p beam profile flux (run7a)/13a nominal flux
KEY: TH1D enu_sk_13a_real_nue_ratio;1 real p beam profile flux (run7a)/13a nominal flux
KEY: TH1D enu_sk_13a_real_nueb_ratio;1 real p beam profile flux (run7a)/13a nominal flux

Untuned/Nominal flux

KEY: TH1D enu_sk_13a_nom_numu;1 13a flux : nominal p beam profile (sigma=0.42cm)
KEY: TH1D enu_sk_13a_nom_numub;1 13a flux : nominal p beam profile (sigma=0.42cm)
KEY: TH1D enu_sk_13a_nom_nue;1 13a flux : nominal p beam profile (sigma=0.42cm)
KEY: TH1D enu_sk_13a_nom_nueb;1 13a flux : nominal p beam profile (sigma=0.42cm)

Nominal flux

KEY: TH1D enu_sk_13a_real_numu;1 real p beam profile flux (run7a)
KEY: TH1D enu_sk_13a_real_numub;1 real p beam profile flux (run7a)
KEY: TH1D enu_sk_13a_real_nue;1 real p beam profile flux (run7a)
KEY: TH1D enu_sk_13a_real_nueb;1 real p beam profile flux (run7a)

Untuned flux

KEY: TH1D enu_sk_tuned13a_numu;1 13a flux : tuning ver.2
KEY: TH1D enu_sk_tuned13a_numub;1 13a flux : tuning ver.2
KEY: TH1D enu_sk_tuned13a_nue;1 13a flux : tuning ver.2
KEY: TH1D enu_sk_tuned13a_nueb;1 13a flux : tuning ver.2

Tuned flux

tuned13av2.tar.gz

```
MissMary:tuned13av2 corinanantais$ ls
run1     run2     run4     run5b    run60    run6c    run6f    run7c
run1-7c  run3b    run58    run5c    run61    run6d    run7a    run8
run1-8   run3c    run5a    run5c-7b run6b    run6e    run7b
```

Why are MR run 58, 60, 61 separate for T2K Run 6a? Emailed Tom

SystematicErrors/beamweights/

old 11a nominal with v3.2 tuning

```
~/ncgamma/SystematicErrors/beamweights@sukap001[660]_% ls
FluxMean.gif
MeanFlux.C
run1-4
run4_full
sk_tuned11bv3.1_11anom_run1-run3c_neu2012.root
sk_tuned11bv3.1_11anom_run1.root
sk_tuned11bv3.1_11anom_run1_and_run2.root
sk_tuned11bv3.1_11anom_run2.root
sk_tuned11bv3.1_11anom_run3b.root
sk_tuned11bv3.1_11anom_run3b_and_run3c_neu2012.root
sk_tuned11bv3.1_11anom_run3c.root
sk_tuned11bv3.2_11anom_run1-run2.root
sk_tuned11bv3.2_11anom_run1-run3c.root
sk_tuned11bv3.2_11anom_run1-run3c_fine.root
sk_tuned11bv3.2_11anom_run1-run4_fine.root
sk_tuned11bv3.2_11anom_run1.root
sk_tuned11bv3.2_11anom_run2.root
sk_tuned11bv3.2_11anom_run3b-run3c.root
sk_tuned11bv3.2_11anom_run3b.root
sk_tuned11bv3.2_11anom_run3c.root
sk_tuned11bv3.2_11anom_run4.root
tuned11bv3.2
tuned11bv3.2.tar.gz
tuned11bv3.2_run4_full.tar.gz
```

sk_tuned*v*_*nom_*
may have been moved from each directory,
e.g., from run1-4

→ See what each piece of code needs

SelectNCGamma_data.py

```
if mcmode:
    runs = ["1","2", "3b", "3c", "4"]
    #runs = ["1","2", "3b", "3c"]
    #runs = ["1-3"]
    fluxdir = "~/ncgamma/SystematicErrors/beamweights"
    #fluxdir = "~/t2k/alex/ncgamma/Processing/skflux"
    tunefiles = { "1"  :"sk_tuned11bv3.1_11anom_run1.root",
                  "2"  :"sk_tuned11bv3.1_11anom_run2.root",
                  "3b" :"sk_tuned11bv3.1_11anom_run3b.root",
                  "3c" :"sk_tuned11bv3.1_11anom_run3c.root",
                  "4" :"sk_tuned11bv3.2_11anom_run4.root"
                 }
    fluxtunes = defaultdict(dict)
```

```
mcmode = False #this is for data analysis
```

so maybe fluxdir and tunefiles can be commented out?

SelectNCGamma_data.py

- cp SelectNCGamma_data.py SelectNCGamma_data.py.bk
- deleted all if mcmode and put in print statement
- $ python SelectNCGamma_data.py -o ncgammahistRun4**test**.root -l ncgammaRun4**test**.list /disk/…/lowedata/ntuple/data.lowfit.7*.merge.root
- diff –u ncgammaRun4.list ncgammaRun4**test**.list → the same
- ncgammahistRun4.root and ncgammahistRun4**test**.root are the same
- → upload to svn

SelectNCGamma.py

```
if mcmode:
    runs = ["1","2","3b","3c","4"]
    fluxdir = "~/ncgamma/SystematicErrors/beamweights"
    tunefiles = { "1"  :"sk_tuned11bv3.1_11anom_run1.root",
                  "2"  :"sk_tuned11bv3.1_11anom_run2.root",
                  "3b" :"sk_tuned11bv3.1_11anom_run3b.root",
                  "3c" :"sk_tuned11bv3.1_11anom_run3c.root",
                  "4"  :"sk_tuned11bv3.2_11anom_run4.root"
                 }
    fluxtunes = defaultdict(dict)

    if options.frienddir:
        friendFiles = {}
        for filenames in groupedFiles.values():
            for fname in filenames:
                weightname = os.path.basename(fname).replace(".fit.root","_weights.root")
                weightname = os.path.join(options.frienddir, weightname)
                friendFiles[fname] = weightname

    for run in runs:
        fluxtune = TFile(os.path.join(fluxdir,tunefiles[run]))
        fluxtunes[run]["numu"] = fluxtune.Get("enu_sk_tuned11b_numu_ratio")
        fluxtunes[run]["nue_x_numuflx"] = fluxtune.Get("enu_sk_tuned11b_numu_ratio")
        fluxtunes[run]["numubar"] = fluxtune.Get("enu_sk_tuned11b_numub_ratio")
        fluxtunes[run]["nue"]    = fluxtune.Get("enu_sk_tuned11b_nue_ratio")
        fluxtunes[run]["nuebar"] = fluxtune.Get("enu_sk_tuned11b_nueb_ratio")
        for hist in fluxtunes[run].values():
            hist.SetDirectory(0)
    samples = [ "ncelastic", "nc1pi", "ncother", "numucc", "nuecc", "mcall" ]
else:
    runs = ["data"]
    samples = [ "data"]
```

I want (not fine, I guess):

sk_tuned13av2_13anom_run*.root

1	numode
2	numode
3b	numode
3c	numode
4	numode
5a	numode
5b	numode
5c	antinumode
6a	58 numode
	60 numode
	61 numode
6b	antinumode
6c	antinumode
6d	antinumode
6e	antinumode
6f	numode
7a	numode
7b	antinumode
7c	numode
8	numode

should edit SelectNCGamma_data.py for tuned13av2 structure

SelectNCGamma.py

```
if mcmode:
    runs = ["1","2","3b","3c","4"]
    fluxdir = "~/ncgamma/SystematicErrors/beamweights"
    tunefiles = { "1"  :"sk_tuned11bv3.1_11anom_run1.root",
                  "2"  :"sk_tuned11bv3.1_11anom_run2.root",
                  "3b" :"sk_tuned11bv3.1_11anom_run3b.root",
                  "3c" :"sk_tuned11bv3.1_11anom_run3c.root",
                  "4"  :"sk_tuned11bv3.2_11anom_run4.root"
                 }
    fluxtunes = defaultdict(dict)

    if options.frienddir:
        friendFiles = {}
        for filenames in groupedFiles.values():
            for fname in filenames:
                weightname = os.path.basename(fname).replace(".fit.root","_weights.root")
                weightname = os.path.join(options.frienddir, weightname)
                friendFiles[fname] = weightname

    for run in runs:
        fluxtune = TFile(os.path.join(fluxdir,tunefiles[run]))
        fluxtunes[run]["numu"] = fluxtune.Get("enu_sk_tuned11b_numu_ratio")
        fluxtunes[run]["nue_x_numuflx"] = fluxtune.Get("enu_sk_tuned11b_numu_ratio")
        fluxtunes[run]["numubar"] = fluxtune.Get("enu_sk_tuned11b_numub_ratio")
        fluxtunes[run]["nue"]    = fluxtune.Get("enu_sk_tuned11b_nue_ratio")
        fluxtunes[run]["nuebar"] = fluxtune.Get("enu_sk_tuned11b_nueb_ratio")
        for hist in fluxtunes[run].values():
            hist.SetDirectory(0)
    samples = [ "ncelastic", "nc1pi", "ncother", "numucc", "nuecc", "mcall" ]
else:
    runs = ["data"]
    samples = [ "data"]
```

I want:

enu_sk_tuned13av2_*_ratio

numu (for numu & nue_x_numuflux)

numub

nue

nueb

these are Tuned/Nominal TH1Ds within root file (Tom's slides)

numu flux
nue appearance
numubar wrong sign background?
intrinsic nue
nuebar wrong sign background?

FHC

numu_x_numu → numu flux

numu_x_nue → nue appearance

nue_x_nue → intrinsic nue

RHC

numubar_x_numubar → numubar flux

numubar_x_nuebar → nuebar appearance

nuebar_x_nue bar → intrinsic nuebar

SelectNCGamma.py

- mv beamweights/ beamweights_flux11a/
- mkdir beamweights/
- scp tuned13av2.tar.gz cnantais@sukap001:/home/cnantais/ncgamma/SystematicErrors/beamweights/.
- tar -zxvf tuned13av2.tar.gz

python SelectNCGamma.py -o ncgammamcRun4test.root /disk01/usr4/cnantais/lemc/lentuple/lentp_nu*.root

```
[~/ncgamma/Processing@sukap001[688]_% python SelectNCGamma.py -o ncgammamcRun4test.root /disk01/usr4/cnantais/lemc/lentuple/lentp_nu*.root ]
TStreamerInfo::BuildCheck:0: RuntimeWarning:
   The StreamerInfo of class TH1D read from file /home/cnantais/ncgamma/SystematicErrors/beamweights/tuned13av2/run1/sk_tuned13av2_13anom_ru
n1_numode.root
   has the same version (=1) as the active class but a different checksum.
   You should update the version to ClassDef(TH1D,2).
   Do not try to write objects with the current class definition,
   the files will not be readable.

TStreamerInfo::BuildCheck:0: RuntimeWarning:
   The StreamerInfo of class TAttMarker read from file /home/cnantais/ncgamma/SystematicErrors/beamweights/tuned13av2/run1/sk_tuned13av2_13a
nom_run1_numode.root
   has the same version (=2) as the active class but a different checksum.
   You should update the version to ClassDef(TAttMarker,3).
   Do not try to write objects with the current class definition,
   the files will not be readable.

TStreamerInfo::BuildCheck:0: RuntimeWarning:
   The StreamerInfo of class TAxis read from file /home/cnantais/ncgamma/SystematicErrors/beamweights/tuned13av2/run1/sk_tuned13av2_13anom_r
un1_numode.root
   has the same version (=9) as the active class but a different checksum.
   You should update the version to ClassDef(TAxis,10).
   Do not try to write objects with the current class definition,
   the files will not be readable.

TStreamerInfo::BuildCheck:0: RuntimeWarning:
   The StreamerInfo of class TAttAxis read from file /home/cnantais/ncgamma/SystematicErrors/beamweights/tuned13av2/run1/sk_tuned13av2_13ano
m_run1_numode.root
   has the same version (=4) as the active class but a different checksum.
   You should update the version to ClassDef(TAttAxis,5).
   Do not try to write objects with the current class definition,
   the files will not be readable.

TStreamerInfo::BuildCheck:0: RuntimeWarning:
   The StreamerInfo of class TList read from file /home/cnantais/ncgamma/SystematicErrors/beamweights/tuned13av2/run1/sk_tuned13av2_13anom_r
un1_numode.root
   has the same version (=5) as the active class but a different checksum.
   You should update the version to ClassDef(TList,6).
   Do not try to write objects with the current class definition,
   the files will not be readable.

TStreamerInfo::BuildCheck:0: RuntimeWarning:
   The StreamerInfo of class TCollection read from file /home/cnantais/ncgamma/SystematicErrors/beamweights/tuned13av2/run1/sk_tuned13av2_13
anom_run1_numode.root
   has the same version (=3) as the active class but a different checksum.
   You should update the version to ClassDef(TCollection,4).
   Do not try to write objects with the current class definition,
   the files will not be readable.

Traceback (most recent call last):
  File "SelectNCGamma.py", line 104, in <module>
    hist.SetDirectory(0)
AttributeError: 'TObject' object has no attribute 'SetDirectory'
```

different ROOT version (can ignore)

Attribute Error
why?
new root file only

SelectNCGamma.py

https://root.cern.ch/doc/master/classTH1.html

When an histogram is created, a reference to it is automatically added to the list of in-memory objects for the current file or directory. This default behaviour can be changed by:

```
h->SetDirectory(0);          for the current histogram h
TH1::AddDirectory(kFALSE);   sets a global switch disabling the reference
```

When the histogram is deleted, the reference to it is removed from the list of objects in memory. When a file is closed, all histograms in memory associated with this file are automatically deleted.

maybe I can use default instead?

SelectNCGamma.py

- commented out 2 lines with SetDirectory(0)
- ncgammamcRun4test.root is same size as ncgammamcRun4.root and 7Jan

- → come back and add runs >4

```
if mcmode:
    runs = ["1","2","3b","3c","4"]
    fluxdir = "~/ncgamma/SystematicErrors/beamweights"
    tunefiles = { "1"  :"sk_tuned11bv3.1_11anom_run1.root",
                  "2"  :"sk_tuned11bv3.1_11anom_run2.root",
                  "3b" :"sk_tuned11bv3.1_11anom_run3b.root",
                  "3c" :"sk_tuned11bv3.1_11anom_run3c.root",
                  "4"  :"sk_tuned11bv3.2_11anom_run4.root"
                 }
    fluxtunes = defaultdict(dict)

    if options.frienddir:
        friendFiles = {}
        for filenames in groupedFiles.values():
            for fname in filenames:
                weightname = os.path.basename(fname).replace(".fit.root","_weights.root")
                weightname = os.path.join(options.frienddir, weightname)
                friendFiles[fname] = weightname

    for run in runs:
        fluxtune = TFile(os.path.join(fluxdir,tunefiles[run]))
        fluxtunes[run]["numu"] = fluxtune.Get("enu_sk_tuned11b_numu_ratio")
        fluxtunes[run]["nue_x_numuflx"] = fluxtune.Get("enu_sk_tuned11b_numu_ratio")
        fluxtunes[run]["numubar"] = fluxtune.Get("enu_sk_tuned11b_numub_ratio")
        fluxtunes[run]["nue"]    = fluxtune.Get("enu_sk_tuned11b_nue_ratio")
        fluxtunes[run]["nuebar"] = fluxtune.Get("enu_sk_tuned11b_nueb_ratio")
        for hist in fluxtunes[run].values():
            hist.SetDirectory(0)
    samples = [ "ncelastic", "nc1pi", "ncother", "numucc", "nuecc", "mcall" ]
else:
    runs = ["data"]
    samples = [ "data"]
```

changed tunefiles

commented out

changed fluxtunes

para/Calcmc.py

```
fluxdir = "~/ncgamma/SystematicErrors/beamweights"
tunefiles = { "1"  :"sk_tuned11bv3.1_11anom_run1.root",
              "2"  :"sk_tuned11bv3.1_11anom_run2.root",
              "3b" :"sk_tuned11bv3.1_11anom_run3b.root",
              "3c" :"sk_tuned11bv3.1_11anom_run3c.root",
              "4" :"sk_tuned11bv3.2_11anom_run4.root"
              }
fluxtunes = defaultdict(dict)


# MC Scales from Ueno
ncel_scales = { "numu":    1./1.375e23 * 100.,
            "nue":    1./6.798e24 * 100.,
            "numubar":    1./3.041e24 * 100.
}

if options.frienddir:
    friendFiles = {}
    for filenames in groupedFiles.values():
        for fname in filenames:
            weightname = 'banff_prefit.'+os.path.basename(fname).replace(".fit.root","_weights.root")
            print "weight name is %s" %weightname
            weightname = os.path.join(options.frienddir, weightname)
            friendFiles[fname] = weightname

for run in runs:
    fluxtune = TFile(os.path.join(fluxdir,tunefiles[run]))
    fluxtunes[run]["numu"] = fluxtune.Get("enu_sk_tuned11b_numu_ratio")
    fluxtunes[run]["nue_x_numuflx"] = fluxtune.Get("enu_sk_tuned11b_numu_ratio")
    fluxtunes[run]["numubar"] = fluxtune.Get("enu_sk_tuned11b_numub_ratio")
    fluxtunes[run]["nue"]    = fluxtune.Get("enu_sk_tuned11b_nue_ratio")
    fluxtunes[run]["nuebar"] = fluxtune.Get("enu_sk_tuned11b_nueb_ratio")
    for hist in fluxtunes[run].values():
        #pull out 1D histogram, and save hist to current memory
        hist.SetDirectory(0)
samples = [ "ncelastic", "nc1pi", "ncother", "numucc", "nuecc", "mcall" ]
```

changed tunefiles

changed fluxtunes

(same as SelectNCGamma.py)

mv dat/ dat_11/
mv hist/ hist_11/

mkdir dat/
mkdir hist/

python Calcmc.py /disk/…/lemc/lentuple/*.ncgamma_flux**11a**_neut532.*.root

no errors, dat and hist files are same size

(files I recently generated)

Processing/Scrapper.py

```
def PrepareFluxWeights(self, fluxdir = "~/ncgamma/SystematicErrors/beamweights/"):
    print "Getting flux weights from",fluxdir
    tunefiles = {  "1"  :"sk_tuned11bv3.2_11anom_run1.root",
                   "2"  :"sk_tuned11bv3.2_11anom_run2.root",
                   "3"  :"sk_tuned11bv3.2_11anom_run3b-run3c.root",
                   "12" :"sk_tuned11bv3.2_11anom_run1-run2.root",
                   "3b" :"sk_tuned11bv3.2_11anom_run3b.root",
                   "3c" :"sk_tuned11bv3.2_11anom_run3c.root",
                   "4"  :"sk_tuned11bv3.2_11anom_run4.root"
                   }

    for run in self.runs:
        fluxtune = TFile(os.path.join(fluxdir,tunefiles[run]))
        self.fluxtunes[run]["numu"] = fluxtune.Get("enu_sk_tuned11b_numu_ratio")
        self.fluxtunes[run]["nue_x_numuflx"] = fluxtune.Get("enu_sk_tuned11b_numu_ratio")
        self.fluxtunes[run]["numubar"] = fluxtune.Get("enu_sk_tuned11b_numub_ratio")
        self.fluxtunes[run]["nue"]    = fluxtune.Get("enu_sk_tuned11b_nue_ratio")
        self.fluxtunes[run]["nuebar"] = fluxtune.Get("enu_sk_tuned11b_nueb_ratio")
        for hist in self.fluxtunes[run].values():
            hist.SetDirectory(0)
```

changed tunefiles

changed fluxtunes

Scrapper.py is used by ScrapeLE.py, which is run by runscrape.csh

why 3 and 12?
don’t exist for tuned13av2 → try to remove

Scrapper.py

- runscrape.csh for data and SelectionPlots
- runscrape.csh, added test to all suffixes
- ./runscrape.csh

```
Traceback (most recent call last):
  File "ScrapeLE.py", line 97, in <module>
    scrape.PrepareFluxWeights()
  File "/home/cnantais/ncgamma/Processing/Scrapper.py", line 79, in PrepareFluxWeights
    hist.SetDirectory(0)
AttributeError: 'TObject' object has no attribute 'SetDirectory'
```

comment out SetDirectory in Scrapper.py

Scrapper.py

- ./runscrape.csh

```
Traceback (most recent call last):
  File "ScrapeLE.py", line 97, in <module>
    scrape.PrepareFluxWeights()
  File "/home/cnantais/ncgamma/Processing/Scrapper.py", line 72, in PrepareFluxWeights
    fluxtune = TFile(os.path.join(fluxdir,tunefiles[run]))
KeyError: '3'
```

looking for 3 and 12?

no change

```
class Scrapper:
    runs = ["1","2","3","4"] #,"3b","3c"]
```

Scrapper.py

- needed files for 3 and 12, so I added some even though they're old
- copied those 2 old files from beamweights_flux11/

```
def PrepareFluxWeights(self, fluxdir = "~/ncgamma/SystematicErrors/beamweights/"):
    print "Getting flux weights from",fluxdir

    tunefiles = { "1"  :"sk_tuned13av2_13anom_run1_numode.root",
                  "2"  :"sk_tuned13av2_13anom_run2_numode.root",
                  "3"  :"sk_tuned11bv3.2_11anom_run3b-run3c.root",
                  "12" :"sk_tuned11bv3.2_11anom_run1-run2.root", #old
                  "3b" :"sk_tuned13av2_13anom_run3b_numode.root", #old
                  "3c" :"sk_tuned13av2_13anom_run3c_numode.root",
                  "4"  :"sk_tuned13av2_13anom_run4_numode.root"
                 }
```

Scrapper.py

- ./runscrape.csh
- error after 25 min

```
Traceback (most recent call last):
  File "ScrapeLE.py", line 215, in <module>
    for mctree, fileType in scrape.Loop(specialFriend = timingFriend):
  File "/home/cnantais/ncgamma/Processing/Scrapper.py", line 236, in Loop
    bin = self.fluxtunes[run][fileType].FindFixBin(mctree.pnu[0])
AttributeError: 'TObject' object has no attribute 'FindFixBin'
```

python treats fluxtunes as a TObject instead of a TH1D

→ what to do?

NominalXsec.py

```
fflux = TFile("$HOME/ncgamma/SystematicErrors/beamweights/sk_tuned11bv3.2_11anom_run1-run4_fine.root", "read")
banff = {}
fluxes = {}
totflx = 0.
totflxes = {}
for sample in [ "numu", "numub", "nue", "nueb" ]:
    fluxes[sample] = fflux.Get("enu_sk_tuned11b_"+sample)
```

changed fflux

Nominal flux
(Tom's slides)

I want:
tuned13av2/run1-8/sk_tuned13av2_13anom_run1-8_numode_fine.root
what about antinumode?
maybe ask Tom?

noticed ahimmel dependence on banff file too…

NominalXsec.py

- comment out SetDirectory
- but there are many more TH1 specific lines

```
Traceback (most recent call last):
  File "NominalXsec.py", line 101, in <module>
    for b in range(1, fluxes[sample].GetNbinsX()+1):
AttributeError: 'TObject' object has no attribute 'GetNbinsX'
```

what to do?

at least this a quick piece of code for testing

Moving on to /disk01/sklb/OLD/flux

- /disk01/sklb/OLD/flux/flux11a/sk/hbk/nu.sk_flukain.*.hbk

```
[/disk01/sklb/OLD/flux@sukap001[626]_% ls
flux10a  flux10a_2  flux10a_root  flux11a  flux13a  sk  sk_nd5
```

flux13a directories are empty

```
[/disk01/sklb/OLD/flux@sukap001[698]_% cd flux13a/
[/disk01/sklb/OLD/flux/flux13a@sukap001[699]_% ls
sk_nd5
[/disk01/sklb/OLD/flux/flux13a@sukap001[700]_% cd sk_nd5/
[/disk01/sklb/OLD/flux/flux13a/sk_nd5@sukap001[701]_% ls
root
[/disk01/sklb/OLD/flux/flux13a/sk_nd5@sukap001[702]_% cd root/
[/disk01/sklb/OLD/flux/flux13a/sk_nd5/root@sukap001[703]_% ls
/disk01/sklb/OLD/flux/flux13a/sk_nd5/root@sukap001[704]_%
```

Emailed James Feb 2016

- told him /disk/sklb/flux/flux13a/sk_nd5/root was empty, but expecting hbk and root
- he said likely mistake transferring files and they're /disk/sklb/flux/sk_nd5/root
- no hbk files, but names are probably the same in hbk and root

```
/disk01/sklb/OLD/flux/sk_nd5/root@sukap001[714]_% ls
file_m.lst                              fluka_13a_nom_sk_nd5_250ka.511.root
fluka_13a_nom_sk_nd5_250ka.0.root       fluka_13a_nom_sk_nd5_250ka.512.root
fluka_13a_nom_sk_nd5_250ka.1.root       fluka_13a_nom_sk_nd5_250ka.513.root
fluka_13a_nom_sk_nd5_250ka.10.root      fluka_13a_nom_sk_nd5_250ka.514.root
fluka_13a_nom_sk_nd5_250ka.100.root     fluka_13a_nom_sk_nd5_250ka.515.root
fluka_13a_nom_sk_nd5_250ka.1000.root    fluka_13a_nom_sk_nd5_250ka.516.root
fluka_13a_nom_sk_nd5_250ka.1001.root    fluka_13a_nom_sk_nd5_250ka.517.root
fluka_13a_nom_sk_nd5_250ka.1002.root    fluka_13a_nom_sk_nd5_250ka.518.root
fluka_13a_nom_sk_nd5_250ka.1003.root    fluka_13a_nom_sk_nd5_250ka.519.root
```

- sk_nd5, instead of sk?
- 1080 files, instead of 500 (and more entries per file)
- root, instead of hbk

→ emailed Xiaoyue, but she didn't know
→ emailed Roger

Emailed Roger

- /disk01/sklb/OLD/flux/sk_nd5/root/fluka_13a_nom_sk_nd5_250ka.*.root
  are nominal 13a MC
- OLD probably just indicates directory existed before February upgrade
- additional tree (h3002) is for flux at ND5 (ND280 basket,
  as opposed to magnet or sand muon production)
- doesn't recall reason for including in SK files, but doesn't think affects anything
- check by making flux distribution and checking against release
  → look at one file and see if flux is same as slides (don't need all files for high stats)
- slides:
  https://www.t2k.org/meet/collab/archive/201401/talks/thuram/13afluxprod_mfriend/view
- regarding file size and number, requested more interactions, beam group gave *10
- files I found are usable
- alternatively, download flux files from location described in slides
- Nakayama-san does file management for SKLB on Kamioka machine, can ask for more info

Megan Friend slides Jan 2014

- 2009 NA61 data
- FLUKA 2011, which agrees with NA61

ND280 13a Nominal Flux Release

Released as of 12/19/2013:

- On the GRID
  - At lfn:/grid/t2k.org/beam/mc/beamMC/flux13a/
- On the NEUT cluster
  - At neutsrv2:/neut/datasrv2a/mhartz/flux13a/
- On KEKcc
  - At /gpfs/fs03/t2k/beam/mc/beamMC/flux13a

Available files:

- ND5 → basket
  - 250 kA: flux_13a_sk_and_nd5_250ka_root.tar.gz
    - Includes SK flux
- ND6 → magnet
  - 250 kA: flux_13a_nd6_250ka_root_posfix.tar.gz
  - -250 kA: flux_13a_nd6_m250ka_root_posfix.tar.gz
- ND13 → ND280 muon plane
  - 250 kA: flux_13a_nd13_250ka_root_posfix.tar.gz

Ready but not yet copied to the GRID:

- -250 kA ND5 flux, -250 kA ND13 flux

don't have access to GRID (but could)

I found them on NEUT

I shoud use -250 kA too

NEUT cluster

```
cnantais@neut19:/neut/datasrv2a/mhartz/flux13a
> ls -1
13a_nom_ND6_250ka_new
13a_nom_ND6_m250ka
13a_nom_ND6_m250ka.tar.gz
flux_13a_nd13_250ka_root_new.tar.gz
flux_13a_nd13_250ka_root_posfix.tar.gz
flux_13a_nd13_m250ka_root.tar.gz
flux_13a_nd6_250ka_root_new.tar.gz
flux_13a_nd6_250ka_root_posfix.tar.gz
flux_13a_nd6_m250ka_root_posfix.tar.gz
flux_13a_sk_and_nd5_250ka_root.tar.gz
flux_13a_sk_nd5_250ka_root.tar.gz
flux_13a_sk_nd5_m250ka_root.tar.gz
tmp
```

difference between **sk_and_nd5** and **sk_nd5**?

-250kA

NEUT cluster

- tar –ztvf flux_13a_sk_and_nd5_250ka_root.tar.gz
- 13a_nom_250ka/root/fluka_13a_nom_250ka_iseq639_sd88618444_rn001_flkout.root
- what is iseq? Do I not need these? Asked Roger (and Tom).

- tar -ztvf flux_13a_sk_nd5_250ka_root.tar.gz
- sk_nd5/root/fluka_13a_nom_sk_nd5_250ka.602.root
- looks like sukap. Emailed Nakayama-san, but no reply

- tar -ztvf flux_13a_sk_nd5_m250ka_root.tar.gz
- 13a_nom_m250ka/root/fluka_13a_nom_sk_nd5_m250ka.6.root
- asked Roger if I need these?
- Asked Nakayama-san to have them included on sukap
  → too busy, not usually done, put them in my directory (on disk I guess?)

mk_num.sh (nue, nmb)

```
set num = 0
while ($num <= 99)

set fnum = `printf "%03d" $num`
#set nqs_fname = nqs/neut_514_num.$fnum.sh
set nqs_fname = nqs/neut_532_num.$fnum.sh

cat <<! >! $nqs_fname
#! /bin/csh -f
source /usr/local/sklib_g77/skofl-trunk/env.csh
set hdir = $top_dir
set card = neut_num.card
#set fdir = /net/sukond1/export/data/t2k/flux
#set fdir = /disk/sklb/flux
set fdir = /disk01/sklb/OLD/flux
set odir = /disk01/usr4/cnantais/neutfile
setenv RANFILE \$hdir/seed/random.tbl.$num
setenv RFLIST  \$hdir/rflist.$fnum
cat <<! >! \$RFLIST
10{
!
cat flux.list >> $nqs_fname
cat <<! >> $nqs_fname
}
20{{"\$odir/num.h2o.sk.flux11a.neut_532.$fnum.dat",LOCAL,,WRT,,,"recl=5670 status=new"}}
!
echo ! >> $nqs_fname
cat <<! >> $nqs_fname
cd \$hdir
uname -a
date

time ./t2kneut_sk \$card

date

echo done.
```

This makes the nqs/neut_532_num.*.sh files
no change to fdir
make sure flux.list is correct, which is made by mk_fluxlist.sh

mk_fluxlist.sh

```
#! /bin/csh -f

set i = 0
while ($i <= 499)
cat <<! >> flux.list
{"\$fdir/flux11a/sk/hbk/nu.sk_flukain.$i.hbk",LOCAL,,RED,,,"recl=1024 status=old"}
!
  @   i++
end
```

changed to 1080

changed to sk_nd5/root/fluka_13a_nom_sk_nd5_250ka.$i.root

cp mk_fluxlist.sh mk_fluxlist.sh.bk

mk_fluxlist.sh

- ./mk_fluxlist.sh
- generated flux.list
- appended instead of overwrite
- rm flux.list
- ./mk_fluxlist.sh
- flux.list looks good

regenerating NEUT files

- maybe try a single one first

- mv neutfile neutfile_May
- mkdir neutfile
- rm nqs/*
- ./mk_num.sh (not doing nue or nmb for now)
- go_submit.csh to 1 (instead of 99) → that means 000 and 001

- .dat are 0 instead of 17 MB?
- err/ files are size 0?
- out/

```
RZOPEN: cannot determine record length. File /disk01/sklb/OLD/flux/sk_nd5/root/fluka_13a_nom_sk_nd5_250ka.0.root probably not in RZ format
***** ERROR in HROPEN : Cannot open file :
neopskfxv:file in RFLIST does not exist.
```

probably because root instead of hbk
→ emailed Nakayama-san, but no reply
→ will ask Roger

nqs/neut_532_num.000.sh

```
#! /bin/csh -f
source /usr/local/sklib_g77/skofl-trunk/env.csh
set hdir = /home/cnantais/ncgamma/mc/neut/neut_5.3.2/src/t2kflux_zbs
set card = neut_num.card
#set fdir = /net/sukond1/export/data/t2k/flux
#set fdir = /disk/sklb/flux
set fdir = /disk01/sklb/OLD/flux
set odir = /disk01/usr4/cnantais/neutfile
setenv RANFILE $hdir/seed/random.tbl.0
setenv RFLIST  $hdir/rflist.000
cat <<! >! $RFLIST
10{
{"$fdir/sk_nd5/root/fluka_13a_nom_sk_nd5_250ka.0.root",LOCAL,,RED,,,"recl=1024 status=old"}
{"$fdir/sk_nd5/root/fluka_13a_nom_sk_nd5_250ka.1.root",LOCAL,,RED,,,"recl=1024 status=old"}
{"$fdir/sk_nd5/root/fluka_13a_nom_sk_nd5_250ka.2.root",LOCAL,,RED,,,"recl=1024 status=old"}
```

didn't notice anything

```
{"$fdir/sk_nd5/root/fluka_13a_nom_sk_nd5_250ka.1078.root",LOCAL,,RED,,,"recl=1024 status=old"}
{"$fdir/sk_nd5/root/fluka_13a_nom_sk_nd5_250ka.1079.root",LOCAL,,RED,,,"recl=1024 status=old"}
{"$fdir/sk_nd5/root/fluka_13a_nom_sk_nd5_250ka.1080.root",LOCAL,,RED,,,"recl=1024 status=old"}
}
20{{"$odir/num.h2o.sk.flux11a.neut_532.000.dat",LOCAL,,WRT,,,"recl=5670 status=new"}}
!
cd $hdir
uname -a
date

time ./t2kneut_sk $card

date

echo done.
```

executable is binary
looked at t2kneut_sk.cc, but didn't notice anything

Summary

updated t2k.org instructions for running T2K Run1-4 on new computer, with previously described improvements

working on updating flux

- problem with attribute error when python uses new flux root file
- problem with hbk → root compatibility in NEUT