

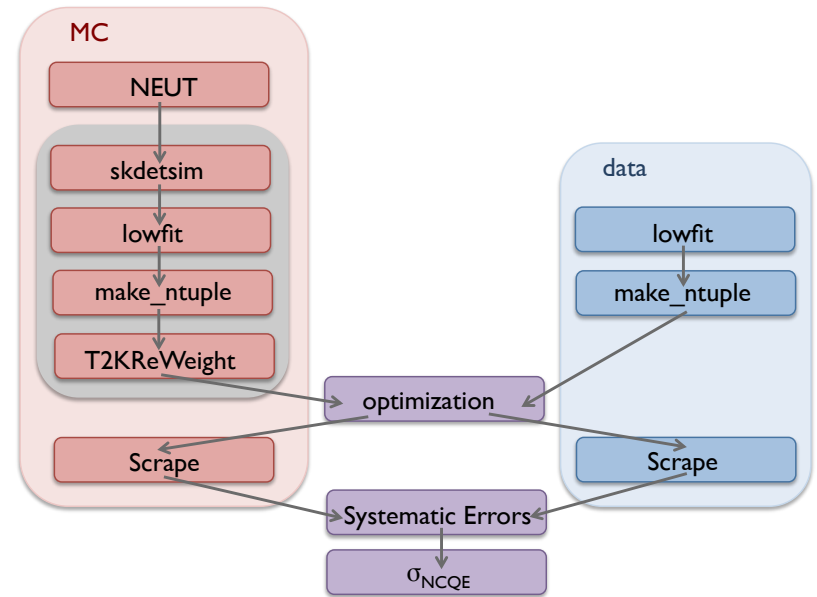
update

Corina Nantais
Group meeting
09 March 2017

- ncgamma analysis tools and the new Kamioka computer system
- E493 energy calibration of HPGe detectors

ncgamma analysis tools

work with the
new Kamioka computer system
from February 2017



Some notes from my processing Run 4 data

- co from svn
- didn't need password this time?
- comment out everything in alexenv.csh, won't use anyway
- ~~comment out everything but LD_LIBRARY_PATH because SterileAna in skenv_py.csh~~ (can't do this, as I will explain)

.cshrc

- try to comment out SKPATH
- without it, there is no SKPATH so put it back

Fukuda-san	Corina
LD_LIBRARY_PATH=/home/skofl/sklib_g77/skofl_14c/lib:/home/cnantais/ncgamma/SterileAna/lib:/usr/local/sklib_g77/root_v5.28.00h/lib:/home/skofl/sklib_g77/skofl_14c/lib:/home/skofl/sklib_g77/root_v5.28.00h/lib:/usr/local/lib	LD_LIBRARY_PATH=/home/skofl/sklib_g77/skofl_14c/lib:/home/cnantais/ncgamma/SterileAna/lib:/usr/local/sklib_g77/root_v5.28.00h/lib:/home/skofl/sklib_g77/skofl_14c/lib:/home/skofl/sklib_g77/root_v5.28.00h/lib:/usr/local/lib: /usr/local/lib
CXX=g++34	CXX=g++34
CPP=gcc34 -E	CPP=gcc34 -E
CC=gcc34	CC=gcc34
F77=g77	F77=g77
CERN=/home/skofl/sklib_g77/cern	CERN=/usr/local/sklib_g77/cern
CERN_LEVEL=2005	CERN_LEVEL=2005
CERN_ROOT=/home/skofl/sklib_g77/cern/2005	CERN_ROOT=/usr/local/sklib_g77/cern/2005/
SKOFL_ROOT=/home/skofl/sklib_g77/skofl_14c	SKOFL_ROOT=/usr/local/sklib_g77/skofl_14c/
ATMPD_ROOT=/home/skofl/sklib_g77/atmpd_14c	ATMPD_ROOT=/usr/local/sklib_g77/atmpd_14c/
NEUT_ROOT=/home/skofl/sklib_g77/neut_5.3.2	NEUT_ROOT=/usr/local/sklib_g77/neut_5.3.2/
ROOTSYS=/home/skofl/sklib_g77/root_v5.28.00h	ROOTSYS=/usr/local/sklib_g77/root_v5.28.00h/
CLHPATH=/usr/local/clhep-2.1.1.0/lib:/home/skofl/sklib_g77/skofl_14c/lib:/home/skofl/sklib_g77/root_v5.28.00h/lib:/usr/local/lib	does not exist (Fukuda-san says this isn't necessary)

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

Fukuda-san	Corina
SKPATH=/home/skofl/sklib_g77/atmpd_14c/const:/home/skofl/sklib_g77/skofl_14c/const:/home/skofl/sklib_g77/skofl_14c/const/lowe:/usr/local/sklib_g77/skam/const	SKPATH=/usr/local/sklib_g77/skofl_14c/const:/usr/local/sklib_g77/atmpd_14c/const:/usr/local/sklib_g77/skofl_14c/const/lowe:/skam/const
PATH=/home/skofl/sklib_g77/skofl_14c/bin:/home/skofl/sklib_g77/root_v5.28.00h/bin:/home/skofl/sklib_g77/cern/2005/bin:/usr/local/emacs-24.5/bin:/usr/local/bin:/usr/local/texlive/2016/bin/x86_64-linux:/usr/lib64/qt-3.3/bin:/usr/local/bin:/usr/bin:/usr/local/sbin:/usr/sbin:/opt/ibucsl/bin	PATH=/usr/local/sklib_g77/skofl_14c/bin:/usr/local/sklib_g77/atmpd_14c/bin:/usr/local/sklib_g77/root_v5.28.00h/bin:/usr/local/sklib_g77/cern/2005/bin:/home/skofl/sklib_g77/skofl_14c/bin:/home/skofl/sklib_g77/root_v5.28.00h/bin:/home/skofl/sklib_g77/cern/2005/bin:/usr/local/emacs-24.5/bin:/usr/local/bin:/usr/local/texlive/2016/bin/x86_64-linux:/usr/lib64/qt-3.3/bin:/opt/kusu/bin:/opt/kusu/sbin:/usr/pgsql-9.0/bin:/usr/local/bin:/usr/bin:/usr/local/sbin:/usr/sbin:/opt/ibutils/bin:~/bin:/
PYTHONPATH=/usr/local/sklib_g77/root_v5.28.00h/lib	PYTHONPATH=/usr/local/sklib_g77/root_v5.28.00h/lib:/opt/kusu/lib64/python:/opt/kusu/lib/python:/opt/primitive/lib/python/site-packages:/opt/primitive/lib64/python2.4/site-packages:/opt/primitive/lib/python2.4/site-packages:/opt/primitive/lib64/python2.6/site-packages:/opt/primitive/lib/python2.6/site-packages
NEUTROOT=/usr/local/sklib_g77/neut_5.3.2	NEUTROOT=/usr/local/sklib_g77/neut_5.3.2/

I need to learn more about environment variables

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

T2K-SK t2k.org needs to be updated, I think

14a Data and MC Info

by [Alexander Himmel](#) — last modified Feb 28, 2017 12:45 PM — [History](#)

MC Files

14a MC are generated based on:

- 13a nominal flux
- NEUT 5.3.2 (Spectral function MC)
- skdetsim-v13p90
- 14b SK software (apfit_14b, fitQun_v4r0).



we are using 14c SK software

neut

hayato@suketto.icrr.u-tokyo.ac.jp

Mar 4 (3 days ago) ☆

to michael.wilking, wendell.roger., okumura, koshio, cnantais, htana ▾

Dear Mike-san,

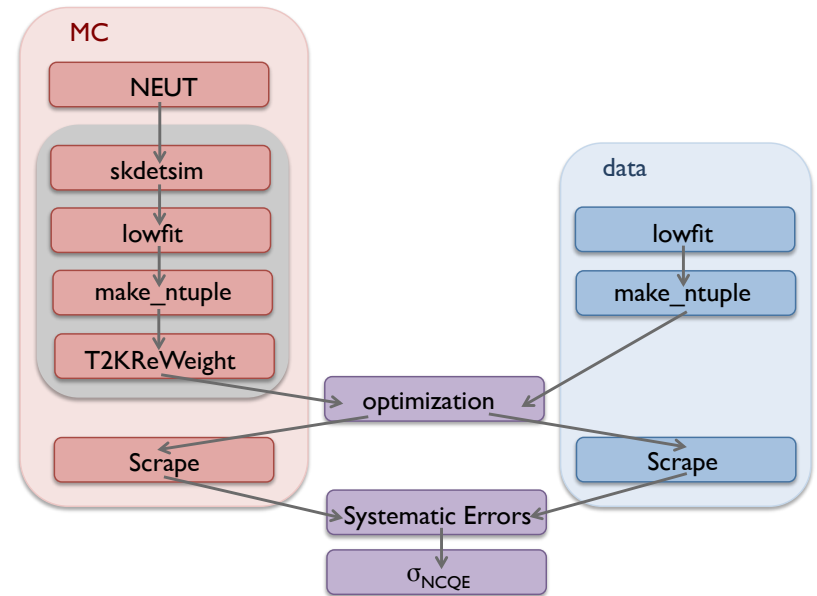
I think it is (basically) fine.

However, one thing I'd like to ask you to keep in mind that the previous low energy gamma analyses used dedicated Monte-Carlo because the nominal ones are not using the spectral function NCEL cross-section. Therefore, one have to reweight NCEL cross-section when they try to obtain consistent plots as Ueno-san and the others made in the previous.

Best,
Yoshinari

Even if the updates to the spectral function are included in the newer versions of neut, like 5.3.5, we would still generate our own MC, correct?

Environmental variables and lowfit both look ok



csh

source skenv_py.csh (not alexenv.csh)

- looks ok, root and python work

lowfit/ make

- looks ok

T2K first reduction, cut on GPS

lowfit/RunData.sh

T2K Run 8 (I found this, James confirmed)

```
/disk01/sklb2/t2kdata/process/1stred[sukap001 1071] ls  
0753 0754 0755 0756 realtime  
/disk01/sklb2/t2kdata/process/1stred[sukap001 1072] █
```

T2K Run 1-7 (from Akutsu-san)

```
/disk01/sklb/OLD/t2k/1stred[sukap001 1069] ls  
0654 0663 0672 0681 0690 0699 0708 0717 0726 0735 0744 0753  
0655 0664 0673 0682 0691 0700 0709 0718 0727 0736 0745 realtime  
0656 0665 0674 0683 0692 0701 0710 0719 0728 0737 0746  
0657 0666 0675 0684 0693 0702 0711 0720 0729 0738 0747  
0658 0667 0676 0685 0694 0703 0712 0721 0730 0739 0748  
0659 0668 0677 0686 0695 0704 0713 0722 0731 0740 0749  
0660 0669 0678 0687 0696 0705 0714 0723 0732 0741 0750  
0661 0670 0679 0688 0697 0706 0715 0724 0733 0742 0751  
0662 0671 0680 0689 0698 0707 0716 0725 0734 0743 0752
```

this is where you find SK beam summary and GPS information
looks the same, so no change

set sklb = /home/sklb/reduction/list/
sk_beam_summary/ and window/

easy

set odir = /disk01/usr4/cnantaish/lowedata/lowfit

T2K Run		MR Run	SK Run	
1		29	66251 - 66295	66251 - 66945
		30	66494 - 66521	
		31	66585 - 66608	
		32	66679 - 66727	
		33	66769 - 66902	
		34	66916 - 66945	
		35		
2		36	67877 - 67978	67877 - 68208
		37	68045 - 68175	
		38	68200 - 68208	
no horn		39	69223	
		40		
3	3b	41	69511 - 69586	69511 - 69753
	3c	42	69626 - 69720	
		43	69724 - 69753	
4		44	70524 - 70619	70524 - 71245
		45	70670 - 70722	
		46	70829 - 70882	
		47	70901 - 71042	
		48	71042 - 71067	
		49	71239 - 71245	
		50		
		51		
		52		
		53		
		54		
5	5a, 5b	55	72674 - 72733	72674 - 72767
	5b, 5c	56	72734 - 72767	
		57		
6	6a, 6b	58	73133 - 73226	73133 - 73654
	6b	59	73238 - 73305	
	6a	60	73331 - 73342	
	6a, 6b	61	73433 - 73521	
		62	73596 - 73611	
		63	73627 - 73654	
		64		
		65		
7		66	74363 - 74398	74363 - 74637
		67	74413 - 74482	
		68	74555 - 74637	
		69		
		70	75363 - 75387	
		71	75402 - 75484	
(as of 19 Jan 2017)		72	75600 - 75617	

FHC

RHC

both

nothing

not sure yet

MR run to SK run, look at runlist.run** in /
home/sklb/reduction/shell/05_final/

T2K Run (1-6b) to MR run (29-61),
see T2K-SK documentation

MC Reweighting 14a Data and MC Info
(needs to be updated)

→ where is T2K Run 7-8 and MR run 62-72?

→ Akutsu-san told me to see TN284 for all
T2K Run to MR run (p.4 & p.6)

lowfit/find_beamrun.sh

Run 58–72 (T2K Run 6–8)

indir=/home/sklb/reduction/shell/05_final

I found Run 29–68 (T2K Run 1-6) here:

indir=/home/sklb/reduction/shell/05_final/2017feb_BSDupdated/

lowfit/runlowedata.py

updated t2kskrun with T2K Run 5–8

easy

pdir="/disk01/usr4/cnantaais/lowedata"

#T2K Run 8

#reducdir = "/disk01/sklb2/t2kdata/process/lstred/%04d/%06d" %(run4,skRun)

#T2K Run 1-7

reducdir = "/disk01/sklb/OLD/t2k/lstred/%04d/%06d" %(run4, skRun)

#writestr = "source /home/cnantaais/ncgamma/alexenv.csh\n"

writestr = "source /home/cnantaais/ncgamma/skenv_py.csh\n"

```
makes csh files
makes nqs list alldata
```

```
16 min
qstat nothing
made run directories
err file said SKOFL ROOT undefined variable, check others
```

```
03 March
echo $SKOFL ROOT, it's ok?
```

used to be /usr/local/sklib g77/skofl l3b in skenv py.csh

File Edit Options Buffers Tools Help

```
SKOFL_ROOT: Undefined variable.
```

[illegible]

```

---:---F1 err_71245_9 Top L1 (Fundamental) -----
For information about GNU Emacs and the GNU system, type C-h C-a.

```

script/sample_*.csh

- sources skenv_py.csh
- maybe put SKOFL_ROOT back in skenv_py.csh?
- now complains about ROOTSYS
- so uncomment all of skenv_py.csh

```
setenv top /usr/local/sklib_g77
setenv SKOFL_ROOT $top/skofl_14c
setenv SOFTVER "14c"
setenv CERN $top/cern
setenv CERN_LEVEL 2005
setenv CERN_ROOT $CERN/$CERN_LEVEL
setenv ROOTSYS $top/root_v5.28.00h
setenv PYTHONPATH $ROOTSYS/lib:${PYTHONPATH}
setenv NEUTROOT $top/neut_5.3.2
setenv NEUT_ROOT $NEUTROOT
setenv LD_LIBRARY_PATH "$SKOFL_ROOT/lib:/home/cnatais/ncgamma/SterileAna/lib:`\
$ROOTSYS/bin/root-config --libdir`:$LD_LIBRARY_PATH"
setenv ATMPD_ROOT $top/atmpd_$SOFTVER
setenv PATH "$SKOFL_ROOT/bin:$ATMPD_ROOT/bin:$ROOTSYS/bin:$CERN_ROOT/bin:$PATH"
setenv SKPATH "${SKOFL_ROOT}/const:${ATMPD_ROOT}/const:${SKOFL_ROOT}/const/lowe\
:/skam/const"
```

It worked!

try I SK run (70524) in runlowedata.py

there are root files in lowfit/run*!!!

compare to last time, January 2016

Warnings in err files?

- warning in err files, but in jan17 err files were empty
- looked at data.lowfit.70524.938.root from today and jan17
- 10.755 kB vs 10.747 kB (jan17), so that's good
- each branch is the same size, can't seem to look at in TBrowser, both crash?
- how else to compare?

```
Warning in <TStreamerInfo::BuildCheck>:  
The StreamerInfo of class TLeafD read from file /home/sklb/reduction/list/skbeamsummary/sk_beam_summary.run44.root  
has the same version (=1) as the active class but a different checksum.  
You should update the version to ClassDef(TLeafD,2).  
Do not try to write objects with the current class definition,  
the files will not be readable.
```

```
Warning in <TStreamerInfo::BuildCheck>:  
The StreamerInfo of class TLeafD read from file /home/sklb/reduction/list/skbeamsummary/sk_beam_summary.run44.root  
has the same version (=1) as the active class but a different checksum.  
You should update the version to ClassDef(TLeafD,2).  
Do not try to write objects with the current class definition,  
the files will not be readable.
```


do all Run 4 data

16 min to submit

2h25 min to run

compare size of lowfit/

du -sh lowfit/

today

3.9 TB

101 MB err/

4.1 GB out/

jan17

5.2 TB

23 MB err/

5.5 GB out/

Jan17 has 70524 – 73521 – that's Run 6!!! from when I was testing antineutrino changes

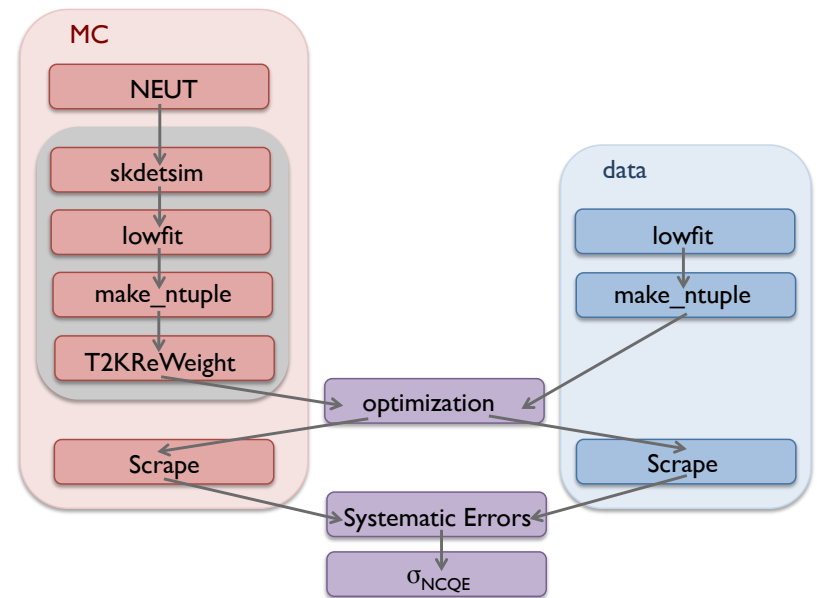
jan7

3.9 TB

23 MB err/

4.1 GB out/

Now, data make_ntuple



ncgamma/make_ntuple/

make

- looks ok

no changes to RunNtupleMaker.sh

rundatafill.py

start with only one SK run to test

```
t2kskrun={4:[70524,70524]}
```

added T2K Runs 5-7

easy

```
#pdir="/disk/usr4/cnantaais/lowedata"
```

```
pdir="/disk01/usr4/cnantaais/lowedata"
```

```
#writestr = "source /home/cnantaais/ncgamma/alexenv.csh\n"
```

```
writestr = "source /home/cnantaais/ncgamma/skenv_py.csh\n"
```

```
#print >>fsub, "qsub -q all -o %s -e %s %s" %(outname, errname, cshfname)
```

```
print >>fsub, "qsub -q ALL -o %s -e %s %s" %(outname, errname, cshfname)
```

It worked!

`python rundatafill.py`

produces `csf` files in `script/` and `nqs_list_alldata`

`./nqs_list_alldata`

took a while because many lowe jobs queued, maybe use **ALL** instead?

output in `disk01/.../lowedata/ntuple/run70524/data.70524.*.root`

root files have a size

insides root file, branches have a size

all err files are size 0 (same as `jan07`)

however, `jan07` has some non-zero err files? look into that later

out files are approximately the same size

runmerge.py

start with only one SK run to test

```
t2kskrun={4:[70524,70524]}
```

added T2K Runs 5-7

easy

```
#rootfdir="/disk/usr4/cnantis/lowedata/ntuple"
```

```
rootfdir="/disk01/usr4/cnantis/lowedata/ntuple"
```

```
#writestr = "source ~ahimmel/skenv.csh\n"
```

```
writestr = "source /home/cnantis/ncgamma/skenv_py.csh\n"
```

It worked!

`python runmerge.py`

produced `merge_*.csh` in `script/` and `nqs_list_merge`

`merge_*.csh` looks messy, but so does one in `jan7`

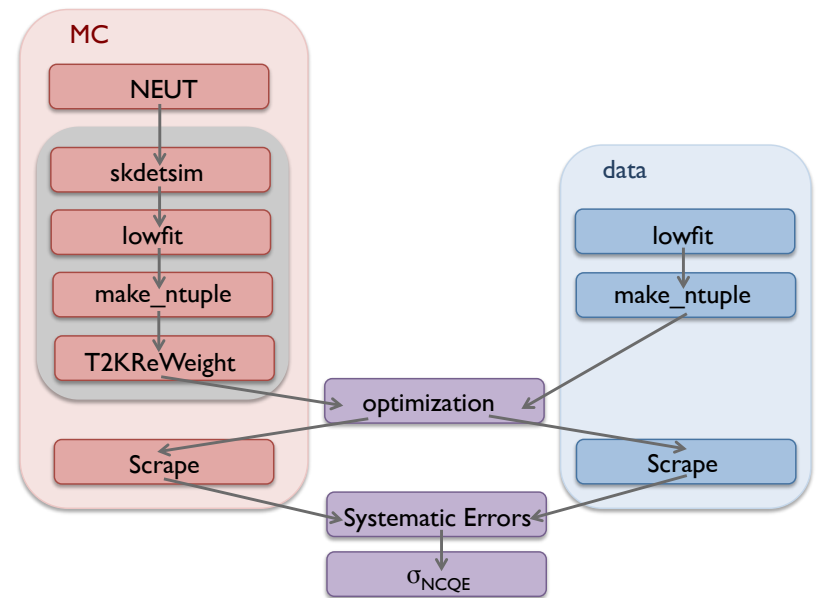
output in `disk01/.../lowedata/ntuple/run70524/data.70524.*.submerge*.root`

root files same size as `jan7`

root branches same size as `jan7`

output in `disk01/.../lowedata/ntuple/data.lowfit.70524.merge.root`

root file and branches same size as `jan7`



Next, do make_ntuple on all Run 4 data

And then MC

Fukuda-san progress

Had started with MC side, having problems with skdetsim.
Asked him to send me details and maybe I could help.

Compiled and ran lowfit for data, no root files in output.
He will follow my instructions in these slides.

Other notes from ncgamma local meeting

Nothing specific, but try to think of ways to improve the reduction step. Currently follows SK lowe. Check each reduction step.

Wait for retuned skdetsim. They might take more LINAC data this summer. Not enough good data from last summer.

Hayato-san strongly recommends moving from g77 to gcc. g77 isn't supported anymore. Do this after we reproduce T2K Run 1–4 results.

E493

I will be responsible for

- HPGe data analysis (two detectors)
- FLUKA simulations
- studying libraries and papers on nuclear reactions

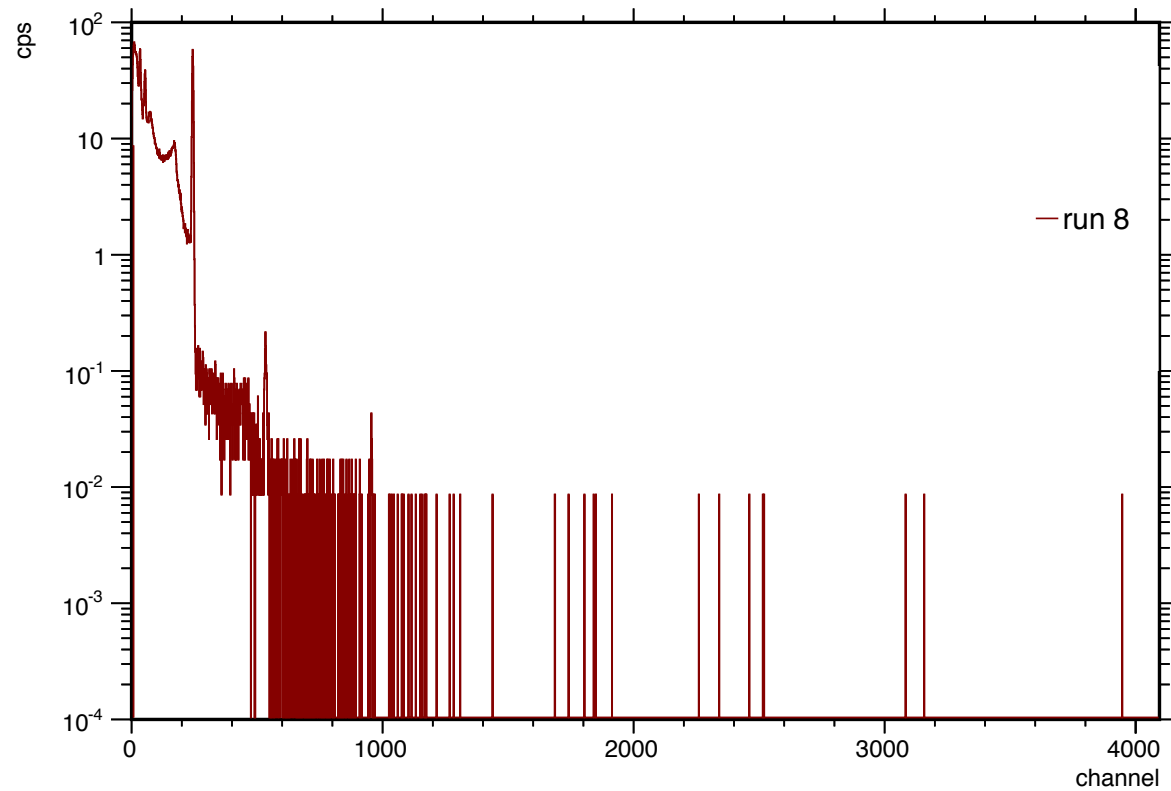
Two HPGe detectors

- small HPGe #1 is the same as E465
- large HPGe #2 is from Canberra
- 2.7 MeV and 3.2 MeV peaks are beam related backgrounds
- large HPGe #2 doesn't see 2.7 MeV and 3.2 MeV peaks?
- will look into
- 8 MeV peak wasn't observed consistently in both detectors, and also seemed to change channel position
- will look into

HPGe #1 small calibration

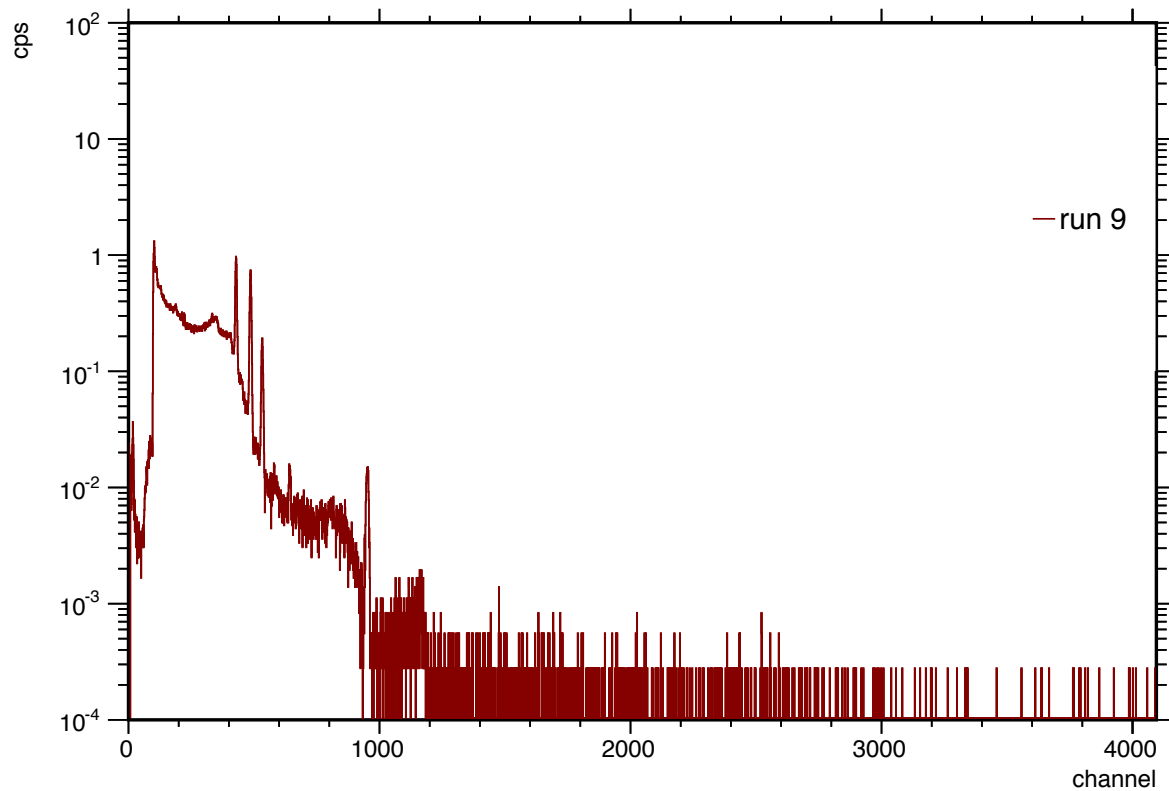
^{137}Cs

- 20170219
- run 8
- 3 peaks: 662 keV, ^{40}K , ^{208}Tl



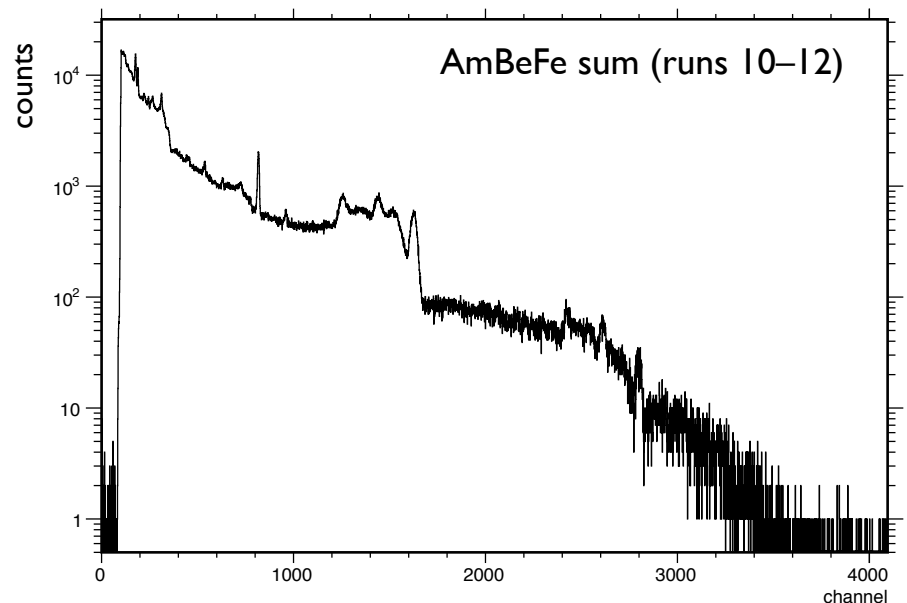
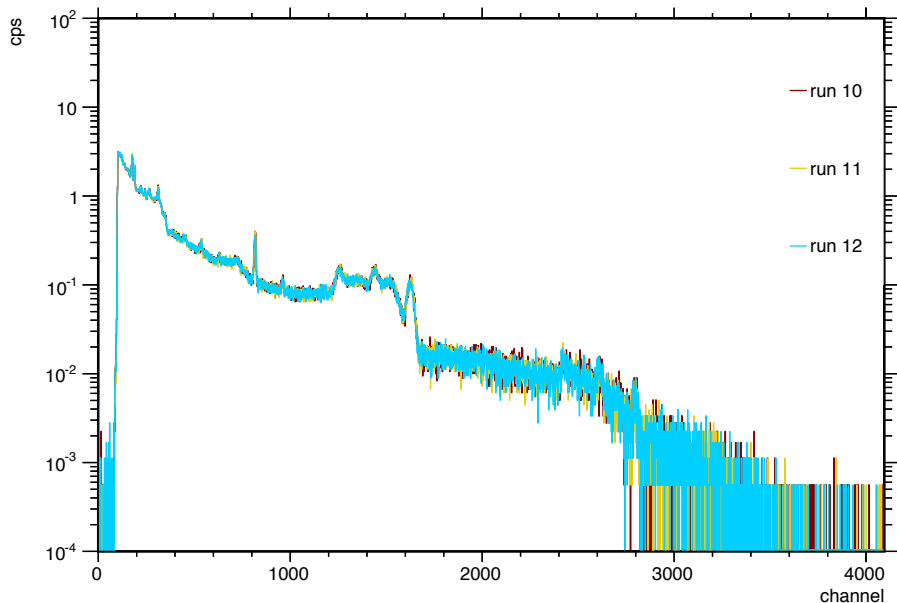
^{60}Co

- 20170219
- run 9
- 3 peaks: 1.17 MeV, 1.33 MeV, ^{40}K
- can't resolve sum peak and ^{208}Tl into 2 peaks, so didn't use ^{208}Tl



AmBeFe

- 20170220
- runs 10–12
- annihilation (and ^{40}K) not clearly visible
- there must be PE too, because can see $^1\text{H}(n,\gamma)$
- 4 peaks = $^1\text{H}(n,\gamma)$, AmBeDE, AmBeSE, AmBe
- same spectra, rate, slope, intercept \rightarrow combined spectrum
- add TI, FeDE, FeSE, Fe for combined spectrum

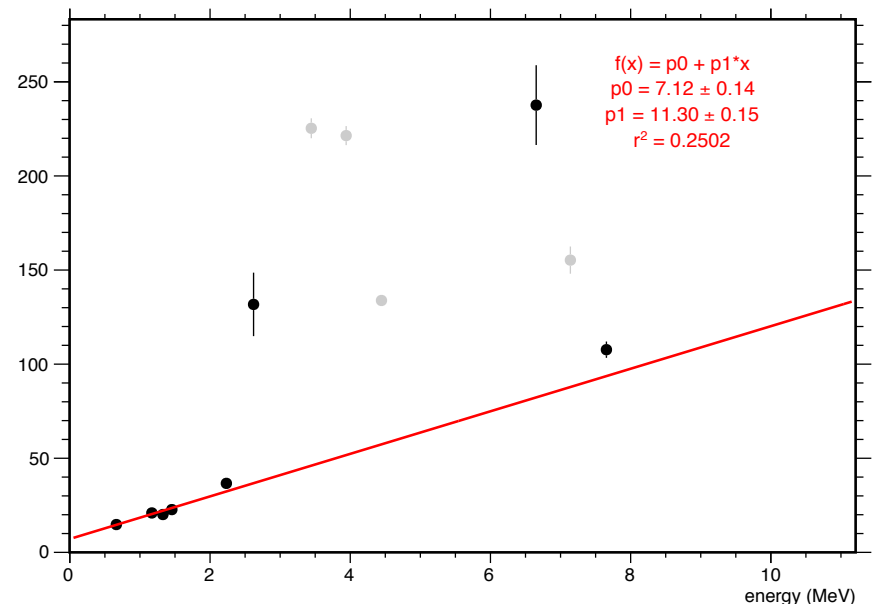
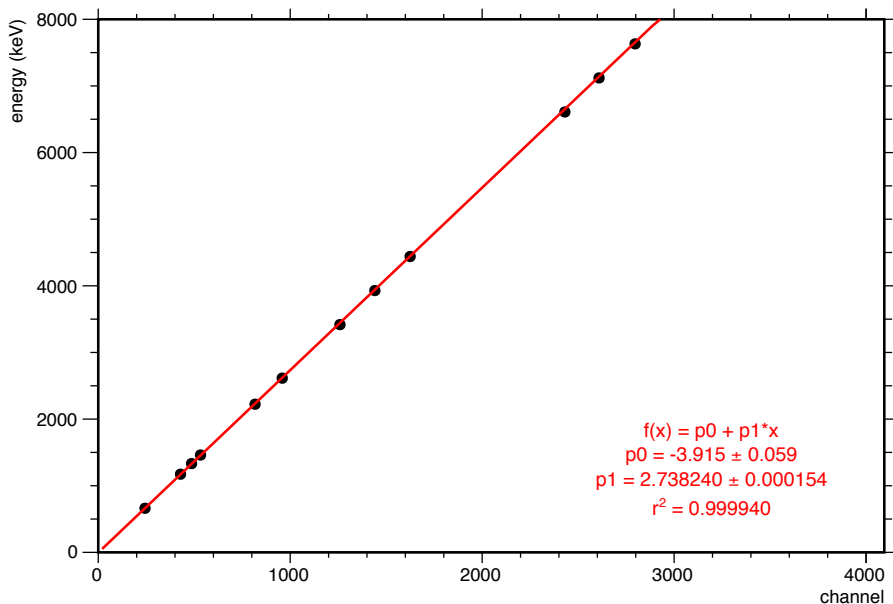


HPGe #1 small

good energy calibration

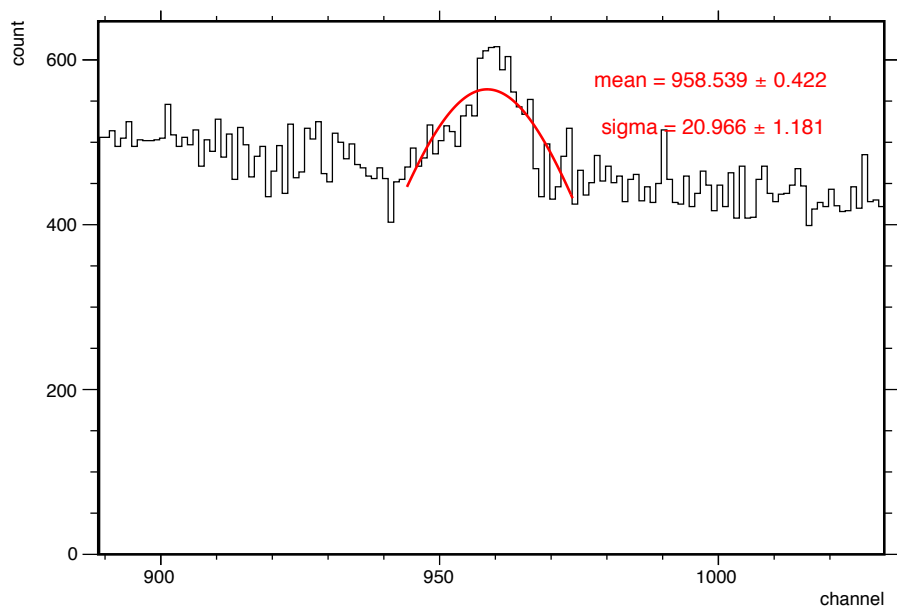
energy resolution

- $^{76}\text{Fe}(n,\gamma)$ SE should be worse resolution than DE (same as E465)
- ^{208}Tl has poor resolution, only 2 poor fits so need background data too
- (20.10 ± 0.15) keV resolution at 1332 keV

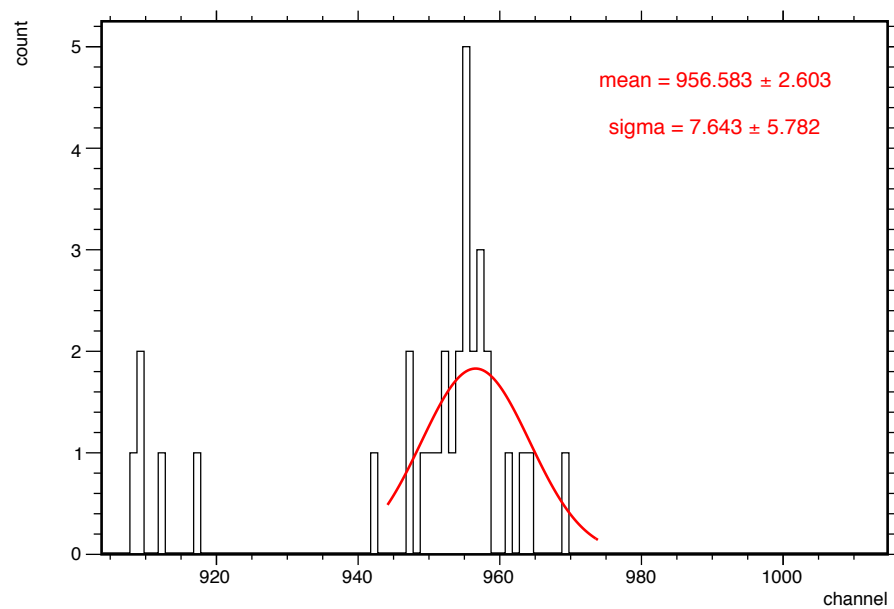


only 2 poor fits for ^{208}Tl

AmBeFe sum (runs 10–12)



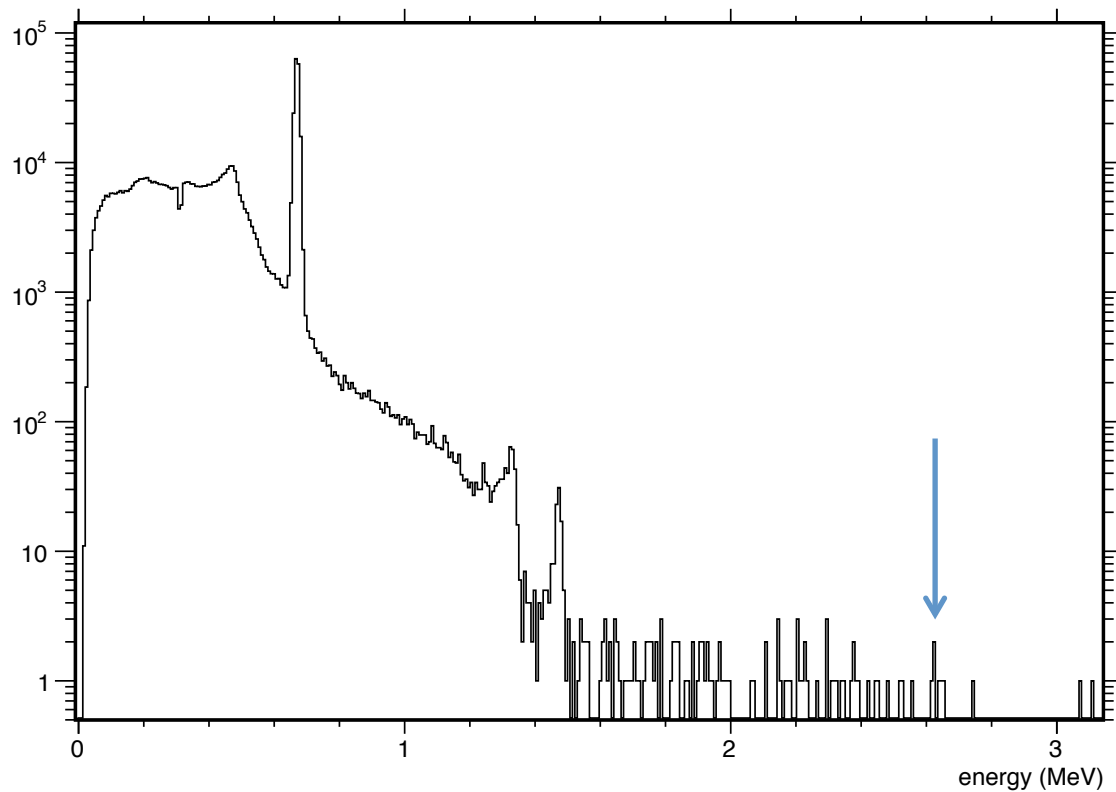
^{137}Cs run 8



HPGe #2 large calibration

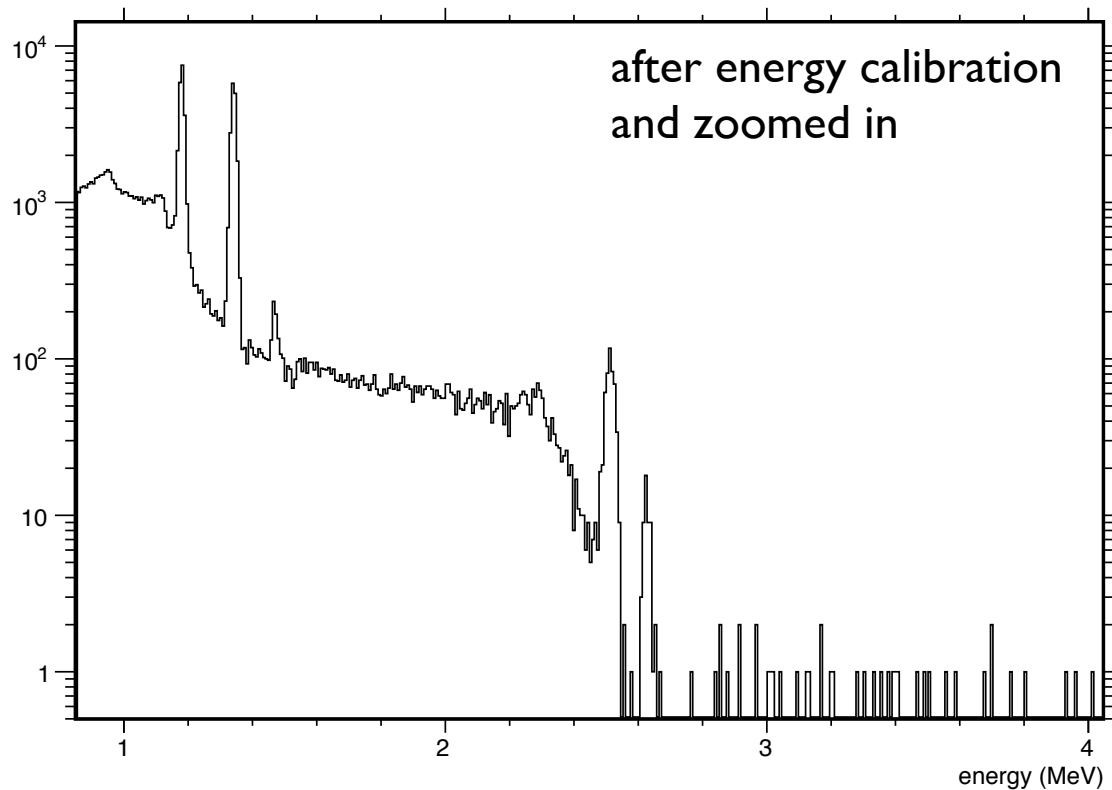
^{137}Cs

- 20170220
- run I
- 2 peaks: 662 keV, ^{40}K
- can't see ^{208}Tl , only 29 s livetime



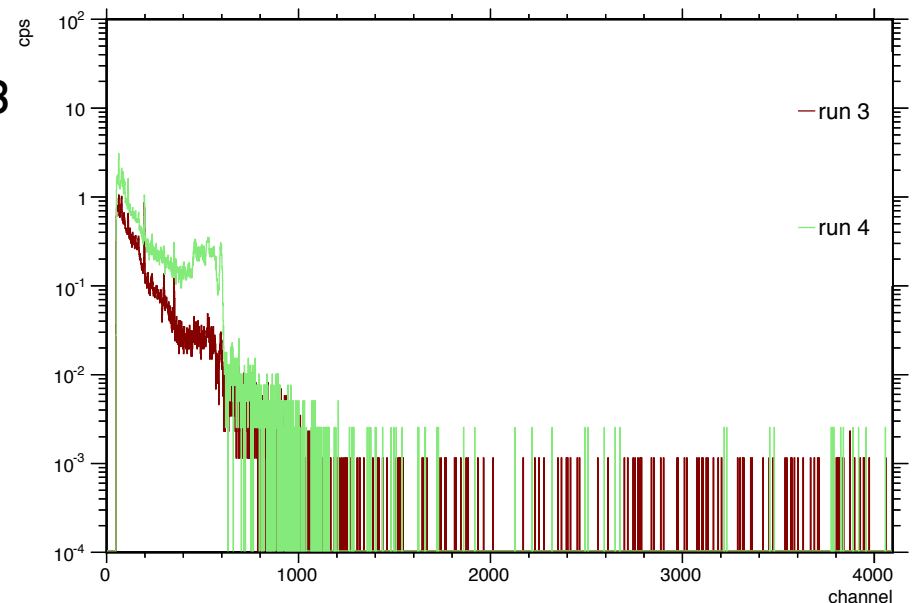
^{60}Co

- 20170220
- run 2
- 4 peaks: 1.17 MeV, 1.33 MeV, ^{40}K , ^{208}Tl
- can resolve sum peak and ^{208}Tl



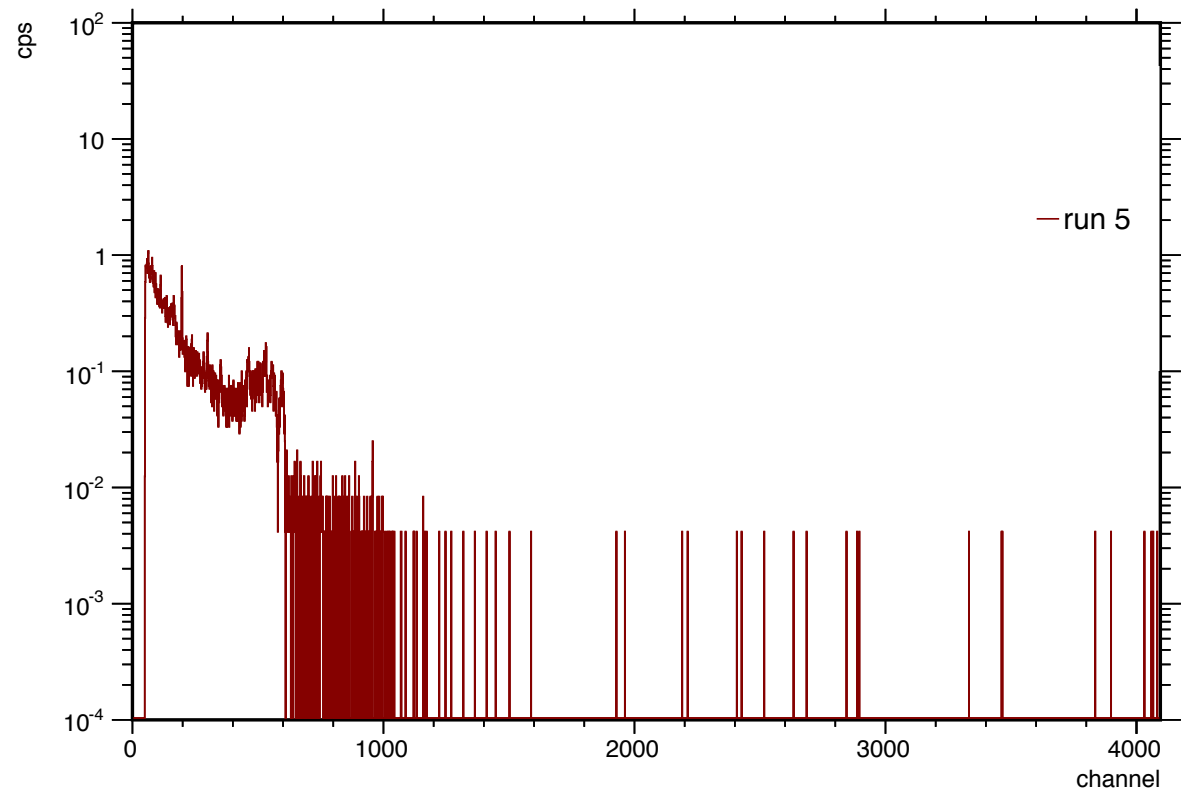
AmBe

- 20170220
- runs 3–4
- Ashida-san says there was polyethylene and iron too, must update run notes
- 6 peaks = ^{40}K , $^1\text{H}(n, \gamma)$, ^{208}Tl , AmBeDE, AmBeSE, AmBe
- can't see Fe peaks
because livetime
too short
- can't see AmBeSE or AmBeDE in run 3
- can't see H in run 4
- spectra and rates are different
- don't use either, for now



AmBeFe

- 20170220
- run 5
- 6 peaks = ^{40}K , $^1\text{H}(n,\gamma)$, ^{208}Tl , AmBeDE, AmBeSE, AmBe
- can't see Fe peaks because livetime too short



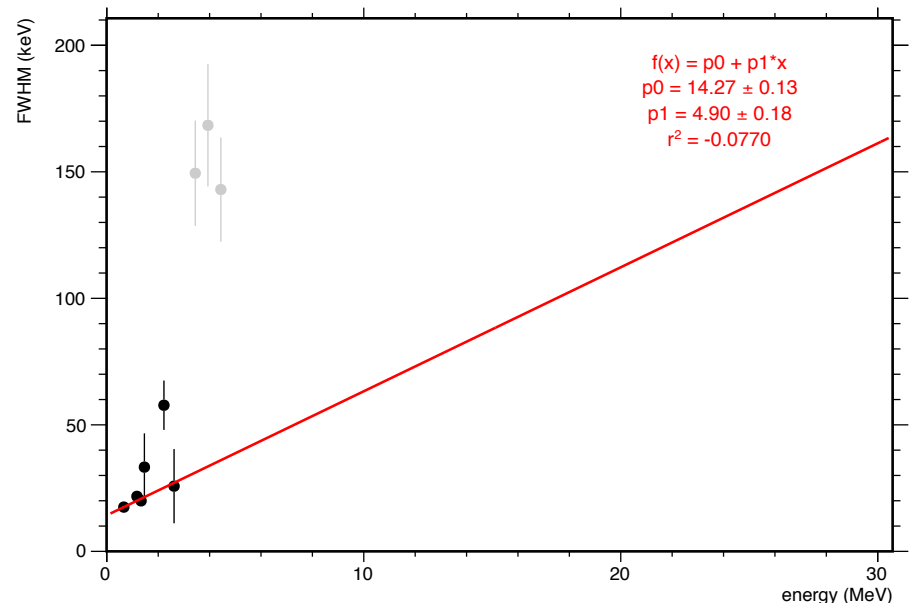
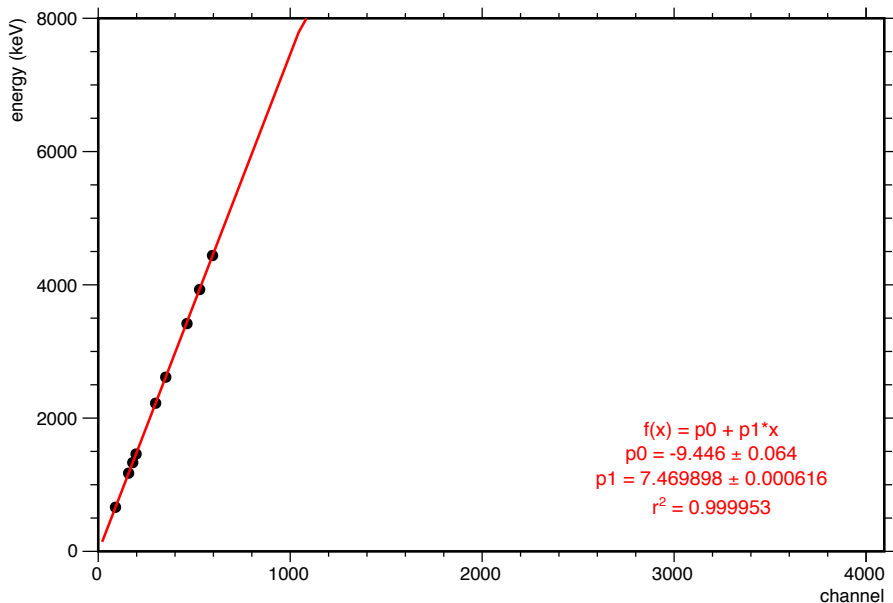
HPGe #2 large

energy calibration

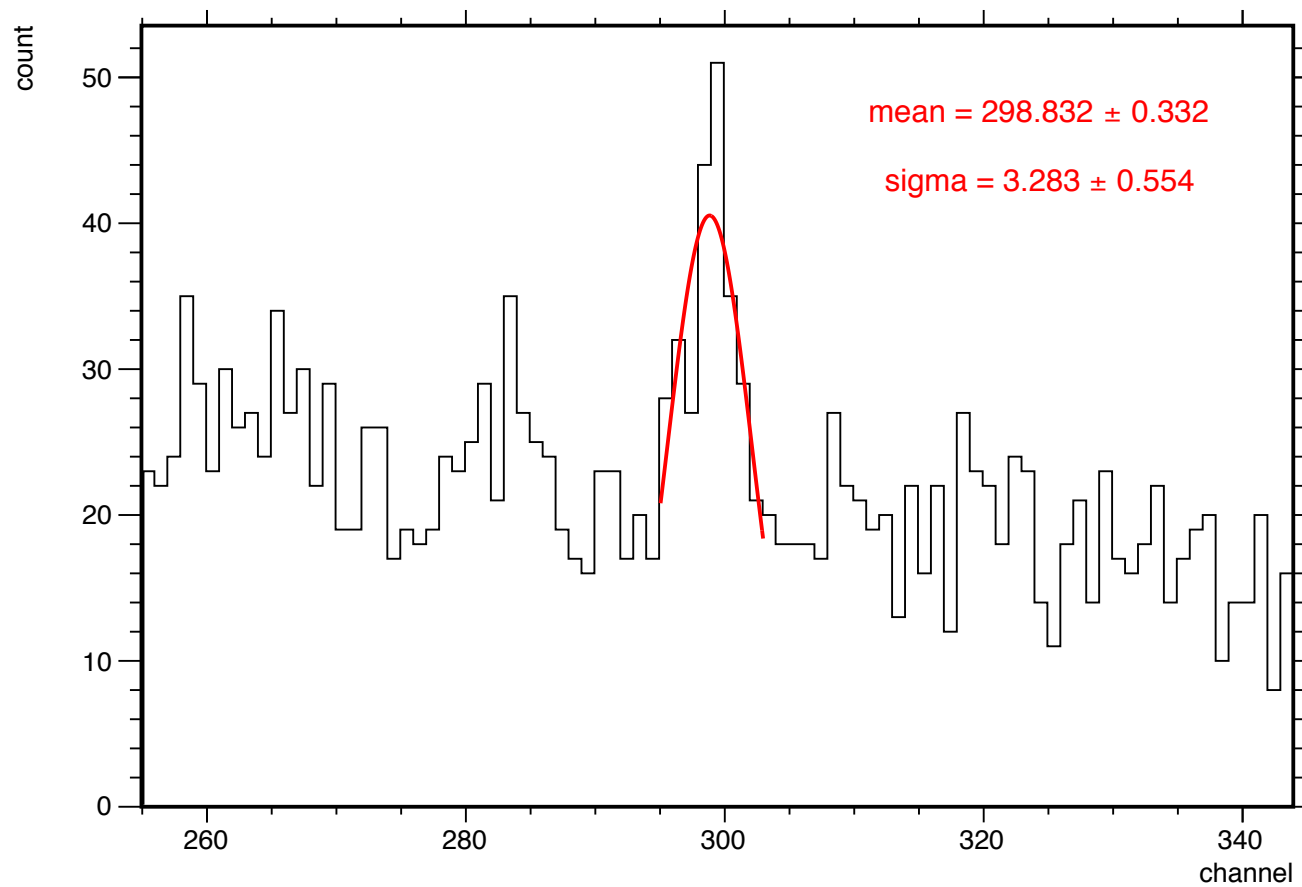
- couldn't adjust dynamic range, only interested up to ~ 10 MeV not 30 MeV

energy resolution

- good that $^{76}\text{Fe}(n,\gamma)$ SE has worse resolution than DE
- $^1\text{H}(n,\gamma)$ has poor resolution, maybe because only 1 fit?
- (19.96 ± 0.13) keV resolution at 1332 keV



$^1\text{H}(n,\gamma)$ fit



Next steps

- background runs
- efficiency, data and FLUKA
- signal runs