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Data analysis for the 96Mo(p,p') experiment done in March 2019 With OSCAR+SiRi
Cecilie, 28 March 2019
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Elog: ssh -p 33 -Y -L 8080:localhost:8080 exp@siri.uio.no
http://localhost:8080/Nd-p-2019/

The experiment was run at the end of the Nd experiment.
Target: 96Mo, 1.94 mg/cm2, enrichment 96.7%

Beam: 16 MeV protons, between 3.4 - 3.7 nA (mostly 3.6 nA), RF is 17.14 MHz

SiRi:
backward angles, 126-140 degrees (f0 is 140 degrees, f7 is 126 degrees)
SiRi is 5 cm from the target center (in the middle, in between strip f3 and f4, which is 133 degrees)
Front detectors are segmented, back detectors are not.
Front detector: 130 um
Back detector: 1550 um
Al in front: 10.5 um

OSCAR:
position from the center (of the target): 16 cm
NOTE: No. 30 should not be used, it is jumping around (something wrong with the voltage divider possibly?)

XiA DAQ:
The E was the validation signal (if one E gives signal, the data for everything are written to disk)
The validation signal is 2 us long, and if a new E gives signal within this time, another 2 us is added.

Files, 96Mo
Placed (at least for now) on Tiger: /d8/exp/Nd-p-2019
sirius-20190314-084105.data
sirius-20190314-084105-big-000.data
sirius-20190314-084105-big-001.data
sirius-20190314-084105-big-002.data
sirius-20190314-084105-big-003.data
sirius-20190314-084105-big-004.data
sirius-20190314-084105-big-005.data

sirius-20190314-145712.data
sirius-20190314-145712-big-000.data

Files, 28Si (for OSCAR calibration)
sirius-20190313-142346.data

sirius-20190313-142346-big-000.data
sirius-20190313-142346-big-001.data
sirius-20190313-142346-big-002.data

Sorting

Folder 96Mo_p_2019_data
Using Frank's sorting codes :)

To convert into .root files:
read_data_96Mo.cpp (here the spectra are calibrated, check out declarations.h)

To read the .root file and do the analysis:
read_tree_96Mo.cpp

Using peaks2D.C from Alexander Bürger to get the SiRi calibration coefficients, reference peaks are the ground state in 96Mo (elastic peak) and the 5/2+ ground state in 95Mo from the 96Mo(p,d)95Mo reaction. Note that NuDat claims that there is a (5/2+) level at 59.3(6) keV, but I don't think this level really exists (it is seen only in one reaction: $^{65}Cu(^{36}S,APNG)$).

QKinz:
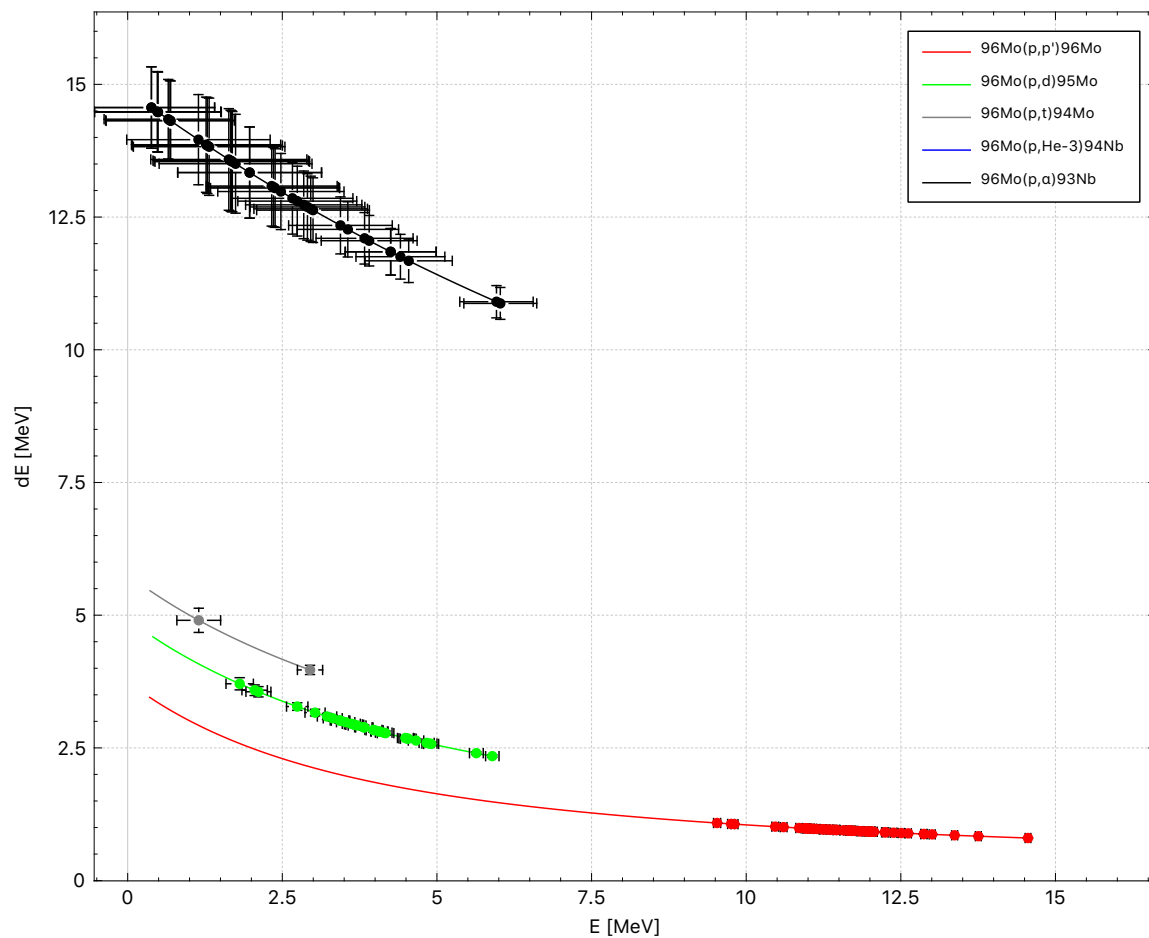
From one of the strips:
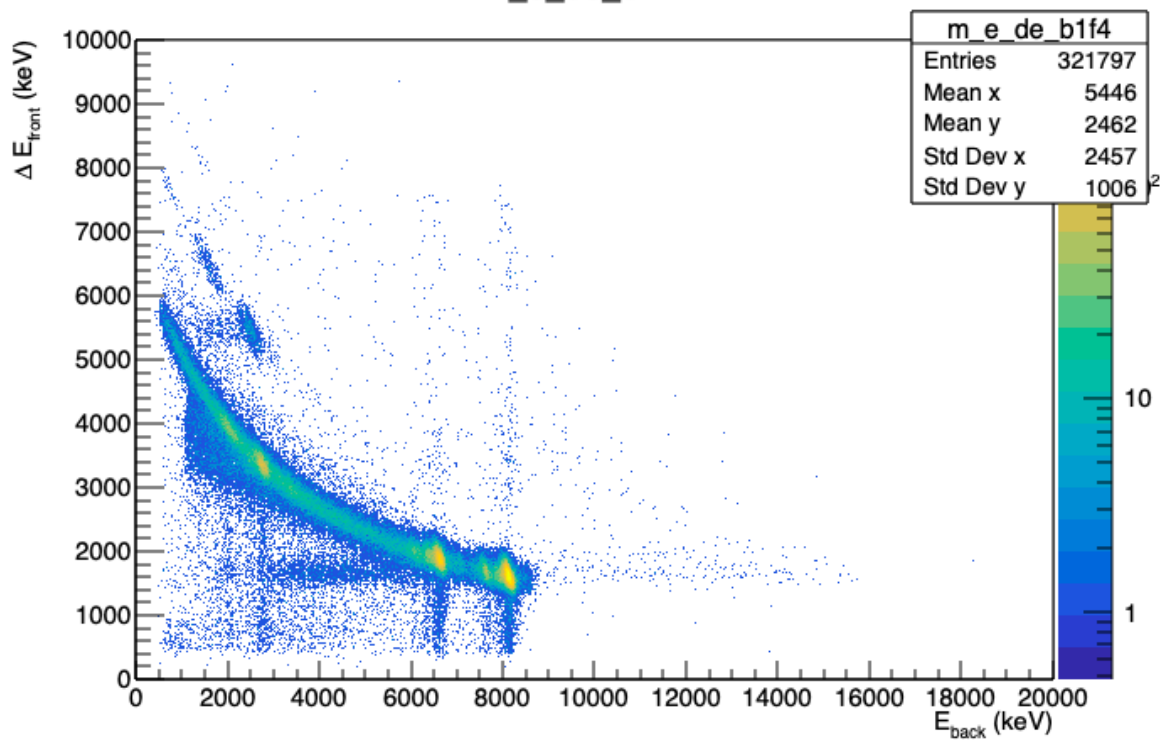
SiRi calibration

Will also try to program a nice script in Julia -> calibration_SiRi_96Mo.jl, but for now (Frank needs the calibration coefficients :)) I will use the old-fashioned excel sheet: calibration_96Mo.xlsx

Running peaks2D.C to get all the peak positions of the 64 matrices m_e_de_b0f0 -> m_e_de_b7f7.

Running QKinz to get the theoretical values for the deposited energy in the Delta E and E detectors for each angle.

For 96Mo
The SiRi values are put into declarations_sirical.h
=> now sort the data file again
Output:

```
anncecil@Ann-Cecilies-MacBook-Air-3:96Mo_p_2019_data> c++
read_data_96Mo.cpp XIA_CFD.cpp `root-config --libs --cflags` -
o read_data
anncecil@Ann-Cecilies-MacBook-Air-3:96Mo_p_2019_data> ./
read_data sirius-20190314-084105.data
Results of file 'sirius-20190314-084105.data':
Warning in cling::IncrementalParser::CheckABICompatibility():
  Possible C++ standard library mismatch, compiled with
_LIBCPP_VERSION '5000'
  Extraction of runtime standard library version was: '7000'
...........................................................
...........................................................
..........
Total number of hits:       134217728
Number of correlated events: 20325400
Total number of pile-ups:    2032325
Total number of cfd fails:   6277619
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anncecil@Ann-Cecilies-MacBook-Air-3:96Mo_p_2019_data>
```

I need to fix the c++ library mismatch, but that probably requires re-installing CMake => later…

The back detector 2 + front strip 0-2 and 7 seem bad, bad resolution, probably a bad contact somewhere.
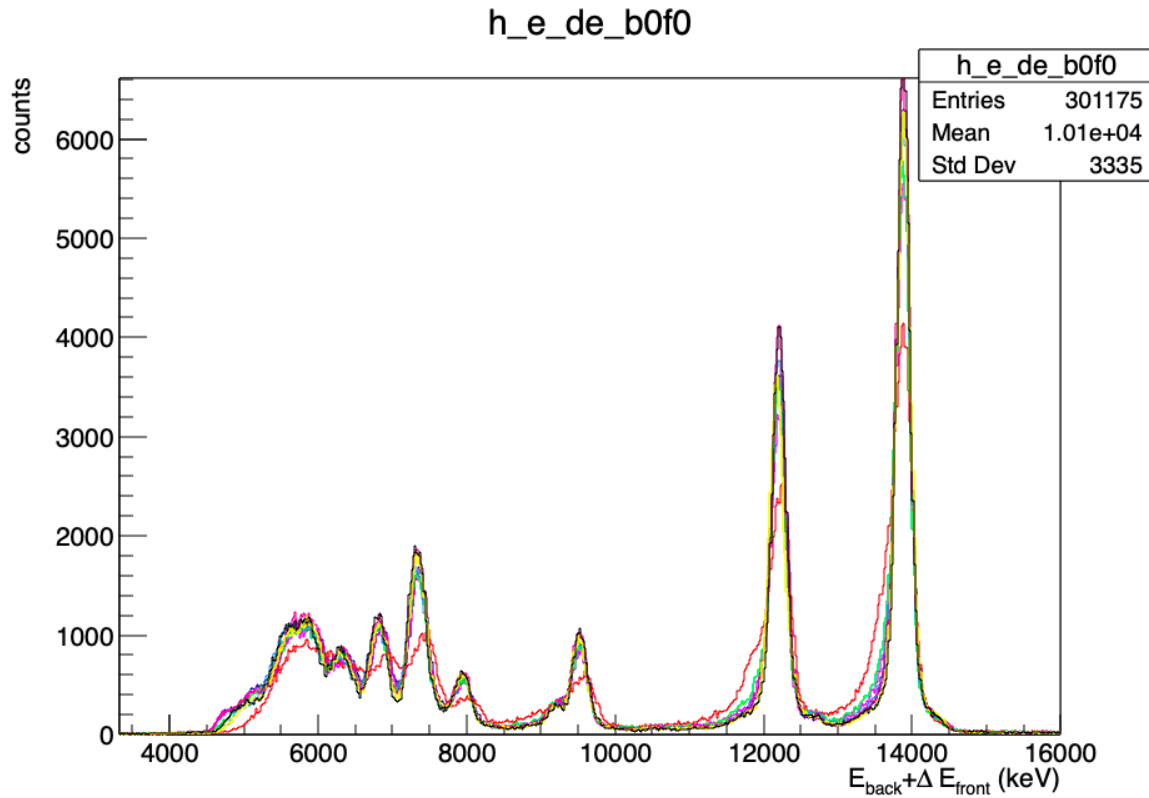
For 28Si
From the resolution of the elastic peak, about 275 keV FWHM, it seems like the
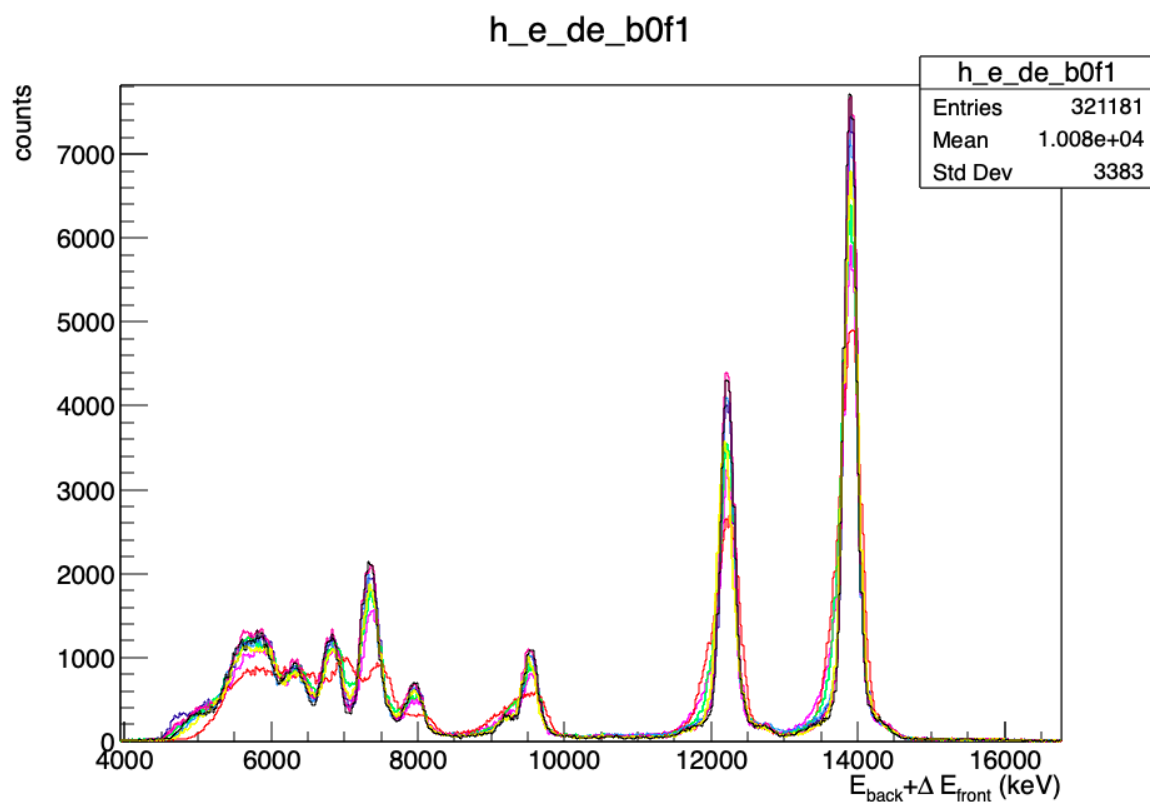
target thickness is around 9 mg/cm2

NOTE: the elastic peak varies quite a bit for the different back detectors but looking at the same strip (angle). This indicates that we are NOT hitting in the center of the target. => should look into the phi dependence later
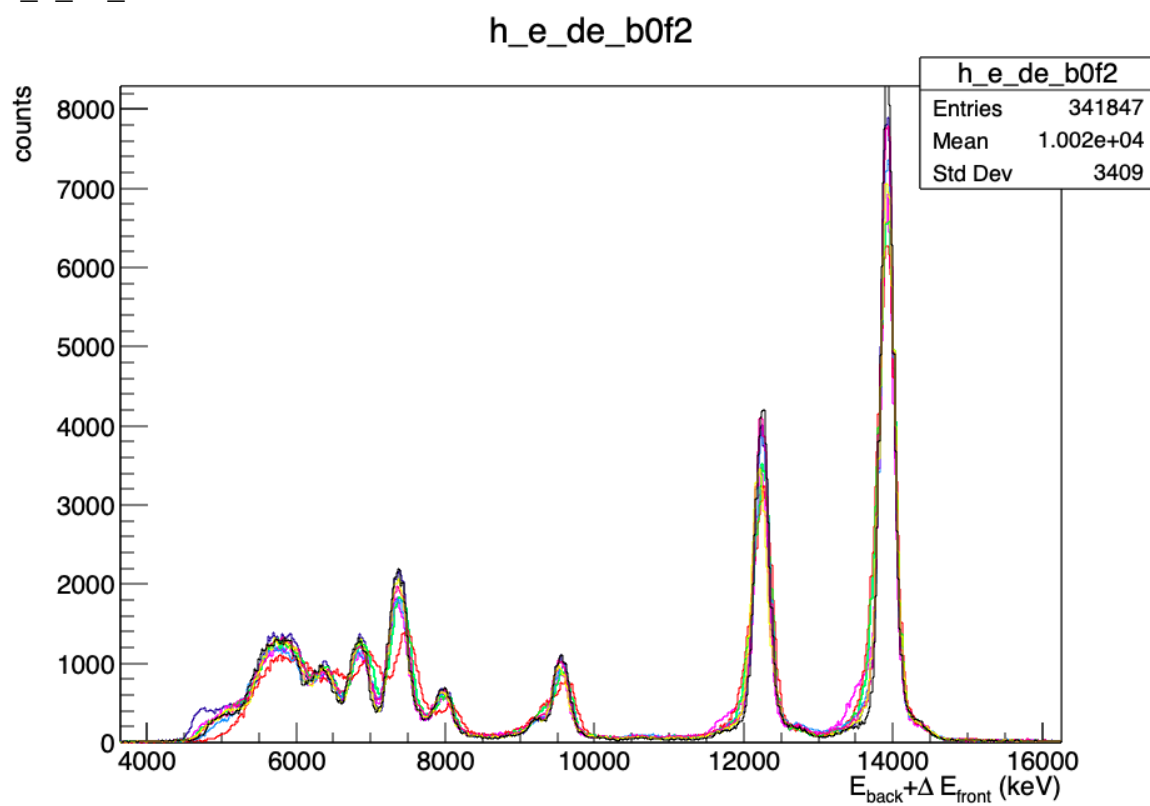
Check of rings:
h_e_de_bXf0:

h_e_de_bXf1:

h_e_de_b0f1

h_e_de_b0f1	
Entries	321181
Mean	1.008e+04
Std Dev	3383

h_e_de_bXf2:

h_e_de_b0f2

h_e_de_b0f2	
Entries	341847
Mean	1.002e+04
Std Dev	3409

h_e_de_bXf2:

BAD DETECTORS:

b2f0
b2f1
b2f2 has somewhat wrong gain