What I Am Doing

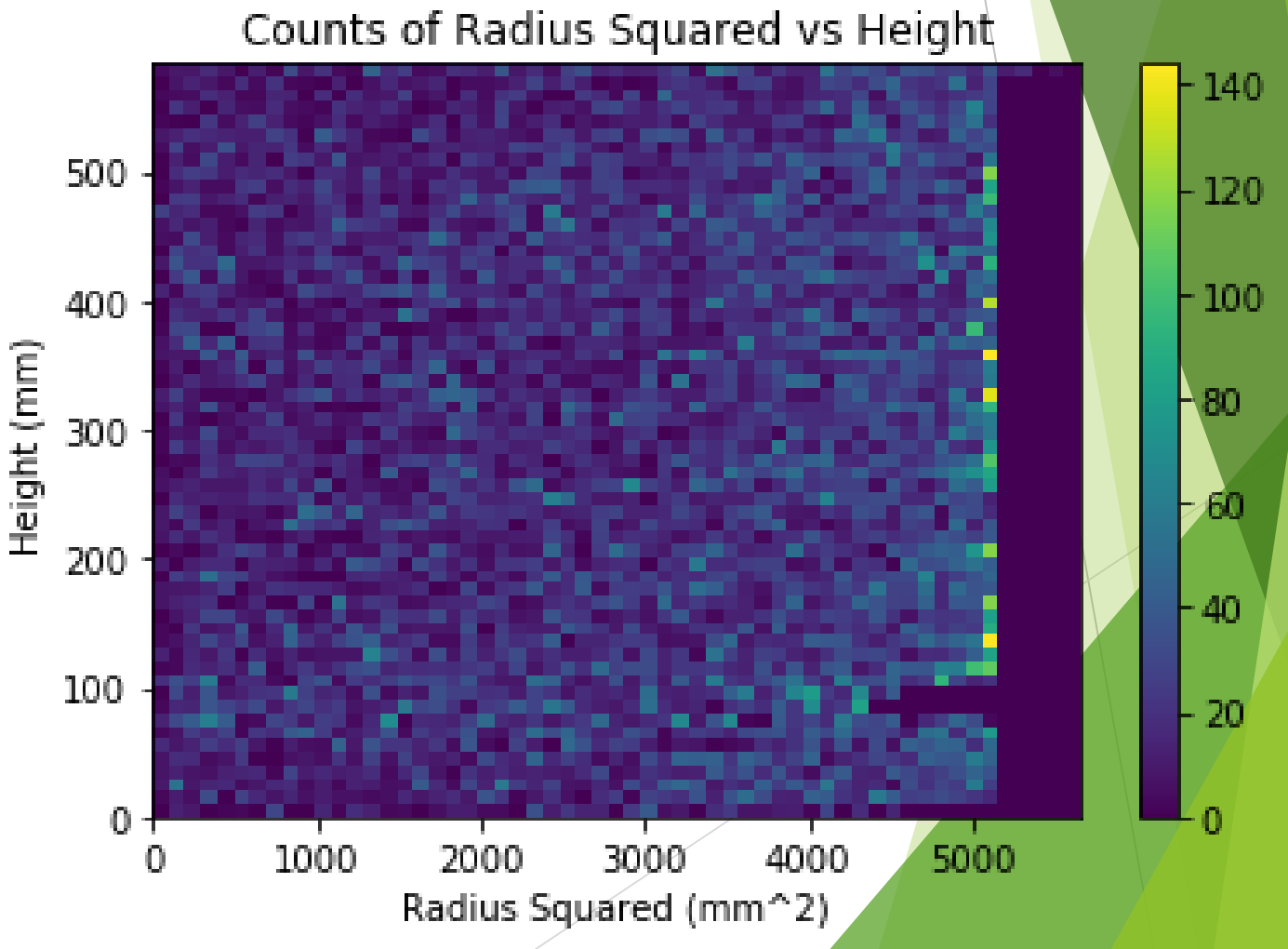
Various Topics for My Thesis

Today's Slide is Here

Plots!

Concerns

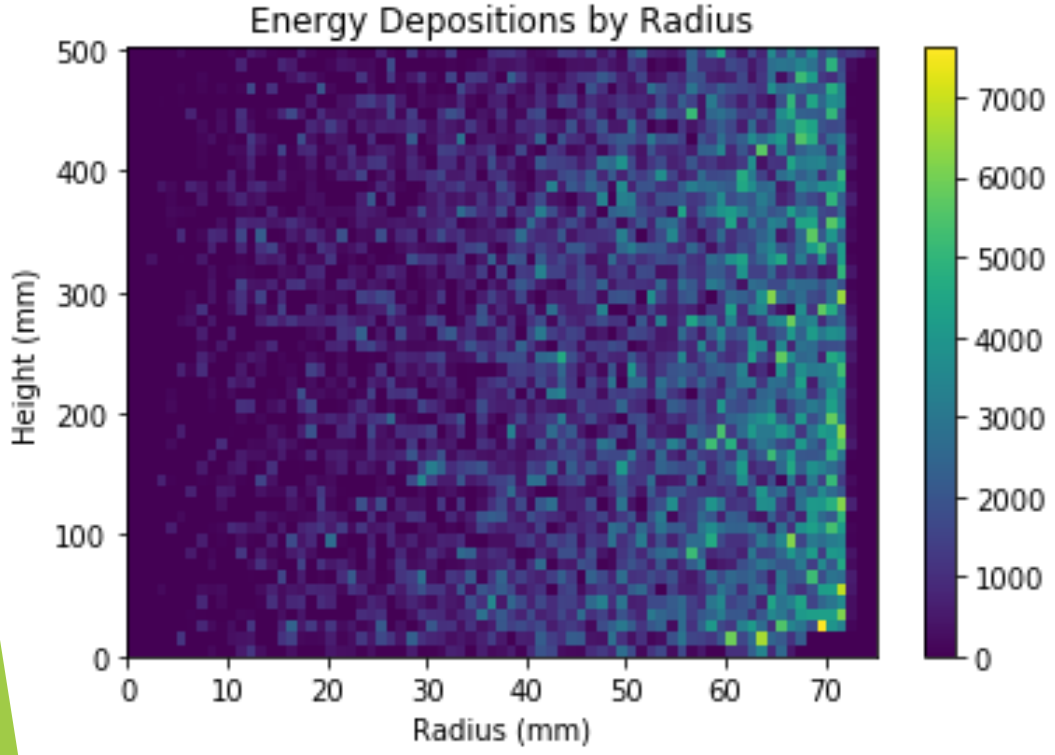
- Time threshold?
- Does not line up exactly with parameters (especially height)
- Gap at 100mm height

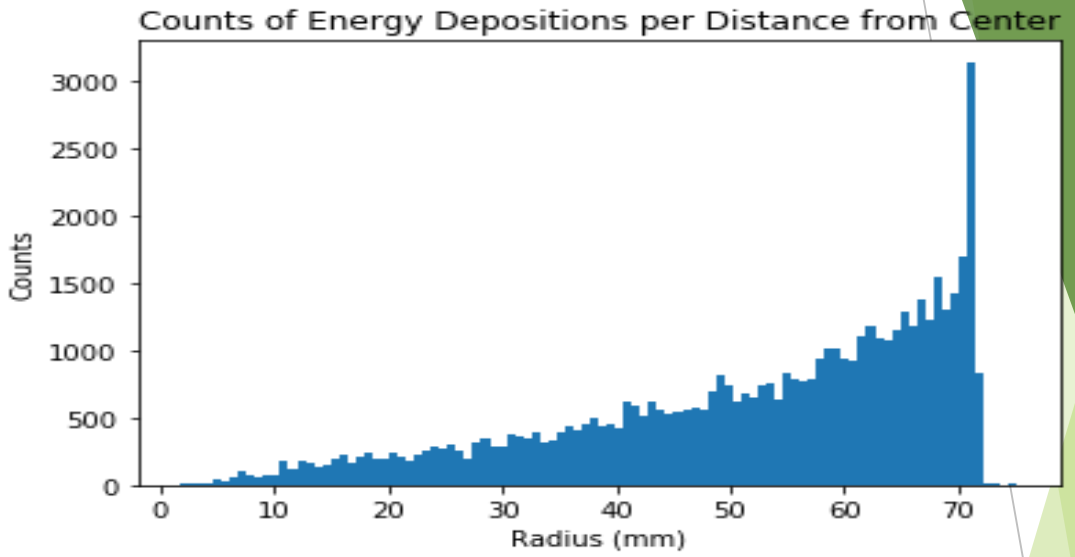


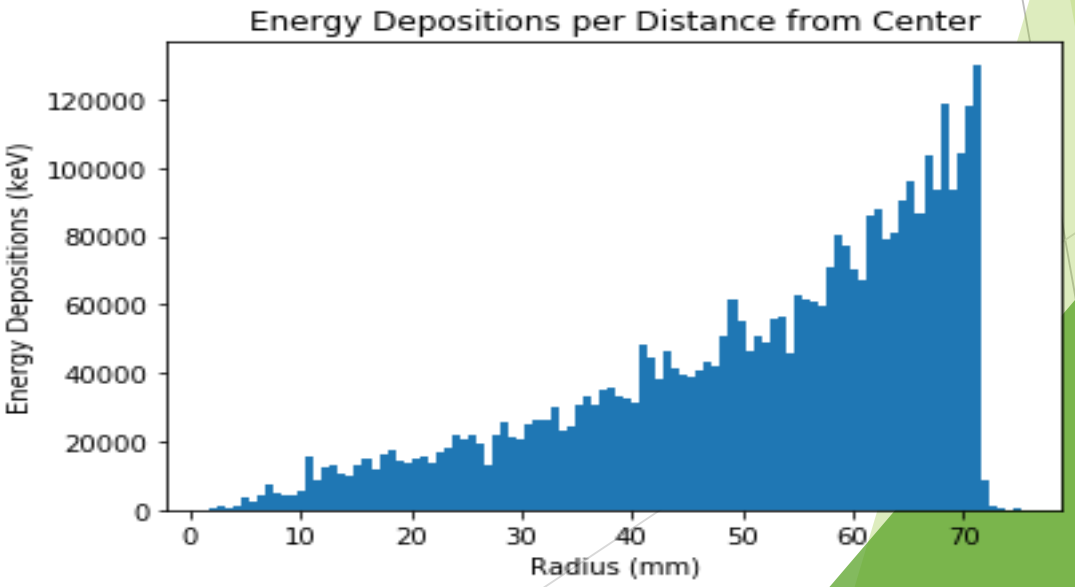
Still To Do

- Fix Current Issues
- Use Energy Values Instead of Counts
- Try Simulating Decays from Bottom
- Possibly other Materials?

Energy Depositions and Correct Dimensions







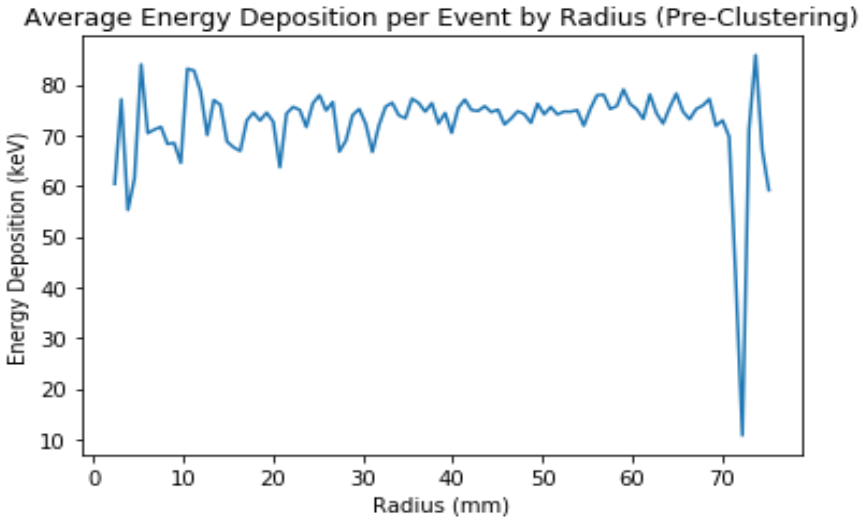
Still To Do

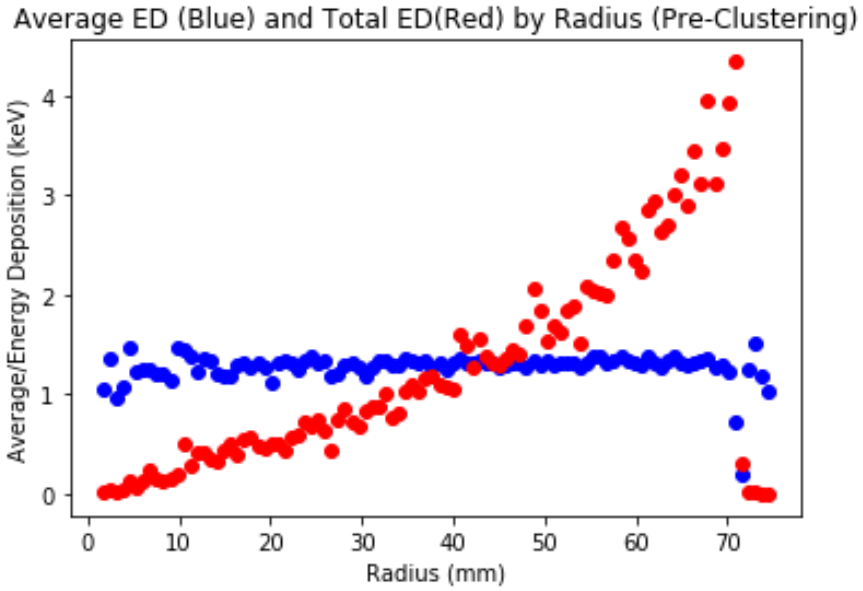
- Find decay rates in area
- Fix geometry problems
- Other materials?

Thermal Neutron Scattering

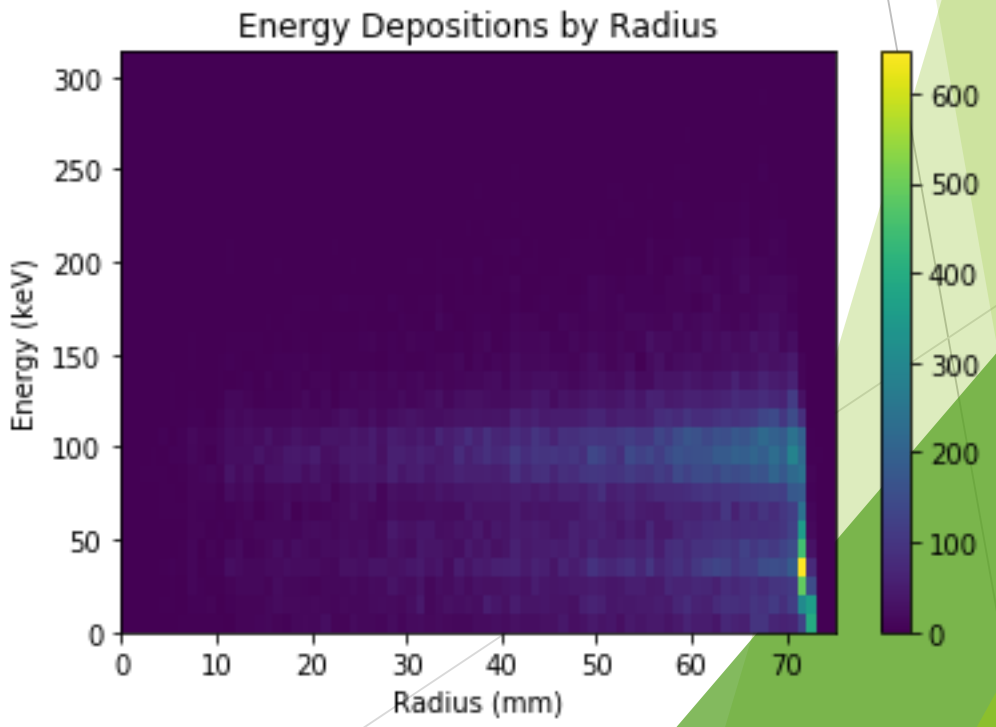
- https://indico.cern.ch/event/245281/contributions/1564676/attachments/420136/583408/thermal_physics_validation_argarcia.pdf
- http://pubs.cnl.ca/doi/pdf/10.12943/CNR.2017.00002

Average Energy Deposition



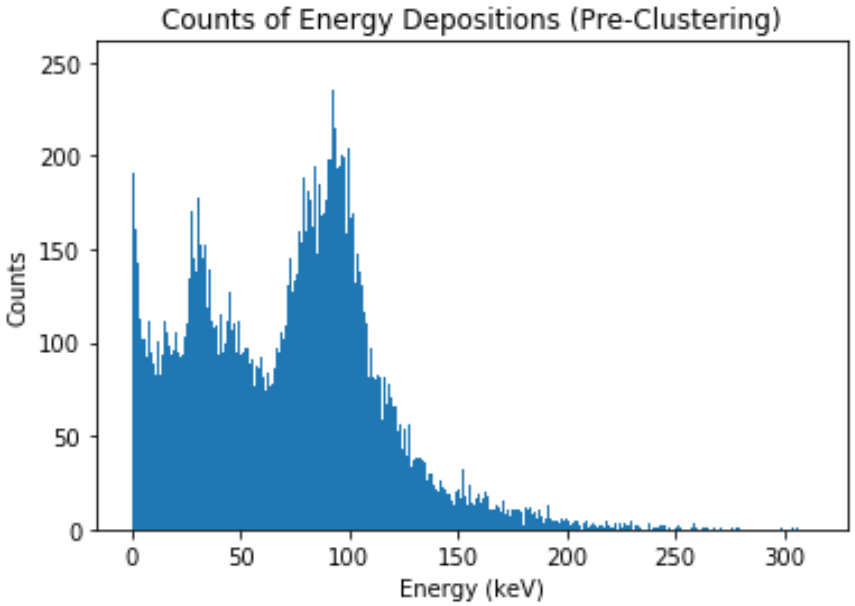


- Why is there so little energy degradation until it is close to the center?
- Why is there a sudden drop at the edge, but regular events past it?
- Why are there so many small-energy events at the edge, but fewer later on?

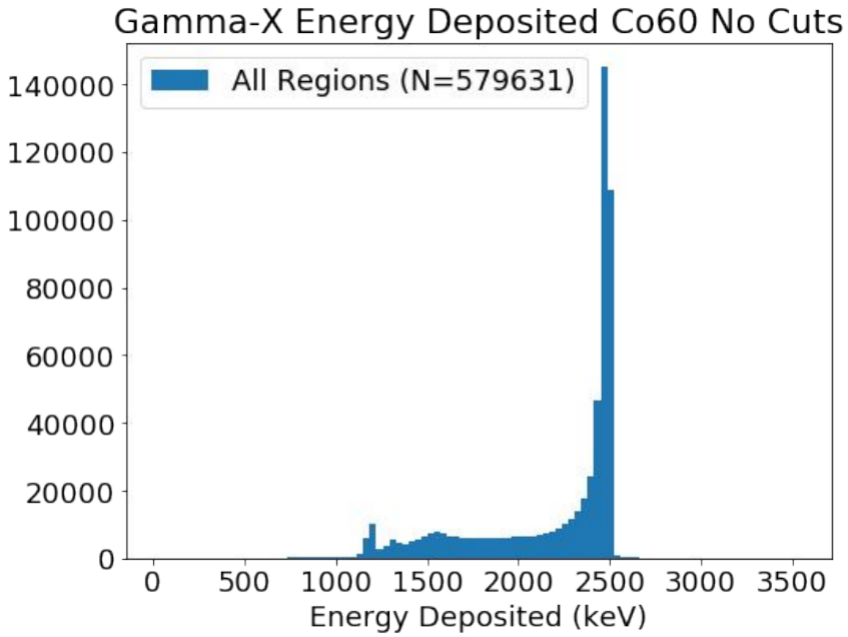


Energy Histogram Very Far Off

Mine

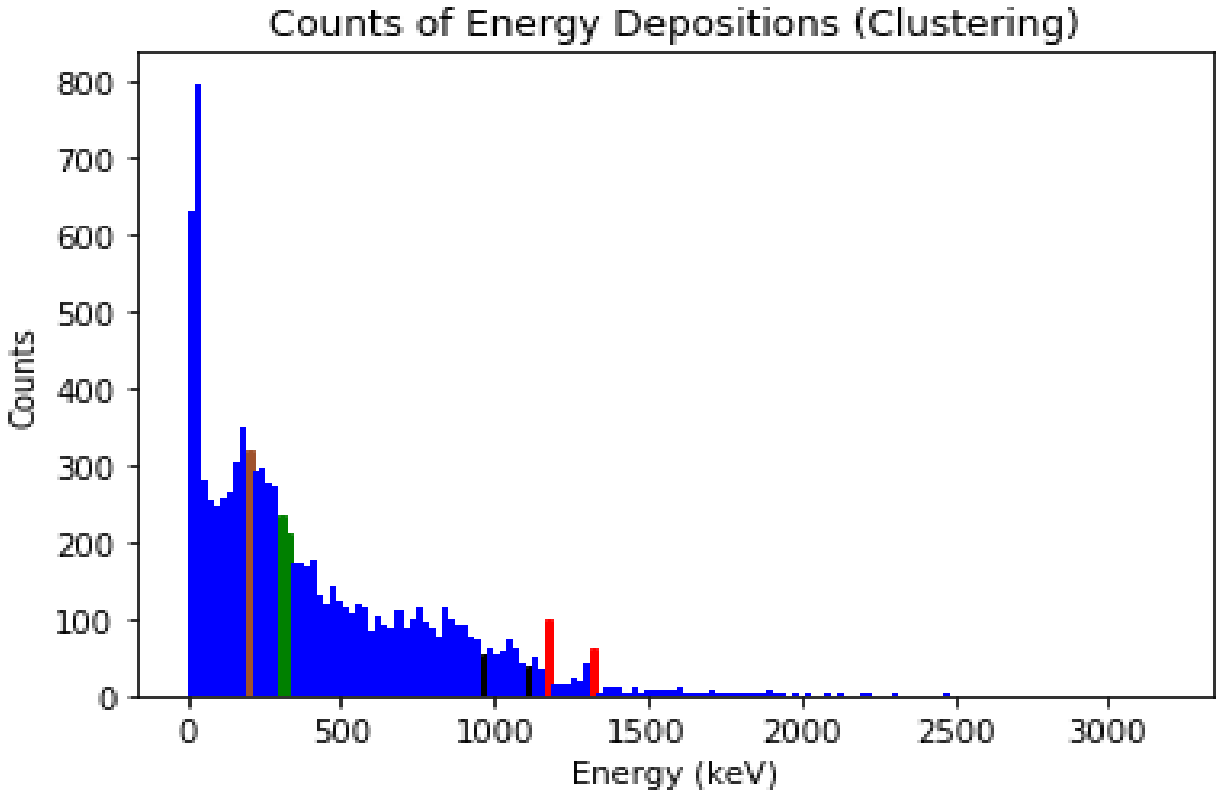


Jonathan's



Now With Clustering

Post-Clustering



Expected Values (keV)

- Brown=E' (204, 208)
- Green=β^{-} max (316)
- Black=E_e (966,1112)
- Red=Photopeak (1173,1333)

$^{60}_{27}Co$	5.271 y	β^-	0.316	100%	1.173	100%
					1.333	100%

Still to Do/Answer

Read

- *Why I am getting so many events well above 1333 keV?
- *What types of events are causing the very small, but numerous energy deposits?
- Why are there relatively few events at photopeak (compared to other measurements)?
- What other energy values do I want to look at?
- Understand equations that I am using

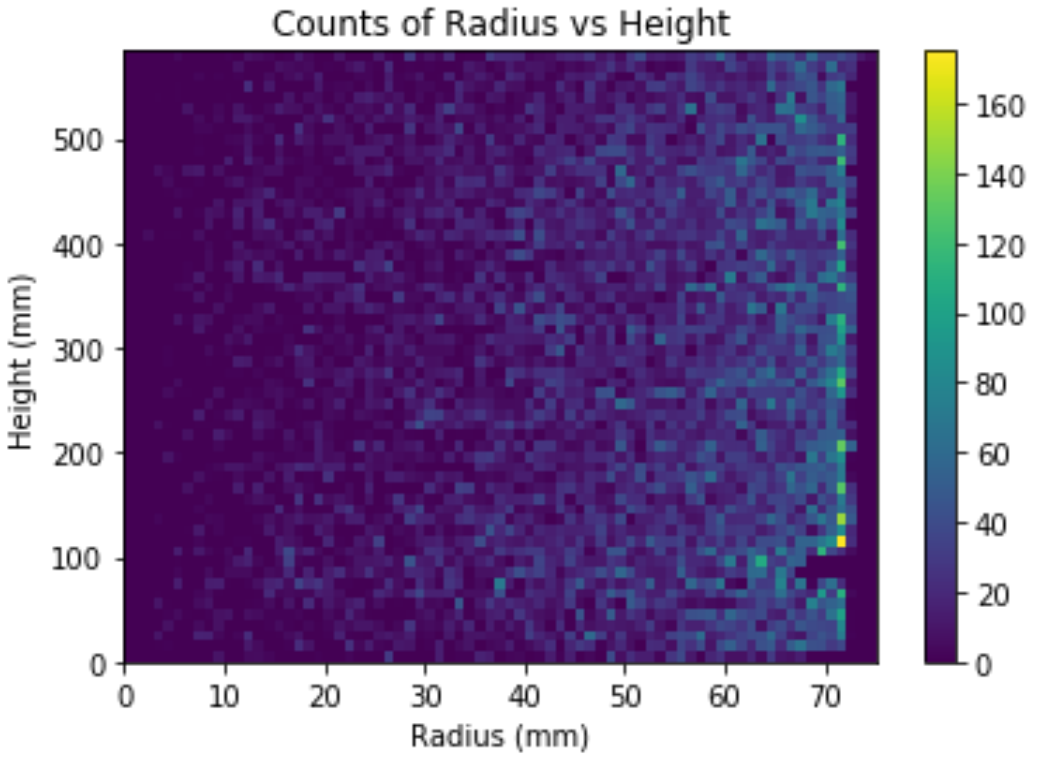
Do

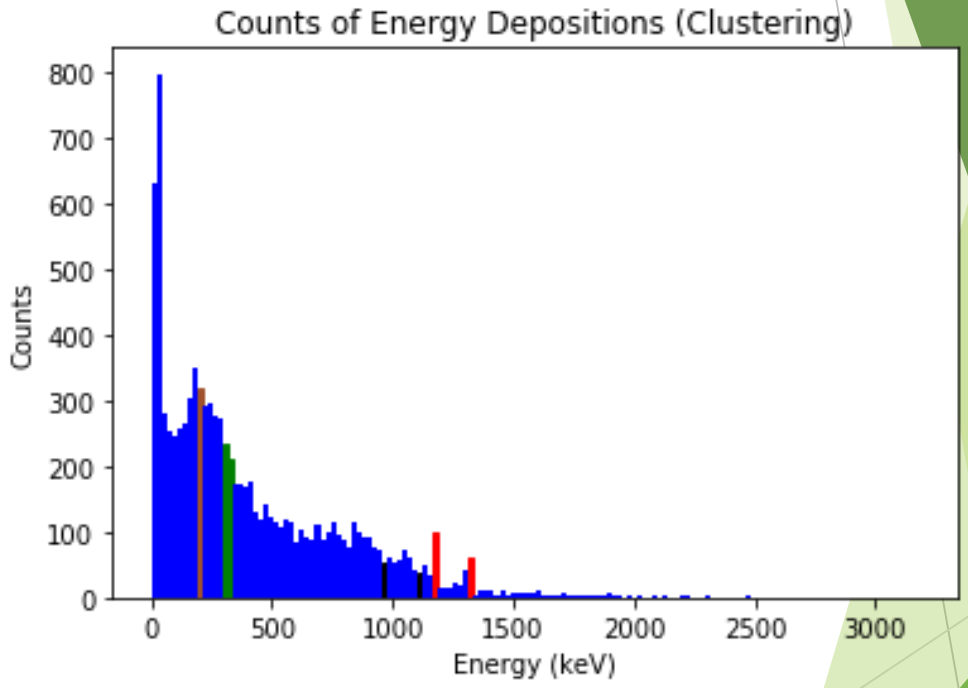
- Find values of other energy factors (escape peaks, detector efficiency, etc.)
- Create rough model of what I should be seeing (ideally)
- Keep reading

Summer Overview

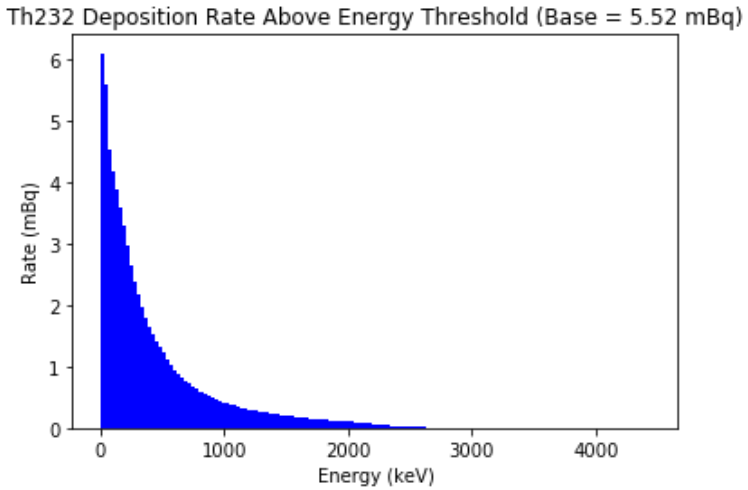
- Got Submission Script/Macro running
- Plotted by position
- Plotted by energy/histograms of energy
- Included Clustering
- Included Accurate Values
- Other elements
- Measured rate above energy threshold
- Cable Making (Minor)
- More components w/ More Decays (In Progress)

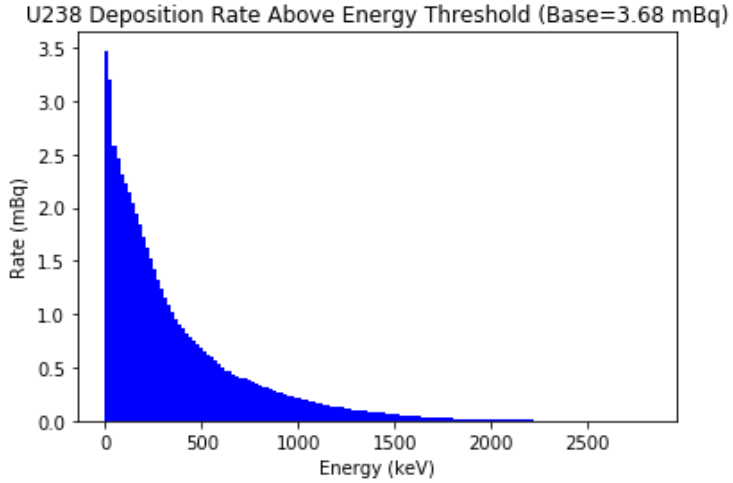
Plotting By Position/Energy/Clustering

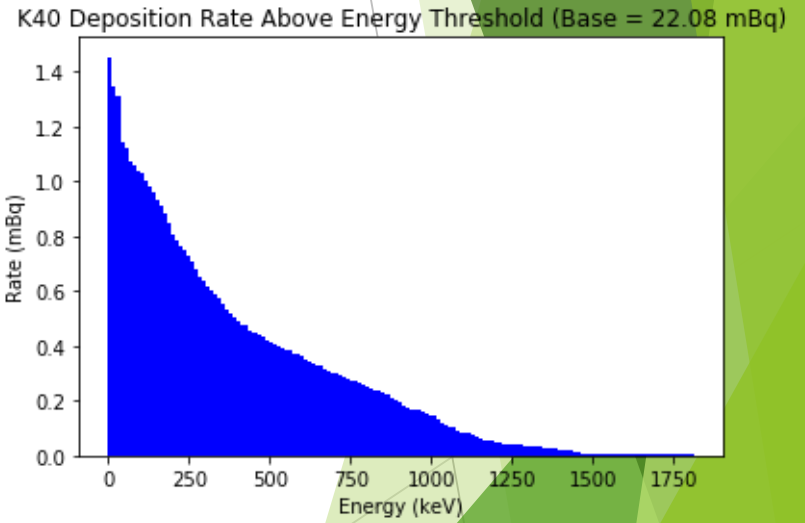


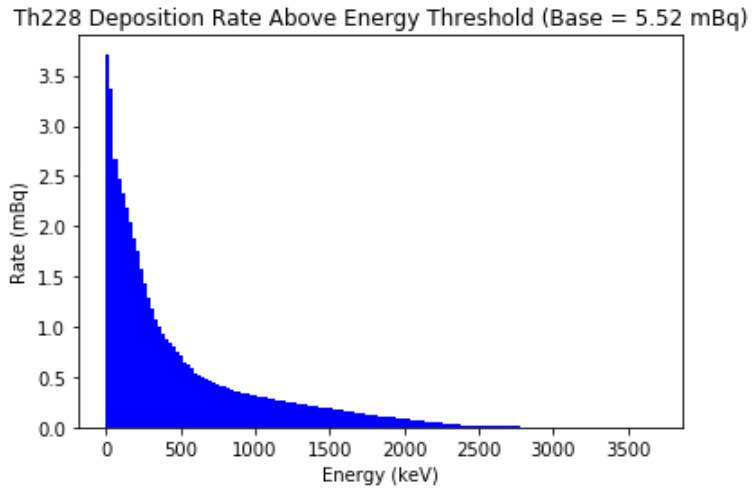


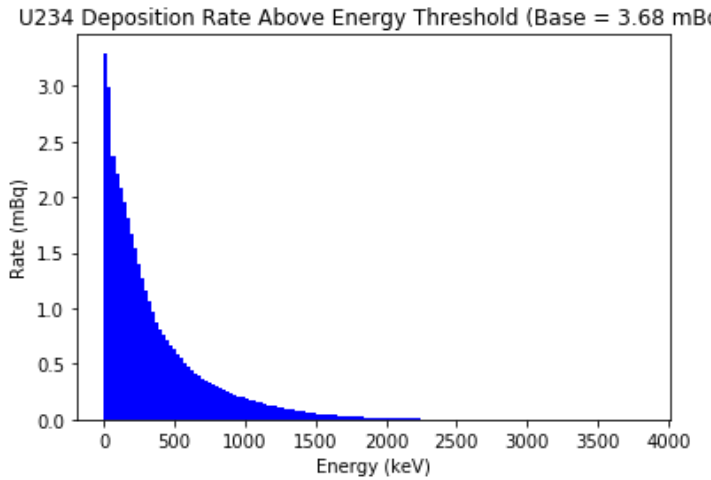
Accurate Values/Rate/More Elements











Goals For Fall 2017 Semester

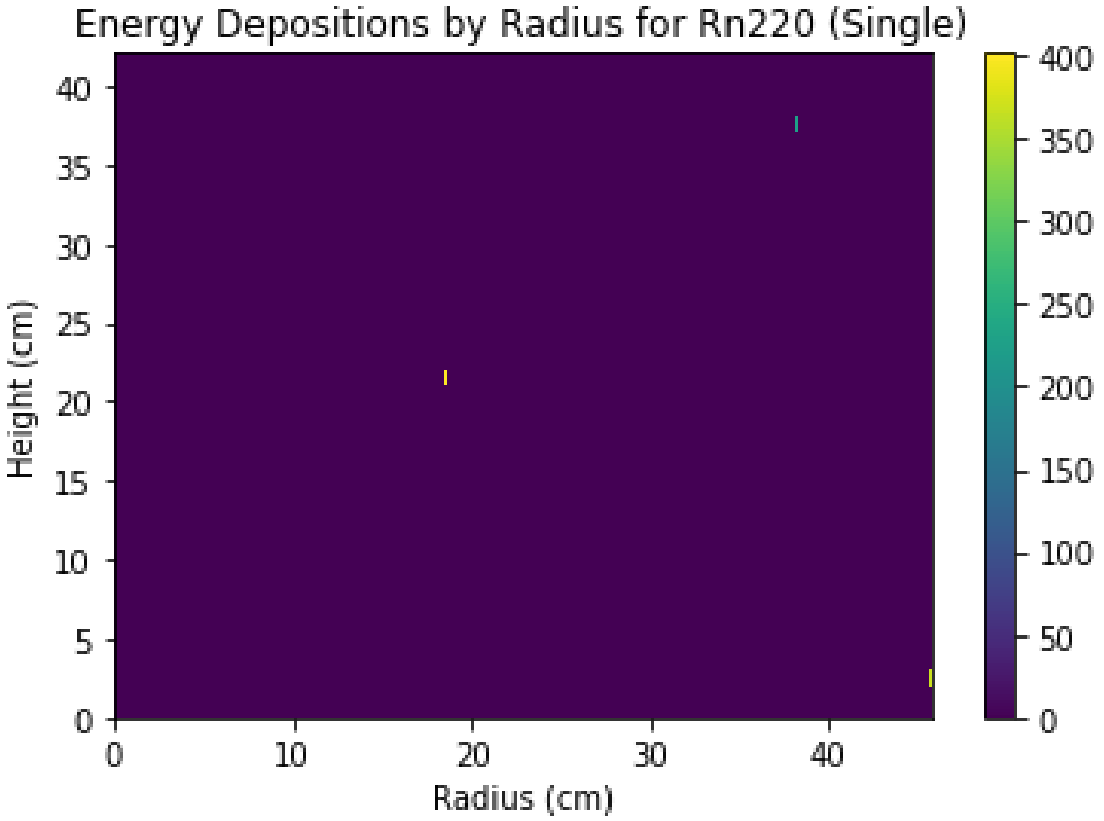
- Research Tasks
  - More Components
  - Give LZ-value estimate range
  - Errors (And More Events)
  - Thorium Alpha Energies
- Conceptual Knowledge
  - What Specific Impact Do Decays Have on Experiment
- Technical Knowledge
  - Learn More C++; be able to write code in C++ instead of Python
  - Getting Better at ROOT

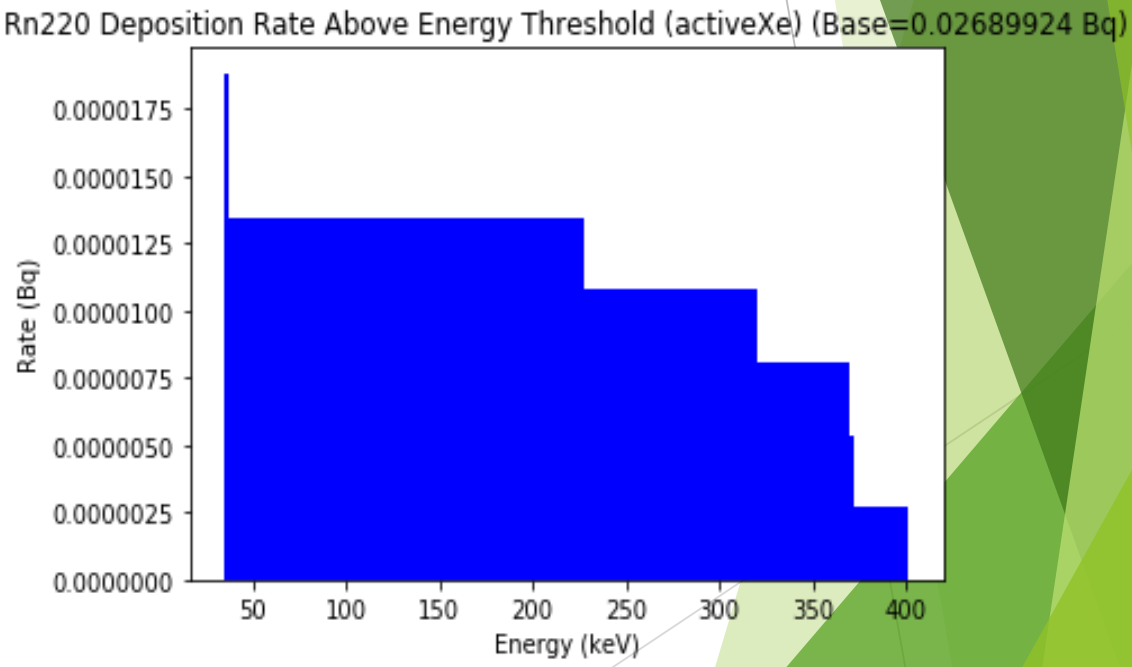
K40 Background Sources

- Each source @ 1mBq/kg
- Rate is for > 0 keV
- Issues

Volume Name	Mass (g)	Other masses	K	%
VacuumSpaceOuterCryoVessel	1.22E-20		8.52E-29	0.7
InnerCryoVessel	78576.8		2.81E-03	3.572002652
LiquidXenonInnerCryoVessel	48918.7	96588.6	1.29E-03	2.64
GasXeInnerCryoVessel	243.699	257.436	2.39E-06	0.98
TPCptfeInLiquid	13548.2		8.91E-04	6.58
TPCptfeConeInLiquid	1531.61		5.05E-06	0.33
gridRingInLiquid	108.655		4.93E-06	4.54
PeekSpacerArc1	7.09061	7.09144	2.67E-07	3.77
PeekSpacerArc2	2.57045	2.56987	9.77E-08	3.8
PeekSpacerArc3	2.57033	2.57025	1.00E-07	3.89
PeekSpacerArc4	2.57021		6.84E-07	26.63056824
PeekSpacerArc5	2.57049	2.57035	6.84E-07	26.62766741
peekSpacersInGas	47.5447		1.73E-06	3.64
gridRingInGas	108.664		4.93E-06	4.54
activeLXeRFRegion	3643.83		9.66E-05	2.65
activeLXeFFRegion	23253.3		1.52E-02	65.23999991
activeGXeFFRegion	2.10509		2.33E-07	11.09
AnodeGridHolder	0.05311		5.53E-09	10.42
CathodeGridHolder	7.8301		9.22E-07	11.77
GateGridHolder	7.86043		1.04E-06	13.19000004
BottomGridHolder	8.14317		7.08E-08	0.87
anodeGridRingSupportInGas	1114.76		2.93E-05	2.63
TPCptfeConeInGas	871.769		2.62E-05	3
top_pmtR9288_adapter	162.704		3.11E-06	1.91
top_pmtR9288_quartzWindow	10.6158	10.6159 (ad)	3.07E-07	2.89
top_pmtR9288_realVacuum	5.76E-24	5.76301e-24 (ad)	1.23E-31	2.128739756
topR9288_PMT_Photocathode_1	4.21468		1.11E-07	2.63
top_pmtR9288_flashing	1.11387	1.11377 (ad)	2.97E-08	2.67
top_pmtR9288_aluminumBody	51.4667	51.4608(ad)	1.03E-06	2.01
TopPMT	0.33035		1.48E-08	4.49
bottom_pmtR9288_adapter	162.726		3.25E-07	0.2
bottom_pmtR9288_quartzWindow	10.6158		2.34E-08	0.22
bottom_pmtR9288_realVacuum	5.76E-24		1.09E-32	0.189900764
bottomR9288_PMT_Photocathode_1	4.21483		7.17E-09	0.17
bottom_pmtR9288_flashing	1.11391		1.89E-09	0.17
bottom_pmtR9288_aluminumBody	51.463		2.11E-07	0.41
BottomPMT	63.5921		3.12E-07	0.49
Total	1.73E+05		2.03E-02	11.78823734

Thoron Calibration





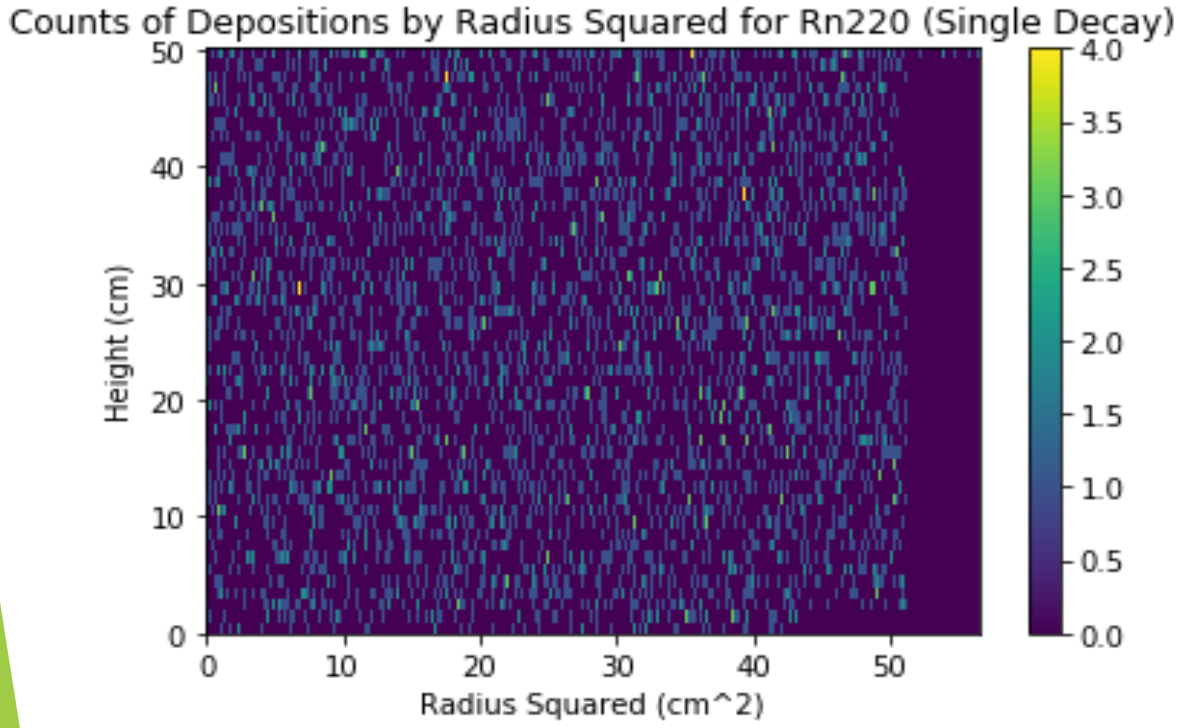
To Work On

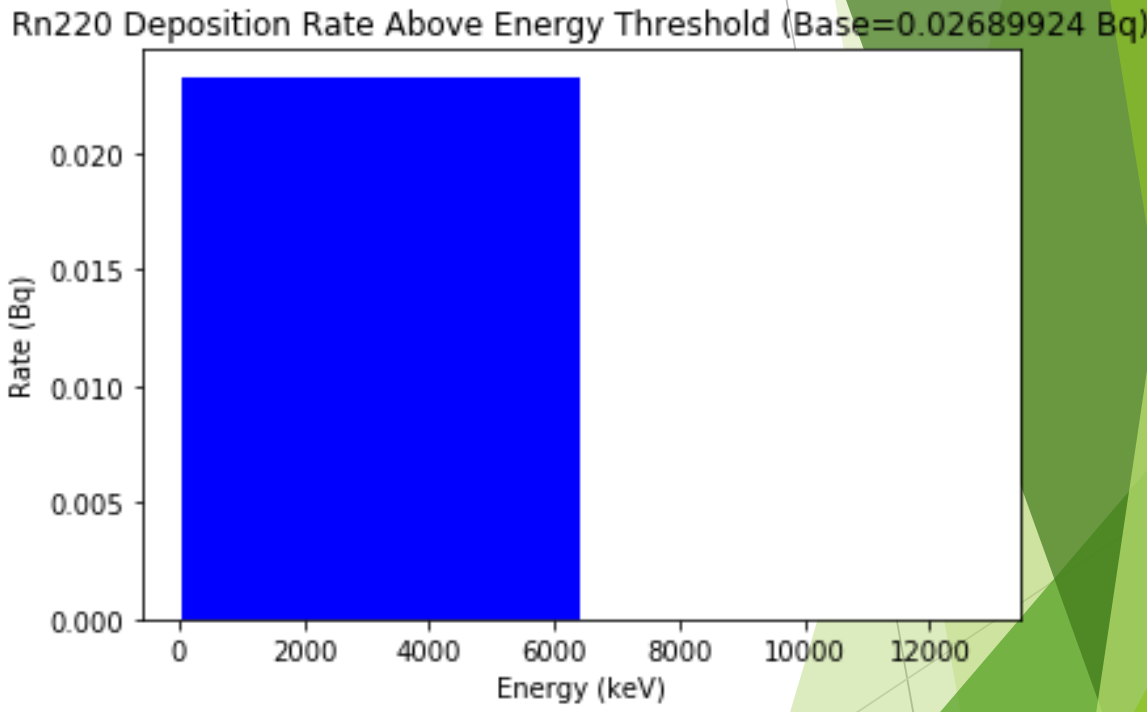
- Backgrounds for other elements
- Give energy threshold histograms
- Better statistics for Thoron calibration source

Tasks/Issues From Last Week

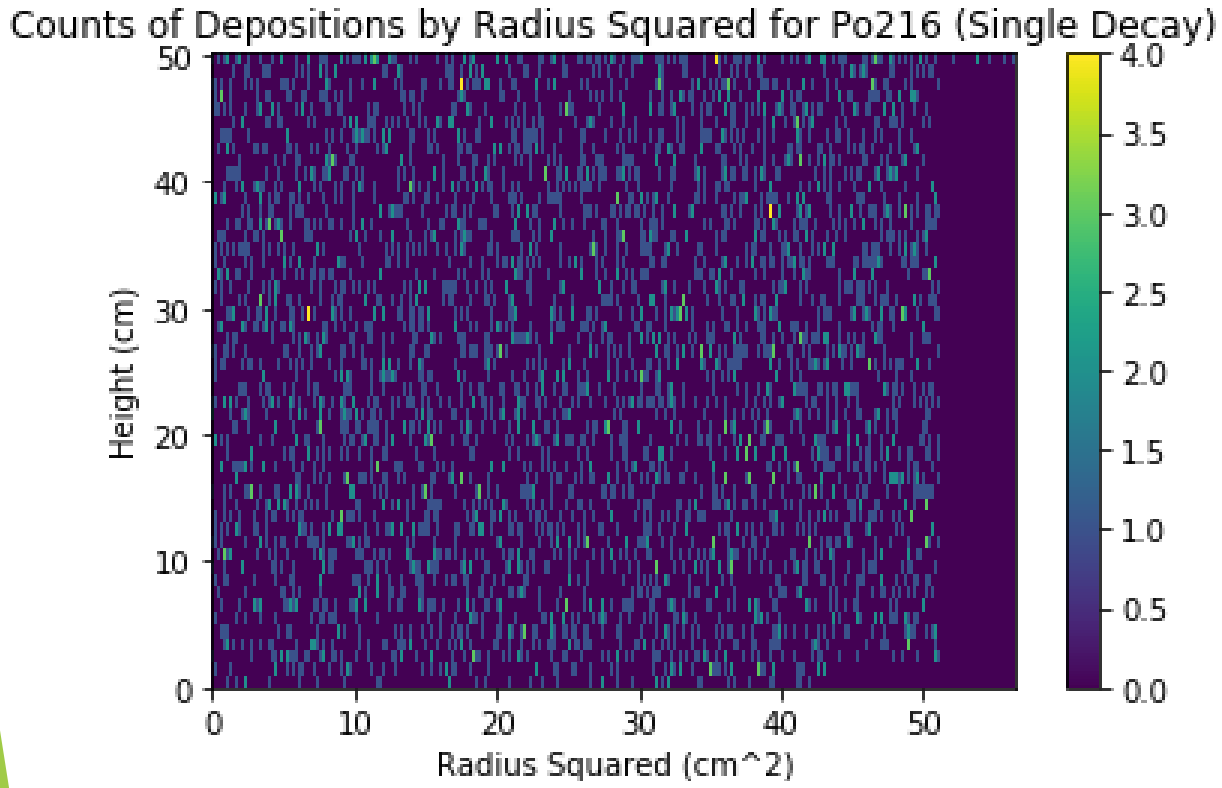
- Data For Other Elements-
  - I looked at single decays of Radon 220 and Polonium 216, as I though that they would be the most important for calibration
- So Few Events/Bad Energies-
  - Combination of coding error and old BACCARAT
- Bad Geometry-
  - Was looking at r^2, so units check out

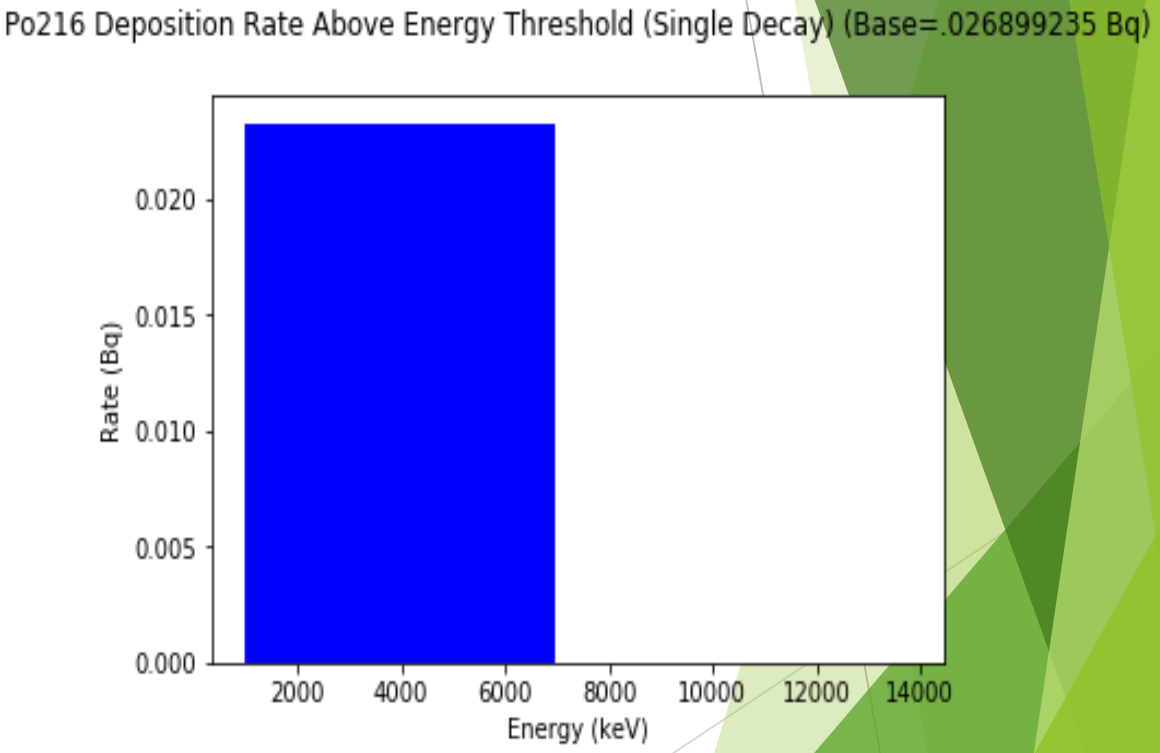
Thoron Single Decay





Polonium Single Decay

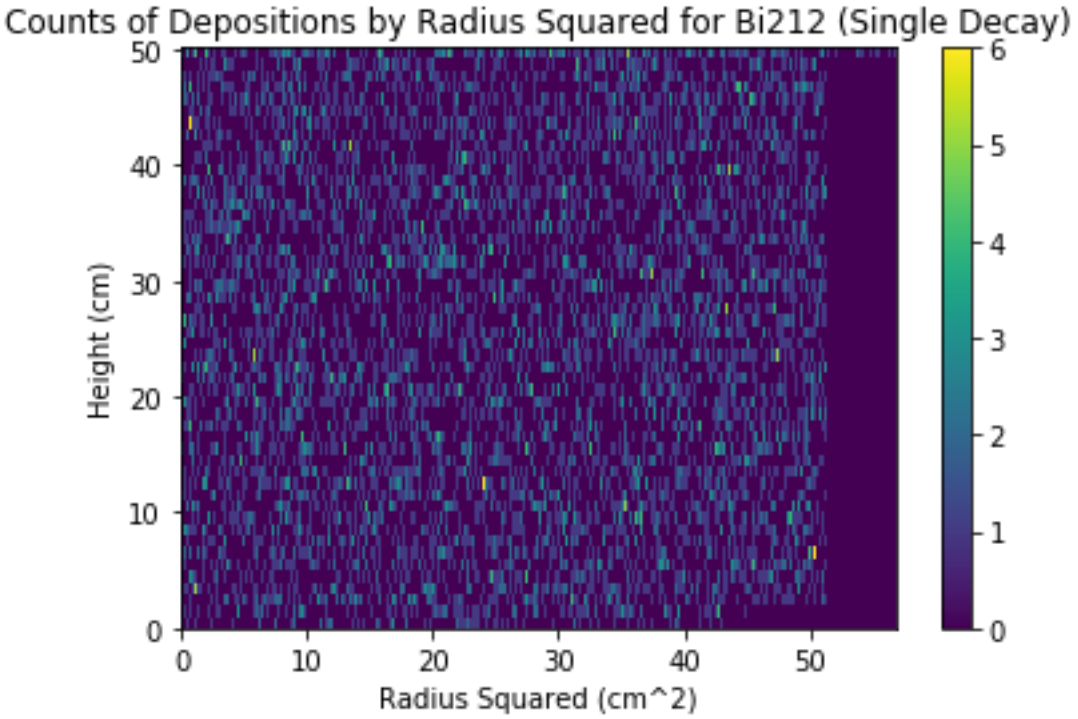


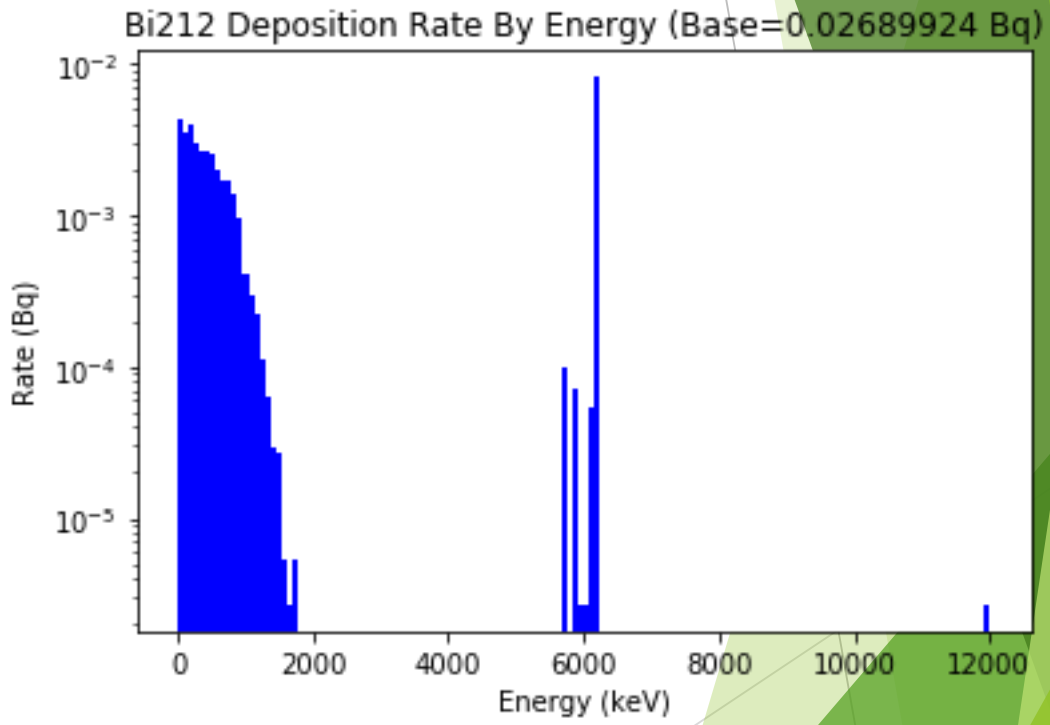


For Next Week

- Use Updated Geometry
- Look into using DER to produce “fake data”

10/25/17
New Geometry + Full Chain





DER and Lzap (Moving Forward)

- Get Phase 1 DER config file from systemtestanalysis channel
- Get LZAP?

- Finish DER User Manual
- Try to understand physics behind S1 and S2 events

11/8/17

- Simulated decays w/ optical photons
  - Only about 20 events
- Talked to Theresa about using DER with Phase 1
  - Says to use her branch
- Read some more about physics about S1 and S2

2/6/18

Get Phase 1 Simulations to Run on Various Analysis Code

- Worked with Theresa and TJ
  - Weird time zones -> slow responses
  - Vague errors
- Try to get code working locally instead
- I (apparently) be able to make it work the whole chain
- BaccMCTruth errors (Permission denied?)

2/20/18

Get Phase 1 Simulations to Run on Various Analysis Code

- Running into “make” issue with ElectronicsSimulation
  - Made post on systemtestanalysis to help resolve
- Made pdsf account
  - Errors making both BACCARAT and ElectronicsSimulation

3/6/18

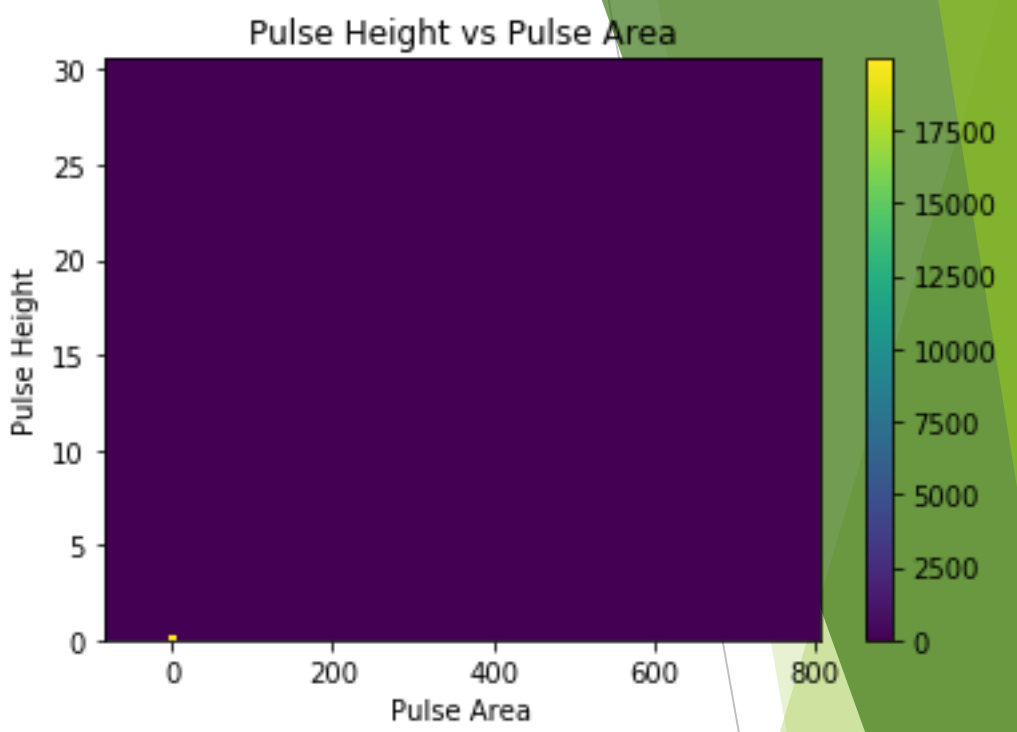
- Got DER to compile on lz login
  - Still trying to find exact problem with Theresa's setup.sh file
  - Got valid output
- Got LZap on lz login and pdsf
  - Getting different errors on pdsf and lz login

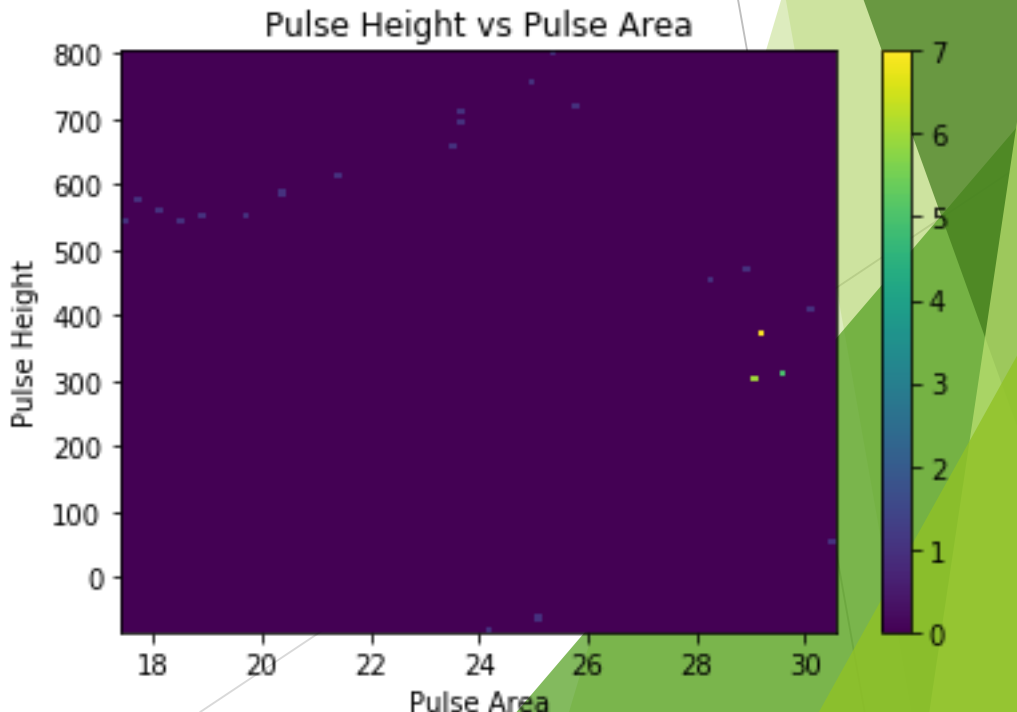
- To Do:
  - Narrow down error/solution for setup.sh file
  - Fix Lzap errors on either server

4/3/18

- Pulse Area vs. Pulse Height Graphs
- Don’t know units, so not very useful
- Don’t know how to interpret data
- Getting a lot of 0’s?
  - Only 38 are not [0,0]

- To Do:
- Other useful graphs
- Make sense of data





4/24/18

- Trying to update branches to get better simulation
- BACCARAT will update, but won't compile
  - TJ had branch that wouldn't, but I can't even after he fixed it
- DER will update/compile, but won't run correctly
  - Other two are more important, so I didn't spend much time on this
- Lzap will run, but possible errors (I think)
  - Pulse areas/heights are 0,0 (but the branches exist)

9/20/18

- Main Tasks:
  - Be able to get sims all the way through Lzap
  - Until I have a topic for my thesis, do thoron calibration simulations?
- Progress:
  - BACCARAT, ElectronicsSimulation, and Lzap all up-to-date and compiled on lzlogin
    - Unable to compile on pdsf
  - Am able to run BACCARAT sims fine, but issues with BaccMCTruth
- To Do:
  - Fix BaccMCTruth so sims go through
  - Prepare for thesis topic?

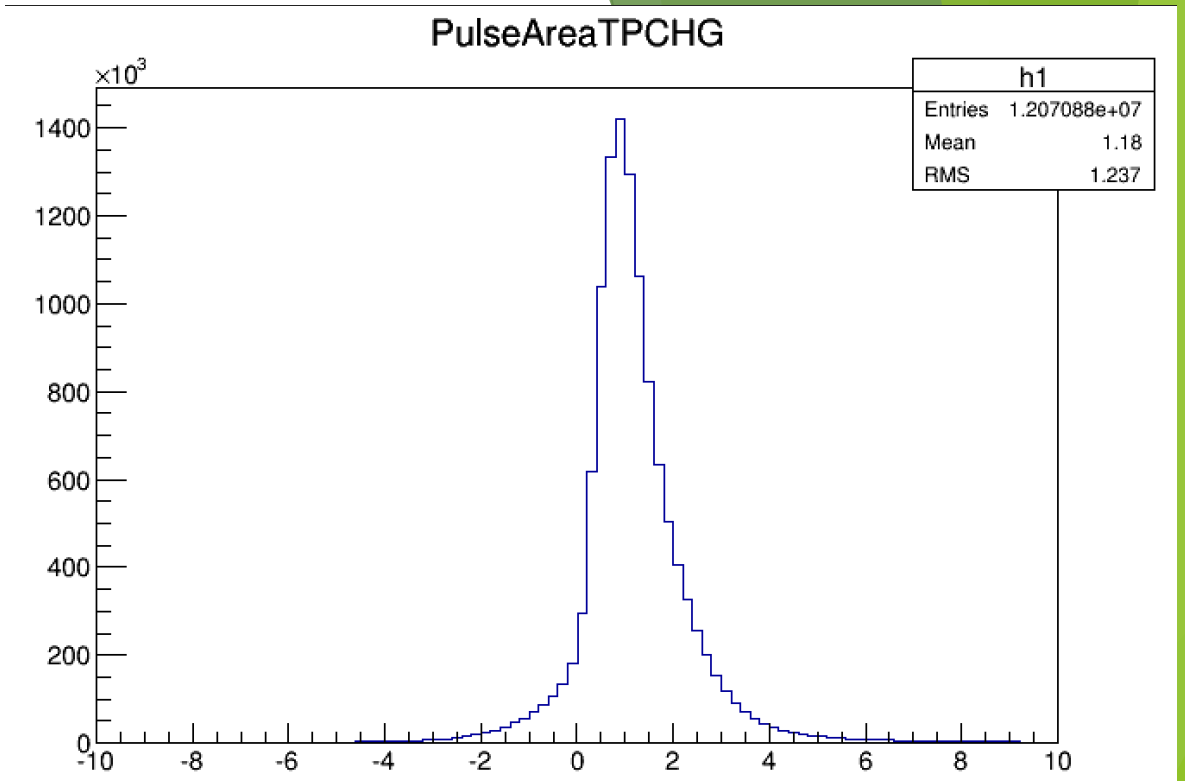
11/1/18

New Topics to Research!

1) Effects of Variables on S2 traits (mostly width)
    1) Tilting of Anode/Cathode
        1) Difference in Electric Field
    2) Flow Rate of Liquid Through Detector
        1) Start with Width vs Time, later Incorporate Flow Rate Data
2) Look at XY Reconstructions to Look at S2 Signals
    1) Possibly do Mercury Reconstruction?
        1) Generate LRFs for Phase 1

11/15/18

- XY Reconstructions
- Able to make histograms of some kinds of data
- Unable to find how to read vectors
- Sample code doesn't work out of box

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*Baskets :        3 : Basket Size=      32000 bytes  Compression= 120.50     *
*                                                                           *
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*Entries :    22829 : Total  Size=     321587 bytes  File Size  =      35956 *
*Baskets :       13 : Basket Size=      32000 bytes  Compression=    8.93     *
*                                                                           *
```

Plate Tilting on S2 Width

- Have (probably) correct method of finding s2 traits caused by plate tilting
- Currently don't have eq (all of my results end up having infinite capacitance when there is no tilt)
- Likely just bad integration
- Getting pressure, voltage data from Jonathan
- Should prioritize getting xy reconstructions ready first, will look again at these calculations afterwards