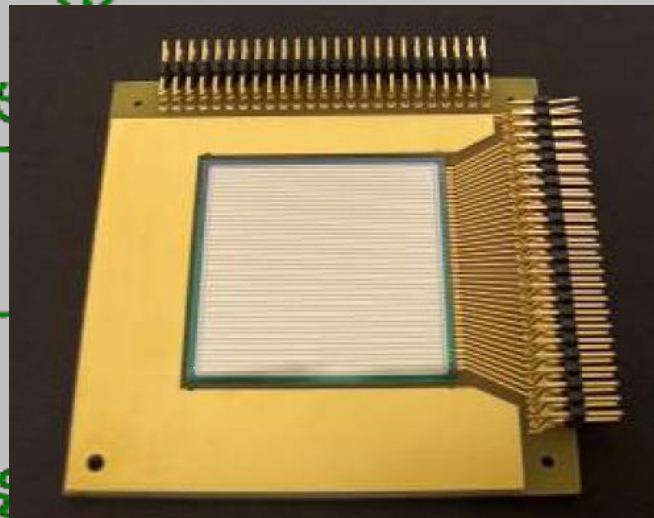


Detector Response Simulations Using MCNPX and GEANT4

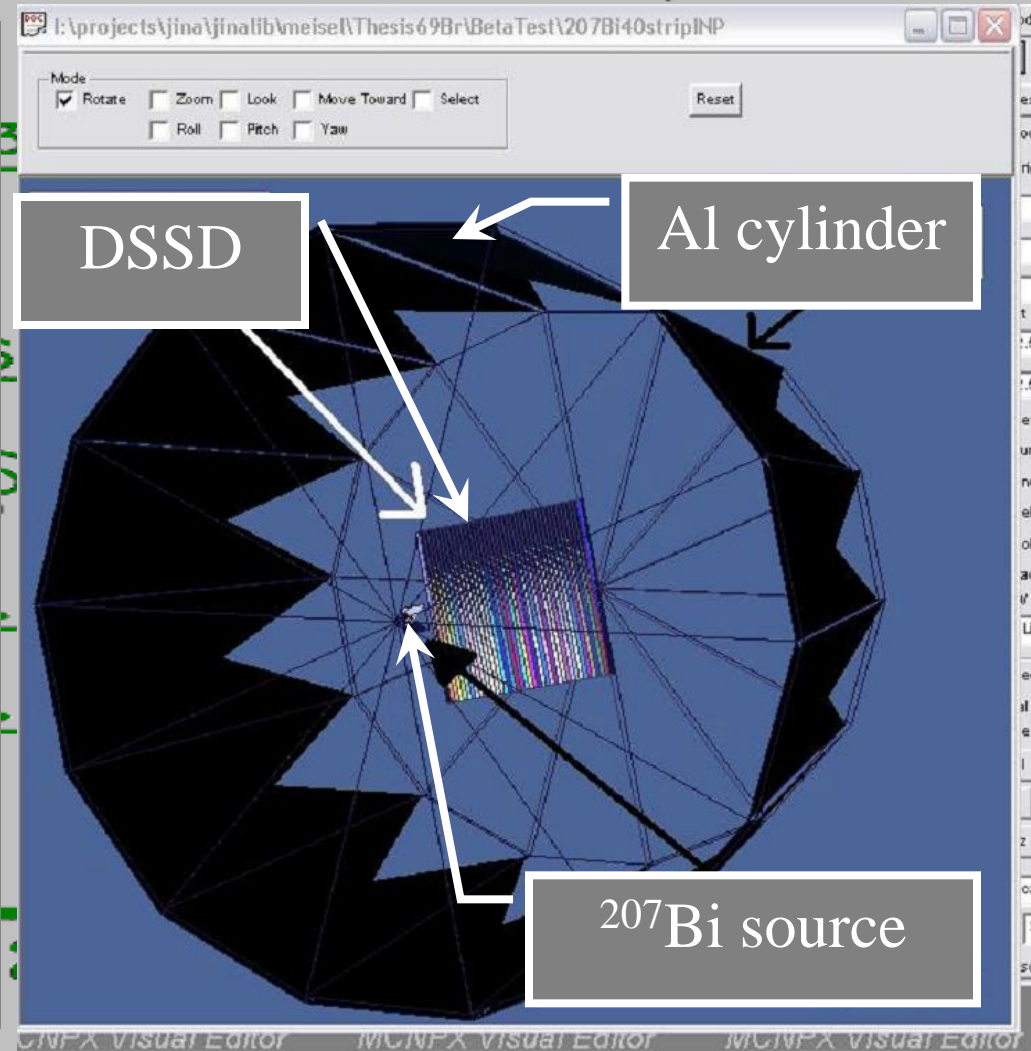


Zach Meisel

(MSU undergrad thesis project)

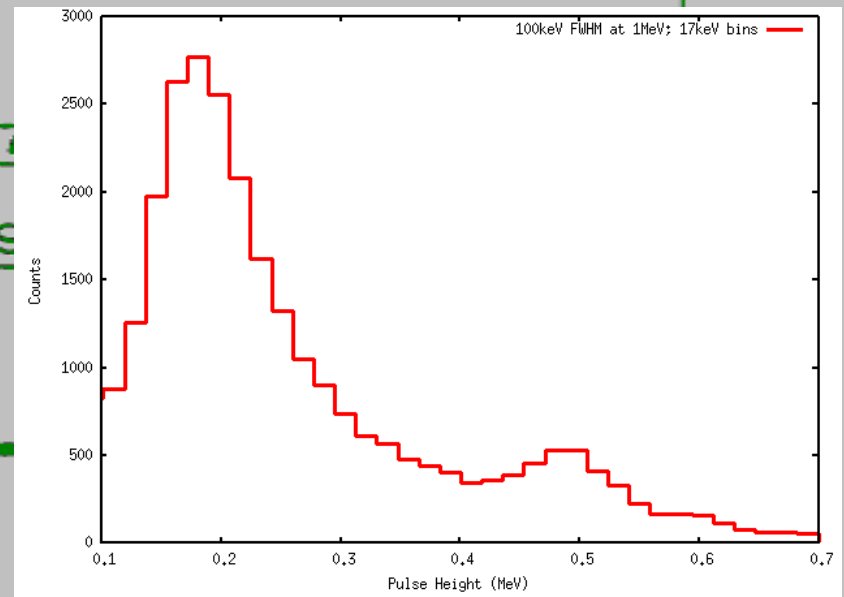
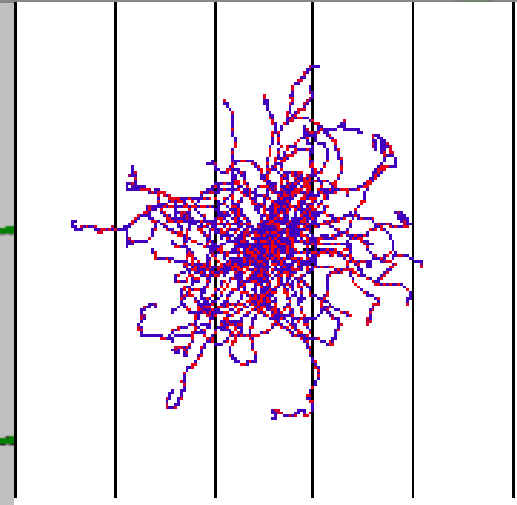
Experimental Set-up for ^{69}Kr β -delayed proton emission

- **Goal:** Provide simulation of calibration and experiment
- **Thus far:** ^{207}Bi calibration runs
 - Source 7cm from 1 to 3 DSSDs in Al chamber
 - 1 hour of data (~17,000 counts after noise removal)



MCNPX: Monte Carlo N-particle Transport

- Transportation of numerous particle types through numerous materials in complex geometries
- Takes some time (and paperwork) to get a hold of a copy



207 Pb 125
82

MCNPX Input/Output

- **Cell cards:** describe volumes by surfaces and filler
- **Surface cards:** describe surface geometry
- **Data cards:** mostly specify what is output (kept track of) and how

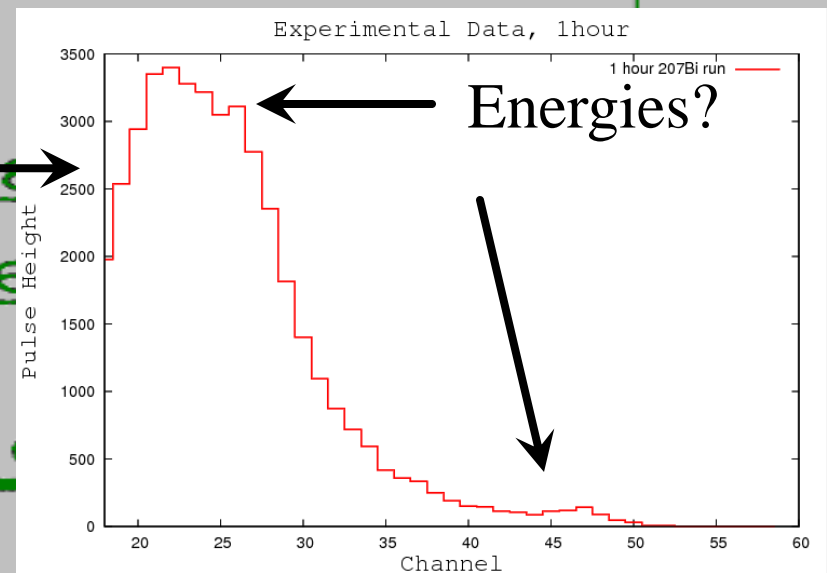
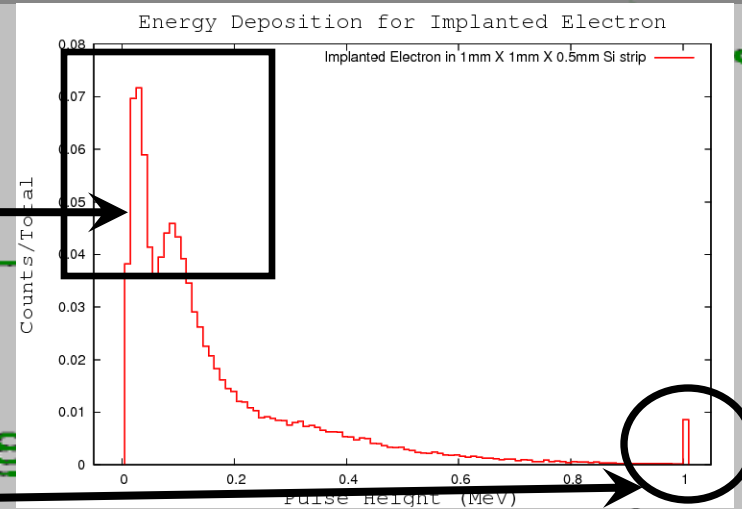
```
Input deck for .5mm Si strip
c cell (rectangular prism & sphere):
1 1 -2.329 1 -2 -3 4 -5 6
2 0 -7(-1 : 2 : 3 : -4 : 5 : -6)
3 0 7
c end cell cards

c surface cards for rectangular prism:
1 PZ -2
2 PZ 2
3 PY 0.025
4 PY -0.025
5 PX .05
6 PX -.05
c end prism surface cards
7 S0 2.05 $void sphere

c DATA CARDS
MODE E
c electron importance card
IMP:E 1 1 0
c source definition card
SDEF POS= 0 0 0 CEL=1 ERG=1 PAR=3
c Tally Type cards
F8:E 1 2 $E deposited in cell 1
c FT8 0 0.1 0
c Tally Energy cards
E8 0. 1.e-5 100I 1.00 1.01
c material cards
M1 14000 1 COND=1 $natural silicon, set to conductor
c cutoff card (number of histories to track)
NPS 1e5
```

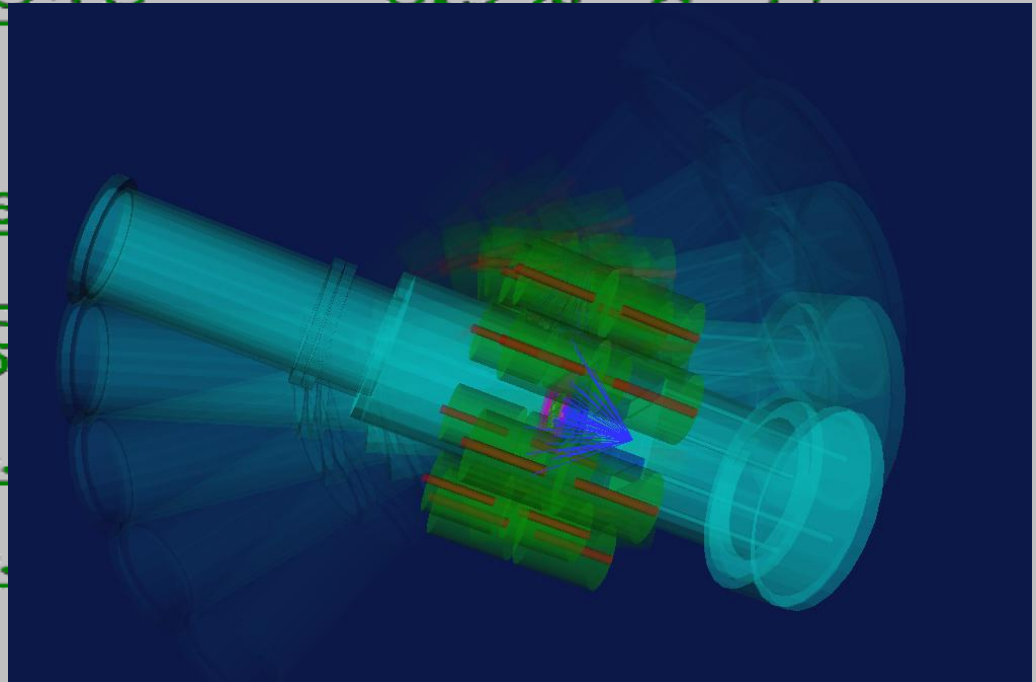
Problems (thus far)

- Unusual geometry dependence for e^- at small volumes ($\sim .25\text{mm}$)
- Bragg peak or e^-e^+ annihilation?
- Difficult to match to data (no Bragg peak)
- Minimum time delay $\sim 10^{-11}$ seconds between particles



GEANT4: Geometry and Tracking

- Same idea as MCNP, except able to simulate multiple particles at once
- Requires knowledge of ROOT and C++
- Easily obtainable



Future Plans

- **MCNPX**: simulate a β rapidly followed by a proton
 - Figure out time delay validity
 - Accurately represent energies
- **GEANT4**: increase set-up complexity to match MCNP simulations
 - Add more strips and aluminum chamber
- **CASINO**: compare backscattering data
 - Extract backscattering data from MCNP (and Geant?)
 - Analyze and devise metric for comparison