

Coldbox Standalone G4 Simulation

Walker Johnson

South Dakota School of Mines and Technology, Department of Physics

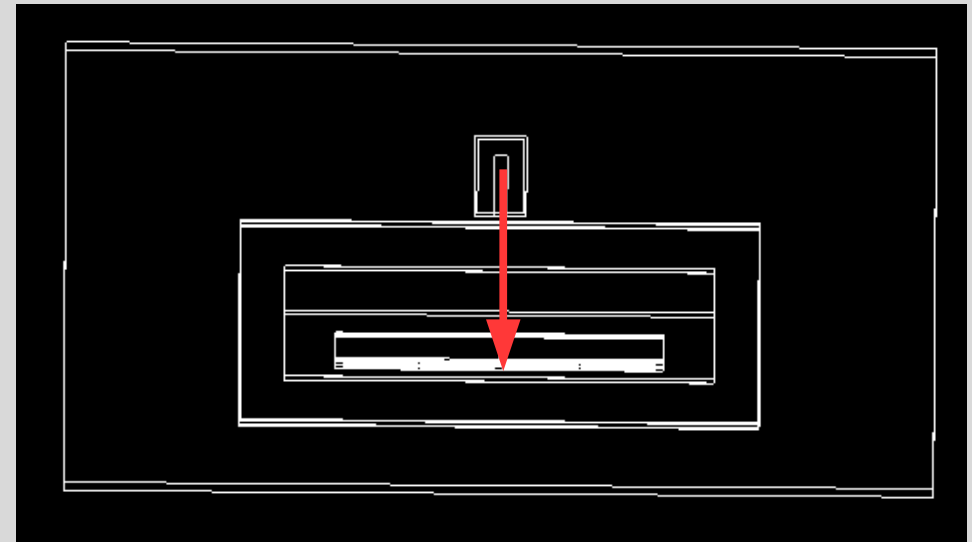
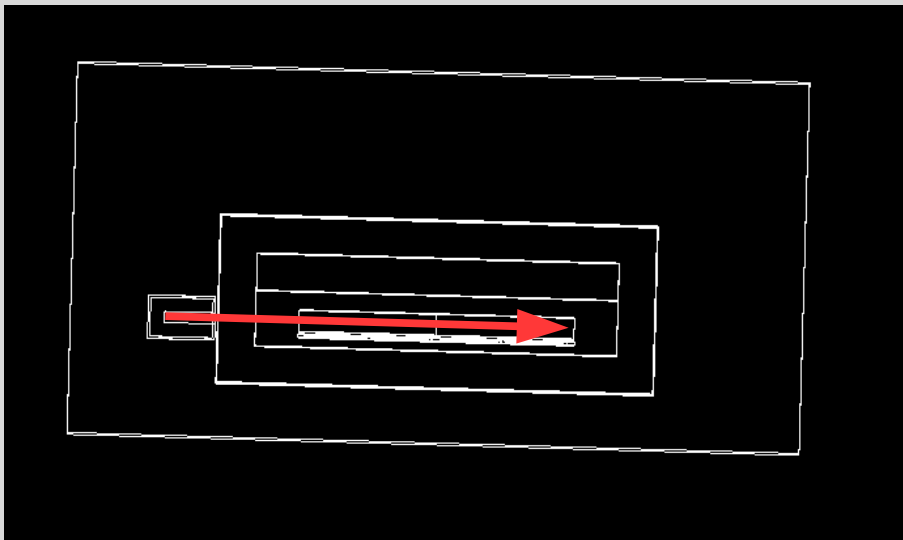


SOUTH DAKOTA MINES

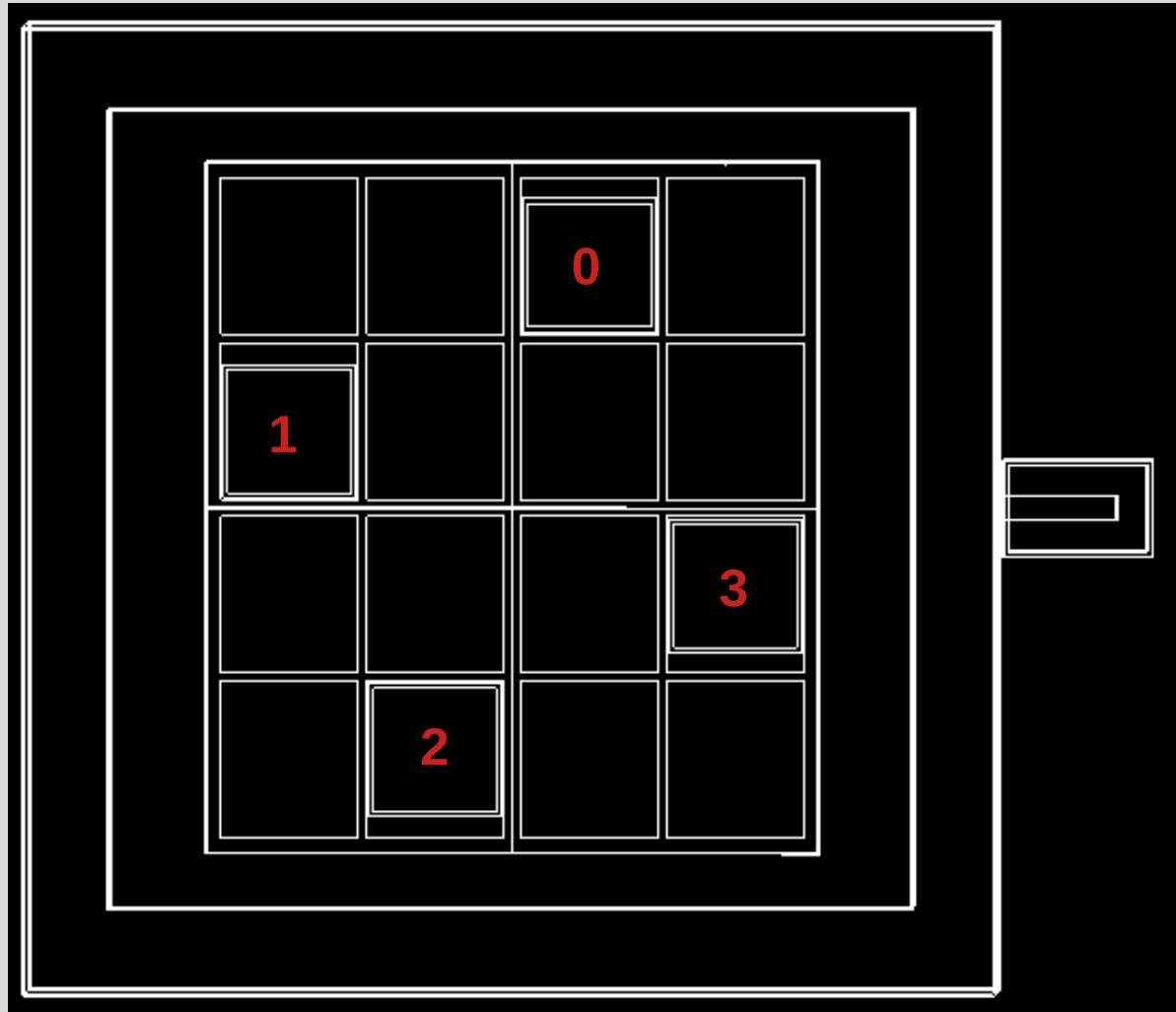
An engineering, science and technology university

Locations

- The two location options are: on top of the Coldbox detector, and on the side of the detector
 - We may be better served pointing the PNS directly over one of the photodetectors to maximize captures that will give us a trigger

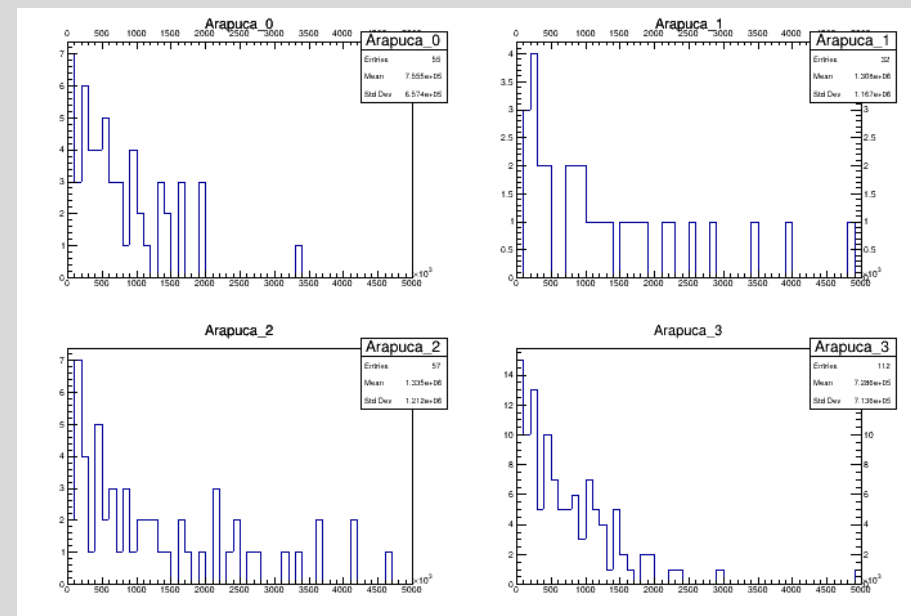
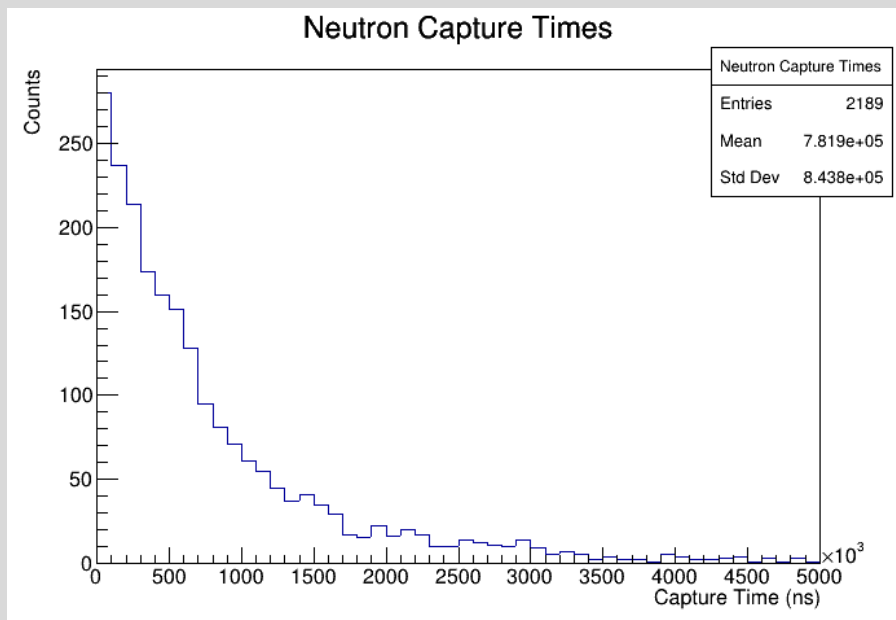


Photodetector locations



Side Position

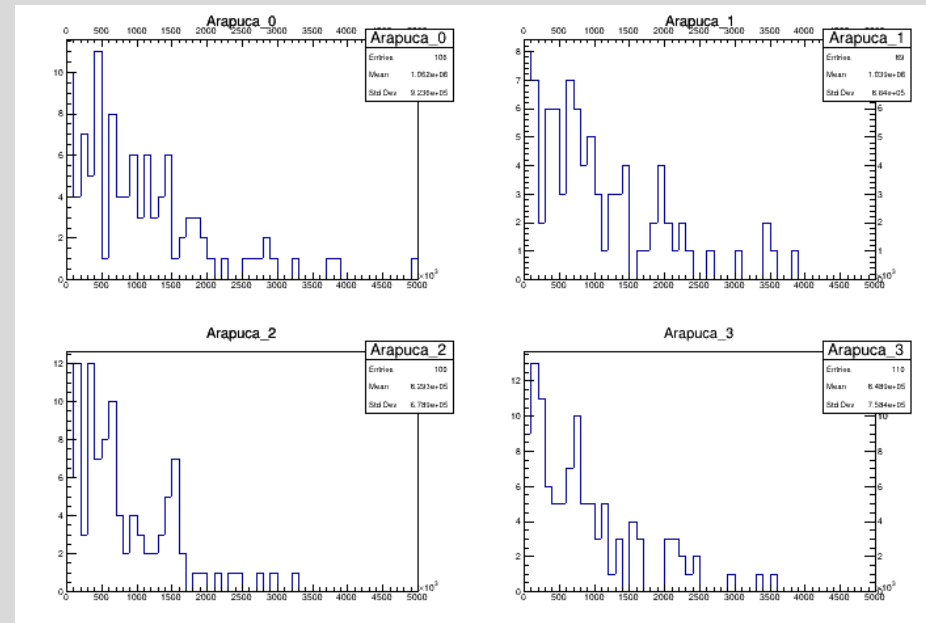
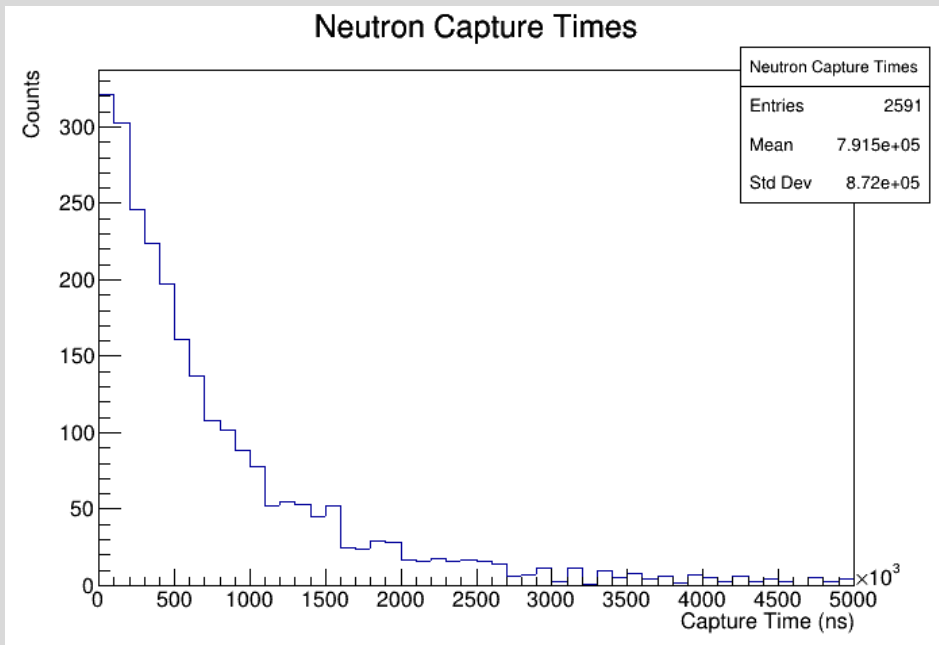
- Centered in x-z
- 5×10^5 neutrons simulated (isotropic from DDG)
- $\sim 0.44\%$ capture rate, .7819 ms mean capture time



Captures in active volume directly above the photodetectors

Top Position

- Centered in y-z
- 5×10^5 neutrons simulated (isotropic from DDG)
- $\sim 0.52\%$ capture rate, .7915 ms mean capture time



Conclusions

- Roughly the same capture rate in both positions
 - Top has slightly higher rate of captures
- For 1s total PNS-On time we can expect ~4000-5000 captures in the active volume
 - For a 400us pulse width, this equates to about 2 captures every pulse
 - With current positions tested ~1/10 of these captures occur directly above a photodetector
 - The chance for a capture to result in a 4.7MeV gamma that undergoes pair production = ~1/5
 - Roughly **1 event for every 25 pulses** (without accounting for the acquisition window)