

Double neutron shield simulation study

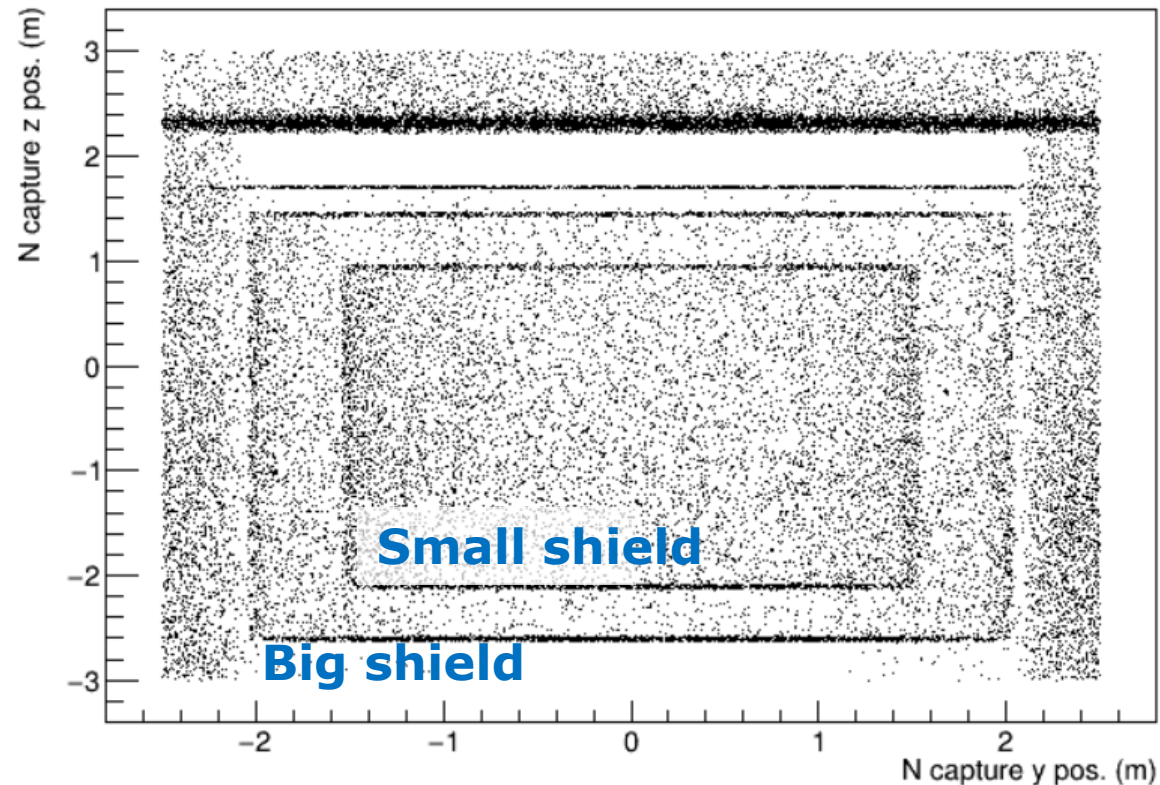
CJ Barton

Motivation and setup

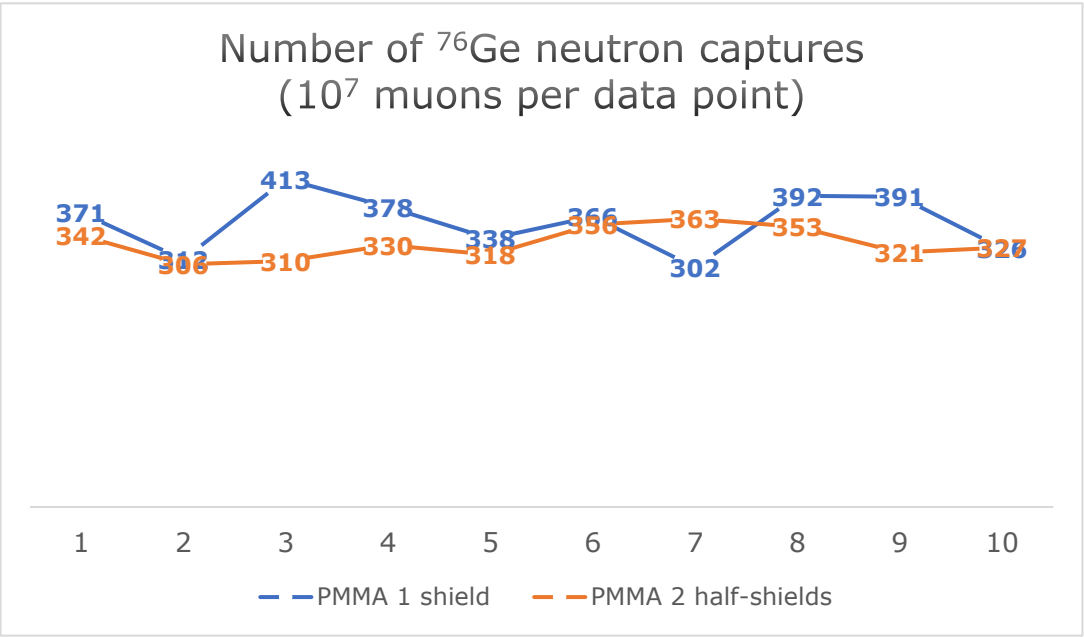
- On May 16th 2023, Natalia on behalf of Bernard presented the idea of a “double” solid neutron shield, with two nested shields, each having half of the standard thickness
- Potential parameters to adjust/vary for each shield:
 - Thickness
 - Material
 - Dimensions/amount of LAr between the two shields
- Setup chosen: 5 cm thickness (both), PMMA material, shields with inner diameters/heights of 3m (small shield) and 4m (large shield)
- 10^8 muons, compared with a 10 cm PMMA shield at 4m (1 shield)

Verifying the dimensions are correct

- WLGD's visualization isn't functional on my system, so I used some cuts on the output data to check the geometry by proxy



Results



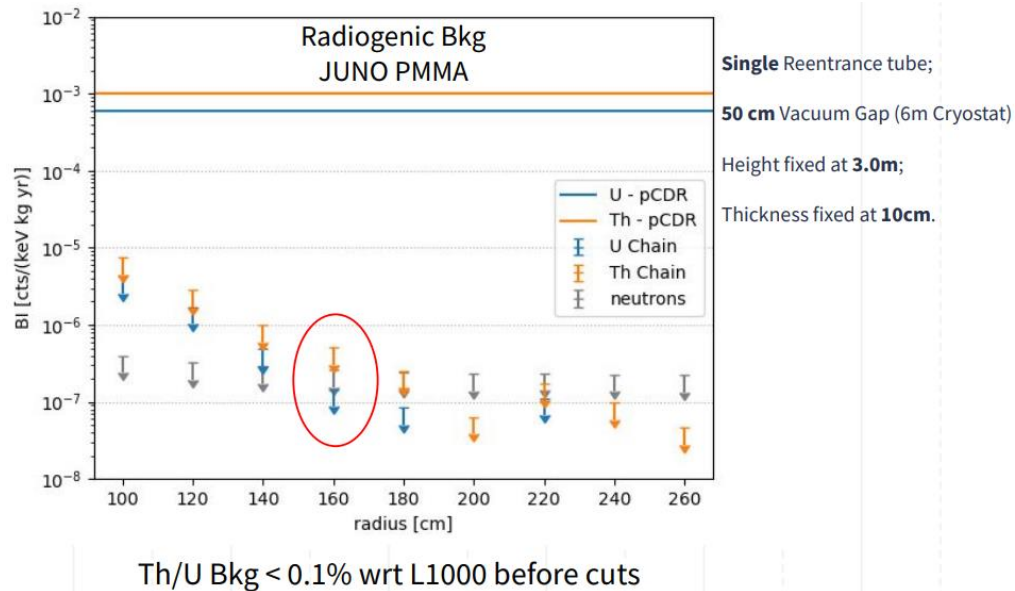
2 shield average ^{76}Ge neutron capture rate is 7.3% lower than the 1 shield setup

The 1 shield setup seems to have a greater variance than the 2 shield setup

High	Low	Average	Standard deviation of data set	Statistical uncertainty
413	302	358.9	0.099	0.0167
363	306	332.6	0.057	0.0173

Radiogenic impact - heuristic estimate

Single ReEntrant Tube - Radius Scan



Naively, by splitting the 10 cm shield into two 5 cm shields with 150 cm and 200 cm radius (300 cm and 400 cm height), the radiogenic contribution would be
 $(0.5 * \text{contribution@150 cm}) + (0.5 * \text{contribution@200cm})$

However, the inner shield would likely moderate the outer shield contribution

So roughly, I would estimate the double shield radiogenic contribution to be half of the contribution of a 10 cm shield at 150 cm radius and 300 cm height