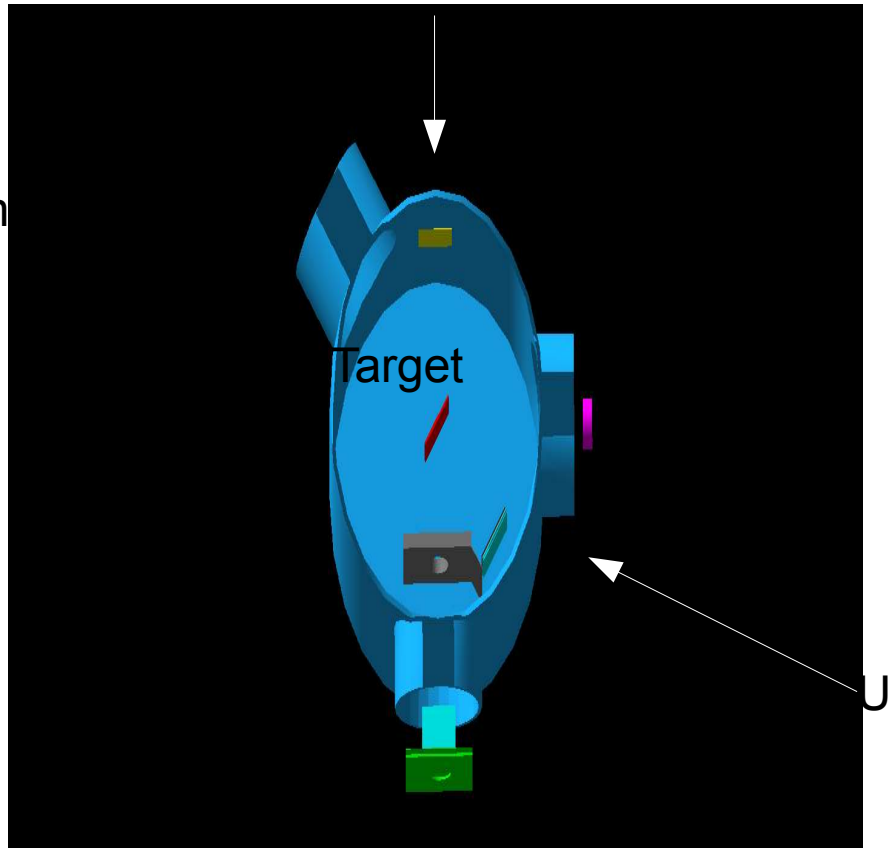
What Noise May We Encounter?

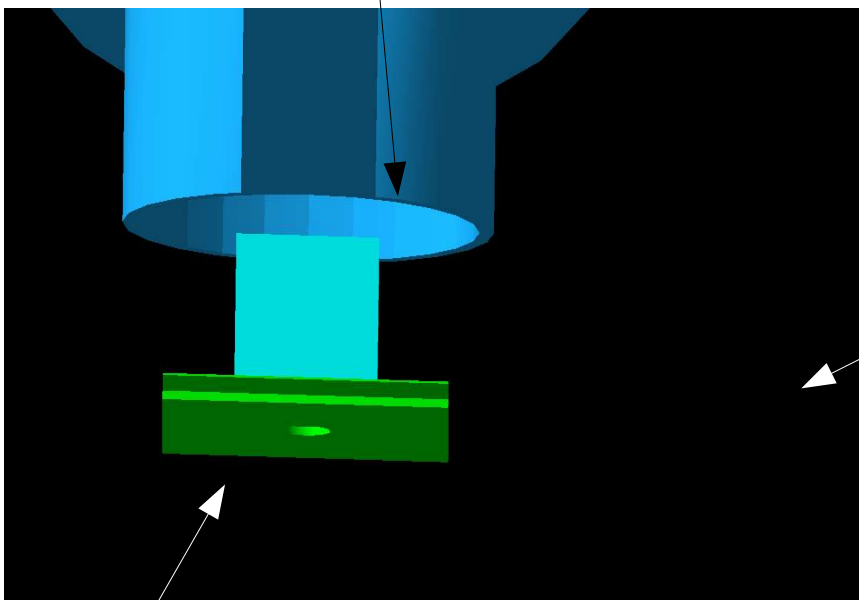
Particle Gun (Borrowed from MuSun Code)

- 1.1% sigma around momentum mean
- 8.33 mm spread horizontally, 5.992 mm spread vertically
- 0.86 degree sigma from straight
- 43 MeV/c used with 2 mm target to get most stops in target

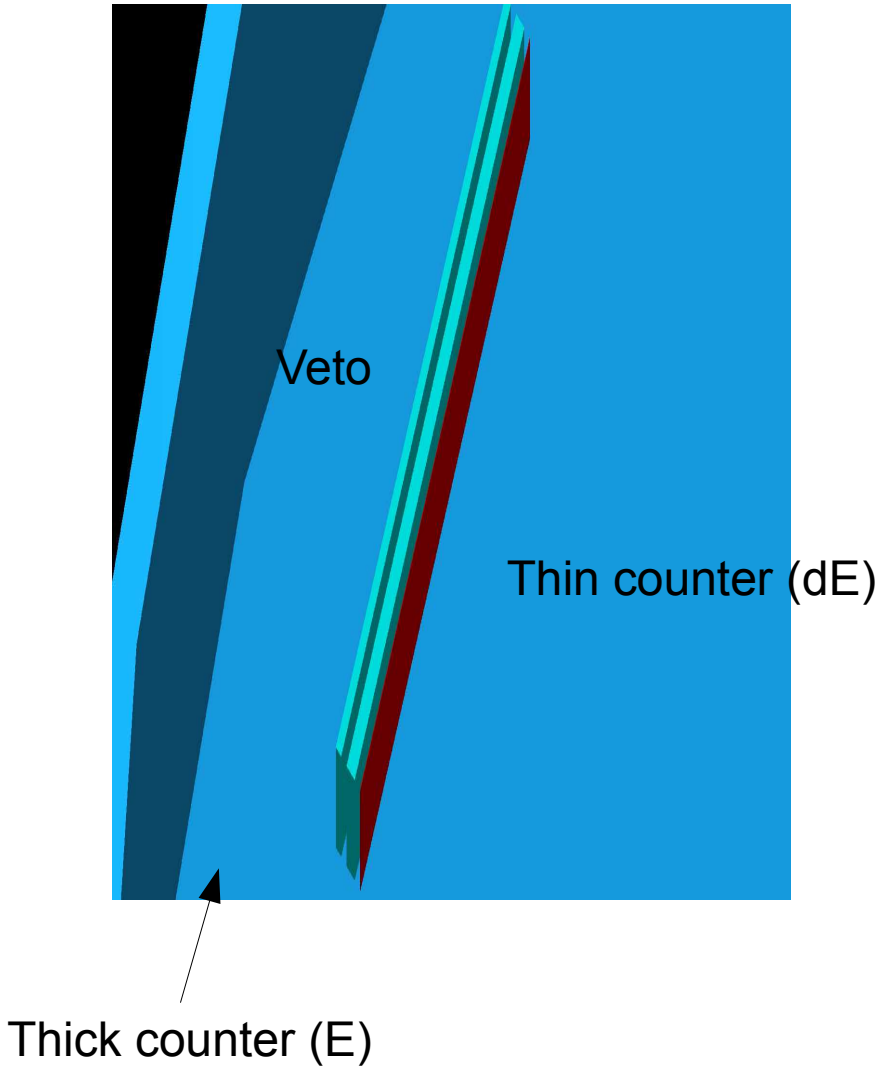
General Setup



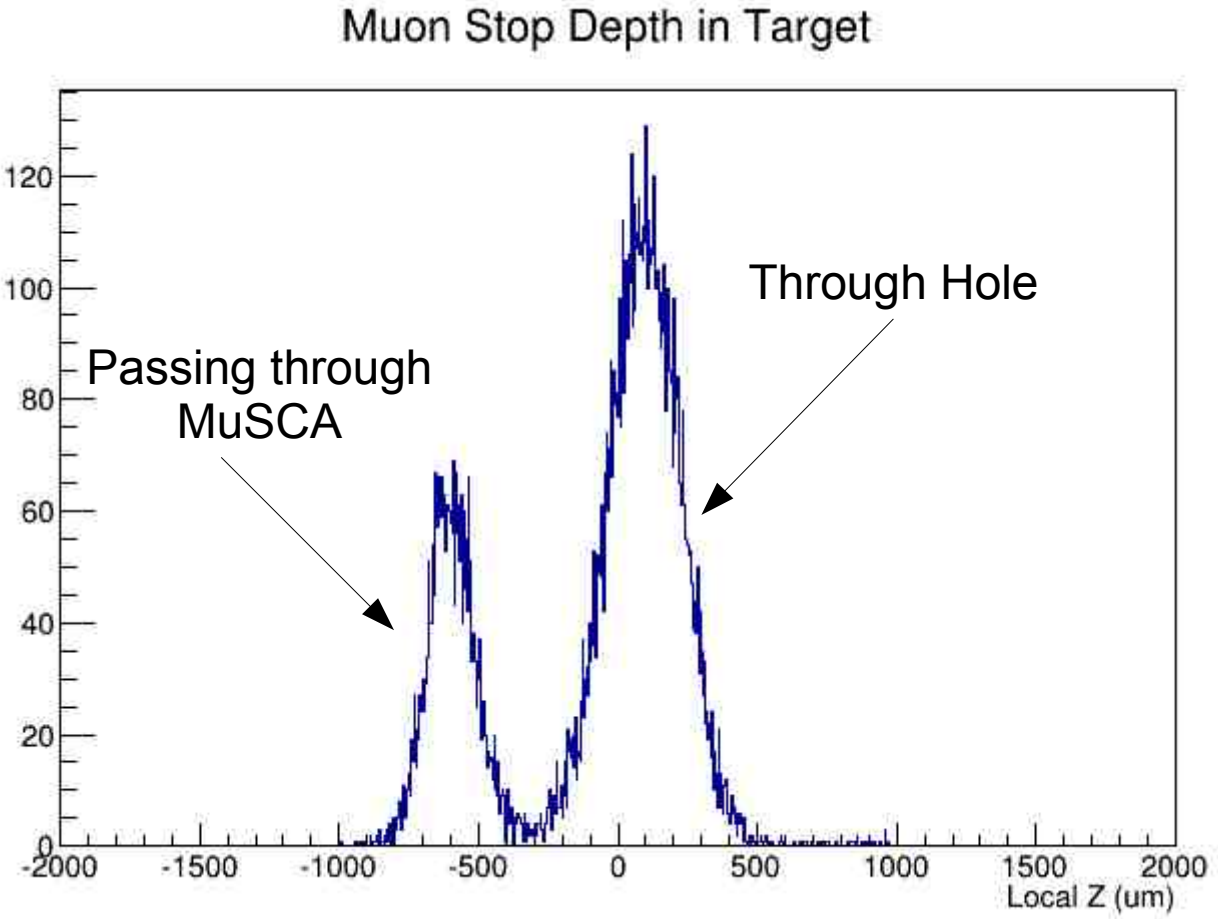
Upstream Detectors



Arms



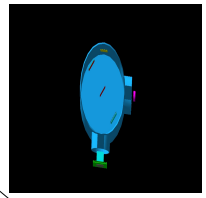
Muon Stops

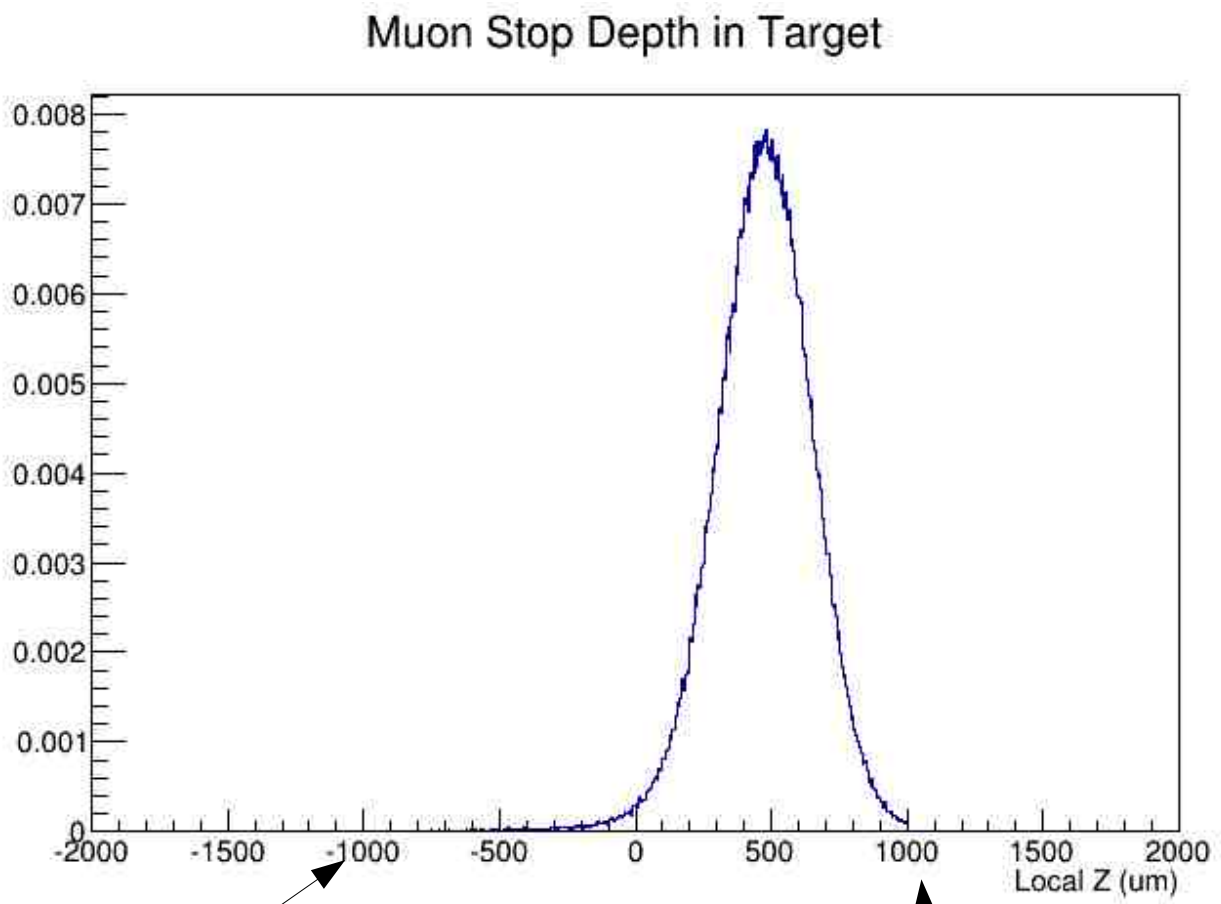


After seeing this, adjusted particle gun to produce fewer muons not passing through MuSCA hole.

Muon Stops

82.7% of the muons are here.





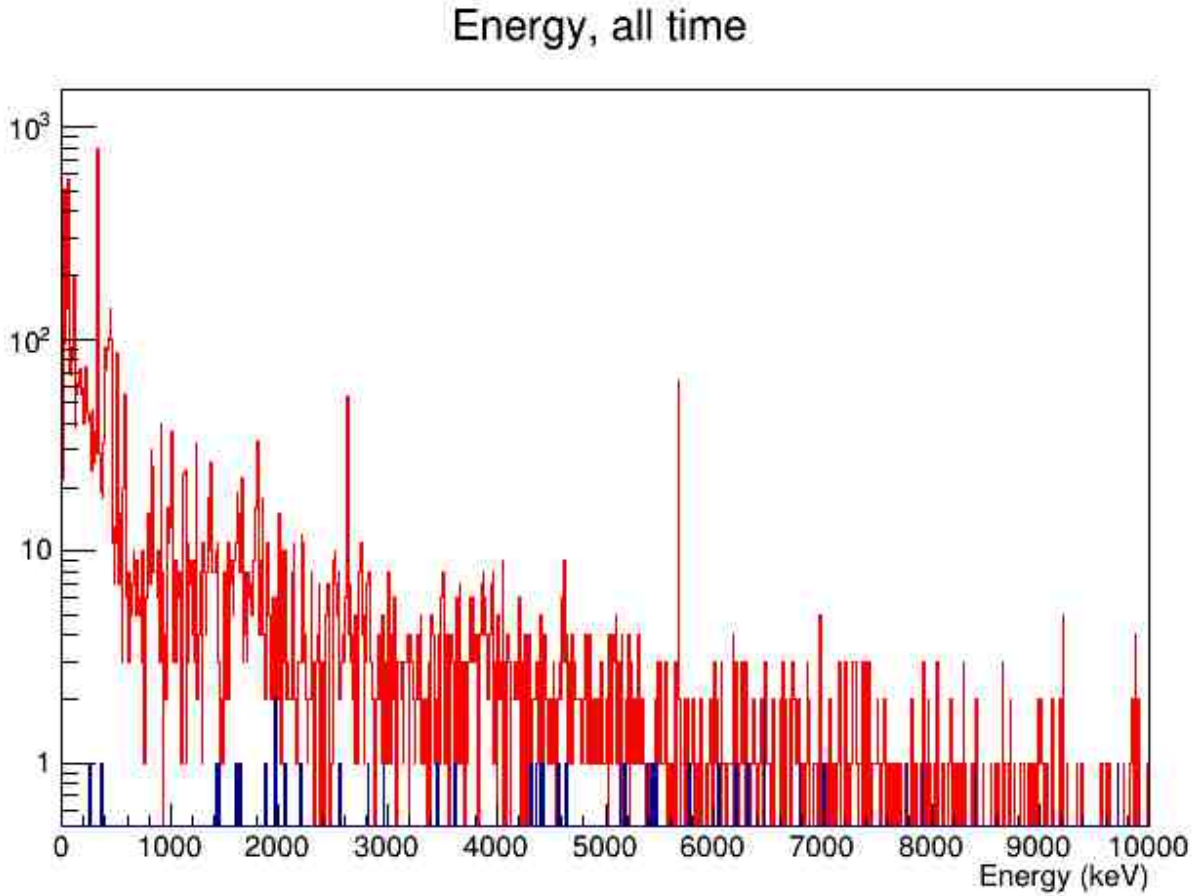
Upstream face

Downstream face

Signal (400,000 simulated muons)

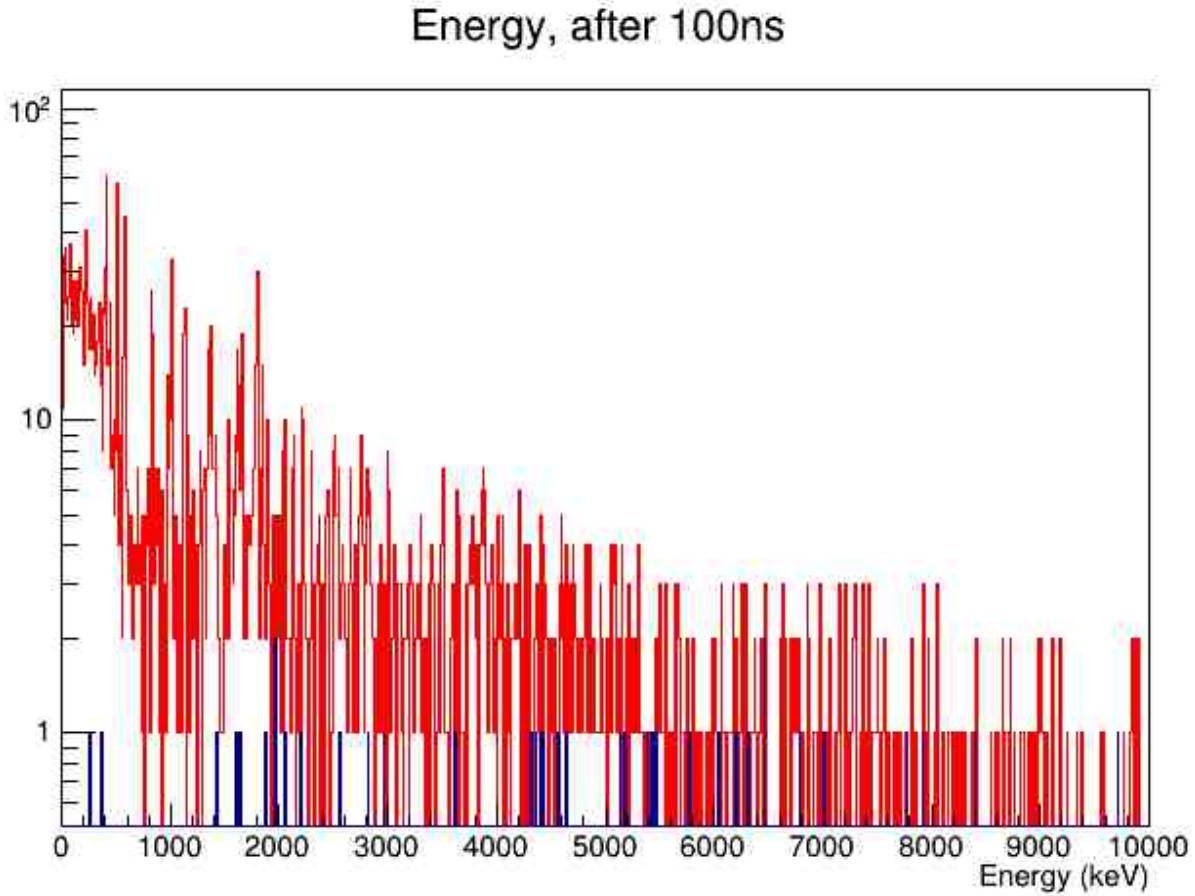
- 56 protons from target to downstream thin detector (dE)
- 41 make it through to thick downstream detector (E)
- 38 do not make it through to downstream veto
- For upstream, respective numbers are 24, 22, and 18
- We would expect to 56 events under these circumstances

Noise



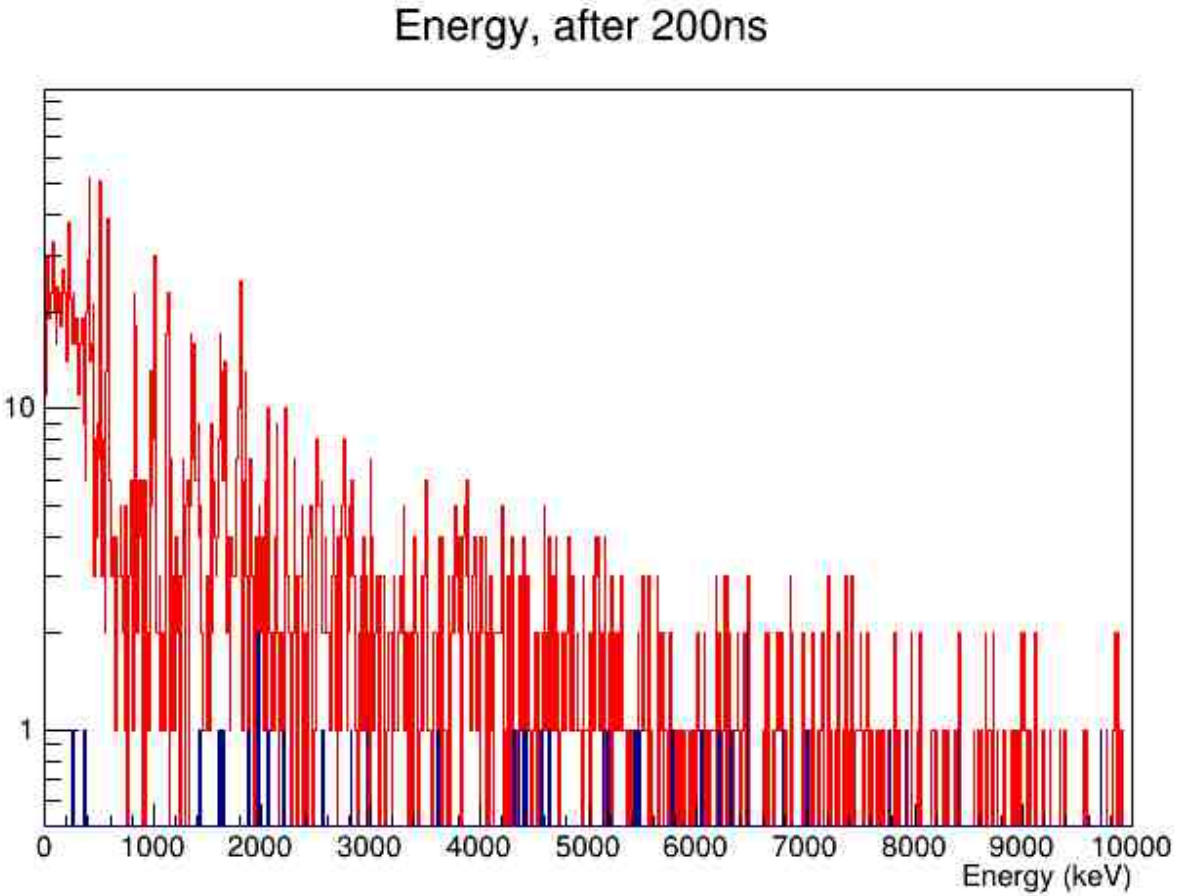
The red line represents the energy of entering muons, electrons, and photons in the downstream thin dE detector and the blue the protons with no time cut.

Noise

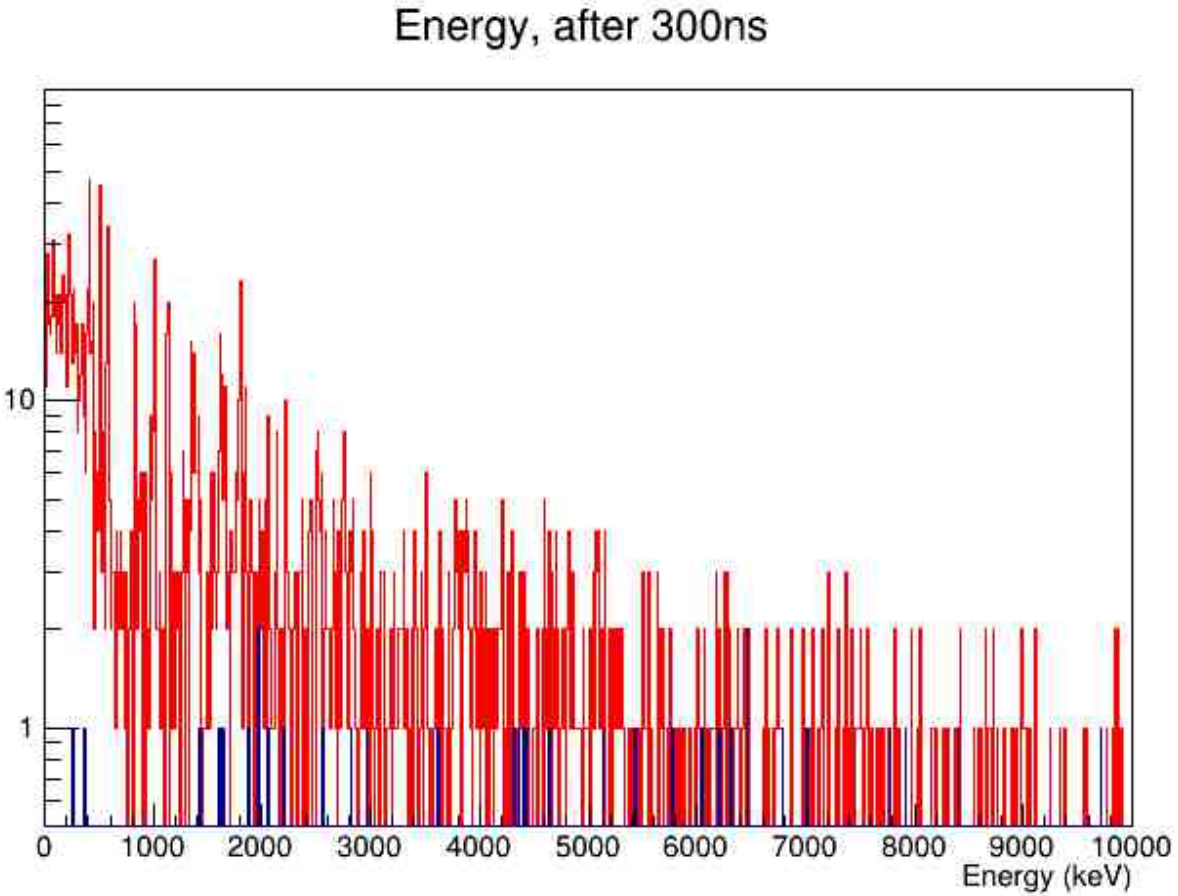


After 100ns...

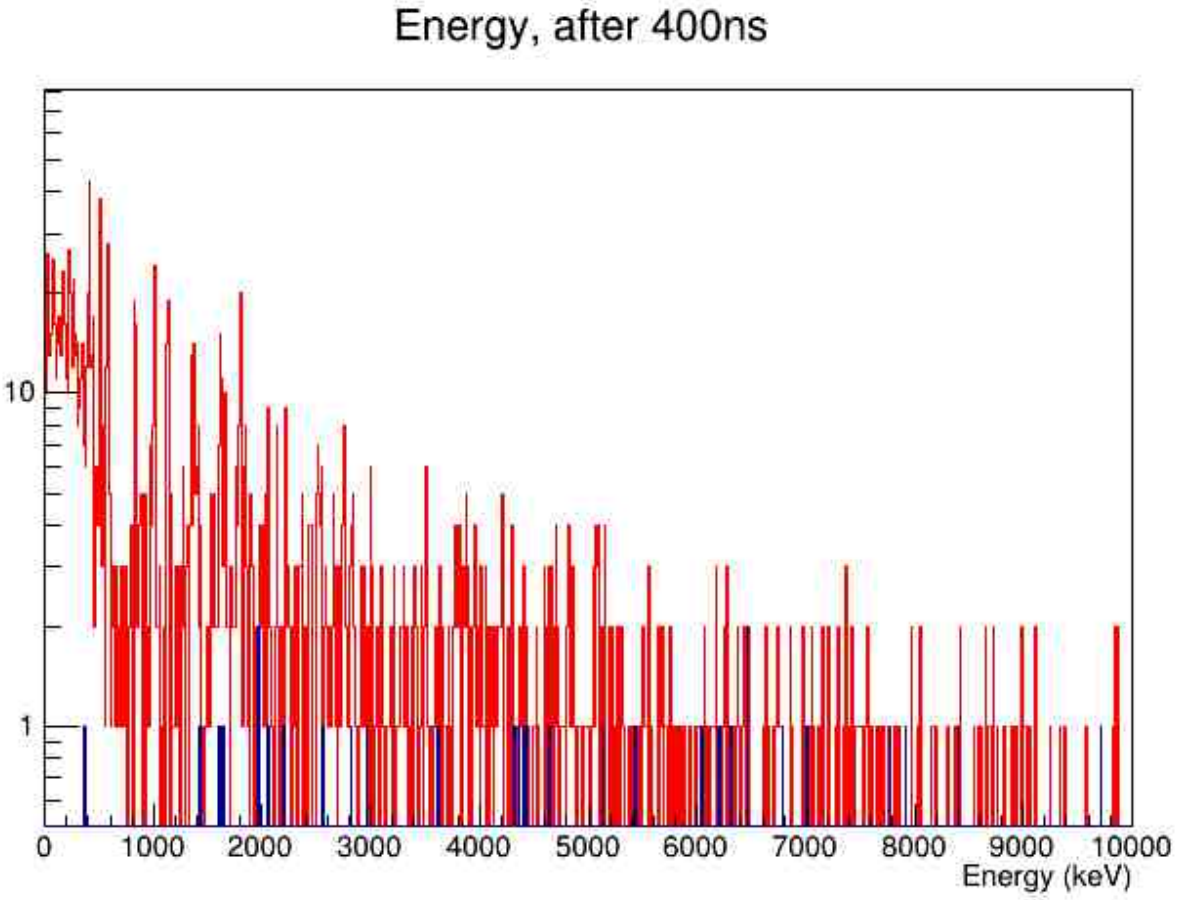
Noise


Energy, after 200ns
10
1
0
1000
2000
3000
4000
5000
6000
7000
8000
9000
10000
Energy (keV)

Noise


Energy, after 300ns
10
1
0
1000
2000
3000
4000
5000
6000
7000
8000
9000
10000
Energy (keV)

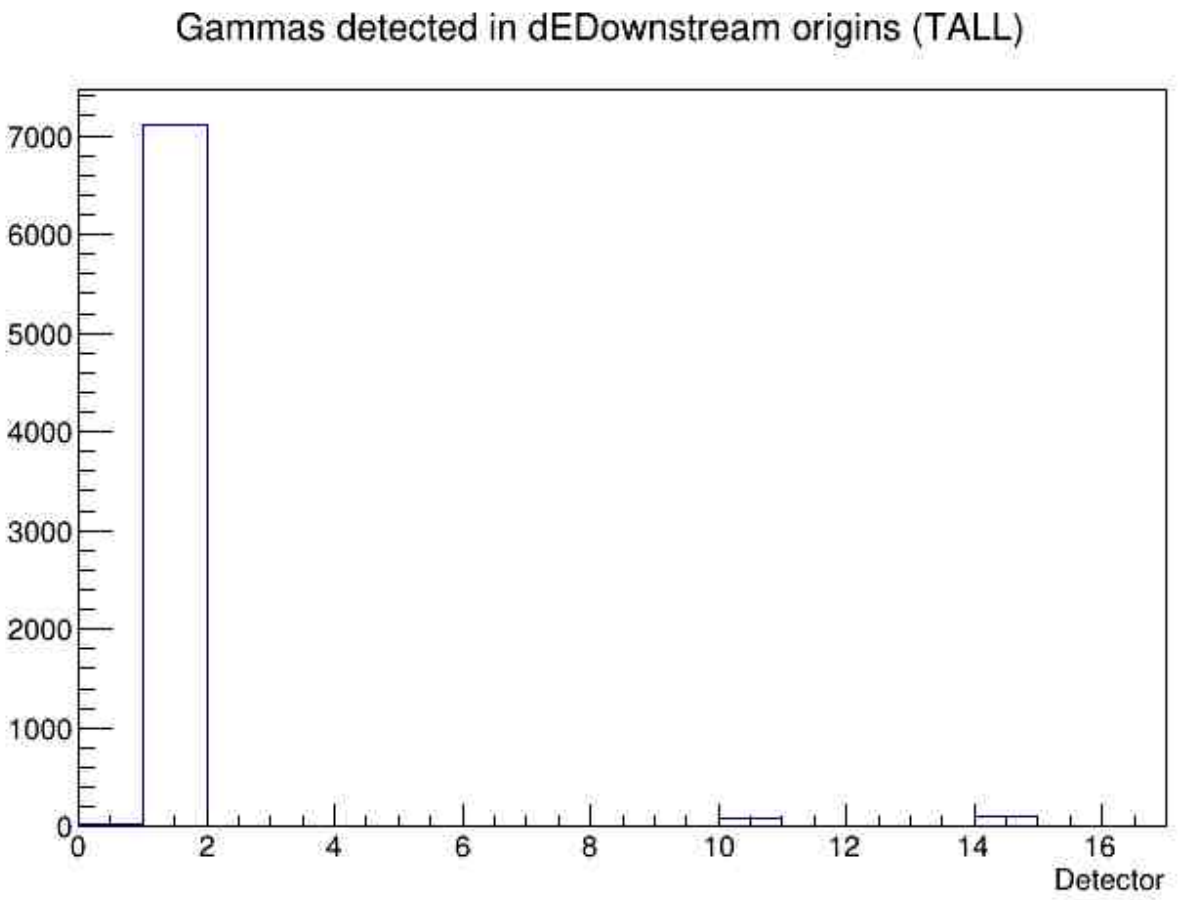
Noise


Energy, after 400ns
10
1
0
1000
2000
3000
4000
5000
6000
7000
8000
9000
10000
Energy (keV)

And where are they coming from?

X-axis:
0. MuSC
1. Target
2. Veto
3. Thin upstream
4. Thick upstream
5. Veto upstream
6. Thin downstream
7. Thick Downstream
8. Veto downstream
9. Ge
10. Chamber
11. MuSCA
12. MuPC
14. Collimator

13,15,16 are invalid



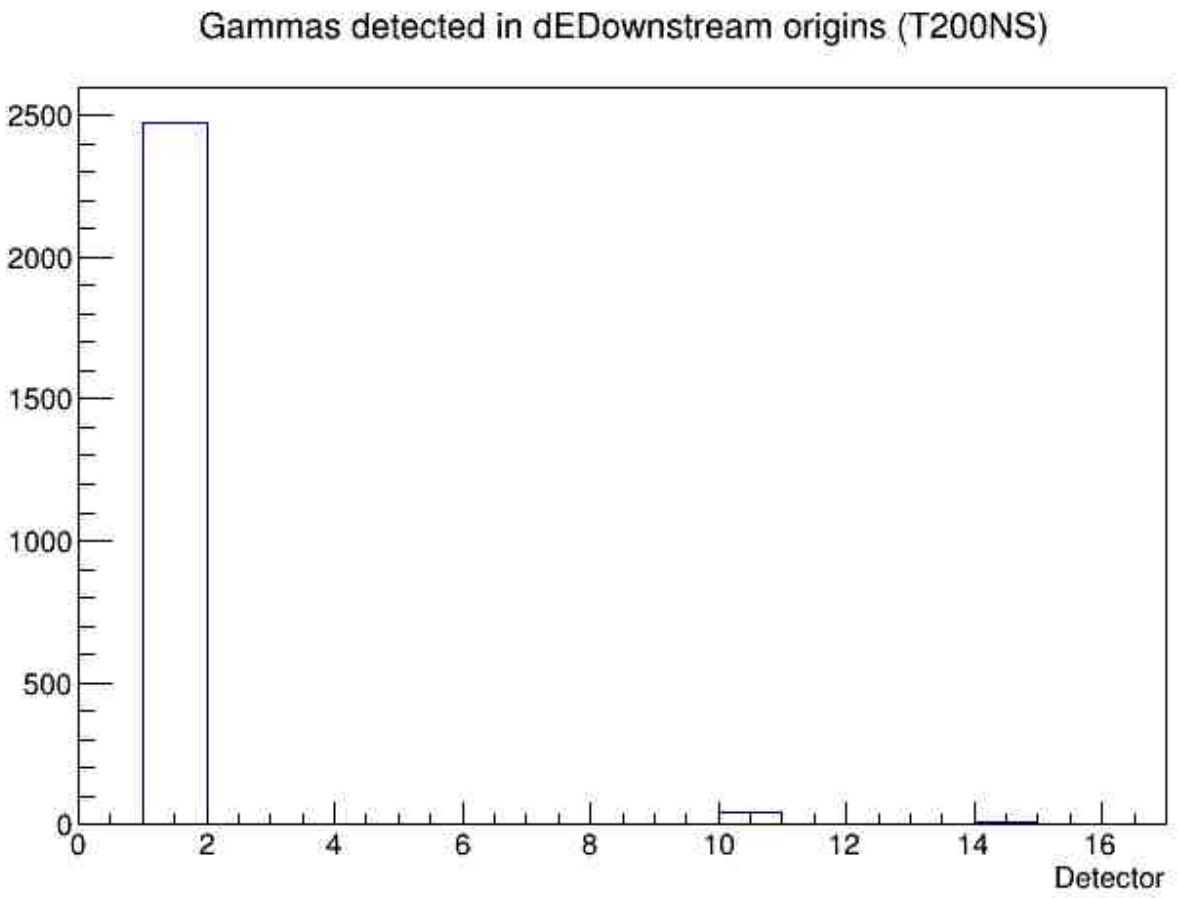
"Detected" here means "Entering." As in the majority of the photons entering the downstream dE detector were produced in the target.

The horizontal axis indicates which detector the photons (detected in the downstream thin detector) came from. The majority is the target (bin 1), some also come from the MuSC (bin 0), many from the chamber (bin 10), and also from the collimator (14).

And where are they coming from?

X-axis:
0. MuSC
1. Target
2. Veto
3. Thin upstream
4. Thick upstream
5. Veto upstream
6. Thin downstream
7. Thick Downstream
8. Veto downstream
9. Ge
10. Chamber
11. MuSCA
12. MuPC
14. Collimator

13,15,16 are invalid

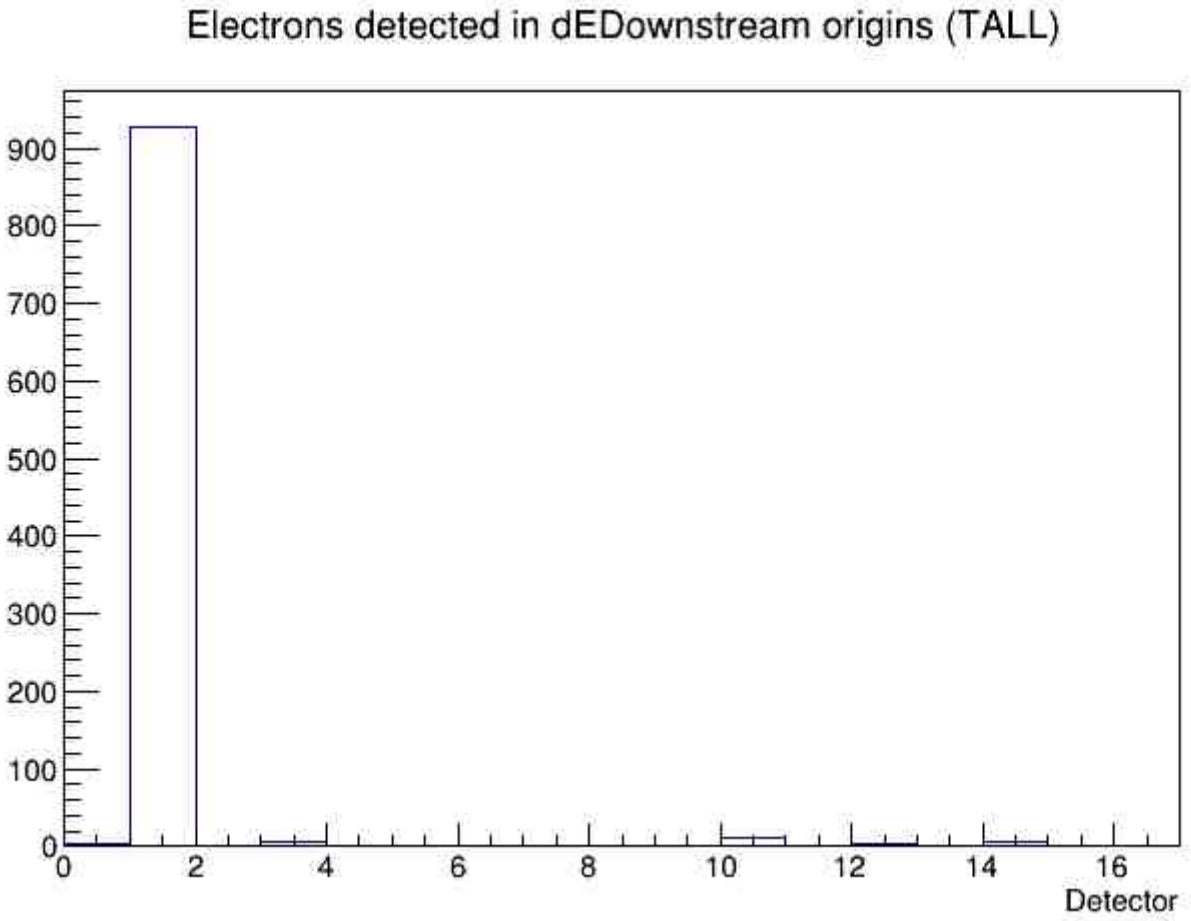


And after 200ns, the number from all sources has decreased. The chamber has increased in its contribution to gammas in the downstream thin detector, but we also have low statistics. The lead seems to have decreased in its relative contribution here.

And where are they coming from?

X-axis:
0. MuSC
1. Target
2. Veto
3. Thin upstream
4. Thick upstream
5. Veto upstream
6. Thin downstream
7. Thick Downstream
8. Veto downstream
9. Ge
10. Chamber
11. MuSCA
12. MuPC
14. Collimator

13,15,16 are invalid

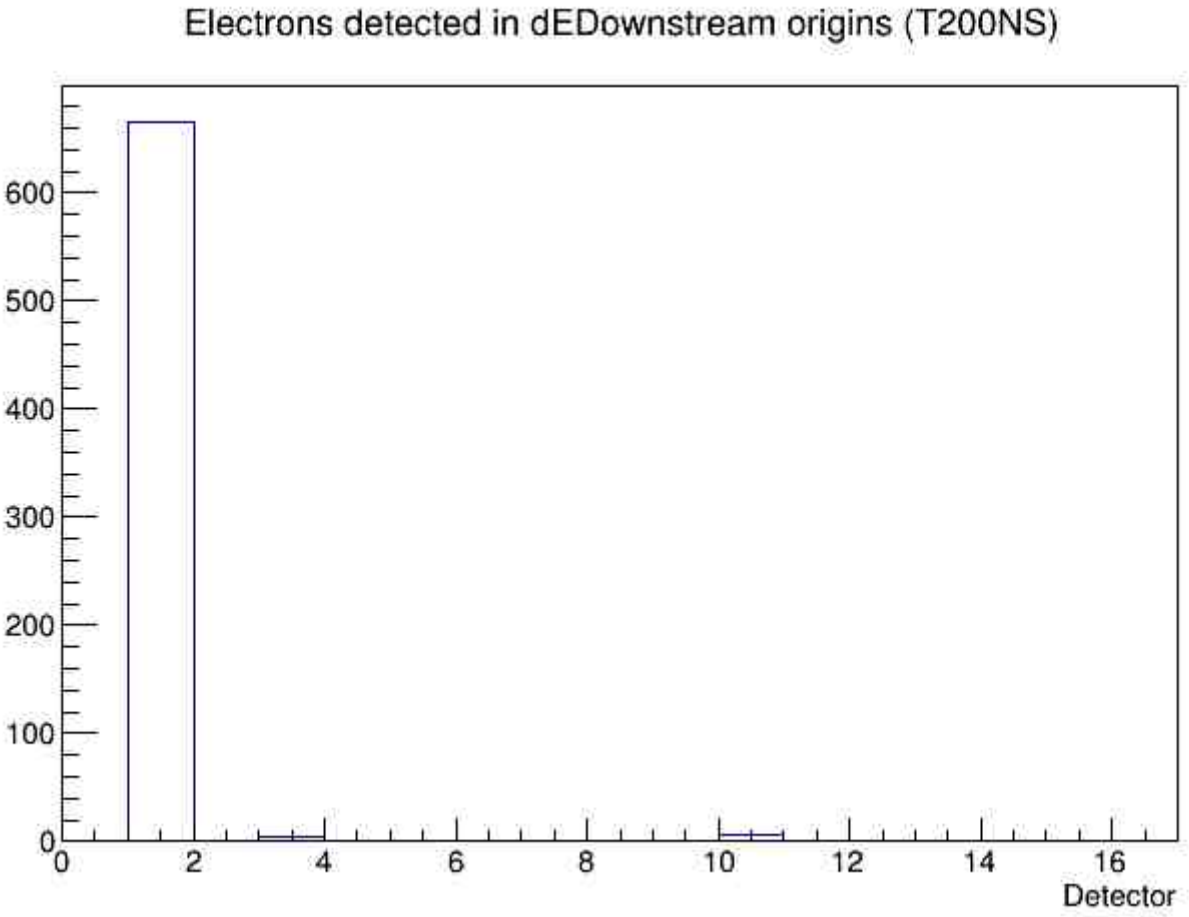


There are electrons coming from pretty far upstream.
But not many. Most, again, come from the target.

And where are they coming from?

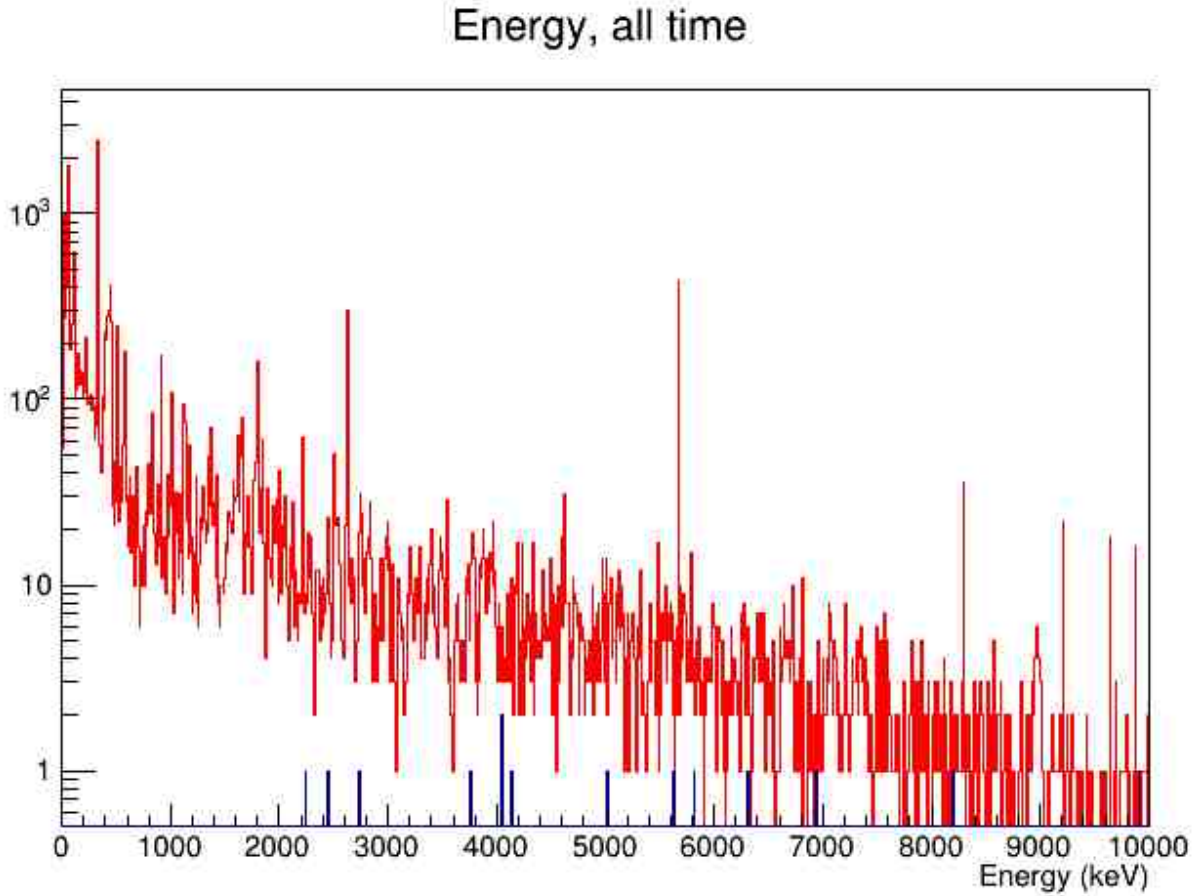
X-axis:
0. MuSC
1. Target
2. Veto
3. Thin upstream
4. Thick upstream
5. Veto upstream
6. Thin downstream
7. Thick Downstream
8. Veto downstream
9. Ge
10. Chamber
11. MuSCA
12. MuPC
14. Collimator

13,15,16 are invalid

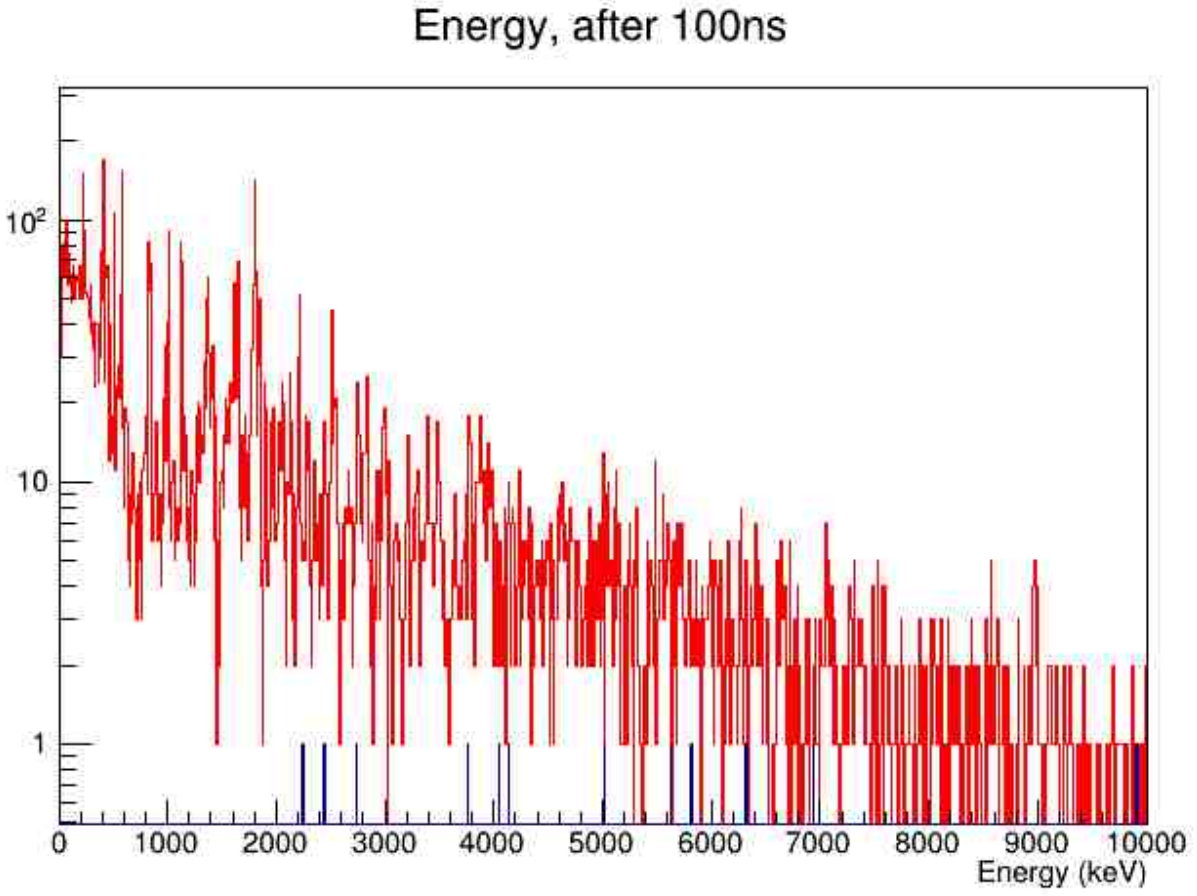


Killed the ones from upstream.

Upstream Thin Counter



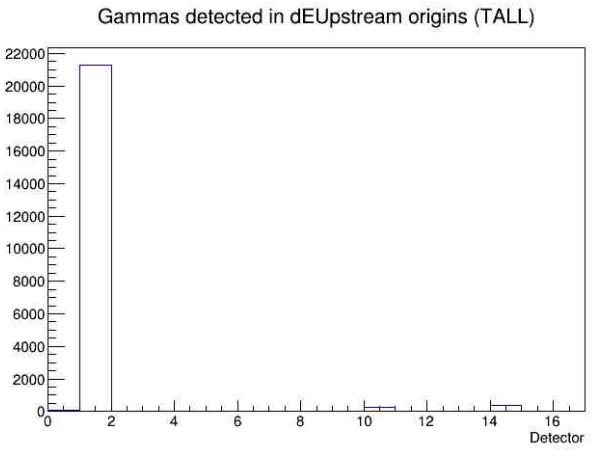
Upstream Thin Counter

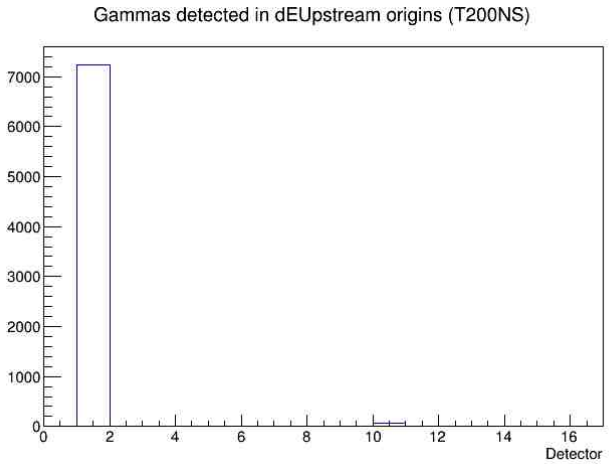


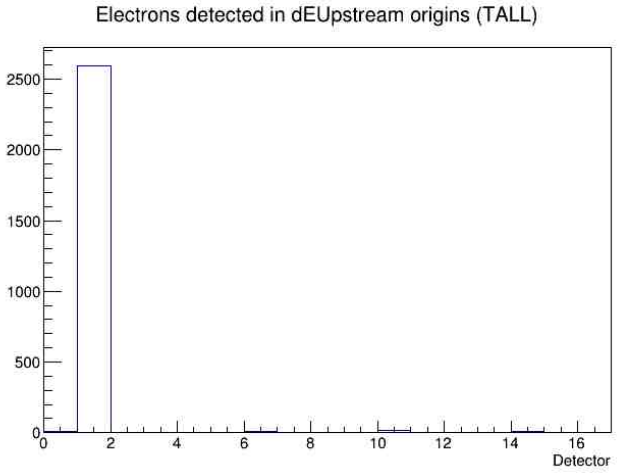
Upstream Thin Counter

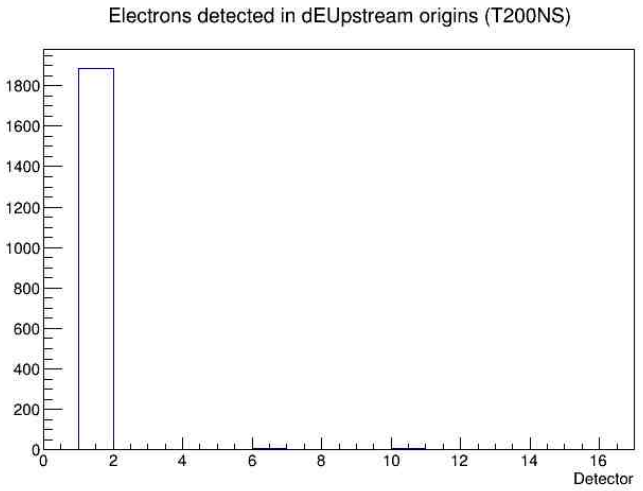
X-axis:
0. MuSC
1. Target
2. Veto
3. Thin upstream
4. Thick upstream
5. Veto upstream
6. Thin downstream
7. Thick Downstream
8. Veto downstream
9. Ge
10. Chamber
11. MuSCA
12. MuPC
14. Collimator

13,15,16 are invalid









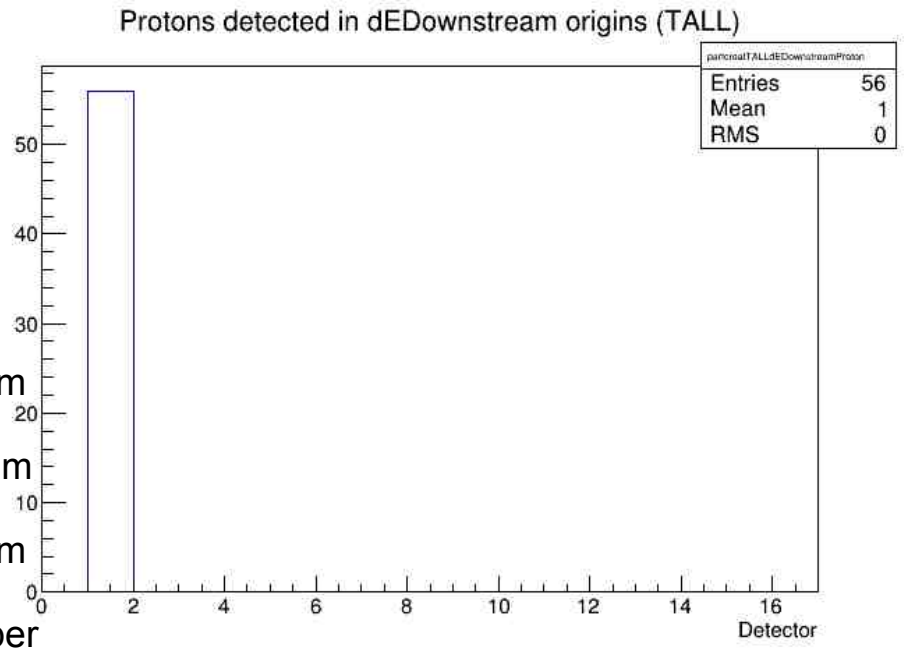
Notice there are a ton more hits here from just the target. In this setup, the target is much closer to the upstream arm.

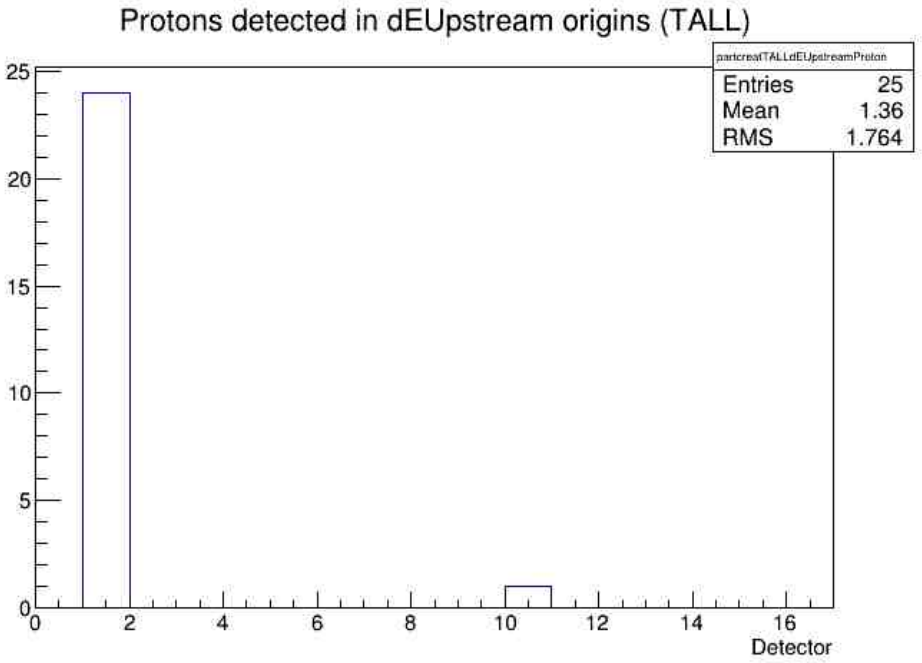
Difference between arms

- Presumably because all the muons stopped at the far face of the target, the downstream arm saw a greater signal.

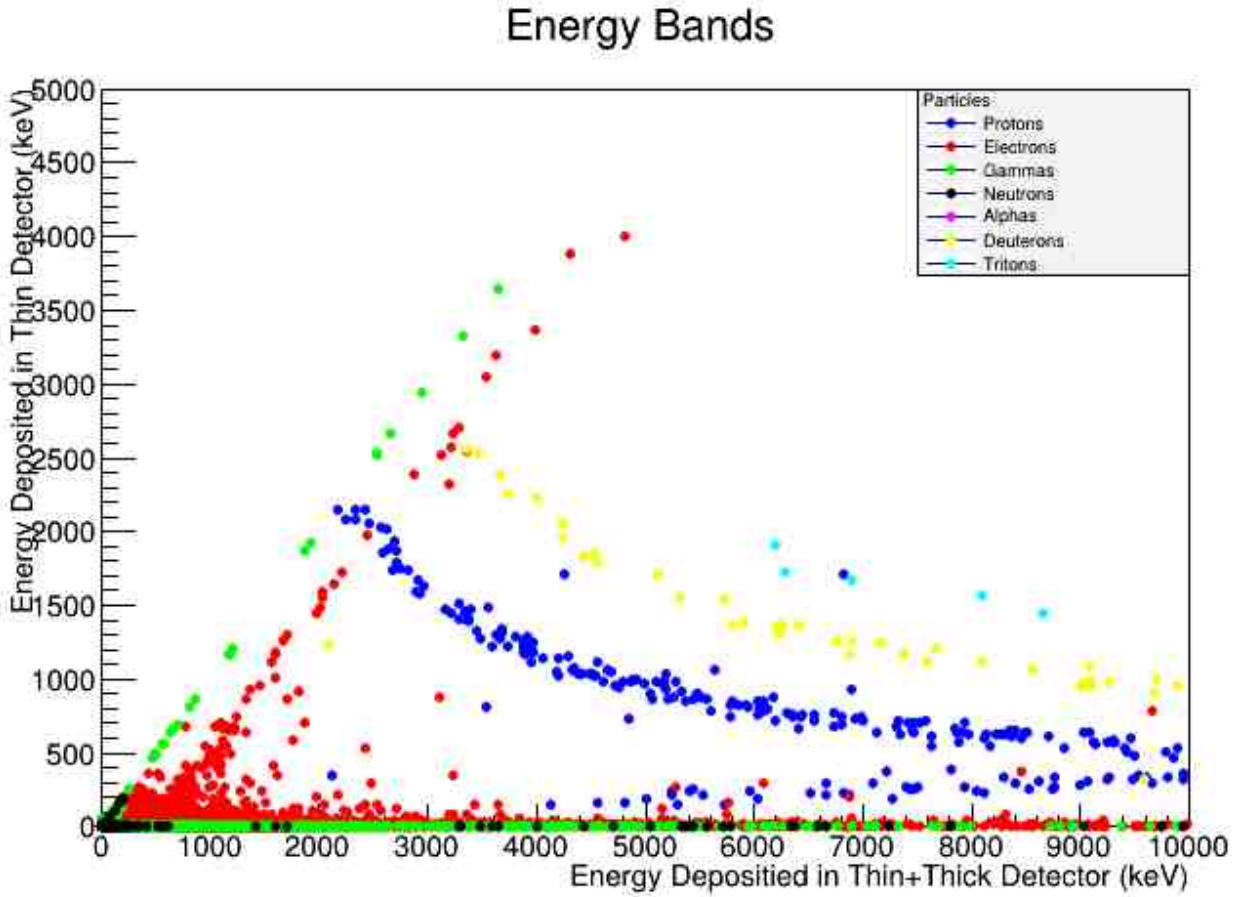
X-axis:
0. MuSC
1. Target
2. Veto
3. Thin upstream
4. Thick upstream
5. Veto upstream
6. Thin downstream
7. Thick Downstream
8. Veto downstream
9. Ge
10. Chamber
11. MuSCA
12. MuPC
14. Collimator

13,15,16 are invalid



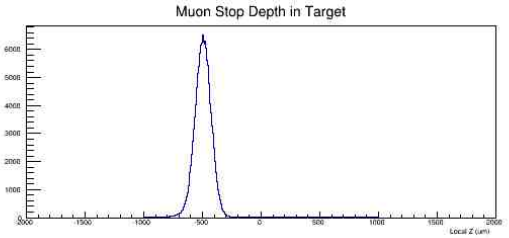


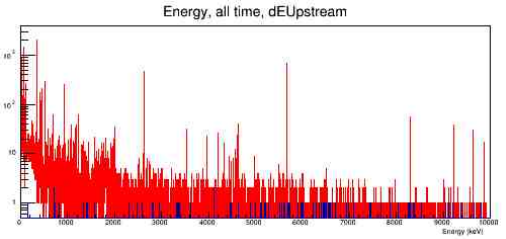
Can we tell the difference?

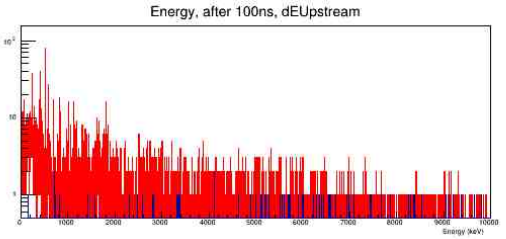


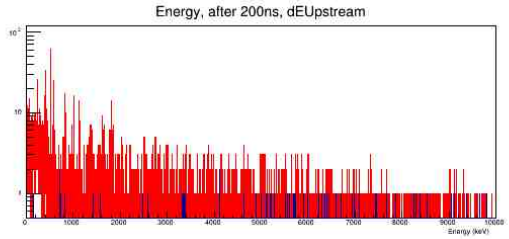
Difference between faces

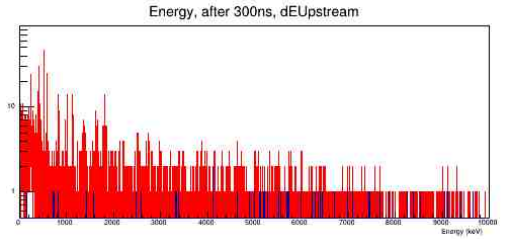
- If we lower the muons to stop nearer to the upstream face, we see what we'd expect

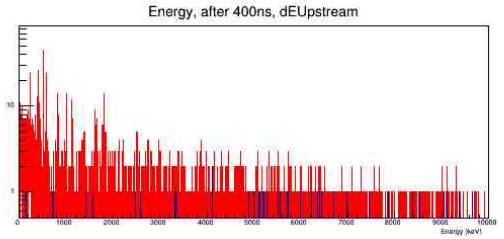


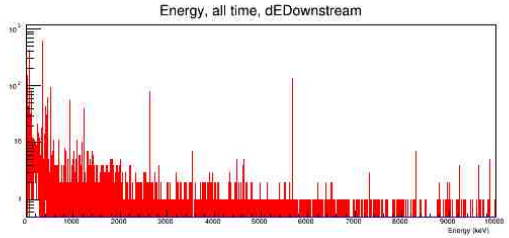


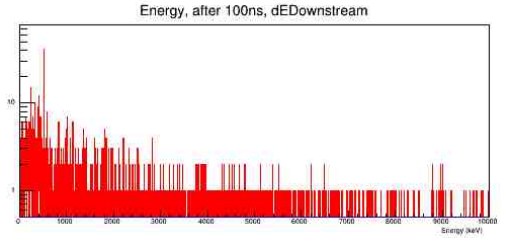


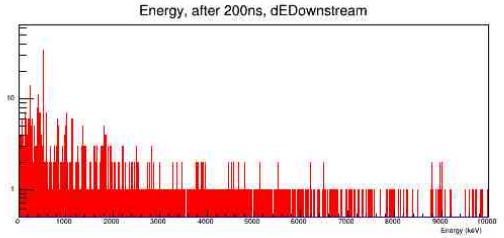


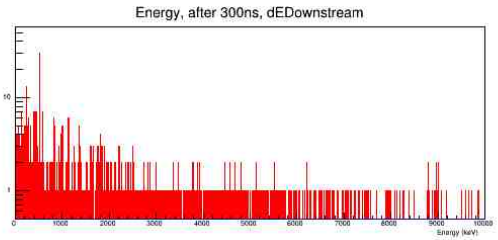


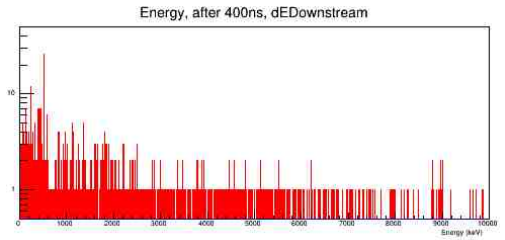












(Only 68% muons stop in target.)

Thin Target

- More noise from other locations?
- Combined with lower signal rate

To do...