C12 Form Factors in Beam generator simulations

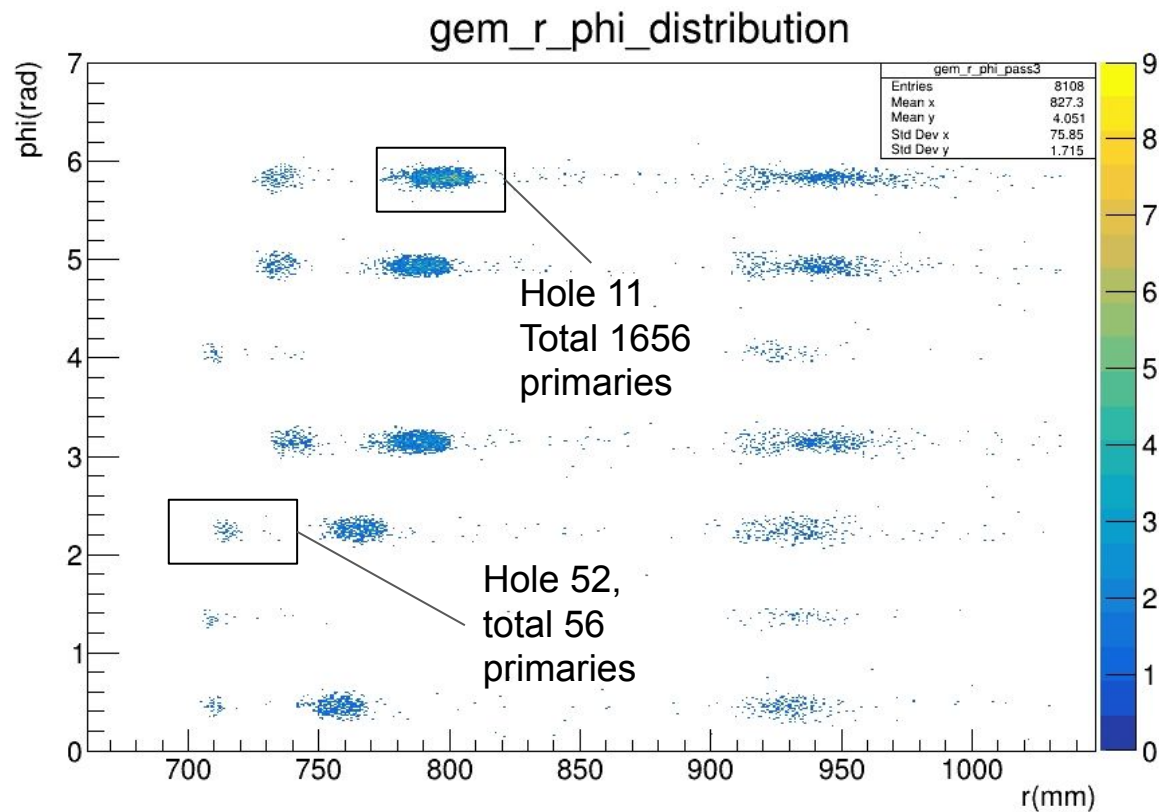Vassu Doomra, Stony Brook University

C12 form factors

The idea is to look at two holes: one at a smaller radius and one at a much larger radius and run the simulation with both beam and C12 generator.

We have chosen holes 11 (39 mm radial location) and 52 (75 mm radial location) for this study.

$$\frac{\text{Counts from 52 per e on target}}{\text{Counts from 11 per e on target}}$$

We are gonna compute this ratio with beam generator (in which case it's just the absolute number of counts) and with the C12 generator (in which it will be the rate weighted counts)

gem_r_phi_distribution

gem_r_phi_pass3	
Entries	8108
Mean x	827.3
Mean y	4.051
Std Dev x	75.85
Std Dev y	1.715

Hole 11
Total 1656
primaries

Hole 52,
total 56
primaries

Beam generator with pass 3. Only the DS C foil has been used in the optics1 target to produce this plot. To get some meaningful statistics 5.97 Billion beam generator events were simulated.

Pass 3 has been chosen for the sake of easily distinguishing between the eC12 and the moller events.

56 / 1656 = 0.0338164

gem_r_phi_distribution
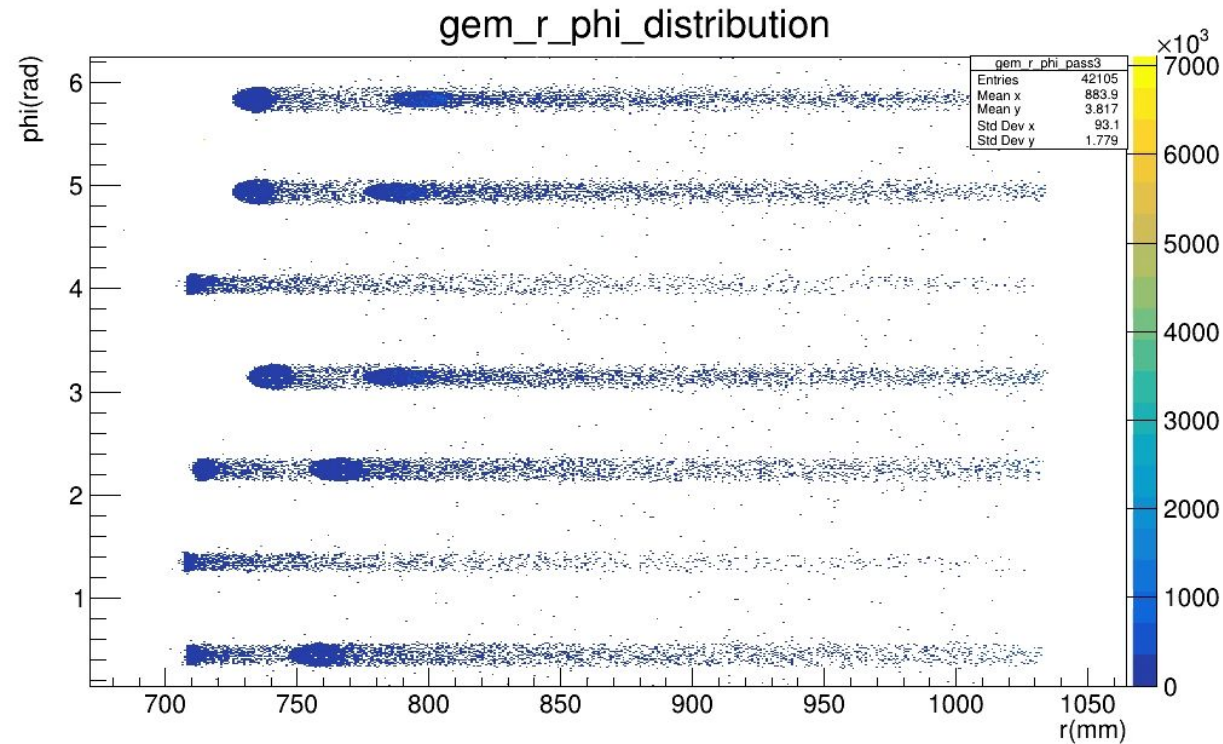
5 Million events were simulated with the C12 elastic generator with only the optics 1DS C foil.

Simple r and φ cut in this case is not gonna work because the system is highly populated here.

So I had to make the hole selection. And since the hole selection is manual there is some uncertainty associated with this calculation.

Rate weighted Counts from Hole 52 = 4792279.6 $\pm$ 33430.0071

Rate weighted Counts from Hole 11 = 1.379e8 $\pm$ 1.286e6

Ratio = 0.0347452 $\pm$ 0.000405

Seems like the C12 form factors are taken into account when we run a beam generator simulation.