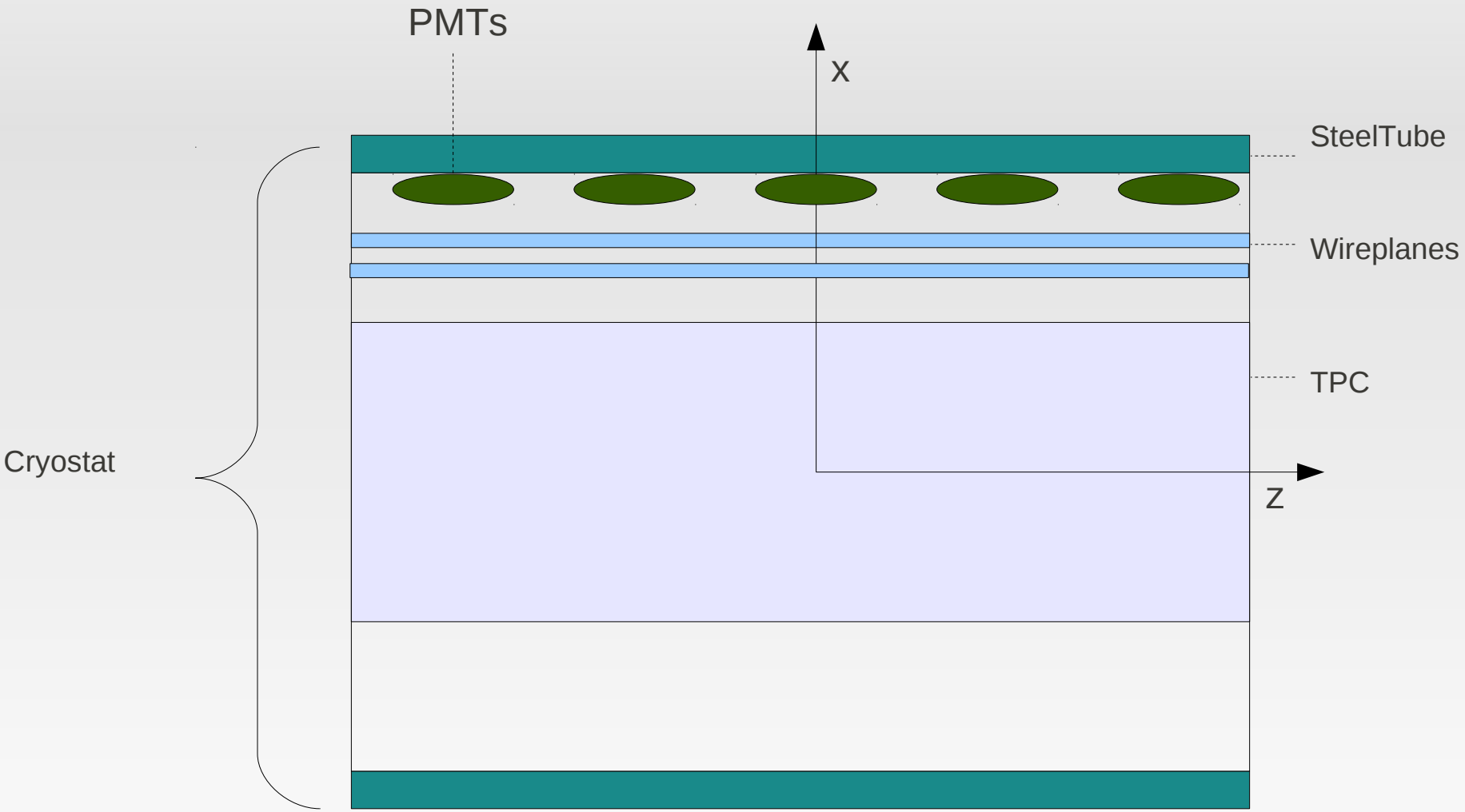
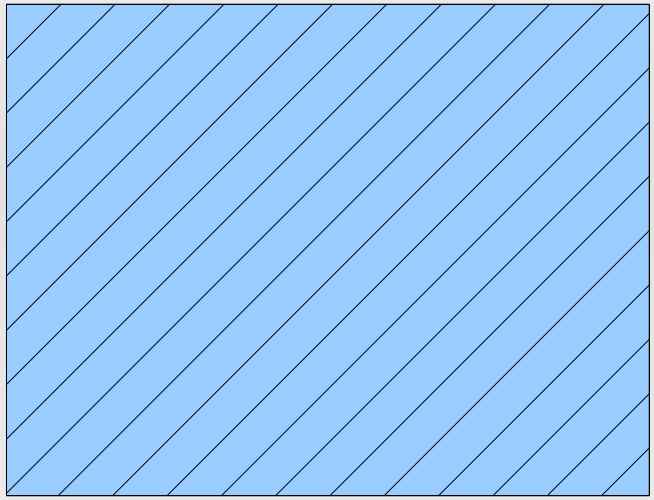
Optical MC Update 07/22/10

Ben Jones, MIT

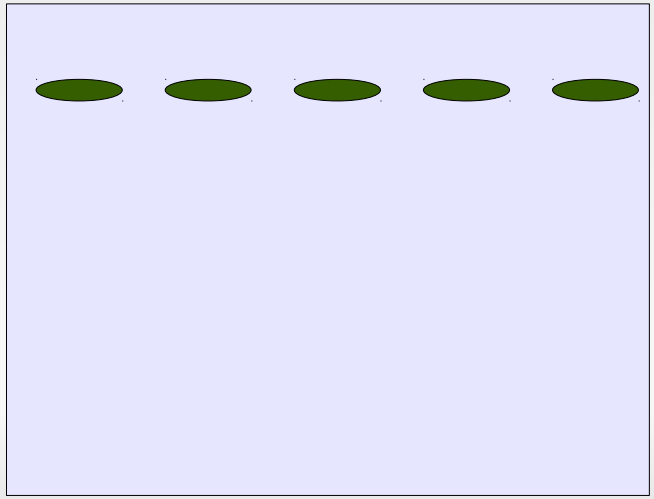
PMT Placement



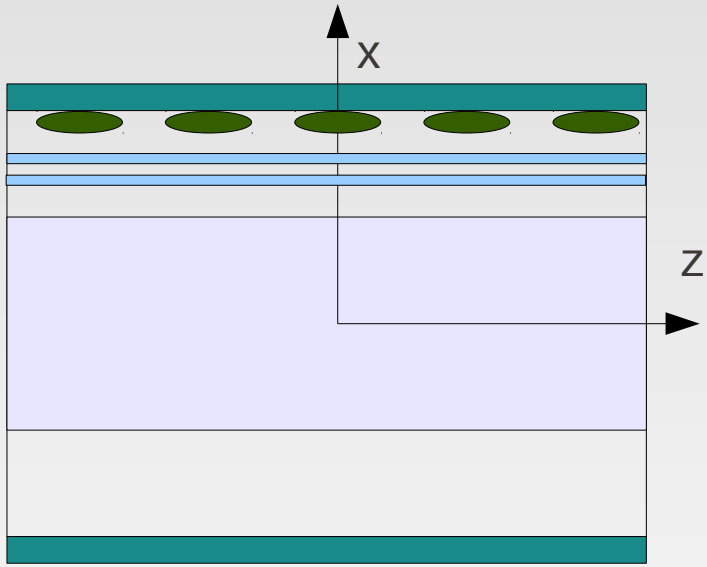
PMT Placement



Build fragment with wires using
gen_microplane.C
gen_microvertplane.C



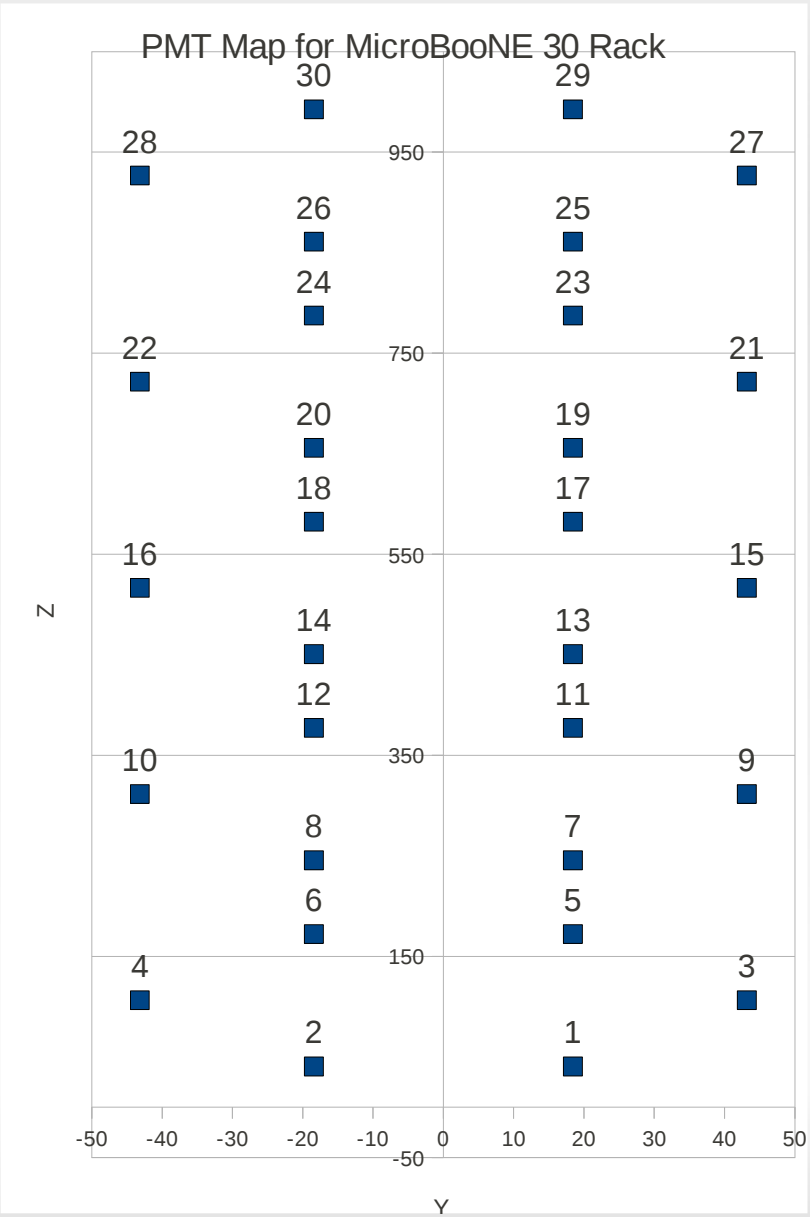
Place PMTs in the cryo volume using
gen_cryostat.C



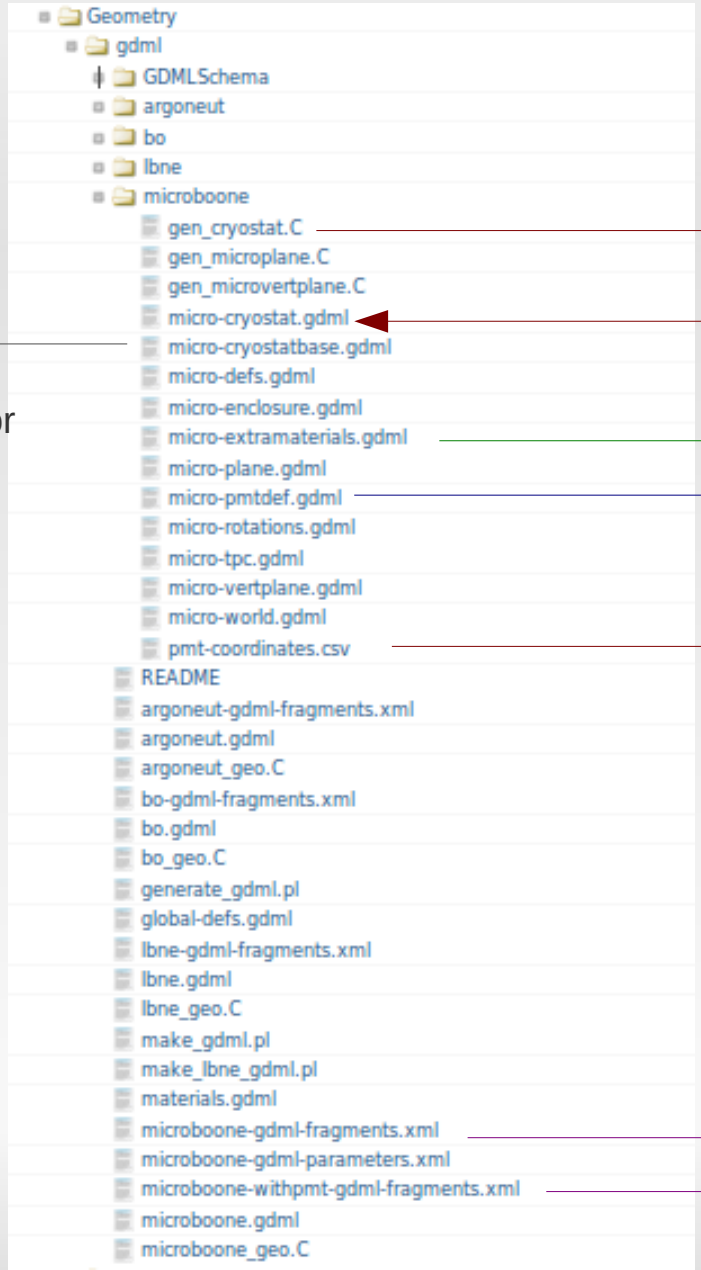
Zip everything together, including material definitions, etc using
make_gdml.pl

30Rack Placement (Thanks to Tess Smidt!)

PMT ID	x	y	z	phi
0	142.2	18.42	40.53	7.5
1	142.2	-18.42	40.53	-7.5
2	136.5	43.18	106.36	17.5
3	136.5	-43.18	106.36	-17.5
4	142.2	18.42	172.19	7.5
5	142.2	-18.42	172.19	-7.5
6	142.2	18.42	245.64	7.5
7	142.2	-18.42	245.64	-7.5
8	136.5	43.18	311.47	17.5
9	136.5	-43.18	311.47	-17.5
10	142.2	18.42	377.3	7.5
11	142.2	-18.42	377.3	-7.5
12	142.2	18.42	450.74	7.5
13	142.2	-18.42	450.74	-7.5
14	136.5	43.18	516.57	17.5
15	136.5	-43.18	516.57	-17.5
16	142.2	18.42	582.4	7.5
17	142.2	-18.42	582.4	-7.5
18	142.2	18.42	655.85	7.5
19	142.2	-18.42	655.85	-7.5
20	136.5	43.18	721.68	17.5
21	136.5	-43.18	721.68	-17.5
22	142.2	18.42	787.51	7.5
23	142.2	-18.42	787.51	-7.5
24	142.2	18.42	860.95	7.5
25	142.2	-18.42	860.95	-7.5
26	136.5	43.18	926.78	17.5
27	136.5	-43.18	926.78	-17.5
28	142.2	18.42	992.61	7.5
29	142.2	-18.42	992.61	-7.5



PMTs in the Geometry Package



micro-cryostatbase.gdml
PMT free cryostat, for building a PMT free geometry

gen_cryostat.C
Build the cryostat containing placed PMTs according to ***pmt-coordinates.csv***

micro-extramaterials.gdml
Extra materials required for description of PMT's (TPB etc)

micro-pmtdef.gdml
The geometrical description of an individual PMT including positioning of the sensitive lens

microboone_gdml_fragments.xml
Configuration for zipping together fragments of detector without PMTs

microboone_withpmt_gdml_fragments.xml
Configuration for zipping together fragments of detector with PMTs

Geometry Problems

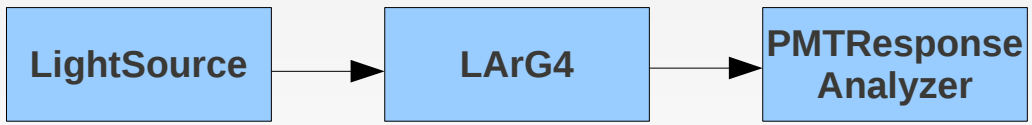
- 1) Cryostat and TPC are the wrong length
- 2) No field mesh
- 3) No TPC support struts

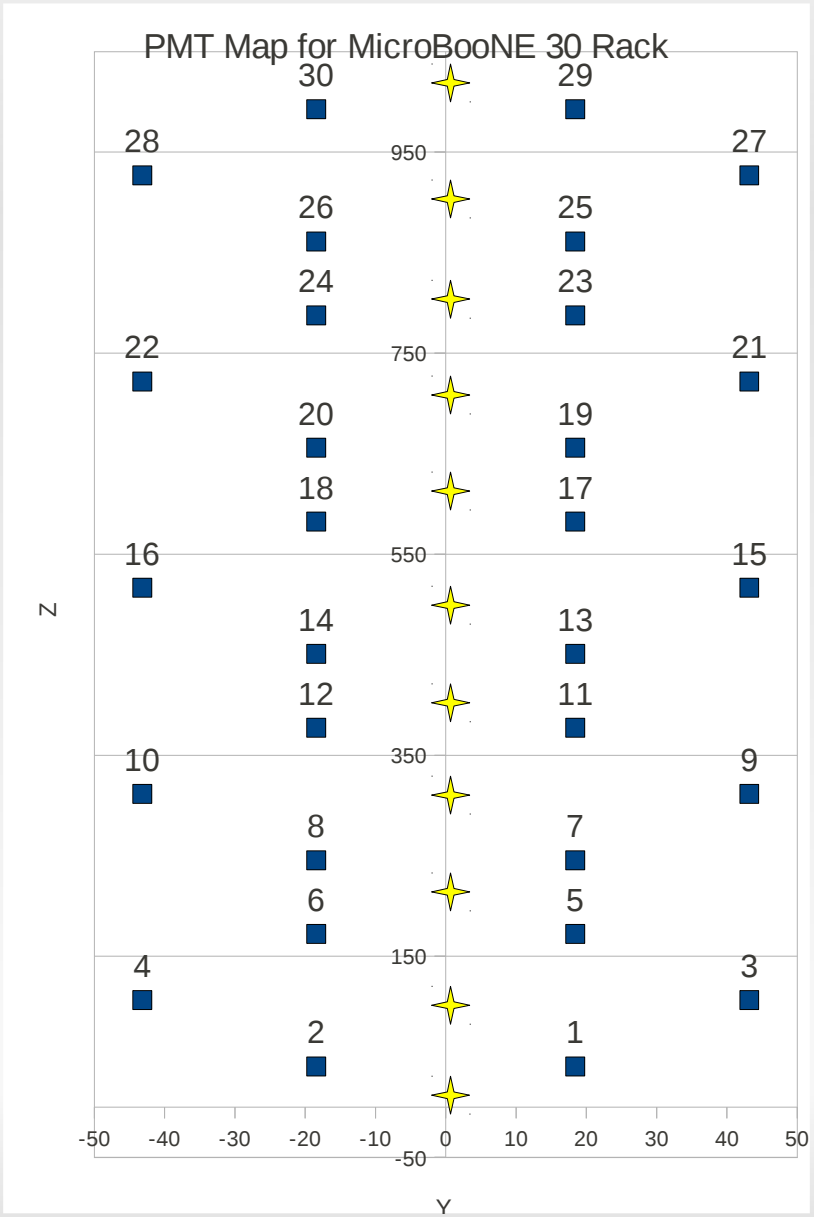
All of these mean that the results I am about to show are very, very preliminary!

Expect 1 to improve photon yield, 3 and 4 to reduce it.

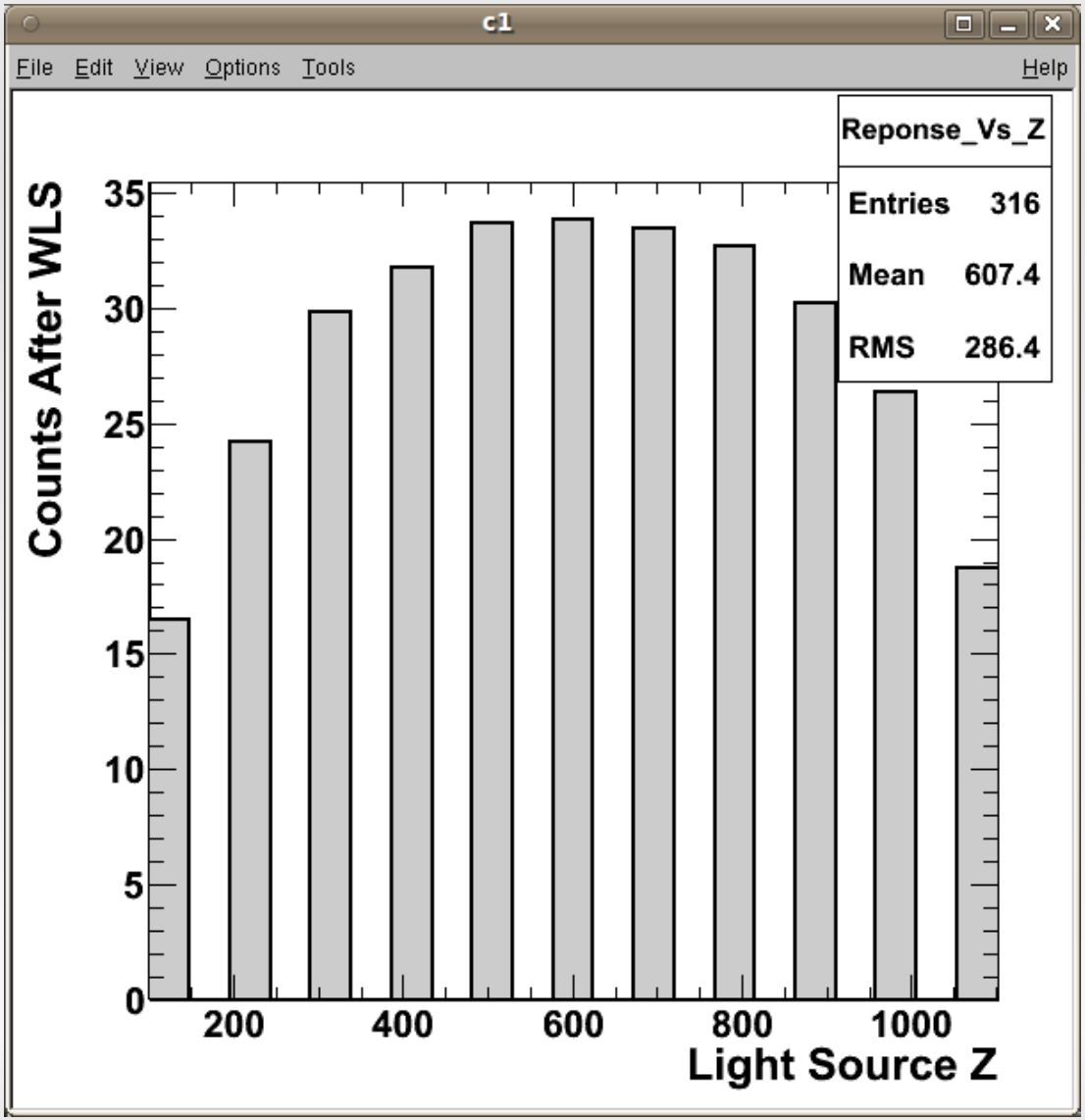
Reponse Test to Light Source

- Place point light sources at various points in the detector
- Run full simulation with photons corresponding to **5MeV scintillation** (120,000 photons)
- Count photons reaching PMT lens
- Note – PMTs here are naked with no wavelength cut, need to include WLS efficiency. In our TDR document, we estimate this to be 0.03.
- Until we have computing power to do more, we only consider on-axis points





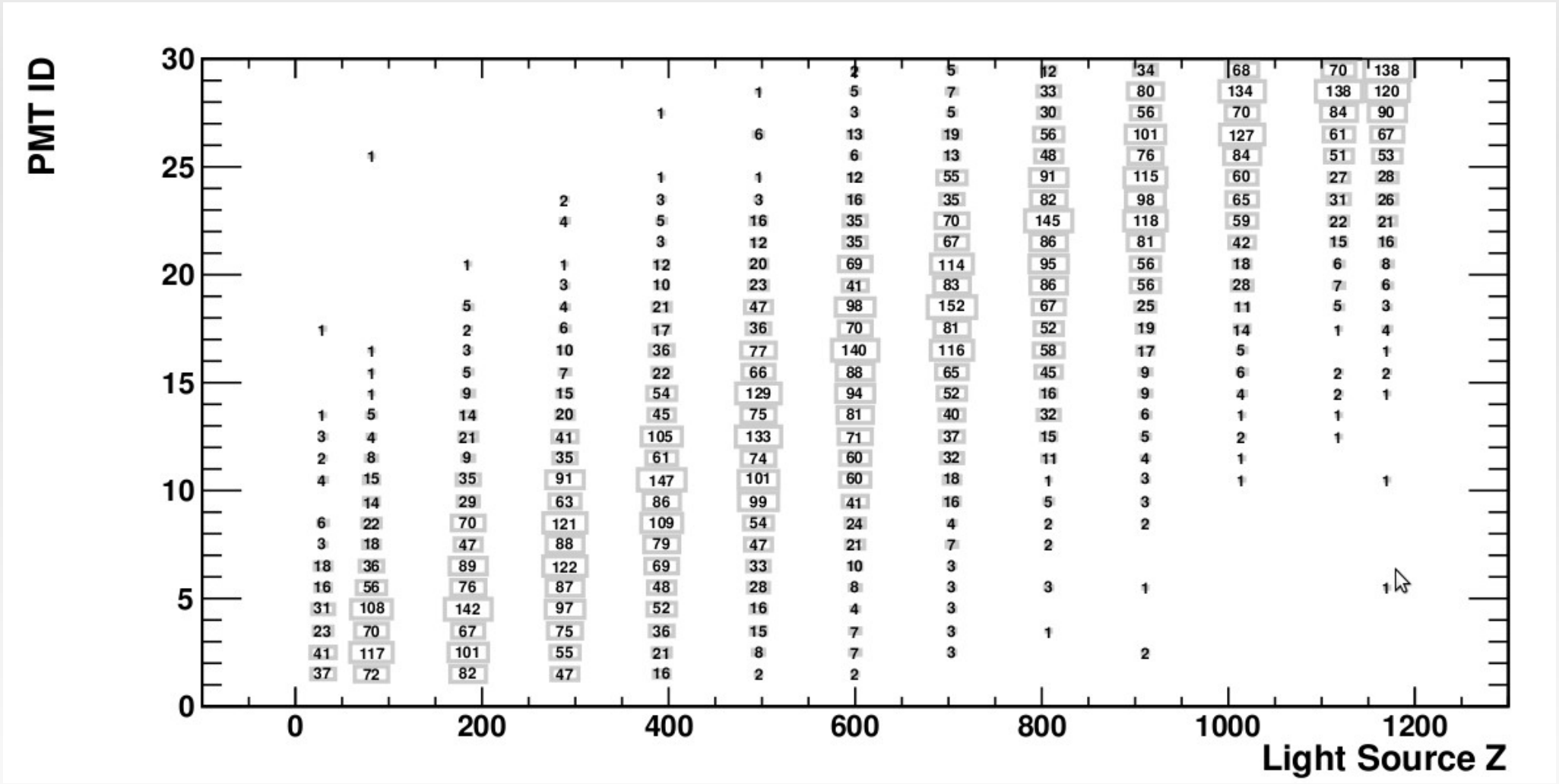
Point Source Response



1) All points on axis have at least 5 photoelectrons.
5MeV of scintillation light anywhere on axis should be triggerable.

2) Slight asymmetry
I don't understand this effect... it is probably because I don't quite have my coordinate system centred on the TPC origin.

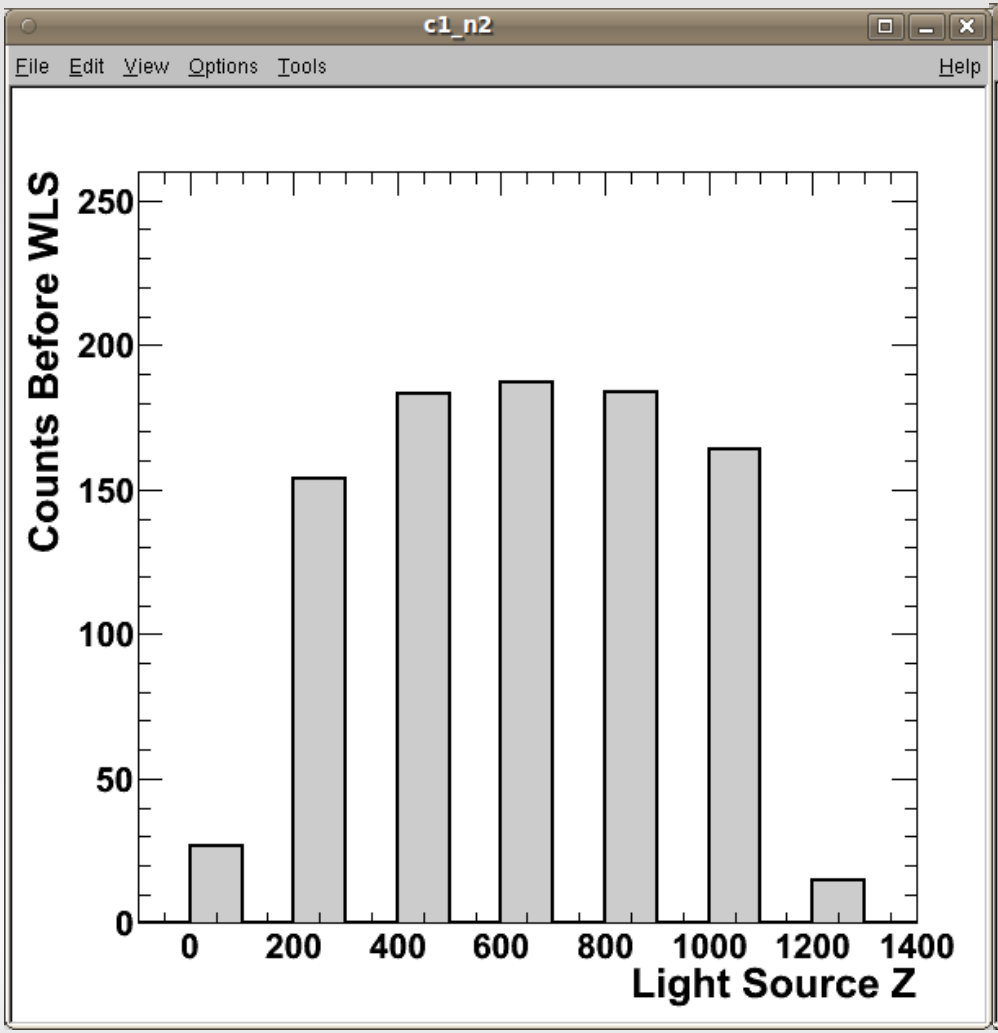
Point Source Response per PMT

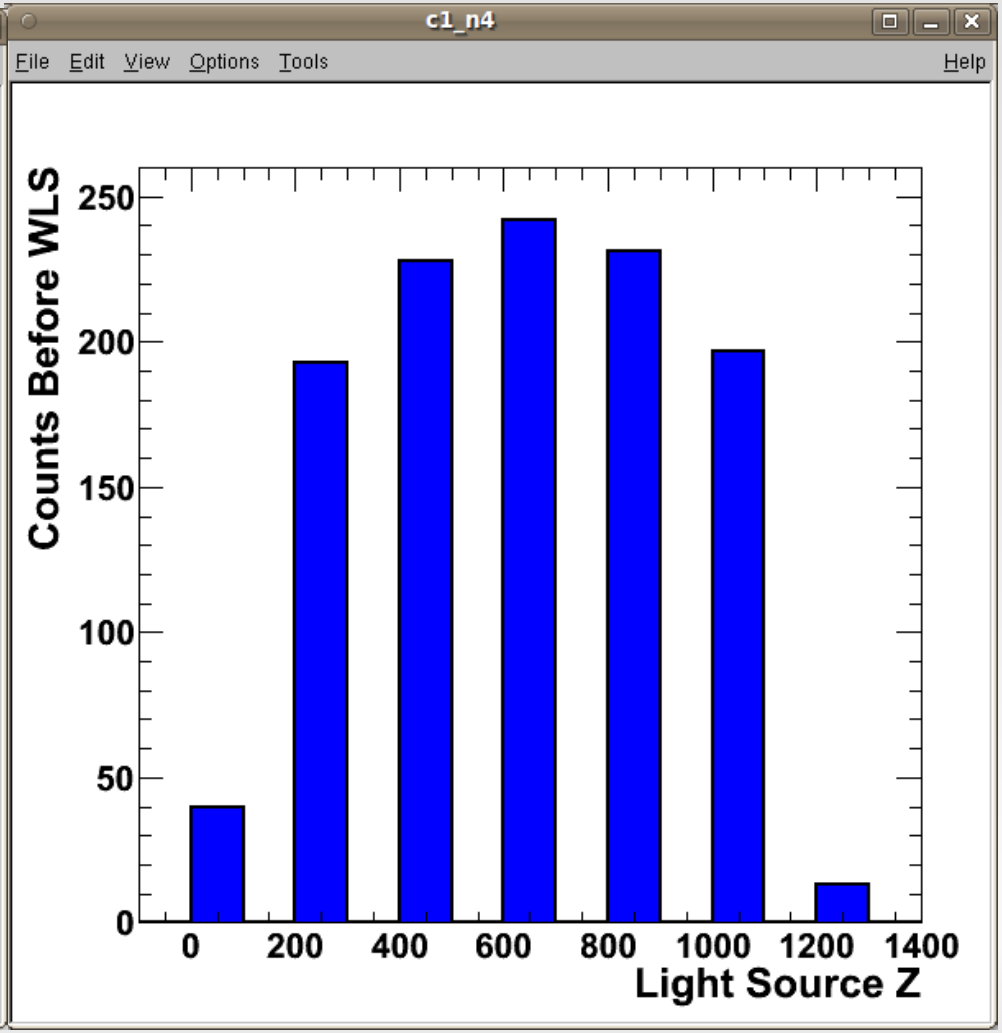


Redundancy – we can lose PMT signals and still trigger

Study of Effect of Wires

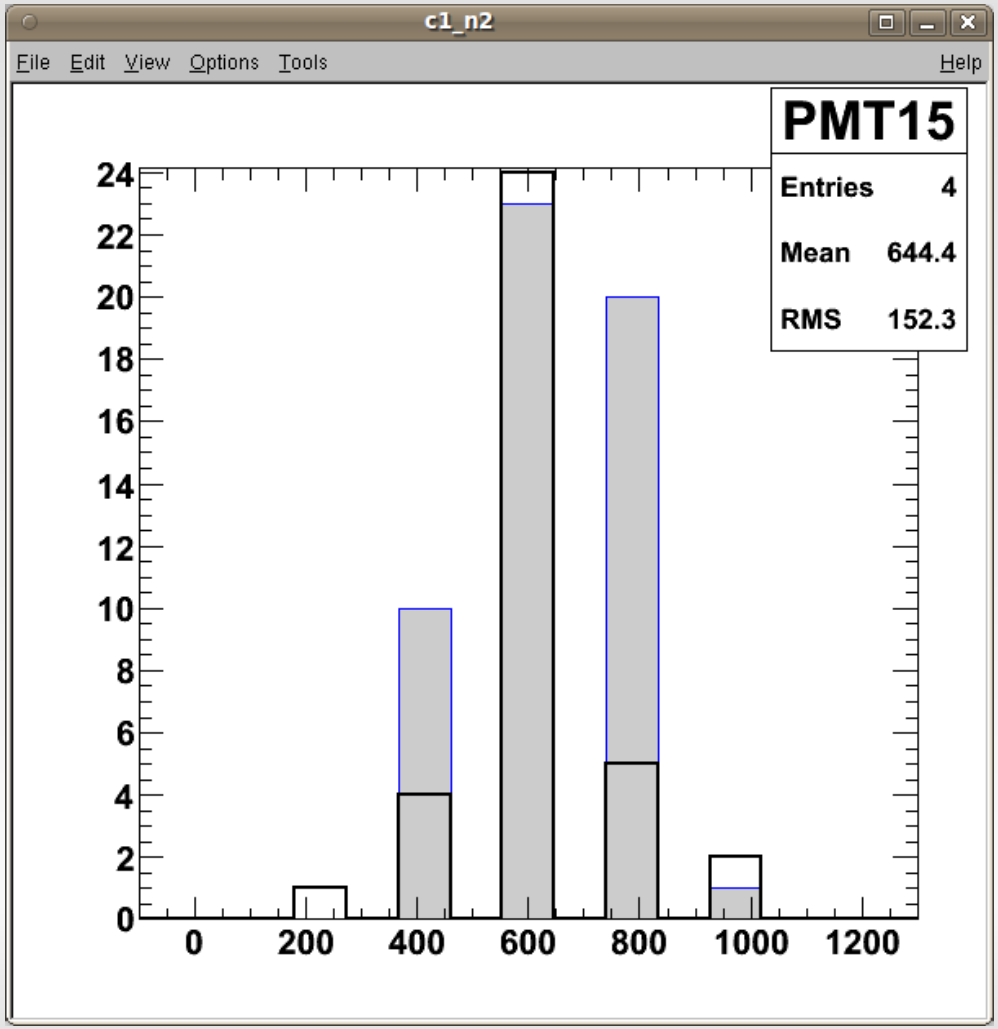
- Wires block ~20% of the light. Note the flattening...

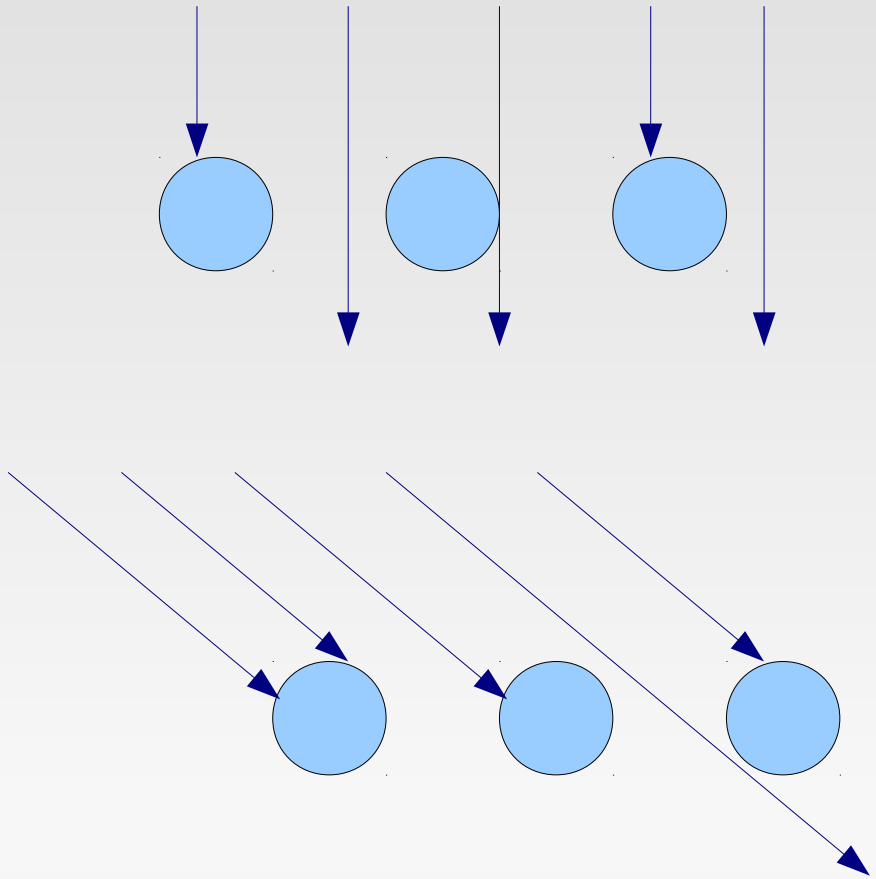




Study of Effect of Wires

- Considering only one central PMT – note that the large angle light is more strongly blocked. Explains the flattening on the previous slide.





Conclusions

- PMT placement has been made a part of the MicroBooNE geometry description
- PMT sensitive geometry has been parallelized. Removing photons from the voxel geometry has given a big boost in speed.
- Preliminary tests using point light sources are encouraging – maybe we can trigger as low as 5MeV!
- Wires appear to block ~80% of light and flatten the sensitivity distribution along Z.
- Problems with the existing geometry mean that we can't really trust anything in these studies yet, but its nice that things work!