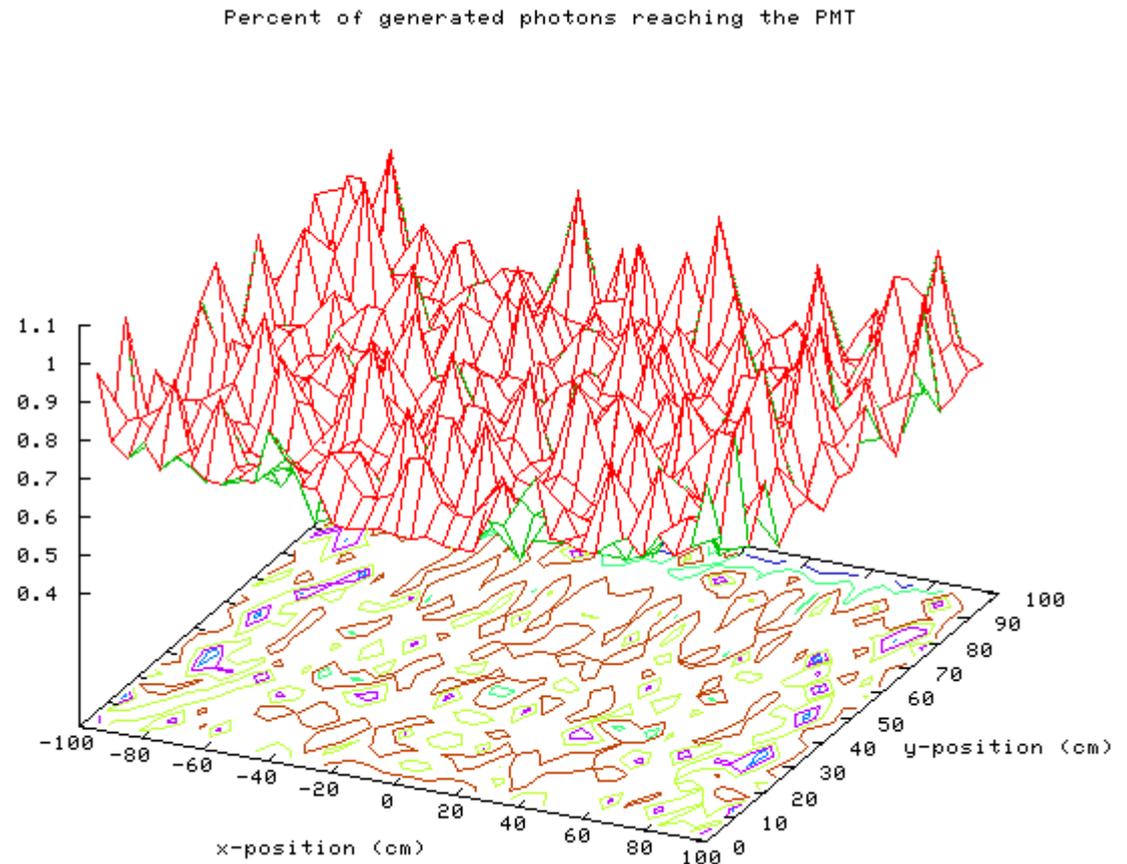


Preradiator Simulation with Geant4 October 8, 2004

- We are simulating the entire 2m by 2m scintillator slab using 125MeV e⁻.
- Due to the size of the scintillator and the number of objects (fibers, claddings, et cetera) being simulated the run time per event is large.
- The report represents the simulation of 1300 e⁻.
- Due to symmetry relationships, only one quarter of the scintillator was illuminated and then the other three quarters were filled in during post-processing. The graphs in this report were generated using the post-processed 5,200 e⁻.

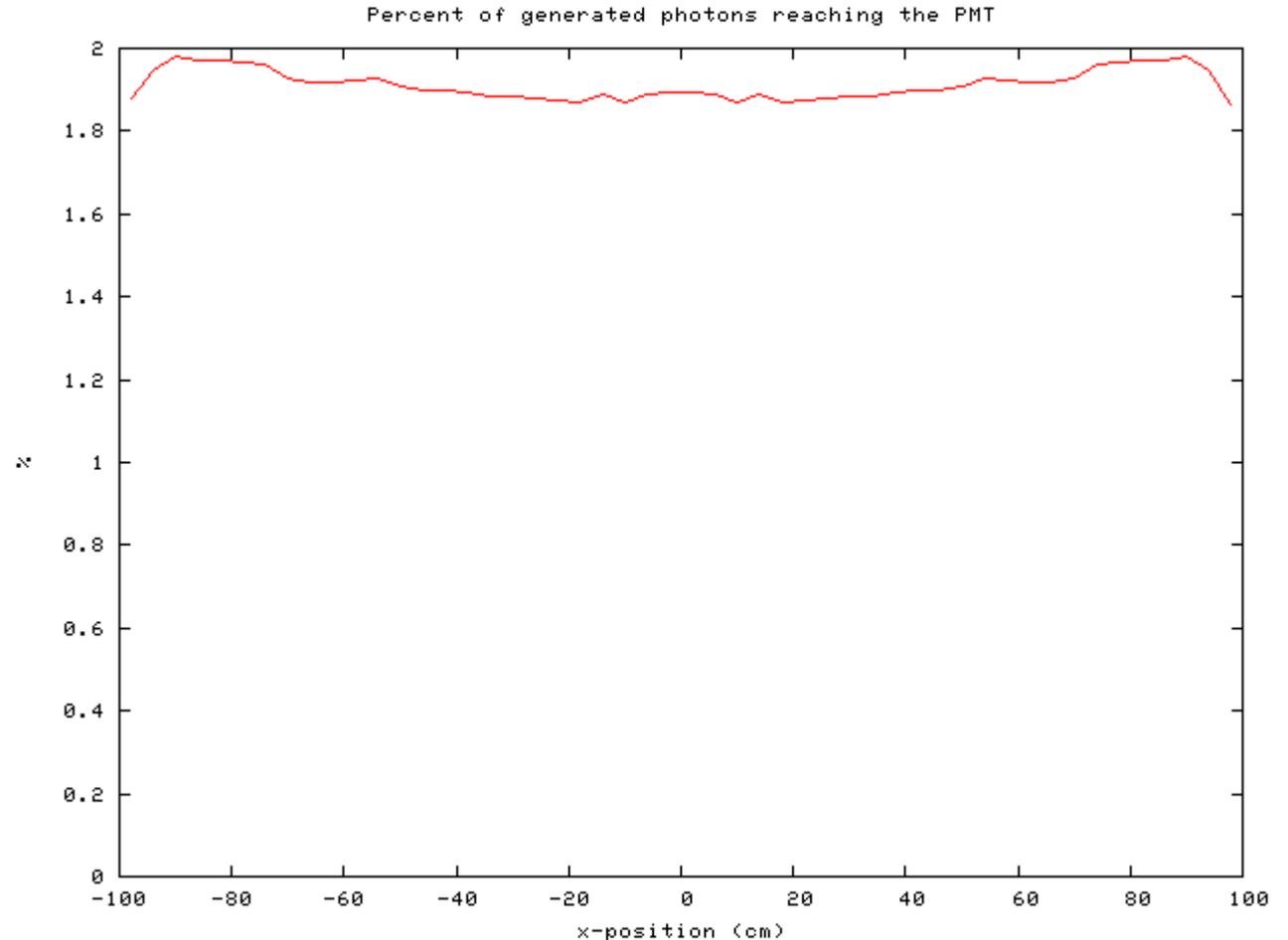


Geometry

- 2m x 2m x 8mm scintillator
- Scintillator is coated with a reflective paint on all sides.
- 192 fibers are spaced 1.05cm apart placed in square, extruded holes centered in the scintillator.
- The fibers extend 25cm past the ends of the scintillator.
- The best available data on the titanium dioxide paint, BC404 scintillator, BCF-99 wave-length shifting fibers, and FEU-115M fibers was used.
- At the end of each fiber is a “PMT”. For the purposes of the simulation, tracking of the photons in the fibers is stopped once they reach a “PMT” region. In post-processing, the effects due to quantum efficiency and PMT response are calculated. A benefit is that the outputs due to having different fibers grouped to PMTs can be calculated during the much faster post-processing stage. (Changes to fiber groupings do not necessitate re-running the whole simulation.

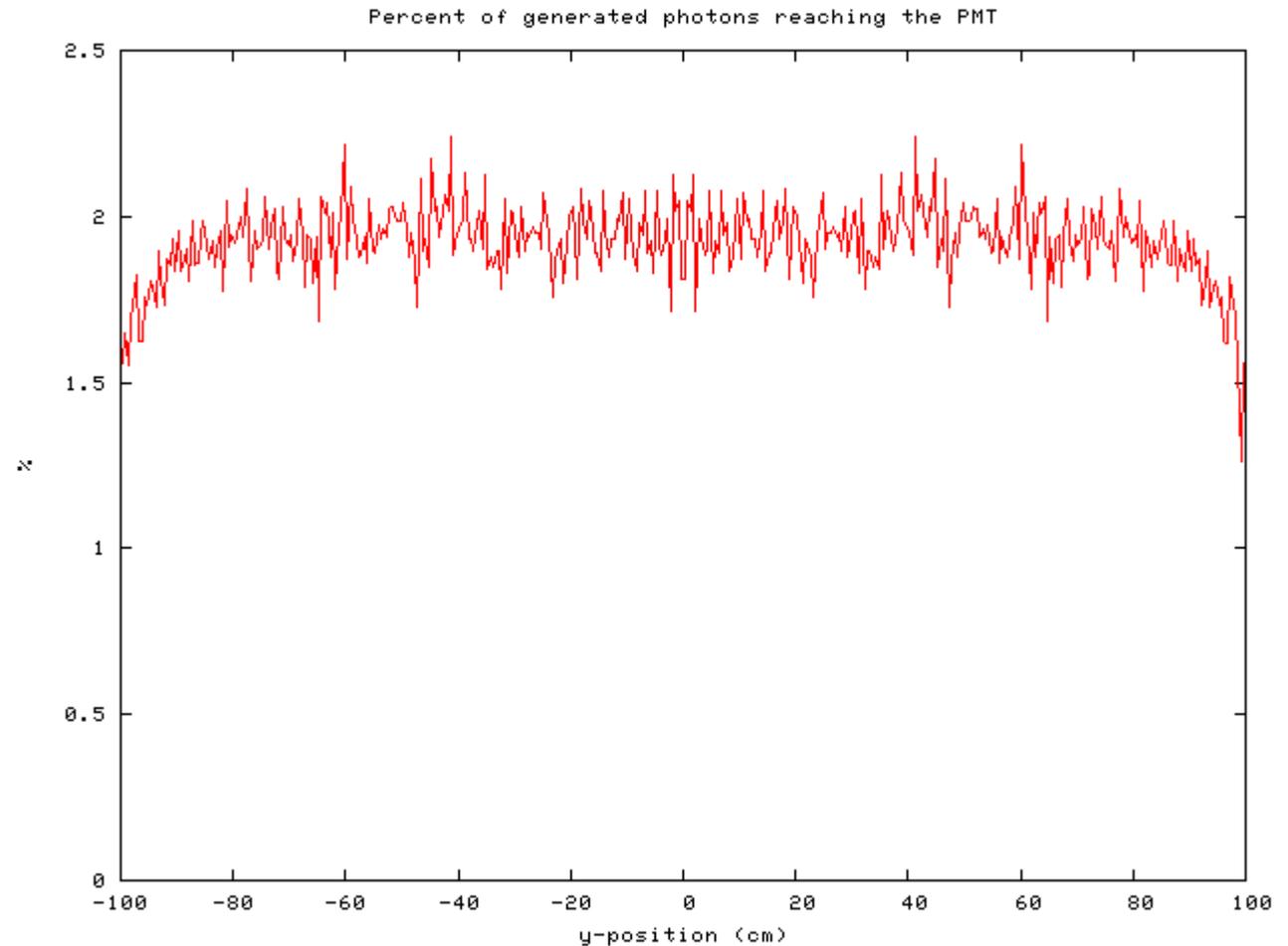
Percent of generated photons reaching the PMT “region”
as a function of position along the x-direction (parallel to the fibers).

- 4cm bins
- Efficiency dips slightly with distance from the PMTs.



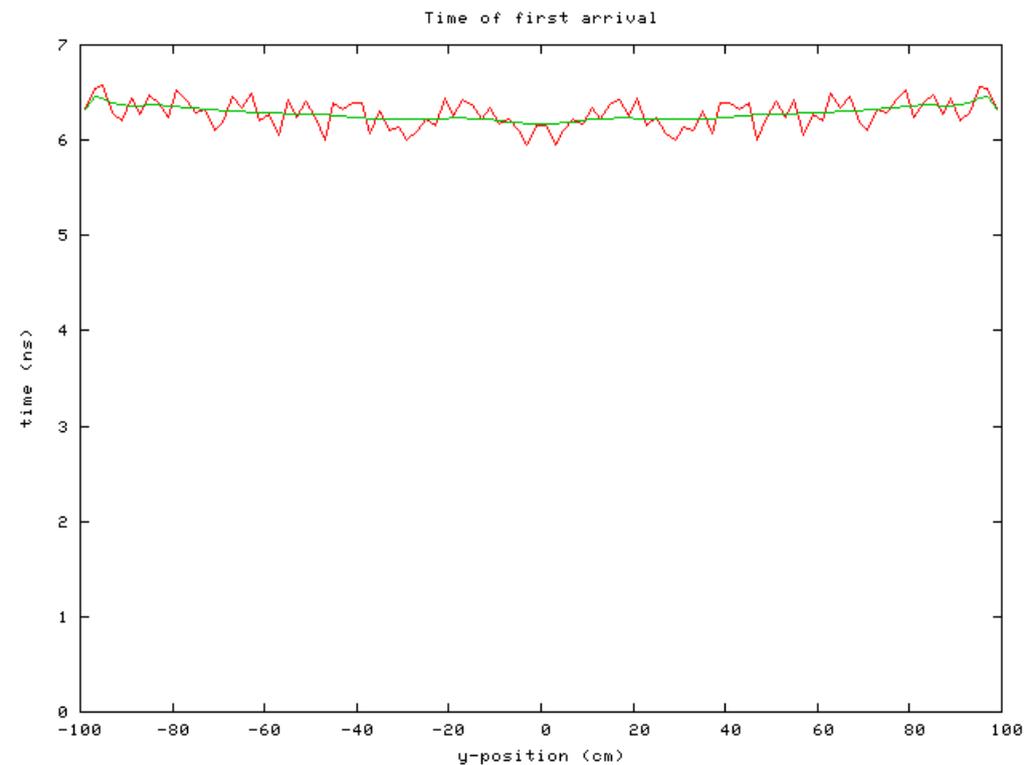
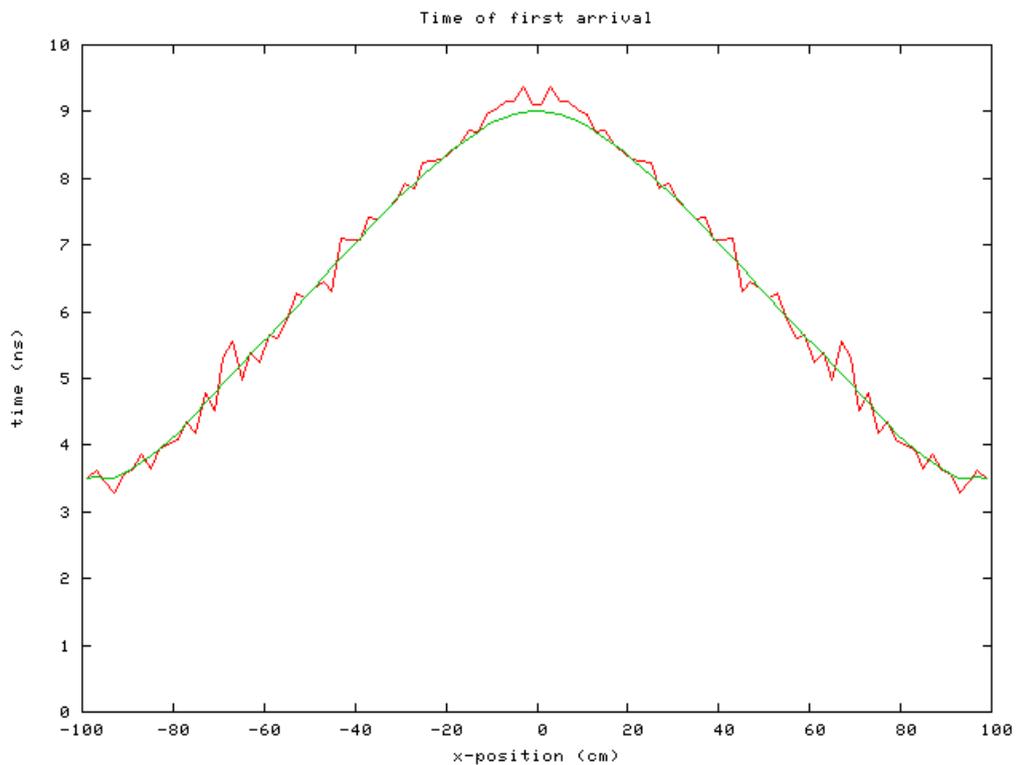
Percent of generated photons reaching the PMT “region”
as a function of position along the x-direction (parallel to the fibers).

- 5mm bin
- Efficiency drops at the edges of the scintillator.



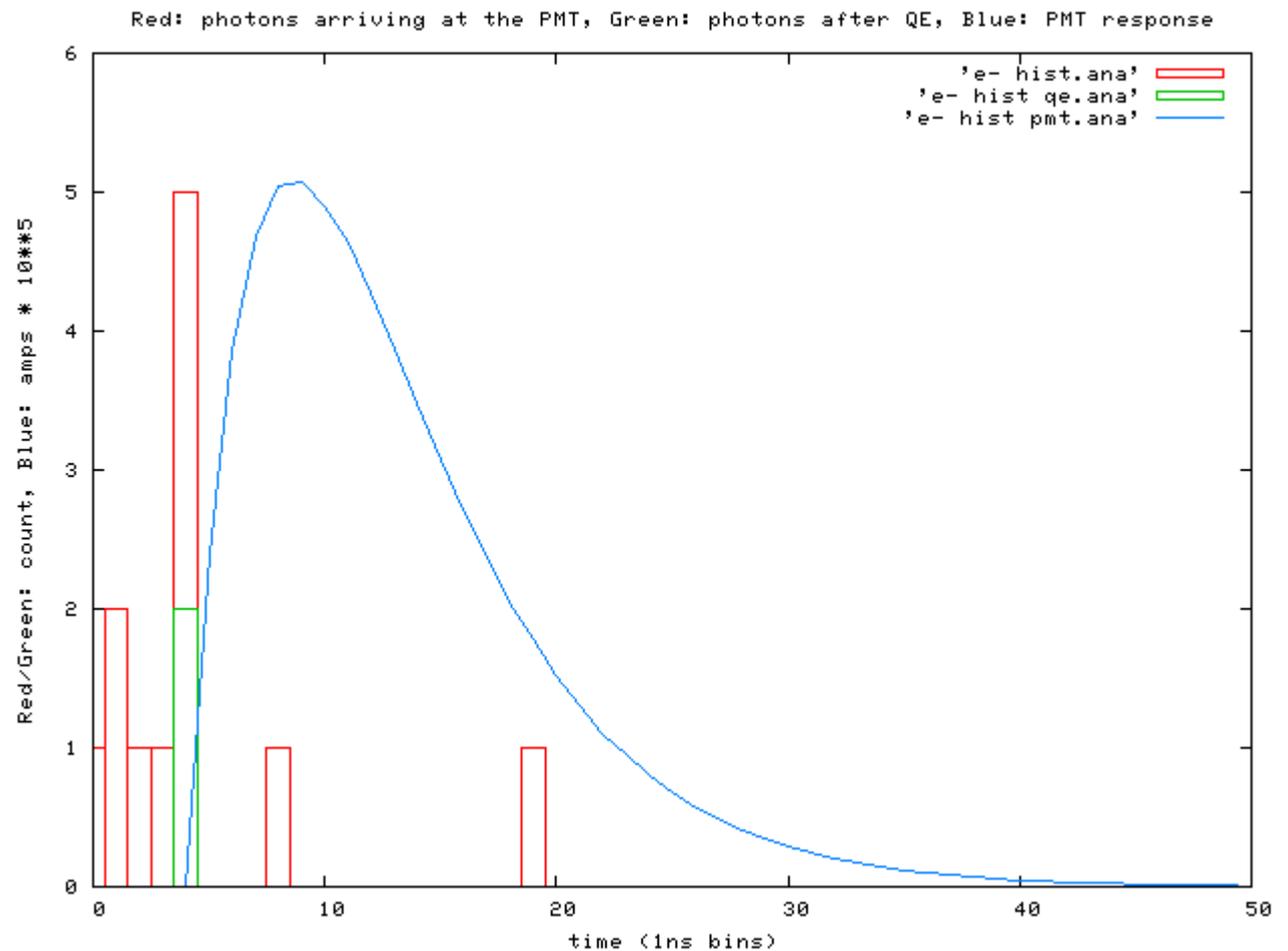
Time after the e- enters the scintillator that the first generated photon reaches a PMT

- There is a slight drop in arrival times towards the center of the scintillator with respect to the y-direction.
- The red points represent the actual data. A green bezier-smoothed trendline is also shown..



PMT Response Single Photon

- This graph shows the PMT response for a single photon (after quantum efficiency).
- Red - The number of photons reaching the PMT
- Green - The number of photons after loss due to quantum efficiency
- Blue - The PMT response in amperes * 10^5 .



PMT Response Fiber 50

- Red - 20 photons reach the PMT
- Green - 3 photons are left after loss due to quantum efficiency
- Blue - The PMT response in $\text{amps} * 10^5$.

