PLUME Detector:

Geant4 Exploration 7

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Simulation Description

The beam is placed 5.0 cm from the quartz tablet at a fixed radius and it is released at $90°$ from the detector. For this study, one hundred thousand events are displayed for each fixed radius between $[0.0$ mm$, 5.0$ mm$]$ in order to perform an analysis of the detected photons.

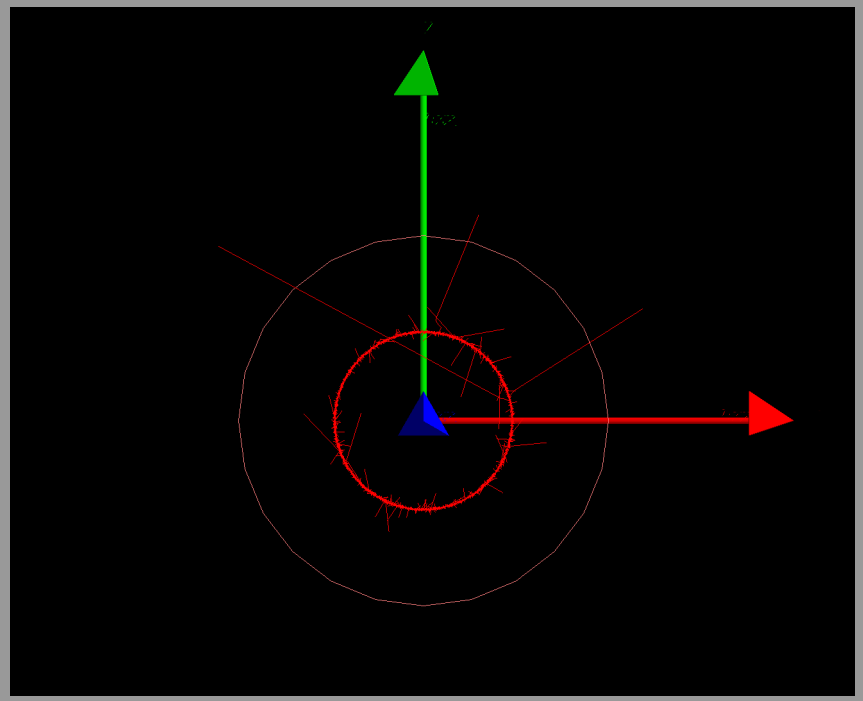

Figure 1: Detector visualization for fixed radius simulation.

Detected Position Normalization

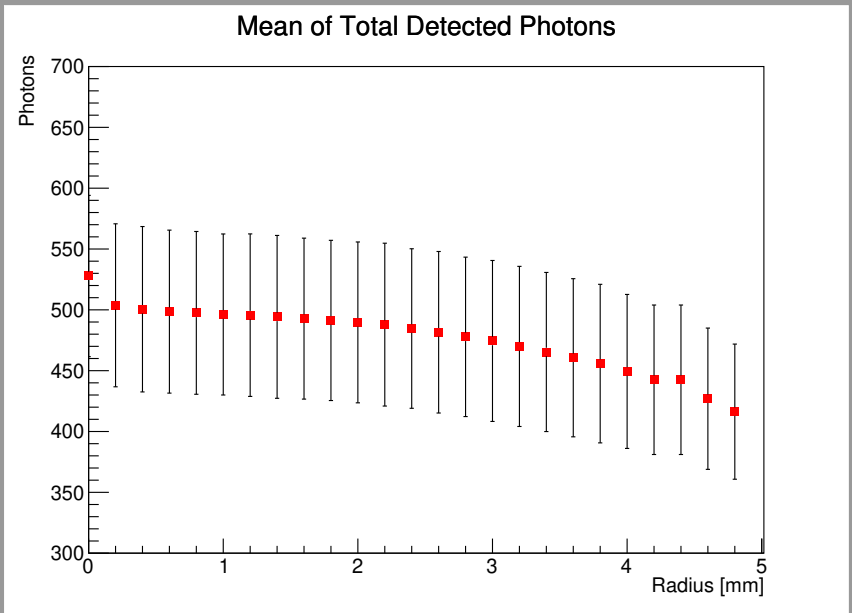

Figure 2: Mean distribution of detected photons in dependence of entrance position.

Figure 2 illustrates the mean of photons that are detected for a certain radius of the primary electron position.

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Simulation Description

The beam is placed 5.0 cm from the quartz tablet at a fixed radius between $[0.0$ mm$, 0.4$ mm$]$ and it is released at $90°$ from the detector. For this study, one hundred thousand events are displayed for a variation of the range between $[0.0$ mm$, 5.0$ mm$]$ in order to perform an analysis of the detected photons.

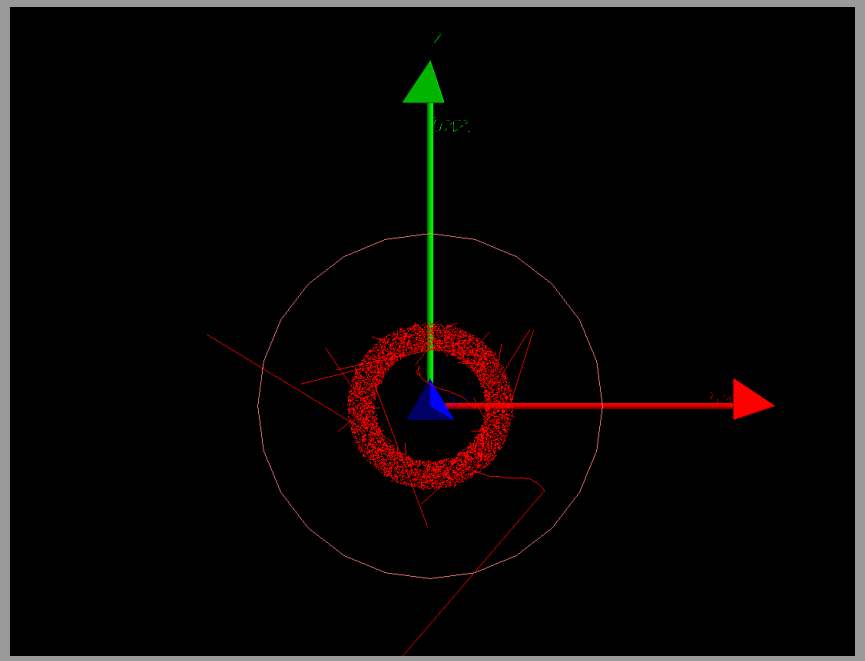

Figure 3: Detector visualization for radius range simulation.

Detected Position Normalization

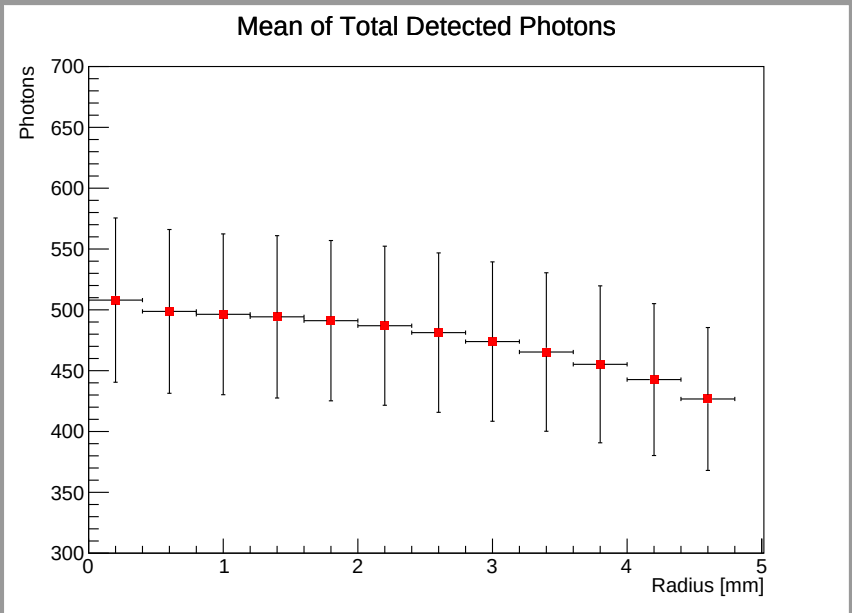

Figure 4: Mean distribution of detected photons in dependence of entrance position.

Figure 4 illustrates the mean of photons that are detected for a radius range of the primary electron position.

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Random Angle Beam

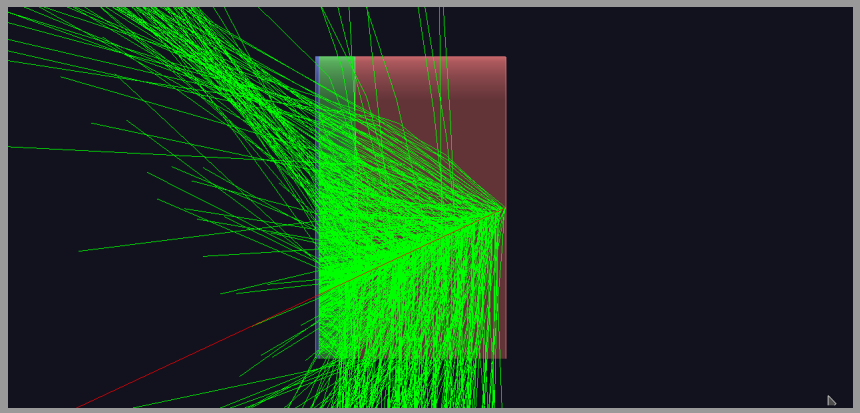

Figure 5: Beam starting at the beginning of the detector.

The primary particle is set at the beginning of the detector, and the momentum direction is configured so that the azimuthal angle varies from 0 to 60 degrees.

Base Line Analysis

We considered a baseline in which the primary particle is set at the beginning of the detector, hitting the detector perpendicularly. The we get 5 groups of data according the following azimuthal angle configuration.

1. $[0, 12)$
2. $[12, 24)$
3. $[24, 36)$
4. $[36, 48)$
5. $[48, 60)$

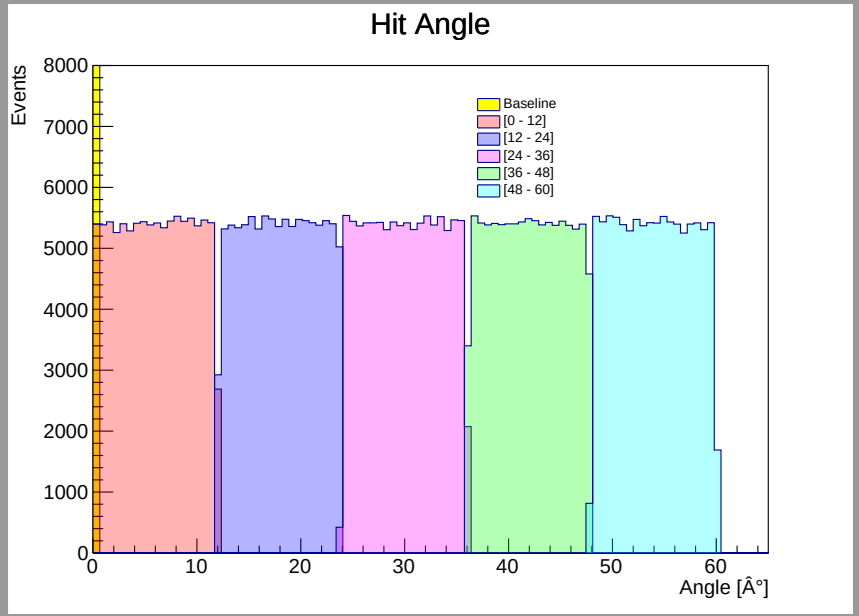

Figure 6: Number of detected photons vs radius.

Photons detection

This is the count of all the photons that reach the detector tablet (the last cylinder). When the hit angle increase, the peak move to the left.
The width and mean were difficult to understand and differentiate.

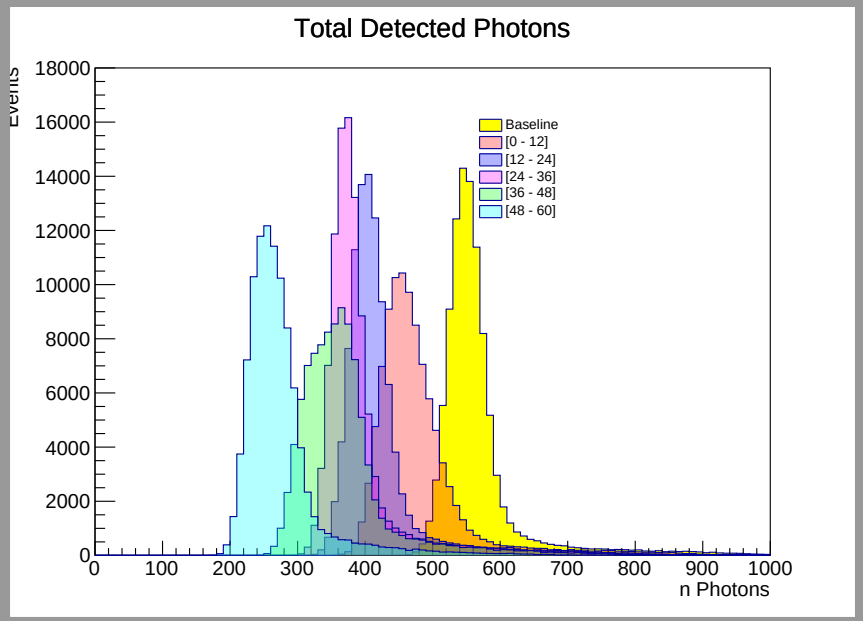

Figure 7: Number of detected photons vs radius.

Mean vs Angle

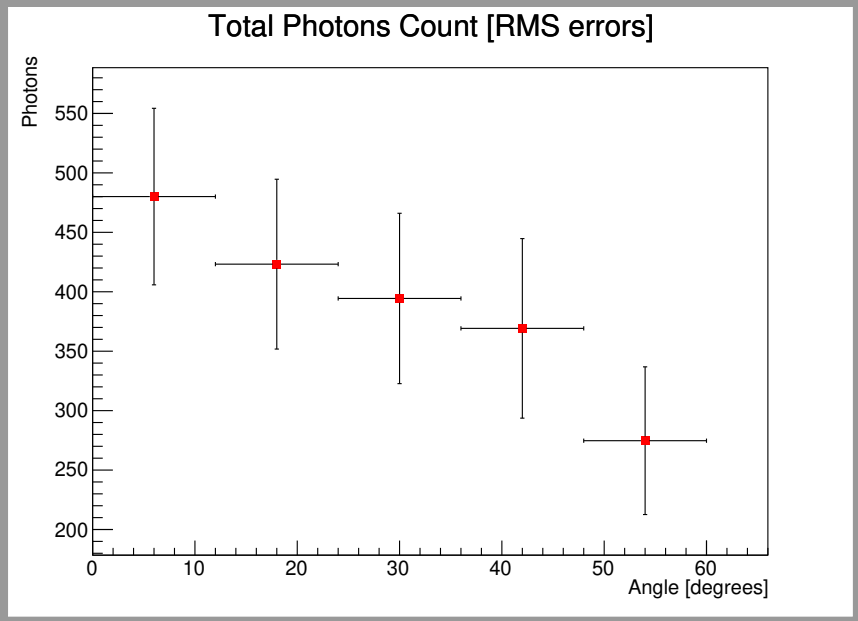

Figure 8: Mean number of detected photons vs hit angle.

We made a plot of the mean of each histogram vs the hit angle. The horizontal error bars indicates the ranges of the hit angle, while the vertical is the RMS for each histogram.

Fixed Hit Angle

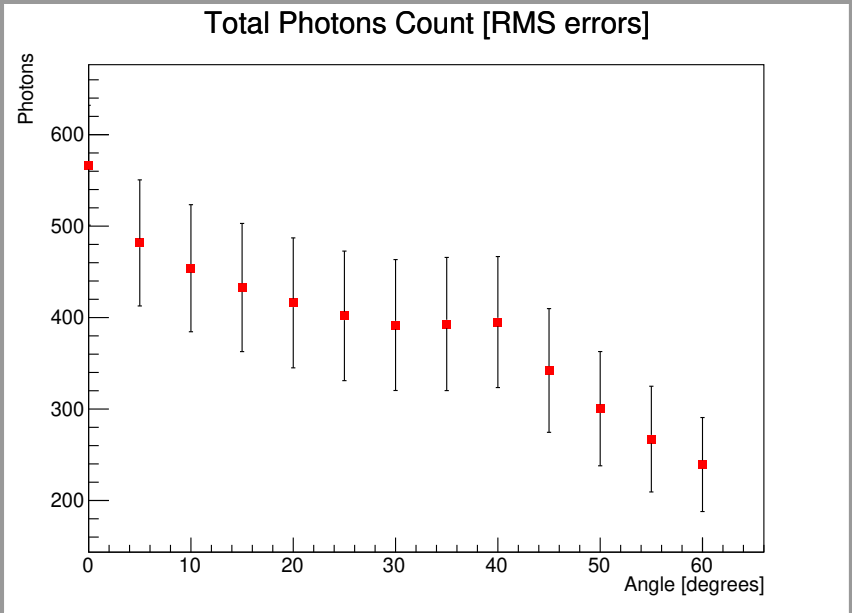

Figure 9: Mean number of detected photons vs hit angle.

To check the results we made the same simulation, but with fixed hit angles, from 0 to 60 degrees, in steps of 5 degrees.

Fixed Hit Angle Histograms