The PLUME Elementary Detection Module

Geant4 Exploration 8

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Construction of the Module

Module Composition

The elementary module is composed by three different coatings:

- Aluminium Cylindrical Shield
- Permalloy Shield
- Polyetheretherketone (Peek) Envelope

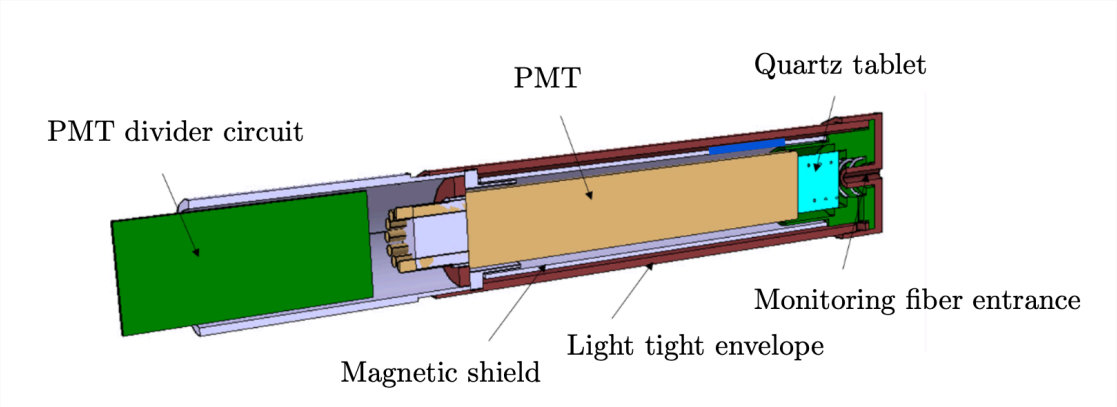

Figure 1: Sketch of the Elementary Detection Module from TDR.

Aluminium Shield

The cylindrical shield is incorporated based on the geometrical shape displayed in Figure 1.

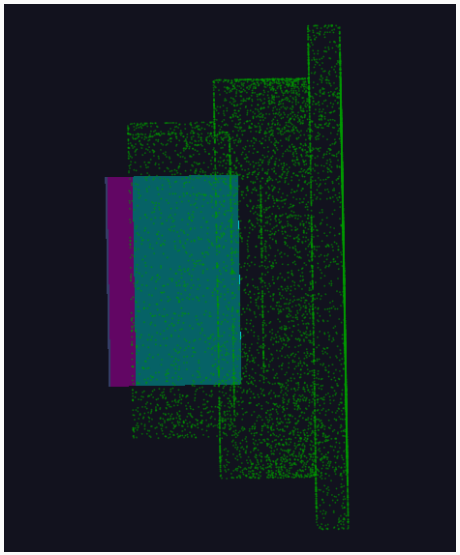

Figure 2: Sketch of the cross-sectional shape from the Aluminium Shield.

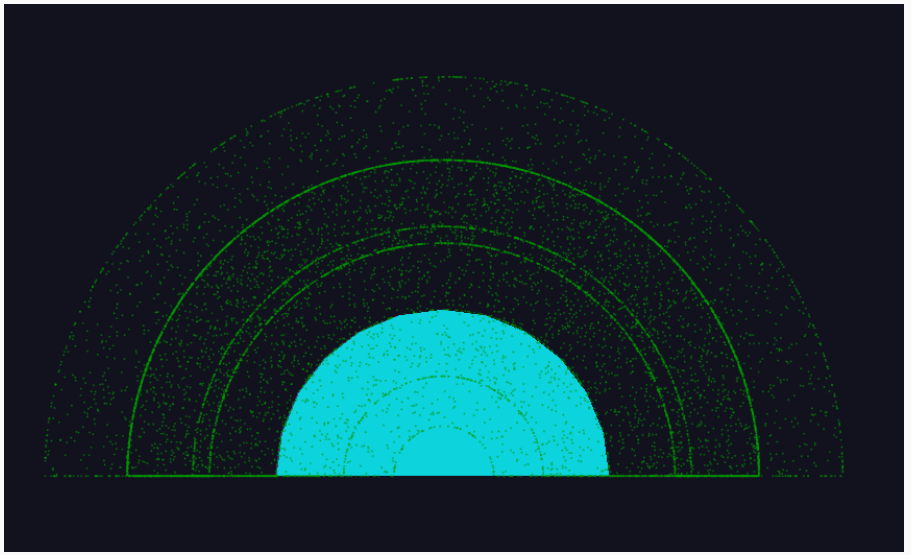

Figure 3: Sketch of the shape from the rear of the Aluminium Shield.

Permalloy Shield

The Permalloy shield is incorporated in order to reduce magnetic effects at the module location.

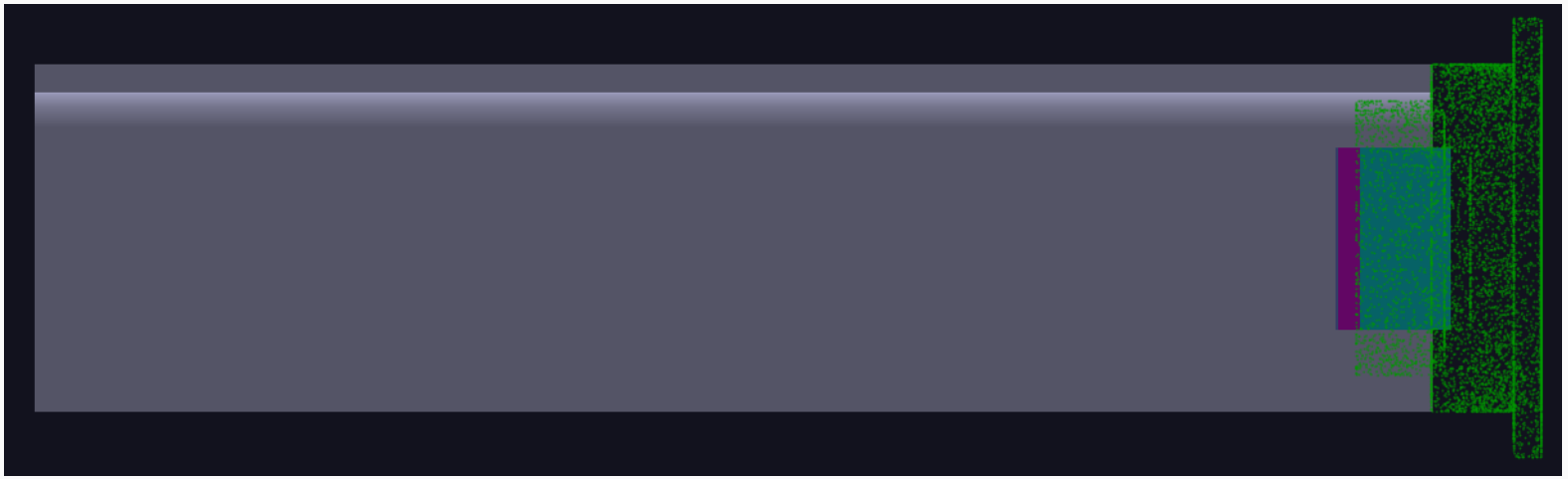

Figure 4: Sketch of the cross-sectional shape from the Permalloy Shield in the elementary module.

PEEK Envelope

Finally, the PEEK coating is implemented to encapsulate the complete module.

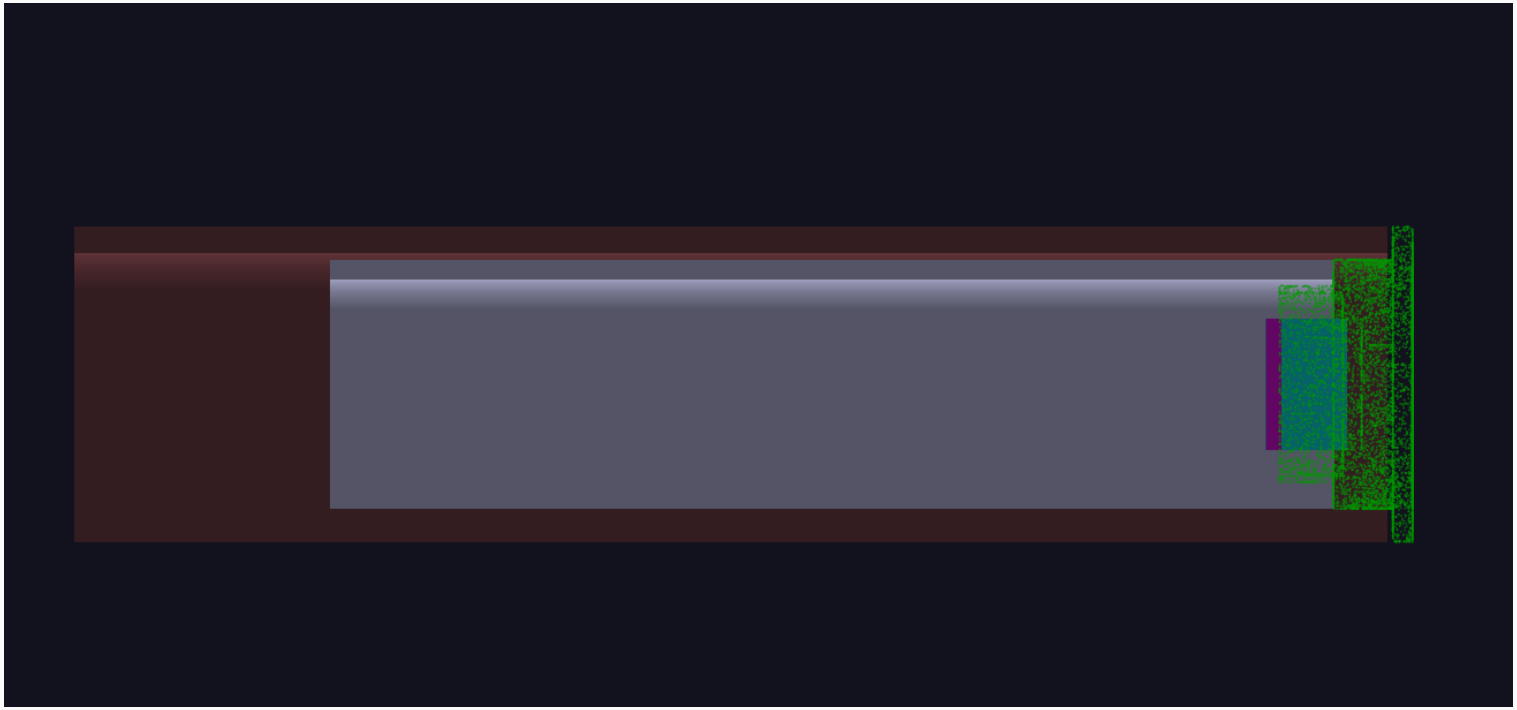

Figure 5: Sketch of the cross-sectional shape from the Elementary Module simulated in Geant4.

Coating Study

Simlation Configuration

An electron of 1 GeV was triggered to the elementary module in the direction $-y$.

This configuration takes place in order to see the interaction between all the layers added to the module.

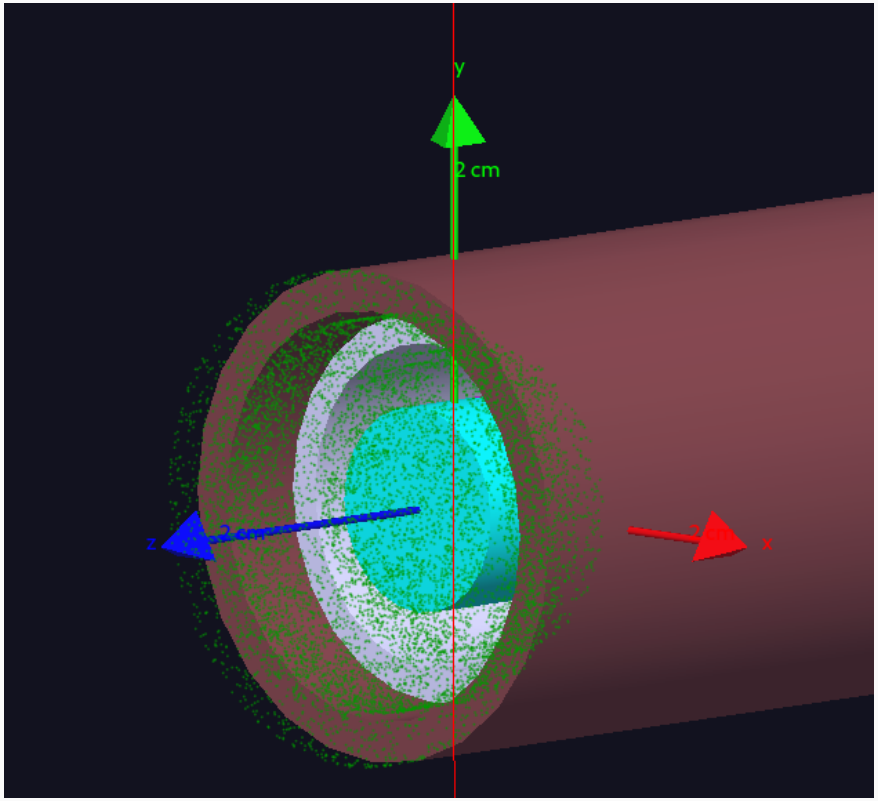

Figure 6: Sketch of the particle displayed in the direction of the module.

Created and Detected Photons

The number of photons that are created in the quartz tablet and reached the detector window are displayed below.

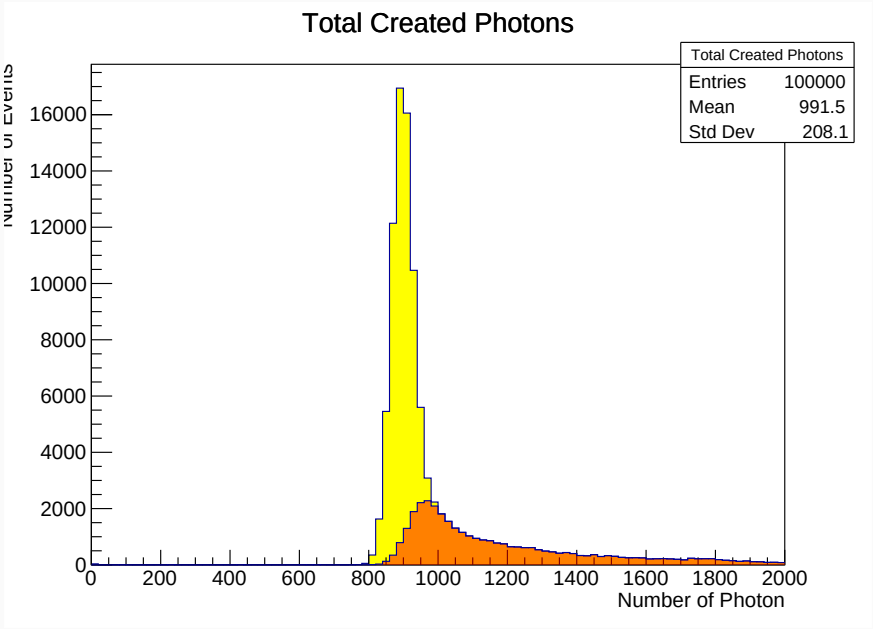

Figure 7: Created photons in the quartz tablet.

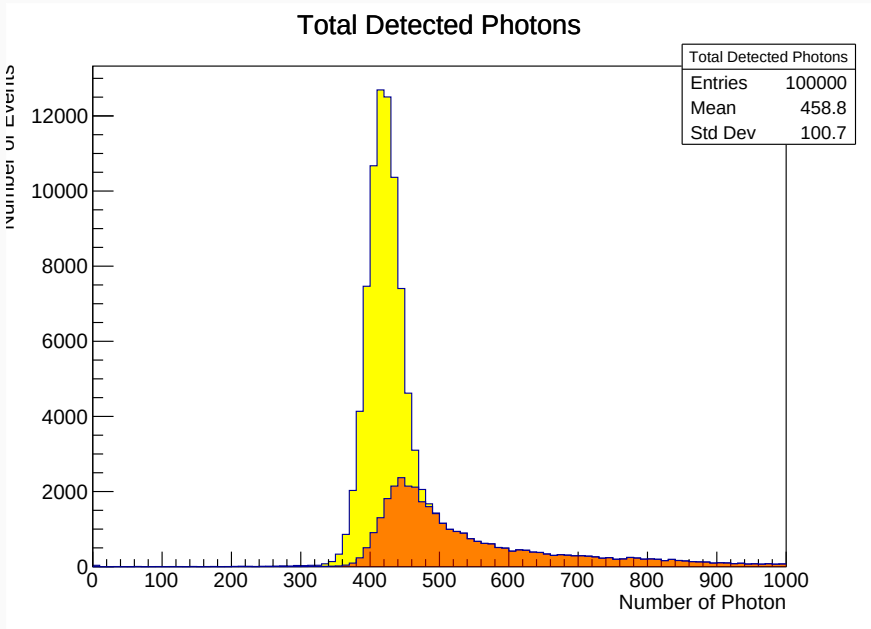

Figure 8: Detected photons in the detector window.

Reflected Photons

The number of reflected photons is shown below.

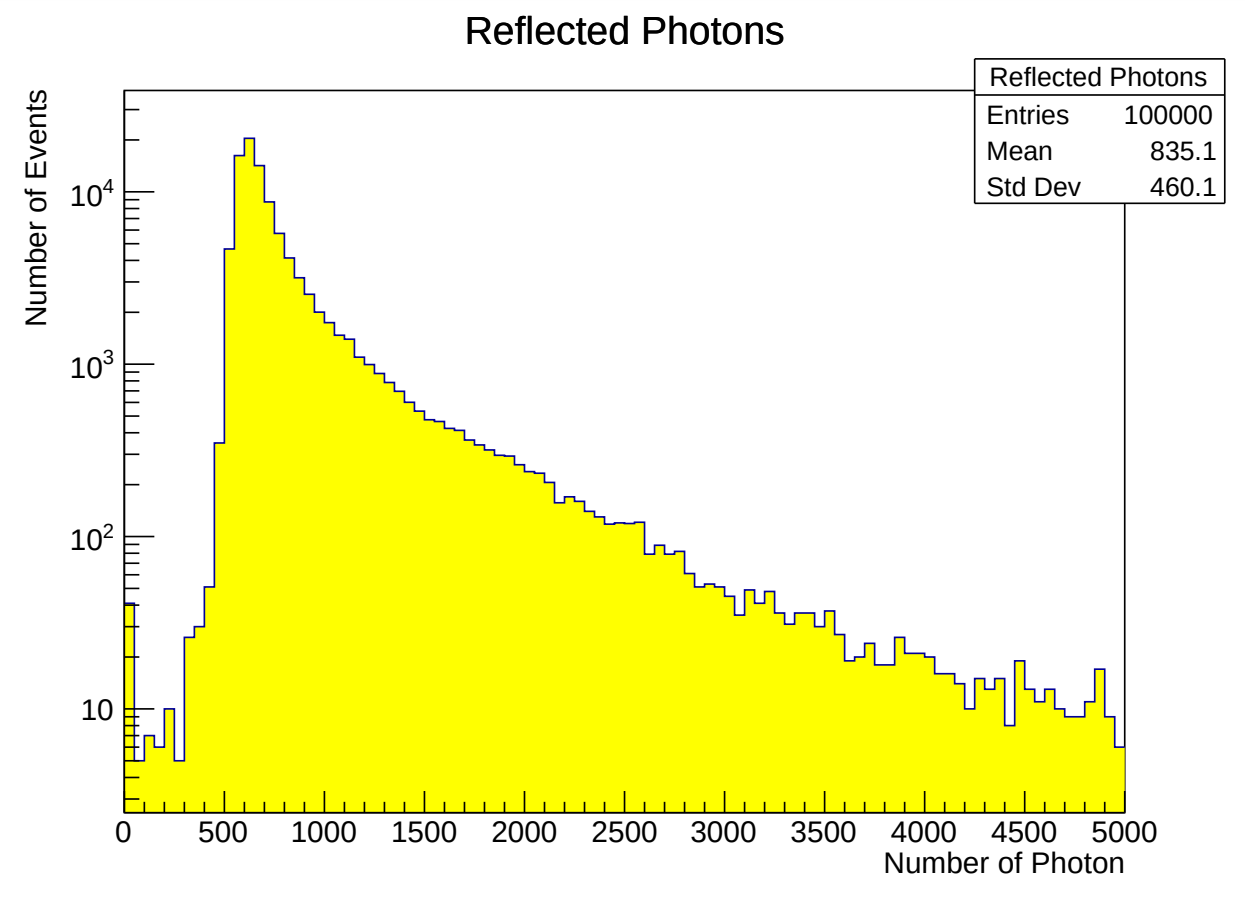

Figure 9: Reflected photons in the quartz tablet.

Random Angle

Simulation Configuration

The beam is configured such that it hits the detector in a random azimuthal angle between 0 to 60 degrees. For this configuration, the beam passes through the aluminium shield before hit the quartz tablet.

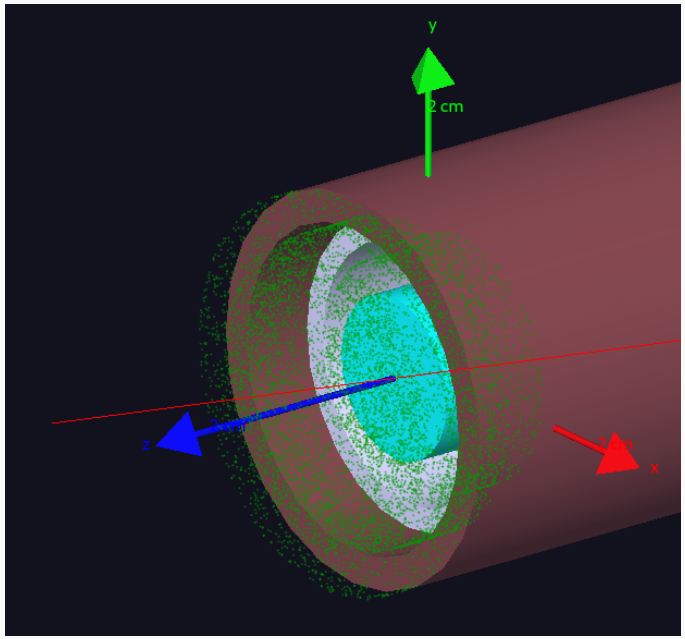

Figure 10: Sketch of the simulation for the random angle configuration.

Photons Creation

As before, we got the number of photons that were created inside the quartz tablet, which show a similar distribution and the mean respect to the simulation without the coating.

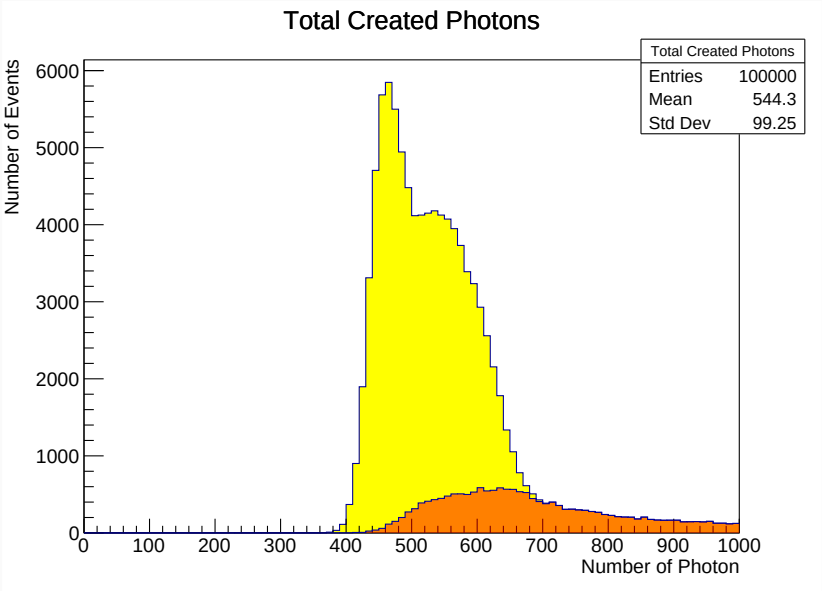

Figure 11: Total photon creation inside the quartz with coating, the red histogram represent events with secondary photons.

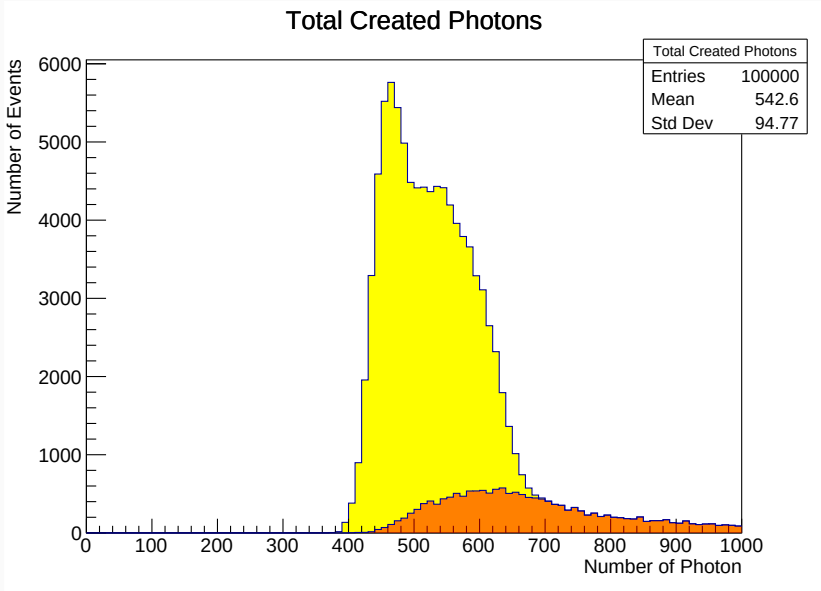

Figure 12: Total photon creation inside the quartz without coating, the red histogram represent events with secondary photons.

Photons Detection

For the detected photons, again the shape and mean are similar to the simulation without the coating simulation.

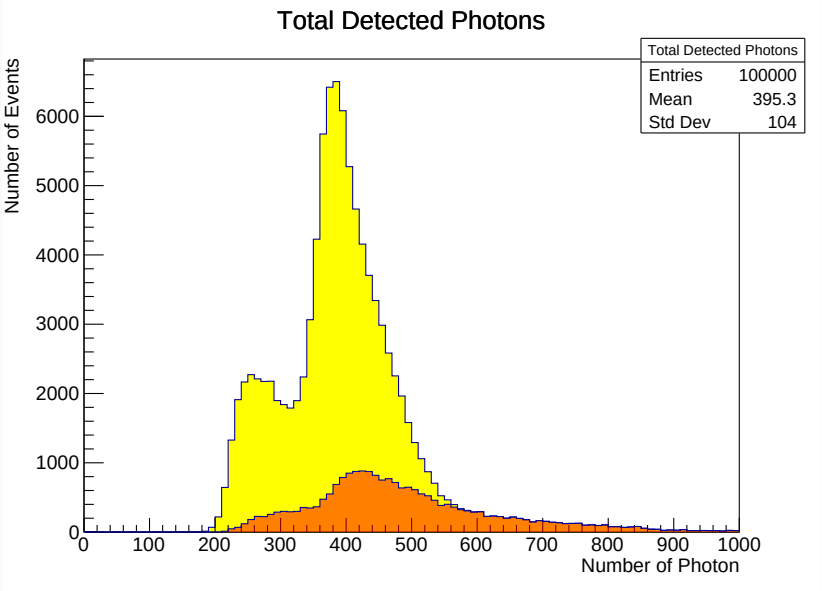

Figure 13: Total of photons detected with coating, the red histogram represent events with secondary photons.

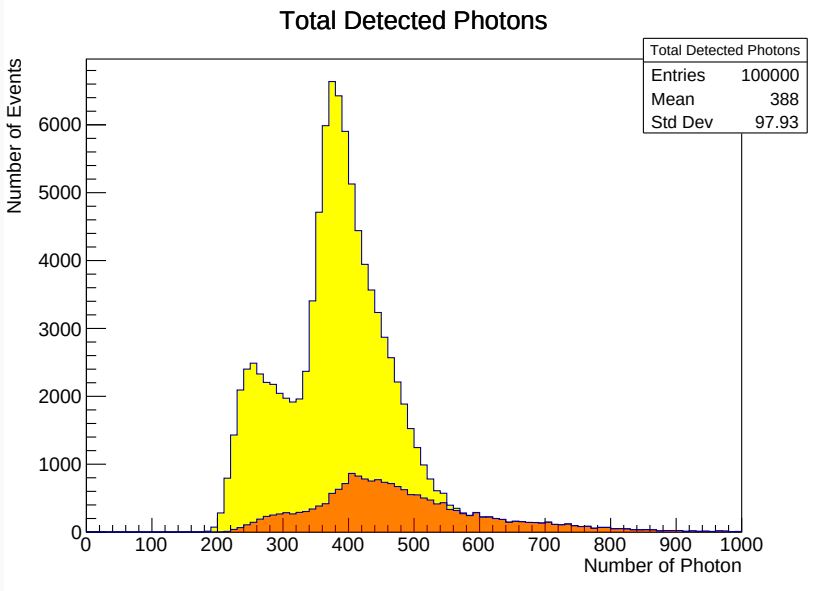

Figure 14: Total of photons detected without coating, the red histogram represent events with secondary photons.

Thank you!