GEANT4 LYSO crystal simulation

February 26, 2018

1 Geometry and conditions

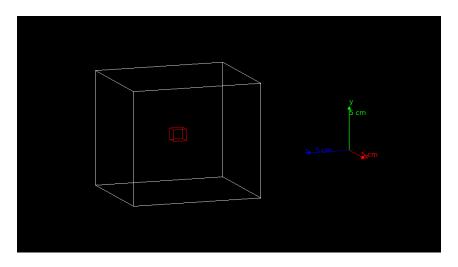


Figure 1: Geometry of a simulation.

LYSO crystal ($13x13x15 \text{ mm}^3$) placed in an air box ($13x13x15 \text{ cm}^3$). Centers of both boxes placed at 0 point (0, 0, 0). Point photon source placed along Z axis at point -2 cm (0, 0, -2). Photon's energy - 511 keV. The particles launched perpendicular to the plane XY(10^6 particles per run).

1. Full absorption events:

• Events with one produced e ⁻ (type I):	216 670	(21.67%)
• Events with more than one produced e ⁻ (type II):	289 463	(28.95%)
• Together:	506 133	(50.61%)
2. Partial energy absorption events(type III):	197 128	(19.71%)
3. No interaction:	296 739	(29.67%)

2 Results

2.1 Energy deposit in crystal

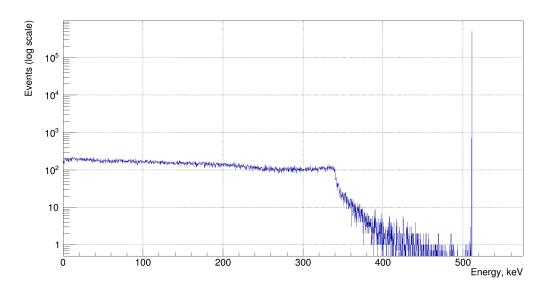


Figure 2: Energy deposit in crystal.

2.2 Number of hits

All histograms normalized to number of events of each type.

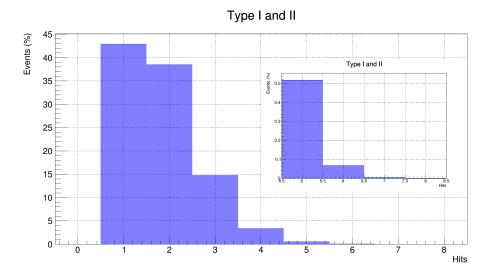


Figure 3: Number of hits before absorption.

2.3 Position of absorption for first type

2.3.1 X coordinate

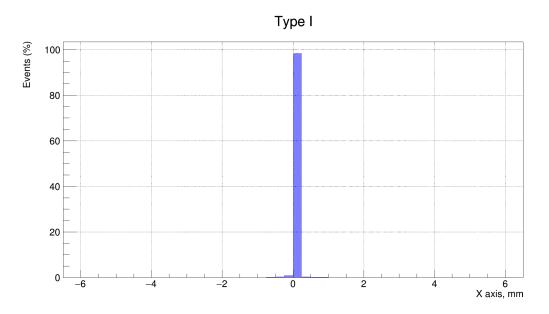


Figure 4: X coordinate of absorption point.

2.3.2 Y coordinate

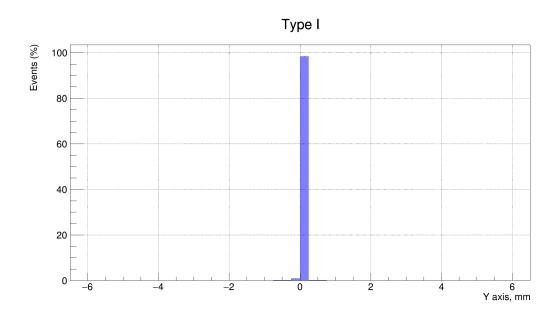


Figure 5: Y coordinate of absorption point.

2.3.3 Z coordinate

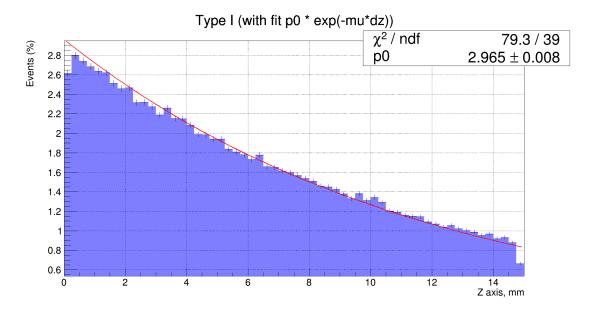


Figure 6: Z coordinate of absorption point.

2.4 Position of absorption for second type

2.4.1 X coordinate

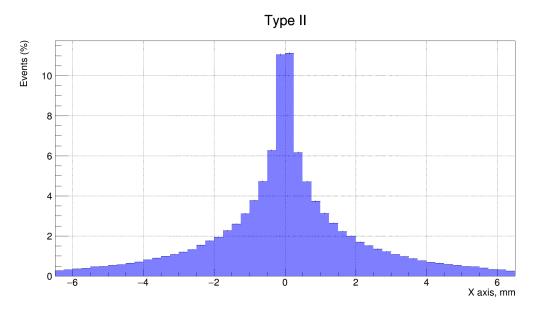


Figure 7: X coordinate of absorption point.

2.4.2 Y coordinate

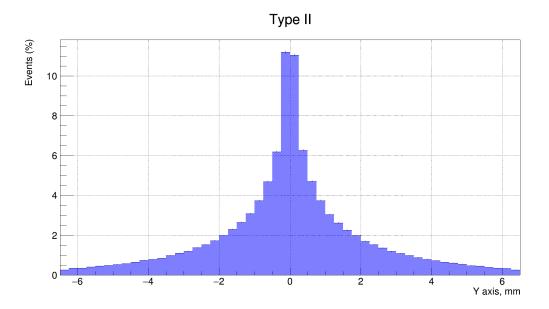


Figure 8: Y coordinate of absorption point.

2.4.3 Z coordinate

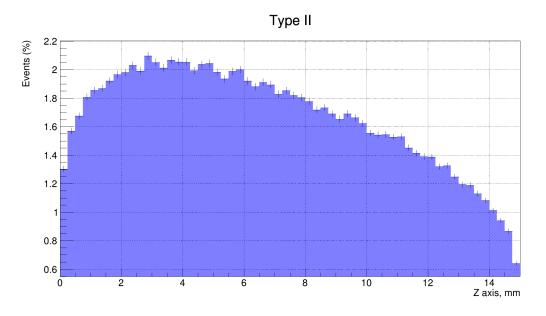


Figure 9: Z coordinate of absorption point.

2.5 Position of last hit for third type

2.5.1 X coordinate

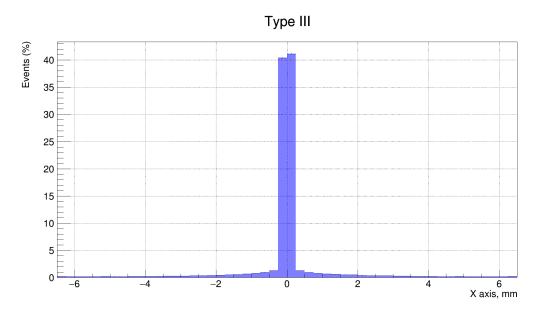


Figure 10: X coordinate of last hit point.

2.5.2 Y coordinate

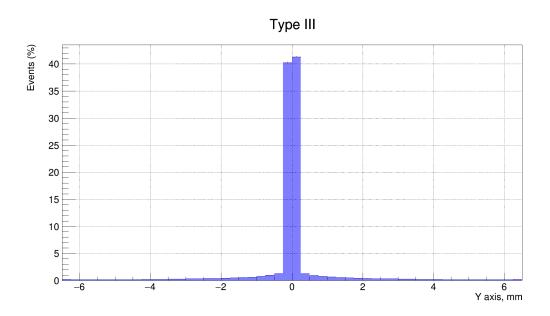


Figure 11: Y coordinate of last hit point.

2.5.3 Z coordinate

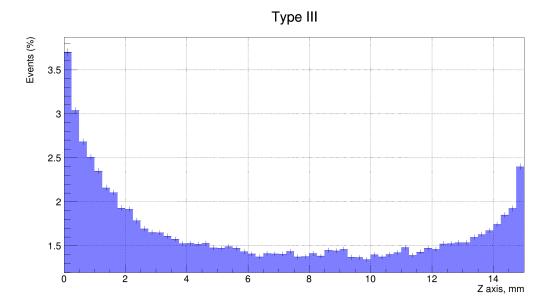


Figure 12: Z coordinate of last hit point.

2.6 Energy deposit per hit

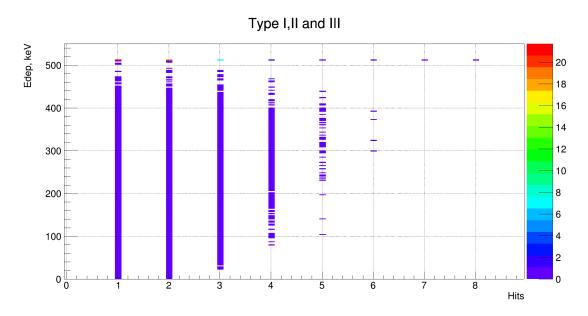


Figure 13: Energy deposit by hits in crystal.

This histogram represent energy deposit in LYSO crystal depend of number of hits. Color palette represent number of events (in % of all events). Bin width for energy (Y) axis - 2 keV.

2.7 Position of each hit

Present both unweighted and weighted histograms. Weight = $\frac{E_{dep}^{hit}}{E_{initial}}$. $E_{initial} = 511 \text{ keV}$.

2.7.1 X coordinate for II type

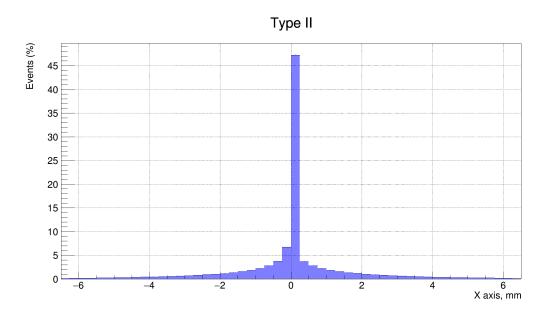


Figure 14: X coordinate of hit.

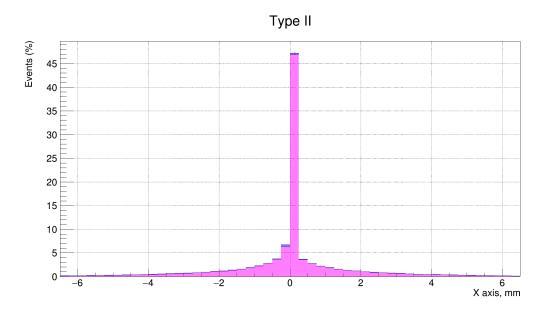


Figure 15: Weighted X coordinate of hit.

2.7.2 Y coordinate for II type

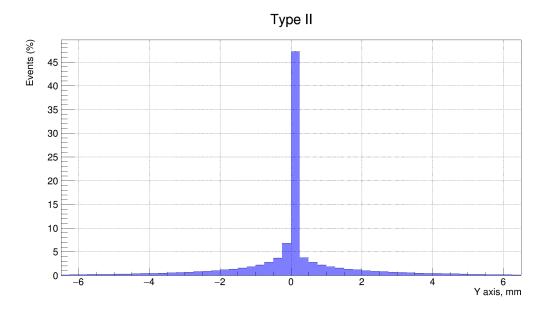


Figure 16: Y coordinate of hit.

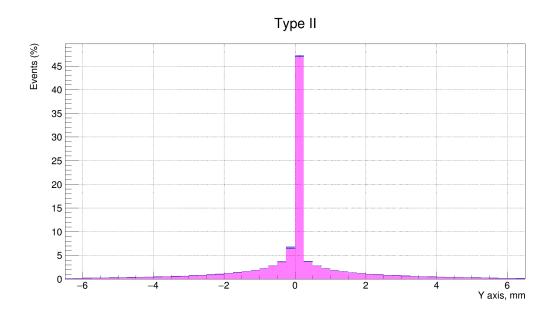


Figure 17: Weighted Y coordinate of hit.

2.7.3 Z coordinate for II type

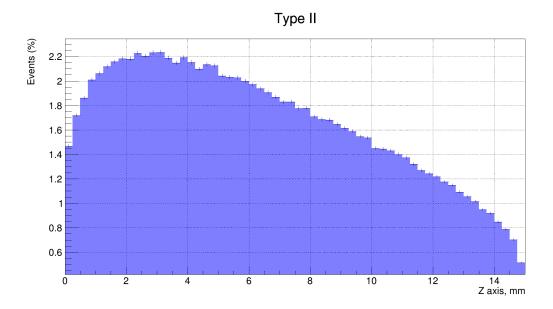


Figure 18: Z coordinate of hit.

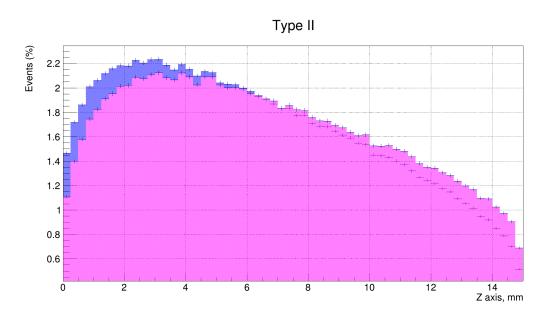


Figure 19: Weighted Z coordinate of hit.

2.7.4 X coordinate for III type

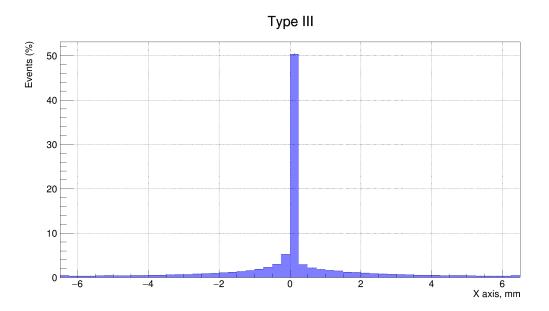


Figure 20: X coordinate of hit.

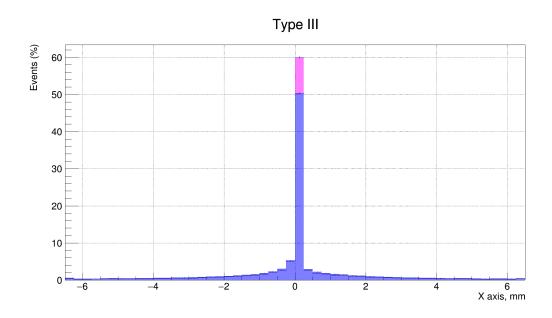


Figure 21: Weighted X coordinate of hit.

2.7.5 Y coordinate for III type

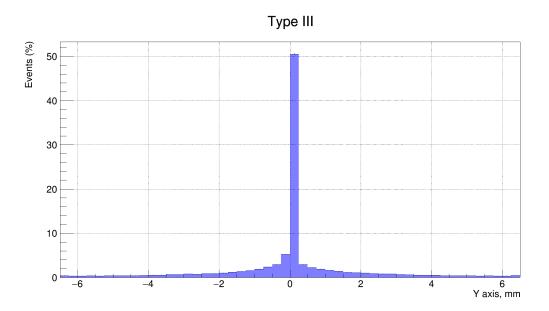


Figure 22: Y coordinate of hit.

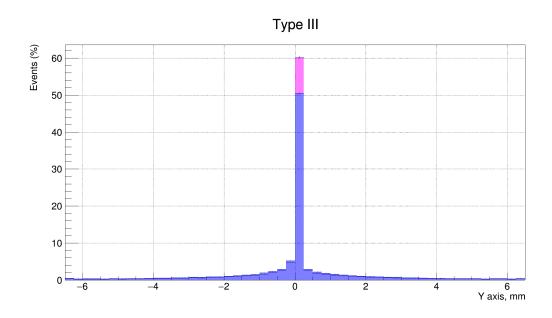


Figure 23: Weighted Y coordinate of hit.

2.7.6 Z coordinate for III type

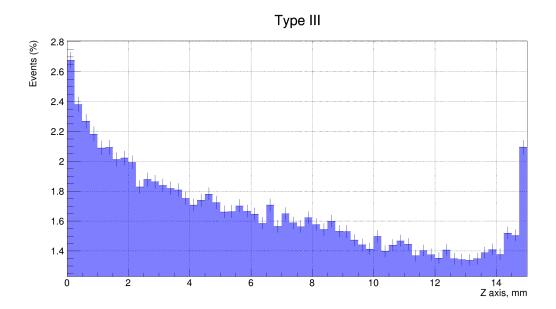


Figure 24: Z coordinate of hit.

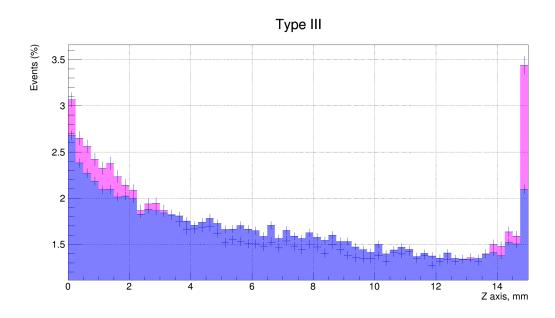


Figure 25: Weighted Z coordinate of hit.