# GEANT4 DPGA simulation

March 26, 2018

## 1 Geometry and conditions

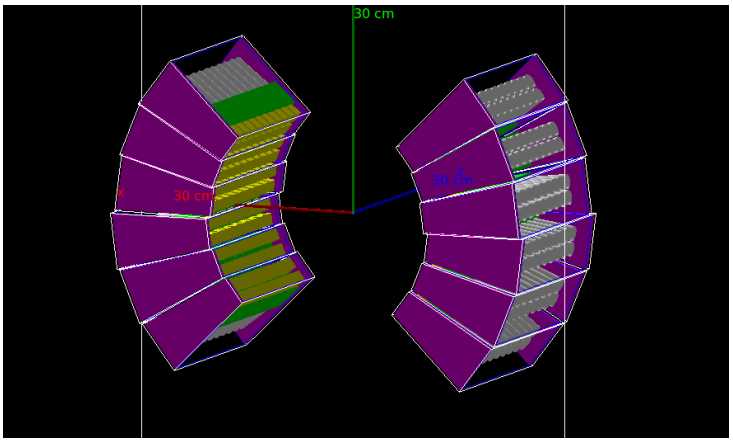


Figure 1: Geometry of the simulation.

Isotropic source of photons with energy 511 keV placed in 0 point (0, 0 , 0). $10^7$ events launched per run.

Type of events in simulation:

Type I - events with one produced $e^-$ (full energy absorption).

Type II - events with more than one produced $e^-$ (full energy absorption). Type IIa - type II events which occurs in single crystal. Type IIb - type II events which occurs in different crystals. Type IIba - type II events which occurs in 2 crystals. Type IIbb - type II events which occurs in more than 2 crystals.

Type III - events where $E_{dep} < 511$ keV.

Type IV - events where all interactions occurs in single crystal (include type I,type II and type III).

Type V - events where interactions occurs in more than one crystal (include type I,type II and type III).

| Event type: | Number: | % of all events: | % of events where photons pass through crystals: | % of full absorption events: |
|---|---|---|---|---|
| Type I | 260 530 | 2.605 | 15.61 | 45.6 |
| Type II | 310 810 | 3.108 | 18.623 | 54.4 |
| Type IIa | 259 647 | 2.596 | 15.557 | 45.445 |
| Type IIb | 51 163 | 0.512 | 3.065 | 8.955 |
| Type IIba | 49 855 | 0.499 | 2.987 | 8.726 |
| Type IIba with Bremsstrahlung | 4 723 | 0.047 | 0.283 | 0.827 |
| Type IIba without Bremsstrahlung | 45 132 | 0.451 | 2.704 | 7.899 |
| Type IIbb | 1 308 | 0.013 | 0.078 | 0.229 |
| Together type I and type II | 571 340 | 5.713 | 34.233 | 100 |
| Type III | 499 526 | 4.995 | 29.93 | |
| Events where photons pass through crystals | 1 669 005 | 16.69 | 100 | |
| Type IV | 976 963 | 9.77 | 58.536 | |
| Type V | 92 670 | 0.927 | 5.552 | |

# 2 Results

## 2.1 Energy deposit in crystal

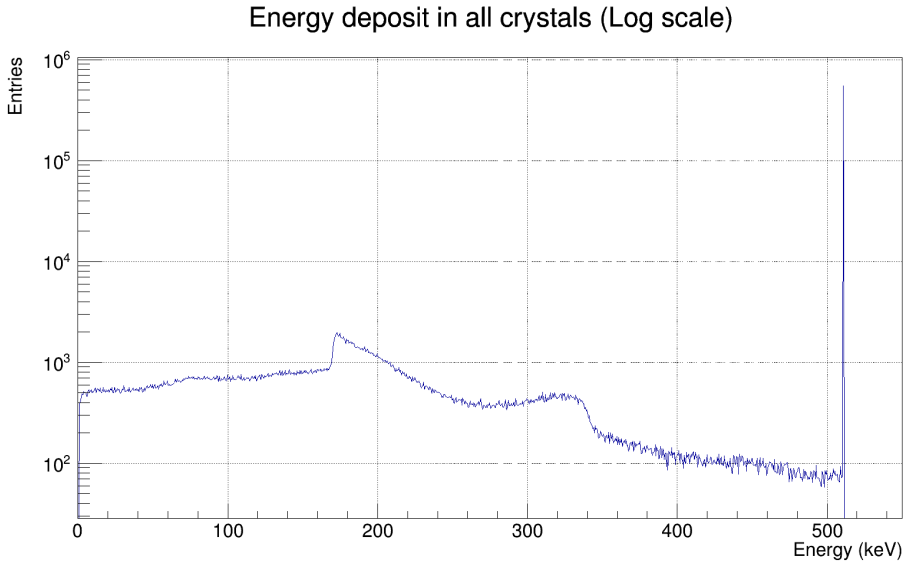


Figure 2: Energy deposit in all crystals.

## 2.2 Number of hits

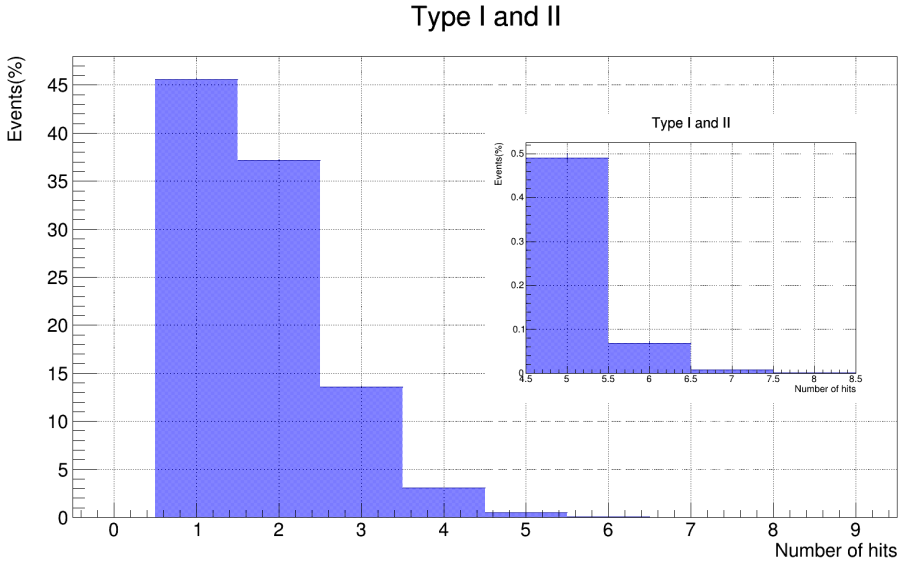


Figure 3: Number of total hits.

## 2.3 Position of absorption for first type

### 2.3.1 X coordinate

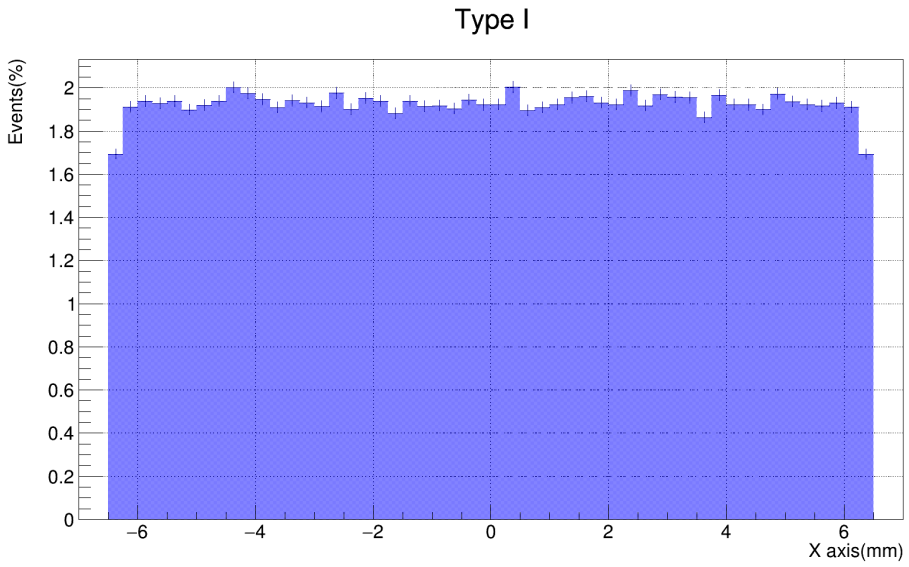


Figure 4: X coordinate of absorption point.

### 2.3.2 Y coordinate

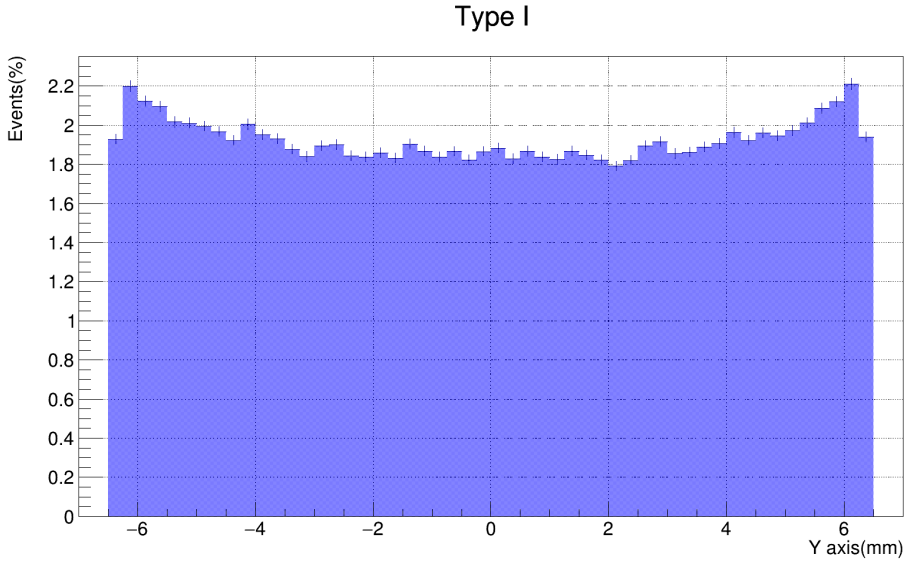


Figure 5: Y coordinate of absorption point.

### 2.3.3 Z coordinate

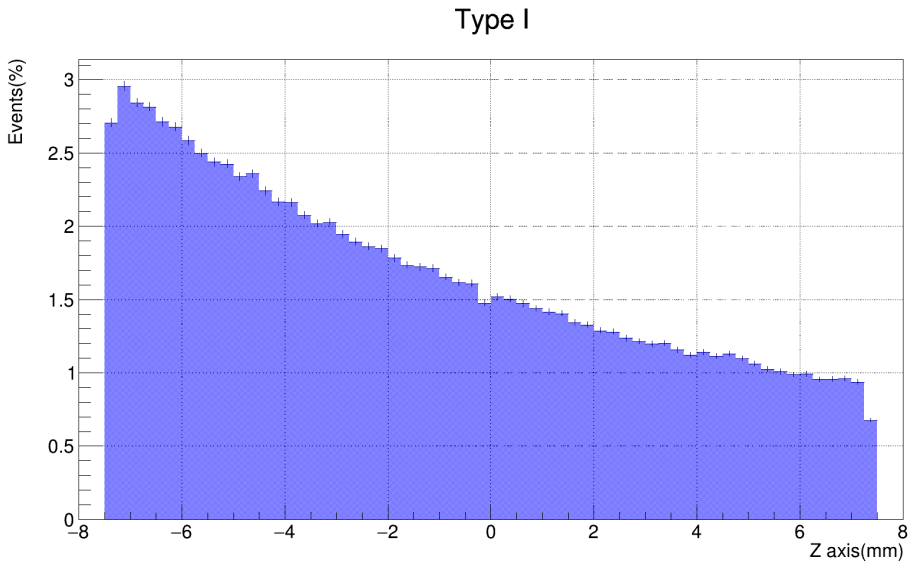


Figure 6: Z coordinate of absorption point.

## 2.4 Position of absorption for second type

### 2.4.1 X coordinate

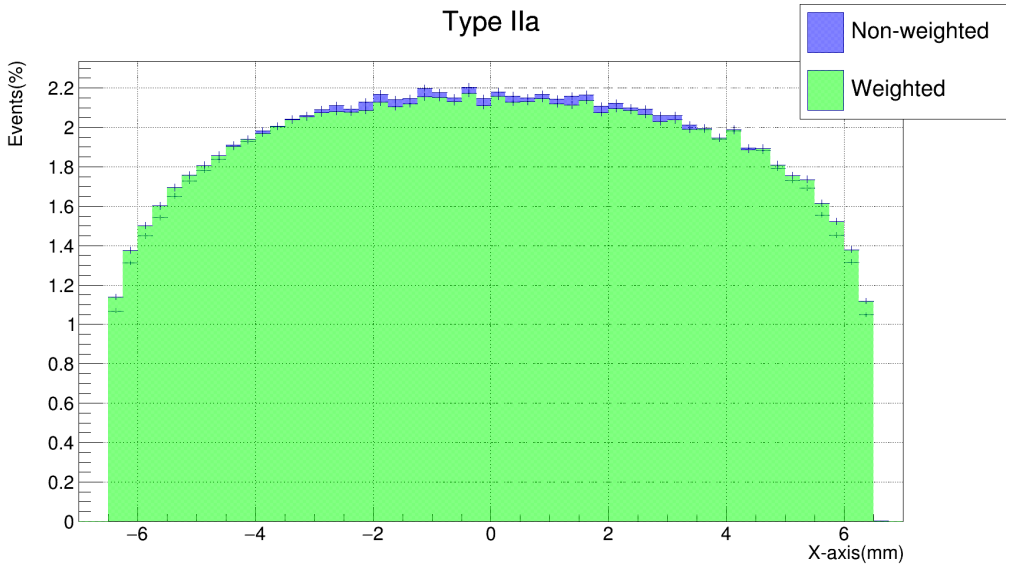


Figure 7: X coordinate of hit point.

### 2.4.2 Y coordinate

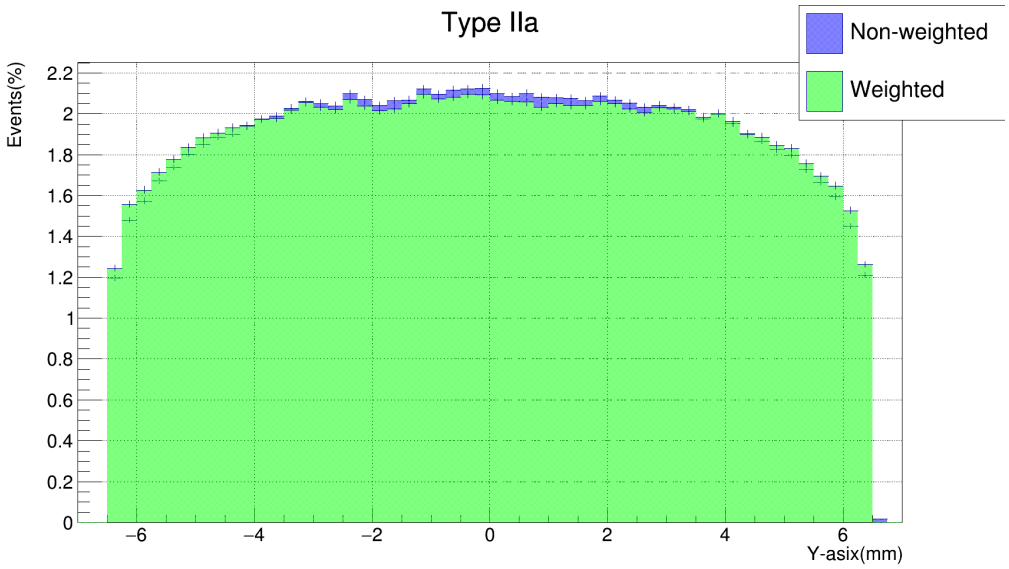


Figure 8: Y coordinate of hit point.

### 2.4.3 Z coordinate

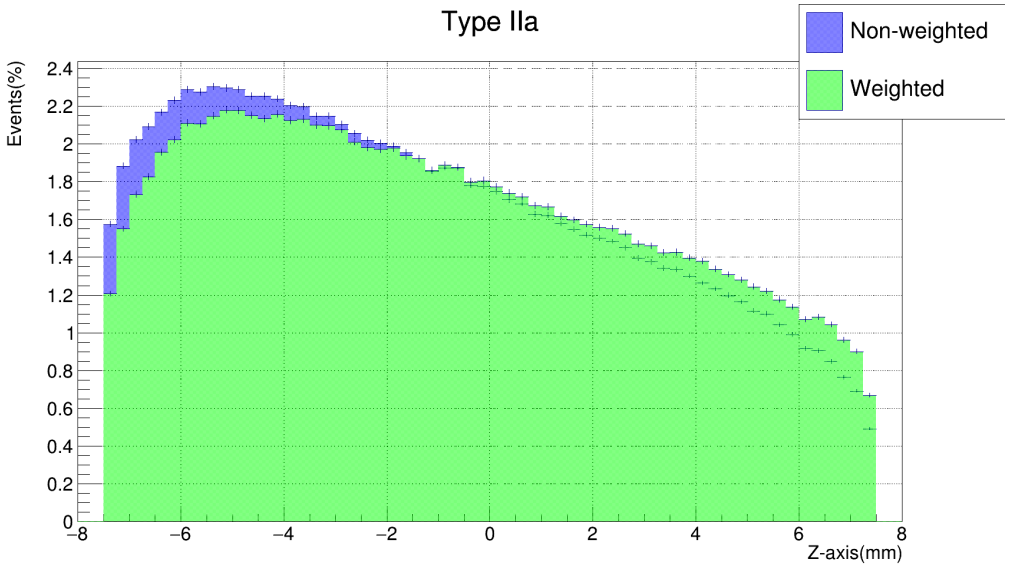


Figure 9: Z coordinate of hit point.

## 2.5 Interaction in crystals

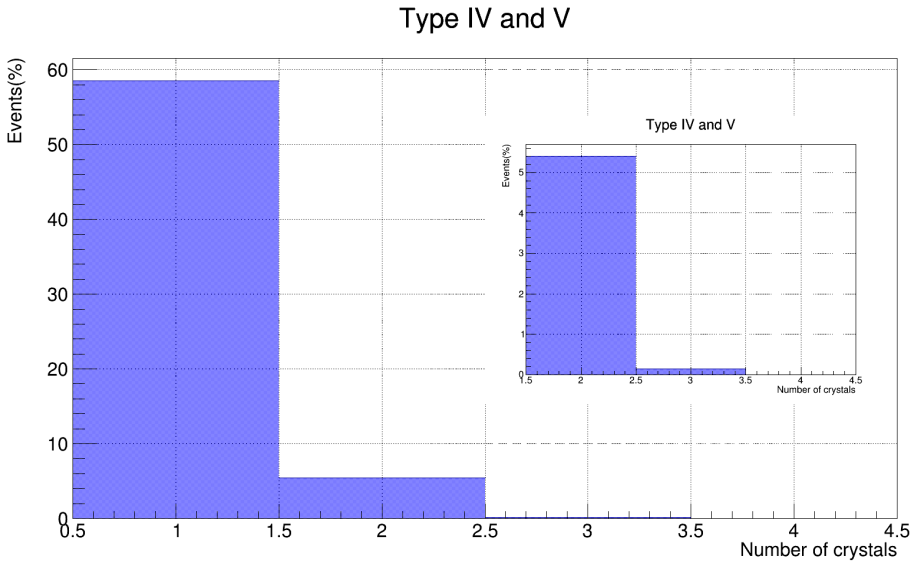


Figure 10: Number of crystals where interaction occurs.

### 2.5.1 Energy deposit in crystals

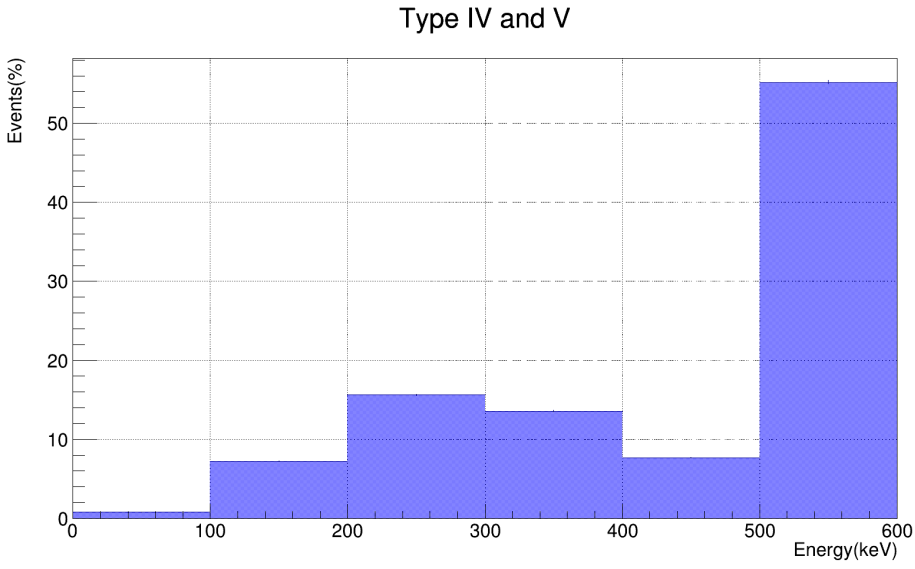


Figure 11: Energy deposit in crystals.

### 2.5.2 Full energy deposit in crystals

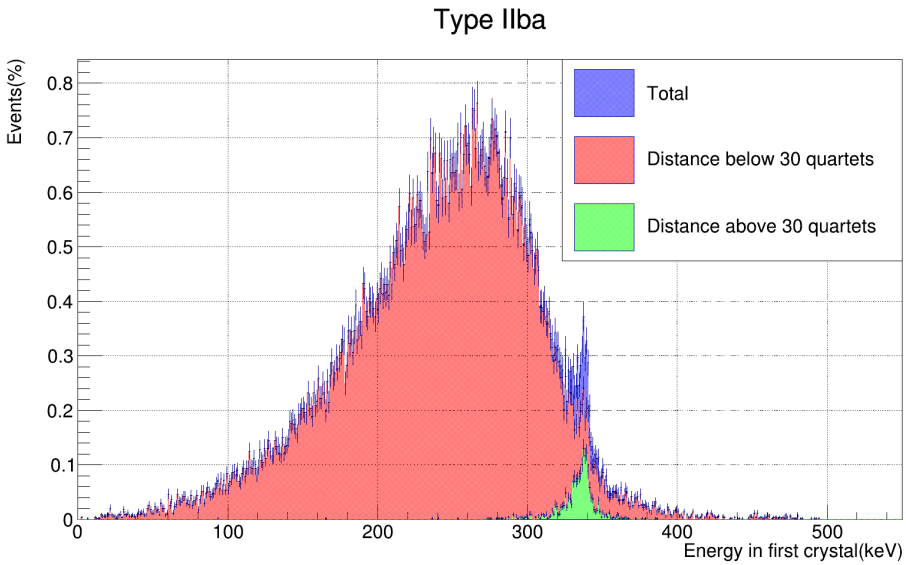


Figure 12: Energy deposit in first crystal.

Peak around 340 keV represent events in which photon backscatter to opposite side of DPGA (in this case distance(in number of quartets) greater than 30).

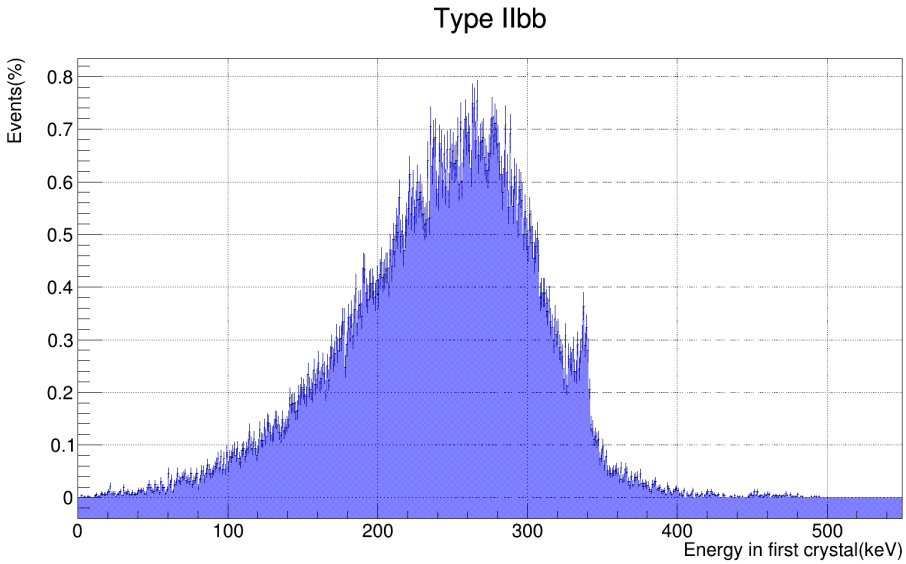


Figure 13: Energy deposit in first crystal.

### 2.5.3 Partial energy deposit in crystals

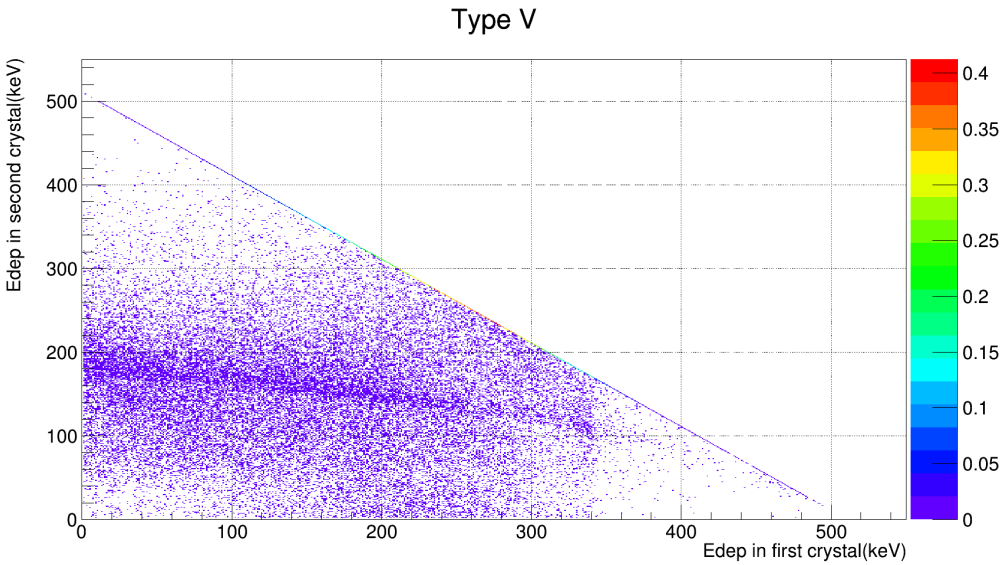


Figure 14: Energy deposit between crystals.

### 2.5.4 Distance between interactions

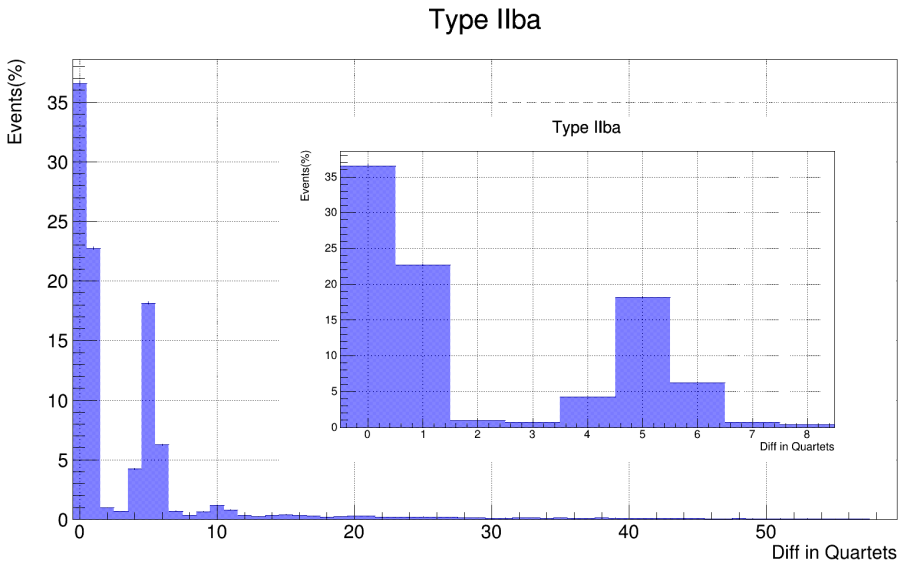


Figure 15: Distance between interactions.

Distance calculated as (max quartet number - min quartet number). In 91.22% this distance less than 10.

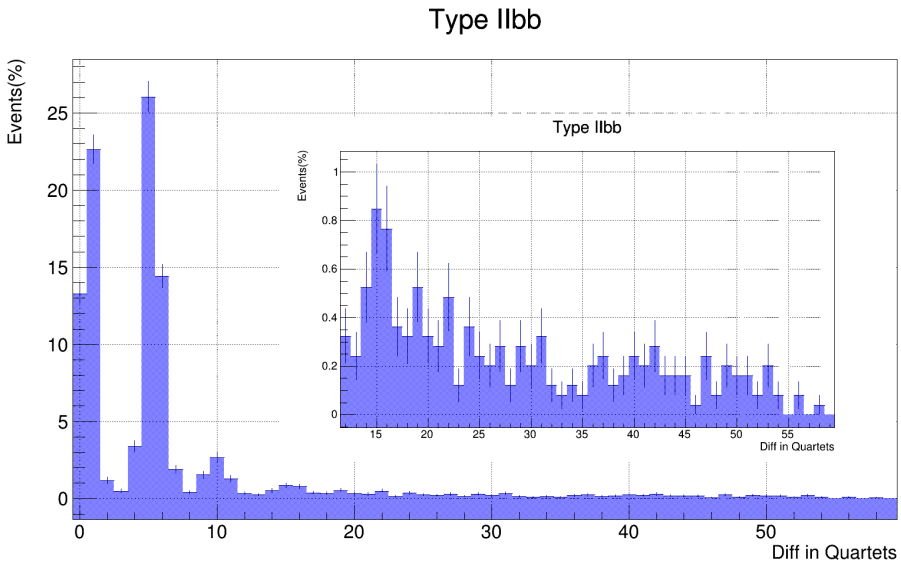


Figure 16: Distance between interactions.

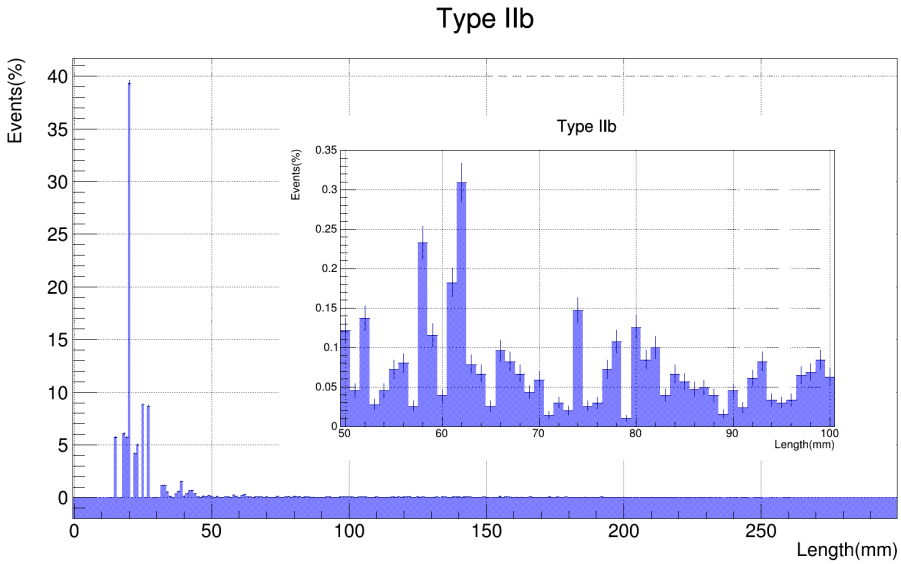


Figure 17: Distance between interactions.