

## *II- Review of the decisions made during the first and second meetings*

# Event-by-event tracking comparison of AGATA and GRETA

GEANT 4 simulated data : good reference

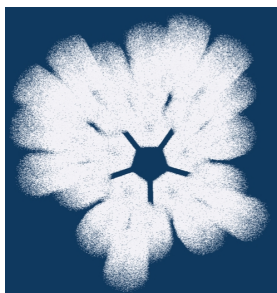
Compare the total tracked gamma-rays with both codes

Compare the first interaction energies as found by AGATA and GRETA codes

Compare the second interactions as found with both tracking codes

Experimental data we have : No reference - blind comparison

Amel  
KORICHI



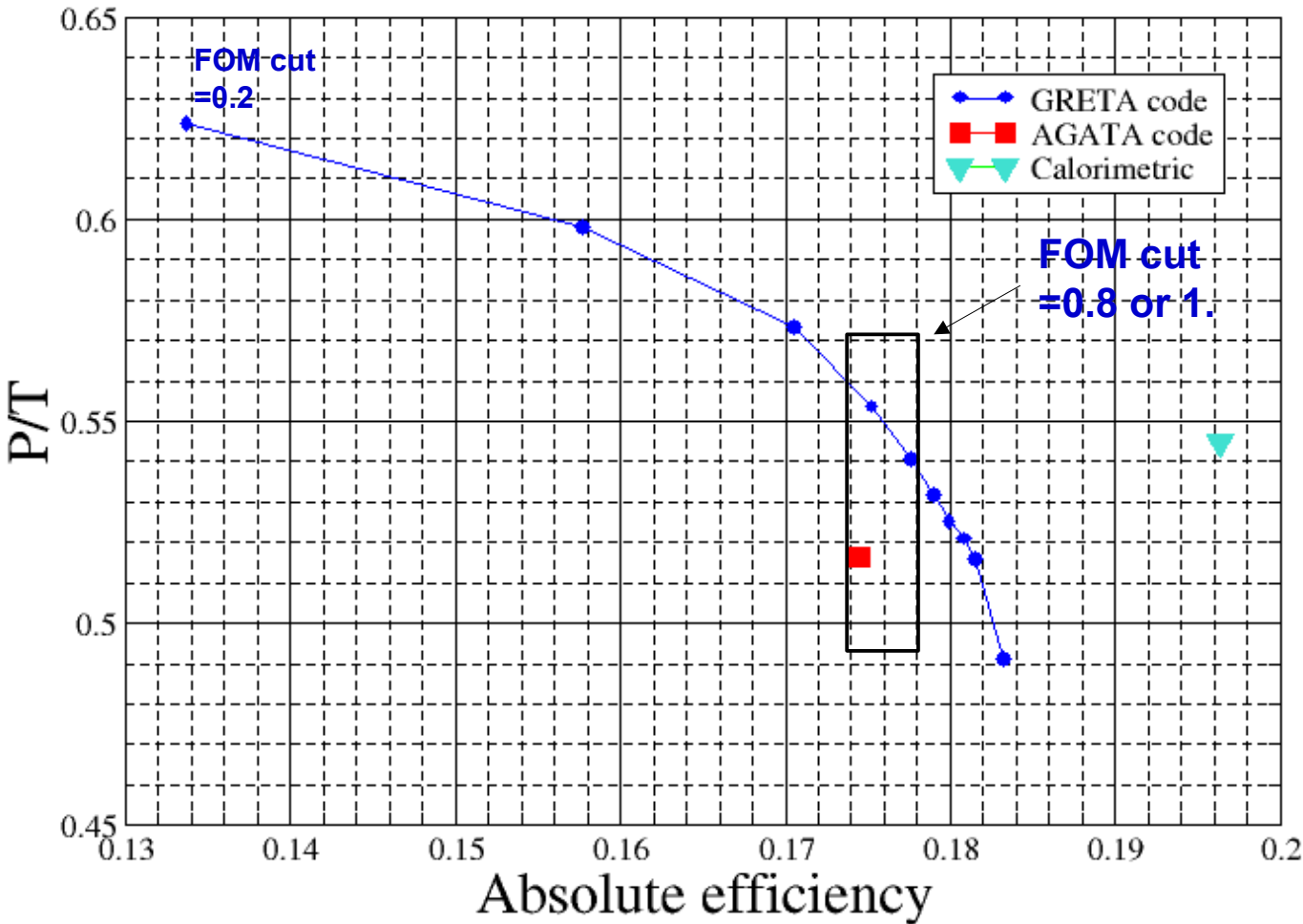
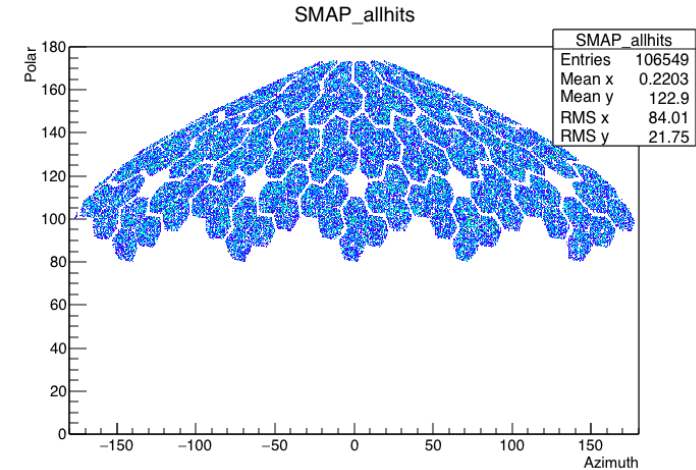
Collaboration meeting October 2019

Simulated data using AGATA G4- the Packing is performed with G4  
 100000 events (1.33 MeV line)  
 2pi configuration (more realistic than 4pi today)

Data integrity checked before comparing the tracking codes  
 Hitpat, central contact & calorimetric spectra ....

AFT (GRETA code)      OFT (AGATA code)

Defaults tracking parameters for both codes



Tracking parameters

OFT : 0.8      0.05      1  
 sigtheta   minprobtrack   clus red. factor

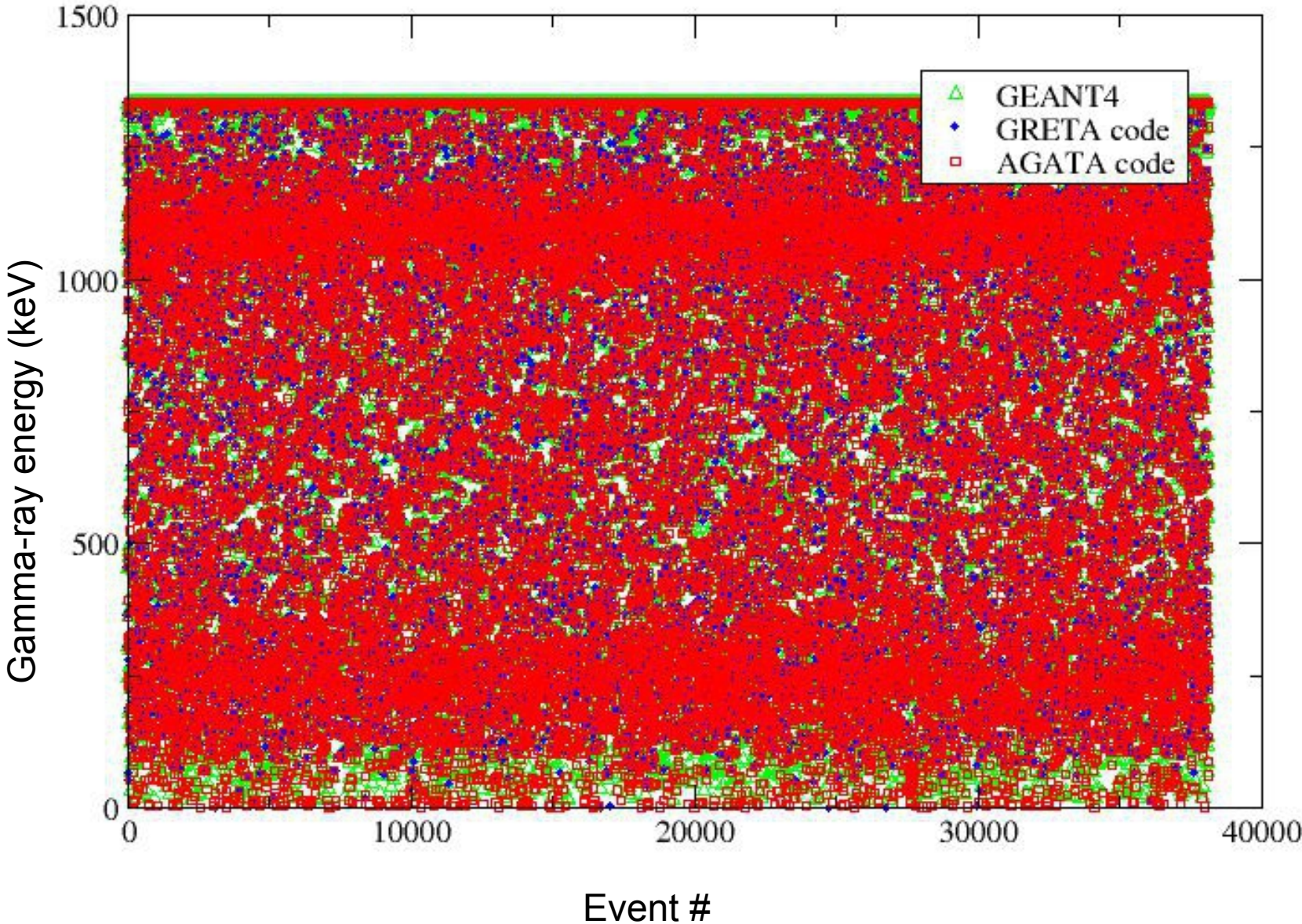
AFT : 20 deg. Clustering angle  
 reclus 1

Tracking efficiency =  
 Tracked/calorimetric

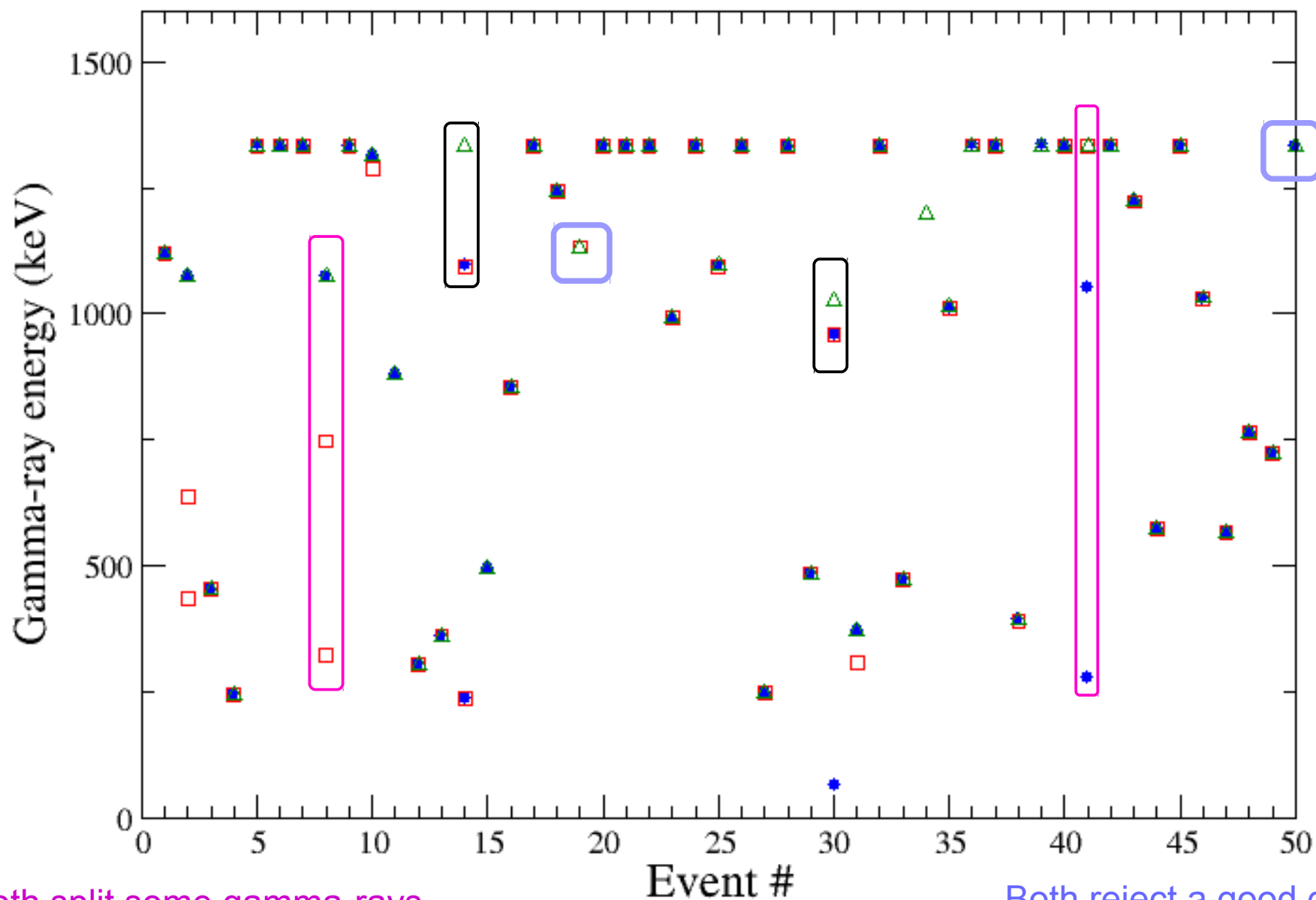
90 % with both codes

From 100000 G4 events : Total number of gamma-rays with interaction = 38119

Evt-by-evt comparison : Tracked energies , First and Second interactions energies  
For selected events (FOM cut)



# Total tracked gamma-rays with AGATA and GRETA codes versus GEANT4



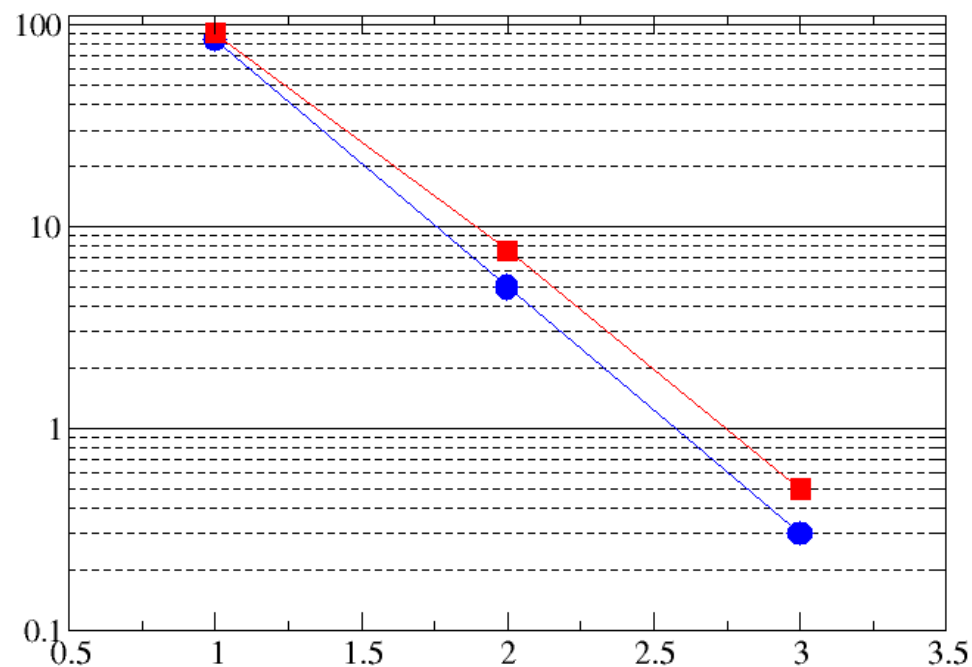
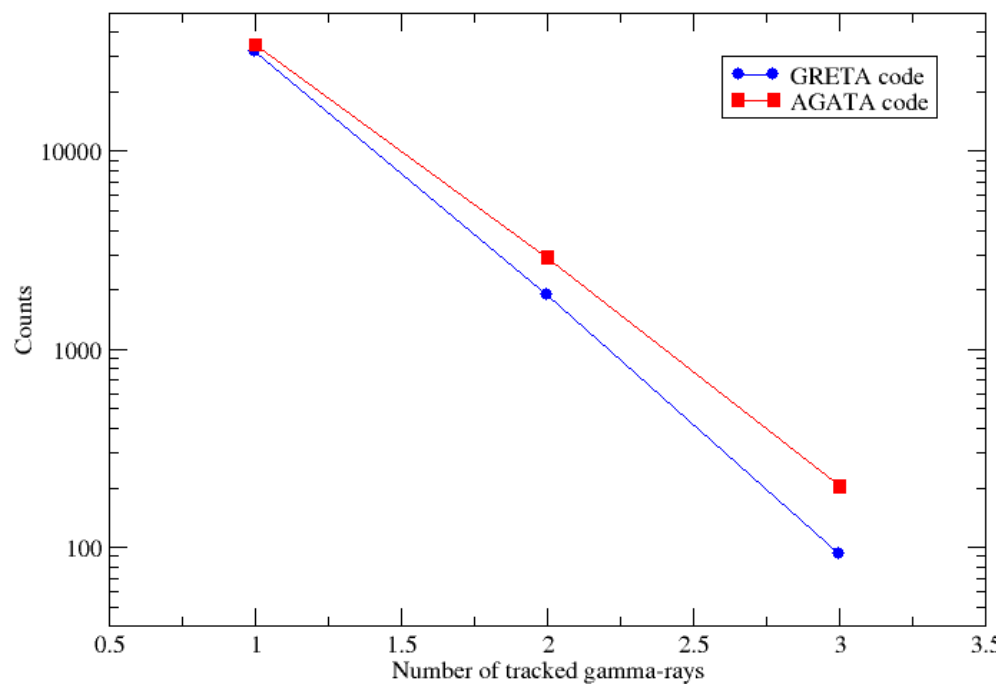
Both split some gamma-rays into 2 or more photons

Both find the same wrong gamma-ray

Both reject a good gamma-ray while the other does not

Number of gamma-rays as found by **AGATA** and **GRETA** codes (with good FOM)

**G4 = 38119 /10000 have been detected in 2pi AGATA configuration**



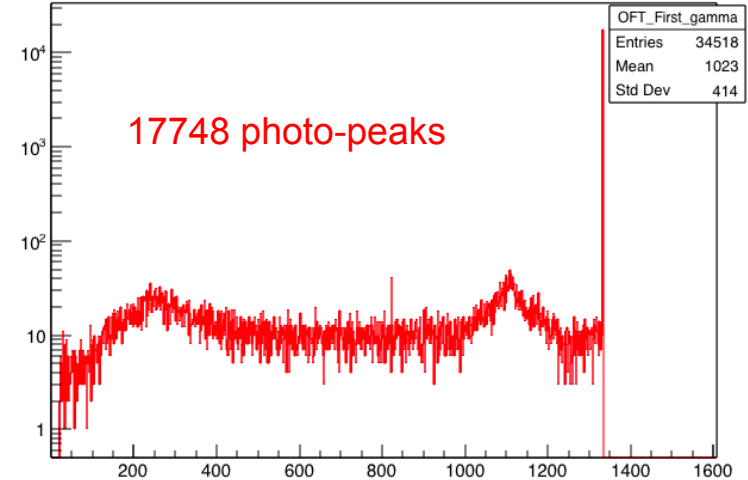
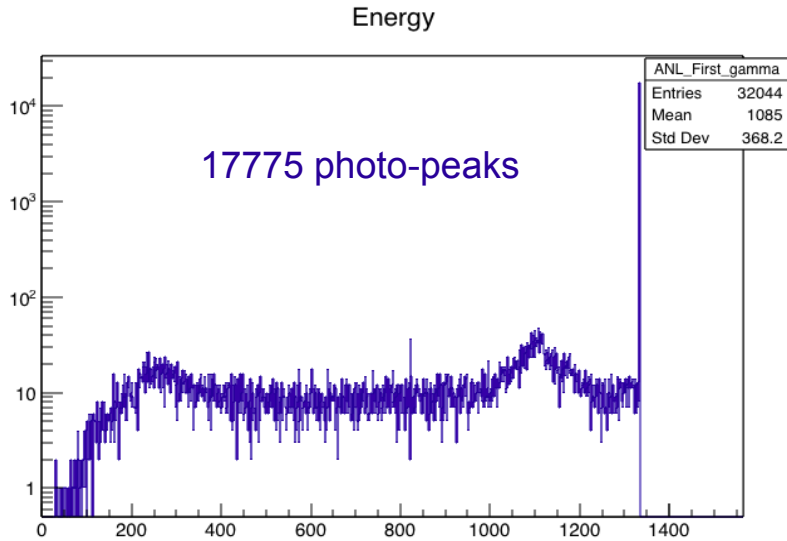
**90 %** versus **84 %** reconstructed as a single gamma-ray

**7.7 %** versus **5 %** reconstructed/split as 2 gamma-rays

Less than 0.5 % split into 3 gamma-ray

# A. Single gamma-ray reconstruction G4 = 38119 gamma-rays

GRETA code reconstruct 32044 gamma-rays AGATA code reconstruct 34518 gamma-rays  
84% have been considered here versus 90%



These events can be analyzed in 2 classes : identical / different – accept/rejet

1- Identical events 30848 as considered and tracked by the 2 codes : 80% relative to Geant4

Relative to the reconstructed events as 1 gamma: GT 96% AG 89%

2- The others accepted or rejected by one another

1196 events for GRETA versus 3670 events for AGATA

Relative to the reconstructed events : GT 3.7 % versus AG 10%

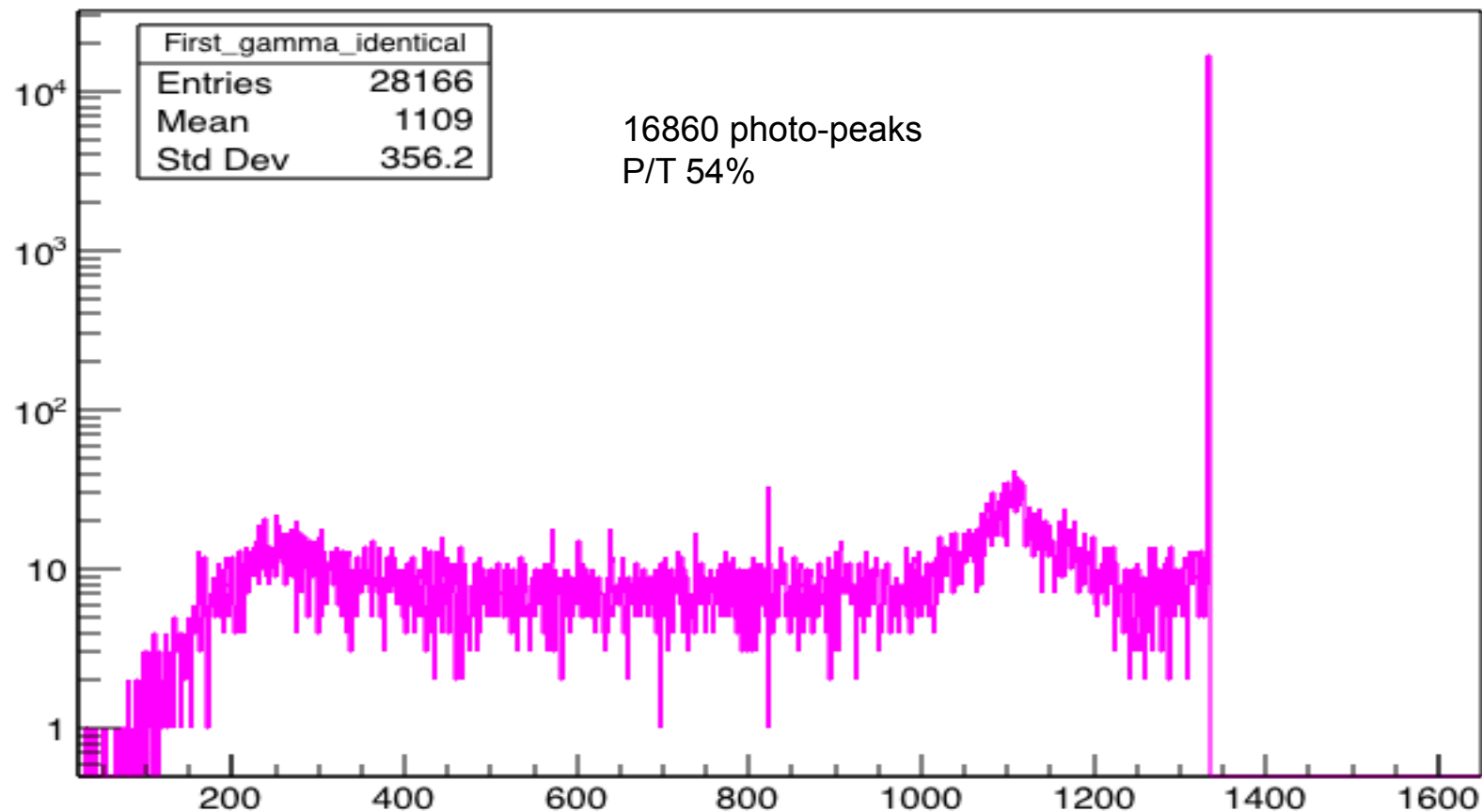
## A. Single gamma-ray reconstruction

1- Identical events 30848 as considered and tracked by the 2 codes

Two Sub-classes are seen : identical tracked energies 28166 or different 2680 events

Sub.Classe 1.1 : identical tracked energies

28166 events are tracked exactly the same : corresponding to 91 % of the considered events



GT -Rel. reconstruction  $28166/32044 = 88 \%$

AG-Rel. Reconstruction  $28166/34518 = 82 \%$

Rel. G4  $28166/38119 = 74 \%$

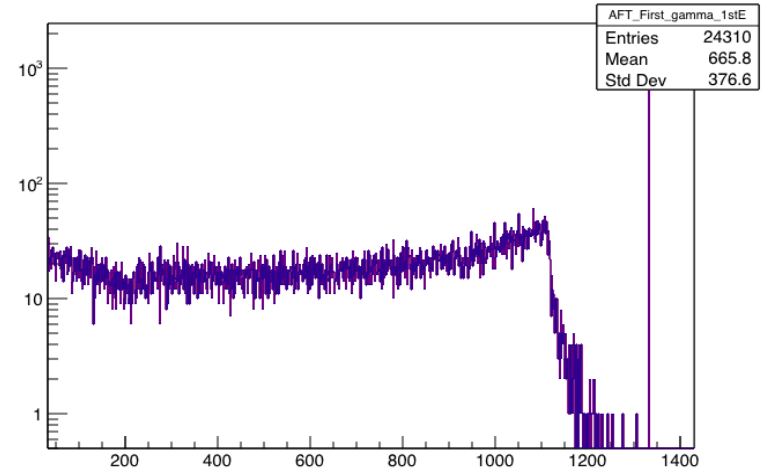
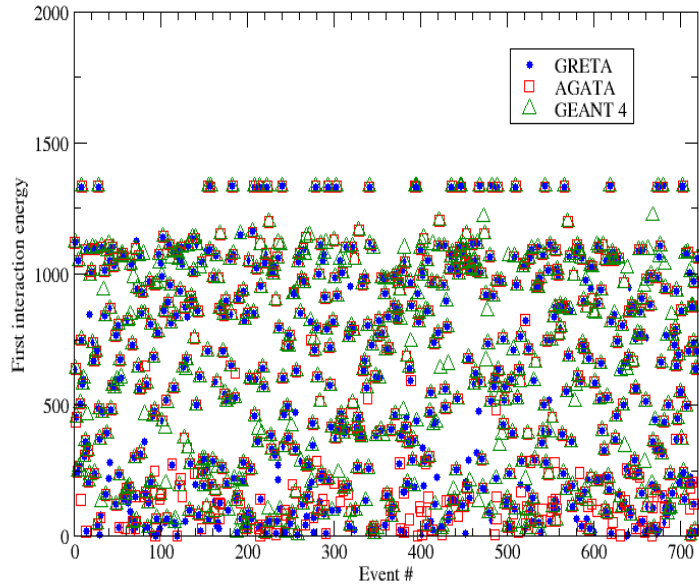
# A. Single gamma-ray reconstruction : Sub. Class Identical tracked energie

## 1- Identical events 30848 as considered and tracked by the 2 codes

28166 events are tracked exactly the same : corresponding to 91 % of the considered events

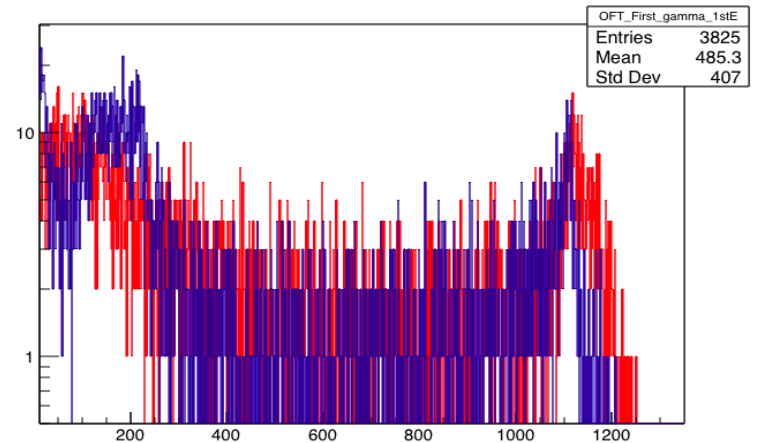
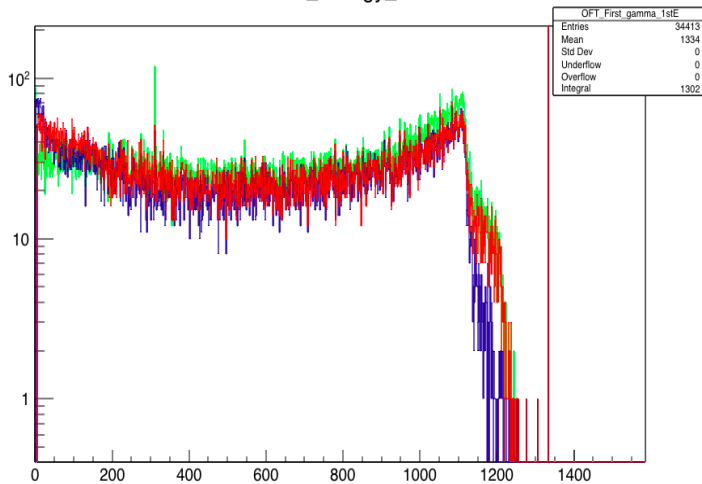
Comparing their First/second interaction energy :

86% with the same first int. energie  
80% with same E\_first and E\_second



14% with different E\_first interaction energie

1st int\_Energy\_G4



7.5 % E\_1st(GT)=E\_2nd(AG) and 5.7 % E\_1st(AG)=E\_2nd(GT)  
The rest different order of the sequence

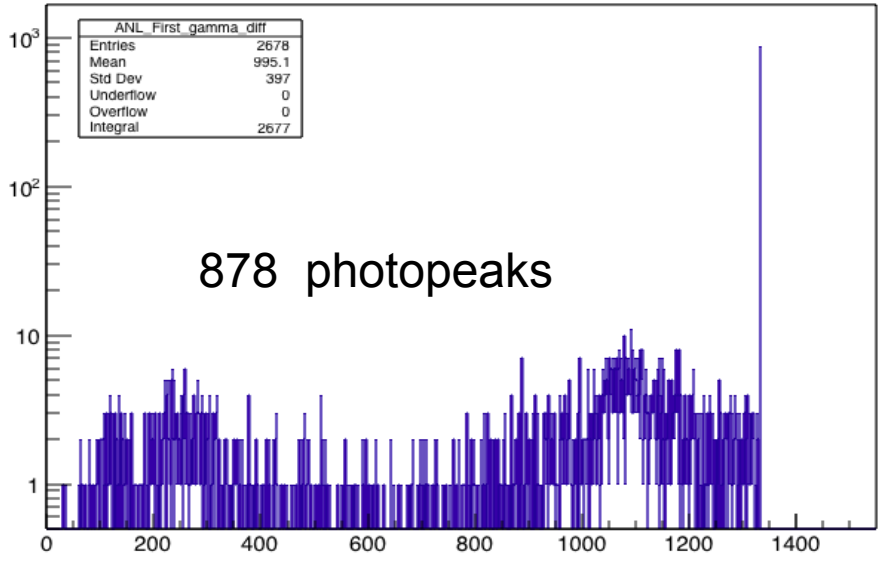


# A. Single gamma-ray reconstruction

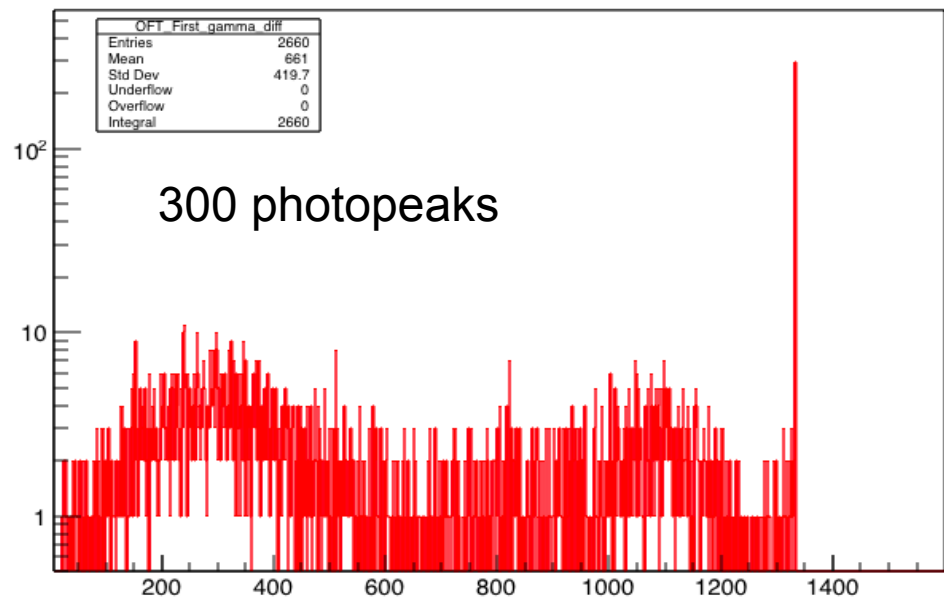
1- Identical events 30848 as considered and tracked by the 2 codes

Sub. Classe 1.2 : different tracked energies

2678 events are tracked differently : corresponding to 9 % of the considered events



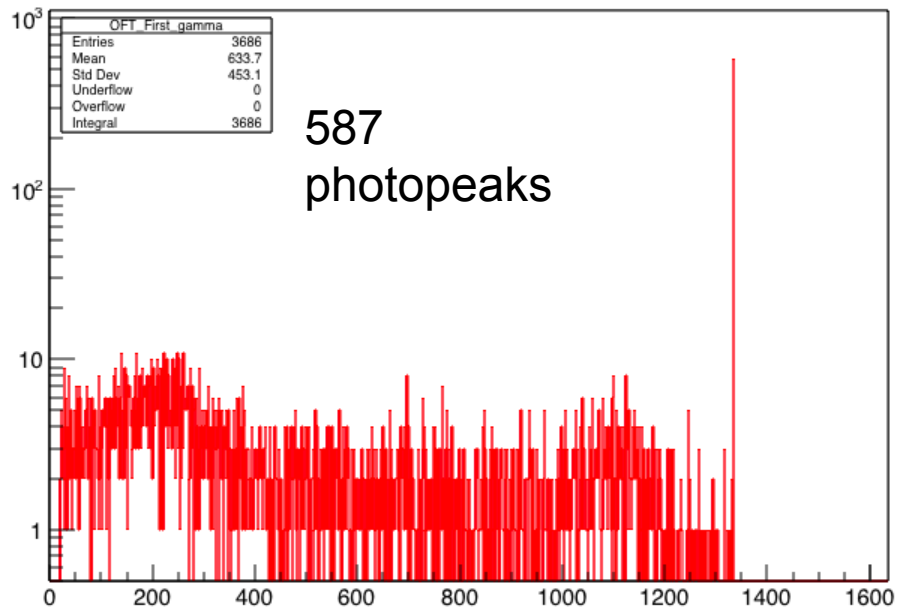
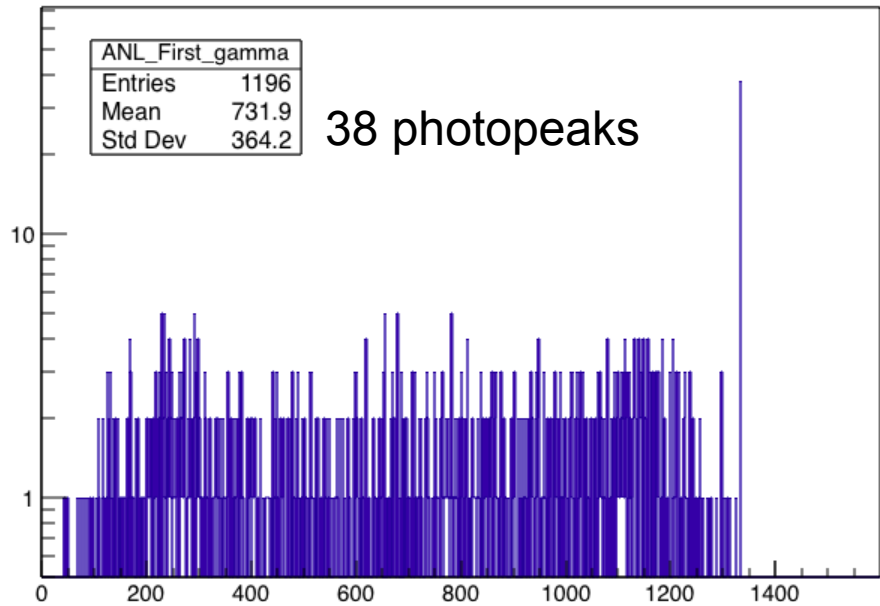
Evt#	GT	evt#	AG
8	1074	8	324
17	1333	17	1265
30	67	30	959
39	1333	39	247
41	280	41	1333
59	1333	59	325
66	296	66	1333
71	1129	71	153
.....			
465	1011	465	1333
.....			
1906	1084	1906	1333
.....			



4758	1055	4758	1333
4773	364	4773	1333
4788	1333	4788	275
4826	1006	4826	1333
4836	301	4836	1333
4839	1333	4839	1039
4877	1333	4877	261
.....			

## 2- The other events accepted or rejected by one another

Classe 2 : No sub!



AFT 31 31 371 0 0  
 AFT 69 69 1055 0 0  
 AFT 105 105 1138 0 0  
 AFT 117 117 268 0 0  
 AFT 129 129 1130 0 0  
 AFT 146 146 1112 0 0  
 AFT 162 162 226 0 0  
 AFT 166 166 1241 0 0  
 AFT 178 178 376 0 0  
 AFT 188 188 461 0 0  
 AFT 224 224 199 0 0  
 AFT 233 233 1110 0 0  
 AFT 238 238 208 0 0  
 AFT 273 273 1184 0 0  
 AFT 275 275 707 0 0  
 AFT 305 305 459 0 0  
 AFT 350 350 251 0 0

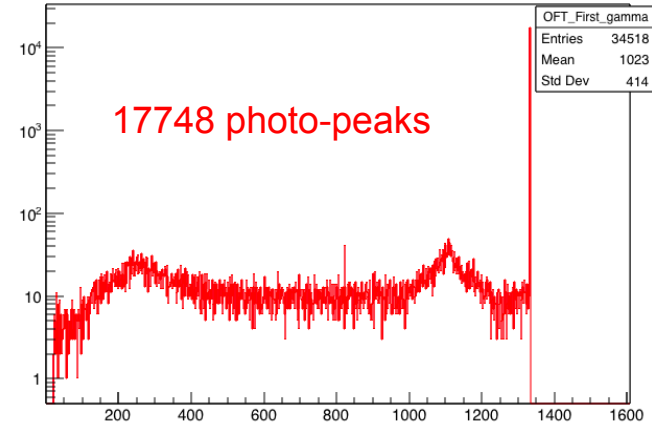
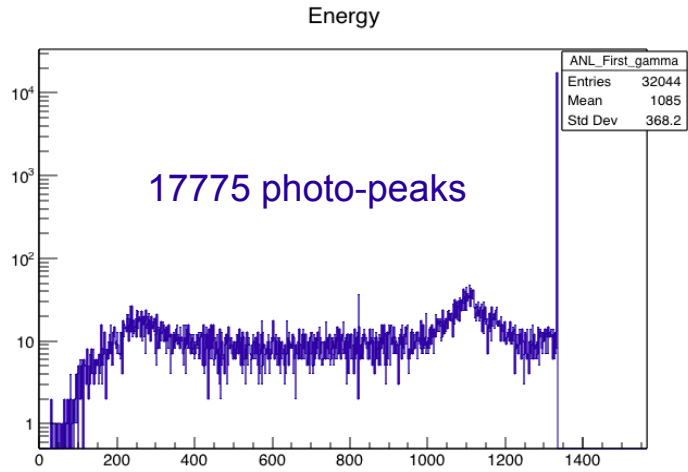
.....  
 OFT 4 0 0 4 246  
 OFT 19 0 0 19 1131  
 OFT 29 0 0 29 485  
 OFT 38 0 0 38 392  
 OFT 84 0 0 84 581  
 OFT 110 0 0 110 174  
 OFT 127 0 0 127 629  
 OFT 139 0 0 139 754  
 OFT 169 0 0 169 1152  
 OFT 187 0 0 187 137  
 OFT 201 0 0 201 89  
 OFT 204 0 0 204 256  
 OFT 221 0 0 221 12  
 OFT 225 0 0 225 1333  
 OFT 239 0 0 239 1245

.....

# The First reconstructed gamma-ray by AFT and OFT G4 = 38119 gamma-rays

## A. one gamma-ray reconstruction

GRETA code reconstruct 32044 gamma-rays AGATA code reconstruct 34518 gamma-rays



### 1- Identical events

Identical tracked gamma-rays : 28166

16860 photo-peaks

Different tracked energies : 2680

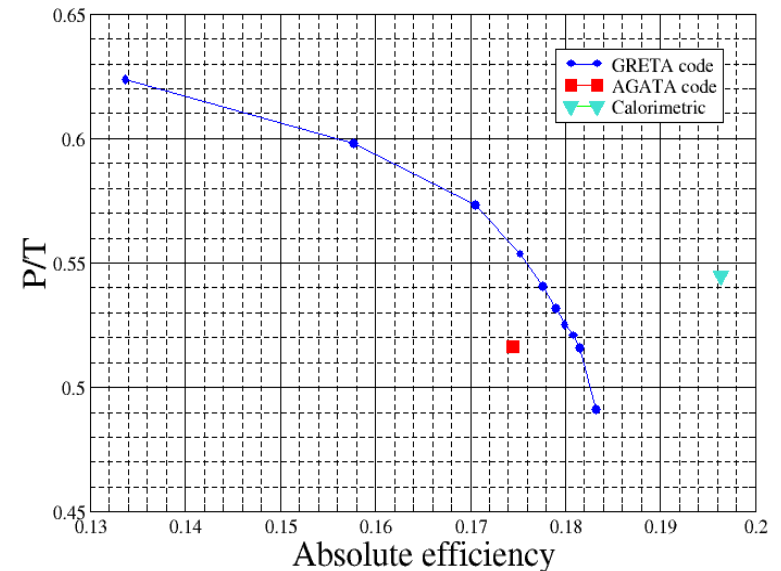
878 versus 300 photo-peaks

### 2- The other events accepted or rejected by one another

1196 events for GRETA versus 3670 events for AGATA

38 versus 587 photo-peaks

Without splitting some events into 2 or more gammas  
Better P/T

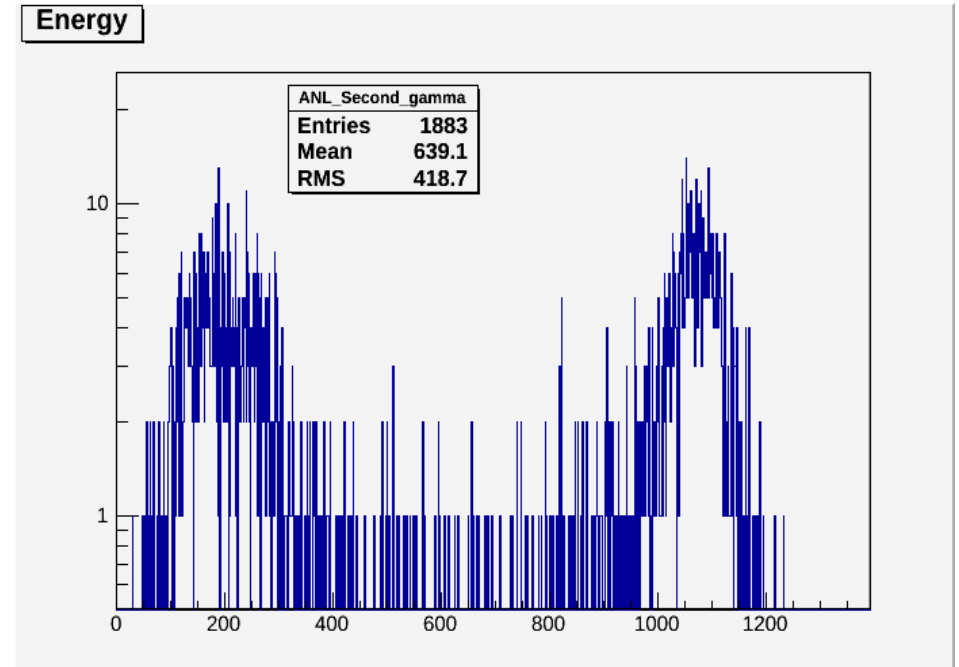
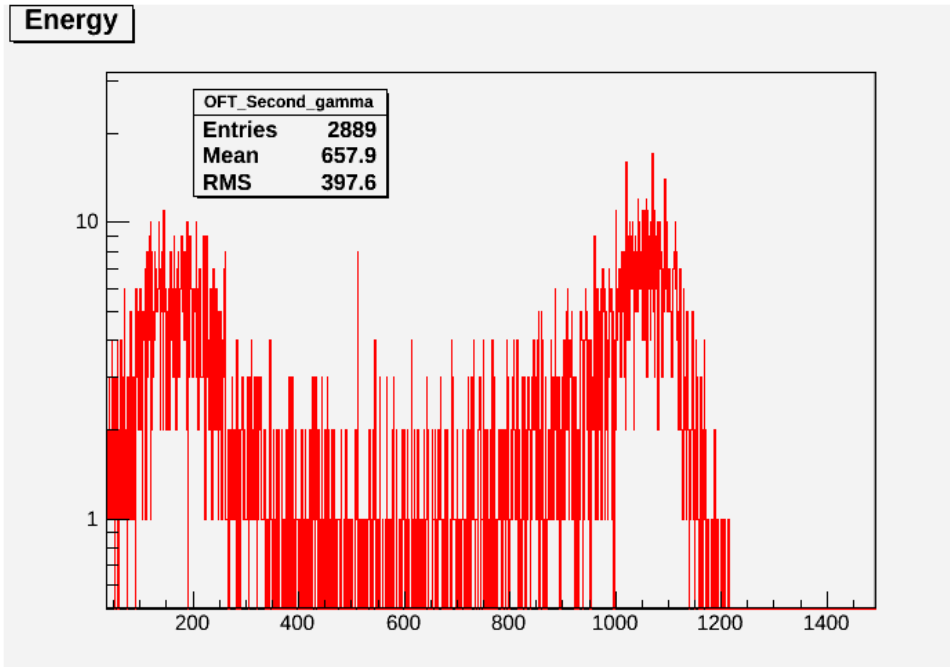
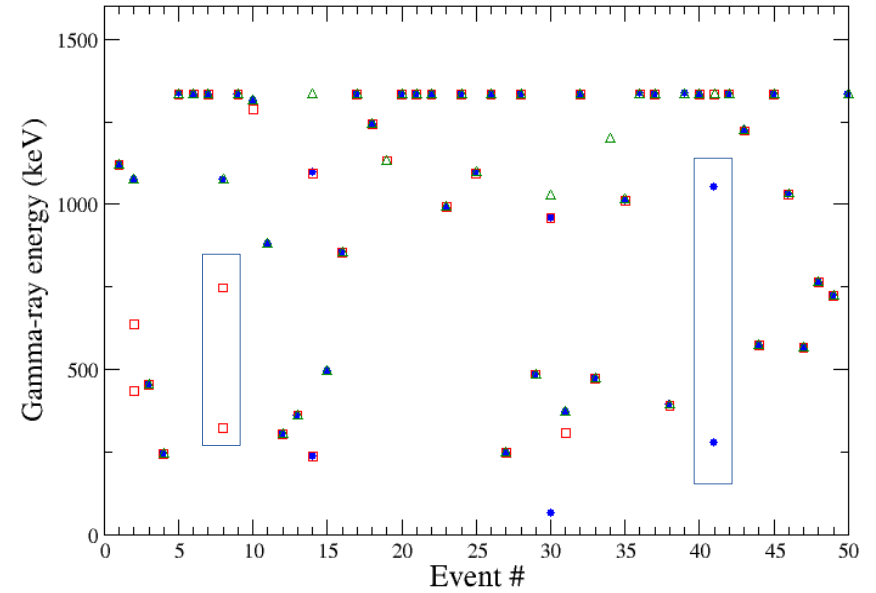
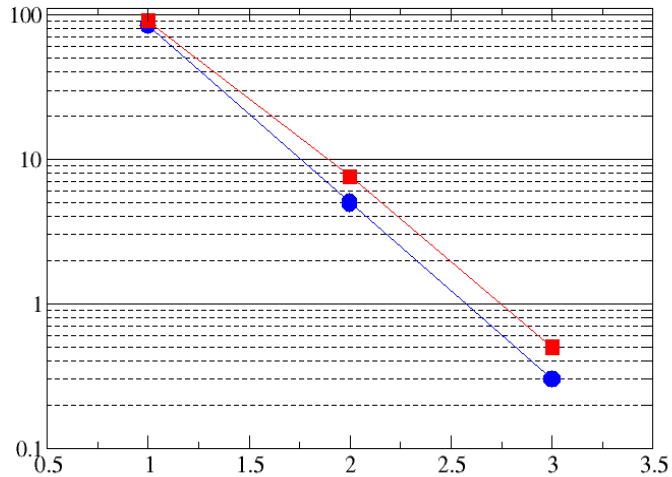


# The second reconstructed gamma-ray by AFT and OFT

## B. Events split into Two gamma-rays reconstruction

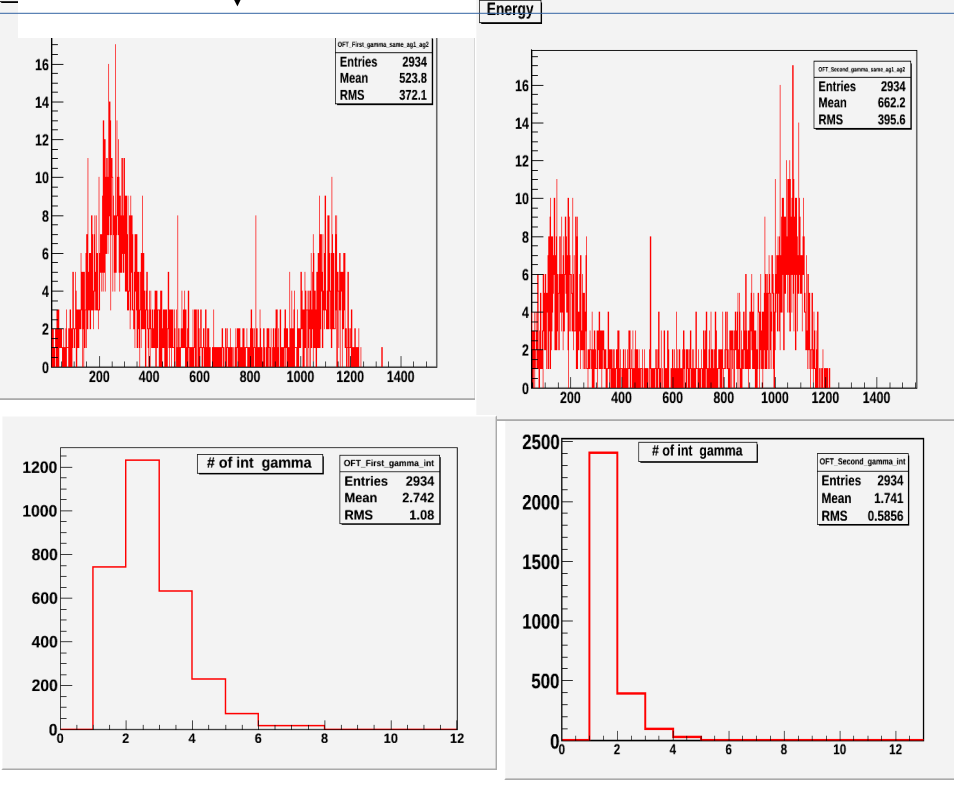
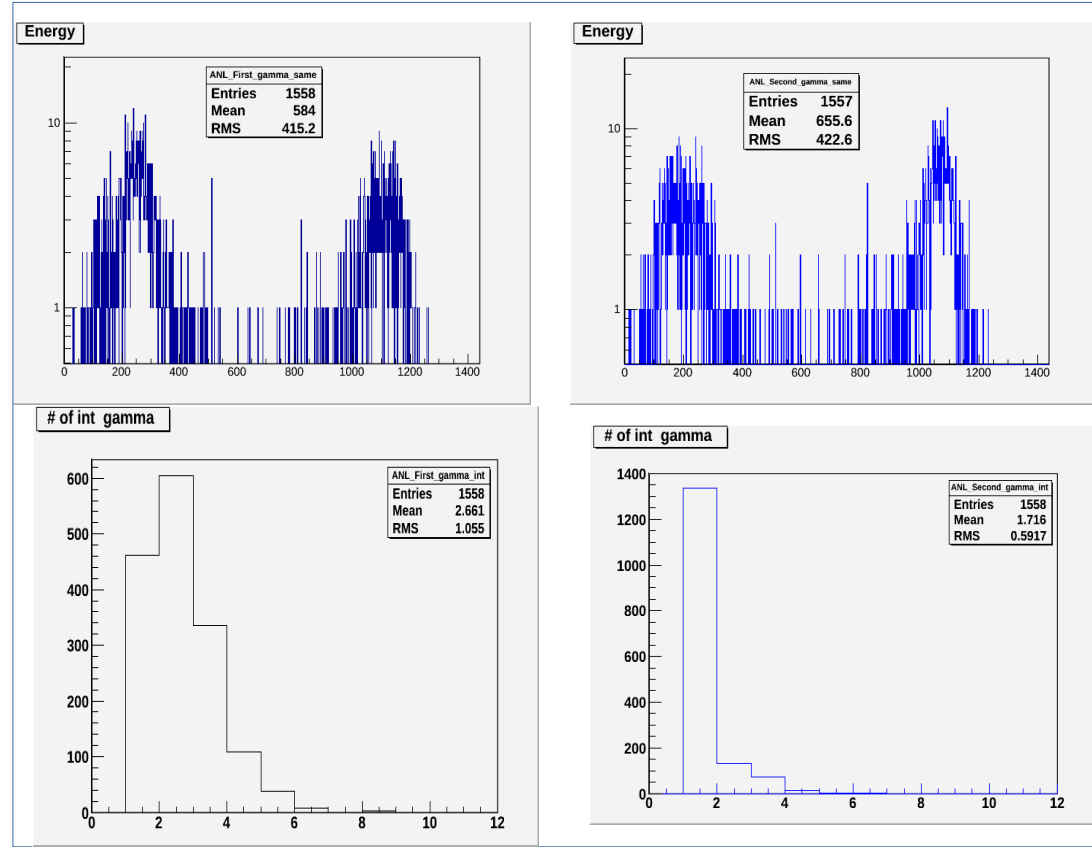
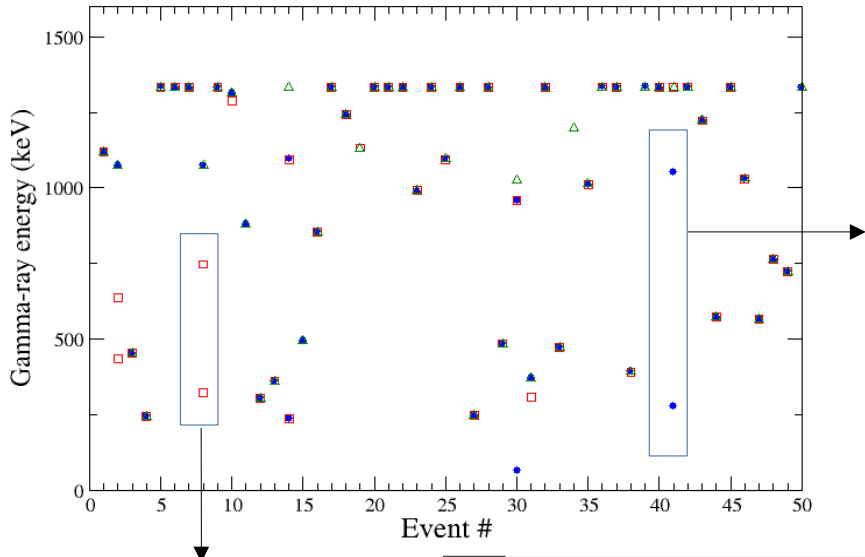
GRETA 5% versus 7.7 for AGATA

G4 = 38119 gamma-rays



# The second reconstructed gamma-ray by AFT and OFT G4 = 38119 gamma-rays

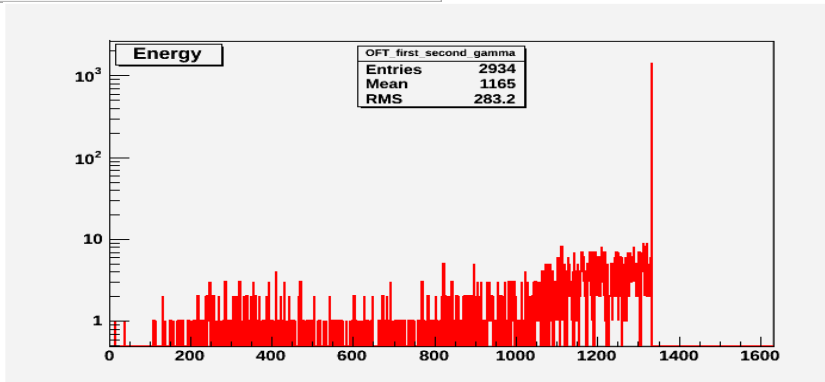
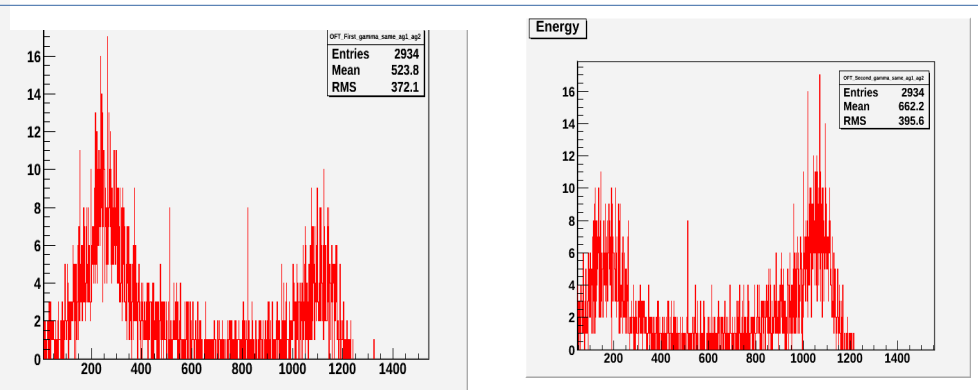
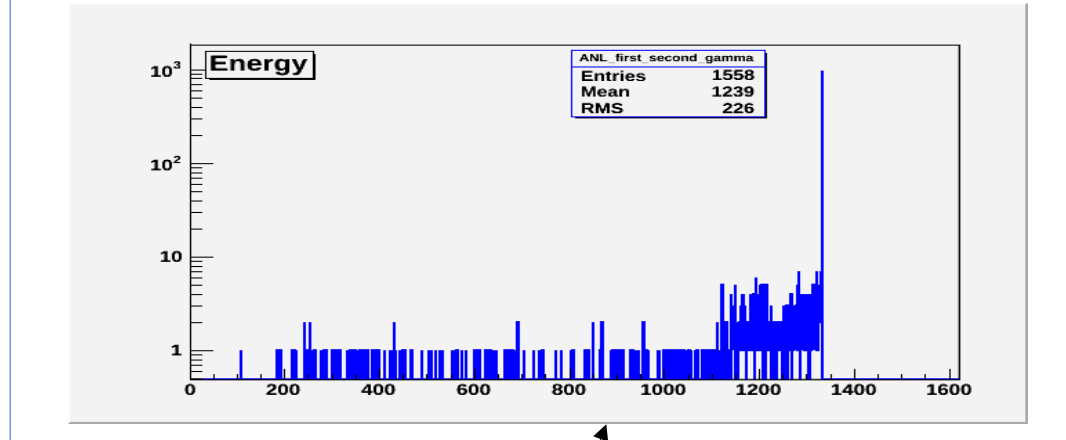
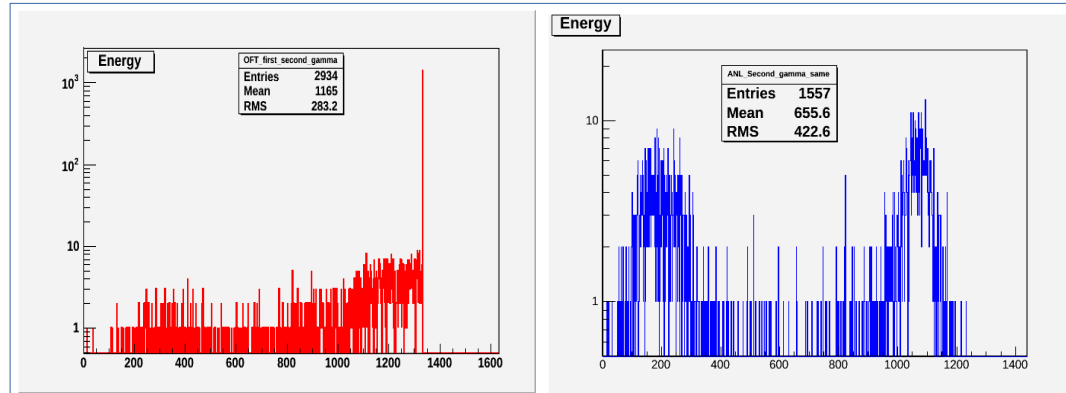
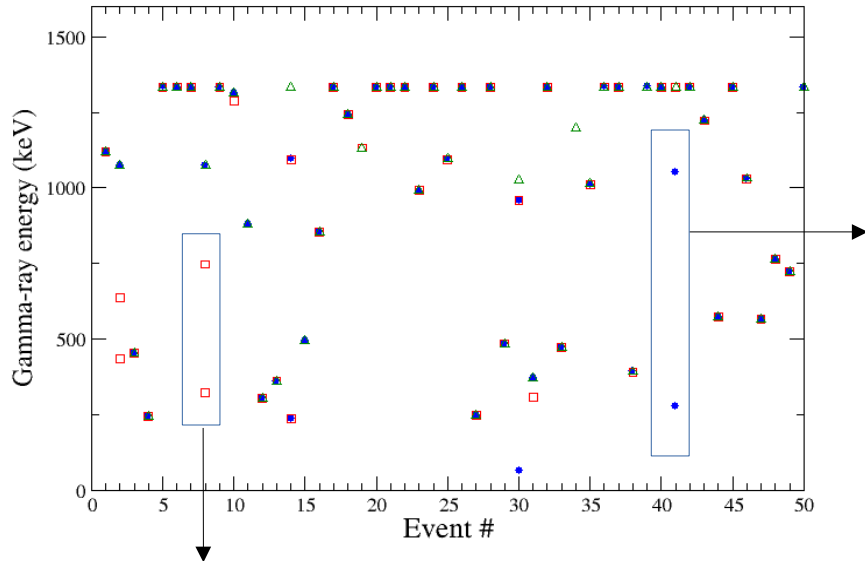
## B. Events split into two gamma-rays reconstruction GRETA 5% versus 7.7 for AGATA



Not necessarily the same events that set  
 Split by the two codes

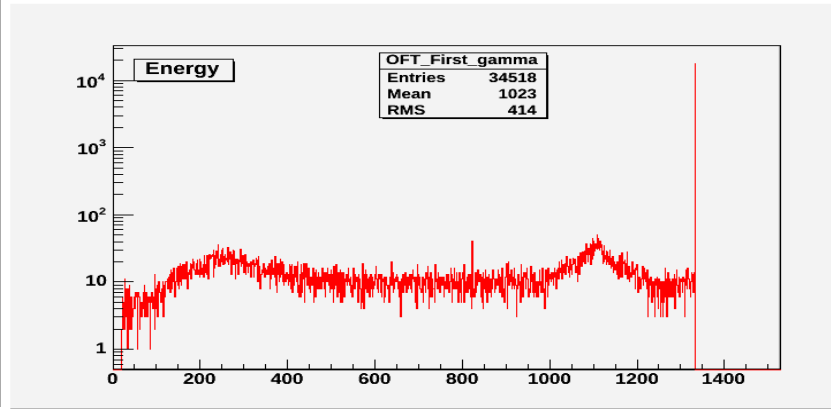
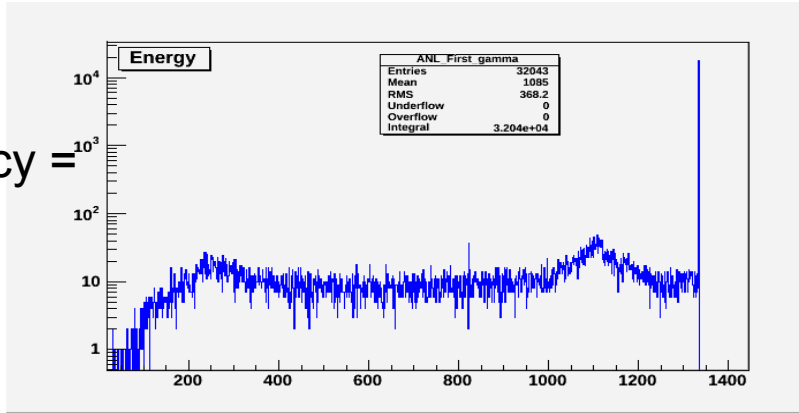
# The second reconstructed gamma-ray by AFT and OFT

B. Events split into Two gamma-rays  
GRETA 5% versus 7.7 for AGATA



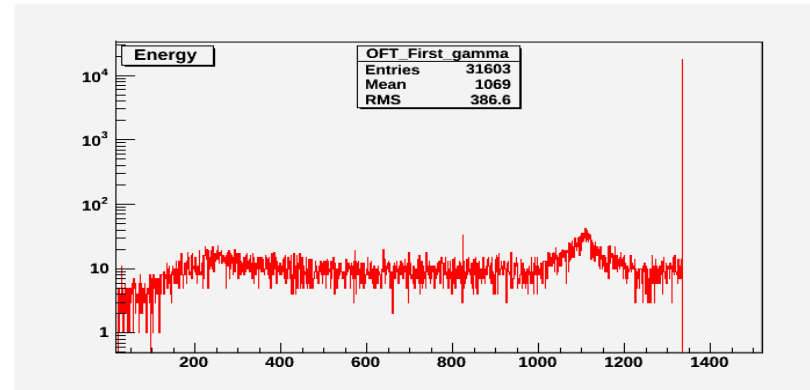
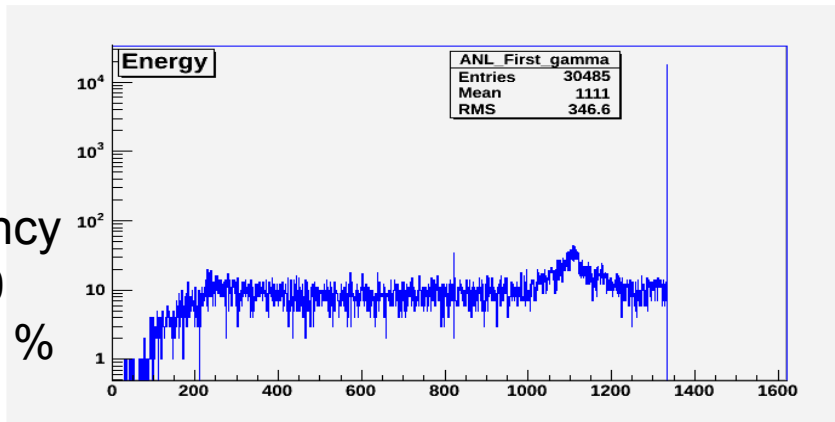
Simple add-back of these events

Efficiency =  
17.8  
PT=  
55 %

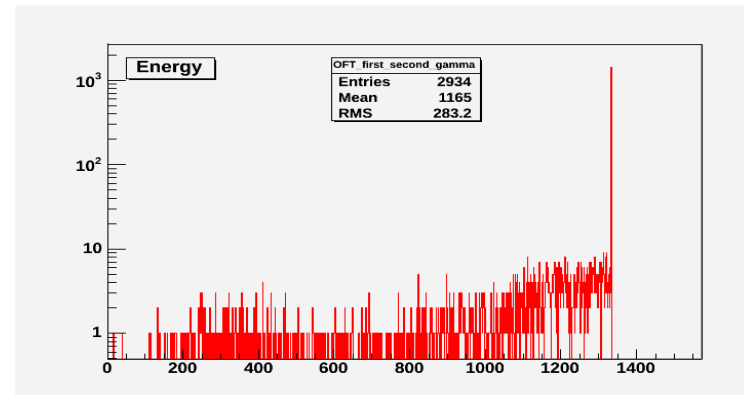
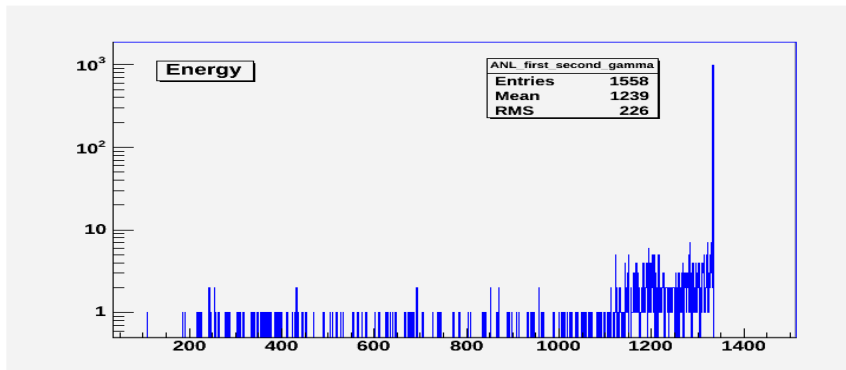


Efficiency =  
17.8  
PT=  
51 %

Efficiency  
=18.80  
PT=58 %



Efficiency =  
19 %  
PT=  
55 %



Summary : Are we comparing apples and oranges using default parameters ?

Event-by-event comparison of AGATA-GRETA tracking code - Simulated data Multiplicity M=1

Single gamma-ray reconstruction versus G4 = 38119 gamma-rays

GRETA code reconstructs 32044 gamma-rays 84%  
AGATA code reconstructs 34518 gammas versus 90%

Identical events # 30848 as considered and tracked by the 2 codes : 80% relative to Geant4

28166 events are tracked exactly the same : corresponding to 91 % of the considered events

Interesting events : those which are tracked differently by the 2 codes ... 9 %

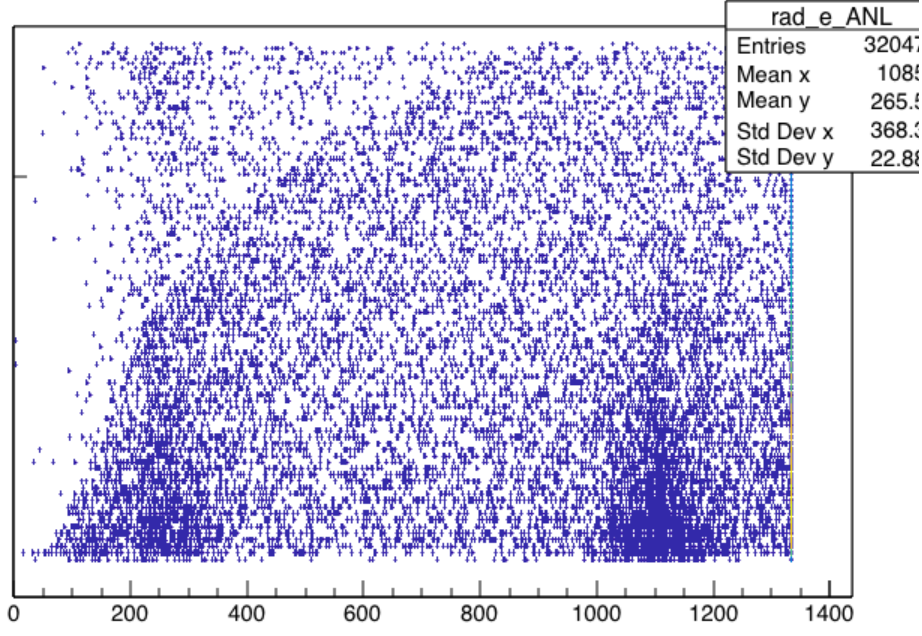
The others accepted or rejected by one another : Can we really compare them FOM wise ?

GT 3.7 % versus AG 10%

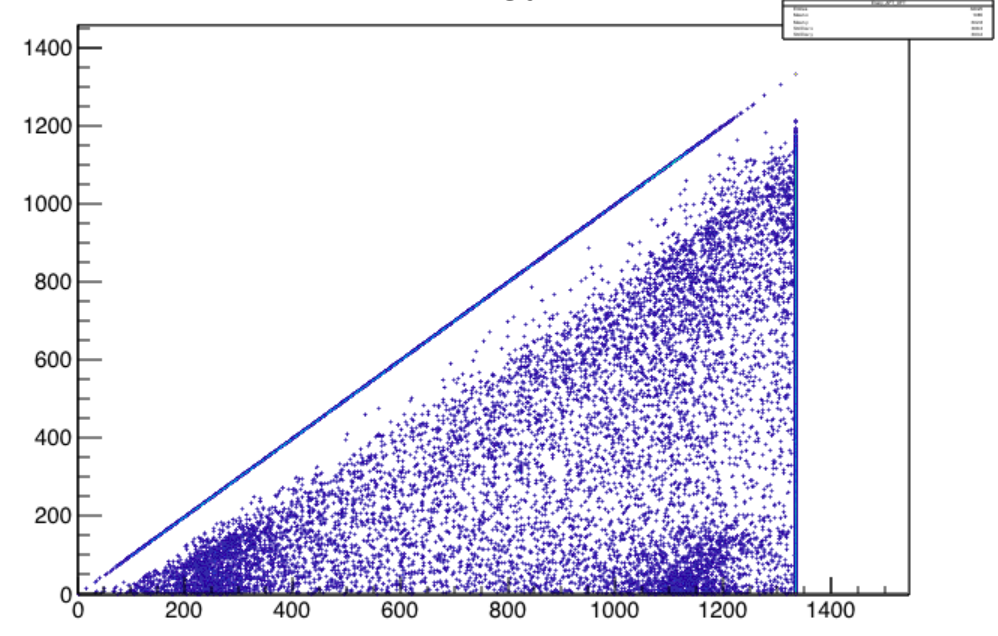


EXTRA SLIDES

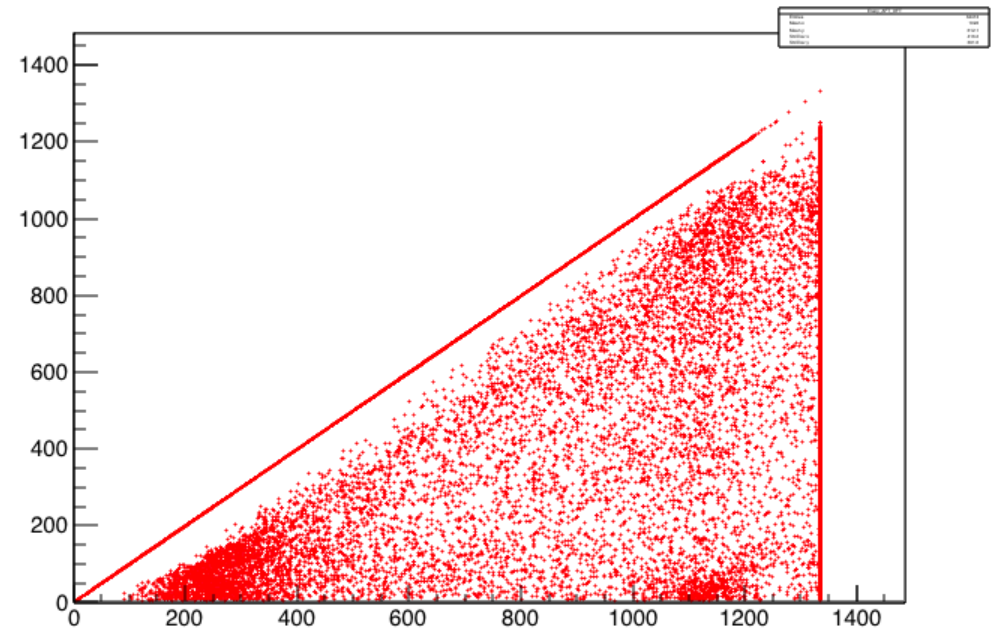
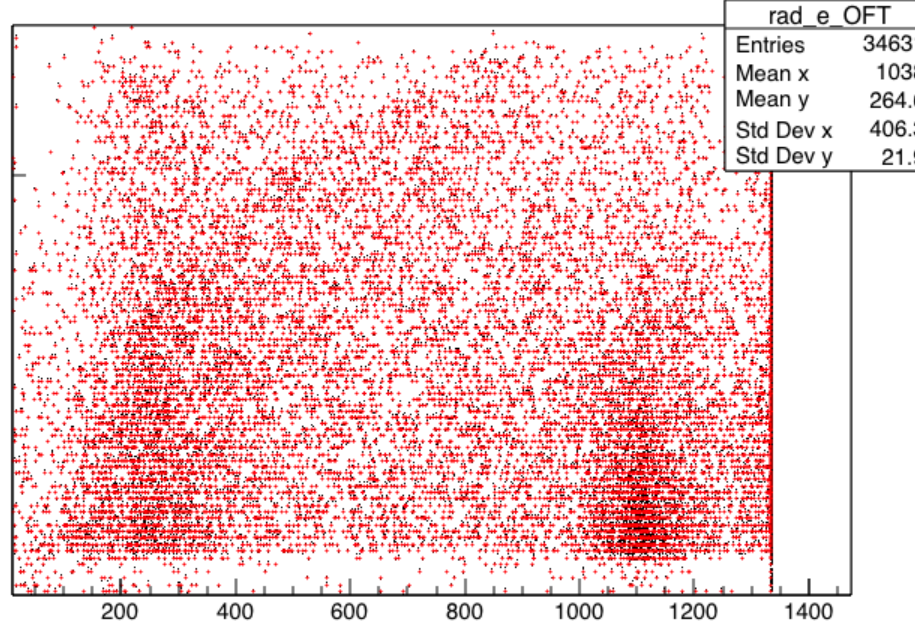
Depth in the array pos



First interaction energy



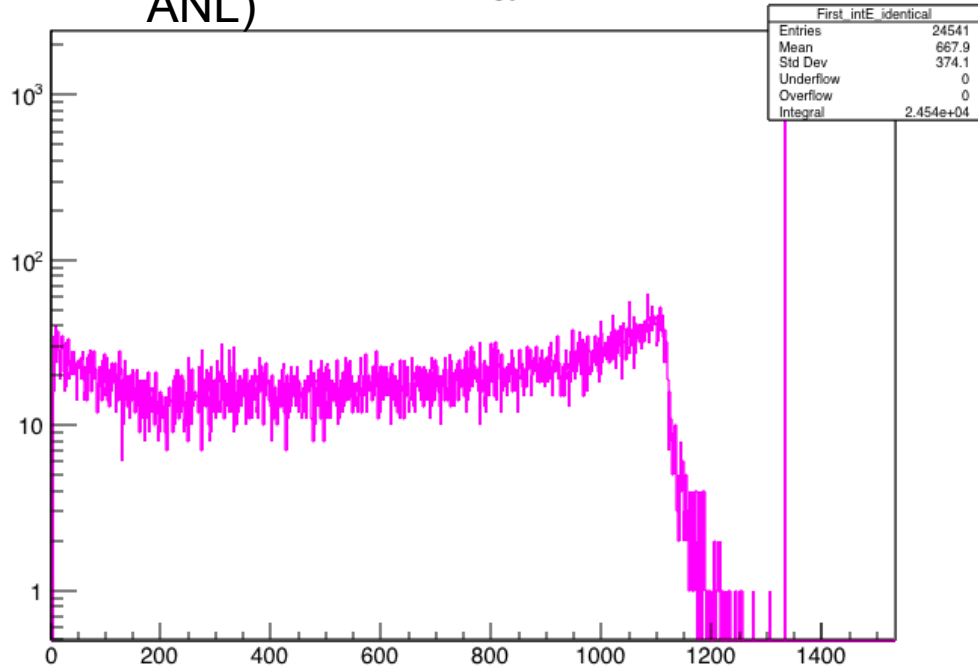
pos



First gamma Energy

First interaction (identical in OFT and ANL)

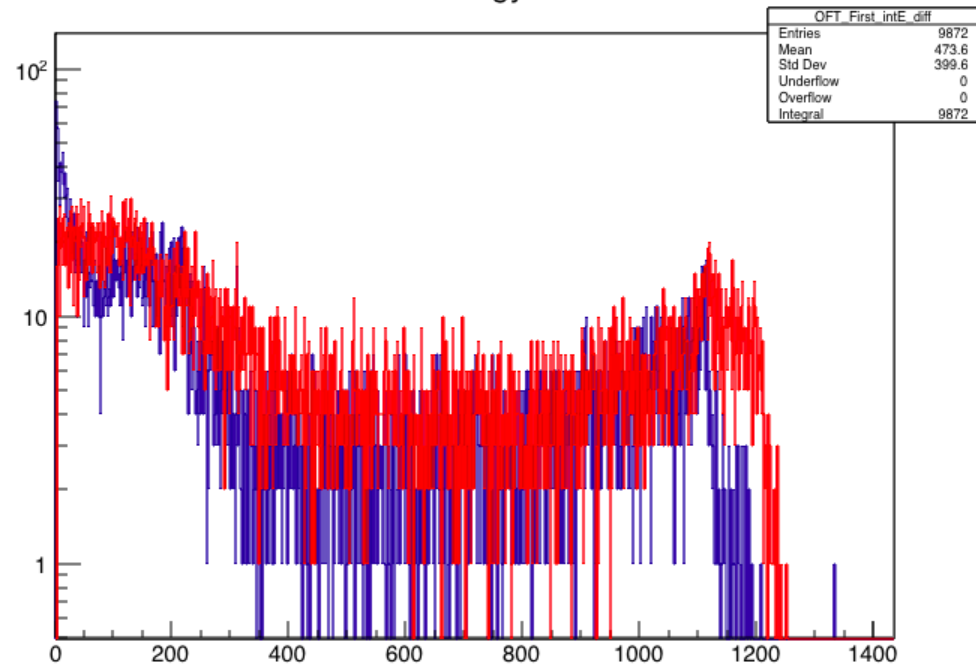
Energy



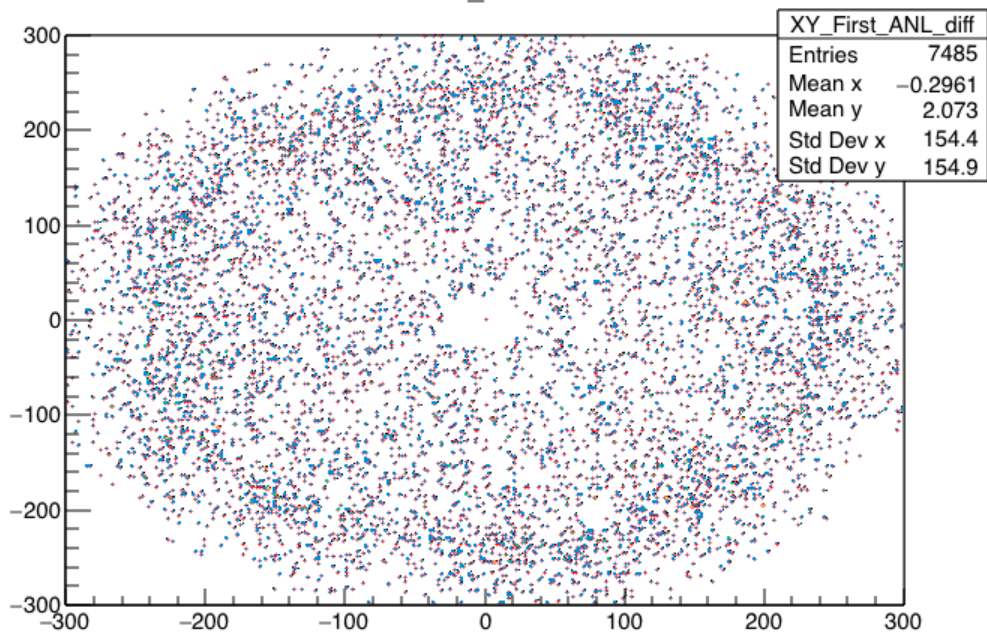
9872

Energy

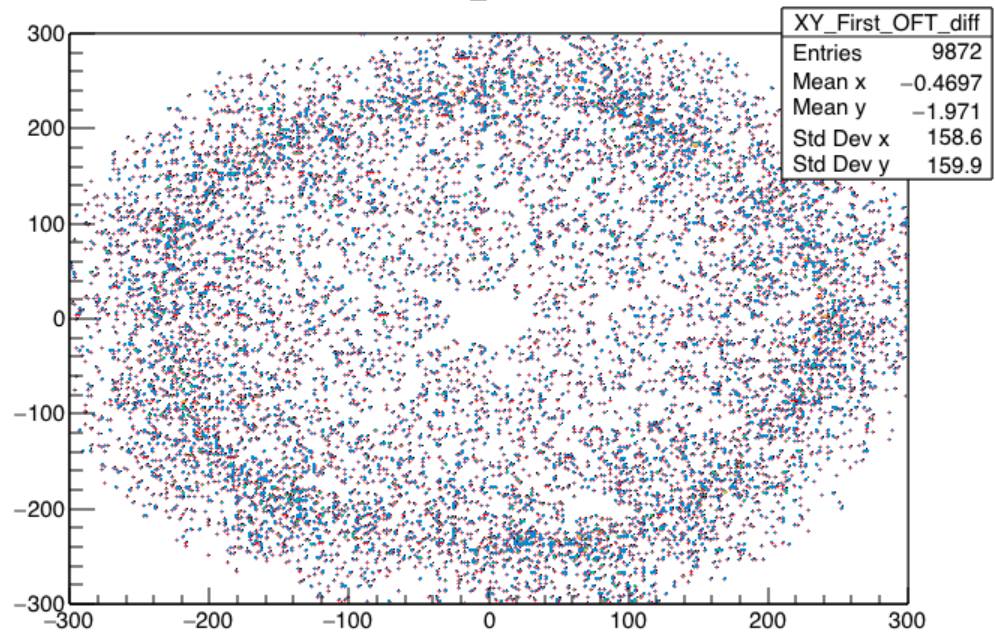
7845



diff\_ANL

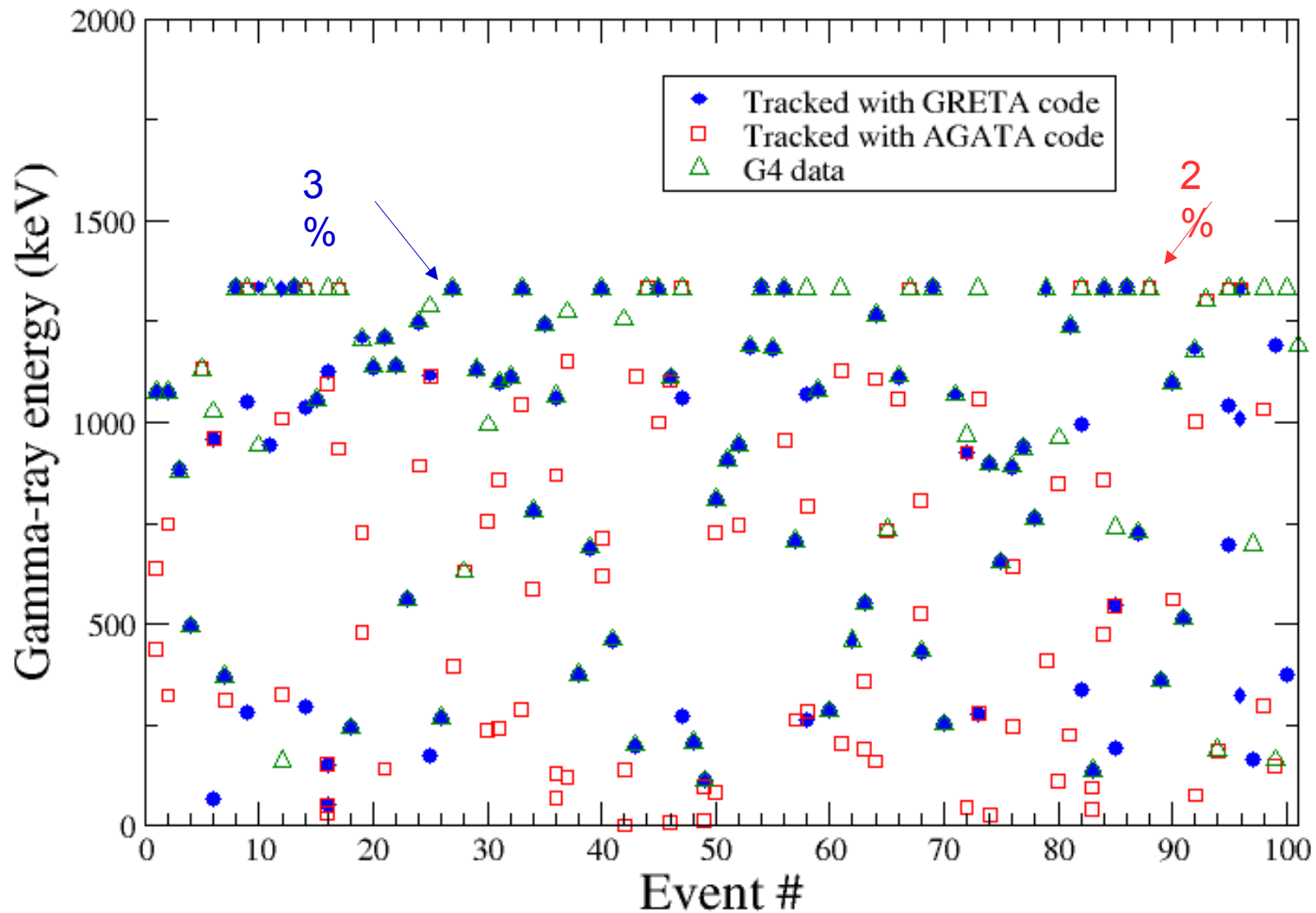


diff\_OFT



Tracked gamma-rays with **AGATA code** **GRETA code** versus **GEANT4**

Grouping the differences on this plot : 20% of the total events

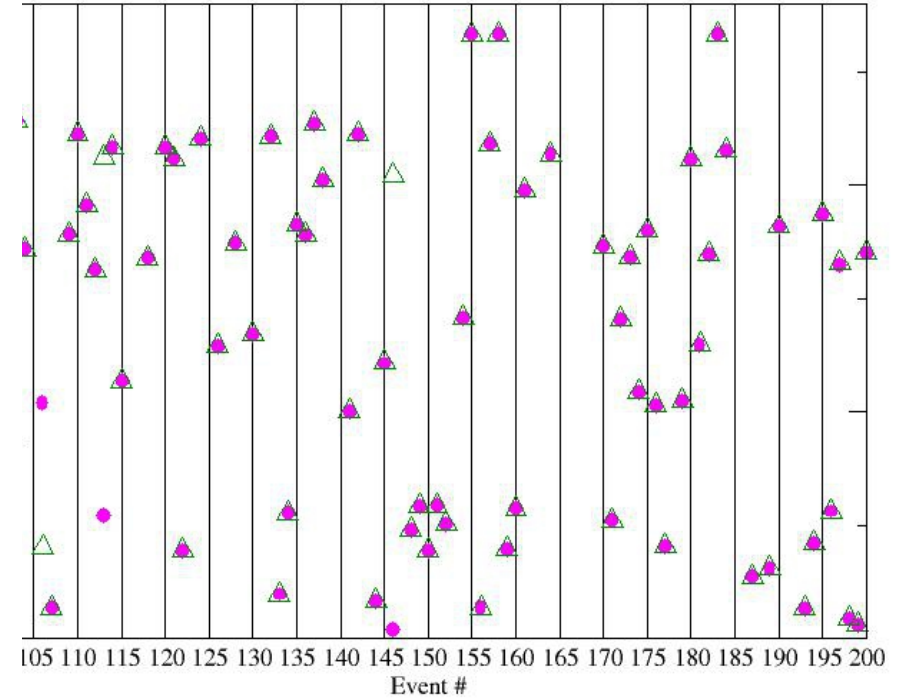
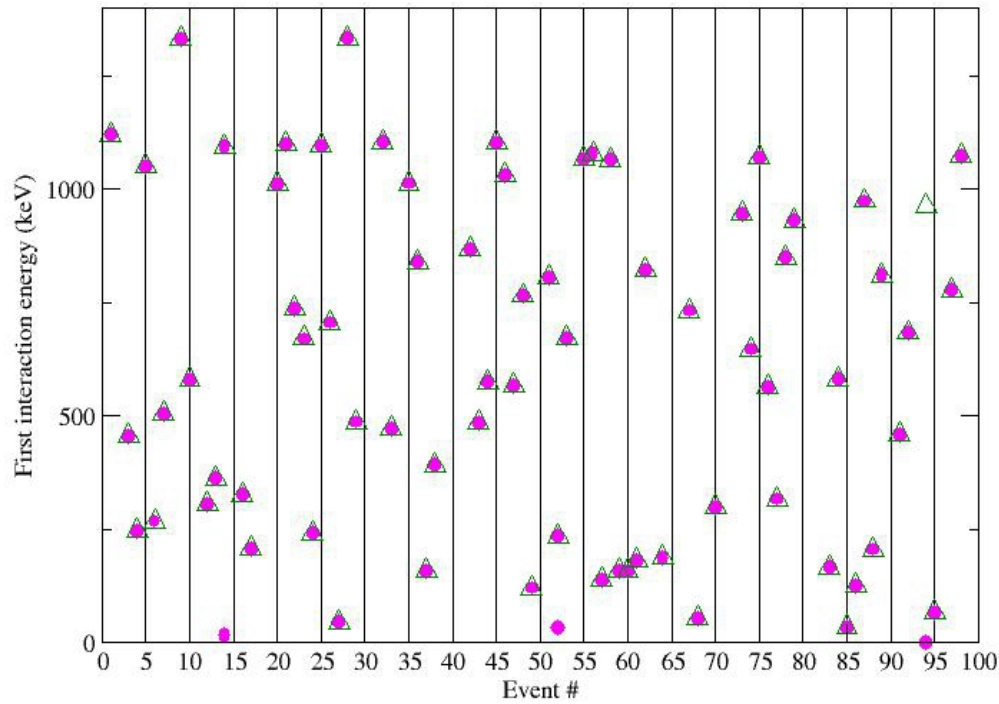


GRETA code finds 2 % that were split into 2 or more gamma-rays/event

AGATA code finds 5% that were split into 2 or more gamma-rays/event

Resulting in a better P/T with GRETA code for this simulated data (55 % versus 52 % )

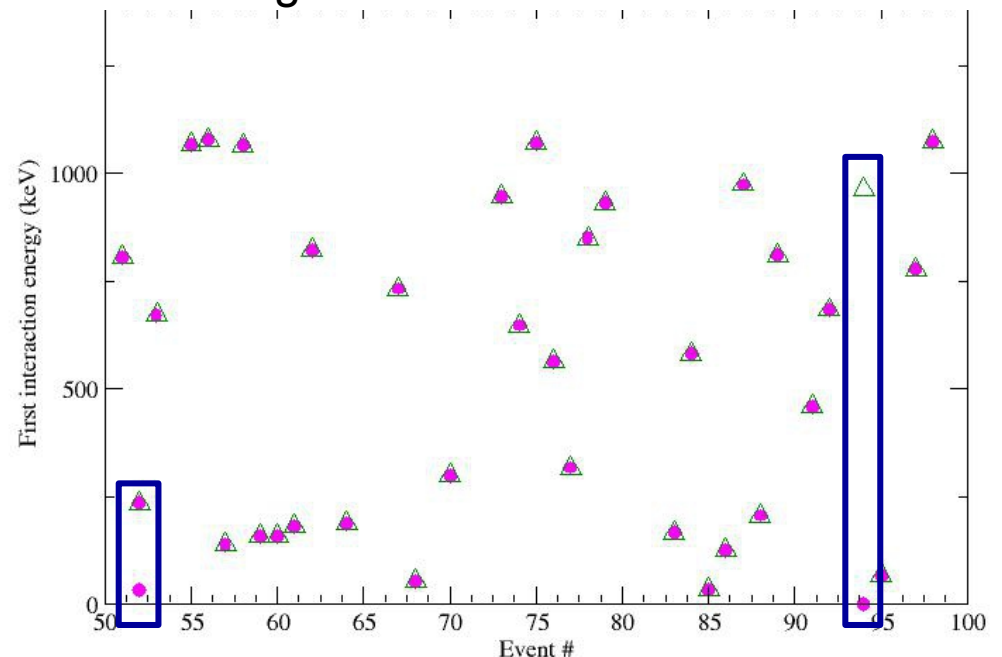
Agreement with GEANT 4 simulated data for these 72 % events : 96%



Few events in disagreement with G4 but same for both tracking codes

Either wrong regarding the first interaction point

or they find 2 gamma-ray for which the assigned first interaction point is correct

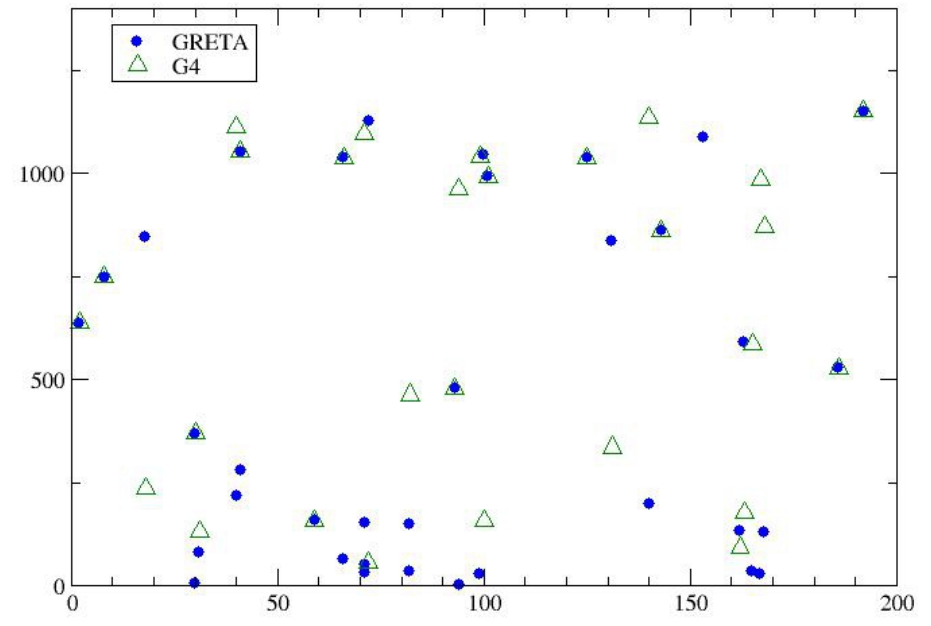
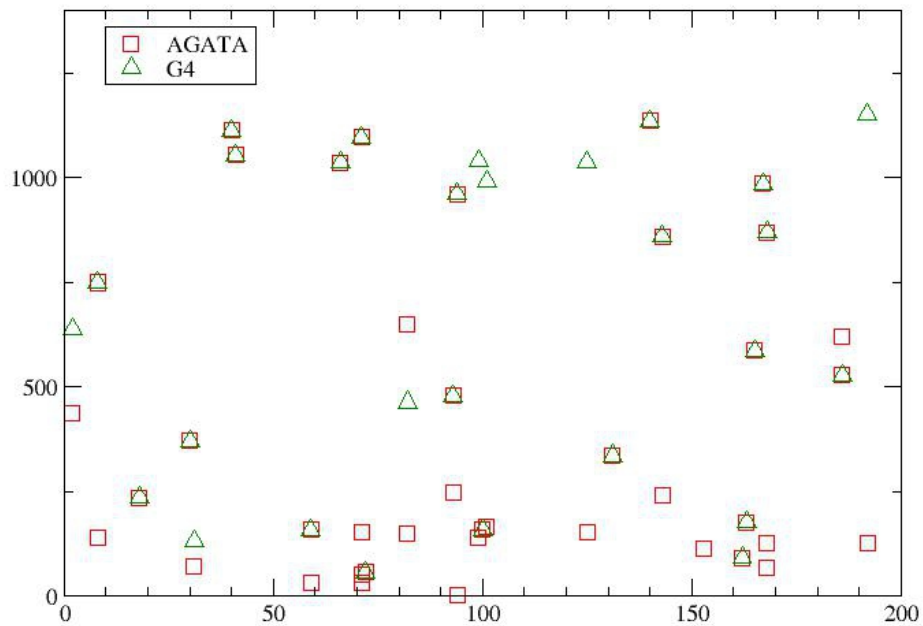


The group of Events for which the First interaction points are different : 14 %

Comparison of those events with Geant 4

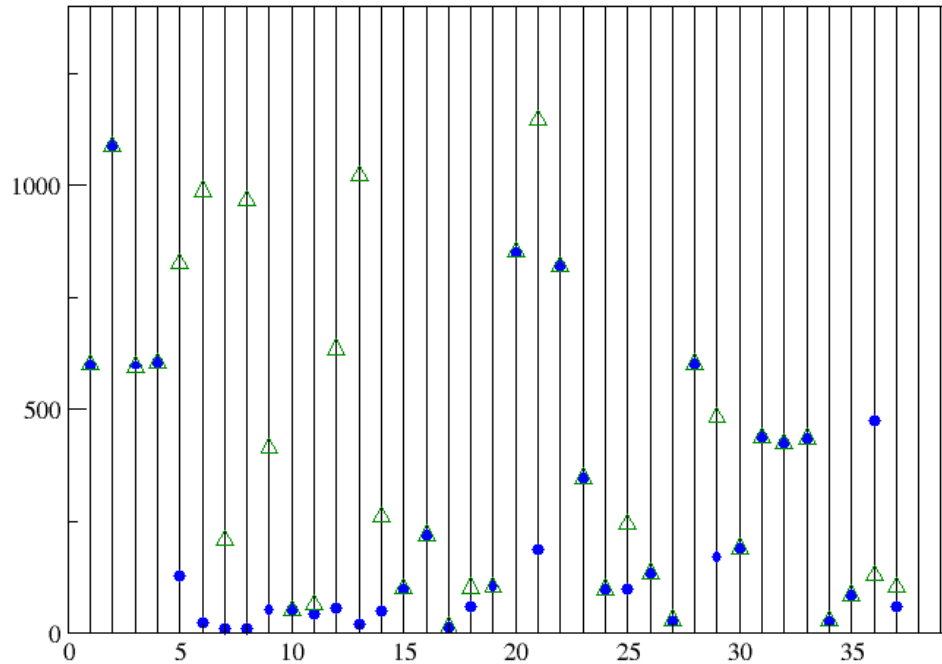
AGATA : 7.5 % good events

GRETA : 5% good events

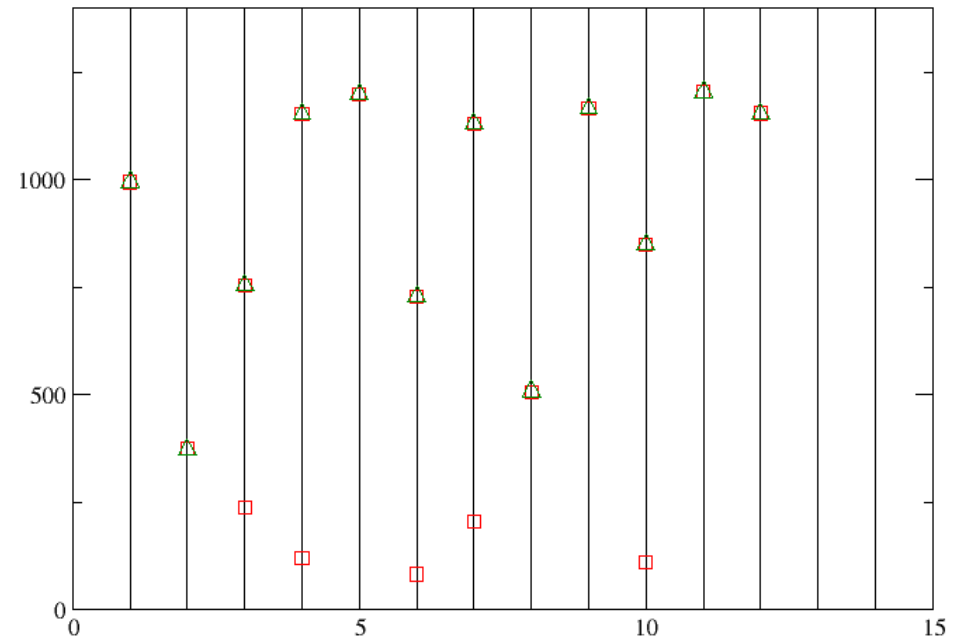


# Events accepted by ANL/Rejected by AGATA and vice-versa

Accepted events by ANL but rejected by OFT  
compared to G4



Accepted events by OFT but rejected by ANL  
compared to G4



7.4% events accepted by GRETA code  
but rejected by AGATA code

60% of these events are correctly tracked :  
This corresponds to 4.5% of total events

2.4% events accepted by AGATA code  
but rejected by GRETA code

67% of these events are correctly tracked :  
This corresponds to 1.7 % of total events

72+ 5+ 4.5 % good events  
events

81.5 % good events

72+7.5+1.7 % good

81.2% good events