II- Review of the decisions made during the first 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

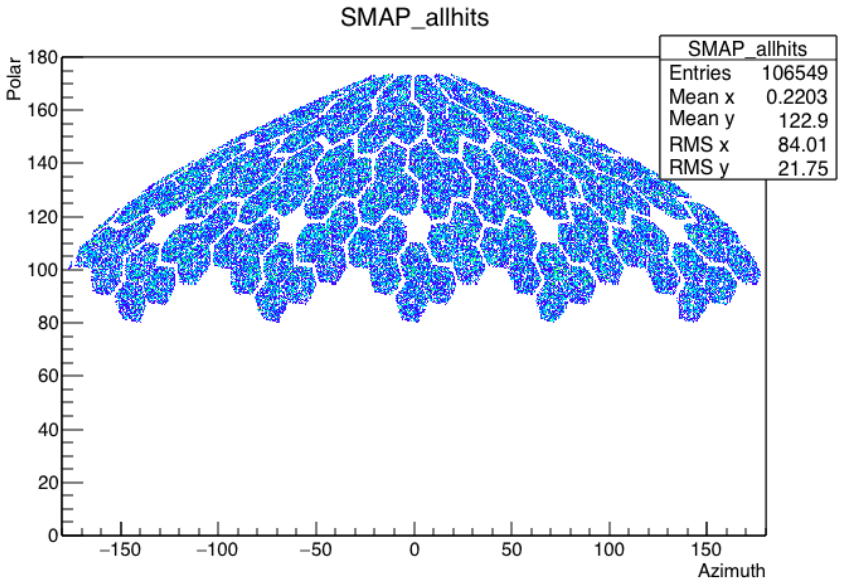
Compare the first interaction energies as found by AGATA and GRETA codes

Compare the second interactions as found with both tracking codes

Experimental data we have : No reference - blind comparison

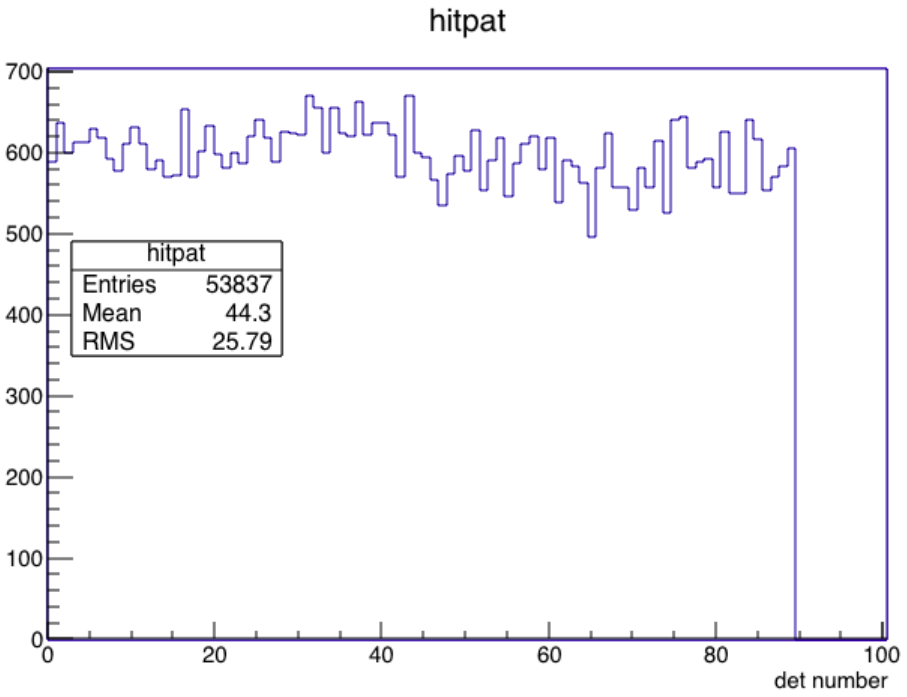
Amel KORICHI

Step 1 : Simulated data using AGATA G4- the Packing is performed with G4
100000 events (1.33 MeV line)

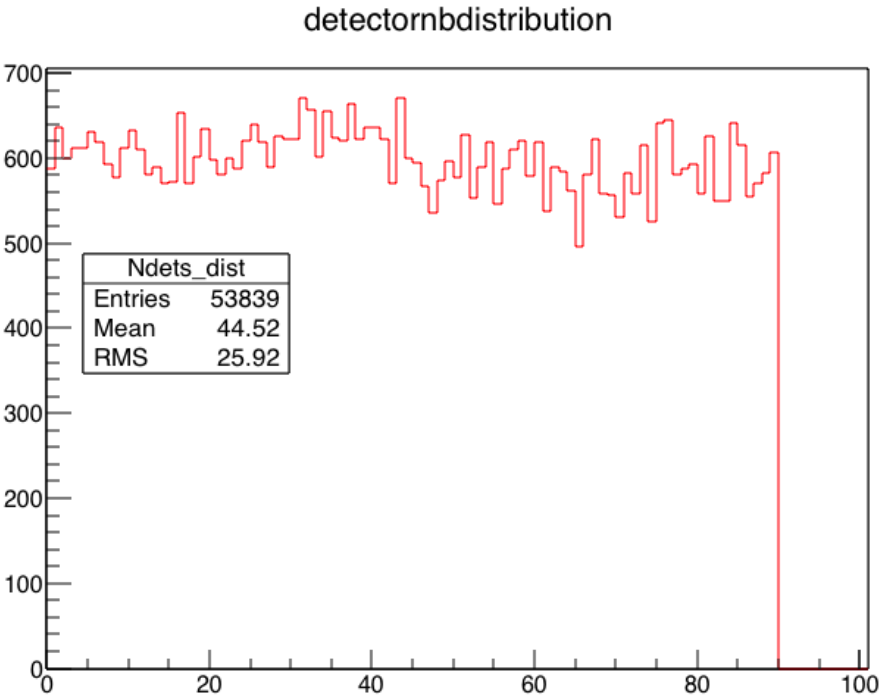


First check the integrity of the data/sorting
before comparing the tracking codes
Hitpat, central contact & calorimetric spectra

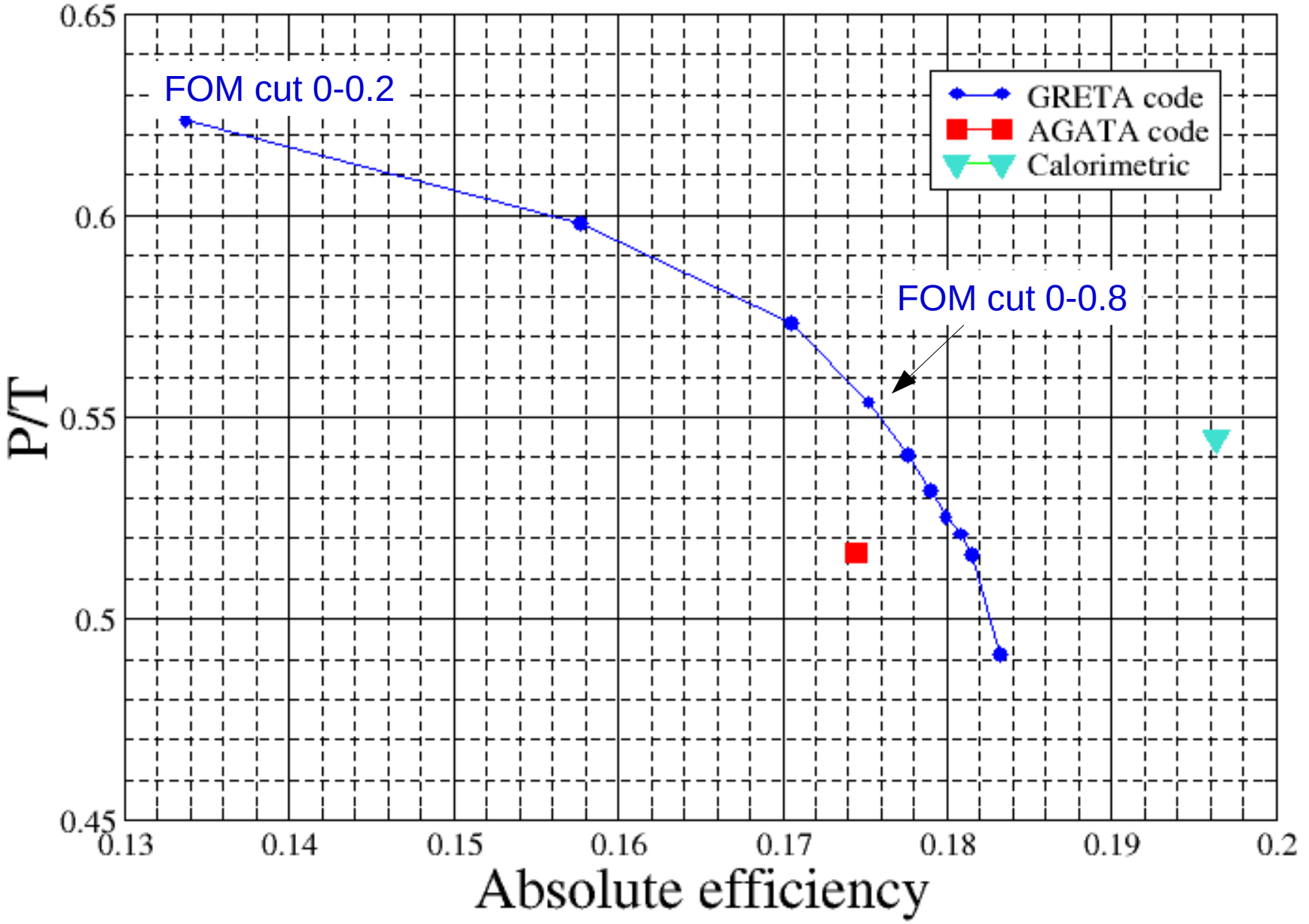
ANL (GRETA code)



OFT (AGATA code)



Use 100000 shoot events from GEANT 4
Use the default parameters for both AGATA and GRETA tracking codes



AG_tracked/calorimetric_eff = 88.85%

GT_tracked/calorimetric_eff= 89.27%

Total tracked gamma-rays with AGATA and GRETA codes :

75% of the tracked data and accepted (FOM wise) are identical = same tracked energy

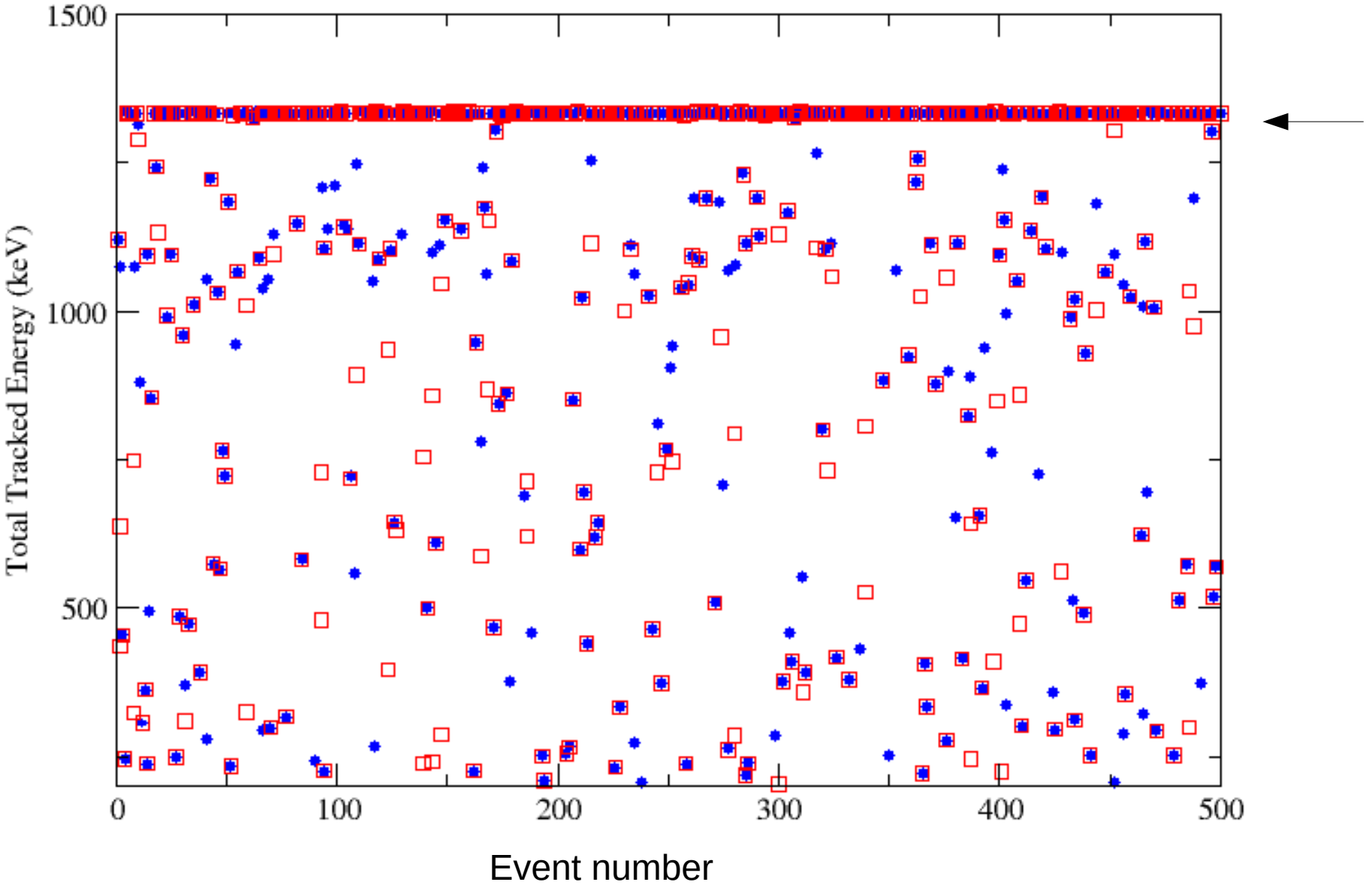
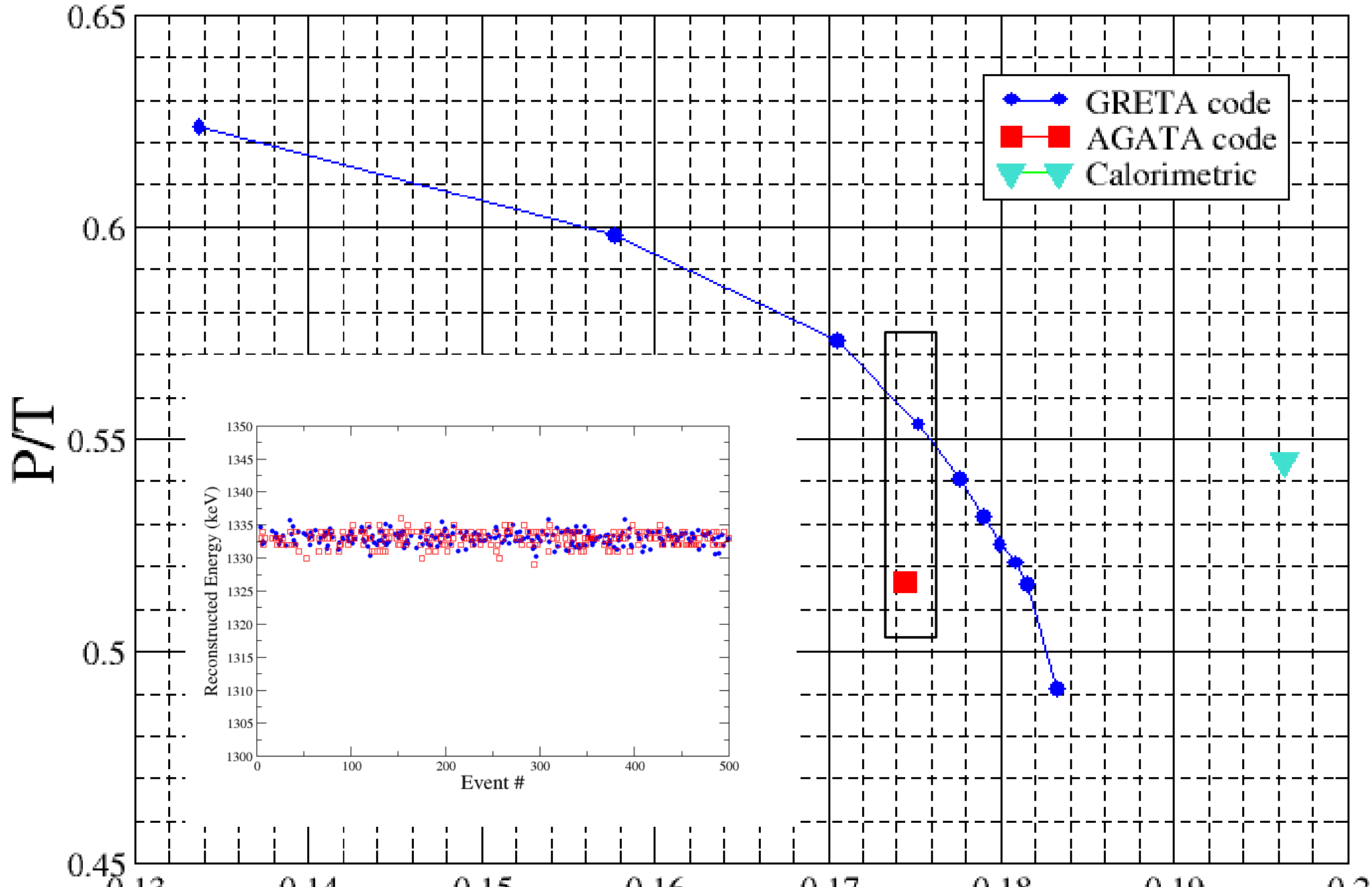


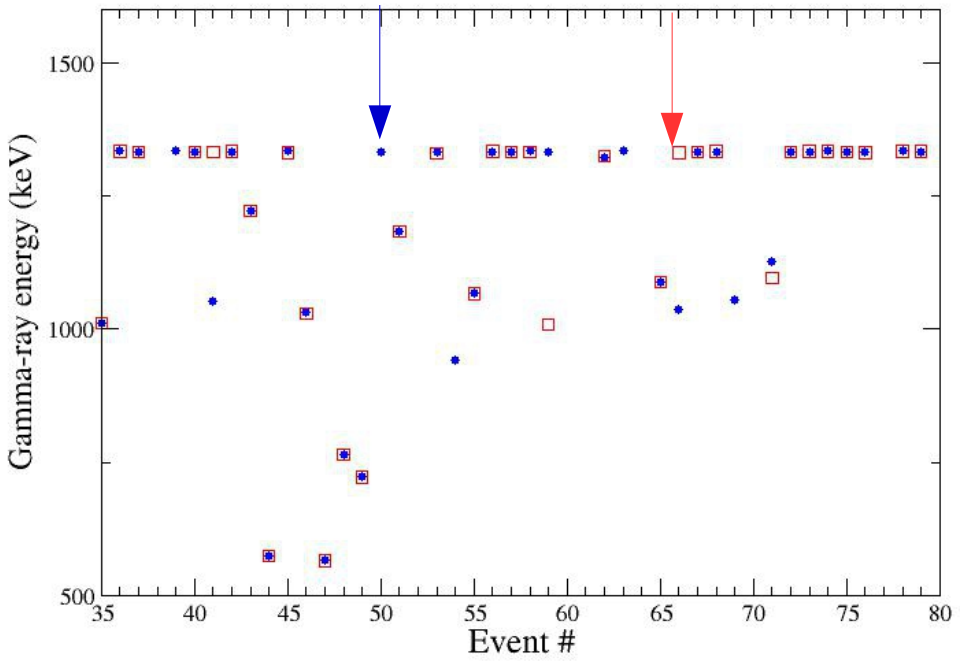
Photo-peak tracked energy

AGATA: 48% of the reconstructed events = 1.33 MeV

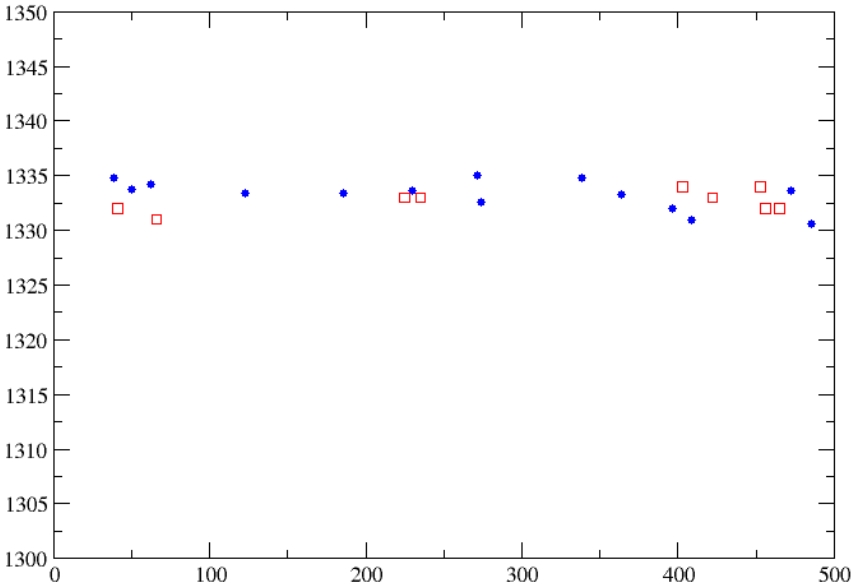
GRETA: 49% of the reconstructed events = 1.33 MeV



Good events (photo-peaks) treated differently



Grouped on this plot



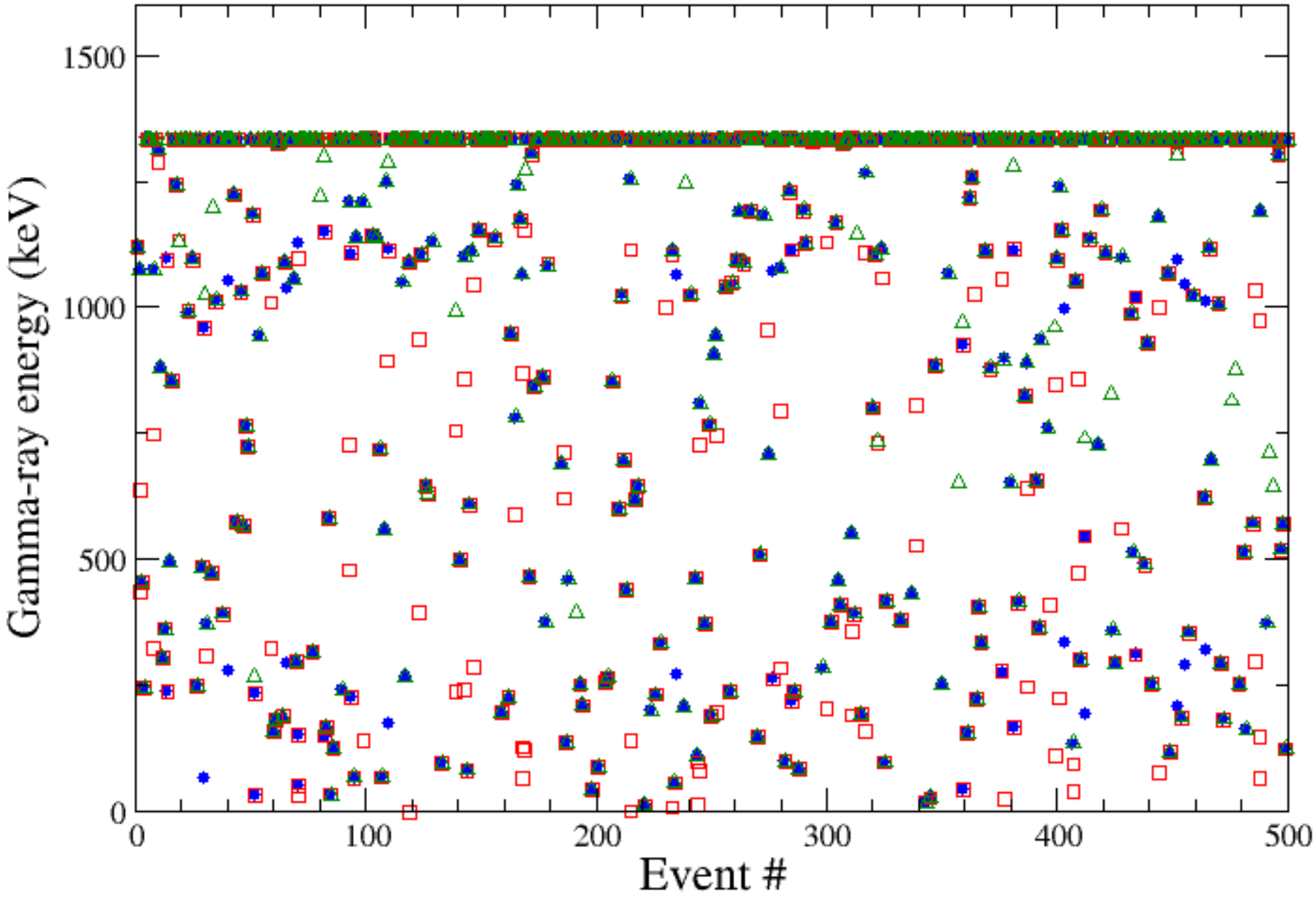
Not correctly tracked or Assigned bad FOM > 0.8 (thus rejected) by GRETA code 2 %

Not correctly tracked or Rejected by AGATA code 3%

Resulting in the same amount of photo-peaks with both codes

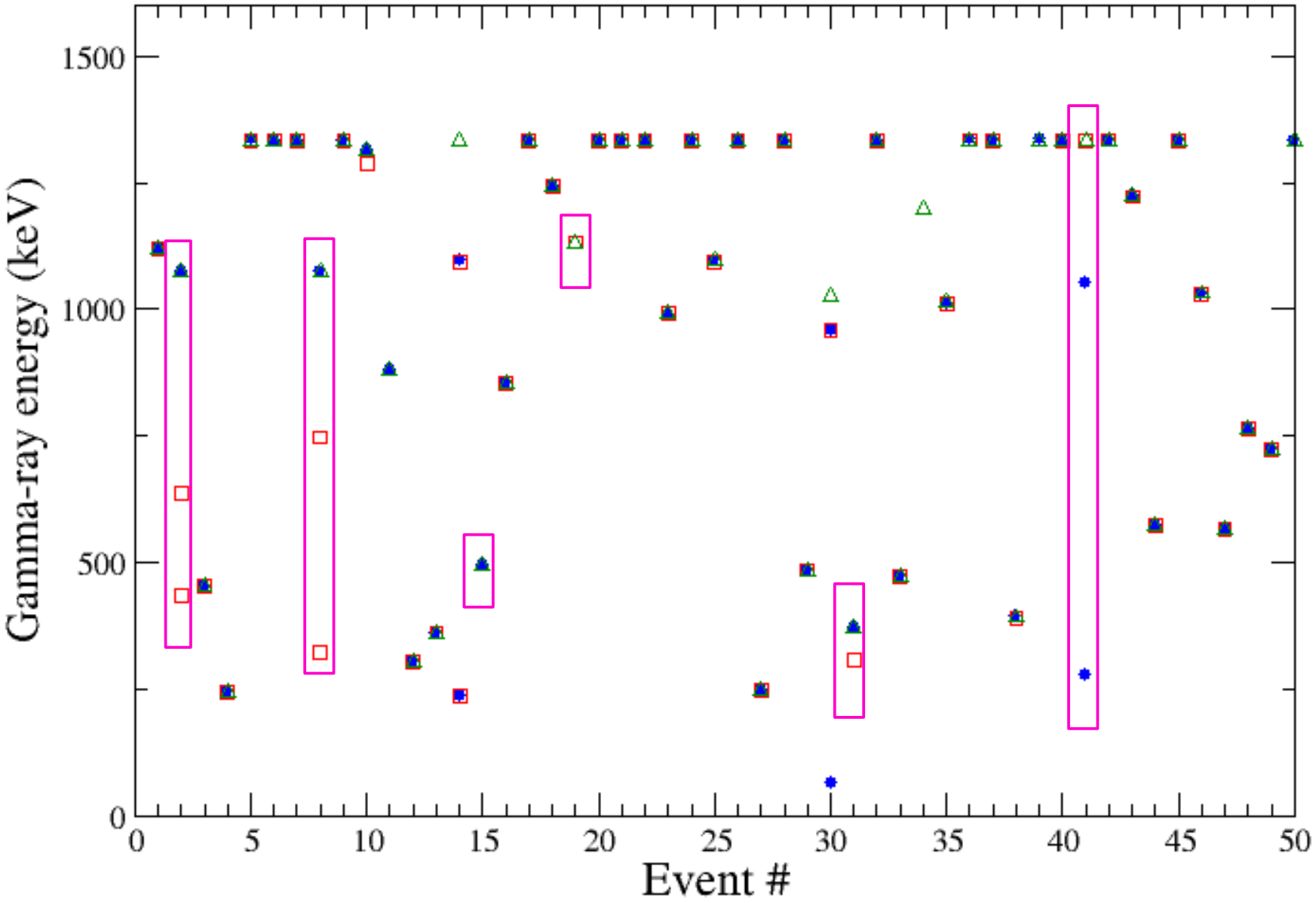
Tracked gamma-rays with AGATA code GRETA code versus GEANT4

Where are the differences?



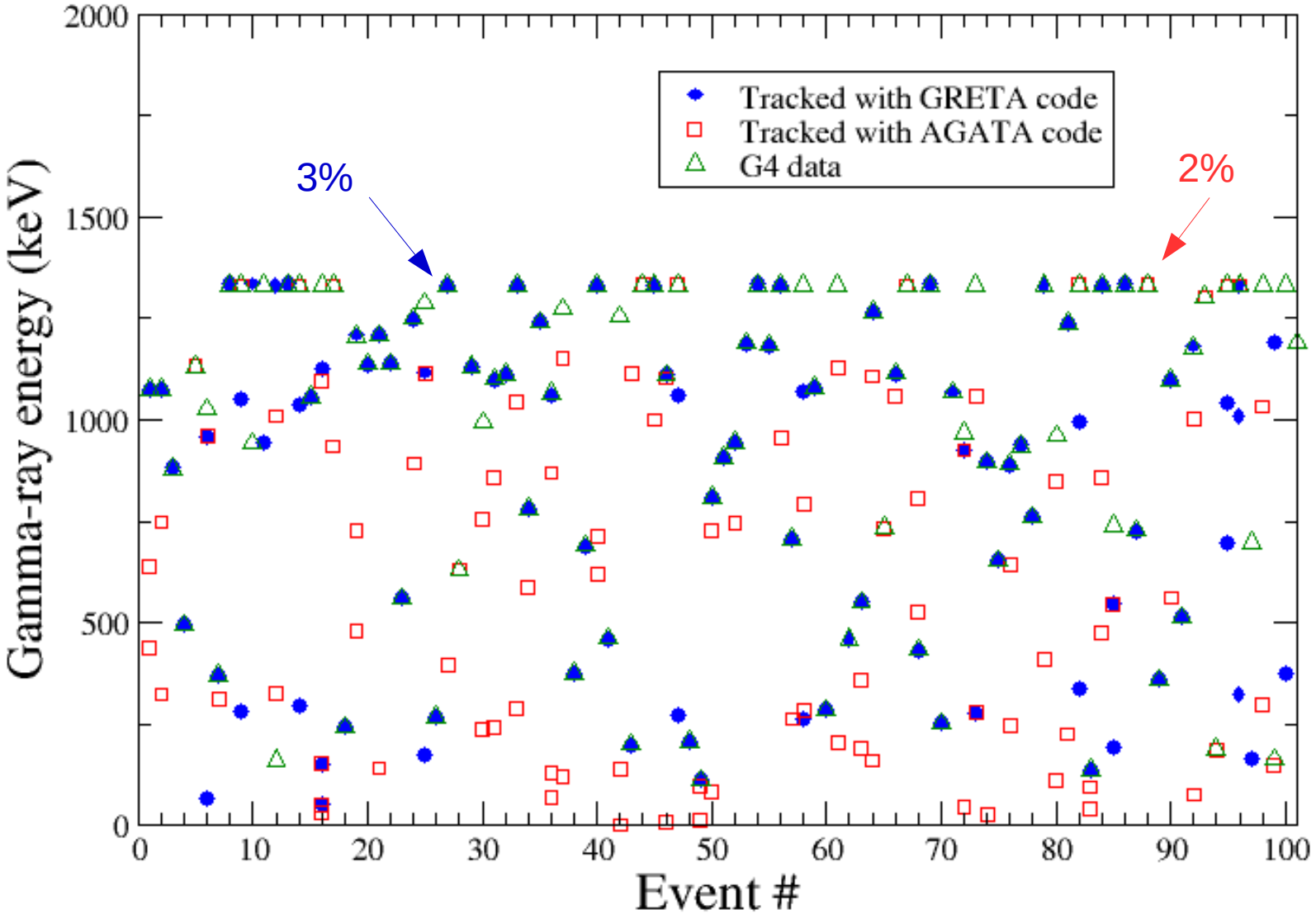
Tracked gamma-rays with AGATA code GRETA code versus GEANT4

Grouping the differences only on next plot



Tracked gamma-rays with AGATA code GRETA code versus GEANT4

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



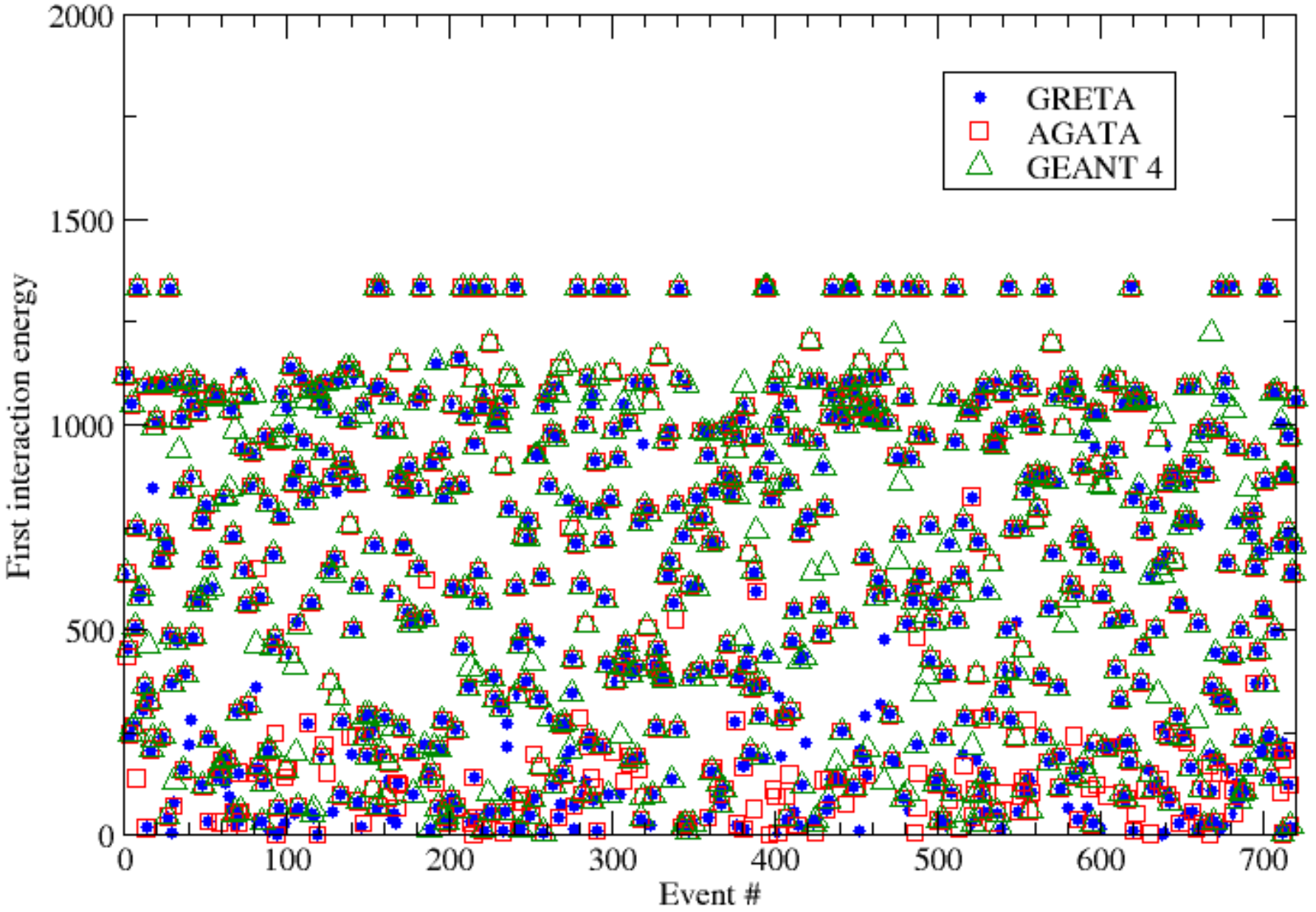
GRETA code finds 2 % that were split into 2 or more gamma-rays/event

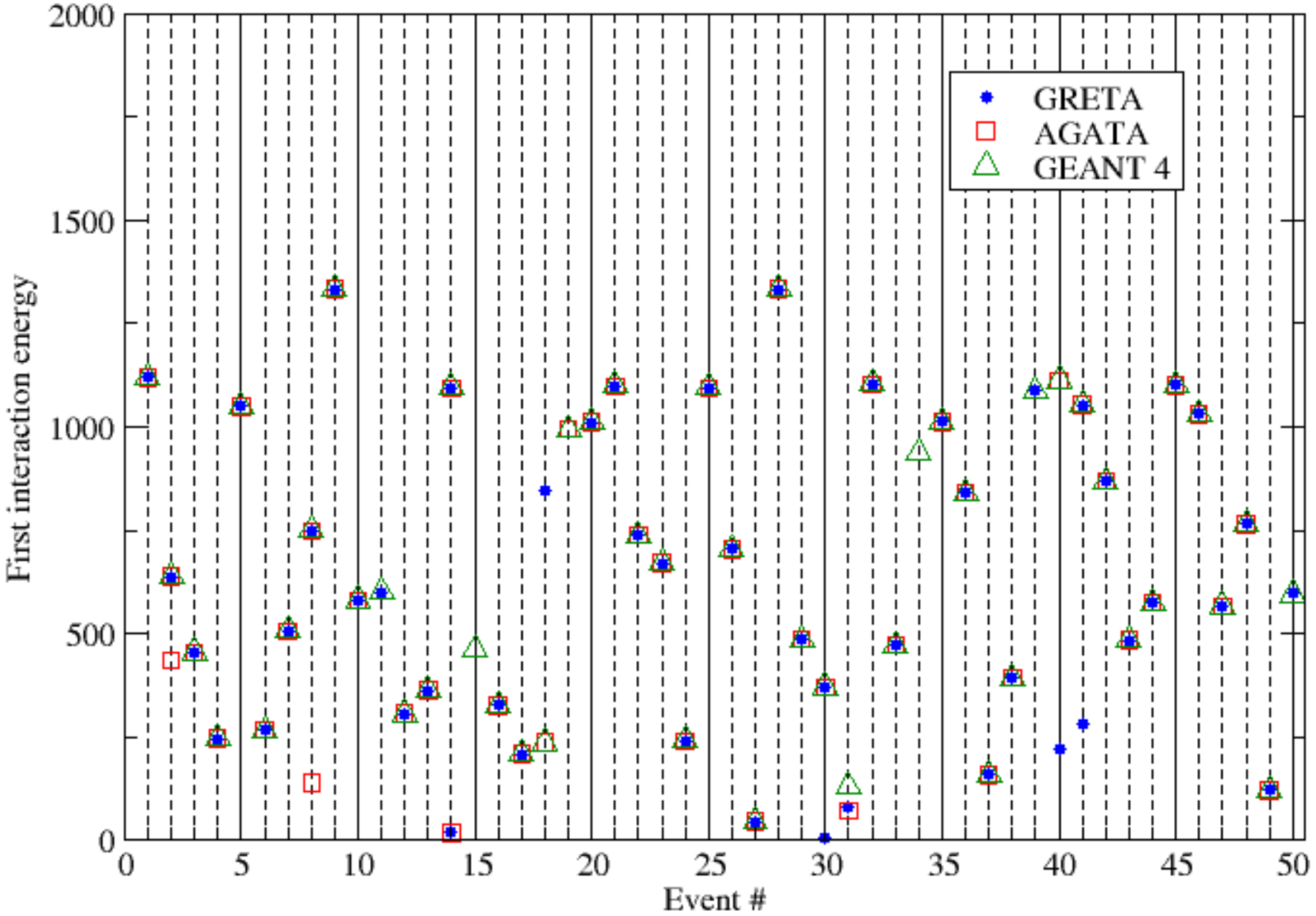
AGATA code finds 5% that were split into 2 or more gamma-rays/event

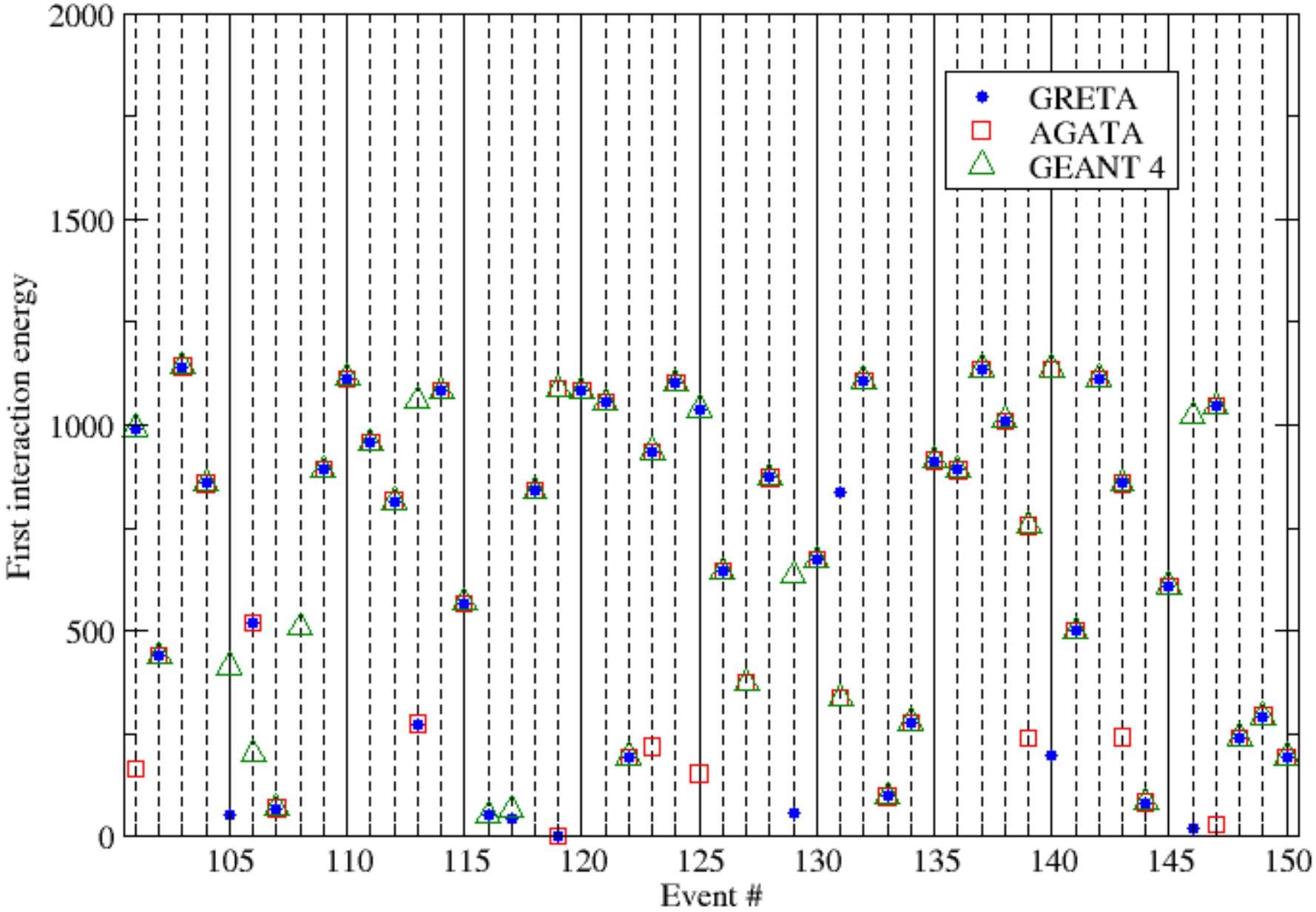
Resulting in a better P/T with GRETA code for this simulated data (55 % versus 52 %)

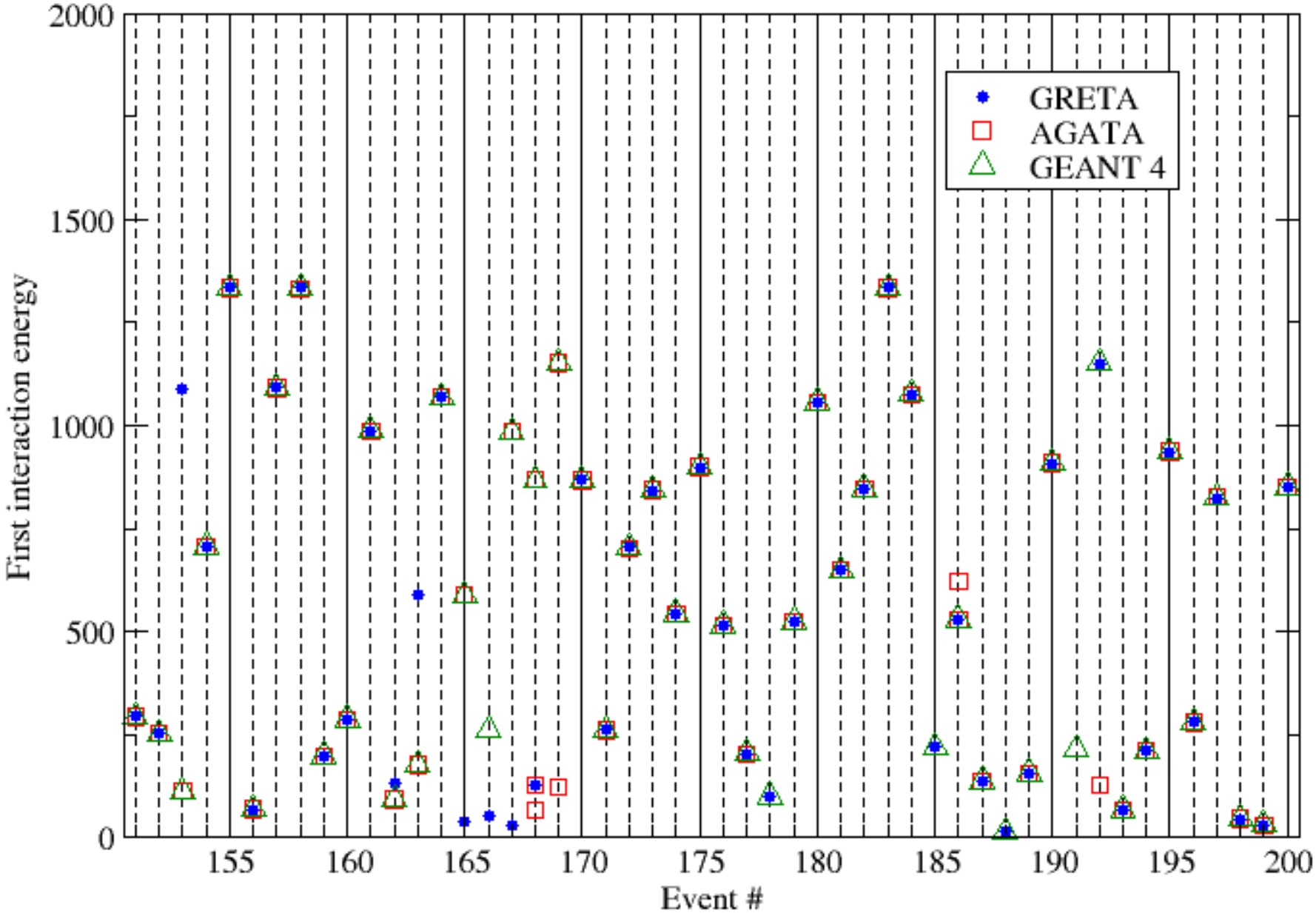
First interaction energy as identified AGATA and GRETA tracking codes

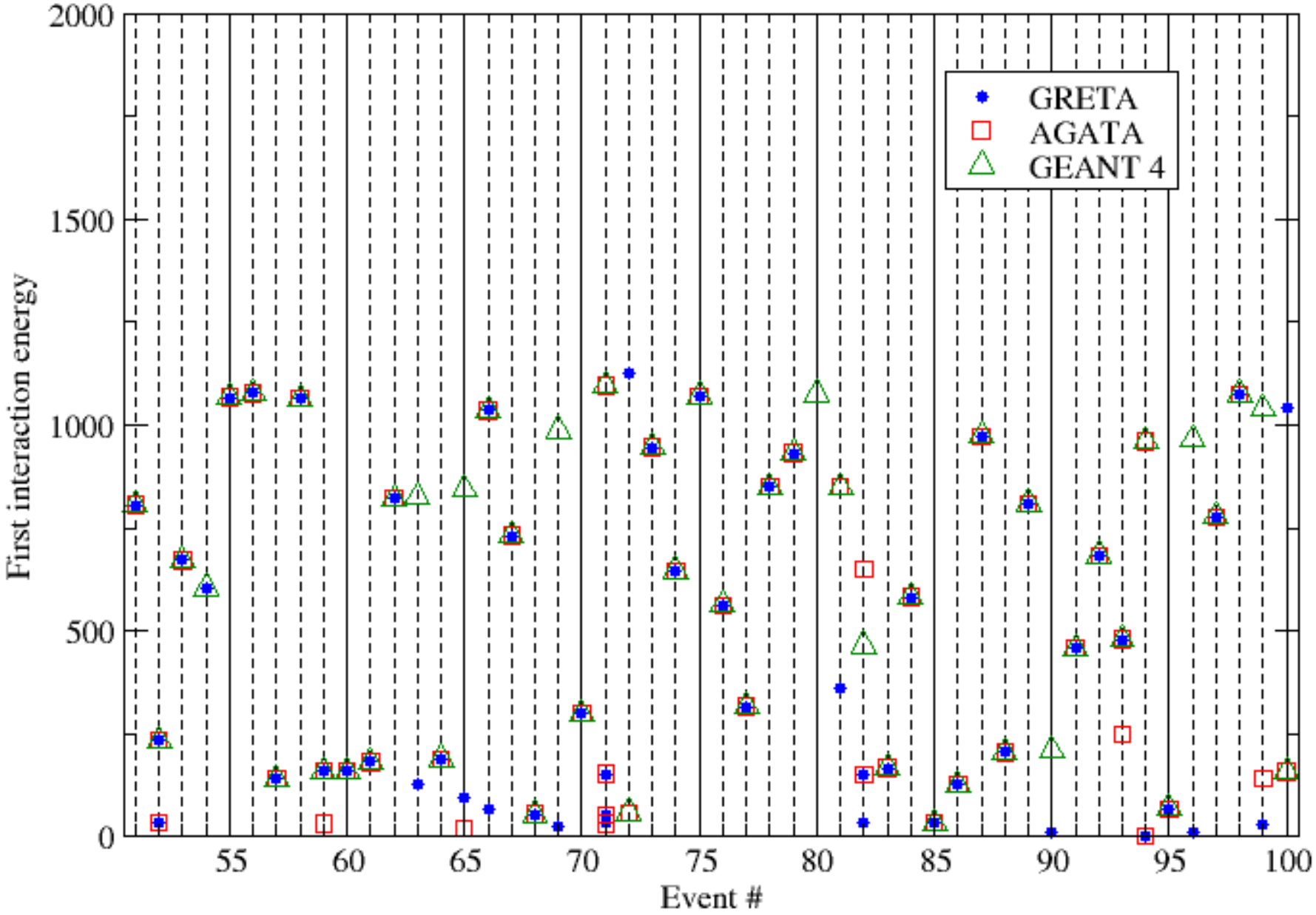
Simulated data (1.333 MeV) using AGATA G4 code in a 2pi configuration

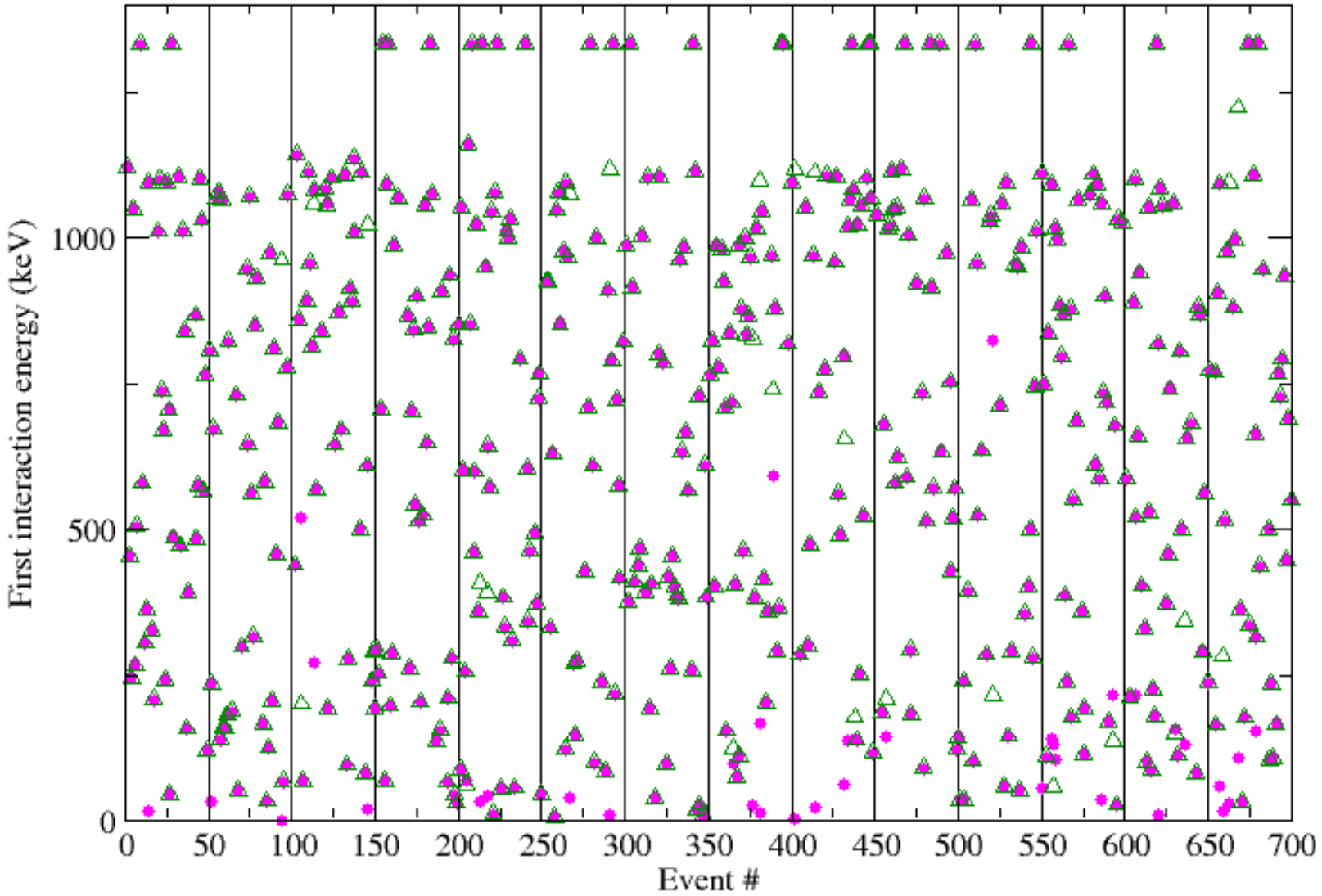



GRETA
AGATA
GEANT 4
First interaction energy
Event #
0
500
1000
1500
2000
0
5
10
15
20
25
30
35
40
45
50


GRETA
AGATA
GEANT 4
First interaction energy
Event #
0
500
1000
1500
2000
105
110
115
120
125
130
135
140
145
150


GRETA
AGATA
GEANT 4
First interaction energy
Event #
0
500
1000
1500
2000
155
160
165
170
175
180
185
190
195
200

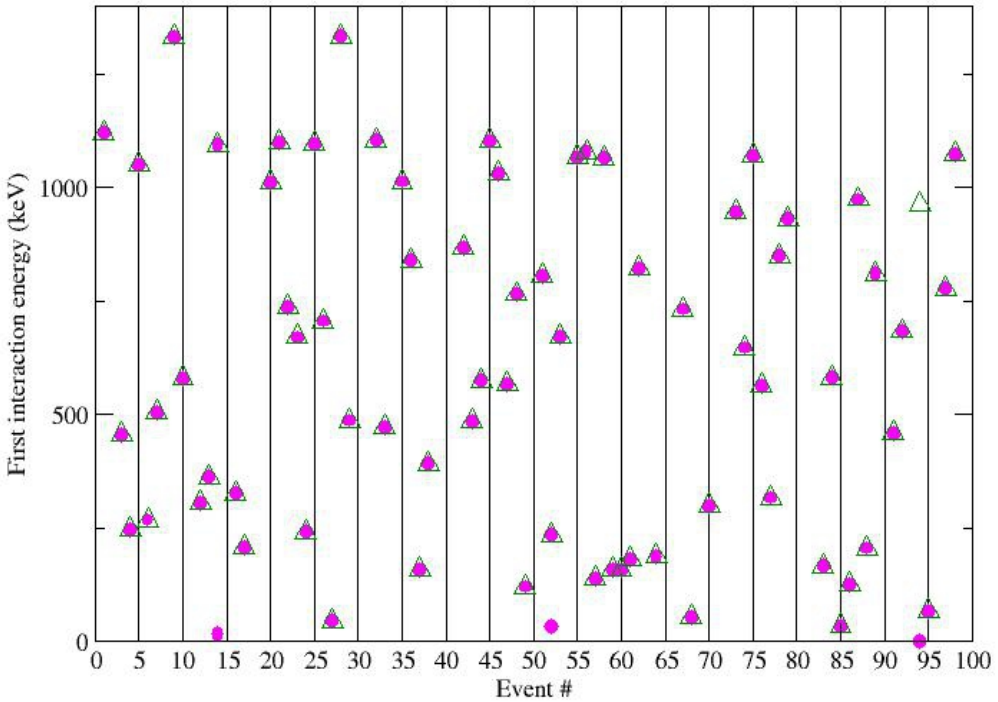

GRETA
AGATA
GEANT 4
First interaction energy
Event #
0
500
1000
1500
2000
55
60
65
70
75
80
85
90
95
100

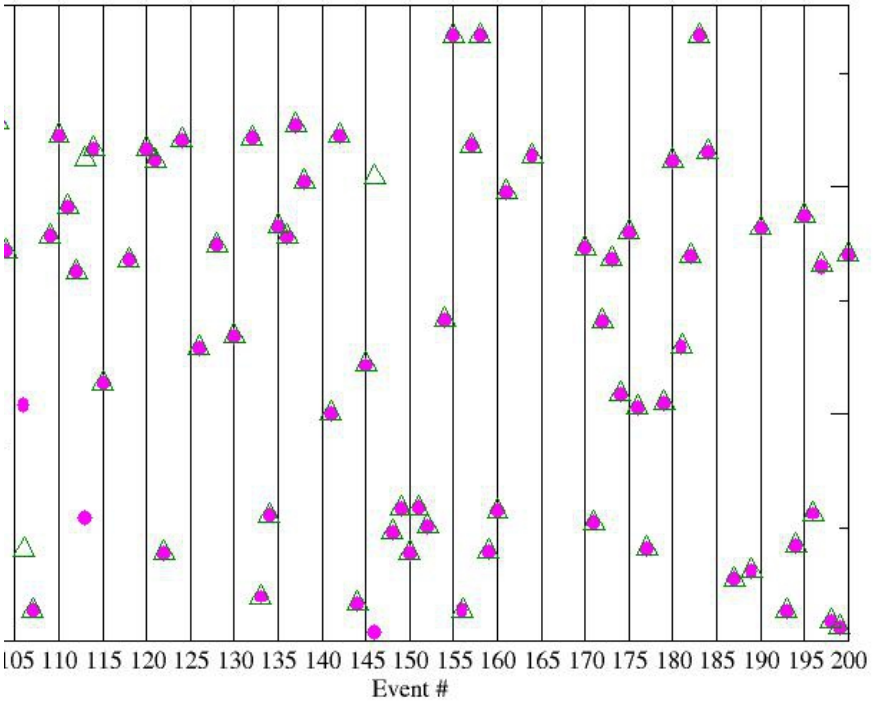


Events for which AGATA and GRETA codes found the Same first interaction energy
This corresponds to 72 % of the tracked data

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

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

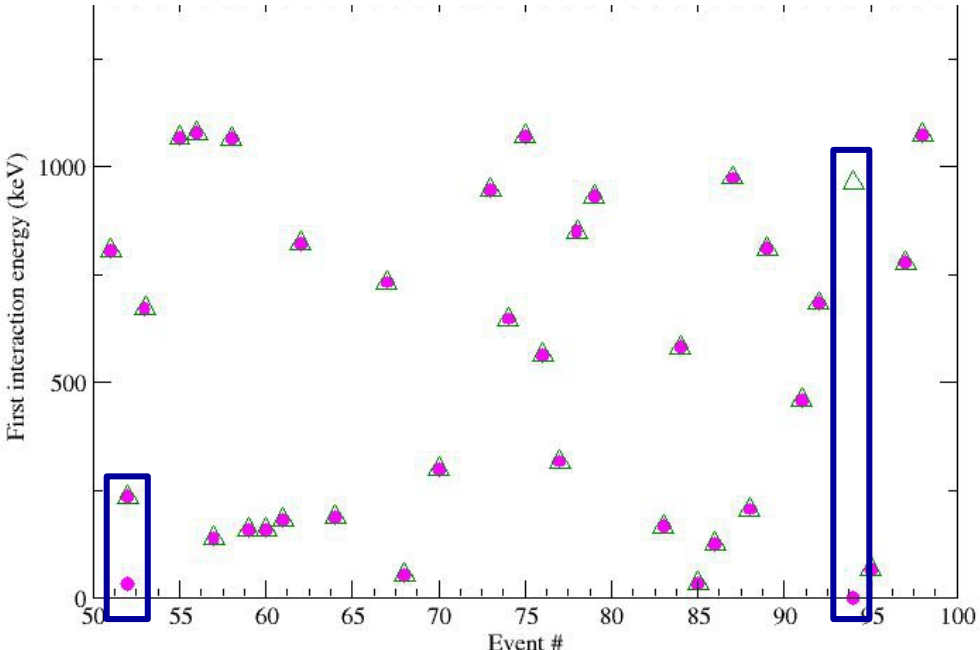




Few events in disagreement with G4 but same for both tracking codes

Either wrong regarding the first interaction point

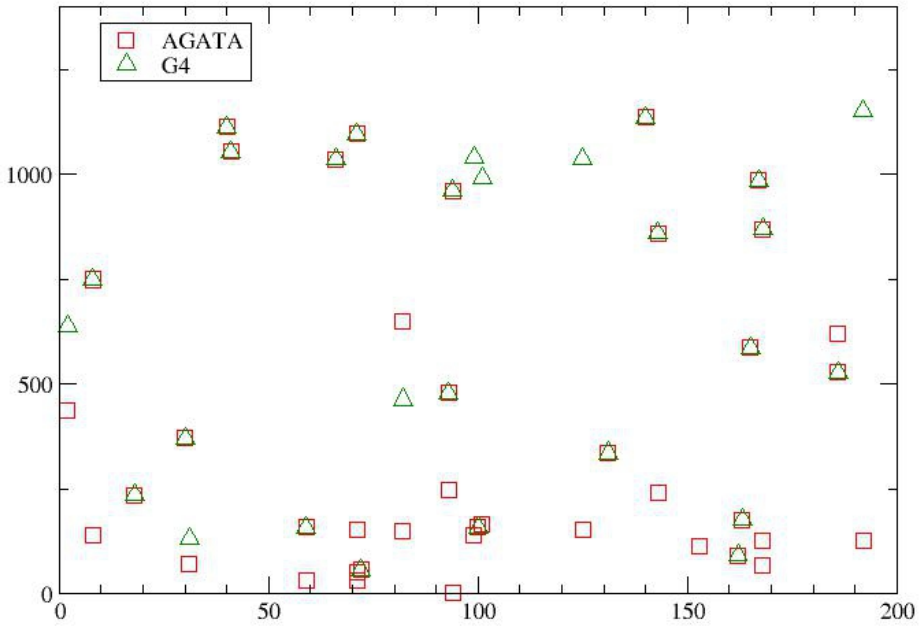
or they find 2 gamma-ray for which the assigned first interaction point is correct



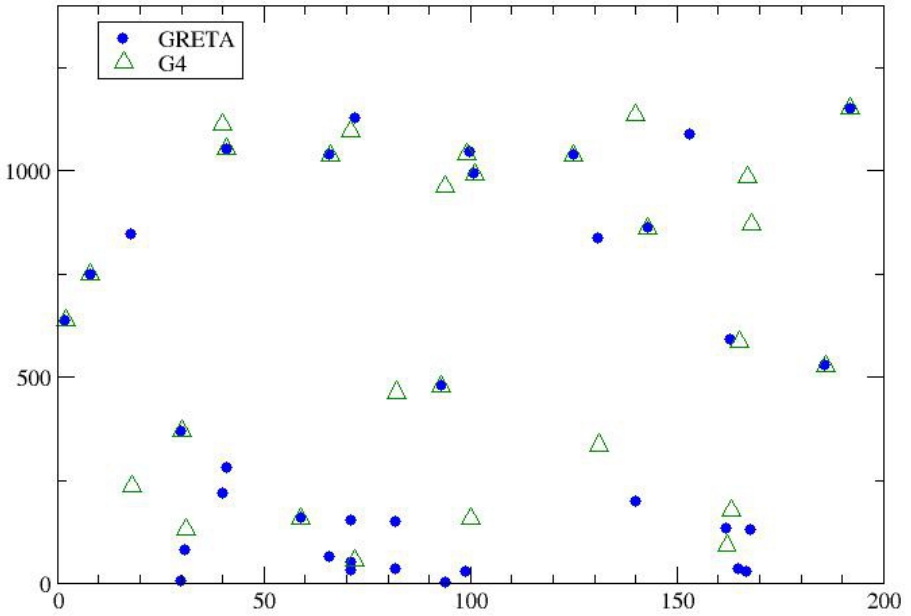
The group of Events for which the First interaction points are different : 14 %

Comparison of those events with Geant 4

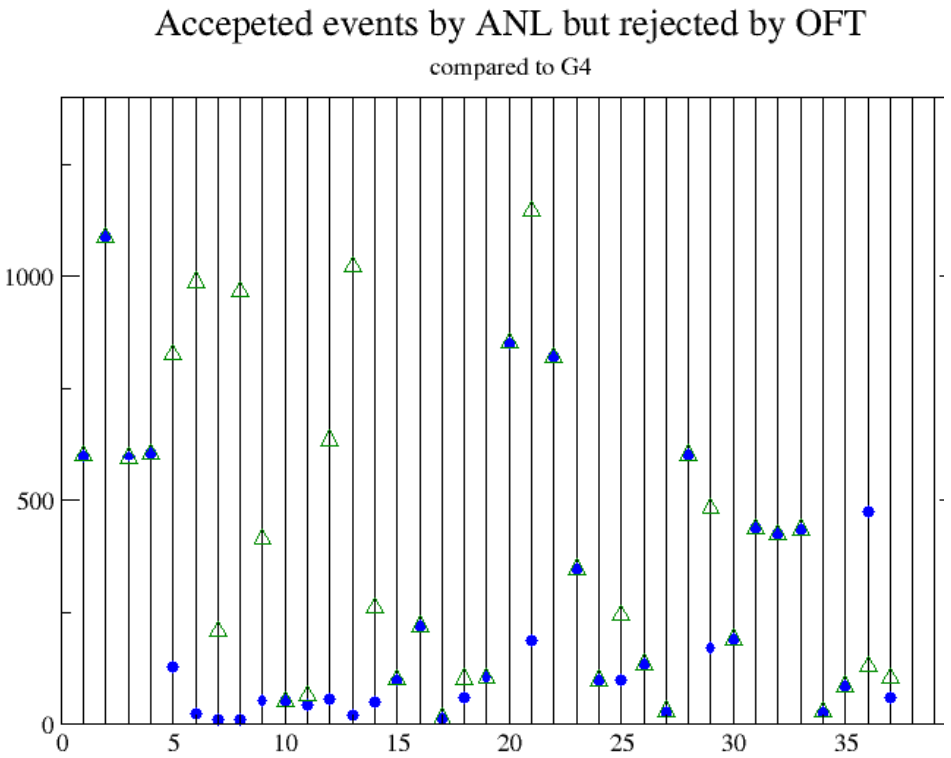
AGATA : 7.5 % good events

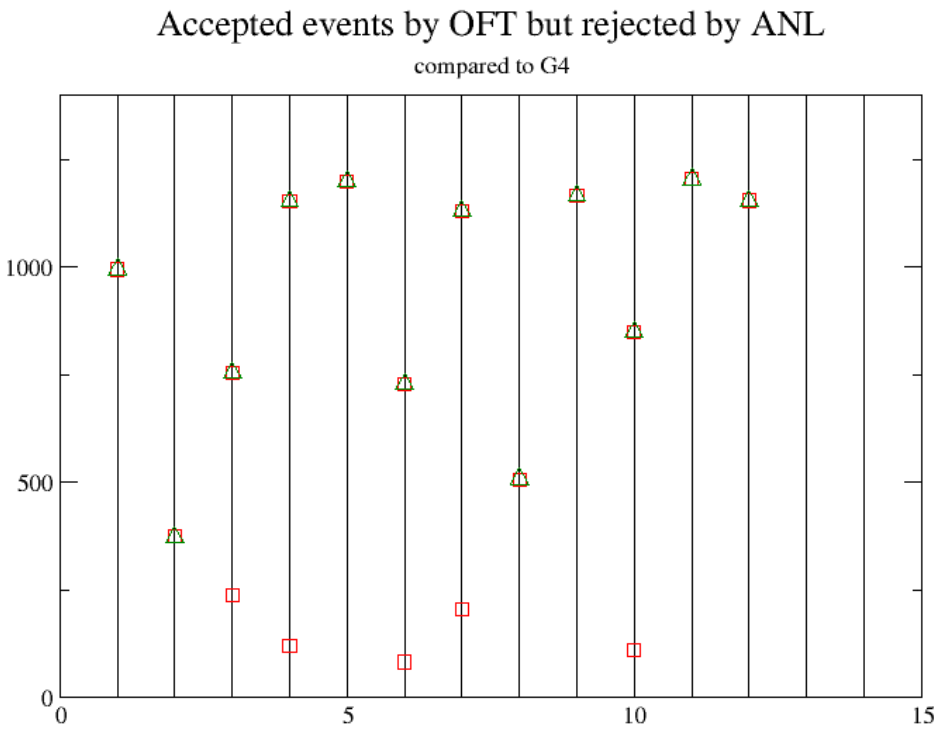


GRETA : 5% good events



Events accepted by ANL/Rjected by AGATA and vice-versa





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

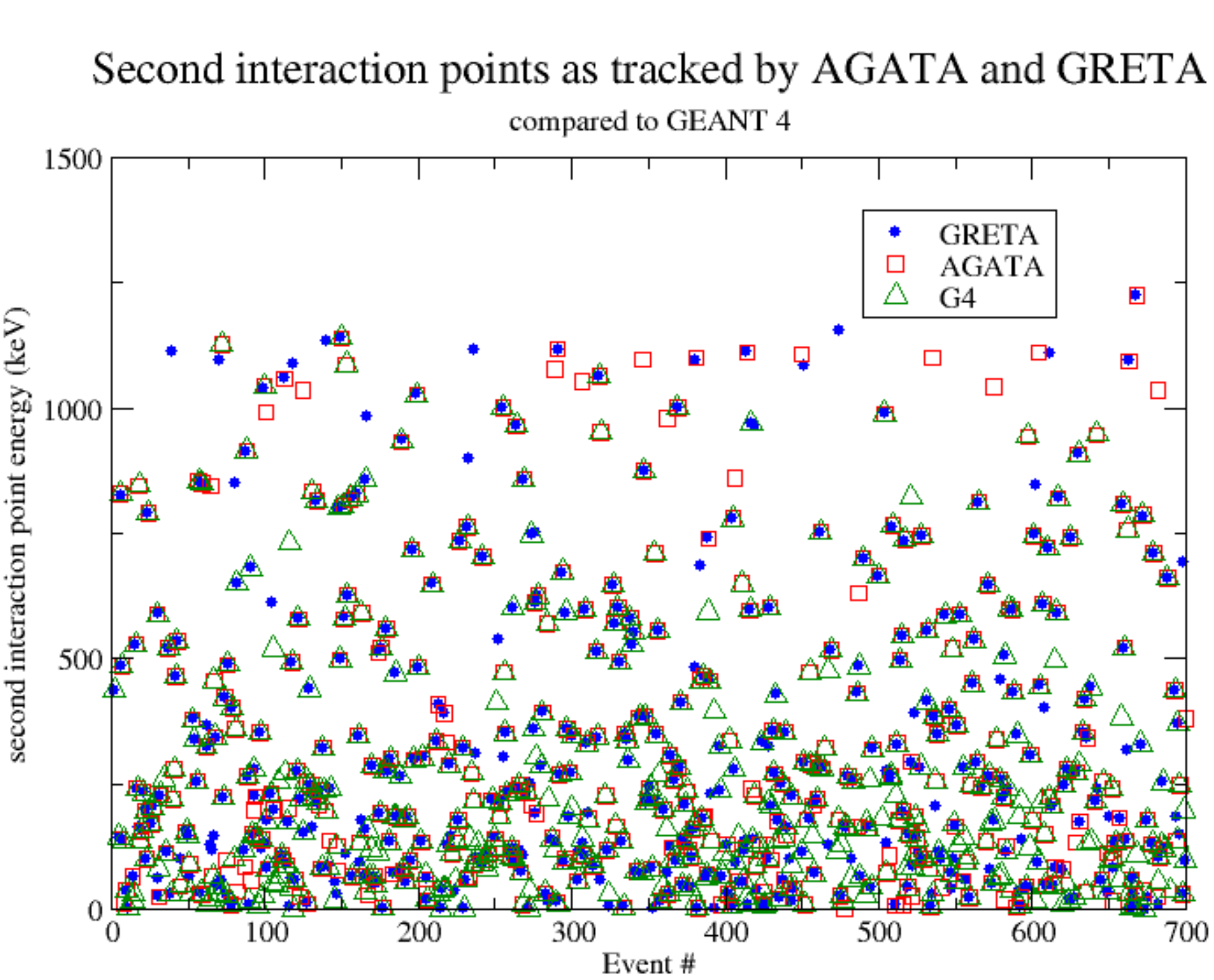
60% of these events are correctly tracked :
This corresponds to 4.5% of total events

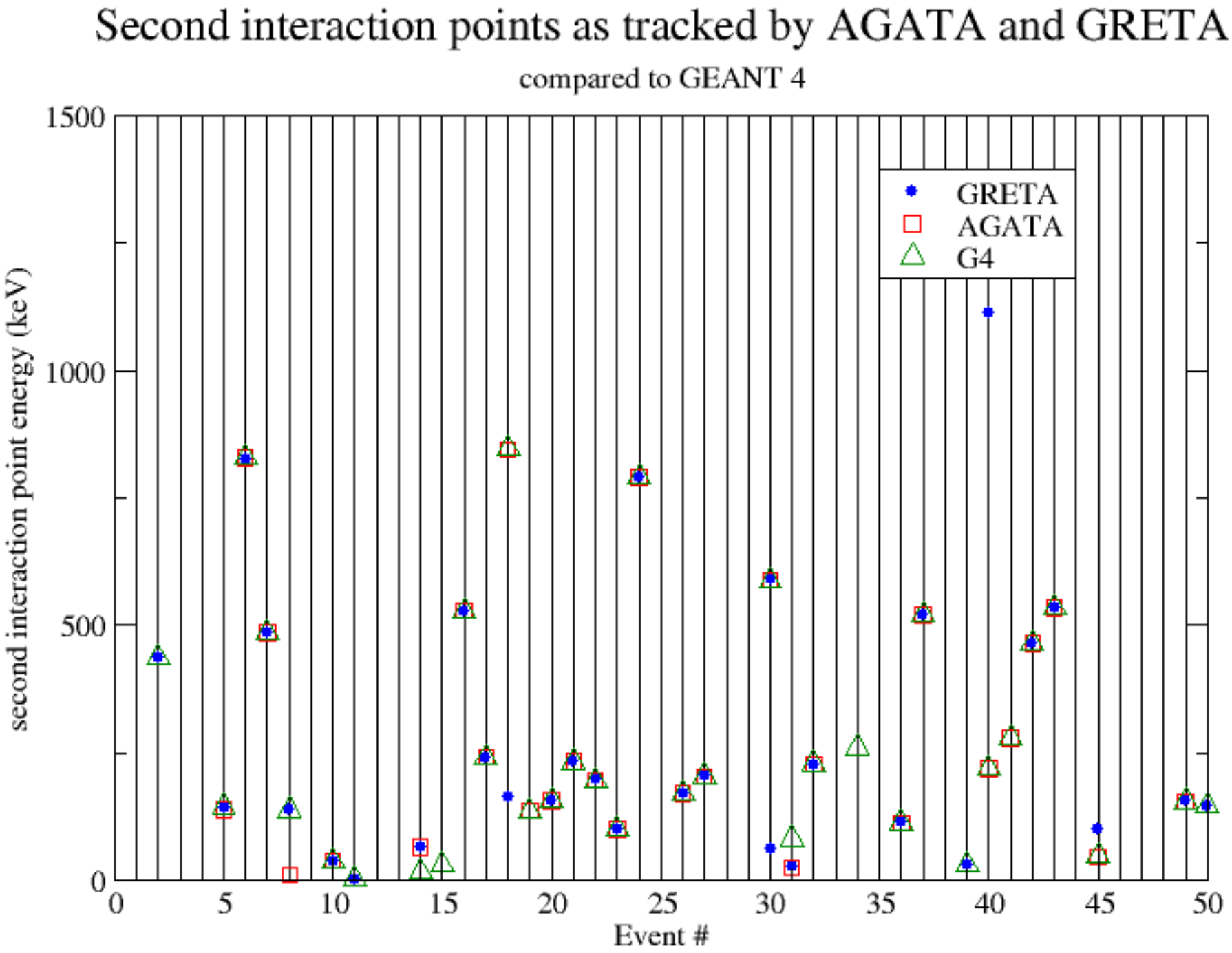
2.4% events accepted by AGATA code
but rejected by GRETA code

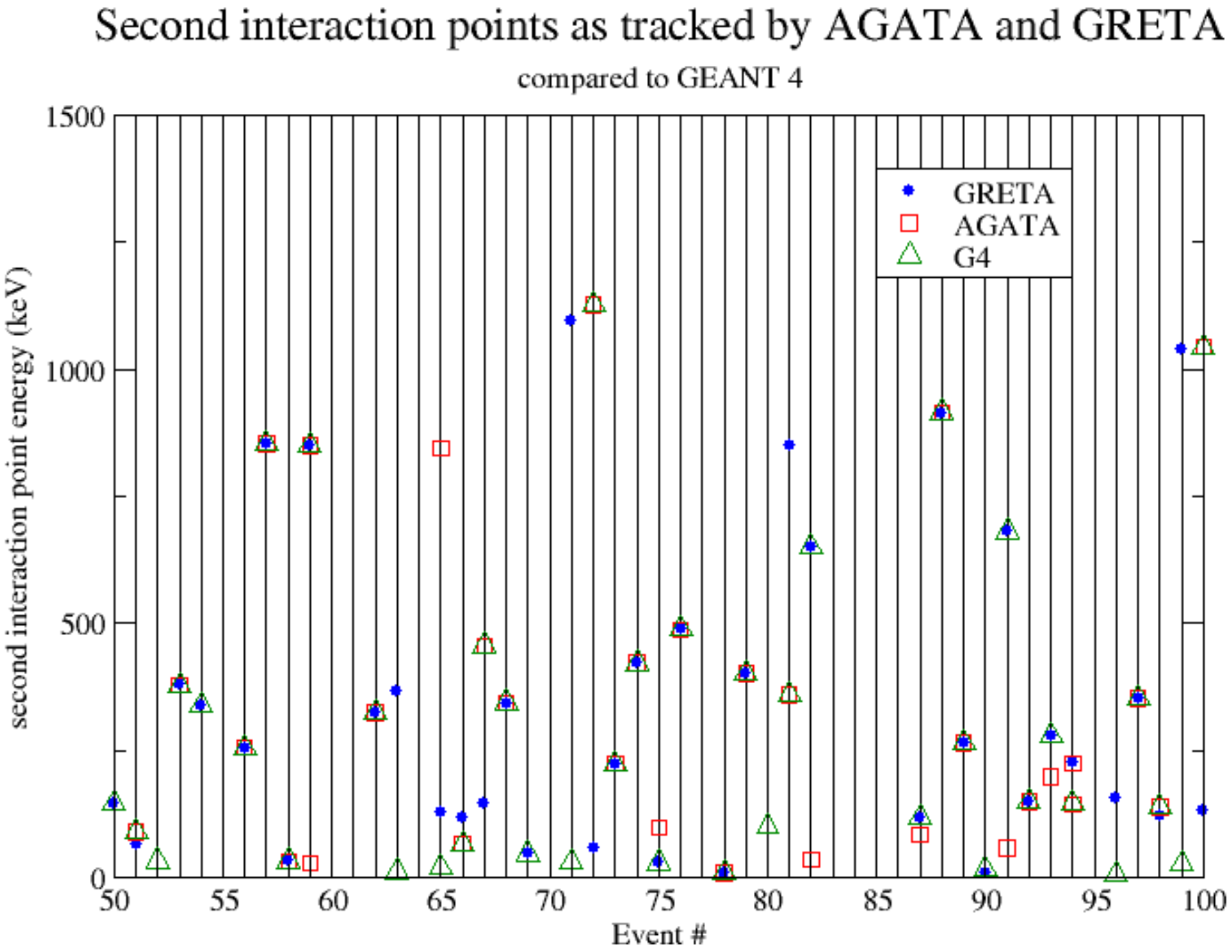
67% of these events are correctly tracked :
This corresponds to 1.7 % of total events

72+ 5+ 4.5 % good events
81.5 % good events

72+7.5+1.7 % good events
81.2% good events


Second interaction points as tracked by AGATA and GRETA
compared to GEANT 4
GRETA
AGATA
G4
second interaction point energy (keV)
Event #
0
500
1000
1500
0
100
200
300
400
500
600
700


Second interaction points as tracked by AGATA and GRETA
compared to GEANT 4
second interaction point energy (keV)
Event #
GRETA
AGATA
G4
0
500
1000
1500
0
5
10
15
20
25
30
35
40
45
50

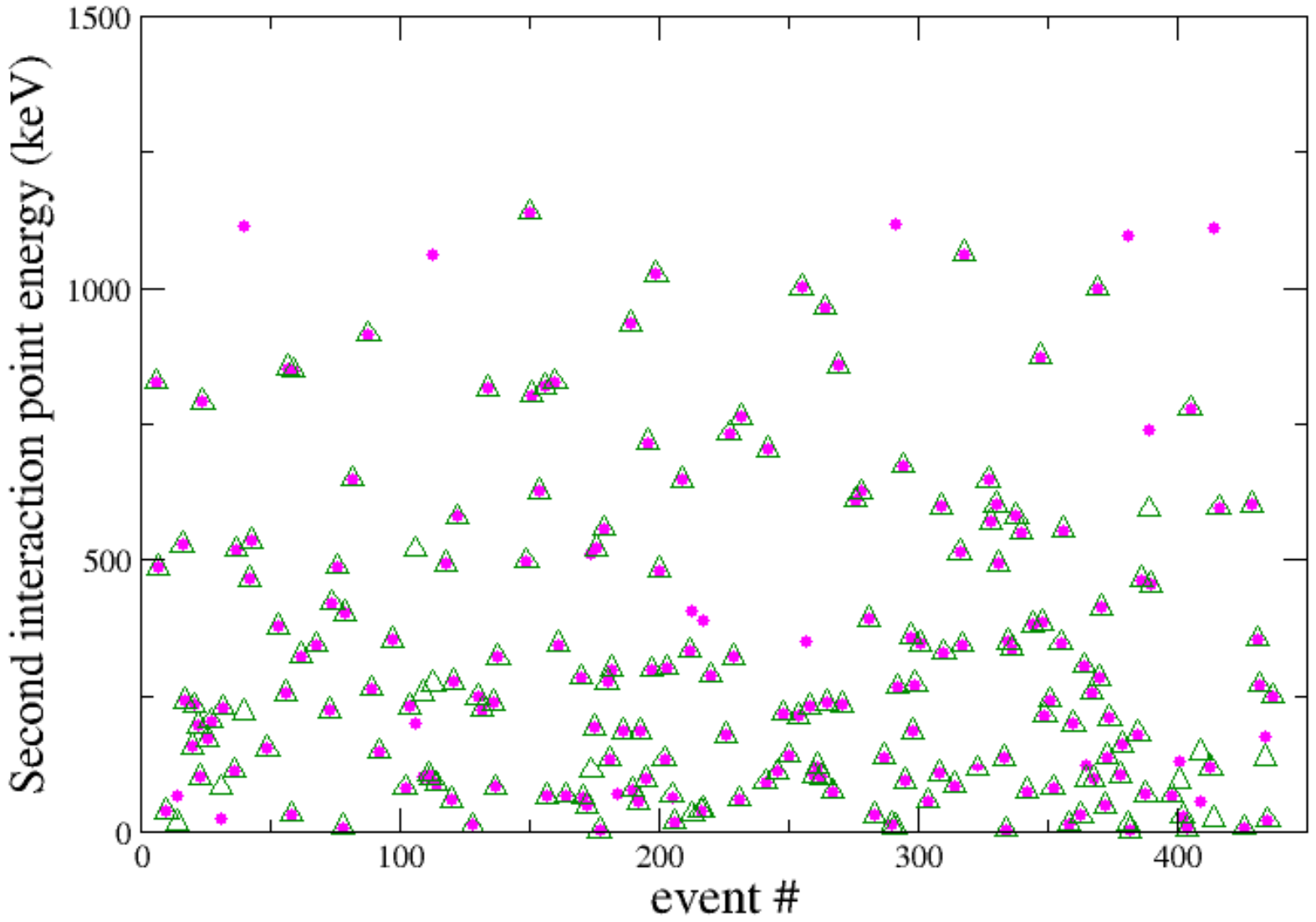

Second interaction points as tracked by AGATA and GRETA
compared to GEANT 4
GRETA
AGATA
G4
second interaction point energy (keV)
Event #
0
500
1000
1500
50
55
60
65
70
75
80
85
90
95
100

Second interaction points which found to be the same in the 2 codes :

58% of the events with more gives the same second interaction point

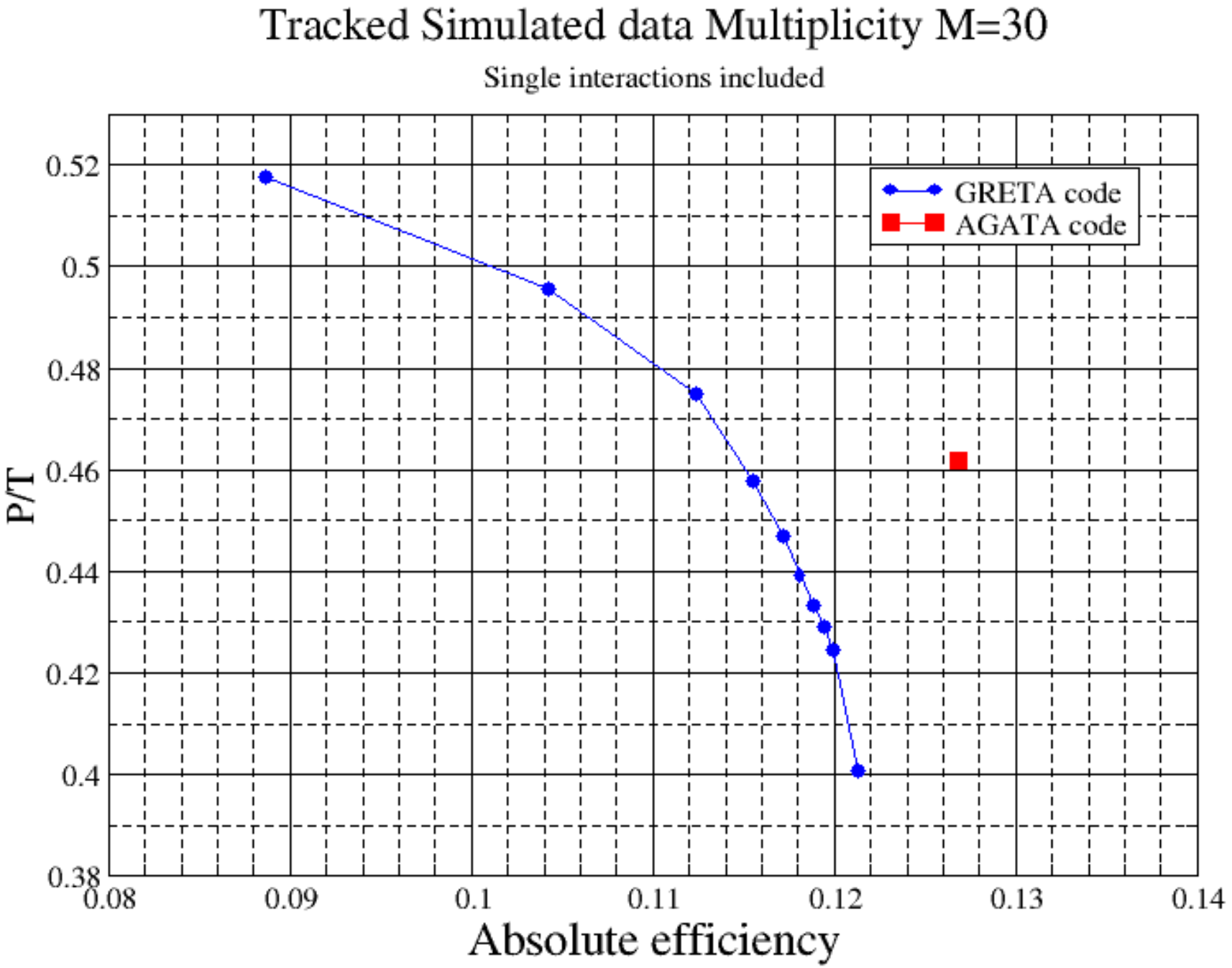
92% of these events in agreement with Geant 4

TBD : split the events where both codes agreed on the 1st int. and track the sequence



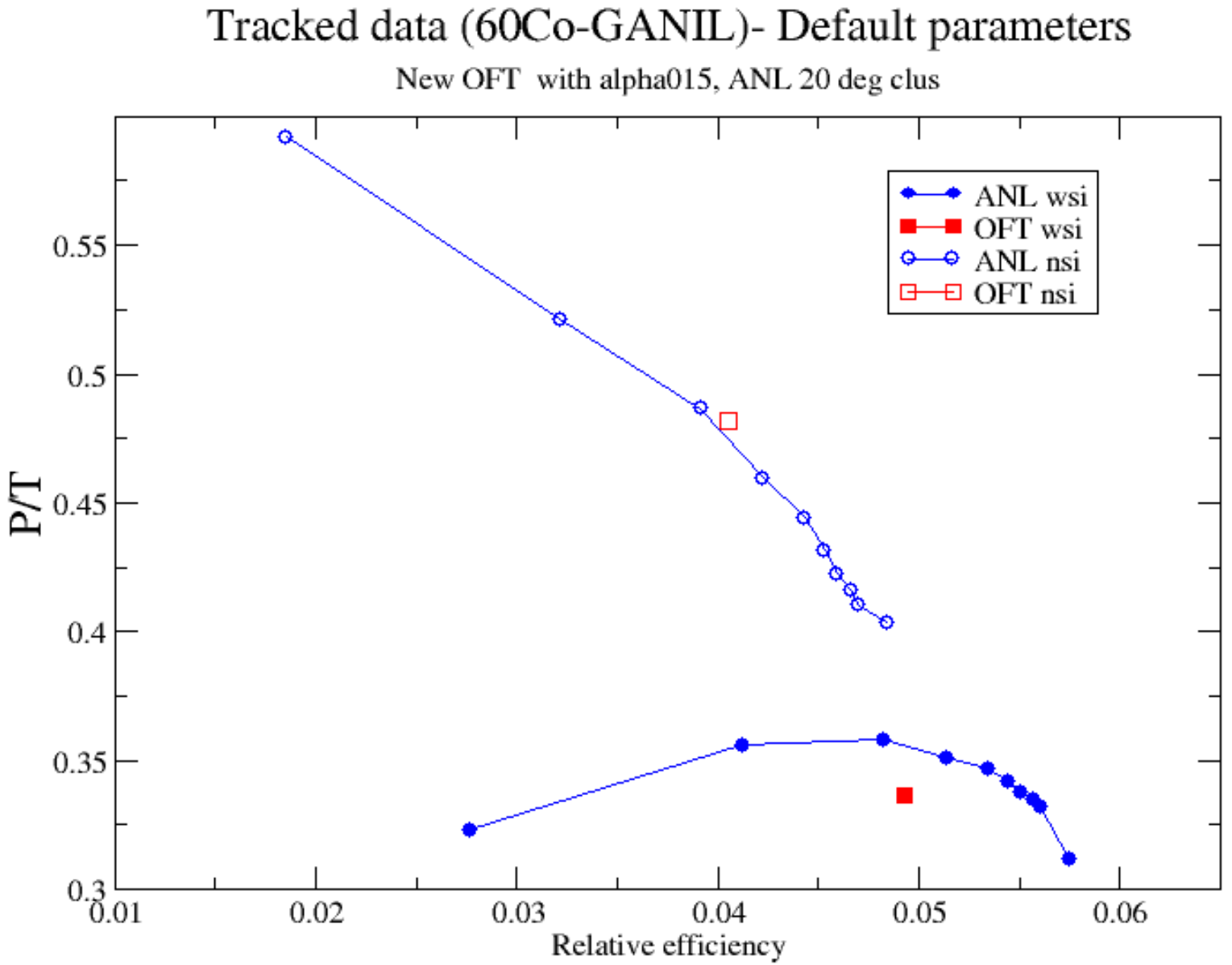
Step 2 : M30 simulated data

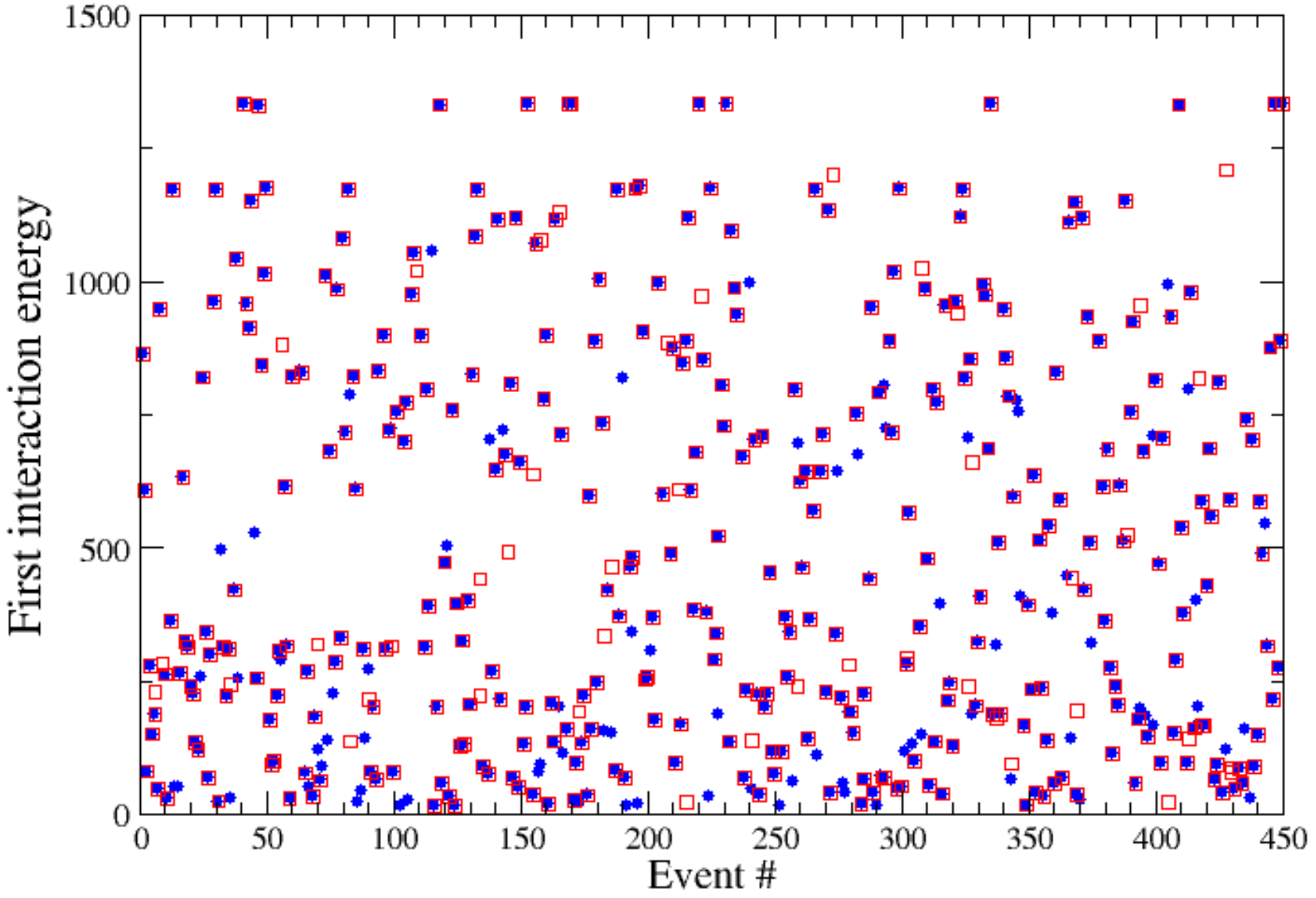
On going but Numbers are tricky …

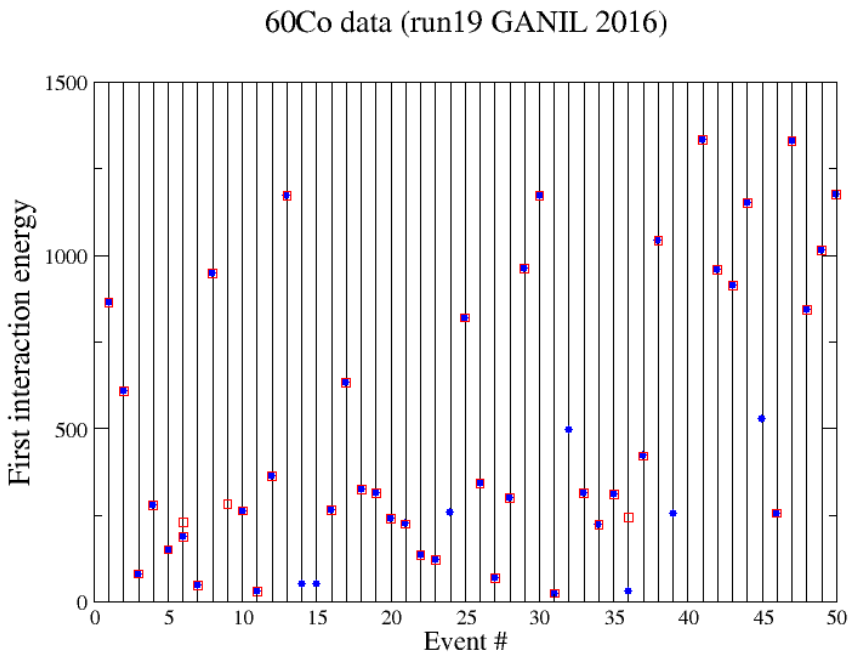


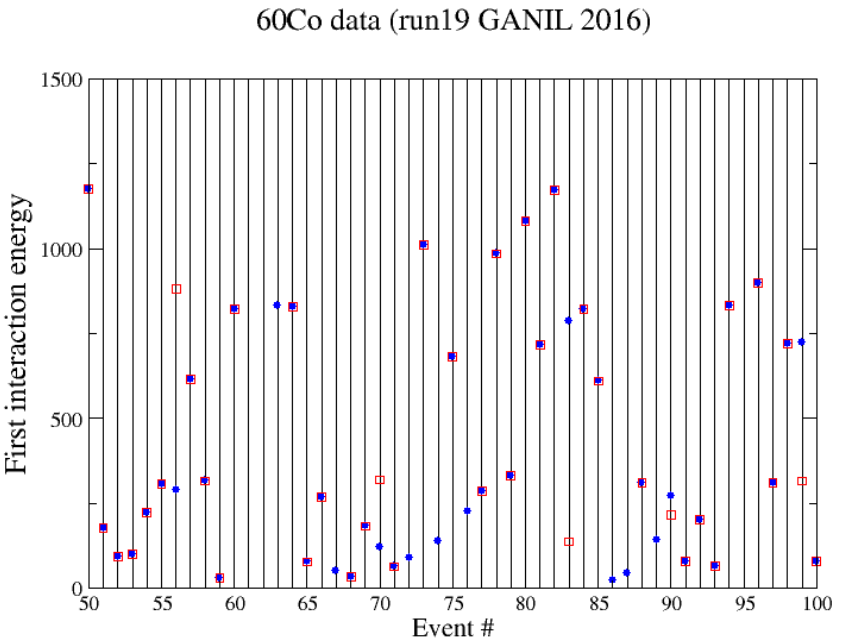
Step 3 : Real data

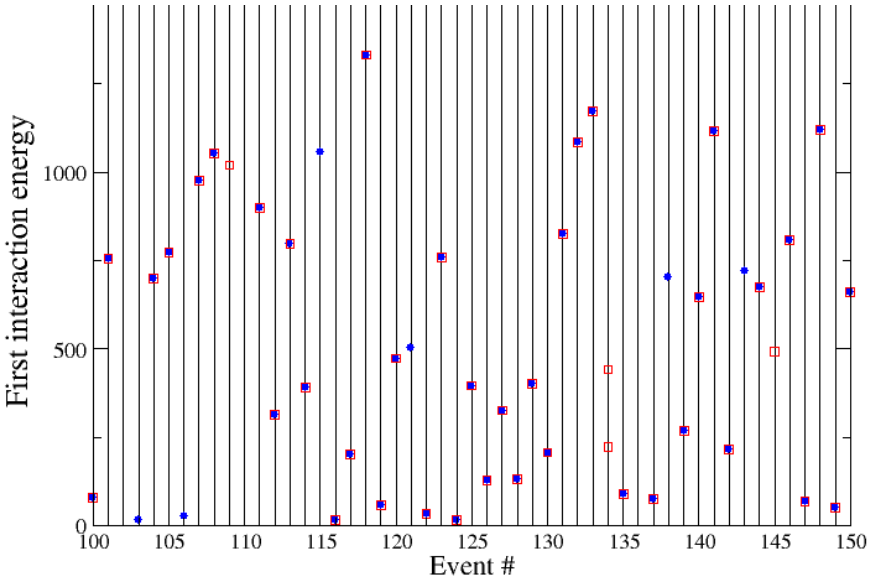
But! No reference as GEANT4 data …

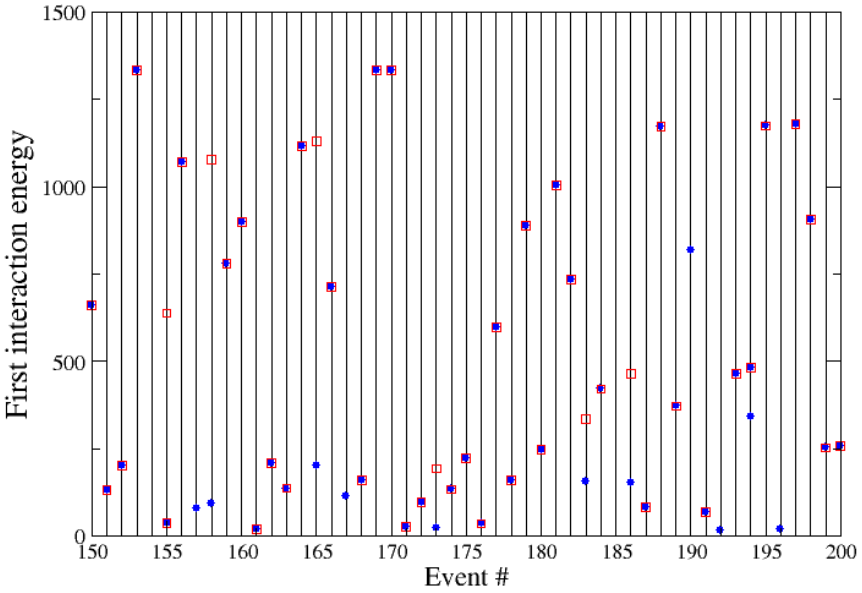



60Co data (run19 GANIL 2016)
First interaction energy
Event #
0
500
1000
1500
0
50
100
150
200
250
300
350
400
450









80% of accepted events : 8 % only found different first interaction !

More analysis is needed - TBD

Summary

Event-by-event comparison of AGATA-GRETA tracking code

Simulated data Multiplicity M=1

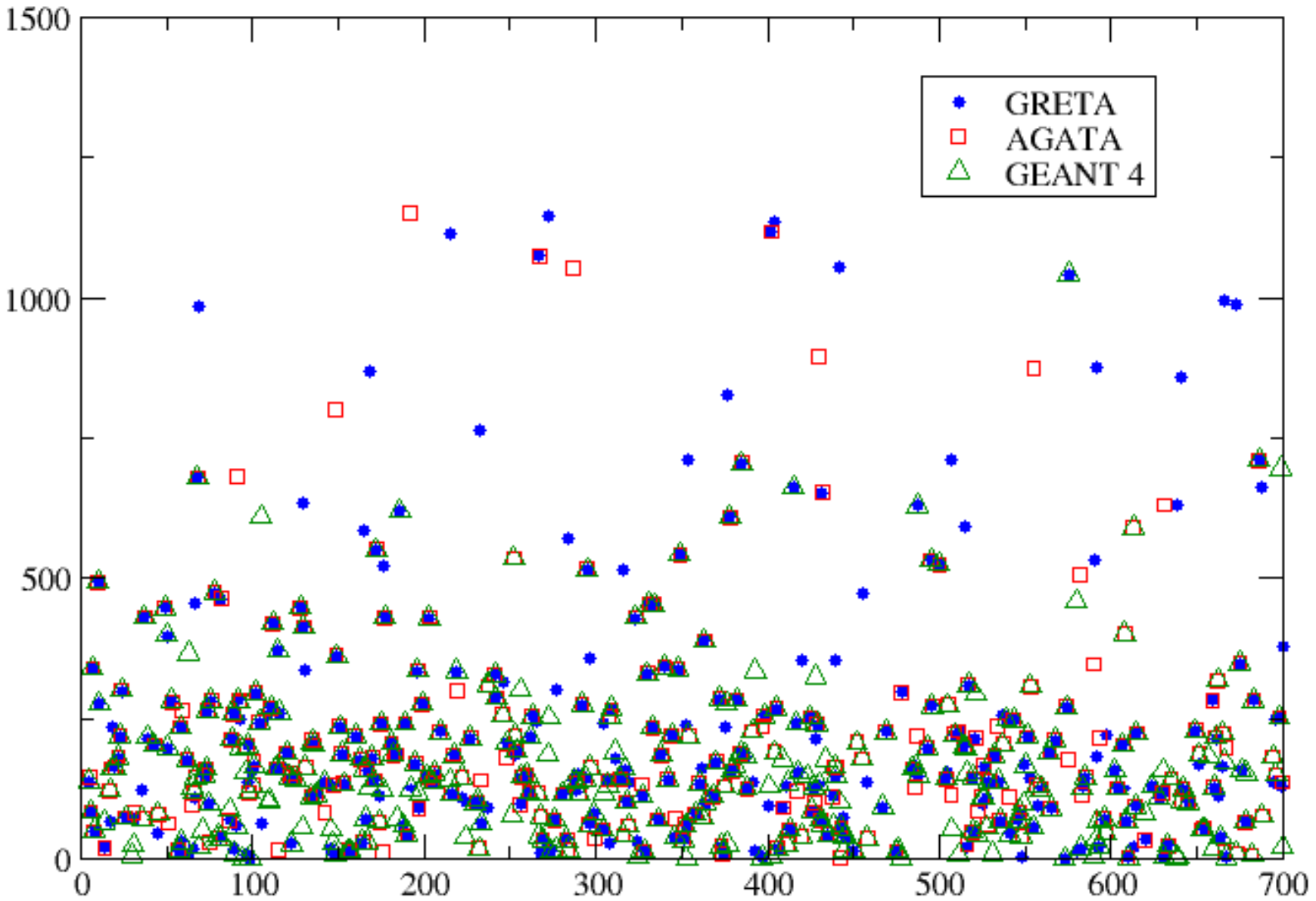
75% of tracked events : identical
About 50% photo-peaks with both codes – 3% differences

TBD : track in more details the 20% difference and learn more
This could be a nice input to improve the deficiency of both codes

TBD : same analysis with simulated data at high multiplicity

Experimental data : 80% of tracked events : identical
But here can not say who is right/wrong

Third interaction point energy



60% of the event find the same 3rd interaction points