AGATA Week January 2010 – 20/01/10

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The effect of position smearing on gamma-ray tracking

Objective :

To include the smearing profile from the PSA algorithms in the position error function of the OFT tracking code to improve simulations

‘Default’ position & energy functions of the Orsay tracking code

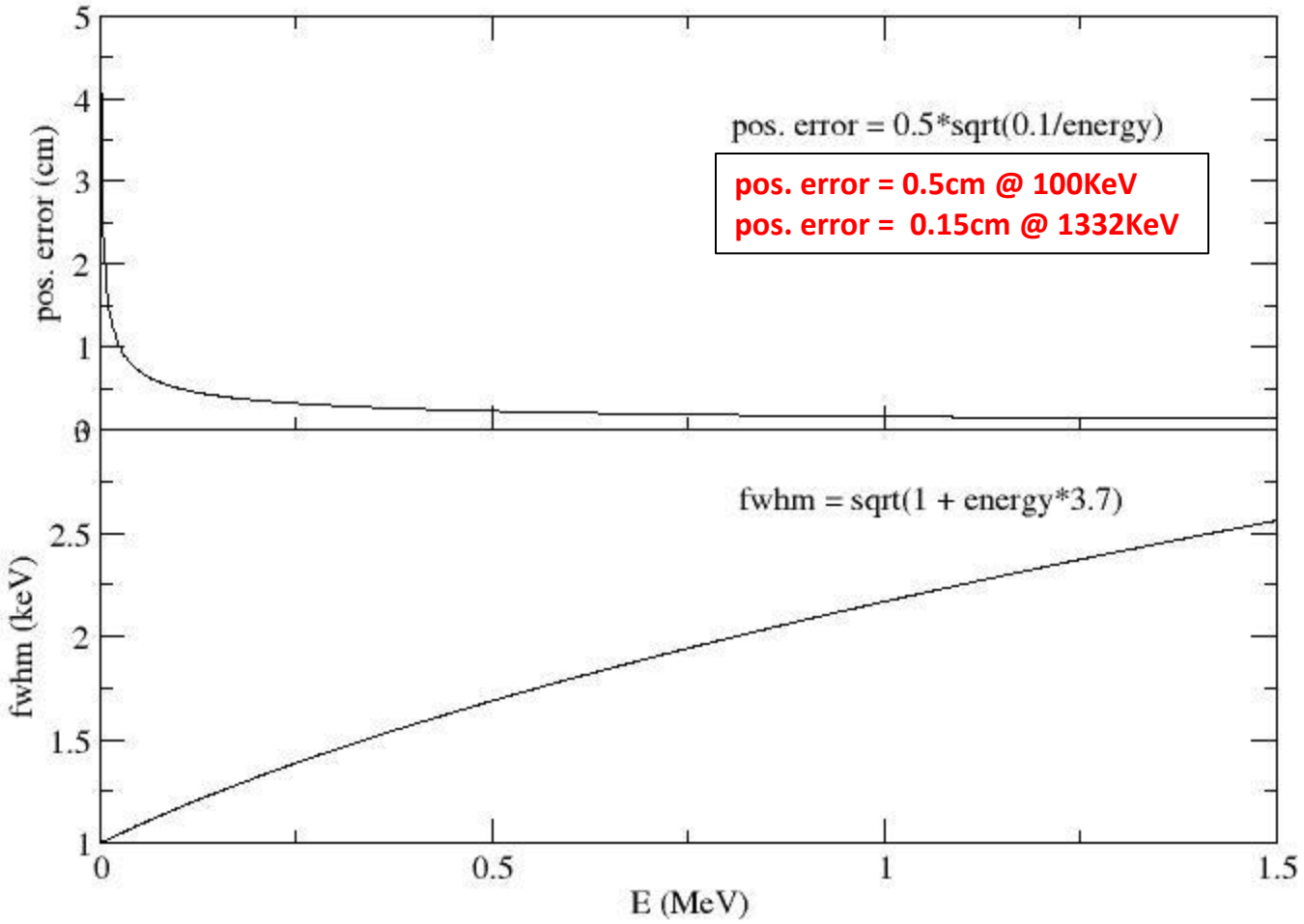

Figure 1.

Tracked and untracked spectra from the August Experiment (60Co)

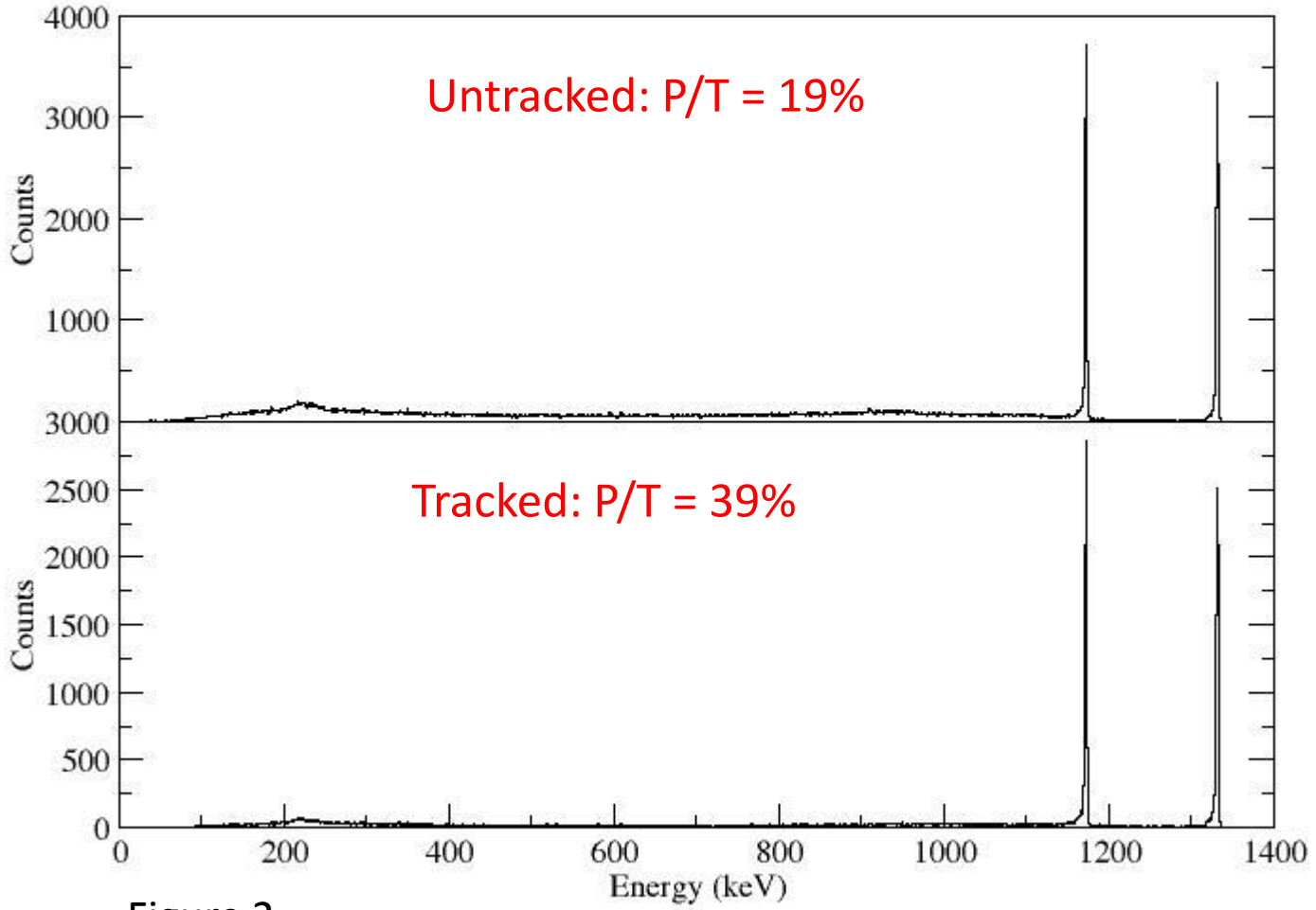

Figure 2.

Courtesy of Waely @ Orsay

Task: Compare the spectrum produced by the OFT tracking code with the tracked spectrum from the August experiment

- Simulate a 60Co source with the 2 x triple clusters geometry loaded in AGATA code and generate events

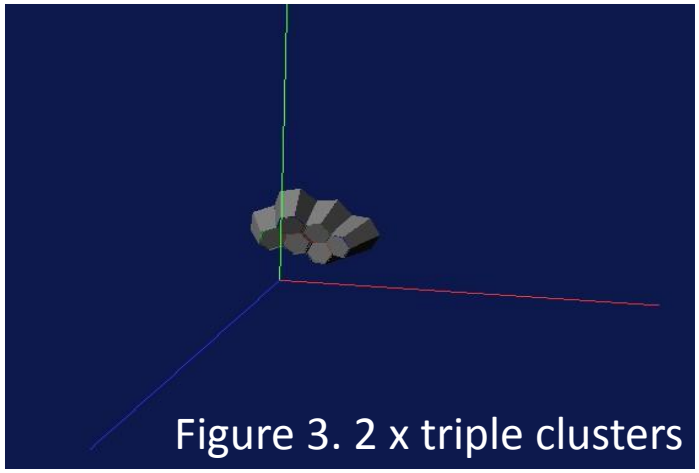

Figure 3. 2 x triple clusters

- Run the output events file through the OFT tracking code using the 'default' position error function

- Compare the output spectrum with the tracked experiment spectrum

Step 1 : Results

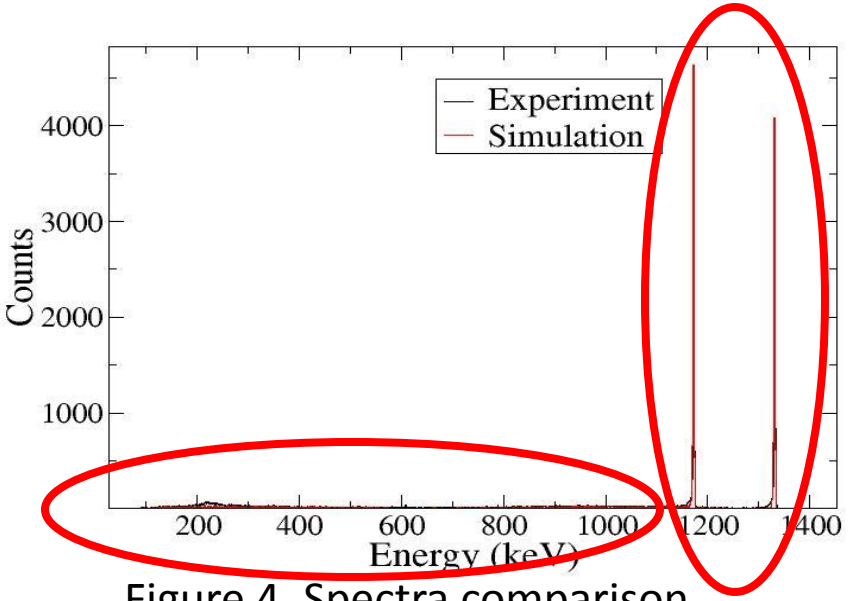

Figure 4. Spectra comparison

	P/T (%)
Simulation	**67.9**
Experiment	**38.9**

Table 1. Results comparison

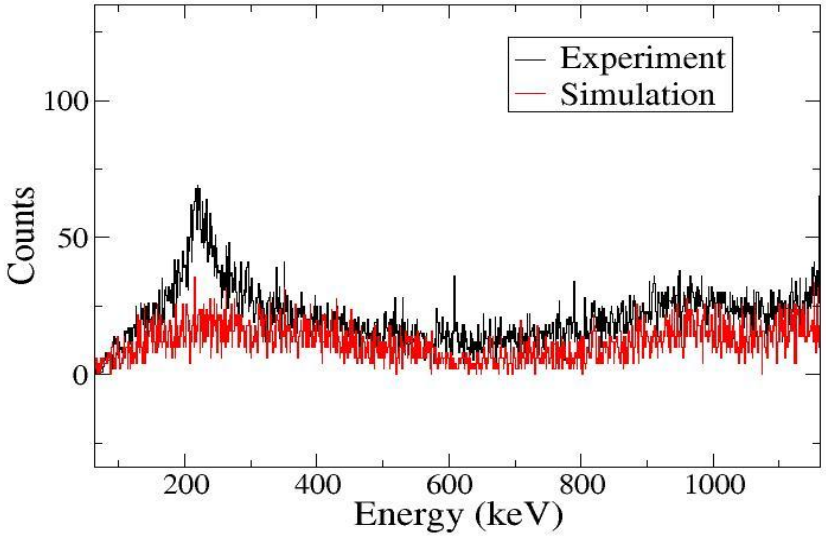

Figure 5. Background comparison

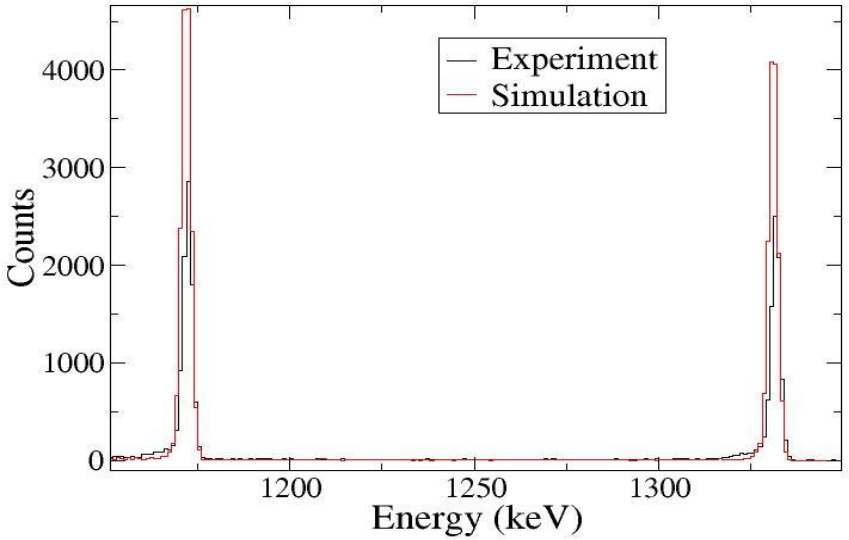

Figure 6. Peaks comparison

Step 2 : Run simulation for various values of the error function

Task: Find the value of the pos. error which gives the closest P/T to the experiment

- Modify the pos. error function in the OFT tracking code
- Run the events file through the OFT tracking code for the different values of the pos. error function
- Calculate the P/T for the various spectra
- Achieve a P/T value similar to the experiment

Step 2 : Simulation results for various values of the error function

Pos. error parameter P	P/T (Simulation) %	P/T (Experiment) %
0.5	67.98	
1.0	64.81	
1.5	60.28	
2.0	55.63	
2.5	51.03	
3.0	44.66	
3.5	41.49	
4.0	37.04	38.9
4.5	32.58	
5.0	28.51	

Table 2. Varying the error function parameter

- Figure 7. Pos. error is larger than default with parameter set to 4.0 – Profile is less flat for larger energies
- Figure 8. P/T decreases as the pos. error increases
- Pos. error inflates for smaller energies. 4cm @ 100KeV , 1.1cm @ 1332KeV

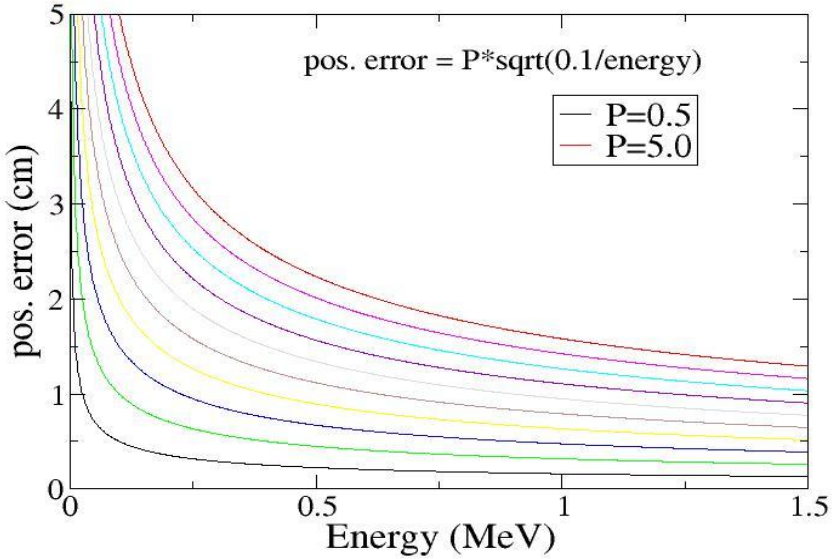

Figure 7. Varying pos. error function

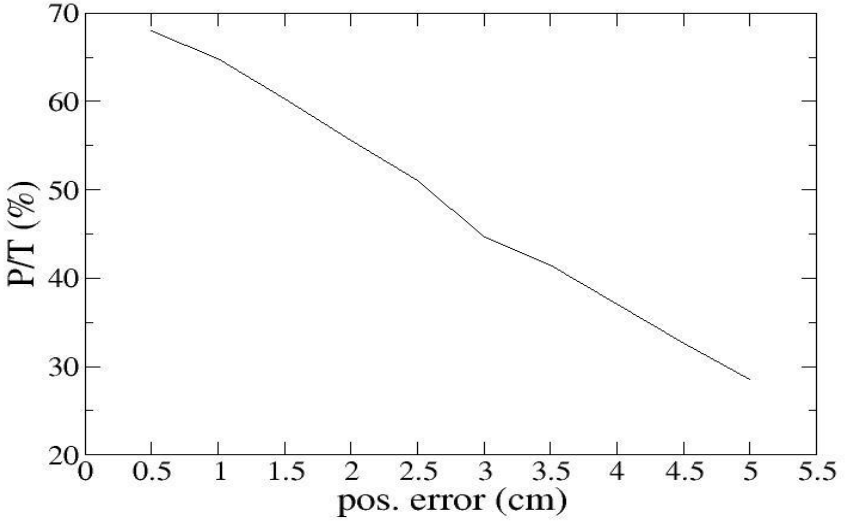

Figure 8. P/T against pos. error

Step 2 : Simulation results for various values of the error function

Pos. error parameter P	P/T (Simulation) %	P/T (Experiment) %
0.5	67.98	
1.0	64.81	
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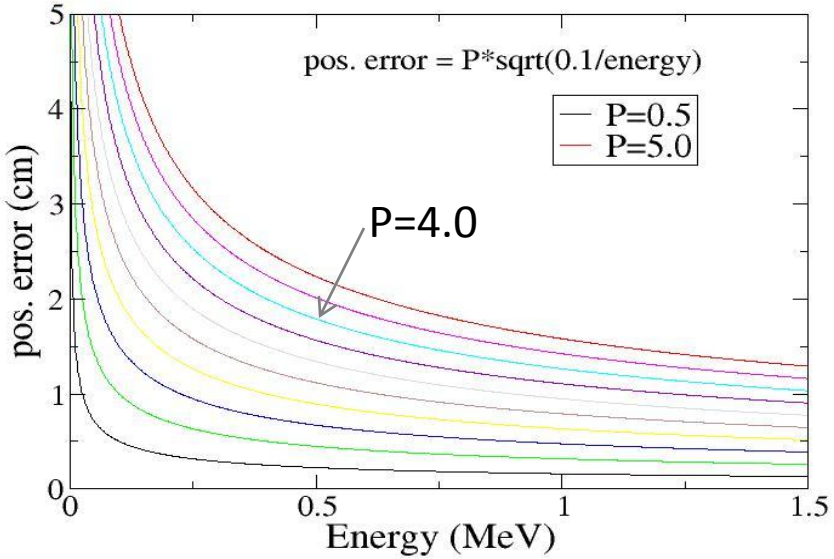

Figure 7. Varying pos. error function

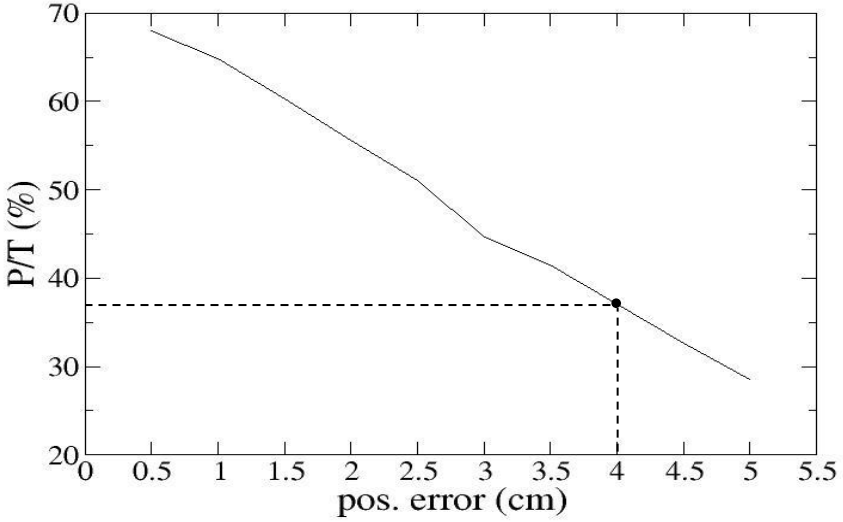

Figure 8. P/T against pos. error

Step 2 : Compare the most similar simulation with the experiment

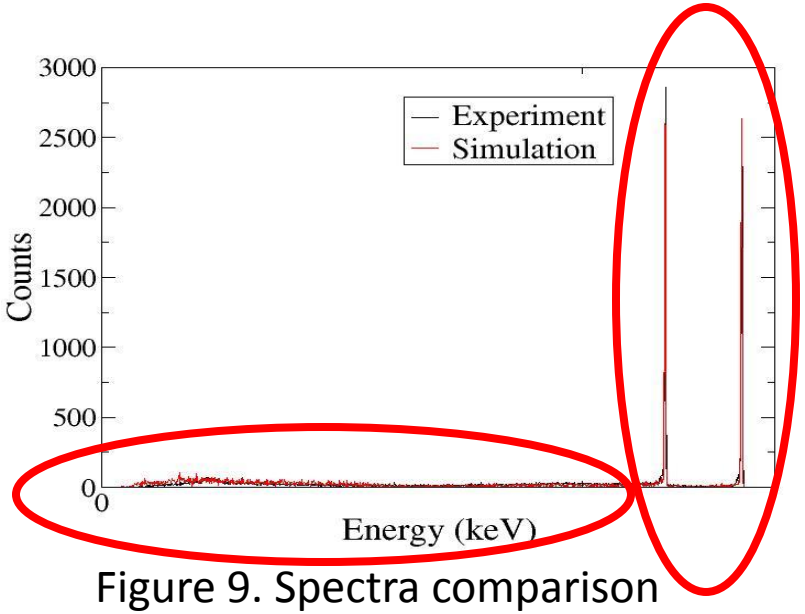

Figure 9. Spectra comparison

	P/T (%)
Simulation	**37.04**
Experiment	**38.9**

Table 3. Results comparison

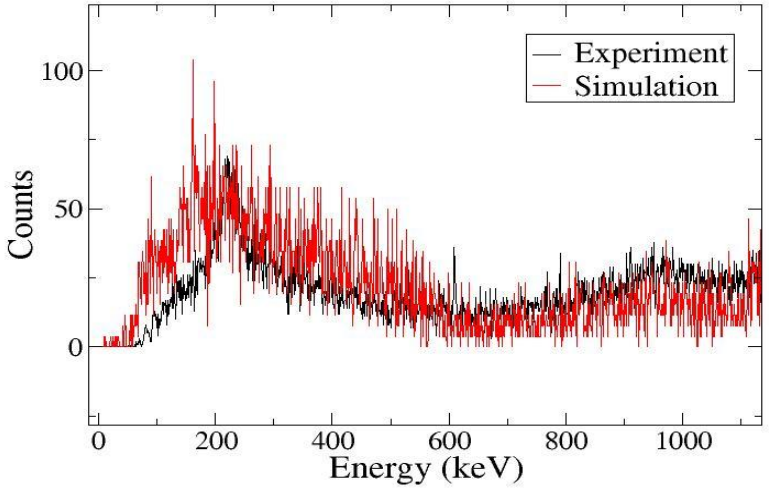

Figure 10. Background comparison

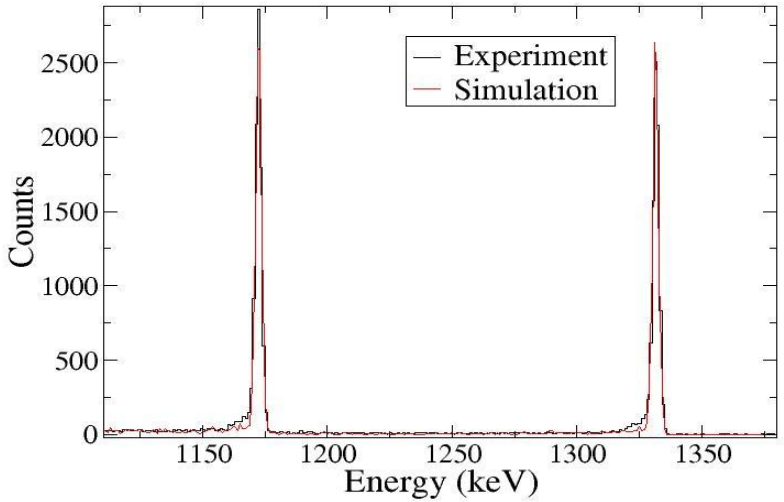

Figure 11. Peaks comparison

Step 3 : Plans for further modification

Modifying the position error function gives a closer P/T to the experiment, but this is not the complete picture:

- Error profile is only a function of energy, although error also has a position dependence

- Error from the PSA algorithms depends on how good electric field has been modelled within the detector volume

- Reasonably well reproduced in the main detector volume but along the edges is not very well understood

- Would like to include this associated error in the tracking code as to what is the position dependence of the error in position itself

  - Currently in contact with the PSA team @ University of Manchester who are running a PSA analysis of the pencil beam scan – extract information by looking at the position error for a number of scan positions across the detector.

- Including this error would improve the pos. error function creating more realistic simulations

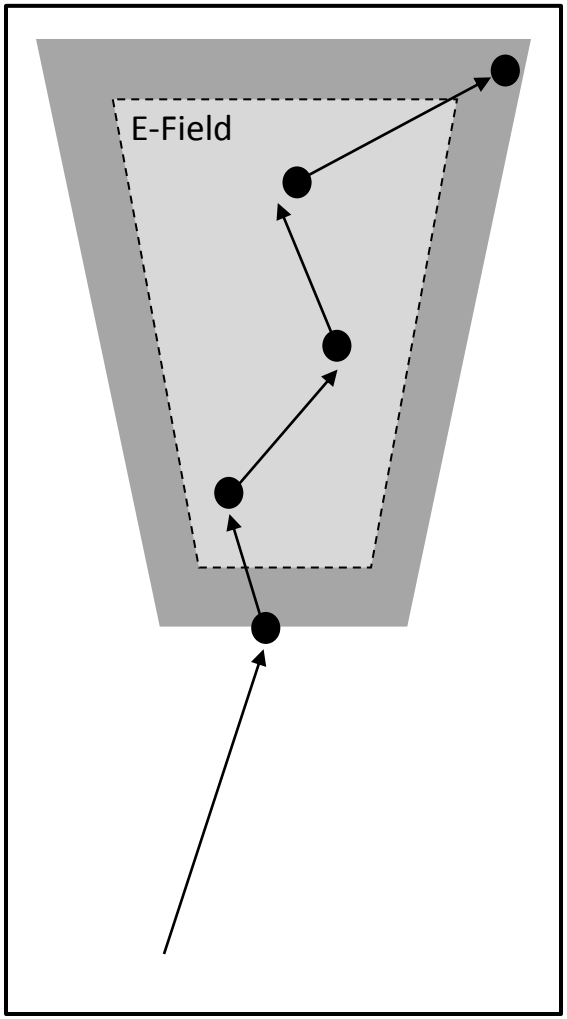

Figure 12. E-Field in detector volume

Conclusions

- In general, all experimental simulations are tracked using the default profile of the position error

- I have investigated only one aspect of this function (scaling)

- Need to acquire the position dependence of the position error function

- Once the correct profile is achieved it will allow future experimental simulations to be more realistic