

UK AGATA Community Meeting – 24/11/09



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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

Position and energy error functions of the Orsay tracking code

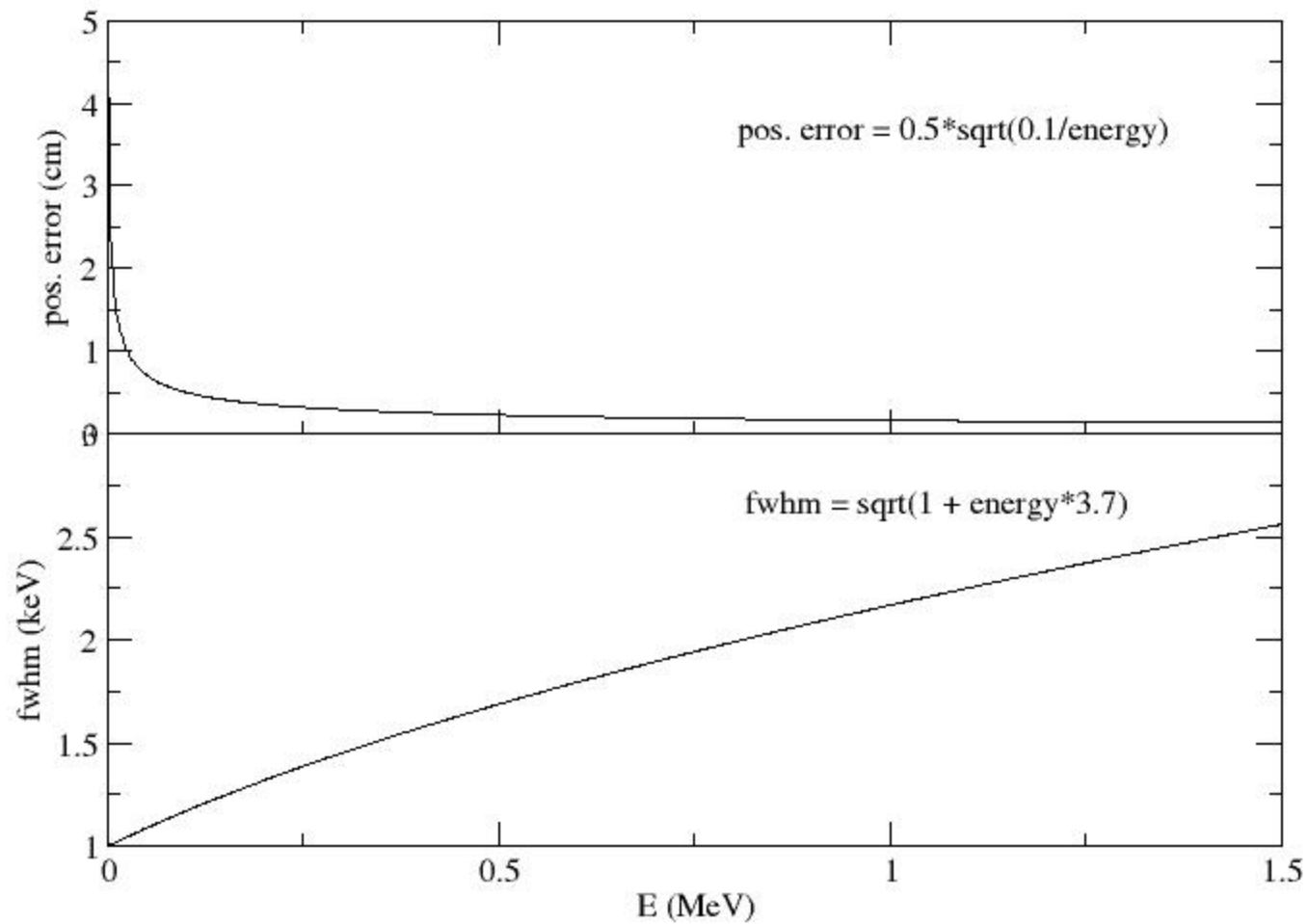


Figure 1.

Tracked and untracked spectra from the August Experiment

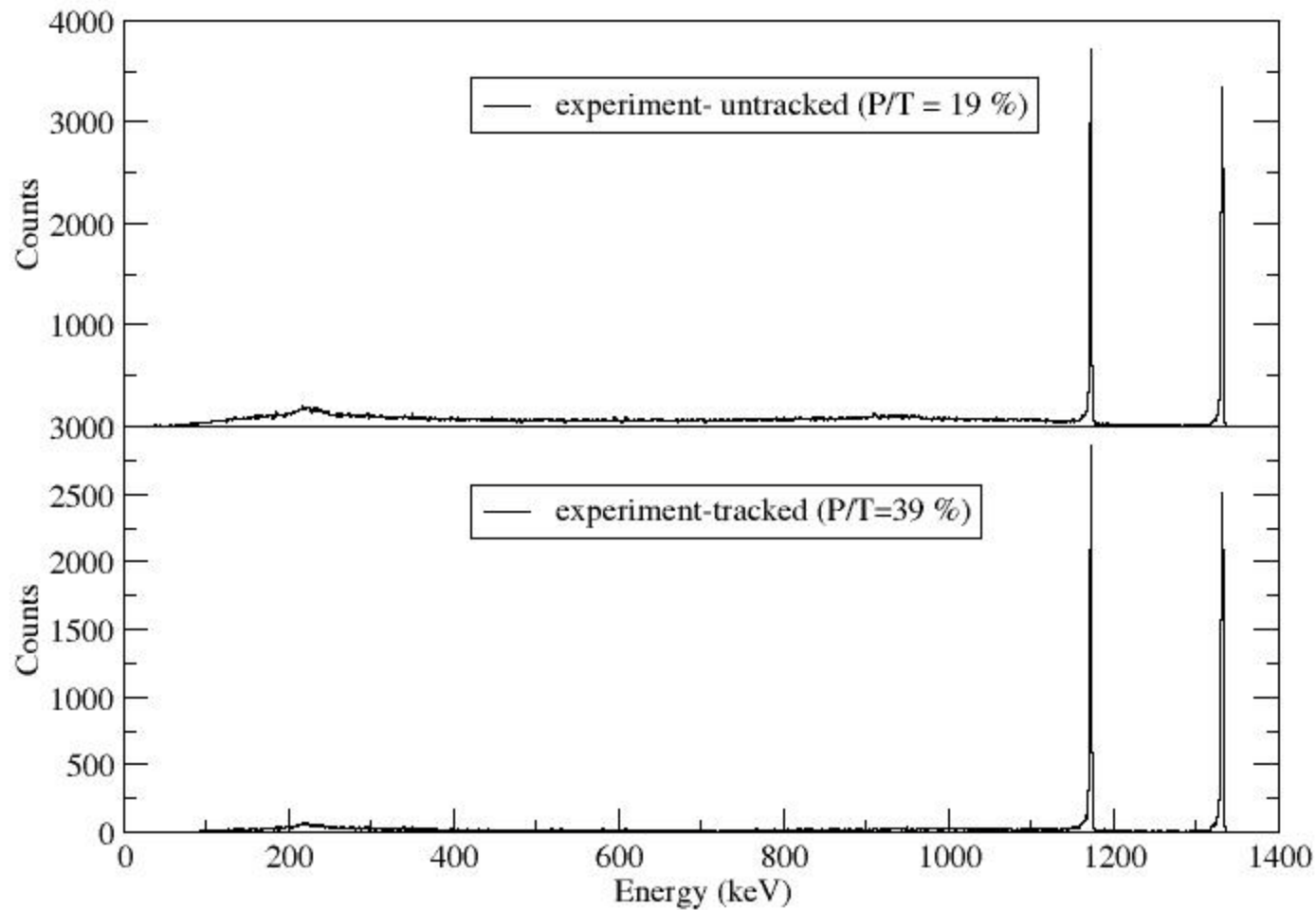
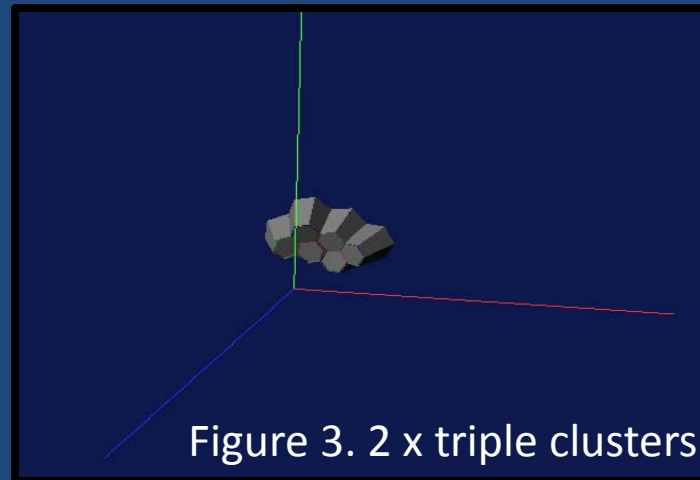


Figure 2.

Step 1 : Initial simulation

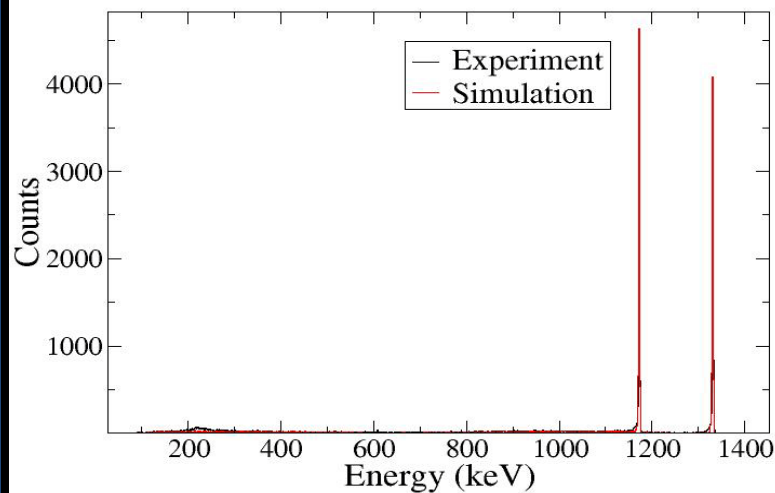
Task: Compare the spectrum produced by the OFT tracking code with the tracked spectrum from the August experiment

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



- 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

Figure 4. Spectra comparison



	P/T (%)	FWHM (1173 keV)	FWHM (1332 keV)
Simulation	67.9	2.78	2.88
Experiment	38.9	3.09	3.30

Table 1. Results comparison

Figure 5. Background comparison

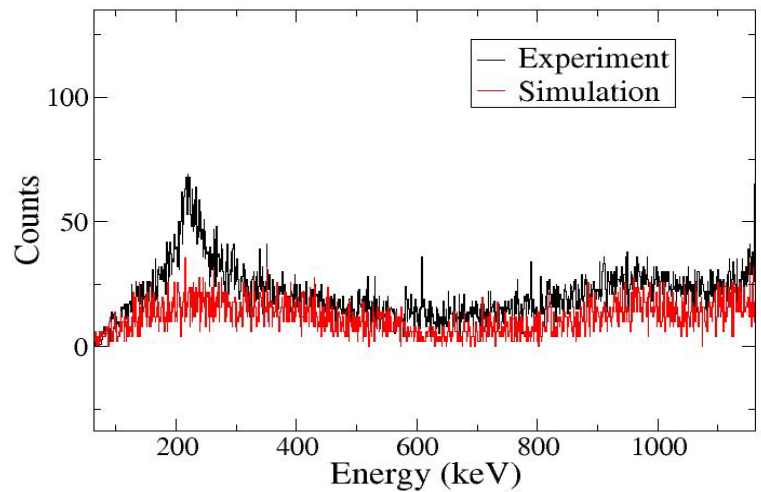
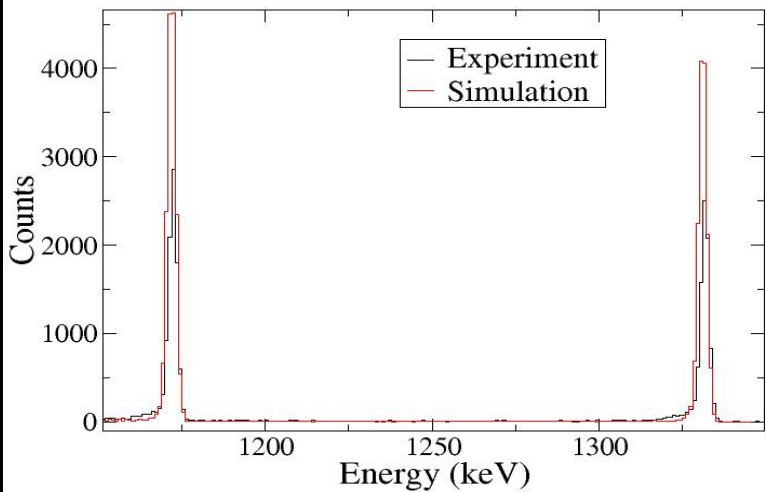


Figure 6. Peaks comparison



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	

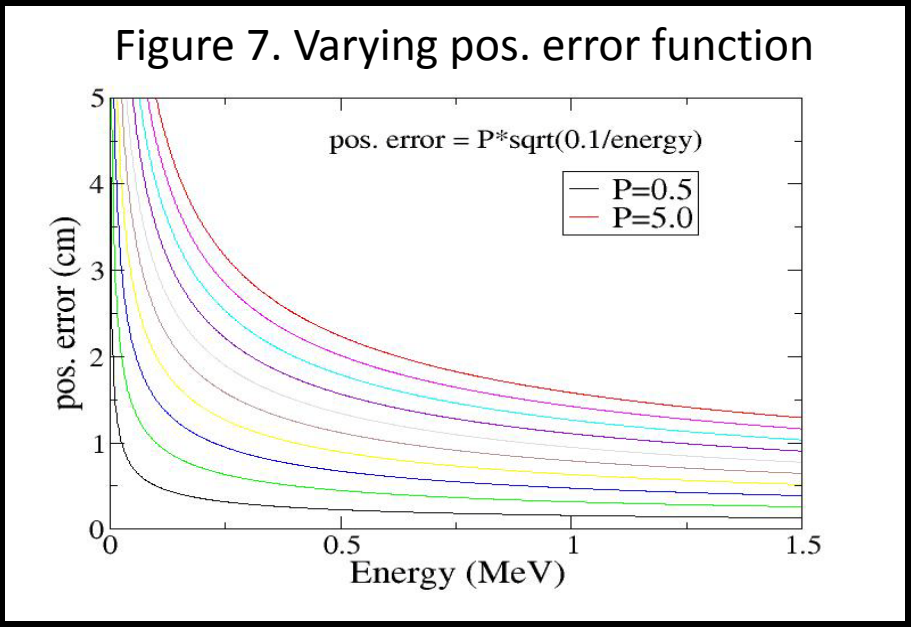
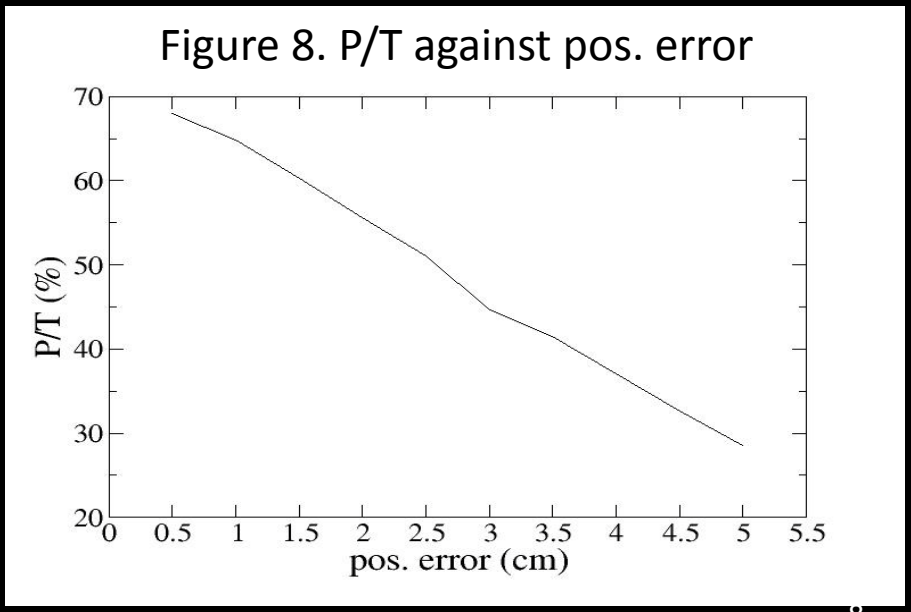


Table 2. Varying the error function parameter

- 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



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

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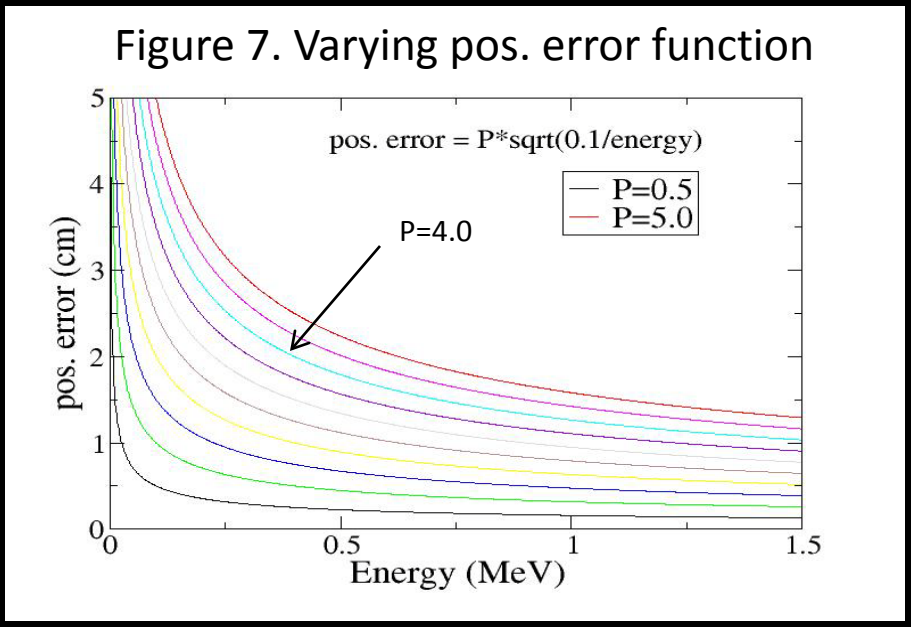
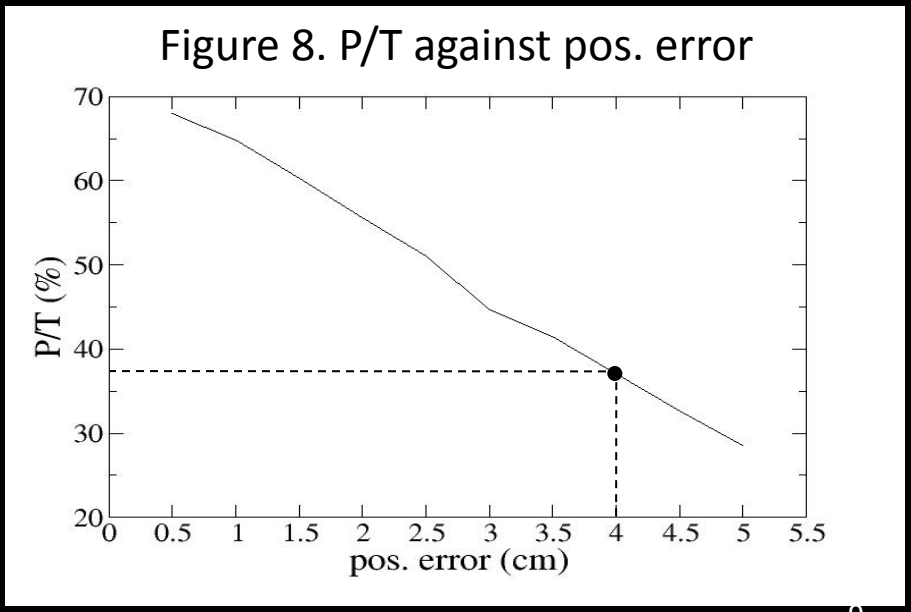


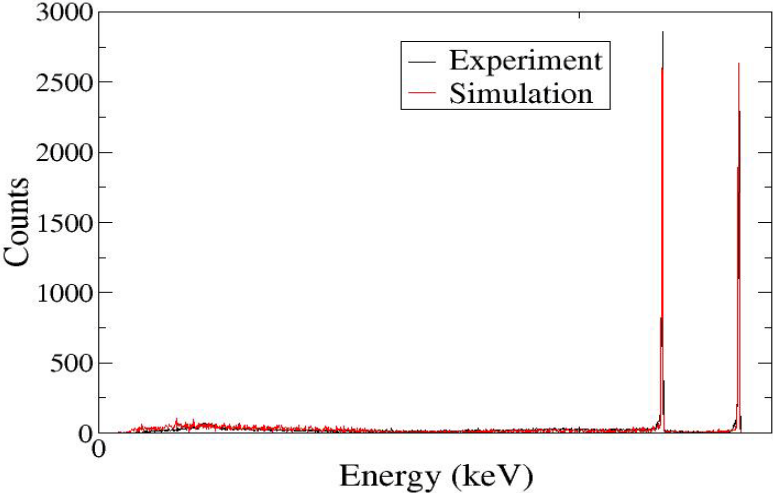
Table 2. Varying the error function parameter

- 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



Step 2 : Compare the most similar simulation with the experiment

Figure 9. Spectra comparison



	P/T (%)	FWHM (1173 keV)	FWHM (1332 keV)
Simulation	37.04	2.73	2.82
Experiment	38.9	3.09	3.30

Table 3. Results comparison

Figure 10. Background comparison

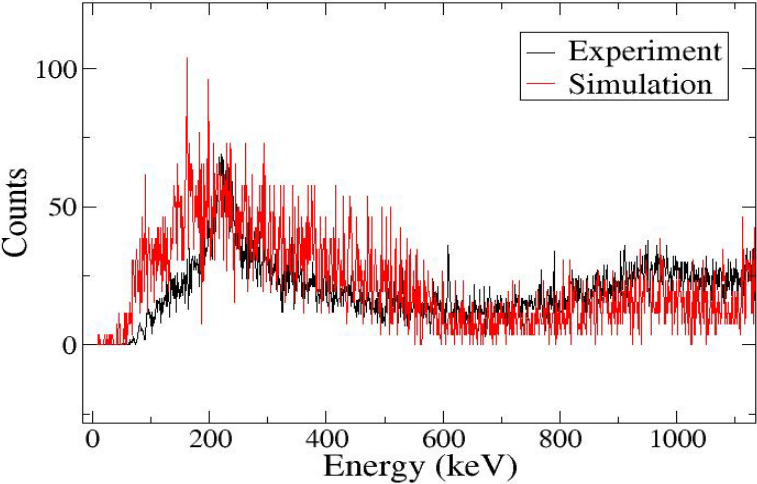
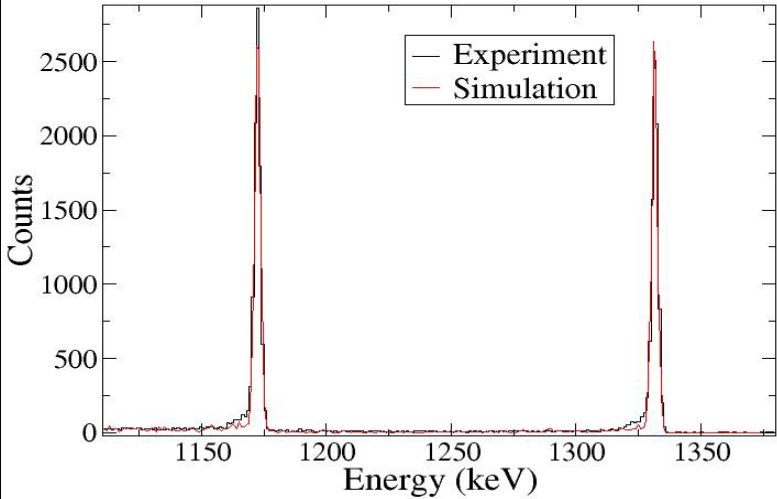


Figure 11. Peaks comparison



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 with input from the PSA community as to what is the position dependence of the error in position itself
- Including this error would improve the pos. error function creating more realistic simulations

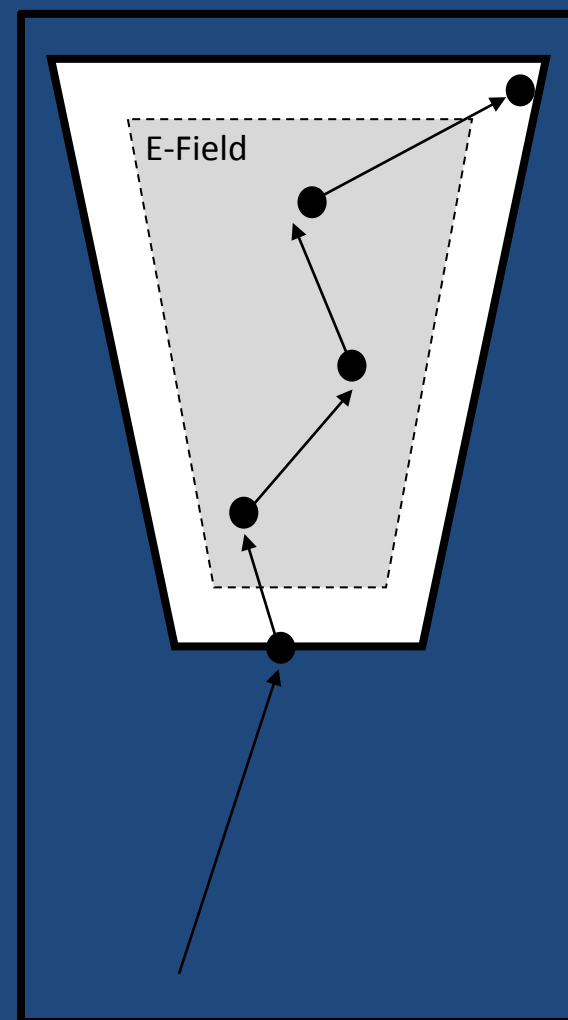


Figure 12. E-Field in detector volume

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