

GATE Simulation study

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Ryo Hamanishi



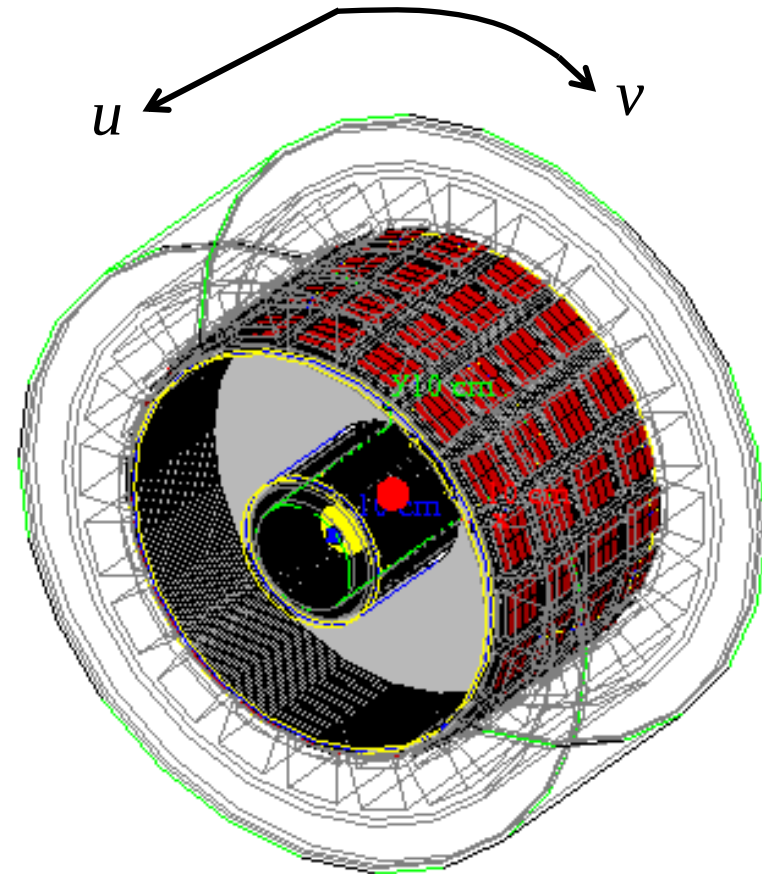
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GATE simulation

XEMIS2 Geometry

- radial $7 < r < 19$ cm
- axial (z) Length = 2×12 cm
(divided by cathode)
- Electric Field in z direction 2 kV/cm
- Pad size : 3.175×3.175 mm²
- Source ⁴⁴Sc (β^+ , γ : 1.157 MeV)
- Source position
(sphere : $r = 1.0$ cm)
- Drift velocity : 3 mm/usec
- PMTs
 - 2inch : 4×20
(4.624×4.624 cm²)
(divide PhotoCathode by $2(v)$ and $4(u)$)



About TSpectrum2

- Peak search function
 - Search(Histogram, sigma, option, threshold)
 - Histogram : pointer to the histogram of source spectrum
 - sigma : sigma of searched peaks
 - option : nobackground, Markov chain algorithm, draw option
 - threshold : (default=0.05) peaks with amplitude less than threshold*highest_peak are discarded. $0 < \text{threshold} < 1$

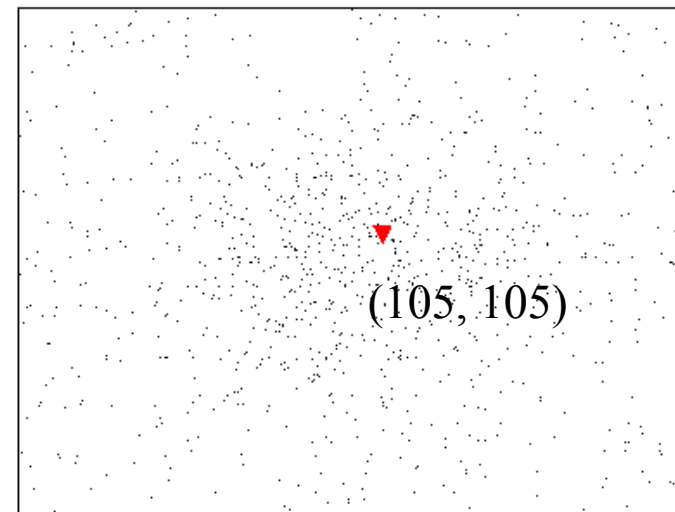
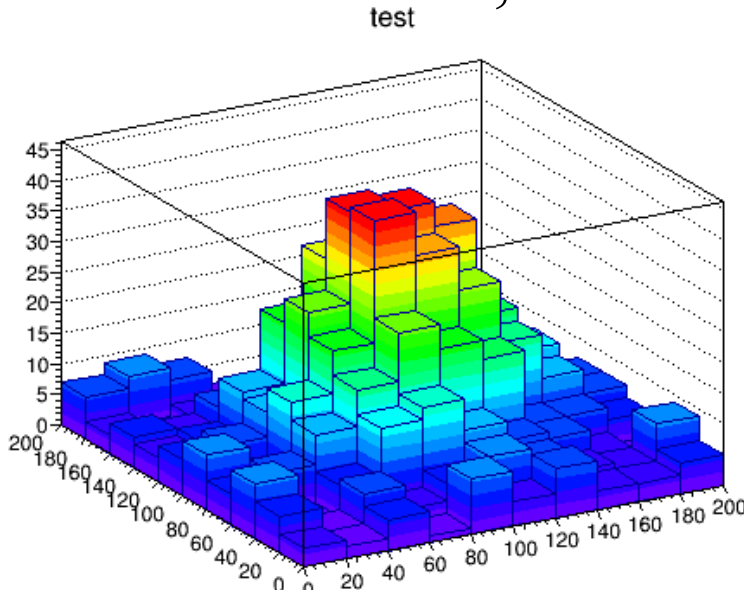
This function eliminate background, smooth the spectrum, deconvolution and get the peak positions

Peak search algorithm

- In order to see the results of each processes, I added the function which shows the spectrums in each process.
- I extracted the peak search program from ROOT source and added it to my analysis program.

Peak search algorithm

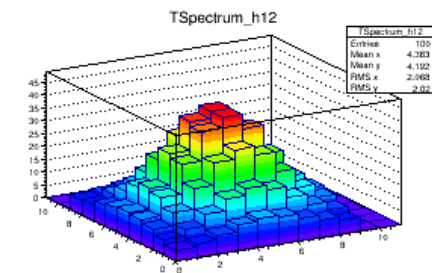
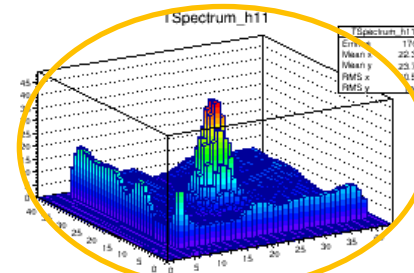
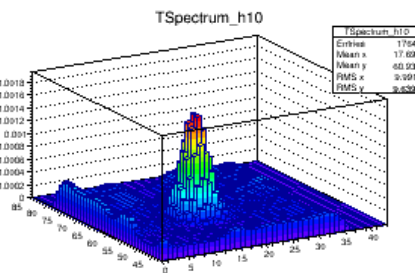
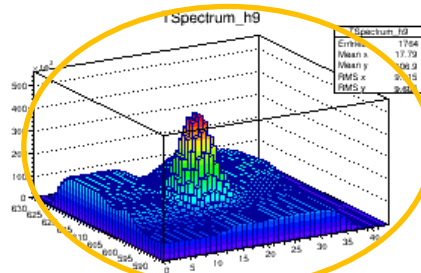
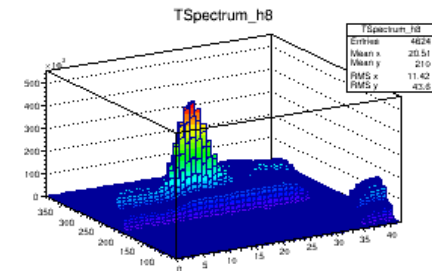
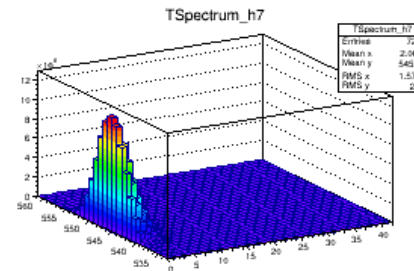
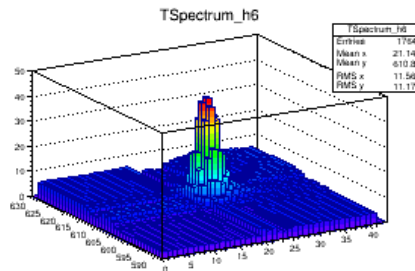
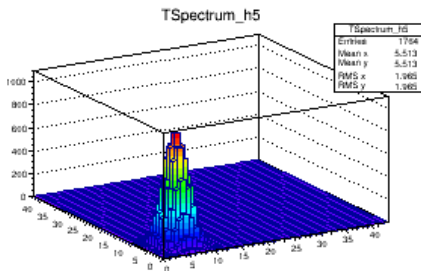
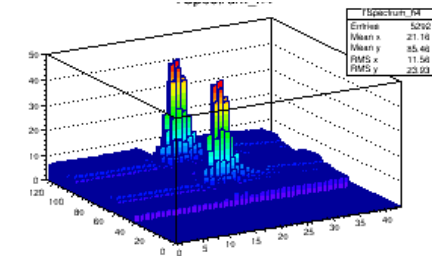
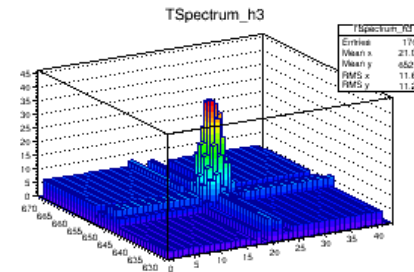
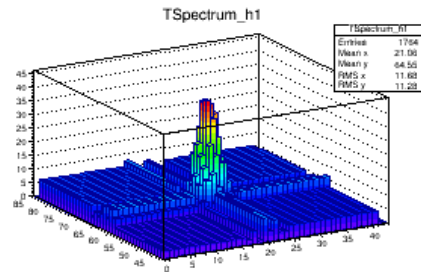
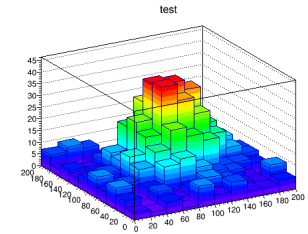
- For the test of TSpectrum2, I generated the spectrum which has 30 sigma and 100 means. (left figure)
- Bin width is 20, so there are 10 bins in this spectrum



- Right figure shows the peak search result.
 - In this case, sigma was set to 2 and threshold was set to 0.5.

Peak search algorithm

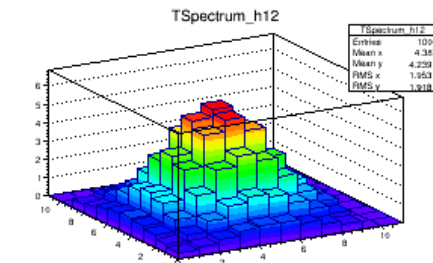
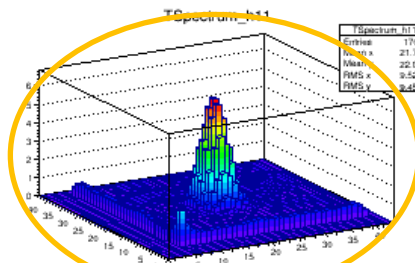
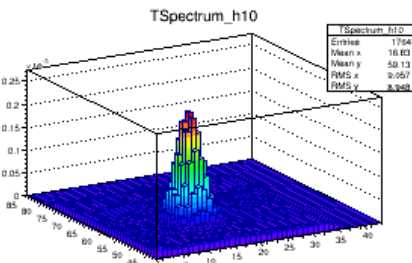
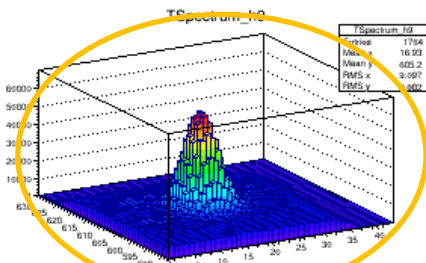
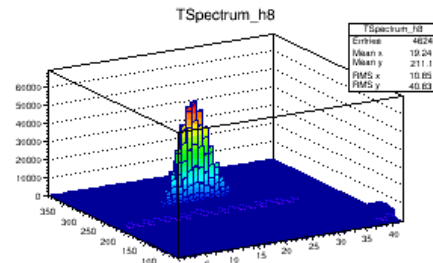
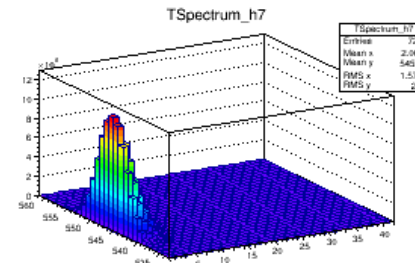
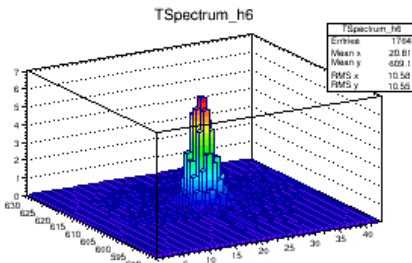
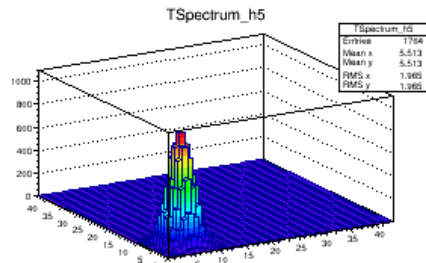
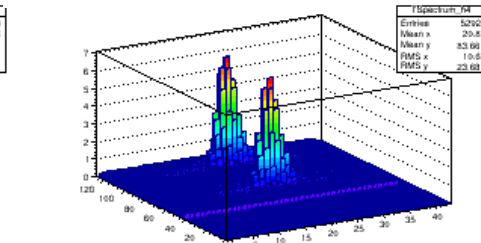
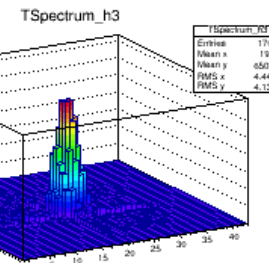
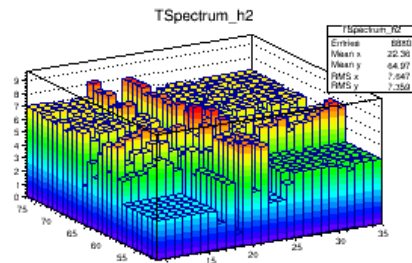
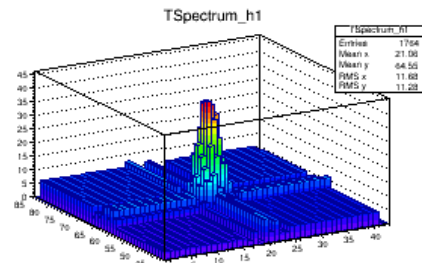
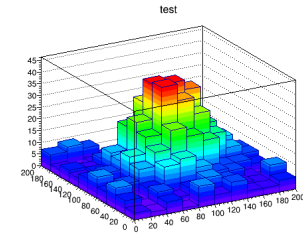
- Checked the peak search process
 - At first, I postulated there is no background.
 - x and y mean bin number



Peak search algorithm

- At second I postulated there is background.

estimated background



Conclusion

- I made the option which shows the peak search processes.
- I need to understand each processes and test various spectrum, e.g. change the sigma and threshold for search, add more one peak to spectrum.