Geant4 Simulation of ^{137}Cs Using NaI(TI) Detector

*The real crystal size of NaI(TI) used in this simulation is 2 inches by 2 inches = 5.08 cm by 5.08 cm

15th December, 2016

Main Simulation Parameters

- **The main features and characteristics included in the Monte Carlo simulation are;**

1. **NaI(TI) crystal 2 by 2 inches of density 3.667g/cm^3**

2. **Glass window of density 2.200g/cm^3**

3. **Aluminum housing/casing for NaI(TI)/PM of density 2.7020g/cm^3**

4. **Polystyrene materials of density 1.06g/cm^3**

Detector Schematic View

PMT   NaI(TI) Crystal

Optical Greece

Glass

Polystyrene   Photocathode   Aluminium
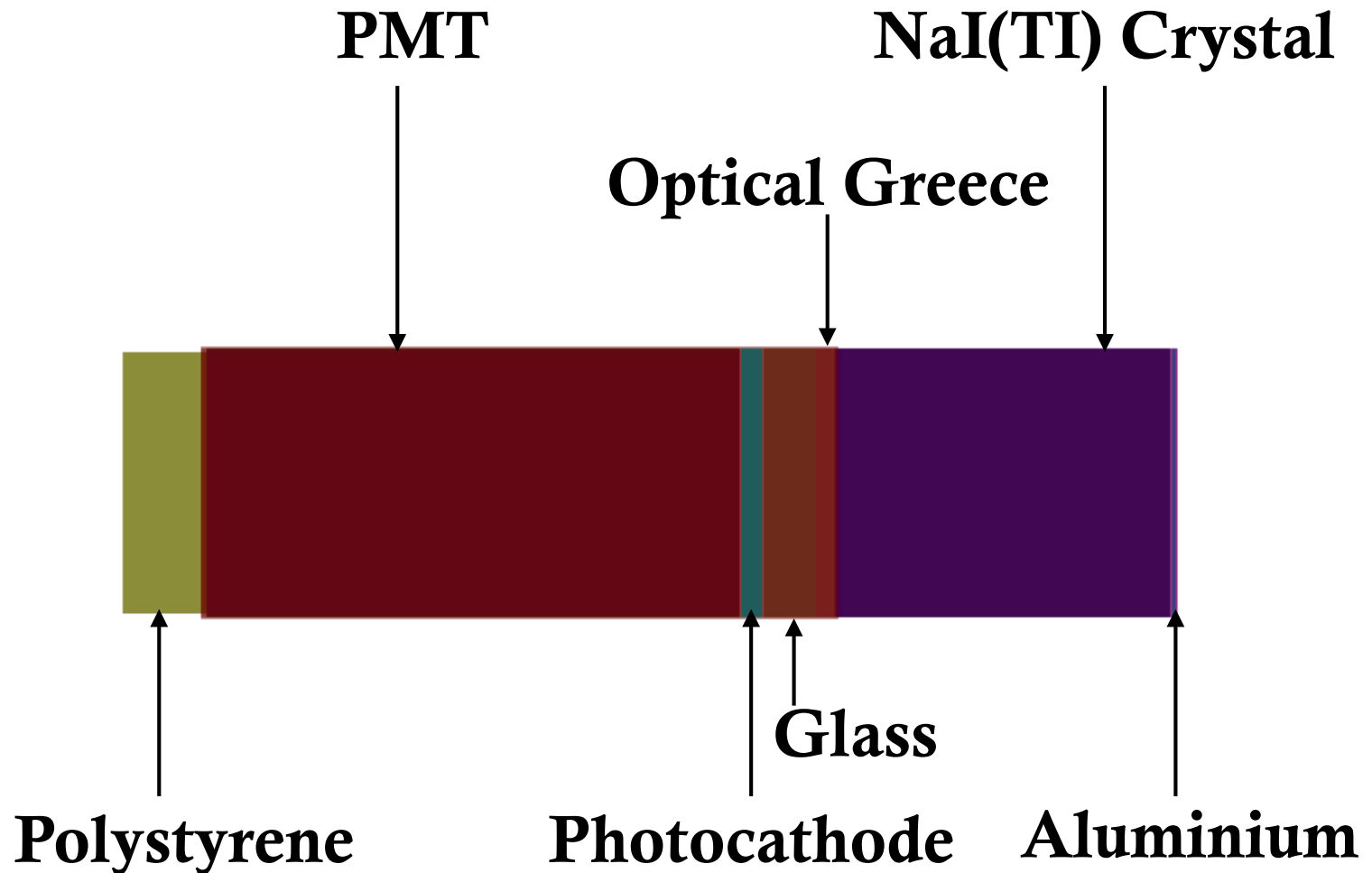
- **In order to reproduce the measured spectra we consider exact detector geometry.**

Simulation Geometry
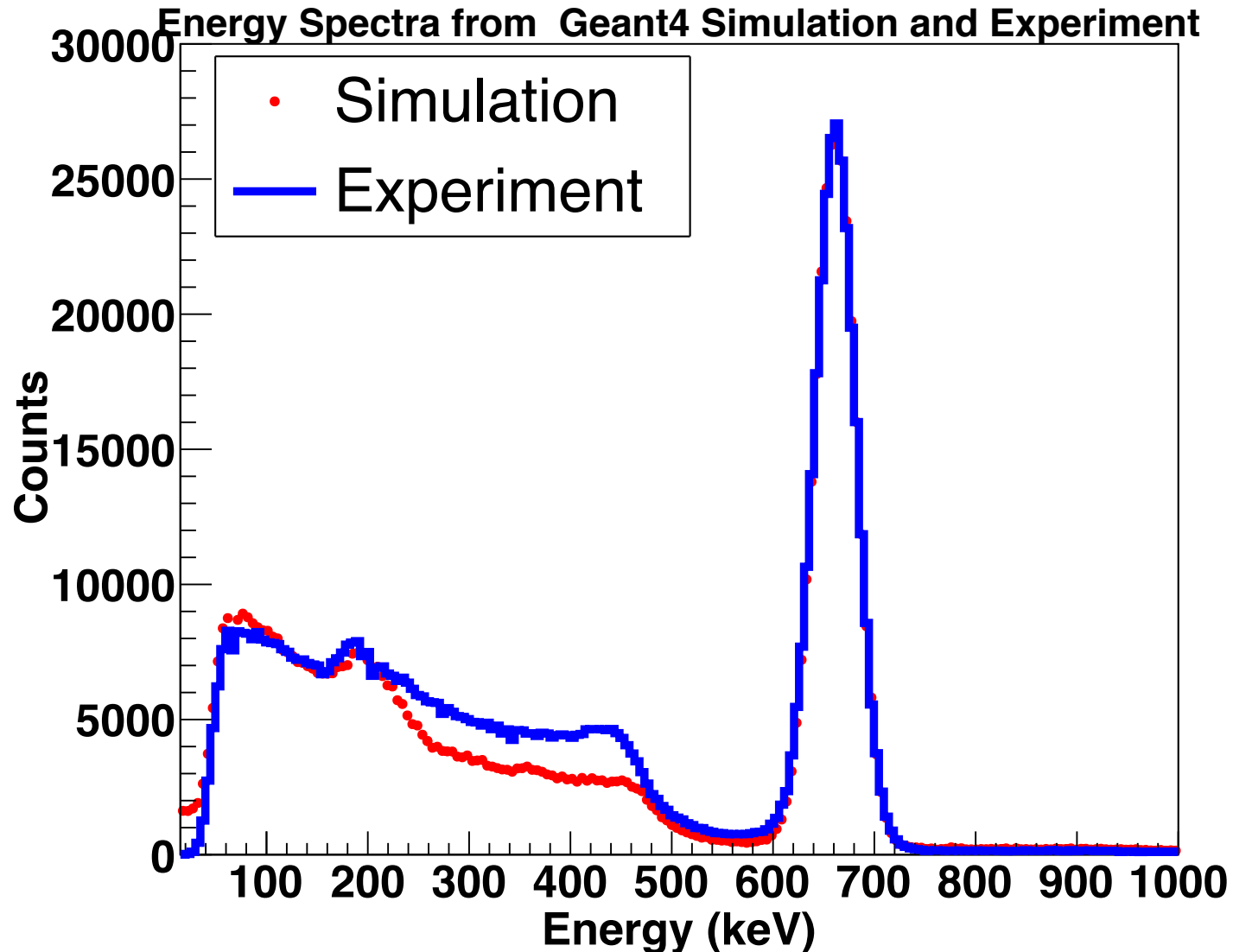

Pb block

NaI(TI) detector
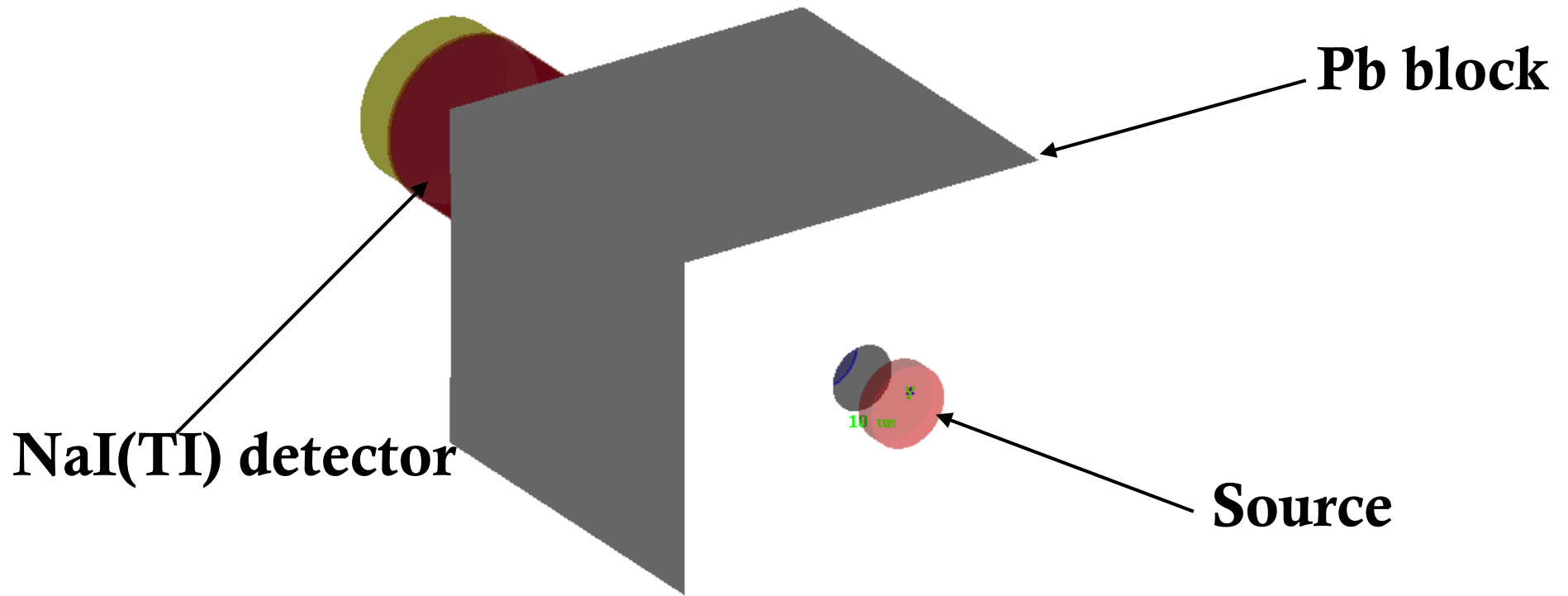
Source

- **The distance from the source to the Pb block front surface is 3cm while the thickness of lead block to the surface of NaI(TI) crystal is 3cm.**
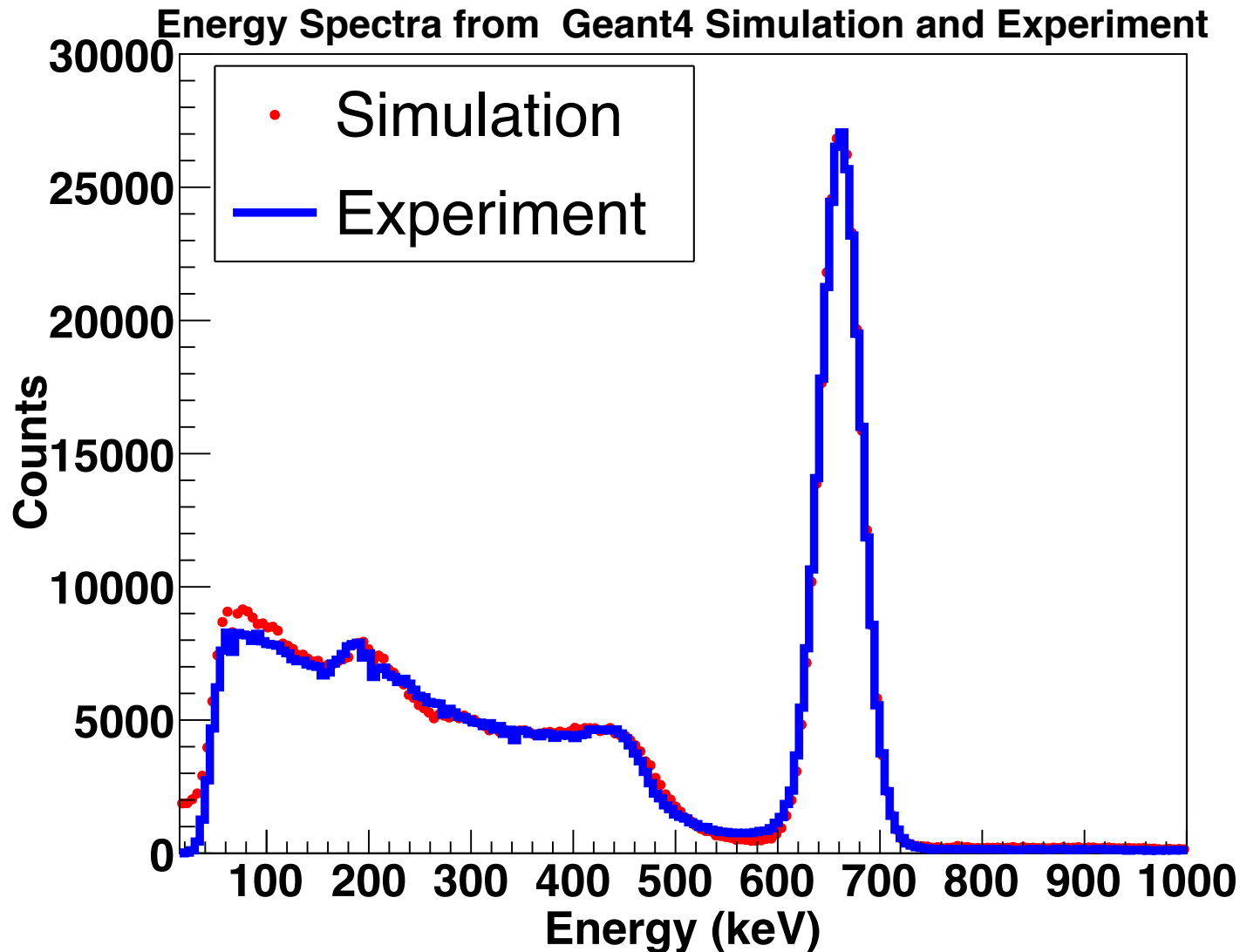
4
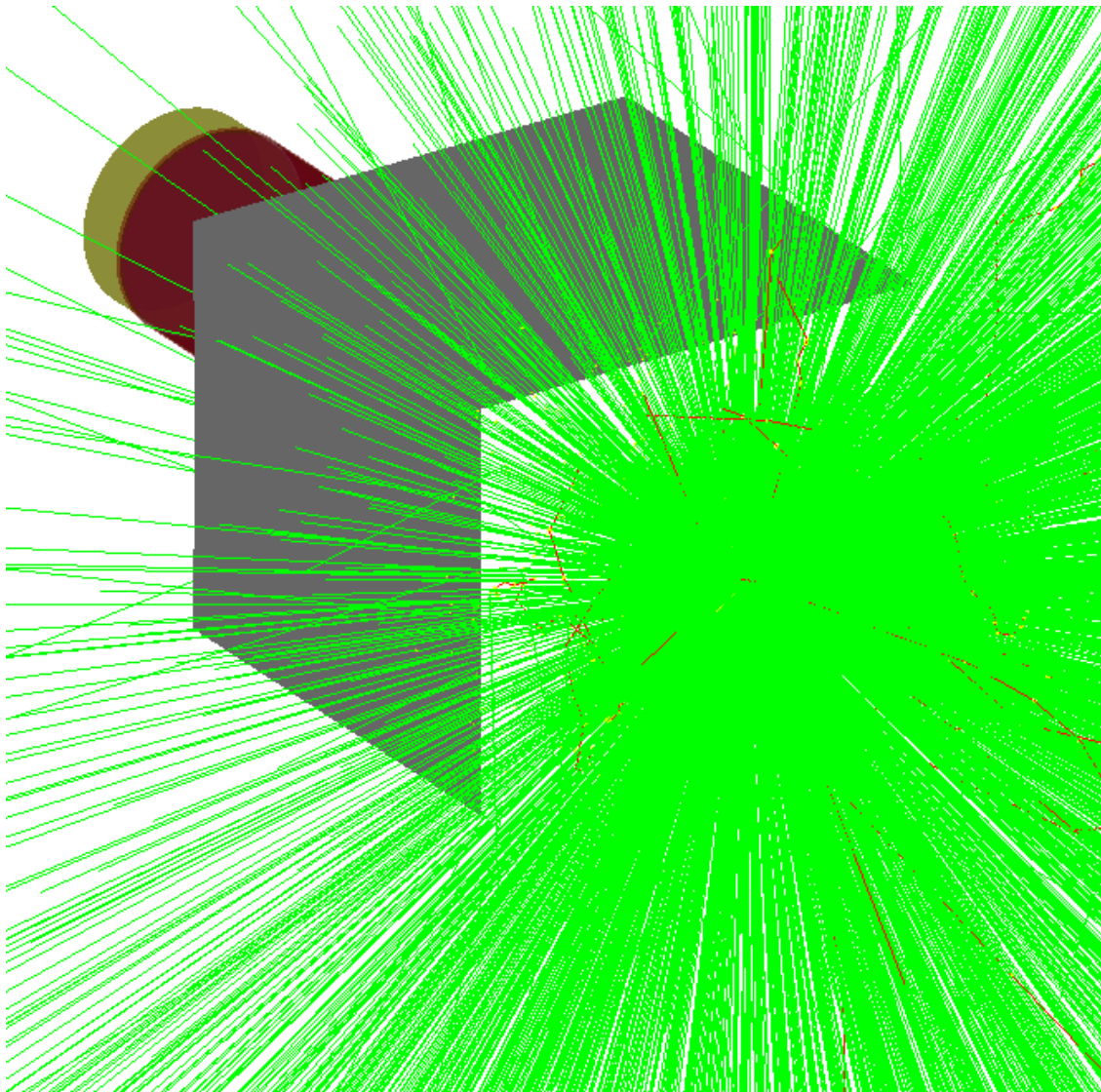
- **The figure display the real events display from Geant4 simulation**

Results from Simulation

Energy Spectra from Geant4 Simulation and Experiment

- **The figure is obtained when housing materials (Al) used in the crystal is very thin.**

Energy Spectra from Geant4 Simulation and Experiment

- **In this figure the crystal size is 5.08cm by 5.08cm (1420000 events to match low energy region and photo-peak). Peak-to-Compton ratio is 5:1**

Remarks

- Very good reproduction of the entire spectrum is obtained by considering the exact detector geometry.

- The peak structure around 200 keV is due to backscattering of the gamma rays.

- The figure (in slide 7) shows that the photo-peaks and corresponding Compton edges were correctly reproduced.

- The minor differences is also observed between the simulated data and the experiment data in the low energy region (slide 7).

- Based on this simulation results, next work is to do deconvolution for data analysis.