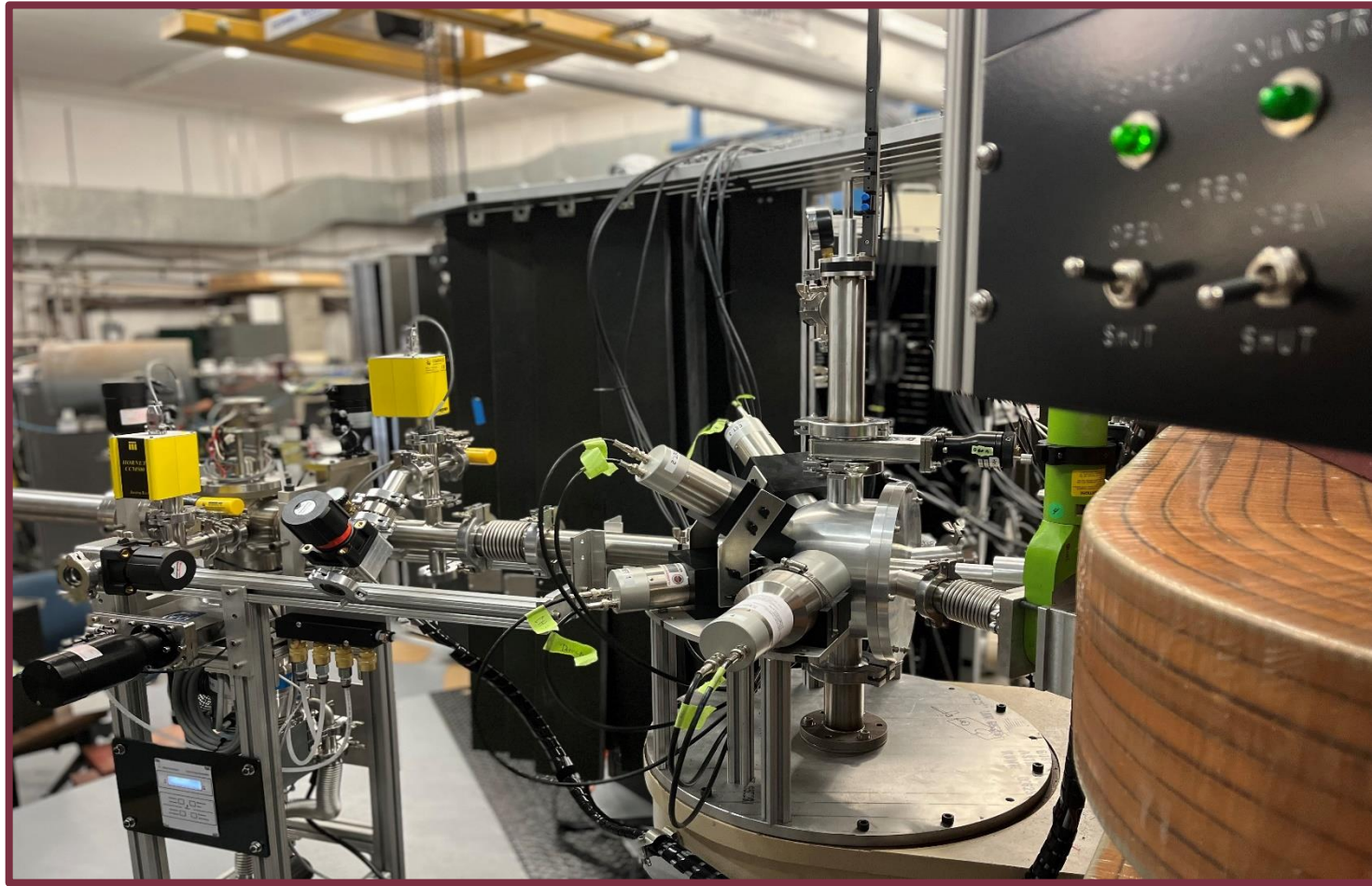




Geant4 Simulation of CeBr₃ Detectors for CeBrA

Scott Baker, Alex Conley, Dennis Houlihan, Bryan Kelly, and Mark-Christoph Spieker



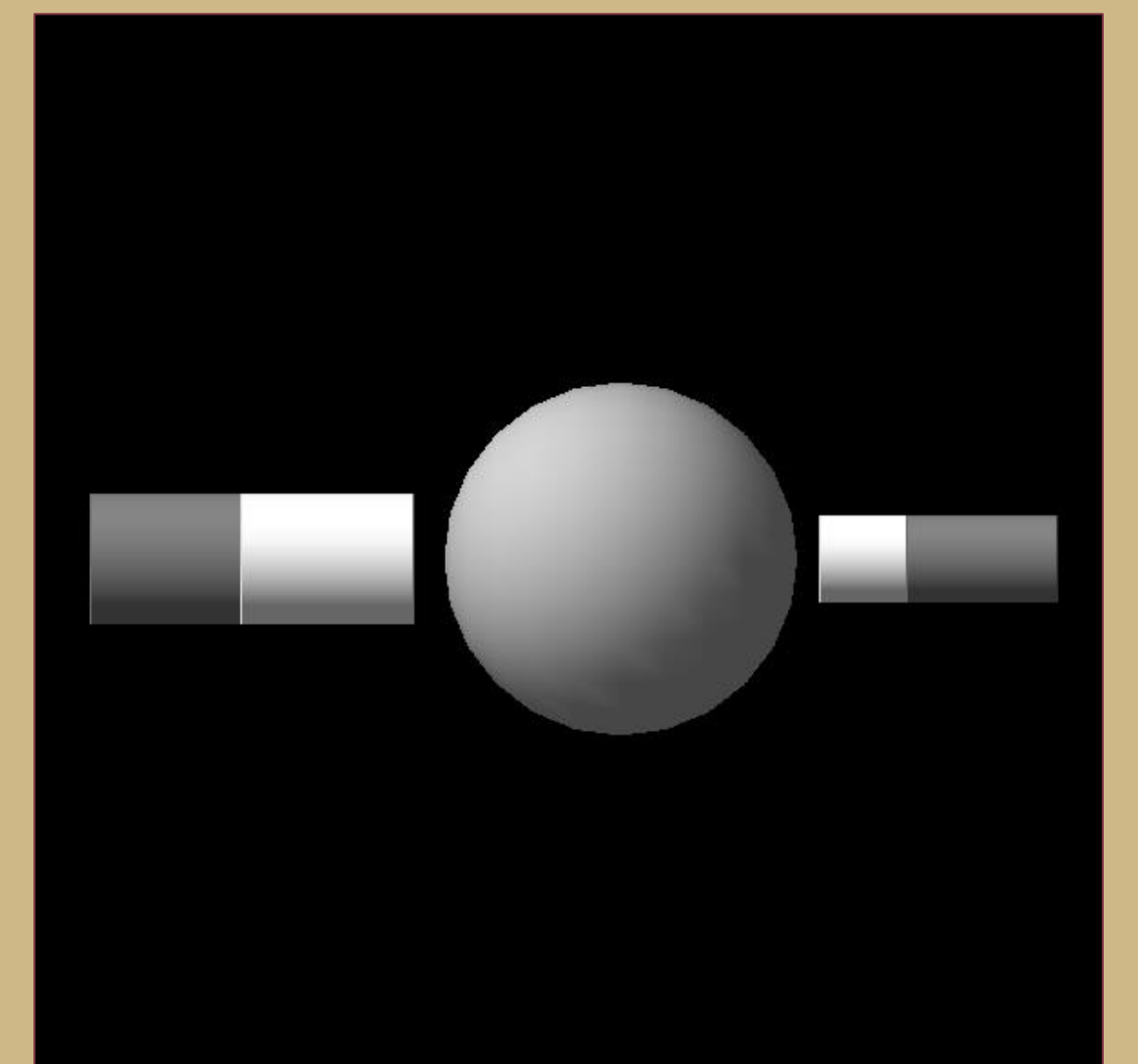
CeBrA demonstrator at SE-SPS

Cerium Bromide Array (CeBrA)

- CeBrA is a new experimental setup being developed at the Super-Enge Split-Pole Spectrograph (SE-SPS).
- CeBrA will allow particle- γ coincidence experiments to be performed in conjunction with the SE-SPS.
- The CeBrA demonstrator currently consists of four 2" x 2" CeBr₃ scintillators and an additional 3" x 4" CeBr₃ scintillator.

Simulation

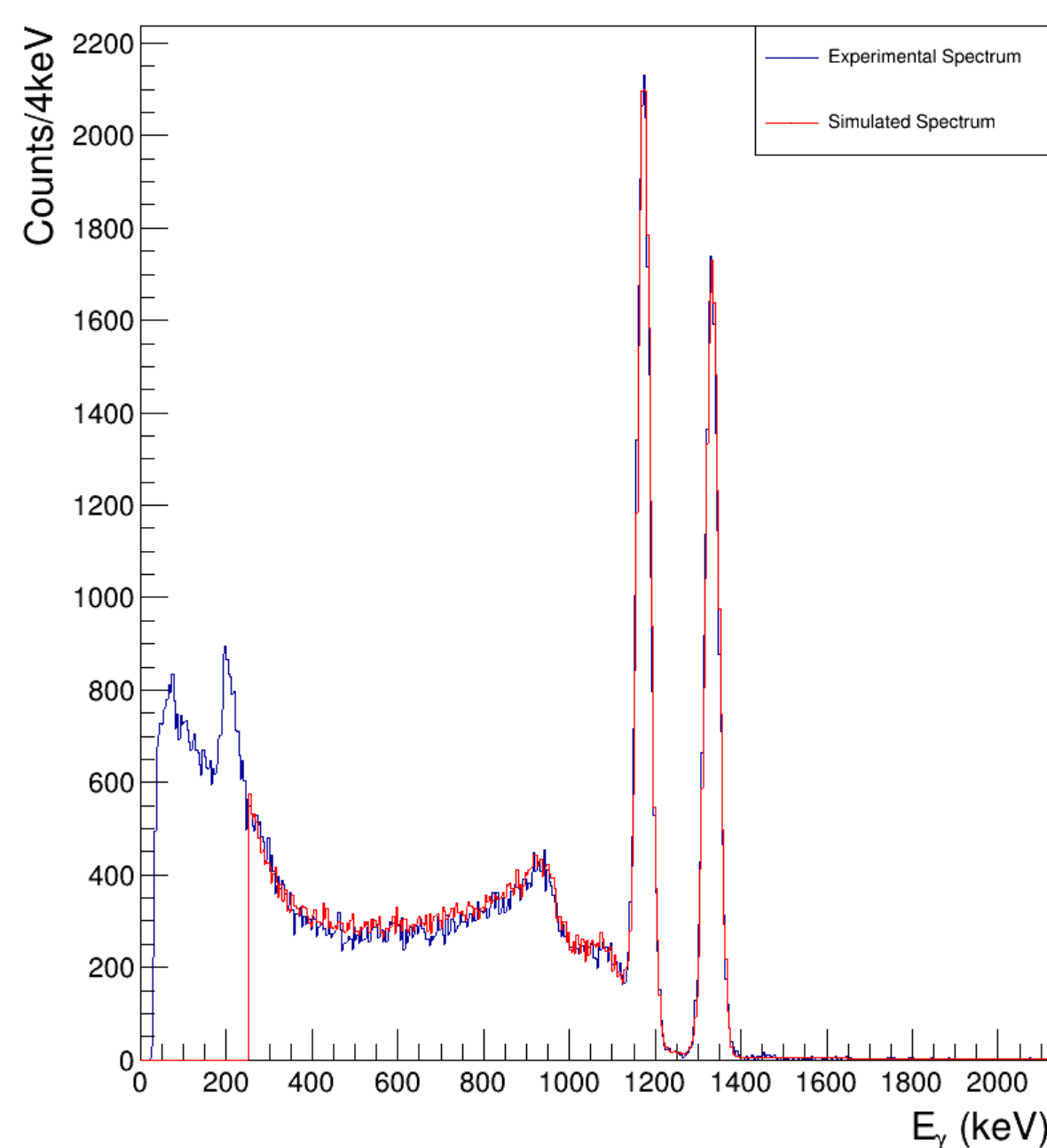
- A simulation of CeBrA is being developed using Geant4.
- Geant4 is a toolkit for simulating particles passing through and interacting with matter using Monte Carlo methods.
- The simulation is designed to reproduce the response of the detectors to γ rays.
- A well-constrained simulation will allow the determination of detection efficiencies at energies inaccessible with standard calibration sources.



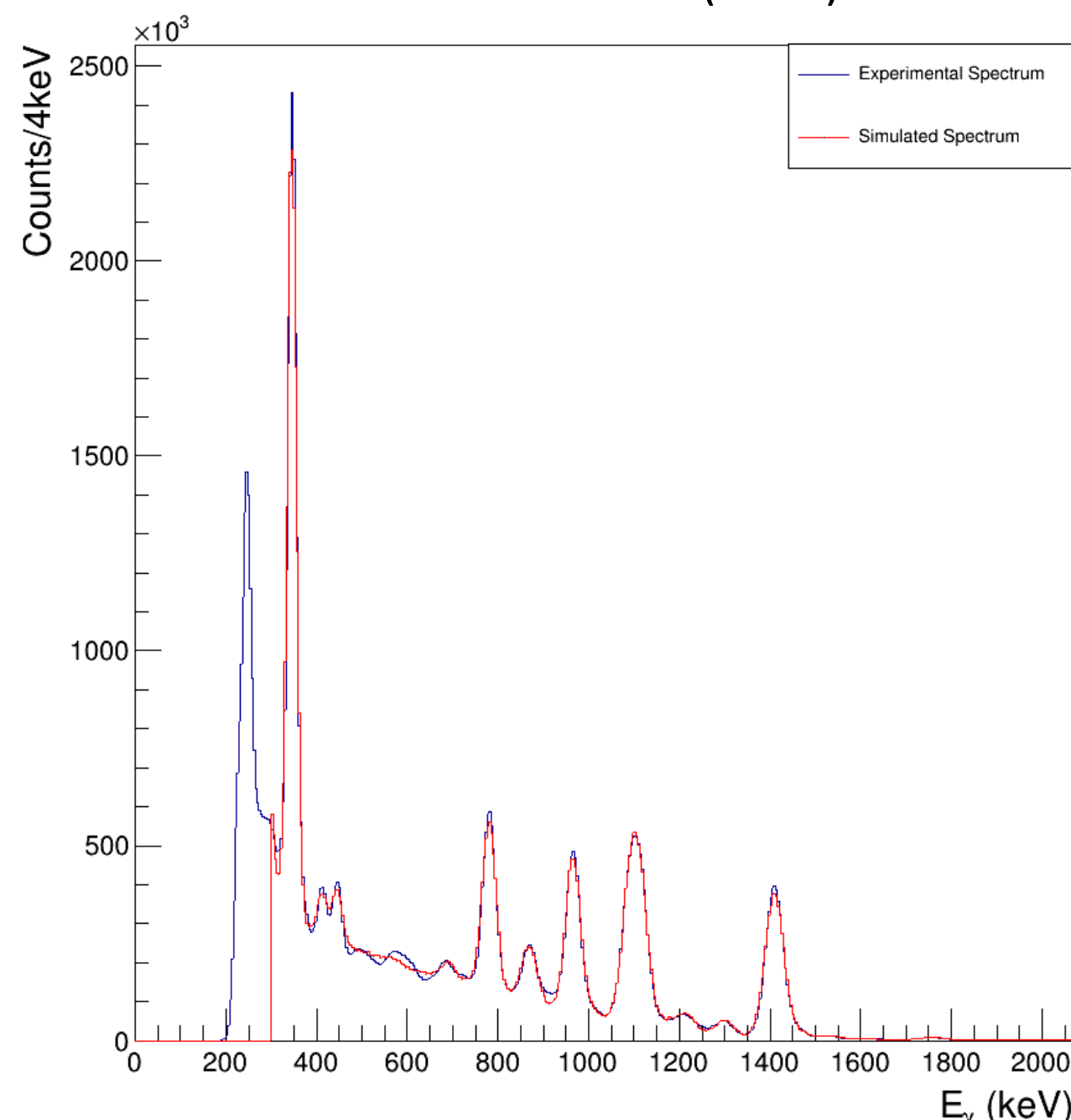
Visualization of simulated 2" x 2" and 3" x 4" detectors with scattering chamber model

Results

2" x 2" Detector (⁶⁰Co)

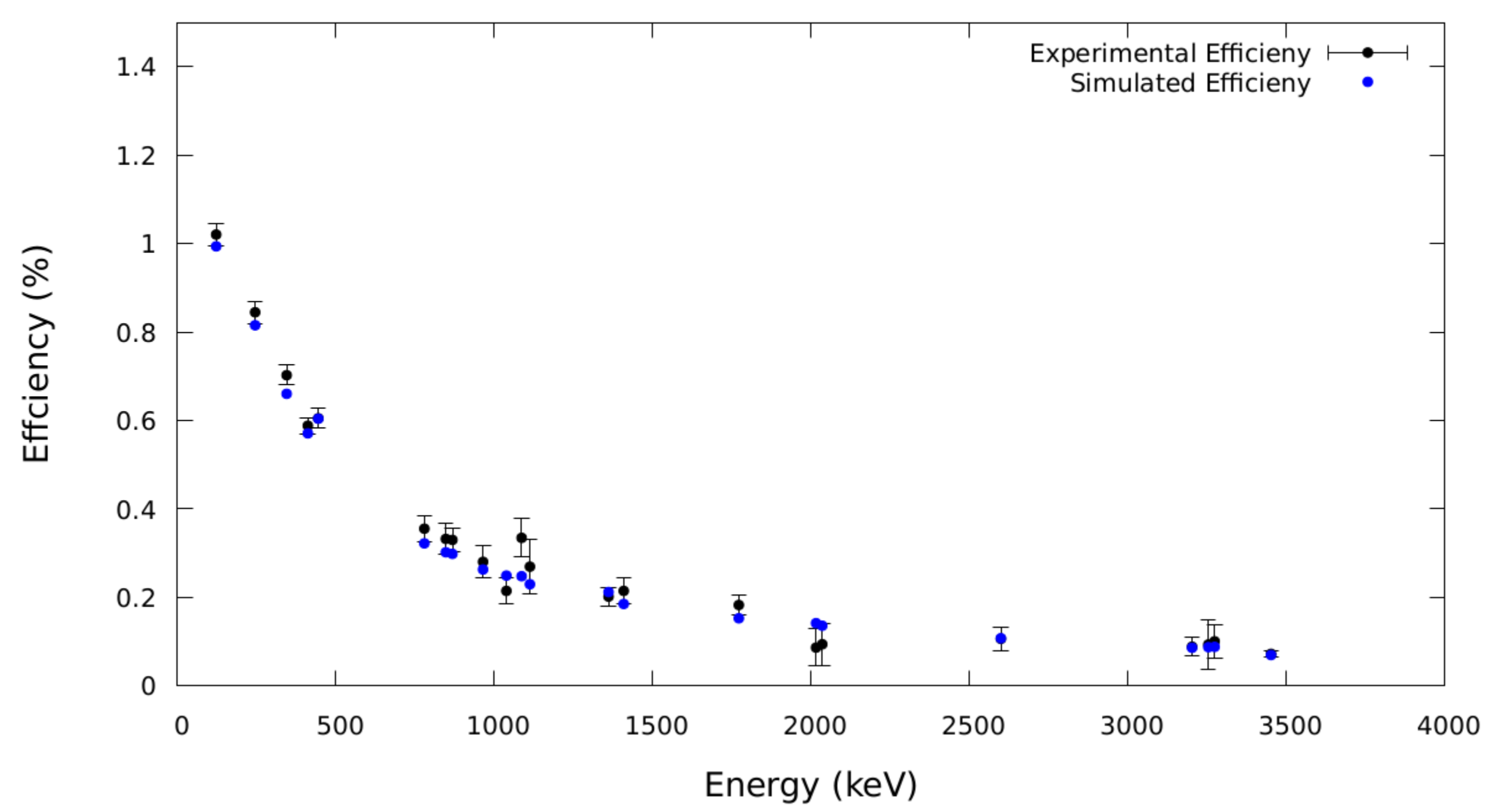


3" x 4" Detector (¹⁵²Eu)



Comparison of experimental spectra and fitted simulated spectra for the 2" x 2" detector with ⁶⁰Co (top) and the 3" x 4" detector with ¹⁵²Eu (bottom).

2" x 2" Detector Efficiencies



Comparison of simulated and experimental full energy peak efficiency curves for a 2" x 2" detector conducted with the scattering chamber at a fixed distance.

- The simulation reproduces the experimental spectra measured for ⁶⁰Co and ¹⁵²Eu with 2" x 2" and 3" x 4" detectors.
- The simulation correctly describes the full energy peak efficiency measured for the 2" x 2" and 3" x 4" detectors with standard calibration sources.

Future Work

Verify the simulation reproduces experimental spectra and full energy peak efficiency without the scattering chamber.