Simulating Decay Energy Spectra Using Geant4

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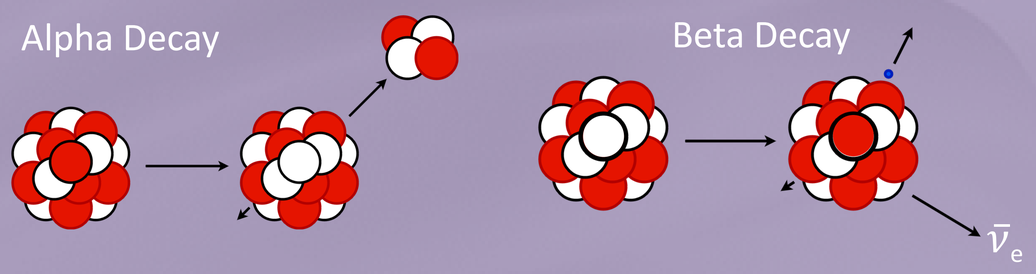
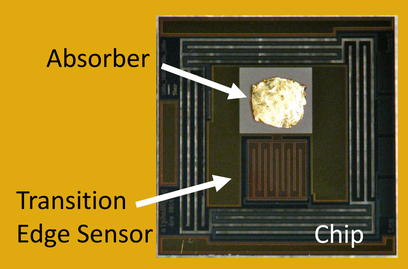
Nuclear Safeguards and Metrology

Trustworthy measurements are essential to managing risk and informing decisions

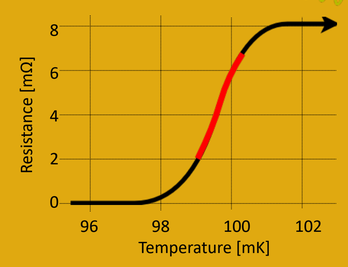


Examples of decay modes measurable with Decay Energy Spectroscopy

What is Decay Energy Spectroscopy?



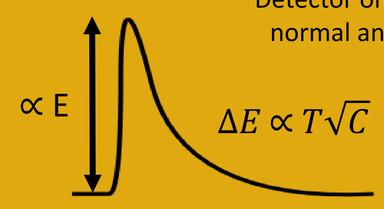
Source embedded in absorber



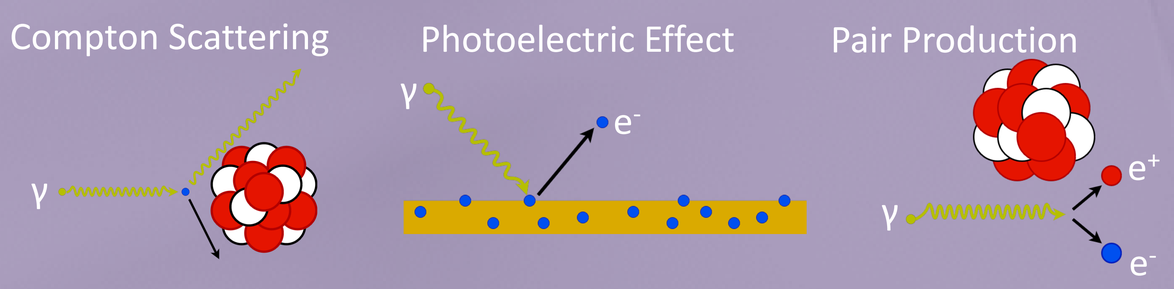
Detector on transition between normal and superconducting

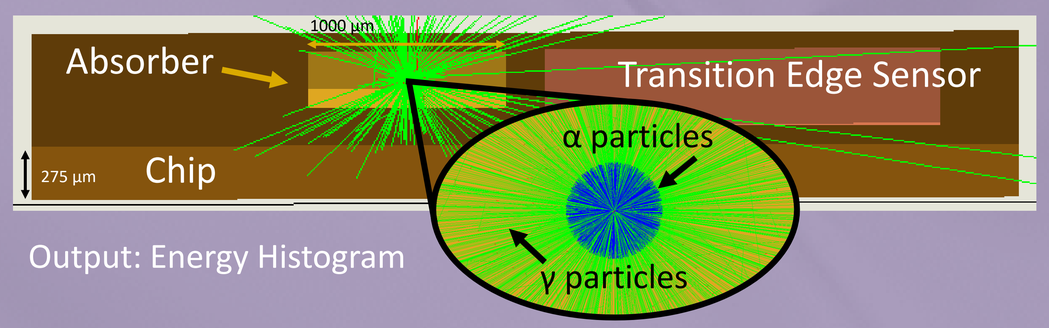
Advantages of DES:

- High Energy Resolution (1 keV to 5 keV @ 5 MeV)
- Can measure multiple isotopes simultaneously without chemical separation
- Low activity requirement (~1 Bq)



Simulating Energy Transport





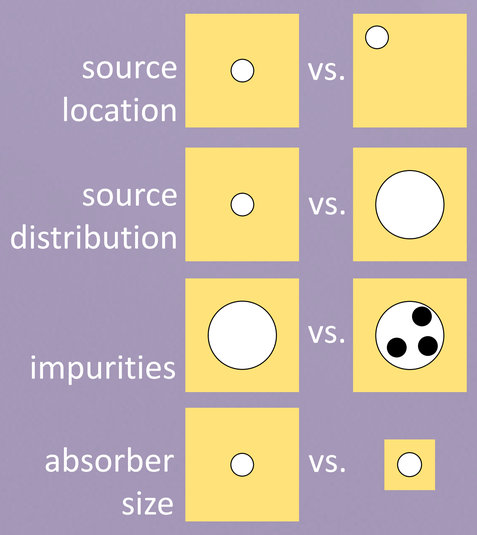
Output: Energy Histogram

Simulation Assumptions

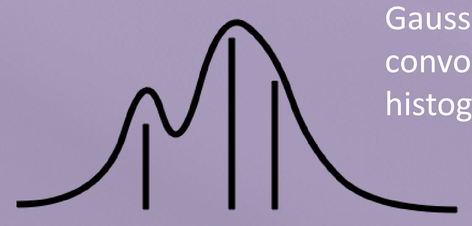
All decays measured by detector (e.g. no deadtime)

All energies measured perfectly (e.g. linear response)

Simulation Parameters

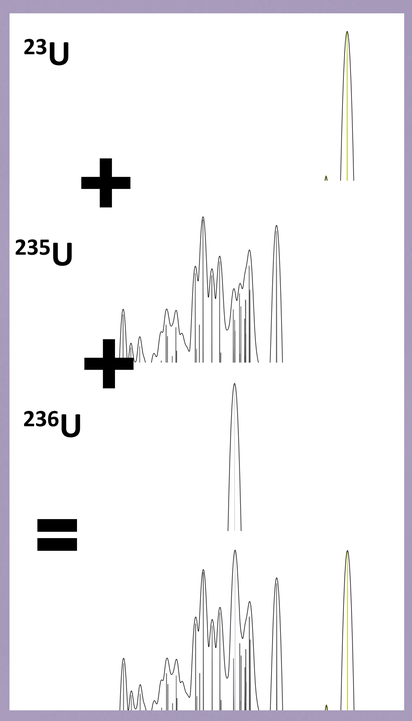


Convolving with Detector Response

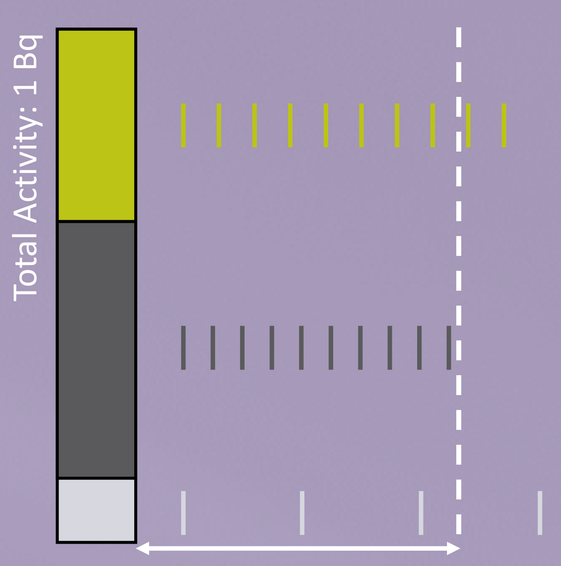


Gaussian detector response convolved with Geant4 energy histogram output

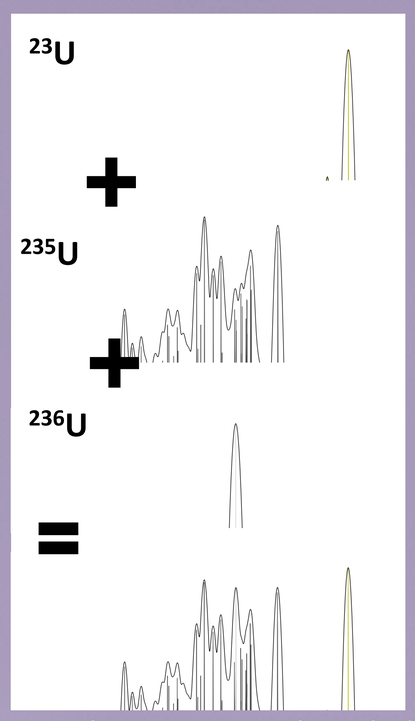
Decay Energy Spectroscopy SIMulation for Absolute Total Efficiency



Total spectrum with all simulated events

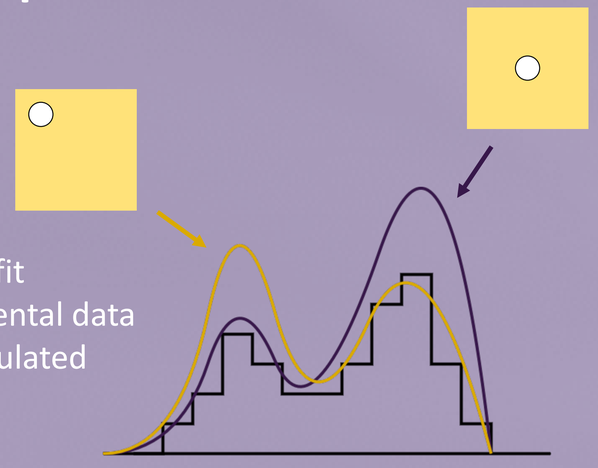


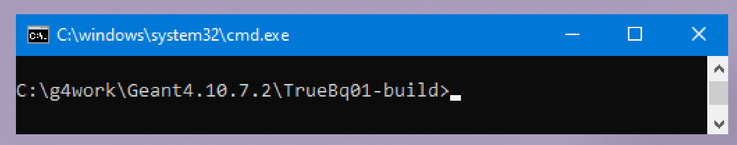
Measurement Time: determined by time it takes the highest activity isotope to reach total simulated events



Total spectrum with scaled number of simulated events

Next Steps



Linearly fit experimental data with simulated spectra

Run Geant4 directly from DESSIMATE instead of command prompt