Characterizing the Directional Dependence of Organic Scintillators from a Fission Source
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Introduction and motivation:
- Organic scintillators important for nuclear security:
  - Ability to detect, discriminate n vs. γ
  - Relatively affordable and robust
- Efforts to produce a new generation of materials with improved performance:
  - Understanding of internal processes governing light production incomplete
- Study the effect of anisotropy on light output production and pulse shape to better understand the internal processes.
- What are the methods used to characterize anisotropy from:
  - Mono-energetic neutron source
  - Fission source

Prior Method to Characterizing the Effect
- Need to know the direction and energy of the proton recoil
- For mono-energetic sources, select proton recoil events in the forward direction.
- This will make energy and direction of proton recoil s known

Dependence on particle type, pulse shape discrimination (PSD)

Dependence on interaction direction (of heavy charged particle)

Research Plan
- Take measurements along each of the known crystal axes: a, b and c
- Analyze produced distributions for presence of anisotropy
- Develop a simulation of the experiment and compare results

Research Question:
How does the anisotropy effect appear for measurements of distributed energy neutron sources, such as Watt-spectrum fission sources?
- When using a fission source, direction and energy of proton recoil are no longer known.
- The light output response from a fission source is a decaying exponential.
- The response could be viewed as a multiple mono-energetic light output responses produced by each neutron in the fission spectrum

Measurements
- Take measurements along each of the known crystal axes: a, b and c
- Analyze produced distributions for presence of anisotropy

Light Output Spectrum from CF-252
Treat Spectrum as Multi-Mono-Energetic Sources

Research Plan
- Analyze produced distributions for presence of anisotropy
- Develop a simulation of the experiment and compare results

As E of proton recoil increases, it’s scattering angle decreases