Comparison of Radiogenic Neutron Background Calculations

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Outline

- Radiogenic Neutron backgrounds
- Generating Initial Neutron Spectra
  - Cross section libraries : EMPIRE and TENDL
  - Nuclear code: SOURCES4 and TALYS
  - Comparisons of neutron spectra
- Propagation of neutrons with GEANT4
  - Comparisons of neutron induced nuclear recoils

Radiogenic Neutron backgrounds

- Add text on importance, for experiments, images of U and Th decay chains, etc for introductory material
- Importance of simulations for background predictions

Alpha-N cross sections

Cross Section comparisons

- Show comparison in agreement, and one in disagreement
- For more comparisons see http://www.physics.smu.edu/cooley/aarm/webpage.html

SOURCES4 and spectra

TALYS and spectra

Spectra Comparisons

GEANT4 neutron propagation studies

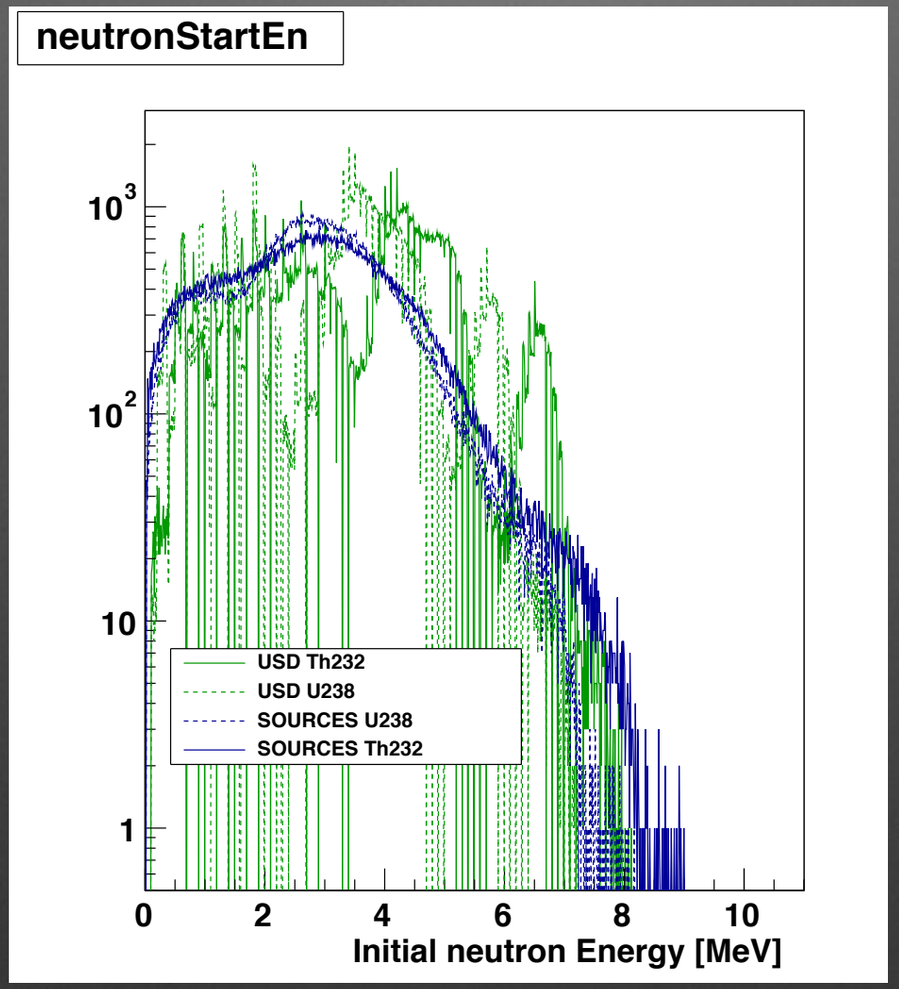
- Working with Geant4.9.5.p02, propagate alpha_n neutrons for the various U and Th spectra from SOURCES and TALYS

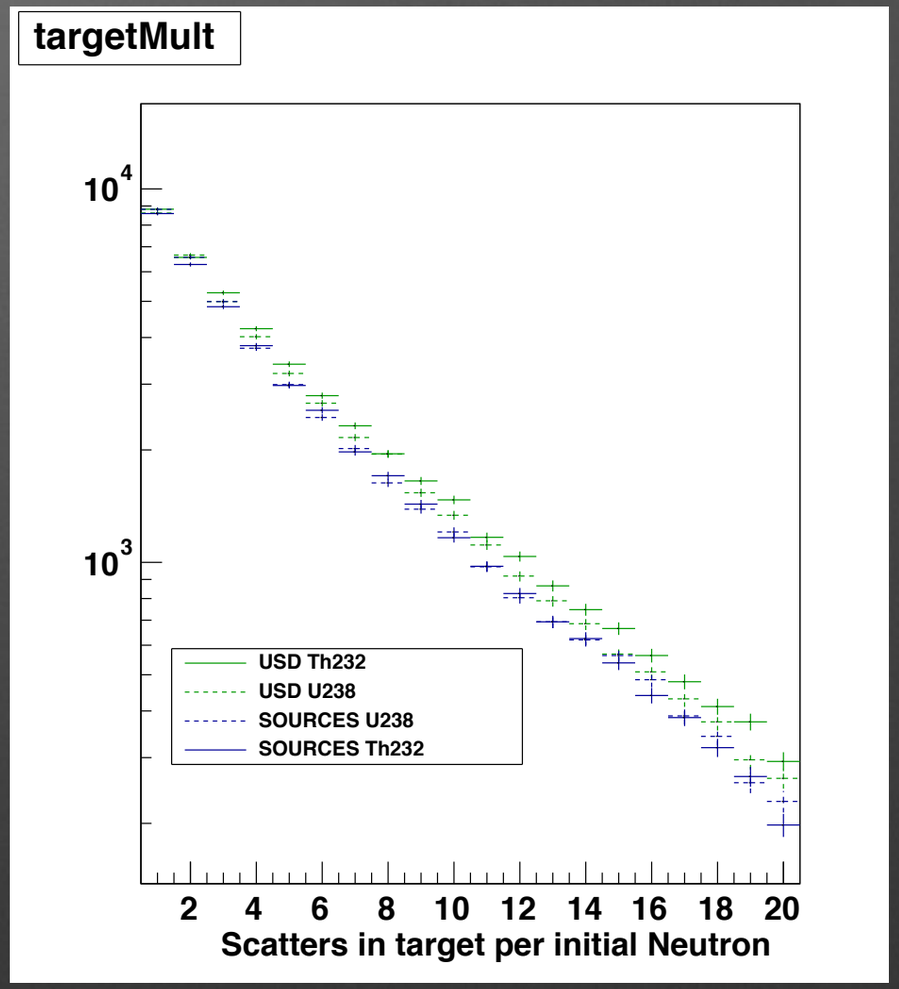
- NeutronHP handles neutrons < 20MeV with cross sections from ENDF

- Create generalized direct dark matter detectors of common materials and neutrons from highest

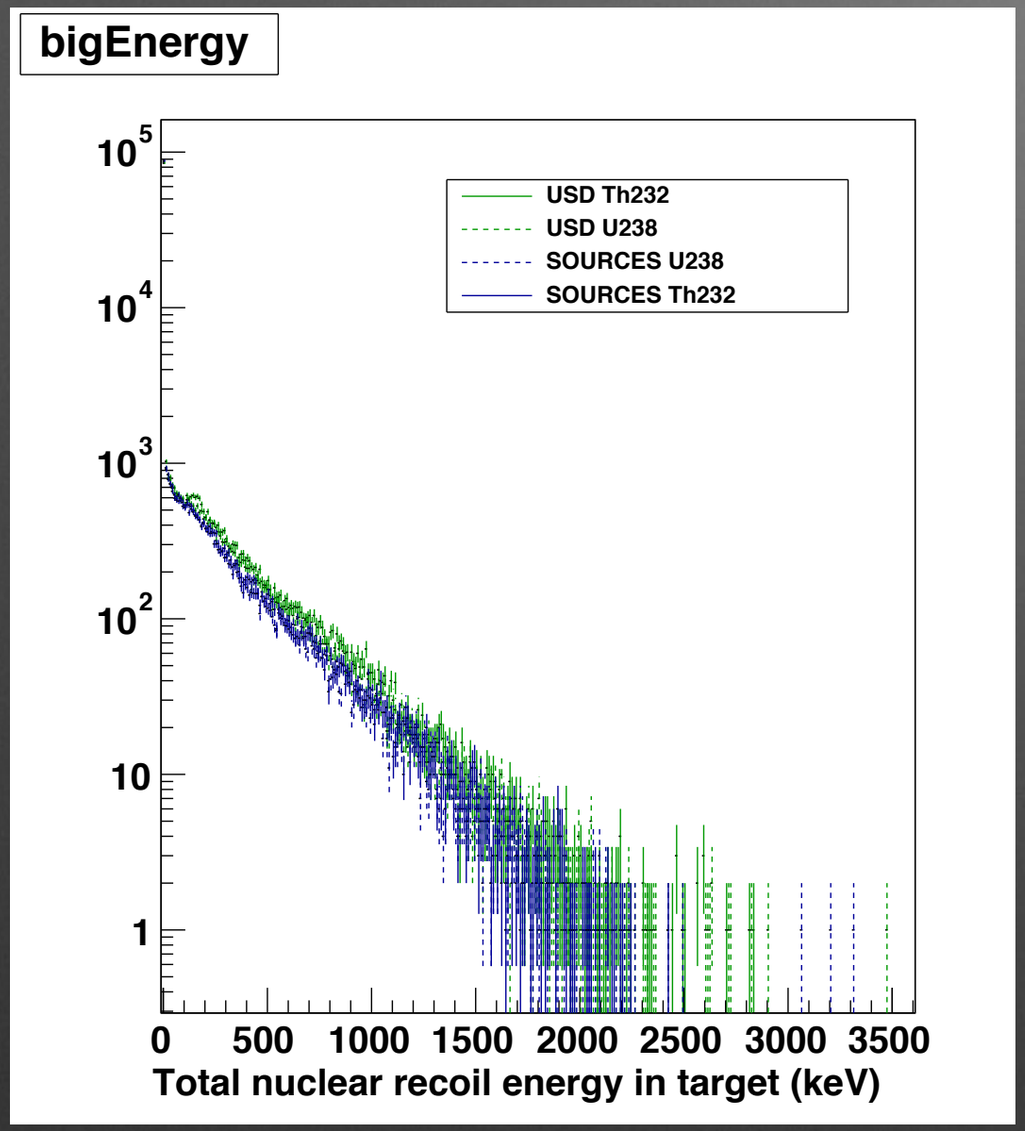
Spherical Argon detector

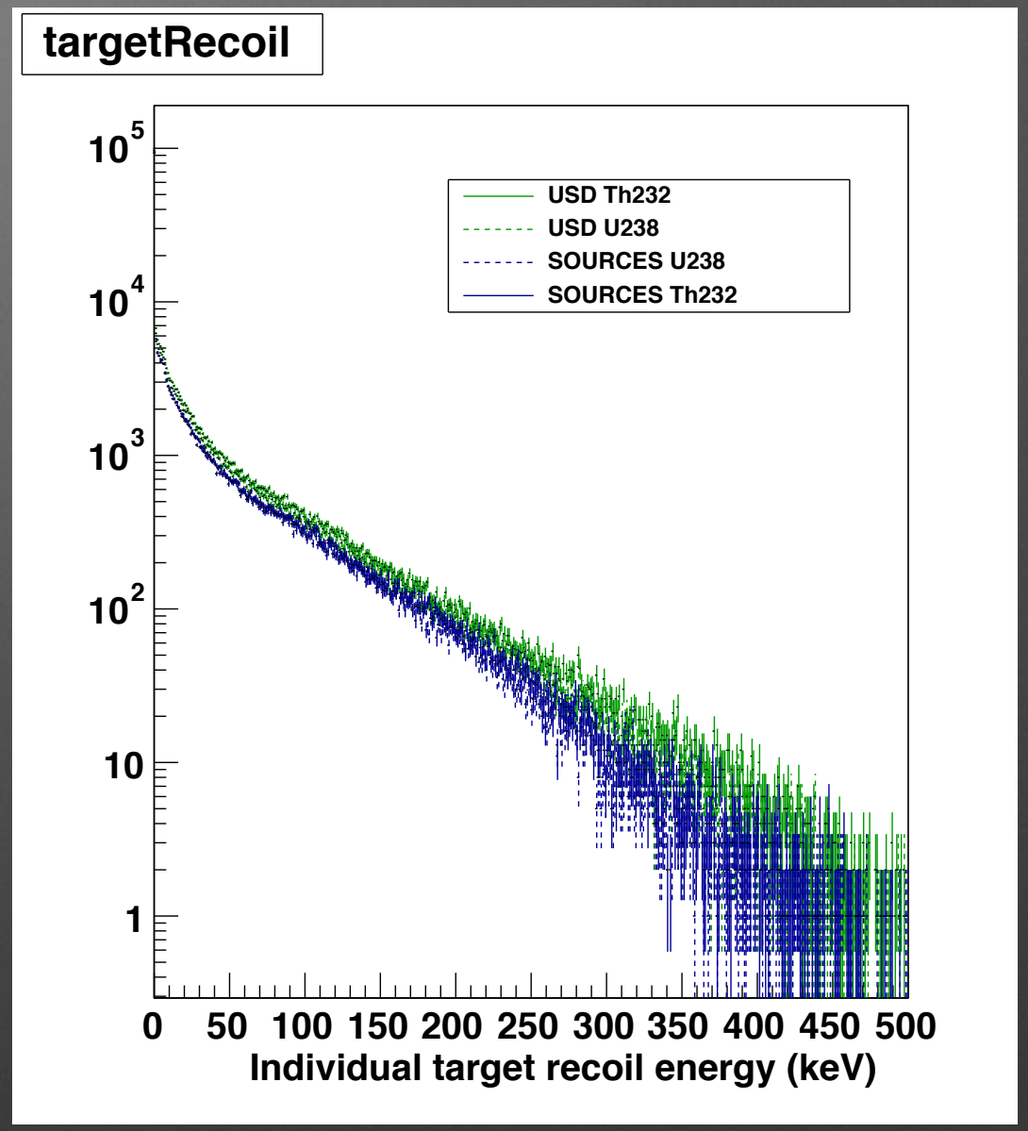
- Add diagram of geometry
- Here just looking at shape impact (same number of neutrons
- More scatters int he argon per neutron for TALYS/ USD spectrum
- No impact on penetration into center of detector





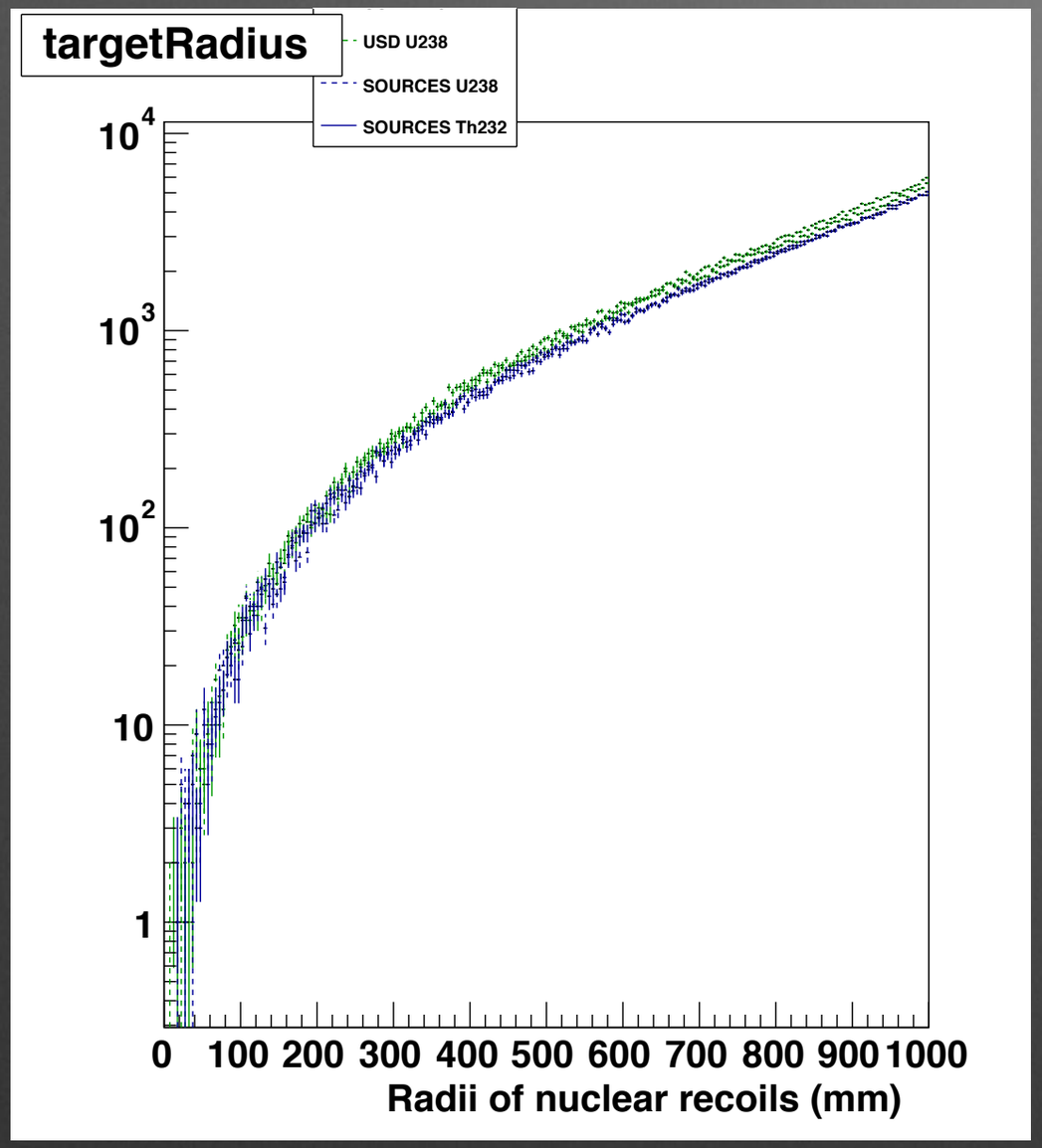
Recoils in Argon

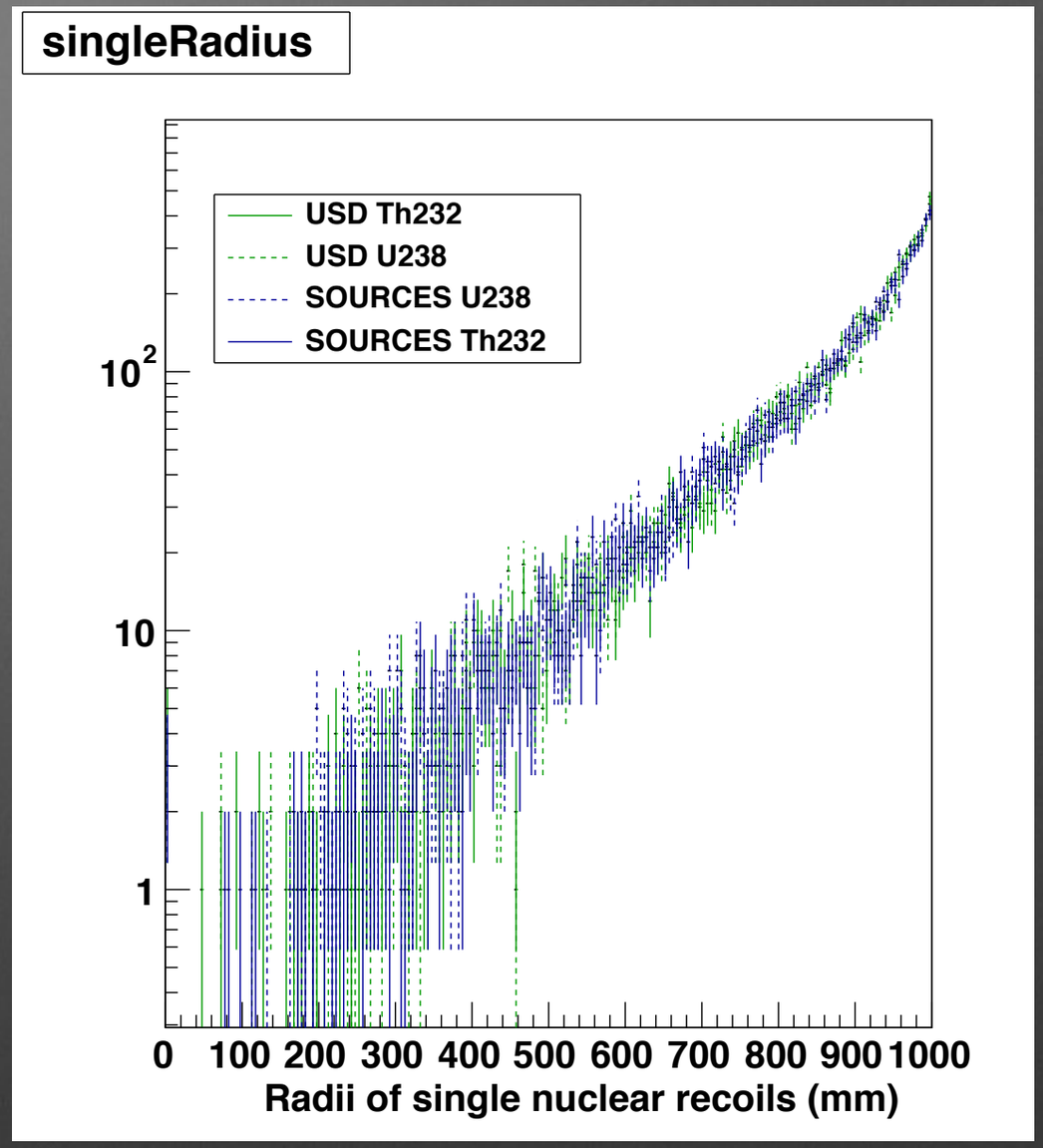




- Need to grab #s, propose just showing one of these

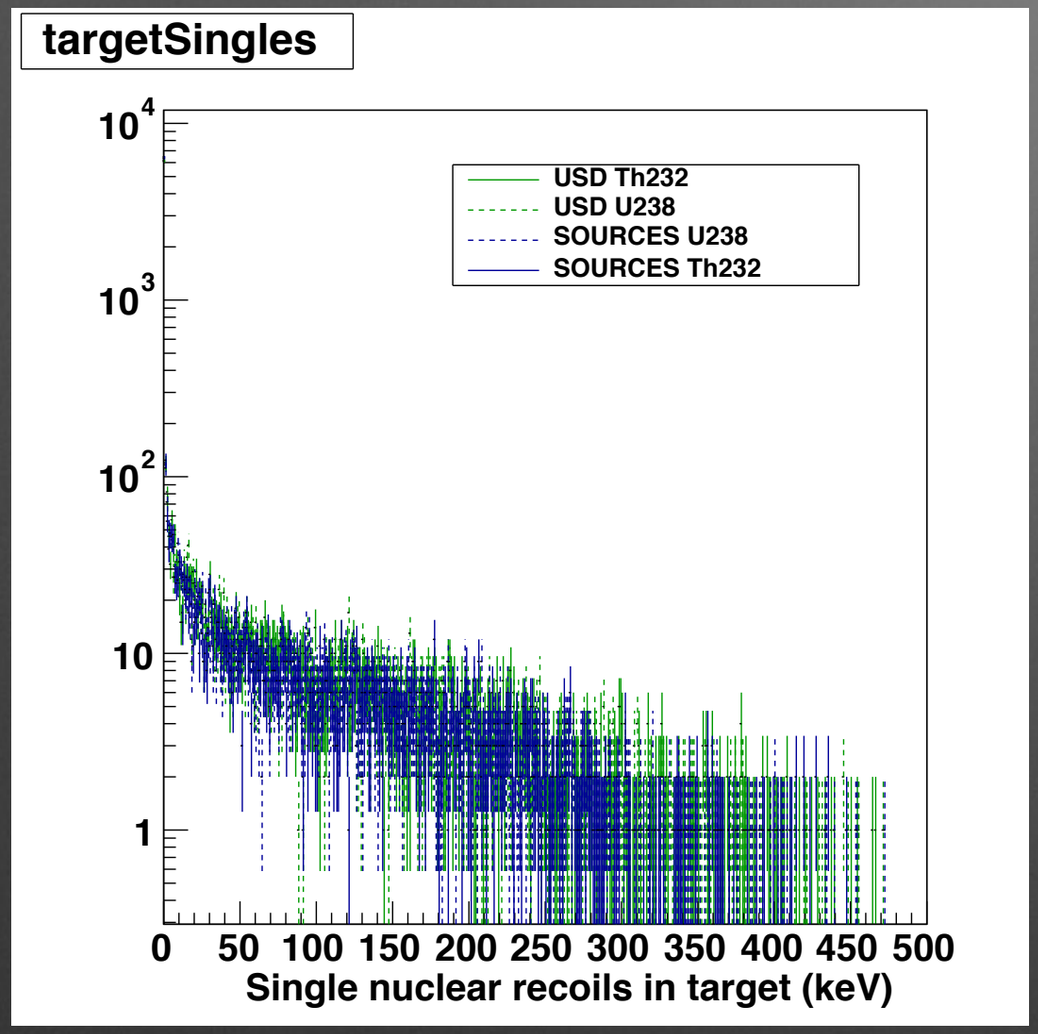
Interaction radii in Argon

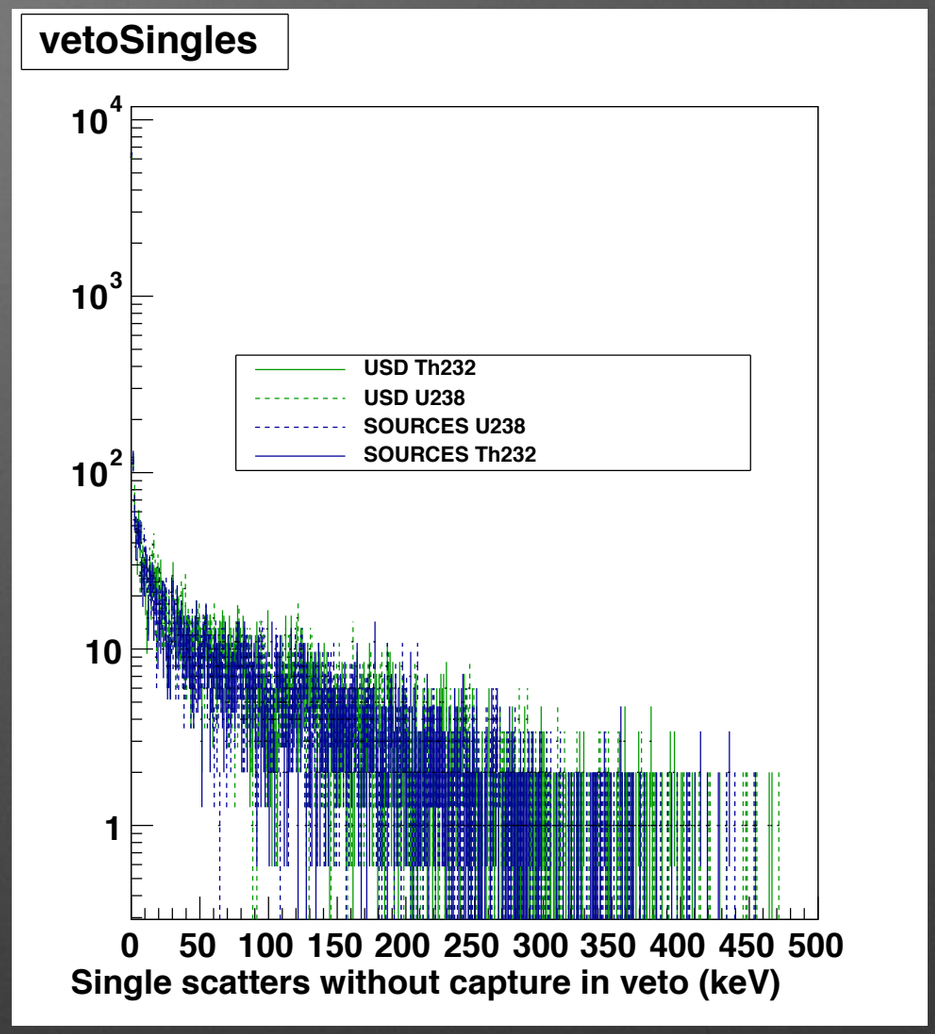




- Don’t propose showing

Argon Single Scatters

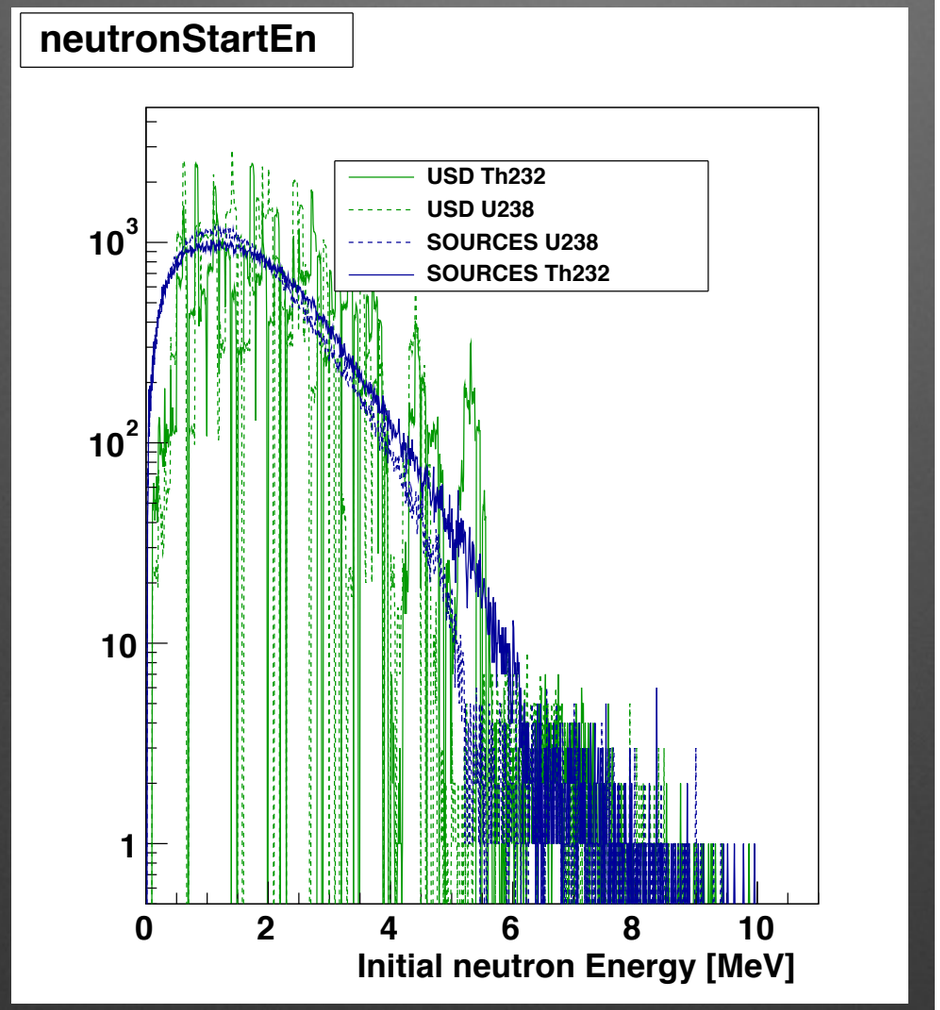


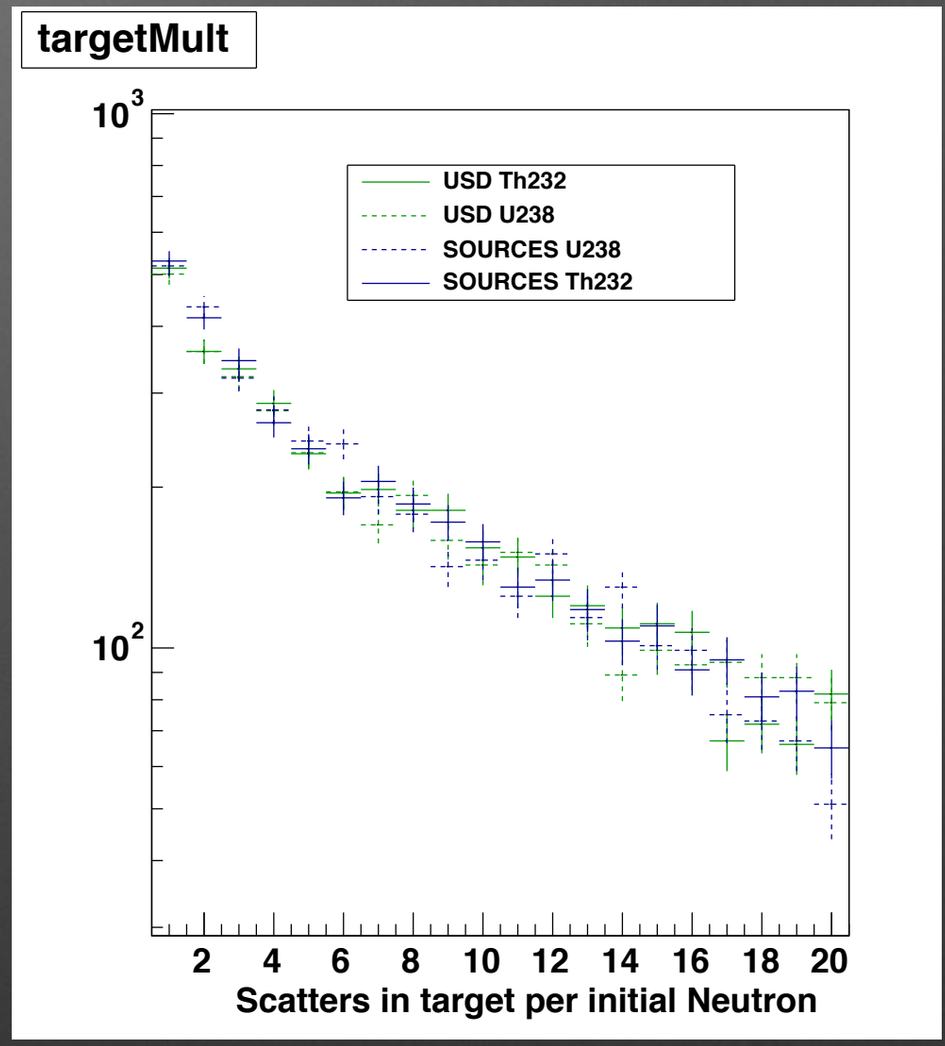


- Need to grab #s, propose just showing veto one

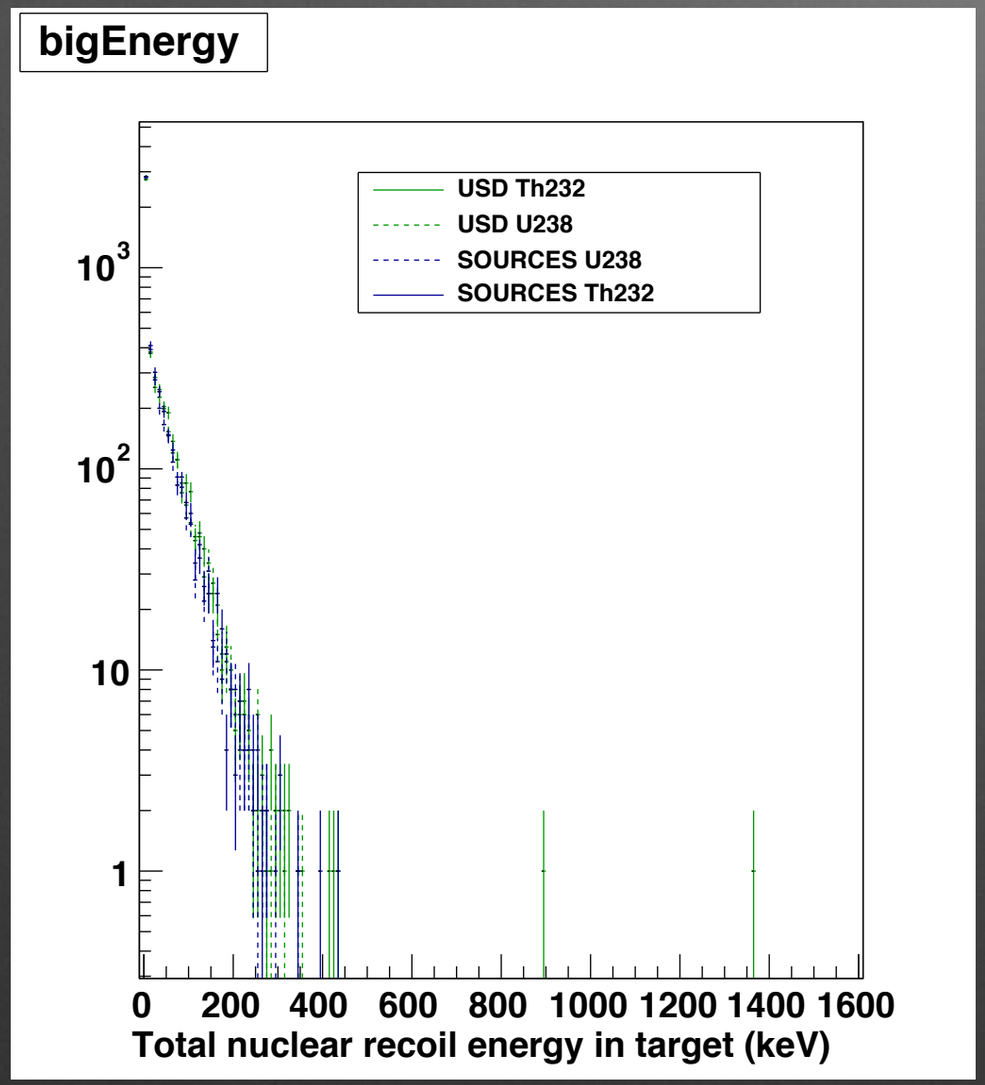
Xe detector

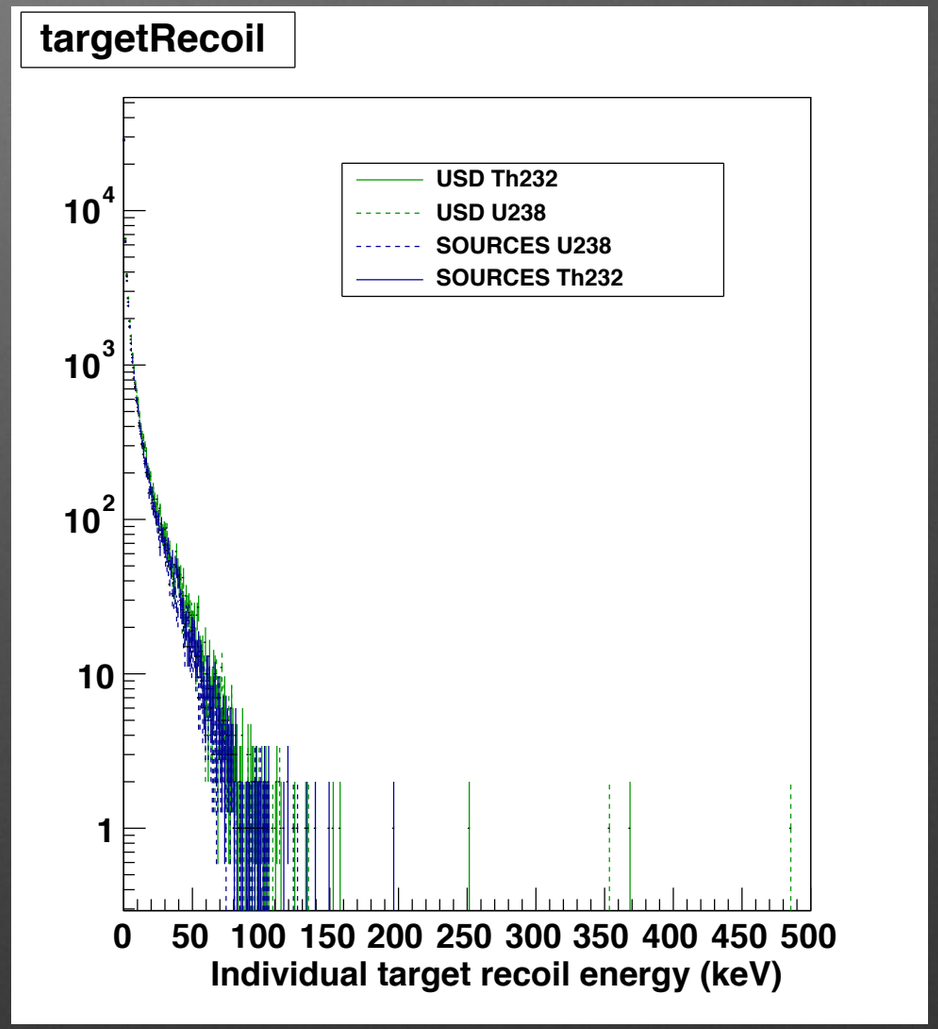
- Include diagram of geometry
- Neutrons simulated from PTFE





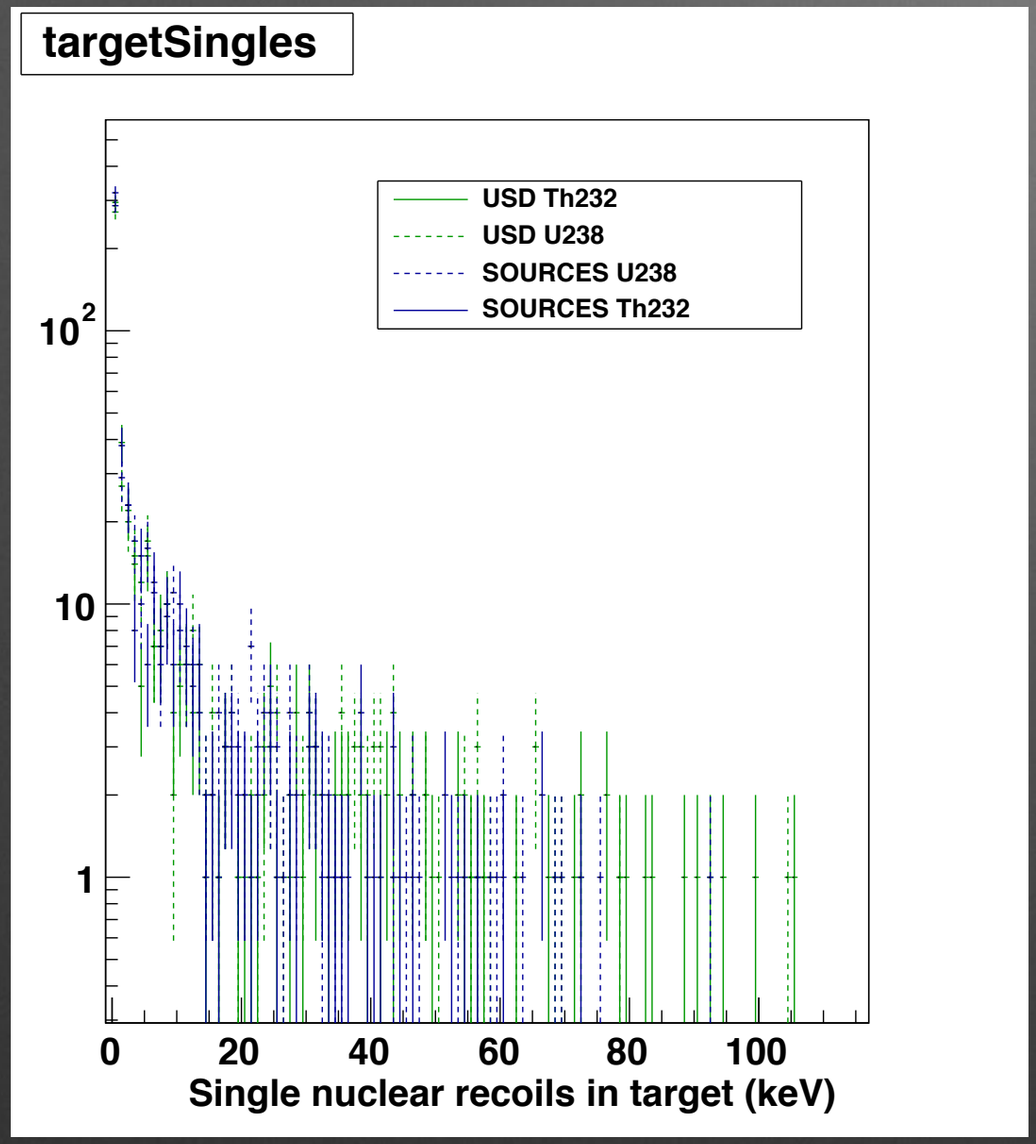
Xenon Recoils

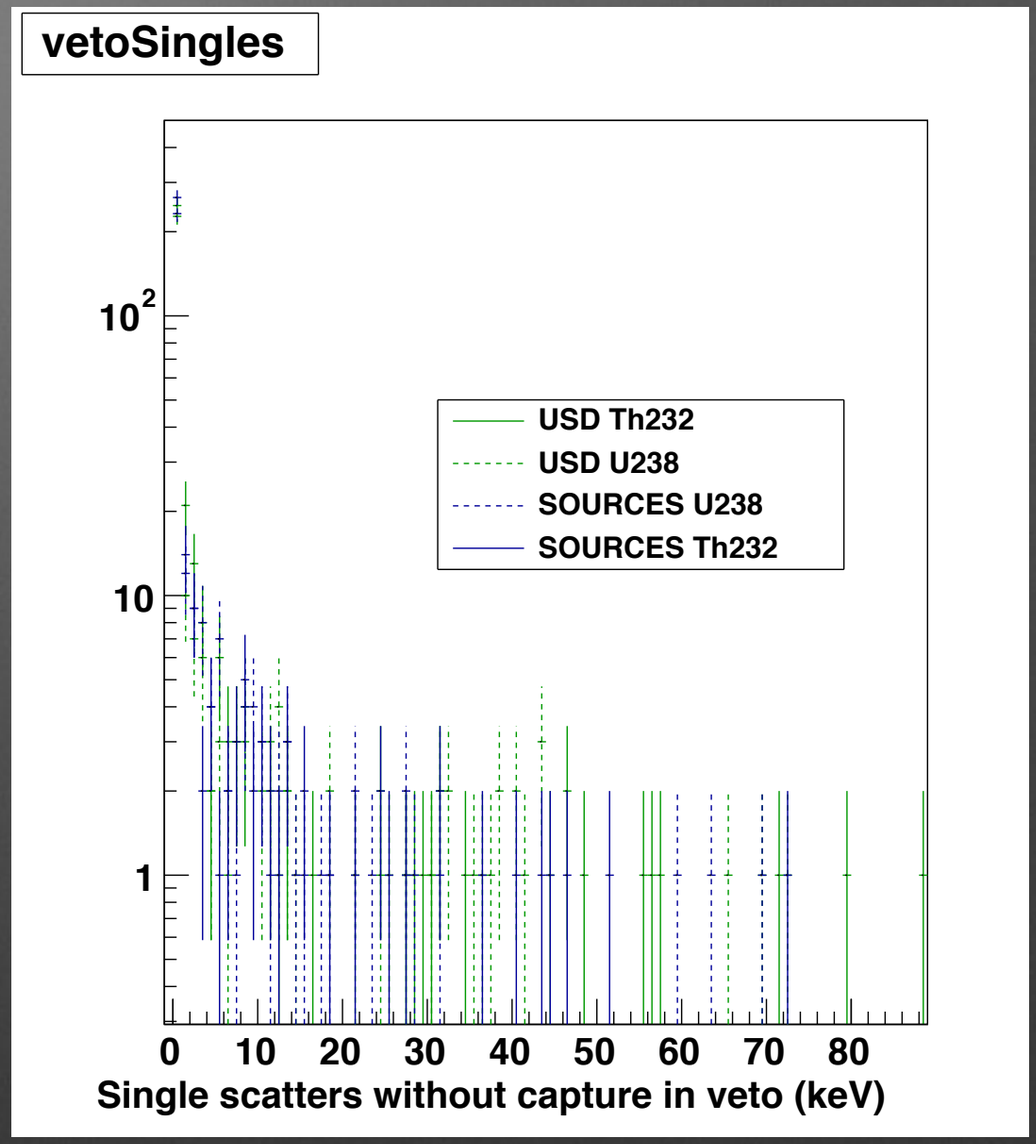




- Need to get #s, higher stats needed for this study

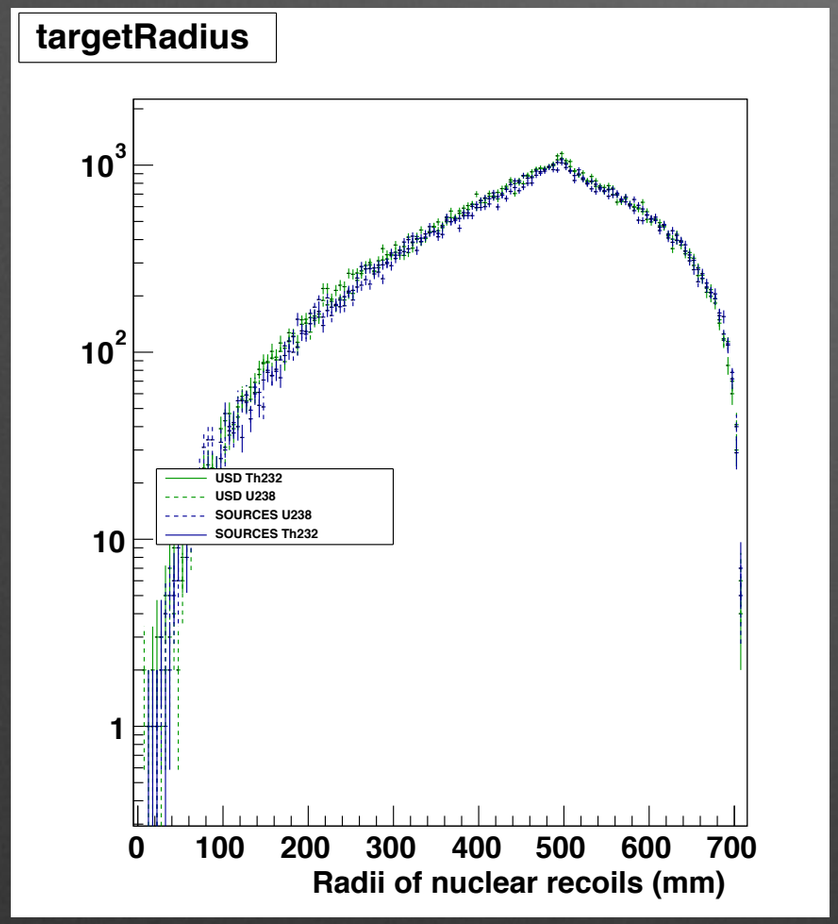
Xenon single scatters

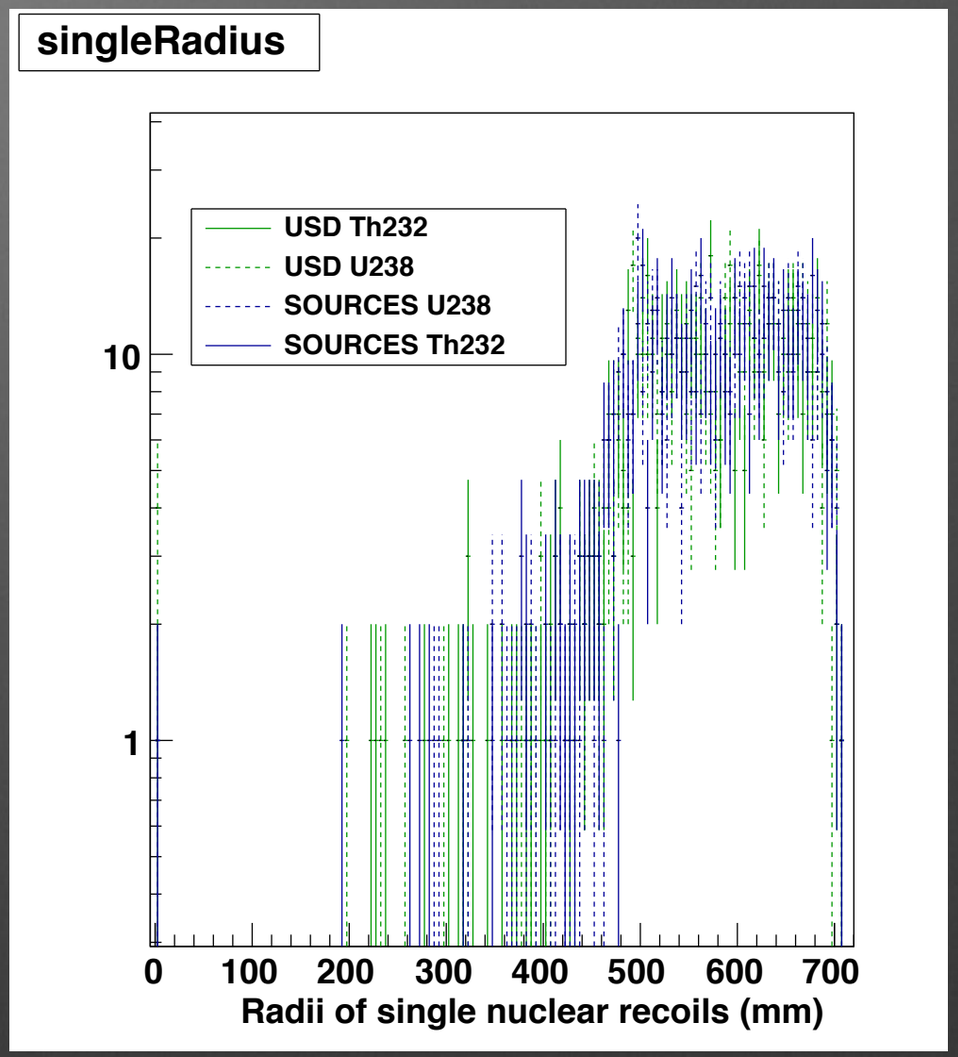




- Need numbers, difference seen, but stat limited?

Xenon radii





- Remember this was a cylindrical geometry, investigate single event at center

Kim’s to-do list

- Populate the early slides with text and plots!
- Add stats to Xenon Ti runs with USD spectra (files only had 50000 events so not plotted here)
- Get Germanium detector working with last seg faulting spectrum
- Scale plots by yield totals so not just looking at shape
  - Decide if more stats will be needed for the Xe PTFE plots
  - Get Pertinent Integrals to explain plots quantitatively
  - Prettify plots and text of explanation fo the propagation studies