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Title: 6Li-glass detector testing

Author(s): Hye Young Lee

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^{6}Li-glass detector testing

Hye Young Lee

I will present the current status of the 6Li-glass detector development done for chi-nu project. The calibration work with 252Cf source and in–beam test on 235U will be discussed for charactering the detector performance and understanding the detector efficiency.

^{6}Li-glass Detector Testing

Hye Young Lee

LANSCE-NS, Los Alamos National Laboratory

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- **Why ^{6}Li-glass scintillators for low-energy neutron measurement?**
- **Experimental Setup**
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- **Preliminary results on the in-beam ^{235}U(n,f) measurements in FY10**
  - Average neutron output spectrum
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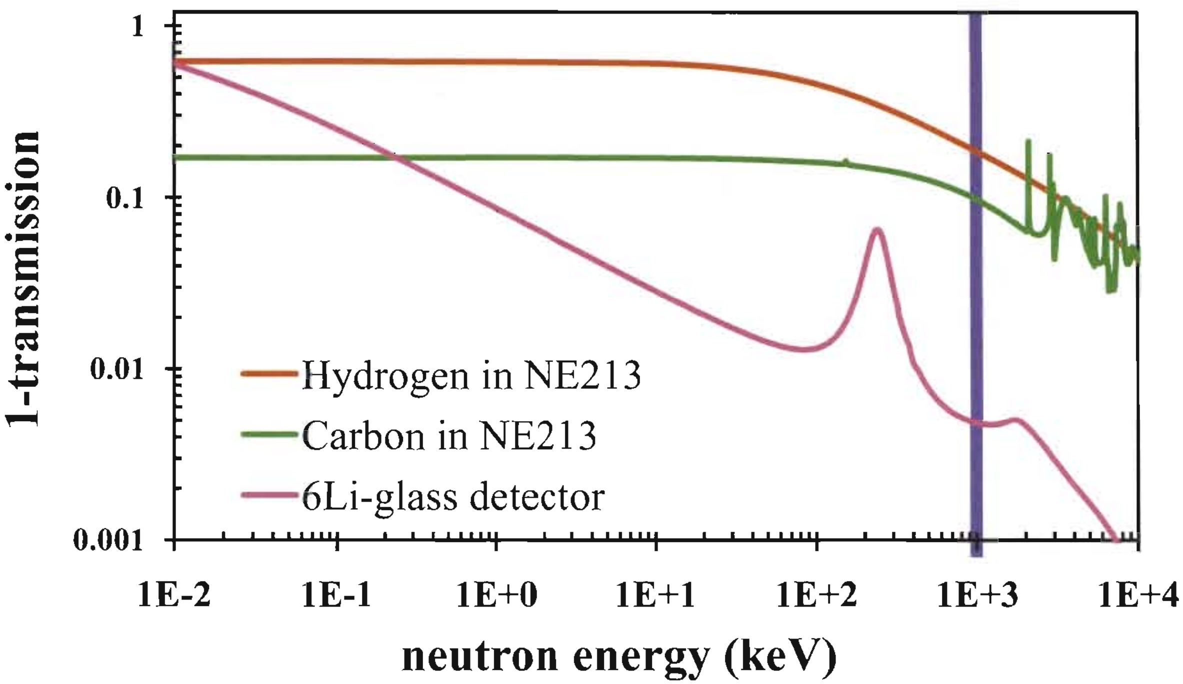
Efficiency comparison between liquid scintillators and ^{6}Li-glass detectors

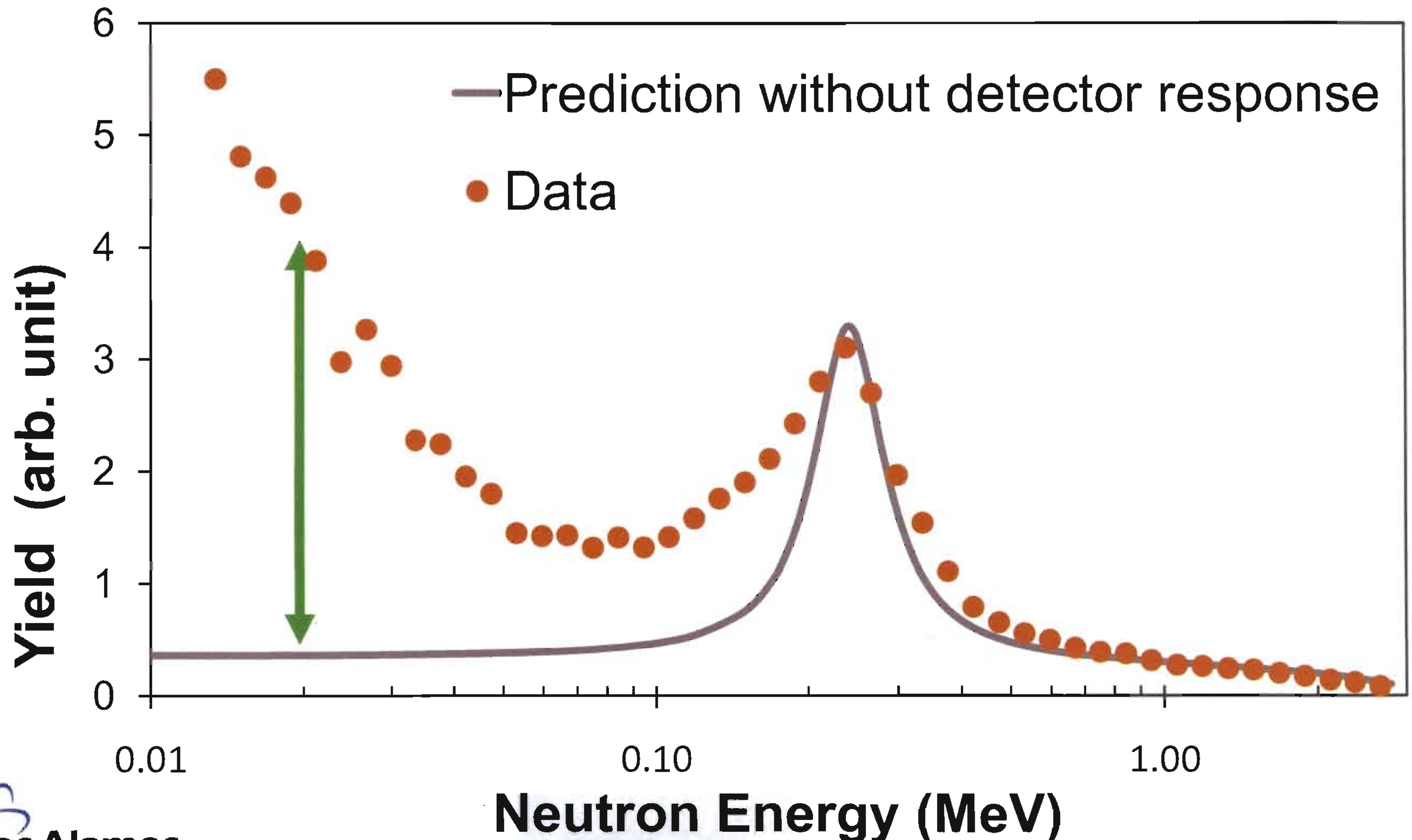


Although the efficiencies in liquid scintillators (**red** and **green** lines) are still high at En < 1 MeV (**blue** divider), it is difficult to separate neutrons from gamma rays using a pulse shape discrimination method.

The pulse height is generated from the $^{6}Li(n,\alpha)^{3}H$ reaction, where the α and triton products have a kinetic energy of about 4.8 MeV.

^{6}Li-glass detector has an usable efficiency below 1 MeV and could differentiate neutrons from most gamma rays in this region.

It is important to understand the detector response at Chi-Nu target room



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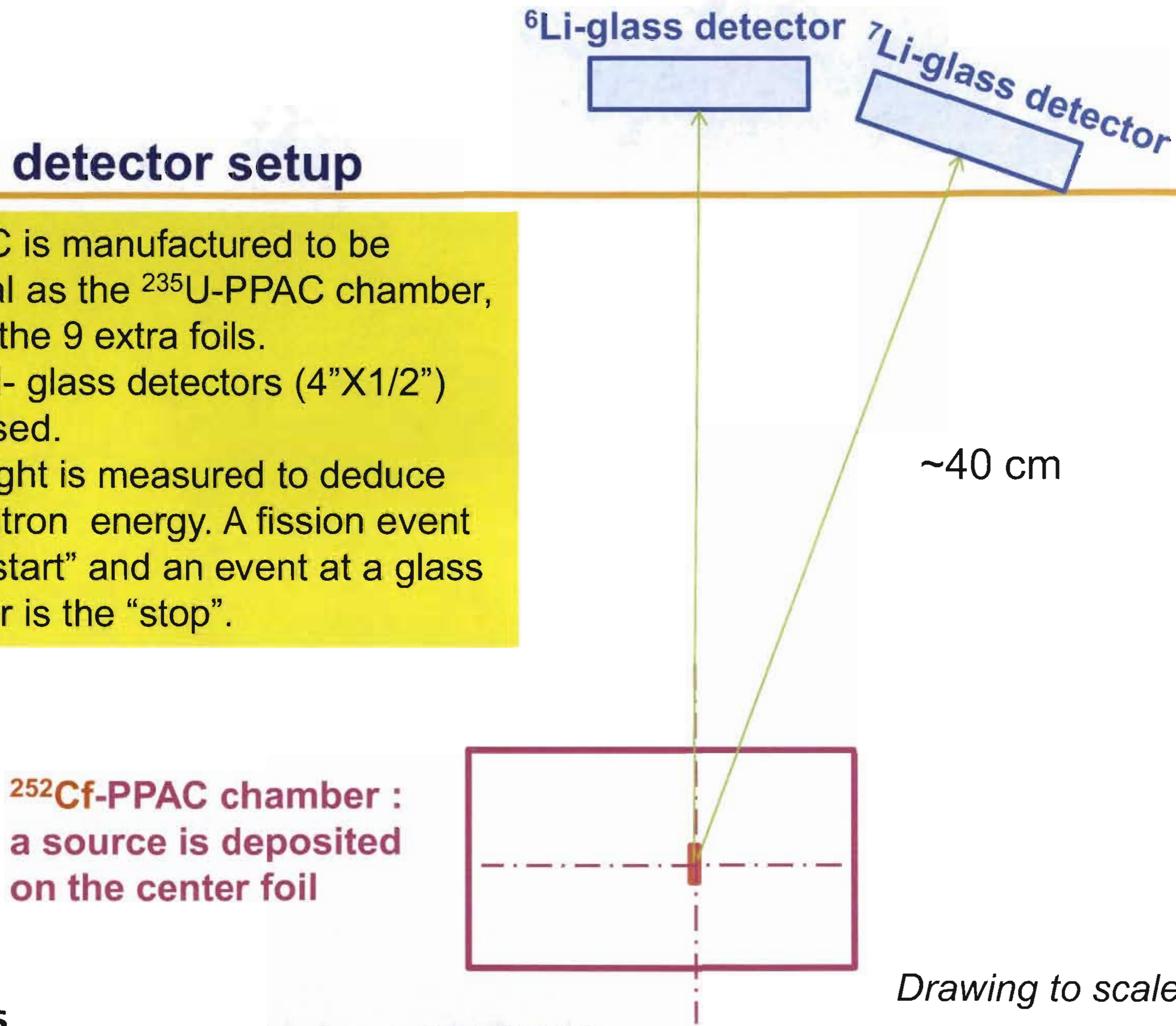
Li-glass detector setup

^{252}Cf-PPAC is manufactured to be identical as the ^{235}U-PPAC chamber, except the 9 extra foils.

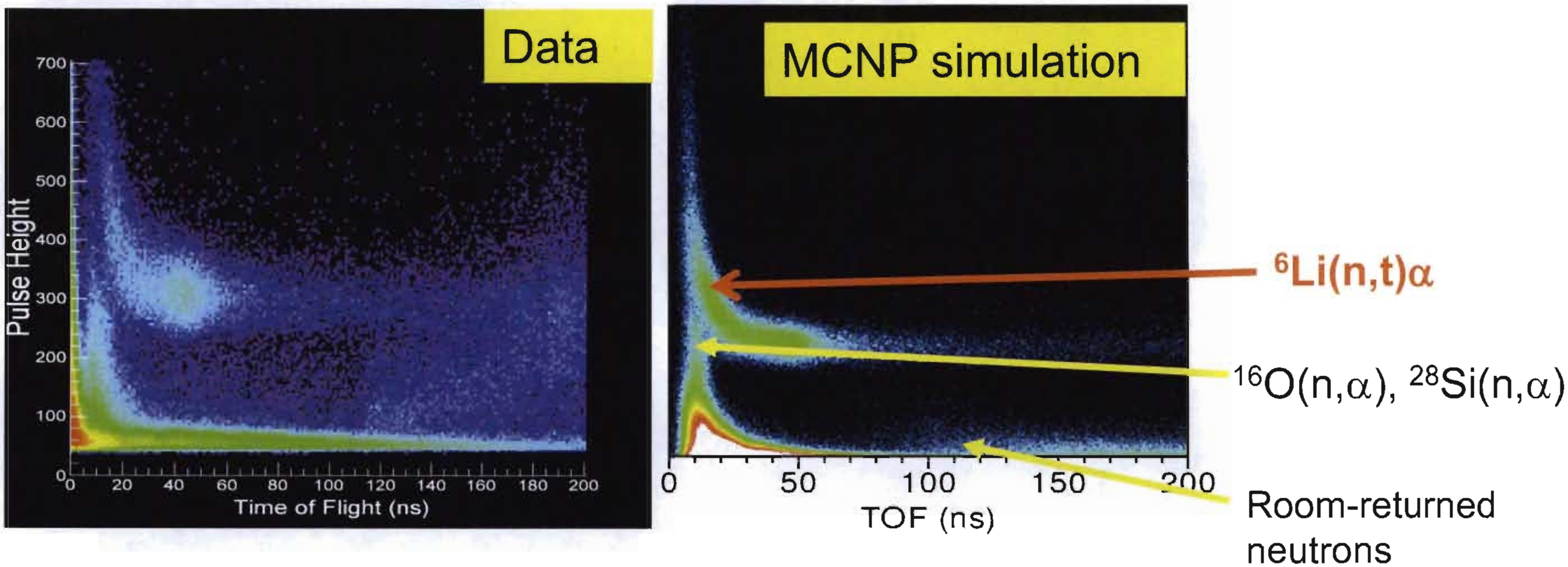
^{6}Li- and ^{7}Li- glass detectors (4"X1/2") were used.

Time of Flight is measured to deduce the neutron energy. A fission event is the "start" and an event at a glass detector is the "stop".



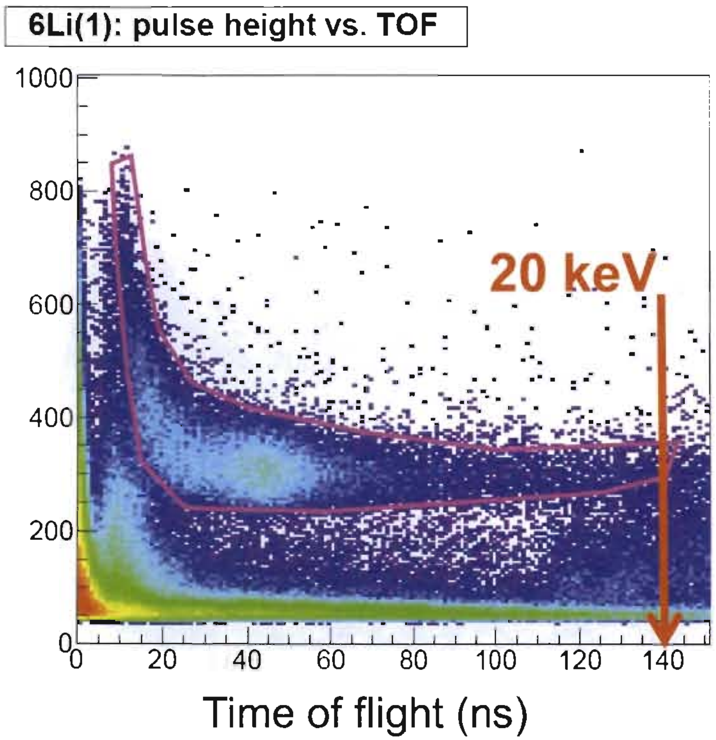
Drawing to scale

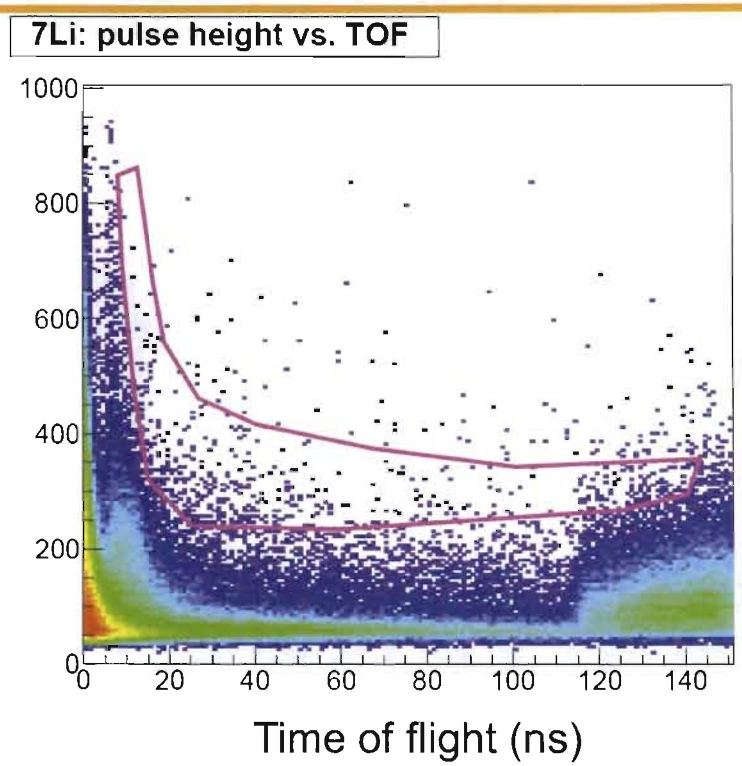
Pulse height vs. Time of Flight in ns



1. Background reactions on glass materials are included.
2. Gamma rays from inelastic scattering on potentially O, Si, Al, Mg, and Li are not included in simulation.

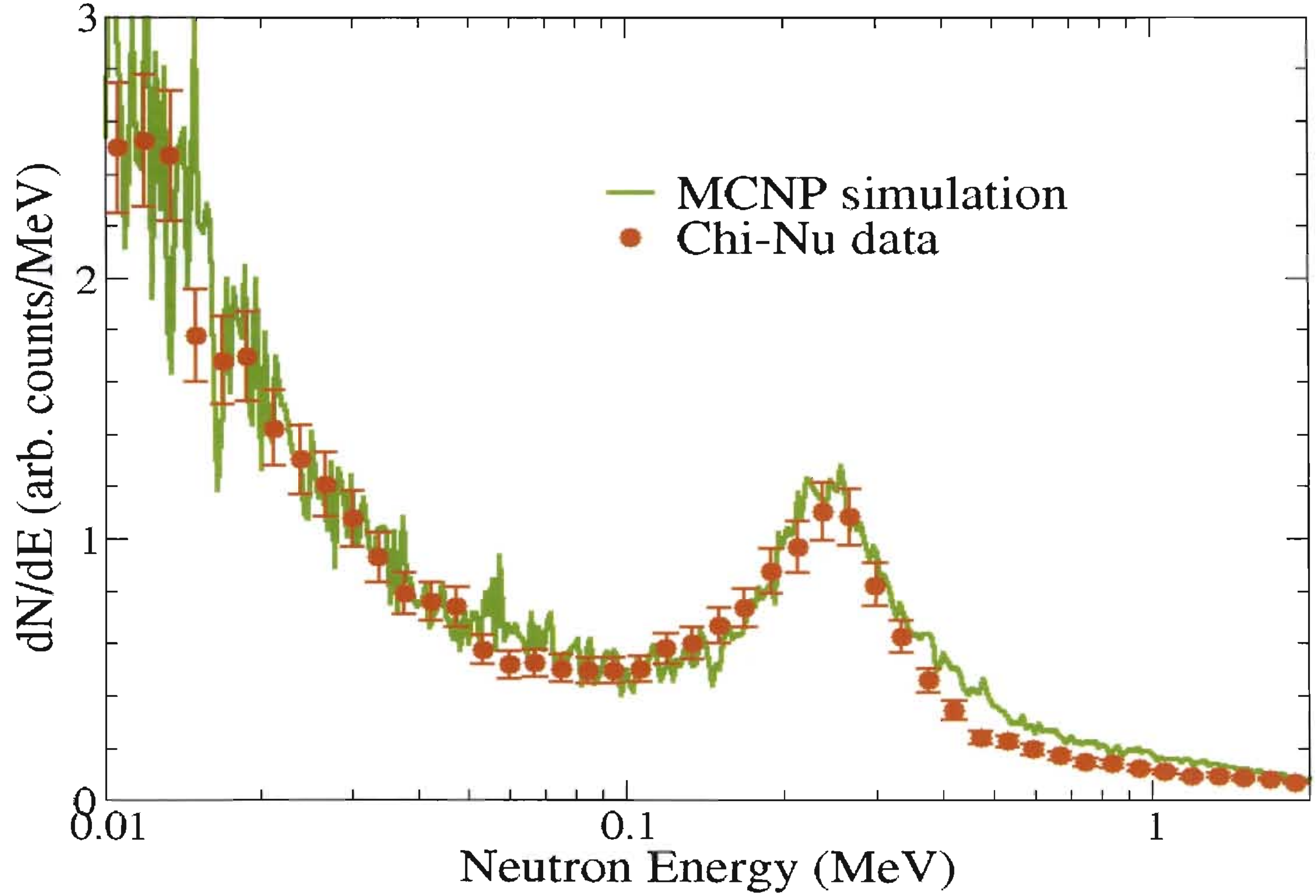
Comparison of ^{6}Li-glass and ^{7}Li-glass detectors



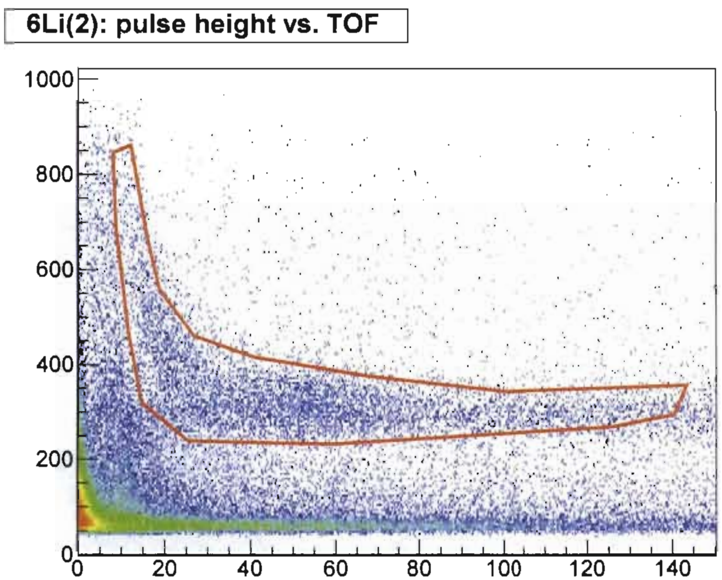


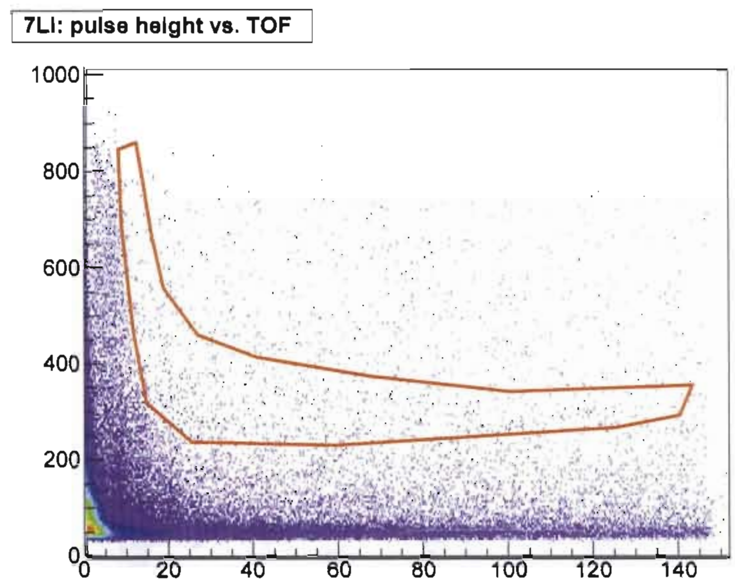
Software cut in pulse height vs. TOF is used to identify low energy neutrons.

MCNP calculation compared to data for ^{252}Cf source



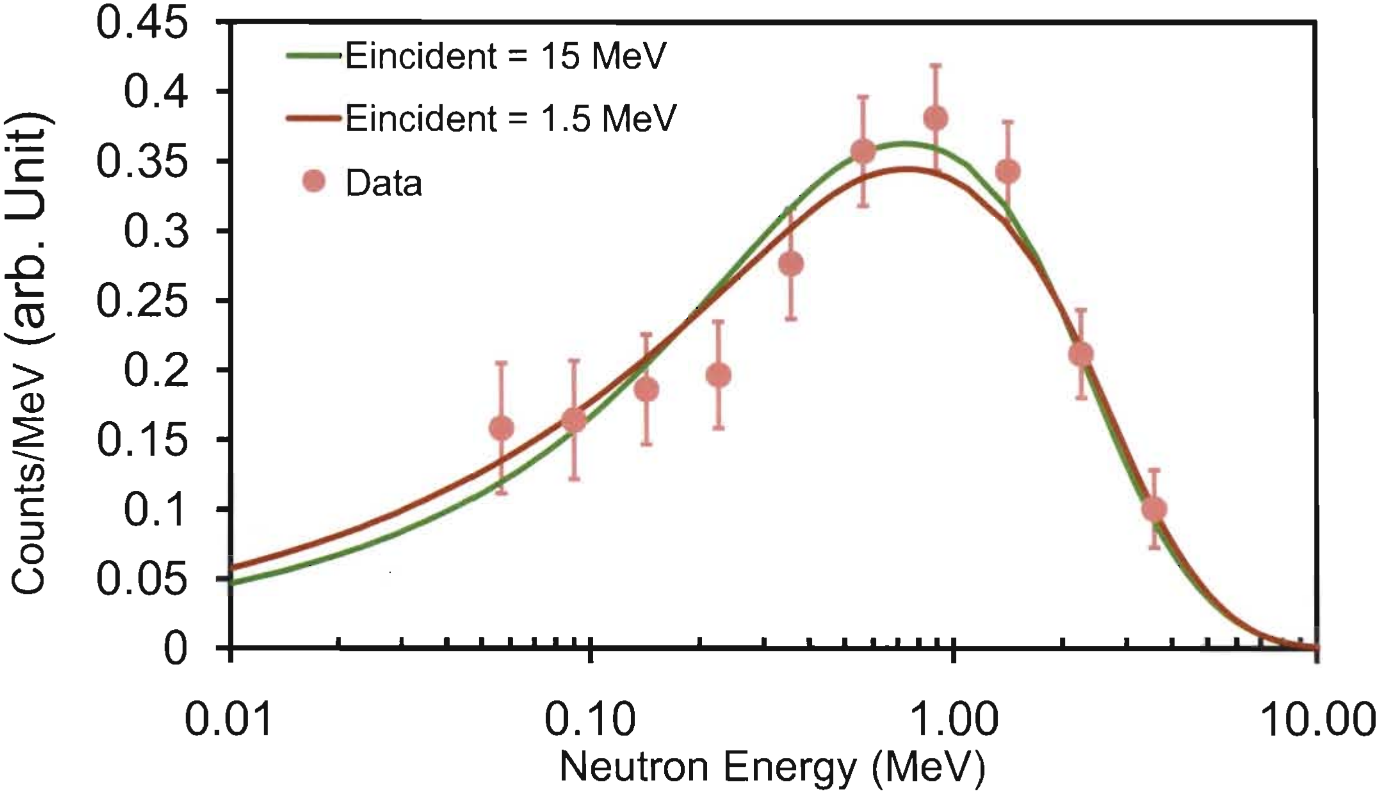
$^{235}U(n,f)$ data taken with ^{6}Li and ^{7}Li glasses





- The software gate obtained from the calibration with a ^{252}Cf source was used to extract the yield.
- The yield of ^{6}Li-glass detector was subtracted by the yield of ^{7}Li-glass detector for the background correction.

Preliminary Neutron output distributions compared with the LA model (Madland and Nix, 1982)



Data are taken for all incident energies, due to a limited statistics.

Summary and Outlook

1. Detector response of ^{6}Li-glass detector with a ^{252}Cf source is well studied using MCNP calculations

2. Expand to have 10 ^{6}Li-glass detectors for improved statistics, and develop digital signal processing of waveform analysis for potentially better selection of low energy neutrons from background gammas.

3. Plan to measure several actinide targets using the PPAC and the “chi-nu” neutron detector array to improve nuclear data with consistently reduced uncertainty.