

New T-16 Actinide (U,Pu,Am,Np isotope) Cross
Section Library: ENDF6++

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Collaborators

T16: Hale, Kawano, MacFarlane, Madland, Moller, Page
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LANSCCE-3

C-INC

T-6

X-2, X-4, X-5

D-5

Summary of New T-16 Actinide (U,Pu,Am,Np isotope) Cross Section Library: ENDF6++

$^{232,233,234,235,236,237,238,239,240,241}\text{U}$, ^{239}Pu , and ^{237}Np , $^{241,243}\text{Am}$

NW: Important for yield, performance, & inventories

Result of a major multi-year effort, involving:

- T-16 Nuclear reaction theory, modeling & evaluation
- Experimental data from LANSCE, ORELA, ...
- Integral data testing from TA-18 critical assemblies
- Testing & feedback from X-2, X-3, X-4, X-5, C
- X-5 libraries for ASC and legacy codes created, NDI

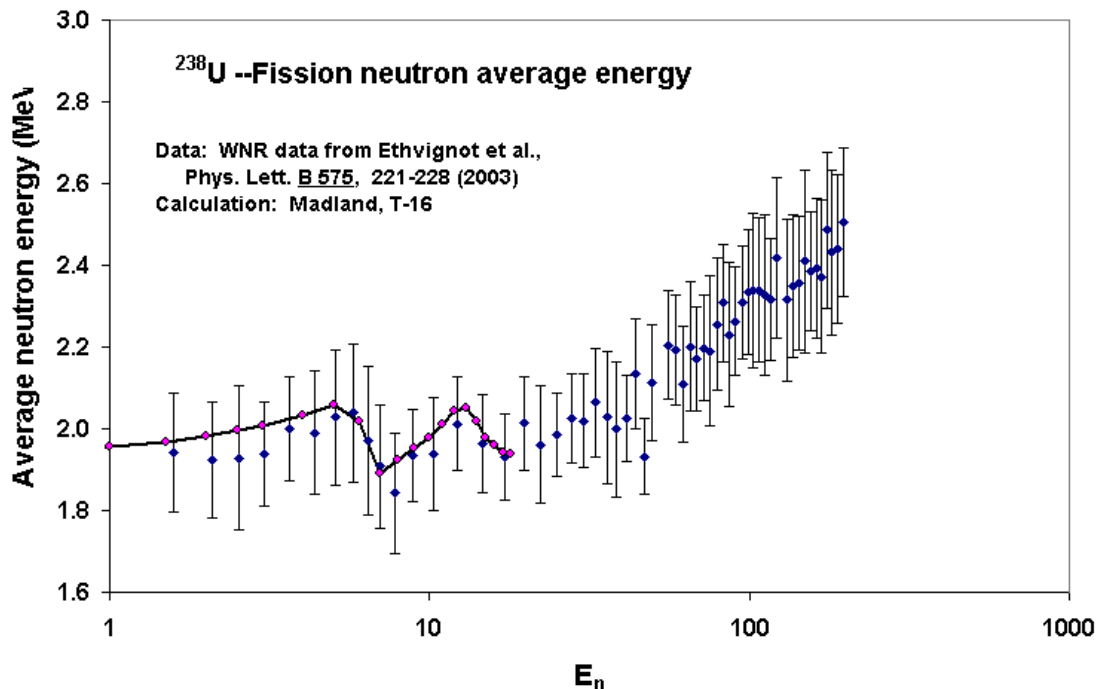
Nuclear modeling & evaluation methods

- **GNASH calculations: (n,f) (n,xn), (n, γ)** [Young, Chadwick, Talou]
 - Hauser-Feshbach, multi-chance fission, preequilibrium theory
 - Fission barriers from experiment where available, and from theory (Moller) and systematics in other cases
 - Elastic & inelastic scattering from ECIS optical model calcs.

Unstable uraniums, where data is sparse, were modeled using an U isotopic chain analysis, to take advantage of systematic trends (also used fission probability data from direct reactions)

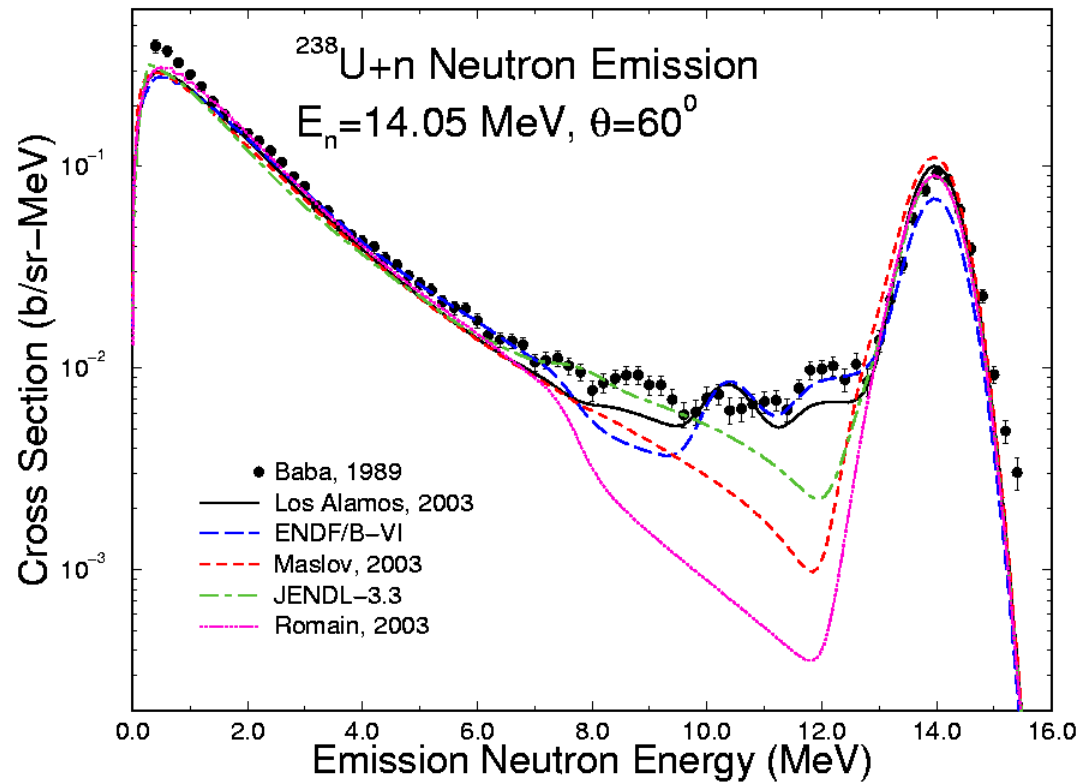
- **Prompt ν -bar spectra from Los Alamos model** [Madland]
 - Provides an E_{inc} – dependent fiss neutron spectrum (matrix)
- **Delayed ν -bar** from summation calculations & expt [Wilson & Moller]
 - Enhanced performance in temporal d.n. production analyses
- **Critical assembly data testing provides crucial feed**

Prompt fission neutron spectrum matrix: Madland calc. & evaluation, & New LANSCE/FIGARO data



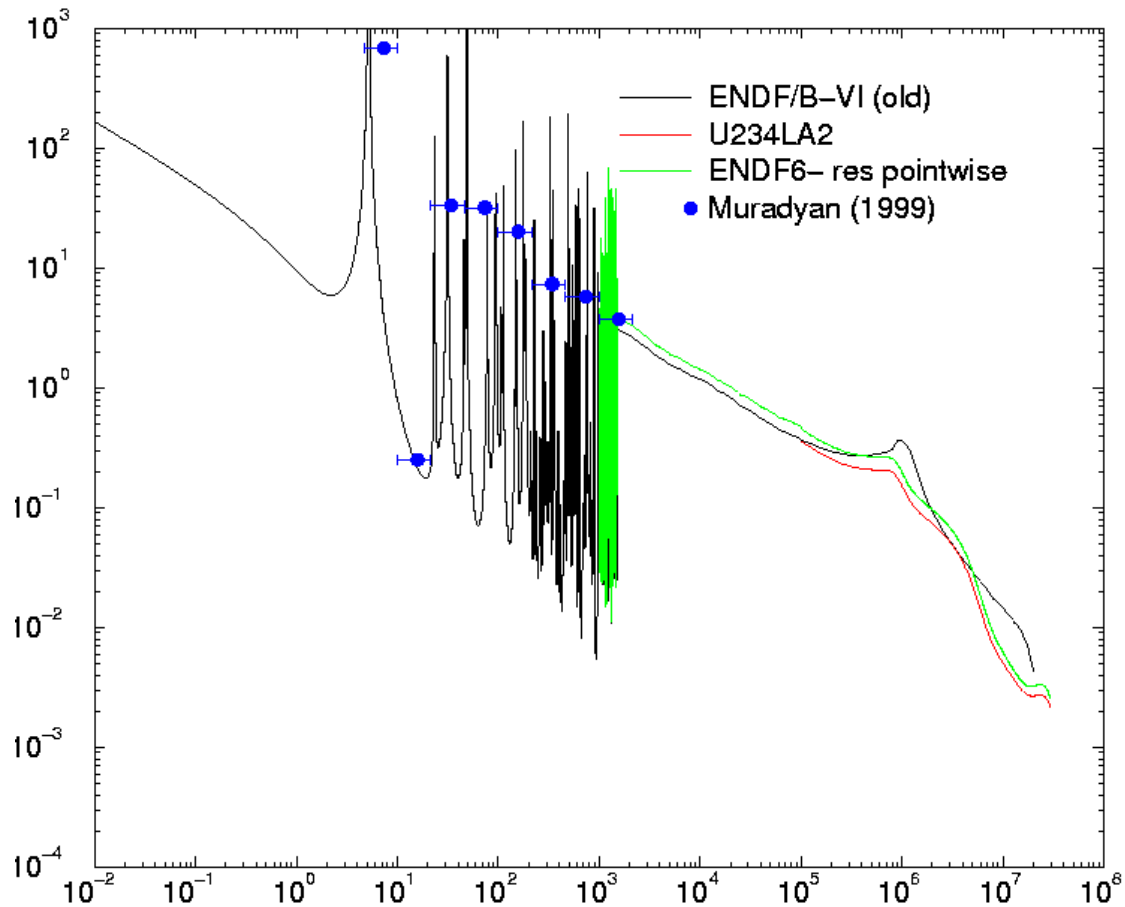
Similar measurements for ^{239}Pu and other actinides are urgently needed

238U high-energy neutron scattering & LLNL pulsed-sphere MCNP simulations



236U neutron capture

DANCE detector will be important (LANSCE/C)



ENDF nuclear cross section databases

Complete representations of all important cross sections, emission energies, angular distributions, ejectile-types

Cross sections

elastic, nonelastic, total
inelastic n, n' to levels
inelastic n, n' to continuum
multiplication $n, 2n, n, 3n$
 n, γ capture
 $n, fission$

Spectra & Angular distributions

for scattering
for n, xn
for fission neutrons

Photon production

Fission nuubar (prompt & delayed)

Energy released in fission

Resonance parameters

