

## Energy-Dependent Fission Product Yields

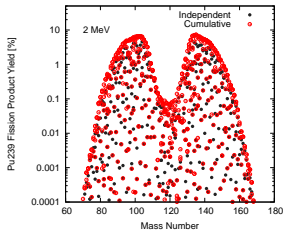
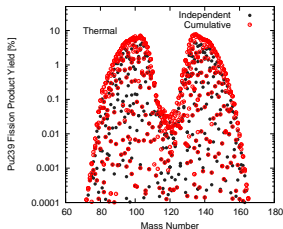
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WANDA: Workshop for Applied Nuclear Data Activities  
George Washington University, Washington DC, Feb. 22 – 24, 2019

# Evaluated FPY Data in Basic and Applied Science

FPY: Fraction of Produced Nuclei per Fission



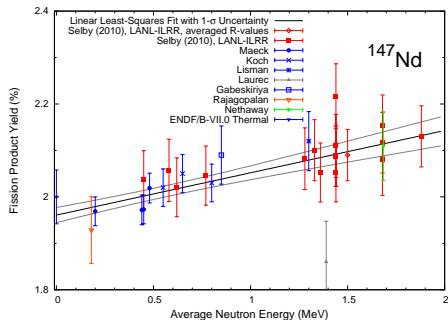
## Basic Research

- Reactor anti-neutrino and decay heat
- Fission study
  - prompt fission observables; TKE,  $\bar{\nu}$ ,  $\chi$ , etc.

## Applied Science

- Advanced Simulation and Computing Program
  - provide data to Stockpile Stewardship
- Severe nuclear power plant accident
- Nuclear waste management, LLFP

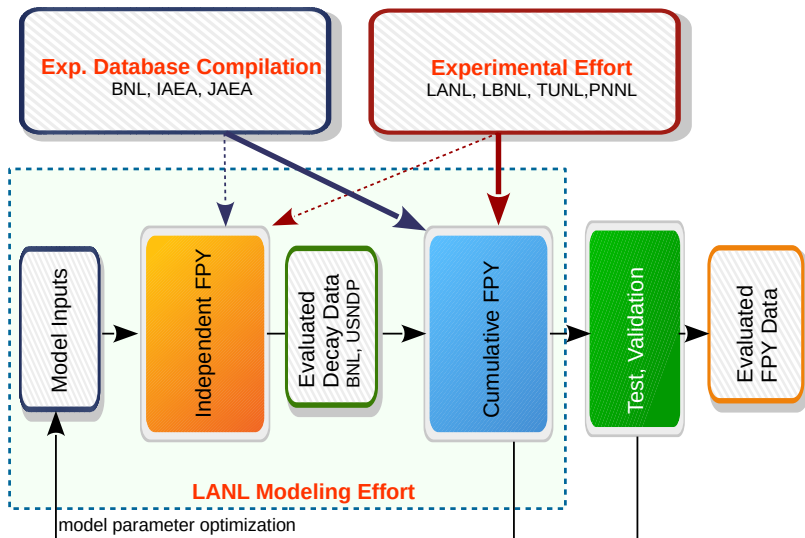
# Significant Deficiency in the Current FPY Library



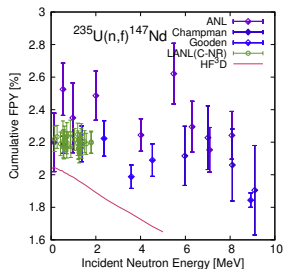
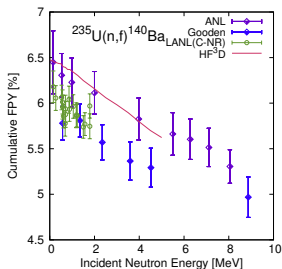
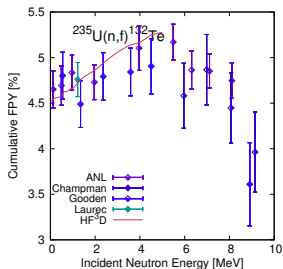
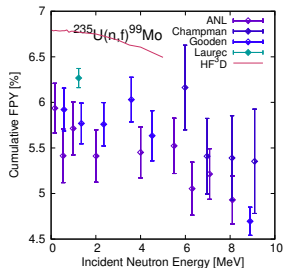
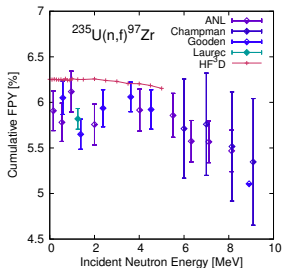
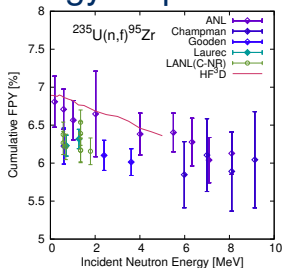
- Evaluation by England & Reider in 1989
  - combined a simple model and experimental data
  - energy limited at thermal, fast, and 14 MeV
- Chadwick identified energy dependency of FPY
  - energies causing fission carefully determined by MCNP simulation
- LANL upgraded FPY but  $^{239}\text{Pu}$  only

Evaluation of FPY at more dense energy grid requires a more predictive model as well as high quality experimental data at different energies.

# Multi-Laboratory Effort Toward New FPY Library



# Energy-Dependent Cumulative FPYs



# New FPY Measurement Effort

- cumulative FPY measurement at C-NR, Bredeweg and Gooden
  - activation measurement in critical assemblies
  - integral data over the fast neutron fission spectrum
- cumulative FPY measurement at PNNL, B. Pierson
  - fission spectrum and mono-energy at 14 MeV
- cumulative FPY measurement at TUNL, Gooden and Tonchev (LLNL)
  - mono-energetic neutron source at several points below 14 MeV
- prompt  $\gamma$ -ray measurement at LBNL, Bernstein (LBNL)
  - semi-integral measurement by MeV-neutron irradiation
- SPIDER measurement at LANSCE, Mosby et al.
  - independent FPY measurement at different neutron energies

# Toward New FPY Data Library, Experimental Data

## Construction of Experimental Database

- Review some personal FPY databases (England, Mills, Katakura)
- Include recent FPY data, which were not given in these databases
- Also compile other data, such as TKE, mass yield, etc, for parameter tuning

## International Cooperation

- Workshop on Fission Product Yield Experimental Data
  - Los Alamos, NM, Aug. 20 – 23 (2018), LANL, IAEA (co-chair)
- IAEA Consultants' Meeting on Fission Product Yield Experimental Database
  - May 27 – 30 (2019), Tokyo Inst. Tech., Tokyo, Japan
- IAEA Fission Product Yield CRP
- LANL plans **an open FPY workshop** in 2019 autumn