

# Additions to the ENDF/B decay data sub-library from NNDC

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# ENDF/B Decay Data Sub-Library

- Current version (VIII.0) current as of February 2018.
  - Decay Data Sublibrary contains spectrum data concerning nuclear decays for over 3800 isotopes (ground states and isomers).
- Version VIII.1 in progress with ~435 materials updated in the last year.
- Motivation: Ensure the published ENDF/B database reflects the most current and accurate evaluations available.
- Updates:
  - Decay Half-lives for neutron rich isotopes of Z 2-28 (2015BI05).
  - TAGS spectra on  $^{100,102}\text{Nb}_{\text{gs,m}}$  (2019GU03).
  - Calculated Antineutrino spectra added for neutron rich isotopes of Z 27-64.
    - Calculation made from summation beta spectra.



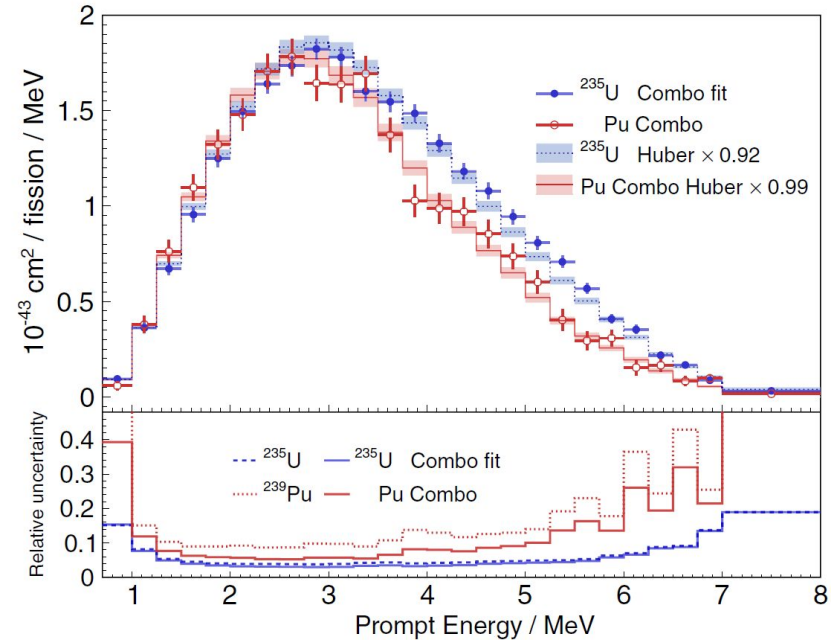
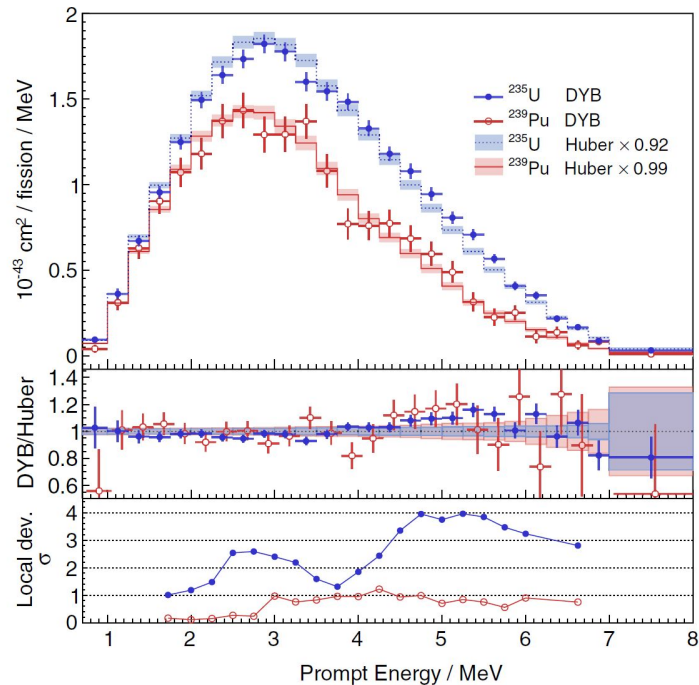
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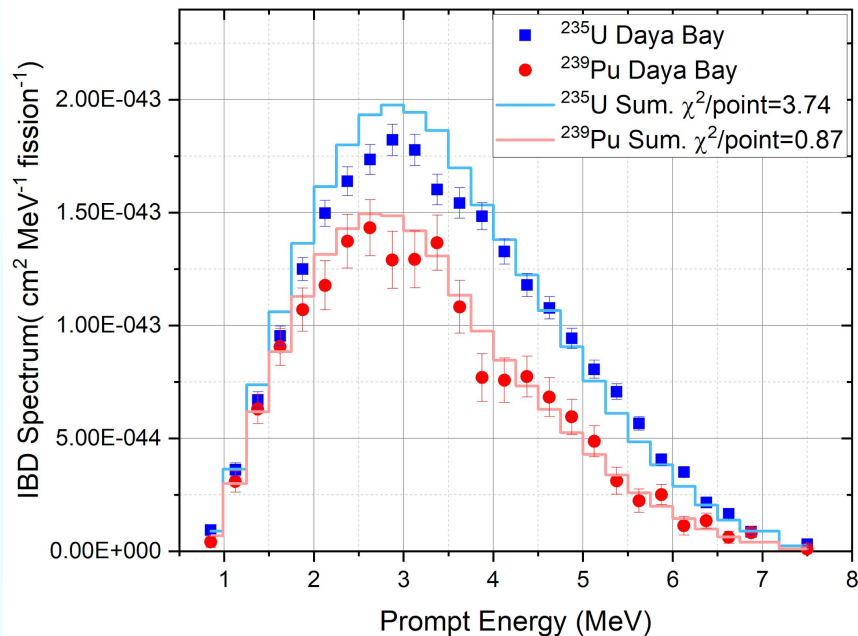
# Application to Reactor Antineutrino Research



- In 2019, the Daya Bay collaboration published the  $^{235}\text{U}$  and  $^{239}\text{Pu}$ , as well as the  $^{235}\text{U}$  and ( $^{239}\text{Pu} + ^{241}\text{Pu}$ ) spectra, which were compared to the Huber model.
- In the next few slides we'll compare them with results from the databases.

# Application to Reactor Antineutrino Research

$^{235}\text{U}$  and  $^{239}\text{Pu}$  IBD Spectra as a function of prompt positron energy.



Summation from ENDF/B-VIII.1 and  
JEFF-3.3 Cumulative Yields.

Daya Bay deduced antineutrino spectra  
For  $^{235}\text{U}$  and  $^{239}\text{Pu}$ .

Nuclear databases suggest  $^{239}\text{Pu}$  spectrum  
should be as smooth as  $^{235}\text{U}$ 's



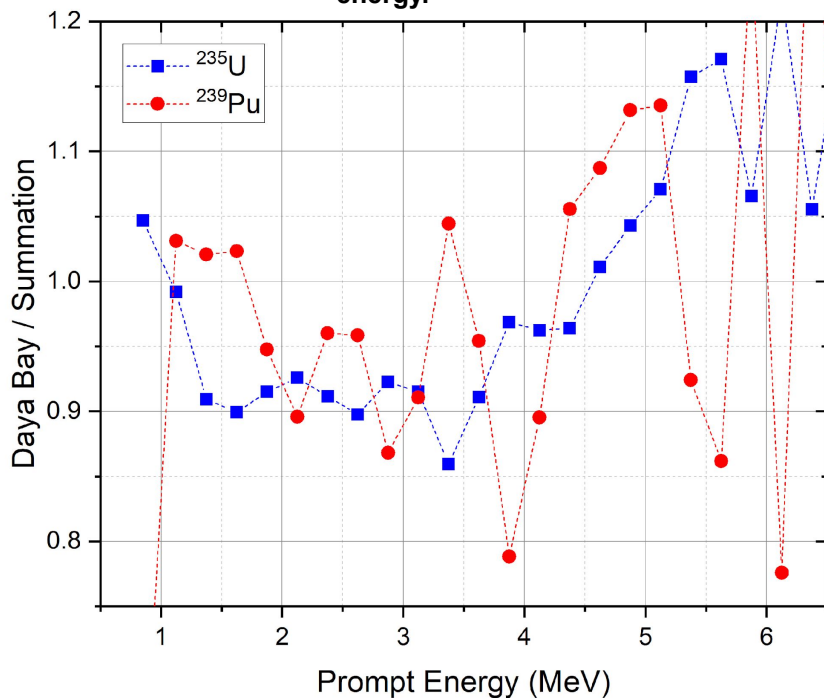
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# Application to Reactor Antineutrino Research

Ratio Daya Bay to Summation IBD Spectra as a function of prompt positron energy.



Ratio of the  $^{239}\text{Pu}$  and  $^{235}\text{U}$  Daya Bay spectra to their respective database summation spectra.

Both fuels appear to contribute to the anomaly, since the ratio is lower than one at 3 MeV, with  $^{235}\text{U}$  making the main contributing to the 5 MeV “Bump”.

The  $^{239}\text{Pu}$  ratio stands out as not smooth compared to the  $^{235}\text{U}$  ratio.

# Conclusions

- Significant updates have been made to the Decay Data Sub-Library that enhance its usefulness as a research tool.
- Application of the Sub-Library to cross check the latest Daya Bay results demonstrates this usefulness and reveals:
  - The database summation spectra do not entirely agree with the deduced spectra generated from the Daya Bay data.
  - The  $^{239}\text{Pu}$  spectra do have a reasonably close match based on the  $\chi^2$  per degree of freedom value, the Daya Bay spectra exhibits features in its shape at and around 4 MeV that are not seen in the summation spectrum and are outside of the error bars of the Daya Bay data.
  - The  $^{235}\text{U}$  spectra fail to produce the same yield values, and shows a similar disagreement with the summation calculation as with Huber's model.



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