Nuclear Data for Antineutrino Detector Response

WoNDRAM 2021

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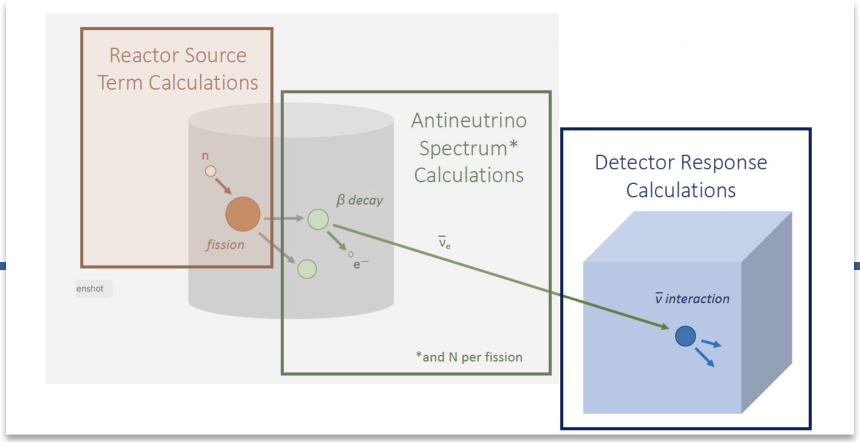
Topic of this Session: Detector Response



Advances in detector modelling capabilities would further the development of basic and applied antineutrino physics technologies. <u>This session focuses on identifying and prioritizing nuclear data needs that impact the ability to model antineutrino detector performance in the reactor energy range</u>—important for detector design, development, and data interpretation. This includes data deficiencies for modeling both neutrino signal and background for a wide range of detection techniques such as CEvNS, electron elastic scattering, and inverse beta decay.

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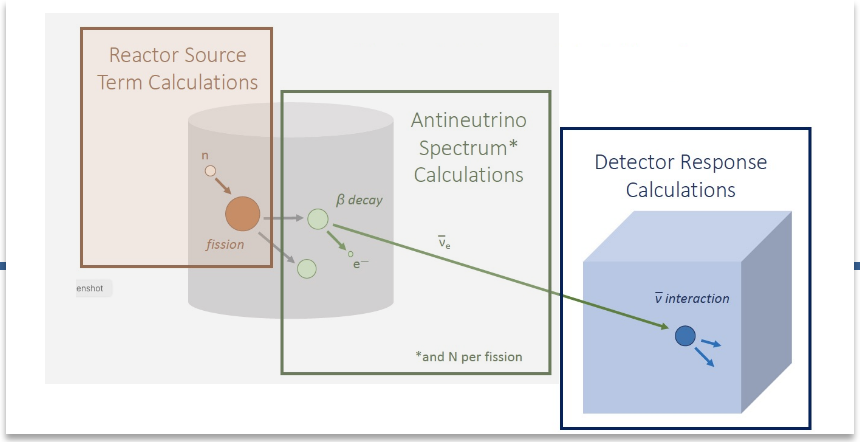

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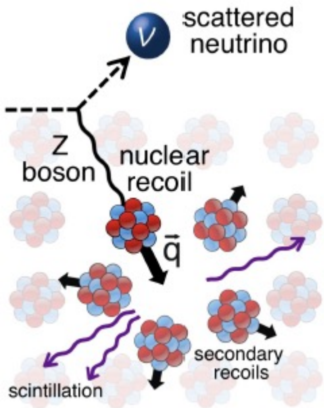

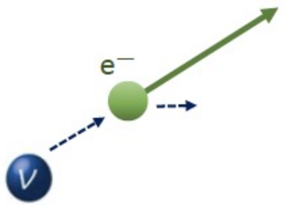

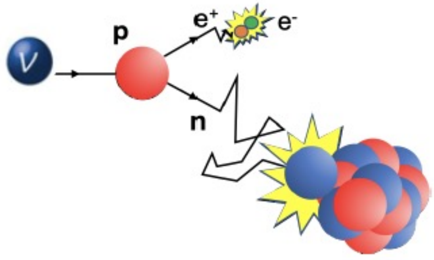

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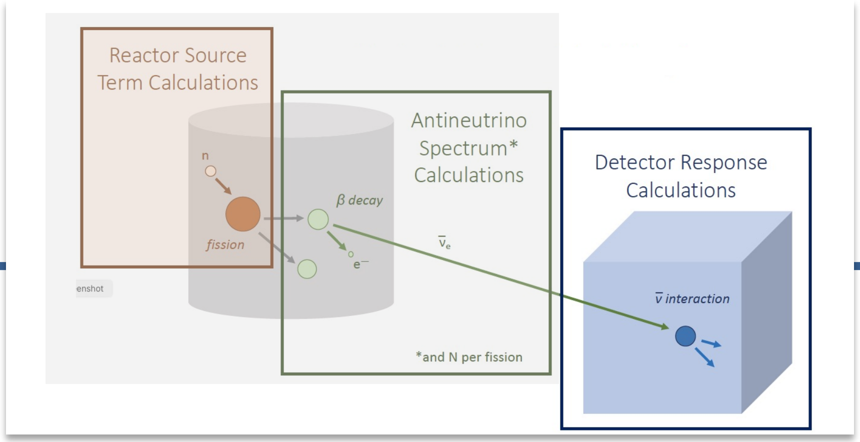

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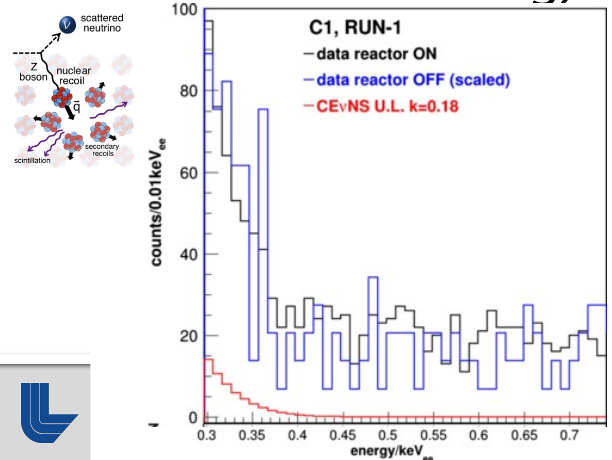

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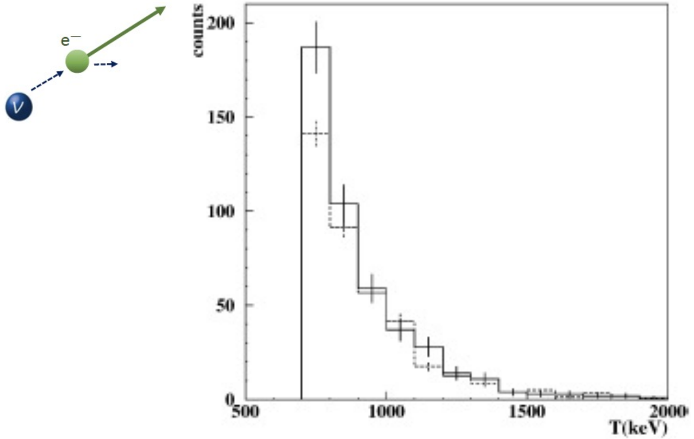

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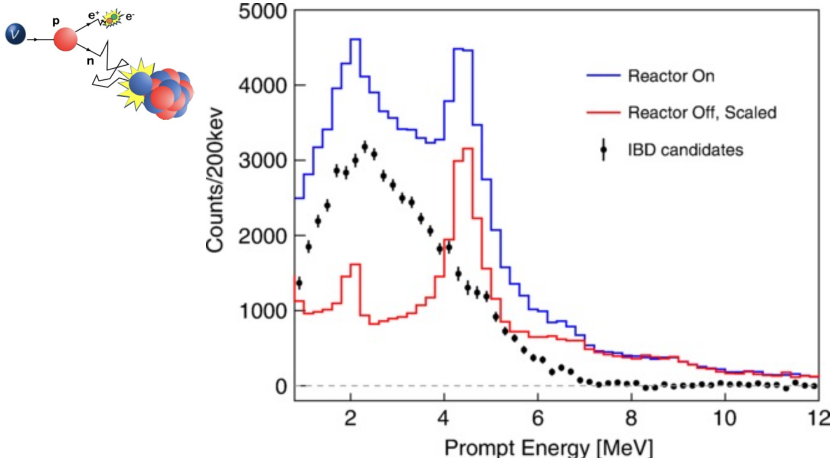

PROSPECT, PRD **103**, 032001 (2021)

Potential Needs

- 'Traditional' nuclear data that underlie modelling and analysis, e.g.:
  - background interaction cross sections
  - nuclear structure data for neutron capture isotopes and detector materials
  - …
- 'Non-traditional' nuclear data that underlie modelling and analysis, e.g.:
  - Electron quenching factors in organic scintillator — *for IBD signal response*
  - Recoil quenching factors in organic scintillator — *for IBD background response*
  - Recoil quenching factors in Ar, Ge, Xe, CsI, NaI, … — *for CEvNS signal response*
  - …
- Improved tools and models for predicting antineutrino detector response
- Compilations or evaluations of data relevant to the above.

Today's speakers have a short time to present some ideas on these topics
We also need input from the audience during Q&A plus the Discussion session

Questions for Discussion

- What are the priority nuclear data needs related to reactor neutrino detector response modeling?
  - What are the tradeoffs between impact on reactor neutrino measurements, precision of improved nuclear data/tools, and the effort required to realize the improvement?
- What precision is required? Is this known, or does it require study?
- What are the actionable tasks, next steps, and hurdles to overcome to meet these needs?
  - e.g., measurement campaigns, scoping studies, new databases, evaluation of existing data, covariance data, benchmarks, etc.?
- Are specific facilities and/or targets required?
- Which programs are funding relevant efforts? Which programs should consider supporting this topic?
- Can the effort be shared between programs? Is there an international effort for potential collaboration?
- What level of effort would be required to address identified needs?

Consider these questions as the session progresses

Session Co-Chairs

- Nathaniel Bowden (LLNL)
  - Neutrino applications, neutrino physics, neutron detection, nuclear data measurement
- Bethany Goldblum (LBNL/UCB)
  - Organic scintillators, nuclear reactions physics, nuclear security and nonproliferation R&D
- Jonathan Link (Virginia Tech)
  - Neutrino physics, neutrino applications, detector technology
- H. Pieter Mumm (NIST)
  - Neutrino physics, neutrino and neutron detector development, fundamental symmetries

Logistics

- Each presentation will have time for some short questions, but we also have extensive discussion time at the end
- Please enter questions in the chat, as they arise
- Notes are being recording here
  - Attendees can review and comment
- Please mute and turn off video if not speaking

Detector Response for Antineutrino Reactor Measurements Thursday Jun 24, 2021			
Introduction			
Time (ET)	Time (PT)	Topic	Speaker
11.00	8:00	Introduction	Nathaniel Bowden
Measurement Approaches (Chair: Jon Link)			
11.15	8:15	CEvNS: Signal	Phil Barbeau
11:30	8:30	CEvNS: Background	Kate Scholberg
11:45	8:45	IBD: Signal	Tim Classen
12:00	9:00	IBD: Background (aboveground)	Michael Mendenhall
12:15	9:15	IBD: Background (belowground)	Marc Bergevin
12:30	9:30	Electron Scattering: Signal & Background	Michael Smy
12:45	9:45	Break	
Crosscutting Topics (Chair: Pieter Mumm)			
1:00	10:00	Quenching Factors for Organic Scintillators	Thibault Laplace
1:15	10:15	Transport Modelling	Ali Haghighat
Discussion			
1:30	10:30	Discussion Session	Bethany Goldblum
3:00	12:00	Adjourn	