Nu Tools:
Exploring Practical Roles For Neutrinos In Nuclear Energy And Security

July 22 & 24, 2020

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PNNL is operated by Battelle for the U.S. Department of Energy

PNNL-SA-154710

What is the Nu Tools study?

- A lab and university effort, commissioned by the US National Nuclear Security Administration (NNSA) Office of Defense Nuclear Nonproliferation (DNN R&D)
  *"...to facilitate broad engagement with interested communities on the topic of antineutrino-based monitoring of nuclear reactors and associated post-irradiation fuel cycle activities. The particular focus... should be on the **potential utility** of antineutrino detection technologies… in the context of existing or potential policy needs."*

- **Approach:** Individual engagement and online workshops including:
  - International and domestic safeguards agencies and practitioners
  - Reactor vendors and operators
  - Nuclear security and safety non-governmental organizations
  - Nonproliferation and nuclear security policy subject matter experts
  - Neutrino physics community

- **Outcome**: A report capturing input from all perspectives, to inform and help guide future efforts of DNN R&D.

Executive Group

- Three laboratory leads:
  - Michael Foxe (PNNL)
  - Nathaniel Bowden (LLNL)
  - Jason Newby (ORNL)

- One academic lead:
  - Patrick Huber (Virginia Tech)

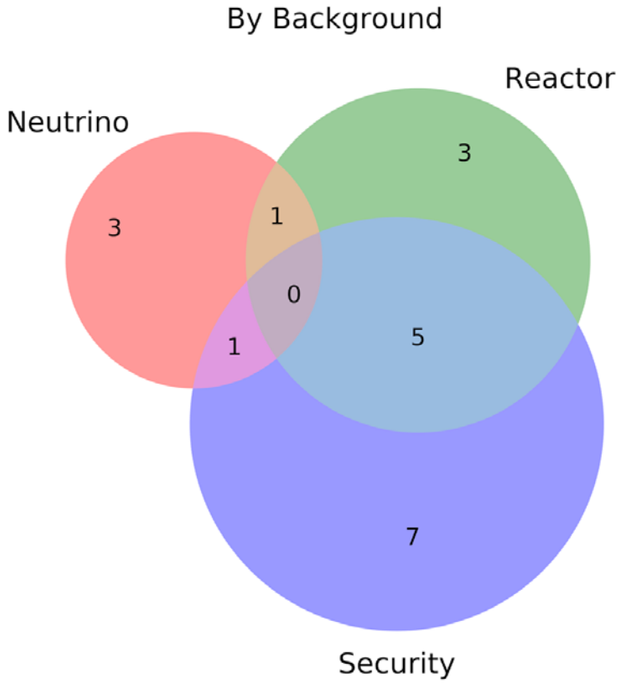
- Additional executive group members:
  - Phil Barbeau (Duke), Rachel Carr (MIT), Andrew Conant (ORNL), Milind Diwan (BNL), Anna Erickson (Georgia Tech), Bethany Goldblum (UC Berkeley), Karsten Heeger (Yale), Igor Jovanovic (Michigan), Jon Link (Virginia Tech), Bryce Littlejohn (Illinois Institute of Technology), Pieter Mumm (NIST)

Starting Points for Discussion: Fact Sheets

- Fact sheets on study website (https://nutools.ornl.gov/) provide background information to non-neutrino participants. Focus on seven broad use-cases:
  - Reactor Power Monitoring
  - Fissile Content Tracking
  - Non-Fissile Material Transmutation
  - Irradiated Fuel Monitoring
  - Post-incident Monitoring
  - Regional Reactor Observation
  - Scientific Engagement

Current Status

- Fact sheets are posted on Nu Tools website
- In the process of first engagement round, interviewing experts
- To date, have interviewed over 20 individuals from a range of organizations:
  - Academia
  - National labs
  - Private industry
  - US government agencies
  - International safeguards agencies
- Compiling information from participants into potential utility areas



Security includes safeguards & nonproliferation

*Note these are rough groupings

Nu Tools FAQs

- What is Nu Tools? What's new about this effort?
  - Focused narrowly on **utility**: identifying practical roles in nuclear energy and security that neutrinos have potential to fill
  - Based on the **broadest possible end-user engagement** we can arrange
  - Primarily seeking the **user perspective**; a "market study"

- Nu Tools is **NOT**:
  - A detector technology assessment
  - Making funding recommendations
  - Advocating for neutrino monitoring in general or any particular technical approach
  - A "push" - goal is to listen for a potential utility "pull" from end user communities
  - Cherry-picking only positive or negative responses - will capture input from all viewpoints

Purpose of this Mini-Workshop

- The technical/scientific community initiated the neutrino reactor monitoring endeavour, and thus it:
  - Represents a repository of utility knowledge and concepts, and
  - Has had a broad range of engagements with experts, reactor operators, agencies, etc.

- For this week's Mini-Workshop: Groups active in relevant technology development and/or the AAP series have been invited to give their perspective on utility, framing this in the context of their own technical interest.

- How will this information be used?
  - Utility perspectives will be incorporated into the final Nu Tools report and may help to frame future engagements with end users.
  - A full range of utility perspectives will be represented in the report.

- How can people continue to engage?
  - Use email or the forum website to get in touch with specific ideas for use cases or other non-neutrino experts we could engage with.

Current Study Timeline

- 2019: Define study areas, plan engagements and in-person workshop soon after Neutrino2020
- Feb – March 2020: Start over, adjusting to the ‘new normal’
- May – July 2020: 1st engagement round
  - Focus on first or second-degree contacts of executive group, including many already familiar with neutrino monitoring concepts
  - Collect information on utility concepts, effective methods to reach beyond ‘usual suspects,’ and follow-up respondents
  - Technology Community Mini-Workshops
- Aug – Oct 2020: 2nd engagement round
  - Emphasis on following new leads, reactor developers & operators, NGO & Agency experts, generally with no/limited neutrino knowledge (no preconceptions)
- Early 2021: Complete public report
- Planning talks and panel discussions, e.g. at 2021 INMM Annual Meeting, to bring the study results to the attention of broader end-user community and facilitate direct engagement of technical and policy communities

Thank you