Snowmass2021 - Letter of Interest
Nu Tools: Exploring Practical Roles for Neutrinos in Nuclear Energy and Security

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In this Letter of Interest, we wish to bring the Nu Tools study to the attention of the High Energy Physics Community as it embarks on the Snowmass process. Nu Tools has been commissioned by Defense Nuclear Nonproliferation Research and Development, an office within the DOE National Nuclear Security Administration, to explore practical roles for neutrinos in nuclear energy and security. While the study focus on the utility of neutrino detection means that stakeholder engagement efforts will concentrate on nonproliferation and nuclear energy end users, input is welcomed from the HEP community. The outcome of this effort will be a public report expected in early 2021.

Neutrino Frontier Topical Group: (NF07) Applications

Community Involvement Frontier Topical Group: (F01) Applications and Industry

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Introduction

The Nu Tools study fulfils a request from the DOE National Nuclear Security Administration (NNSA) Office of Defense Nuclear Nonproliferation Research and Development (DNN R&D) to explore practical roles for neutrinos in nuclear energy and security. Specifically, we have been charged *"... 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 [1]."*

This effort will engage with a broad range of end users. Given the utility focus of the study, we are primarily seeking the user perspective, i.e. are conducting a "market study" of potential applications of antineutrino detection technology. Nu Tools will not be assessing specific neutrino detection technologies, nor will the study recommend individual technology investments.

The purpose of this LOI is to bring the Nu Tools study to the attention of the HEP community and the Snowmass process. We encourage engagement by community members with the study if they have utility perspective or experience they wish to share. One possible outcome of Nu Tools is that it motivates technical R&D by an application-focused organization like DNN R&D. In this case Nu Tools would provide the Neutrino Physics community with a mechanism to understand the unique goals of the applied R&D and the means to explore synergies for the mutual benefit of both science and applications.

Nu Tools Study Method

The Nu Tools study was to be loosely based upon the Basic Research Needs format developed by DOE Office of Science Basic Energy Sciences with a process that empowers topical panels to prepare content in advance of an intense week-long workshop that culminates in a consensus report. However, with such in-person meetings limited and given the utility focus of the study, Nu Tools will concentrate on one-on-one engagement with experts outside the high energy physics community:

- 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

In performing these engagements, study members do not directly advocate for the use of neutrino detection in these contexts; rather we attempt to listen for a potential utility "pull" from end user communities. Introductory fact-sheets have been developed to provide relevant background on neutrino detection and some broad areas of potential application [1].

Expected Outcomes and Timelines

The major work product of Nu Tools relevant to Snowmass will be a public report summarizing the engagements conducted and the potential utility cases found. This will be completed in early 2021. The report will capture input from all perspectives on the application of neutrino detection, whether positive or negative, to inform and help guide future efforts of DNN R&D.

Neutrino Physics Community Engagement

As noted above, we encourage engagement by members of the neutrino physics community with the study if they have utility perspective or experience they wish to share. Study members may be contracted directly or via the study contact form [1]. A mini-workshop dedicated to collecting input from many relevant efforts conducted at nuclear reactors was conducted in July 2020 [2].

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[1] Nu Tools: Exploring Practical Roles for Neutrinos in Nuclear Energy and Security, https://nutools.ornl.gov/.

[2] Nu Tools Mini-Workshop for the Applied Antineutrino Technology Community, https://indico.phys.vt.edu/event/43/.