DUNE ND Review Process

Scott Oser

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Who's Who

Review Committee

- Scott Oser† (chair)
- Ties Behnke
- Patrick Huber†
- Eric Kajfasz
- Dean Karlen
- Naba Mondal†

Ex officio: Beate Heinemann†

Head of LBNC: Hugh Montgomery†

†Also members of LBNC

DUNE proponents

ND conveners:

- Alan Bross
- Hiro Tanaka
- Alfons Weber

CDR editors:

- Mike Kordosky
- Steve Manly

Physics Coordinators:

- Ryan Patterson, Elizabeth Worcester

Spokespersons:

- Ed Blucher, Stefan Söldner-Rembold

Context for the upcoming review

DUNE plans to produce a ND CDR late in 2019, and a TDR in 2020. So why is a review committee being formed now?

Key driver is that the main DUNE TDR (far detectors, physics case, technical coordination) must be ready by July 26, 2019. The next LBNC meeting is a few days afterwards.

The physics TDR necessarily must make assumptions about the ND performance, yet the ND design is not complete. The LBNC must evaluate whether the ND strategy is sound. This review committee will advise the LBNC on this.

Key goals for this summer's review:

- DUNE should provide the ND review committee with an "existence proof" for a plausible and achievable ND design that will meet the requirements set in the physics TDR. This need not be an optimized design, but enough to permit sign-off on the physics TDR.
- The review committee will advise the LBNC on whether the ND concept is feasible and appropriate.
- The review committee will provide early constructive feedback to DUNE, as DUNE prepares to complete the ND CDR later this year.

Schedule

- May 3: DUNE will provide ND reviewers with a “CDR executive summary”. We will discuss today the scope of this.
- May 21: review committee will submit written questions and feedback to DUNE
- In-person meeting at FNAL (with remote connection available): presentations and discussion of the ND between review committee and DUNE proponents. (Most likely dates: June 3 or 4. To be confirmed.)

Contents of executive summary, as proposed by DUNE (1)

“The Near Detector must allow us to disentangle and ultimately reduce the uncertainties due to neutrino flux, cross sections, and detector response. DUNE's ND strategy is two-pronged: (1) deploy a Near Detector that can make sufficiently detailed measurements to improve and constrain the flux, cross section, and detector response models, and (2) employ off-axis samples to reduce in an unprecedented way the reliance on a neutrino interaction model. It is only through this two-pronged approach that the robustness of the oscillation measurements can be assured.

This June, the focus will be on demonstrating to the committee that the Near Detector concept delivers on the above strategy. Key components that will be discussed include:

- joint LAr and MPD samples that allow detailed constraints of differential cross sections on argon
- time-of-flight-based measurements of neutrons
- nu-on-e and low-nu techniques for direct flux constraints
- DUNE-PRISM capability for determining energy response in a model-independent way
- on-axis measurements of beam stability

Contents of executive summary, as proposed by DUNE (2)

"The end-to-end oscillation analysis presented at the February meeting (Marshall) and briefly reprised at the April meeting (Worcester) has demonstrated quantitatively that the ND concept succeeds in the case where the model is known but the parameters must be constrained. In June, we will describe these quantitative tests in more detail, namely:

a) Which uncertainties and model parameters are directly included in the joint ND+FD fit?

b) Which are not included directly but are instead assumed to be constrained by the broader ND suite of measurements?

c) What is the justification for these assumed constraints?

In June, we will also discuss the DUNE-PRISM technique, which is aimed at significantly reducing the model dependence of, and risk of bias in, the oscillation measurements. We will include examples of potential bias and its mitigation through off-axis measurements."

Questions for discussion

- What level of sophistication in simulation, reconstruction, and analysis is feasible on this timescale?
- What can DUNE show us about Far detector only vs FD+ND sensitivity for CP violation? Will we get updated/corrected versions of what was shown in February?
- Can some basic numbers be presented that can be compared to the physics CDR results, such as the fractional uncertainties on ν_e and ν_e-bar at the FD based on ND constraints?
- To what extent can we address the technical feasibility of the proposed ND at this point?
- What studies with alternate cross-section models will be available to demonstrate the need for DUNE PRISM?
- Technical point from physics TDR review: how well will neutron association work for large multiplicity events in the ND?