Planning for the Pulsed Neutron Source Scope Review

Jingbo Wang
University of California, Davis, Department of Physics

UCDAVIS
UNIVERSITY OF CALIFORNIA

PNS WG Meeting
April 14, 2020

Main activities before review

ARTIE experiment at LANL	10/08/2019 – 10/20/19
Prepare DD generator test at CERN	12/10/19 – 04/30/20
Preliminary ARTIE data analysis	04/01/20 – 05/30/20
Finalize PNS conceptual design	04/01/20 – 05/30/20
Calibration Review Workshop	05/11/20 – 05/28/20

Main activities after review

DD generator test at CERN	06/01/2020 – 06/30/20
PNS CAD design at UC Davis	07/01/20 – 07/30/20
Set up a PNS test lab	08/01/20 – 11/30/20
Small-format neutron moderator	08/01/20 – 12/31/20
Identify a DD generator	11/01/20 – 02/28/21
Full-size PNS system	12/01/20 – 03/31/21
PNS system arrives at CERN	08/31/21
ProtoDUNE Run-II	01/01/2022

Recent Work

- Preparing the DD generator test at CERN
  - Test has been postponed
  - DD generator shipped from LANL to CERN
  - Finalizing the shield design

- Finalizing ARTIE Analysis
  - Bubble test at UC Davis to understand the target density
  - Understanding the systematics

Recommendation from last review

- Continue with the program of measurements and simulations to finalize the source design.
- Understand radiation safety issues.
- Work with the LBNF facility and TC to understand mechanical constraints.
- Work with the LBNF facility and TC to understand where to install the third source, under the assumption that two sources will be installed in the manholes at the two ends of the detector.
- Demonstrate the capability of reconstructing the 6.1 MeV shower in simulation.
- Develop a plan for deploying a pulsed neutron source for the 2nd run of ProtoDUNE

Questions to answer

- What exactly are the parameters being determined by the PNS?
- How many wires will a neutron capture cloud hit? How much above noise (~1000 ENC) will the smaller hits be? Does the analysis need clustering algorithms to reduce noise?
- Given the cross section from ARTIE (tbd), what is the fraction of detector volume that can be “illuminated” (more than 100 n/m^3) with a 1hr run of a single source in a corner human access port
- Is there a realistic design for a moderator? Does it obey radiation safety rules? Does it need weight support from cryostat I-beams?
- What is the ratio between close/far capture rates? What is the DD generator rate and total calibration time needed to calibrate the farthest volumes?
- ARTIE results by scope review