PNS Status Update

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SOUTH DAKOTA MINES

An engineering, science and technology university

CALCI Consortium Meeting

July 13, 2023

Outline

- New DD Generator

- PNS Prototyping Status

- Simulation and Analysis

- Neutron Cross Section Measurements

- Summary

New DD-Generator

- Reminder: Thermo Fischer MP320 (old) vs. Starfire n-Gen310 (new)

  – Starfire generator will have increased neutron output, lower possible pulse frequency, and comparable size

Starfire Generator

- Since the Collaboration Meeting we have received the Starfire generator, and performed a physical inspection – everything seems to look fine

  - Currently working with the safety officer at SDSMT to coordinate a safety review and first test with the new generator

  - First test will be to confirm the device is operational

ProtoDUNE-II PNS Prototype

- SD Mines will provide the final design and UC Davis will fabricate the mechanical supporting structure

  - Contractor has been found to cut the borated polyethylene to dimension for the prototype

  - Currently finalizing support structure design

PD-II Prototype
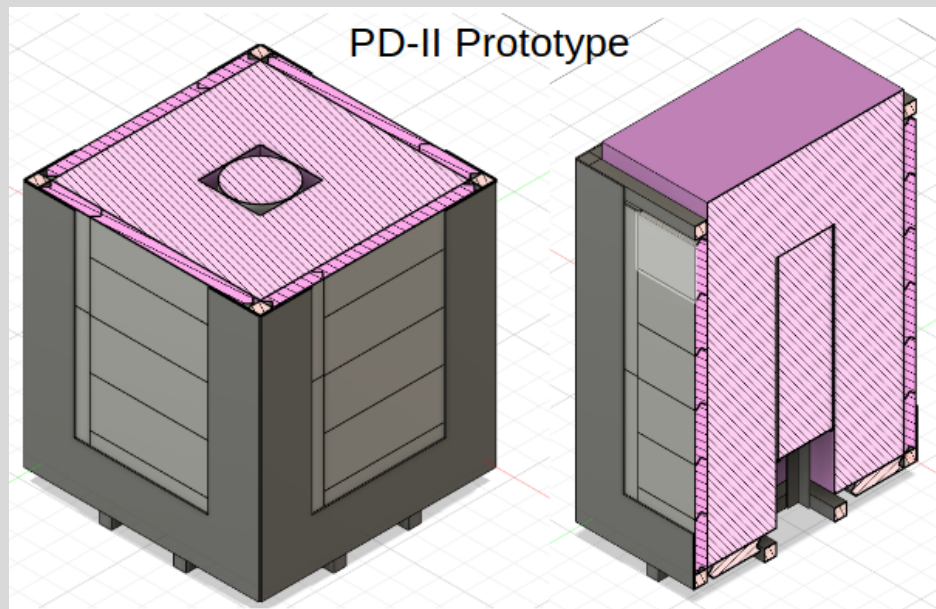
Simulation and Data Analysis

- Continuing to develop both the traditional and machine learning based approaches

- Machine Learning: Arrakis, BLIP, and HDBSCAN-PointNet (developed by Nicholas Carrera)

- Traditional: Hit clustering using DBScan algorithm, low energy specific reco techniques

    - Tools developed for 'blip' finding and reconstruction for MicroBoone will likely be made available for DUNE analysis soon

MicroBoone BlipReco Toolkit

- A comprehensive toolkit used to identify blips developed by Will Foreman

- More info in his talk at the PNS working group meeting

  – Will's Talk

- We expect these tools to be very useful for neutron capture ID
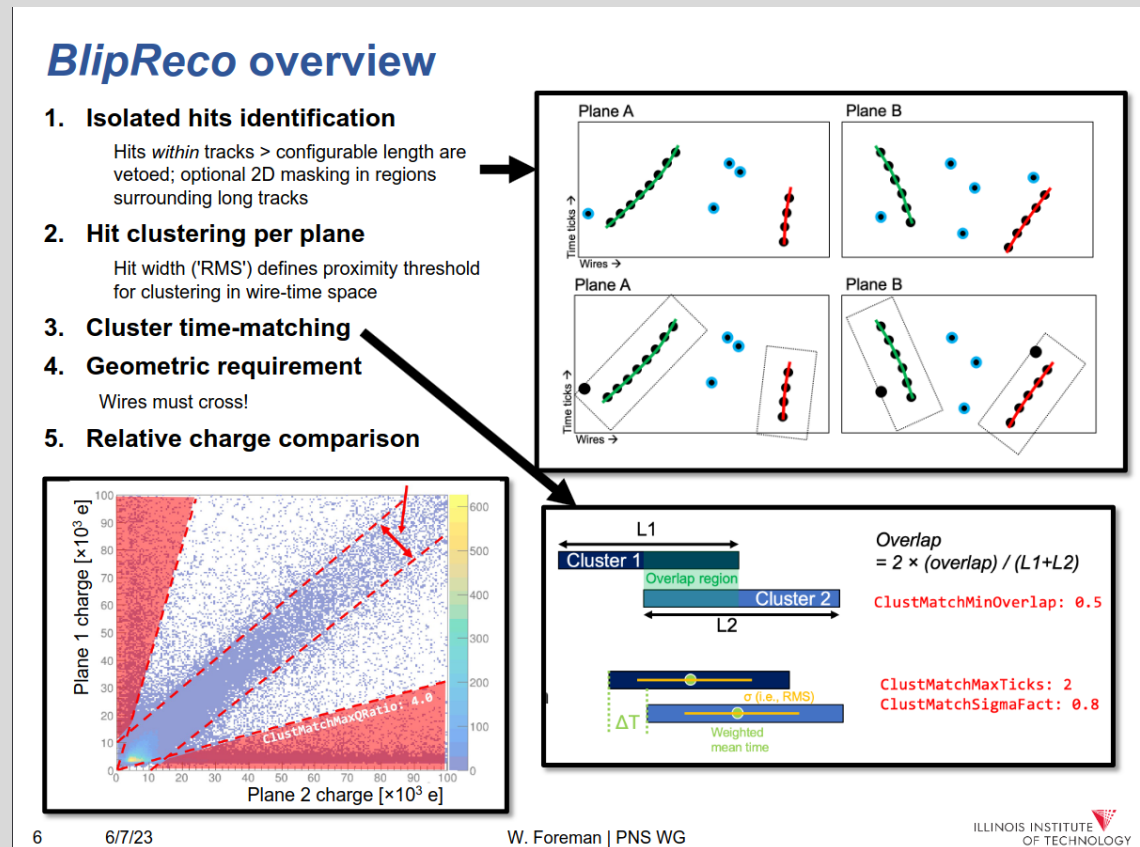
Neutron Cross Section Measurements

- ACED (LANL): Measured neutron capture cross sections at thermal energies

- ARTIE-I (LANL): Measured neutron total cross section for 20-70 keV. Paper has been published in PRC: ARTIE-I

- ARTIE-II (LANL): Measure neutron total cross section with smaller systematic uncertainties and wider energy range from 0 to 200 keV. Proposal submitted to LANL and has been accepted.

- MArEX@n-TOF (CERN): Multiple experiments planned. Measure neutron total cross section, neutron capture cross section from 0 to 500 MeV. LOI submitted to CERN (High pressure Gaseous argon target this year; Liquid argon target next year.)

Summary

- Starfire DD Generator has been received at SDSMT

  – Will perform tests following safety review

- PNS support structure design is near final

- Continuing to develop analysis algorithms

- ARTIE-I paper was published in PRC