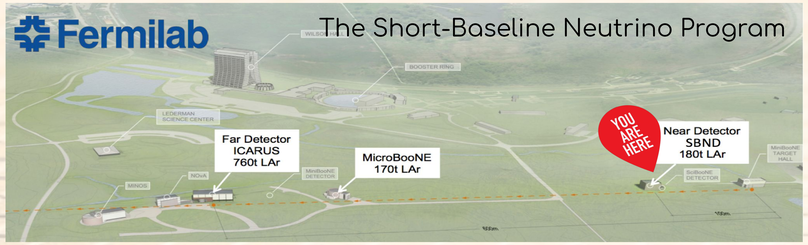
Status of the Short-Baseline Near Detector at Fermilab

G. A. Valdiviesso on behalf of the SBND Collaboration
gustavo.valdiviesso@unifal-mg.edu.br

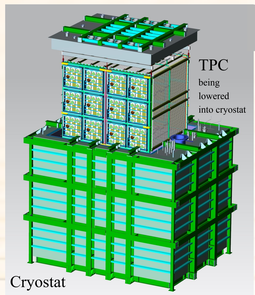
W±I ν 2021

The Short-Baseline Neutrino Program

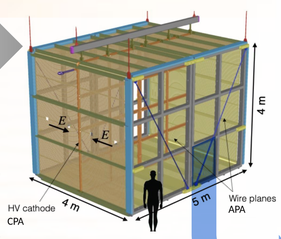


SBND in a nutshell

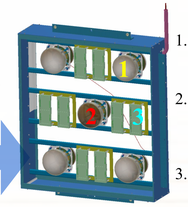
- A Time Projection Chamber (TPC) containing **111,6x10^3 kg** of liquid argon as a neutrino target.
- Located at **110m** from Fermilab's Boost Neutrino Beam (BNB) target.
- As part of the SBN program, it will look for **muon-neutrino disappearance** as well as **electron-neutrino appearance** in the BNB's muon-neutrino beam addressing the puzzle of the **short-baseline neutrino anomaly**.
- Its standalone physics program include **neutrino-argon cross-section** measurements, **Beyond Standard Model** (BSB) searches, as well as potential for **Supernova** observations.



- Two anode planes, each of which with three wire planes.
- One central cathode plane, lined with wavelength-shifter coated foils.
- A uniform cathode-to-anode electric field (**500V/cm**), surrounded by a field cage.



- APAs are equipped with **Photon Detection System** (PDS) boxes.
- Each PDS box contains three photo sensors:

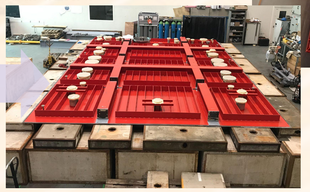


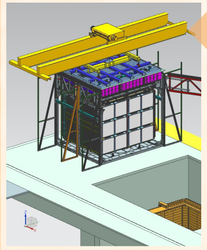
1. Coated PMT
   direct scintillation light
2. Uncoated PMT
   light reflected by the CPA foils.
3. ARAPUCA
   direct scintillation light

Installation Status

Most recently:
- Cryostat external structure already in place.
- Internal wall flatness and dimensions measured.

Up next:
- Membrane cryostat, internal and external cryogenics.
- Top cap assembly and installation.
- The the top cap is assembled at CERN.

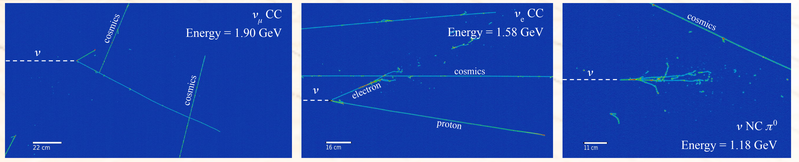




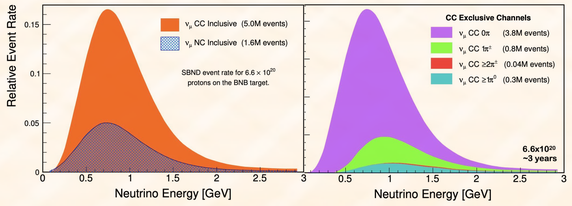
- A special structure, the Assembly Transport Frame (ATF) was built to facilitate the TPC's assembly and installation process.
- The installation procedure was already tested with a mock version of the Anode Plane Assembly (APA).

- In the next few months, there will be a TPC inside this ATF

Physics and Simulation



Recent MC production: high statistics samples of BNB's ν_μ and ν_e, and cosmics.

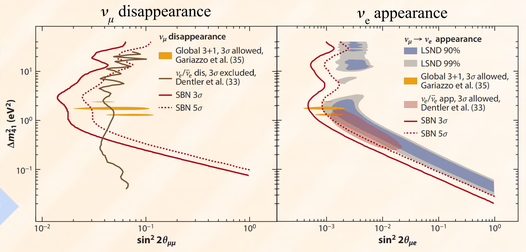


Expecting an unprecedented **6,6 million** neutrino interactions corresponding to **6.6x10^{20}** protons-on-target (delivered in approximately 3 years), of which about **3:4** from charged current (CC) and **1:4** from neutral current (NC) events.

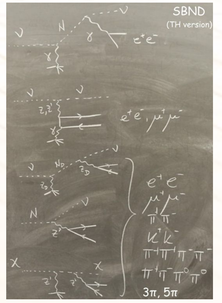
CC events distribution over the most frequent final-state topologies.

Employing three fitting frameworks allowing for detailed validation and cross-checking. These are fed with common inputs, but are independently-developed by other collaborations: CAFAna (by Nova and DUNE), SBNFit (by MicroBooNE) and VALOR (by T2K).

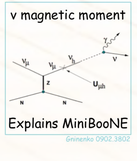
Sensitivity to ν_μ disappearance and ν_e appearance in a 3+1 model.

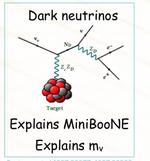


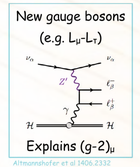
Beyond Standard Model Searches

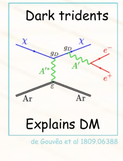


- SBND is potentially sensitive to a huge, new range of BSM physics searches.
- Particular interest in models which predict new particles produced alongside the neutrino beam.
- Most common signatures are di-leptons, mu+pi, e+pi, but many others as well.







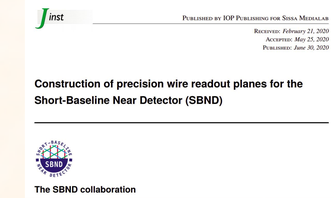


Don't Miss Our Other Poster

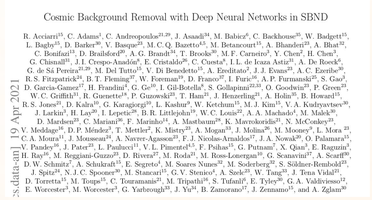
A DAQ-Level Pure Neutrino Stream For SBND
presented by **Erin Yandel** from UC Santa Barbara

A preliminary look at a DAQ-level 100% pure selection of neutrino events, to be used in the development and validation of calibration, monitoring, and analysis tools for SBND.

Recent Publications



DOI 10.1088/1748-0221/15/06/P06033



ArXiv 2012.01301