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SBND in 10 minutes

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On behalf of the SBND Collaboration

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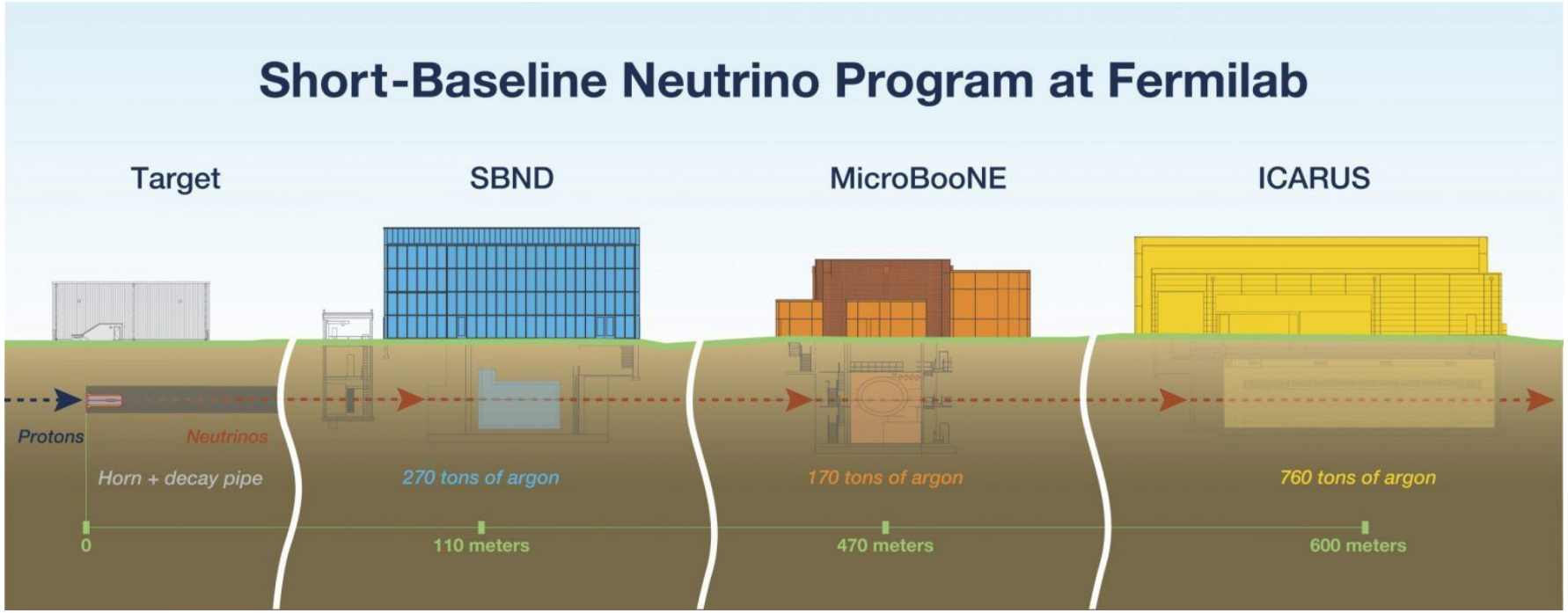
SBND is the near detector in the Short Baseline Neutrino (SBN) program at Fermilab



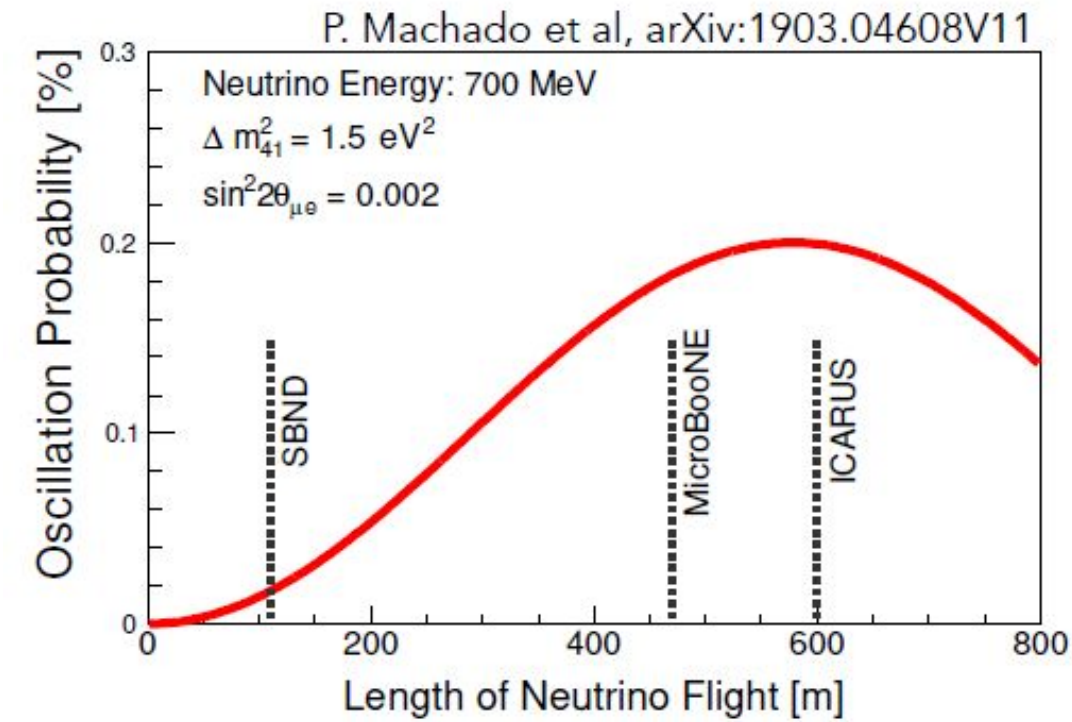
The Short-Baseline Neutrino (SBN) program at Fermilab consists of 3 LArTPCs located along the Booster Neutrino Beamline (BNB) at Fermilab

SBND Physics Program

- Neutrino cross-section measurements
- Search for eV mass-scale sterile neutrinos oscillations in the SBN program
- Search for new and exotic physics signals

SBND Physics: SBN Oscillation Sensitivity

- Three detectors sampling the same neutrino beam at different distances.
- Effective systematics constraint through the near detector (SBND) and same detector technology in the near and far detector.

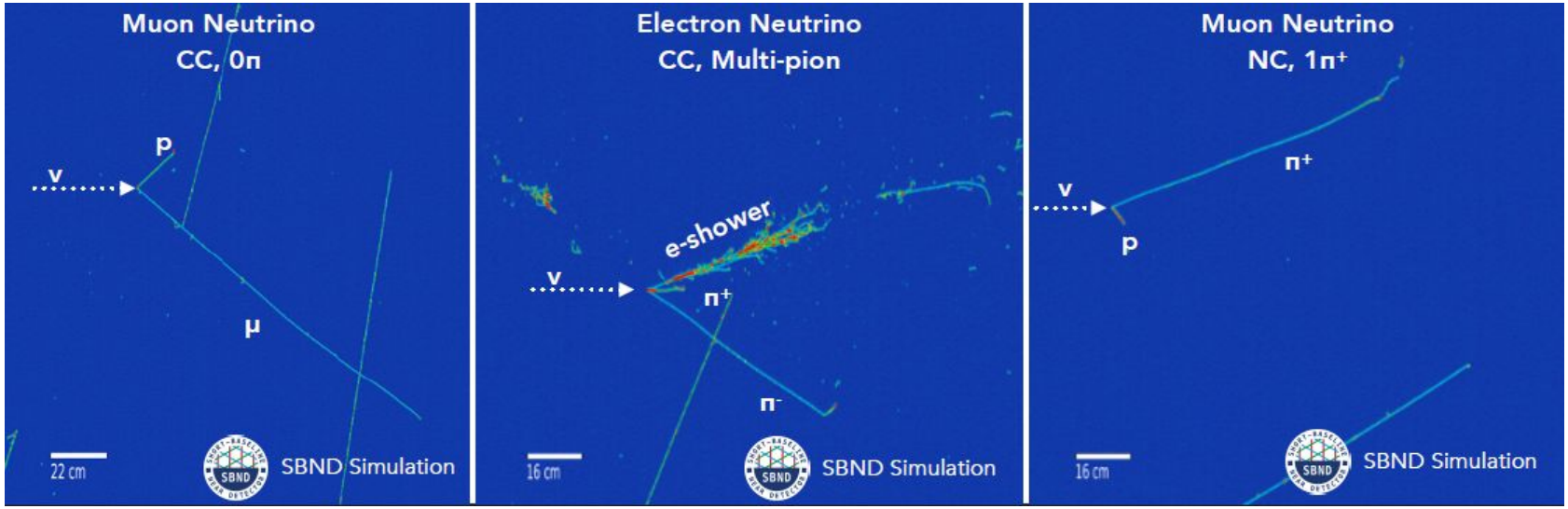


SBND Physics: Cross-section measurements

- Understanding neutrino interactions with argon is crucial for the success of current and future neutrino experiments.

- Argon has a complex and heavy nucleus and not much data exists to constrain current generators;

- SBND will be able to expand the understanding of it with an incredible large-statistic dataset allowing to make multi-dimensional analyses with high statistics.

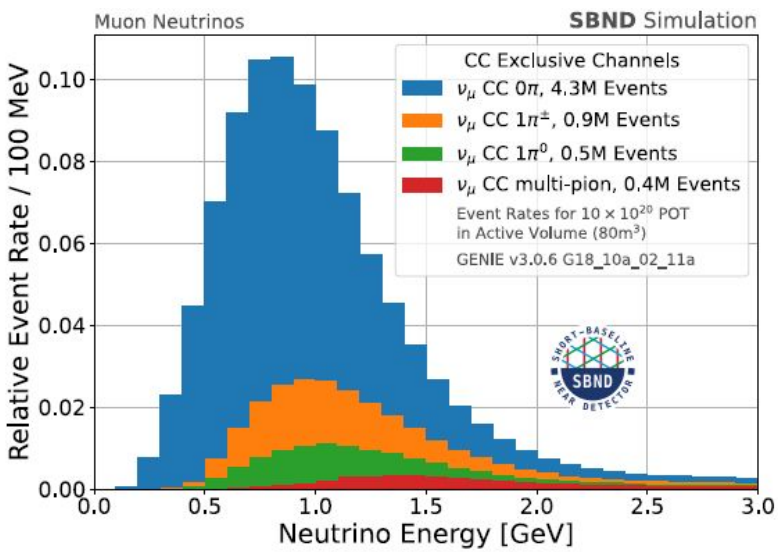


SBND Physics: High-statistics measurements

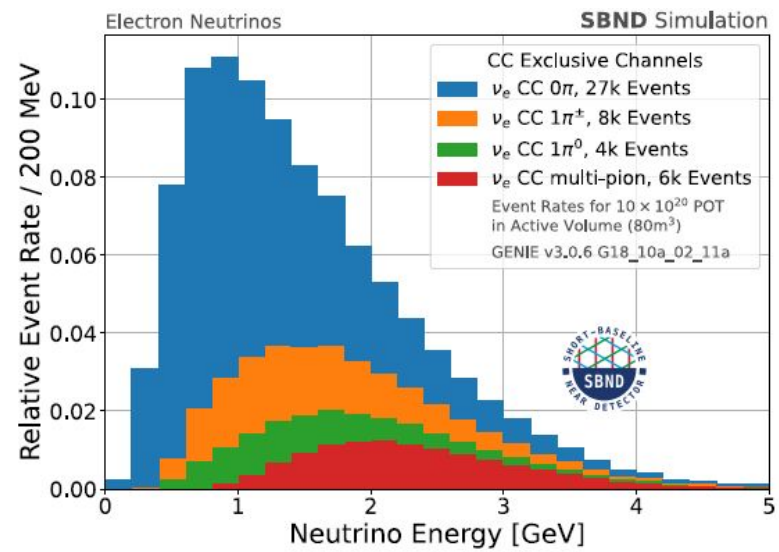
- SBND data will enable a generational advance in the study of neutrino-argon interactions in the GeV energy range, with low thresholds for particle tracking and calorimetry and enormous statistics.

- SBND will be just 110m far from the BNB target so it will get a large dataset of ν-Ar interactions and will do high-statistics measurements of many signatures and can observe rare channels.

- SBND will record 20-30x more neutrino-argon interactions than is currently available. **SBND will observe 5000 ν-events/day!**

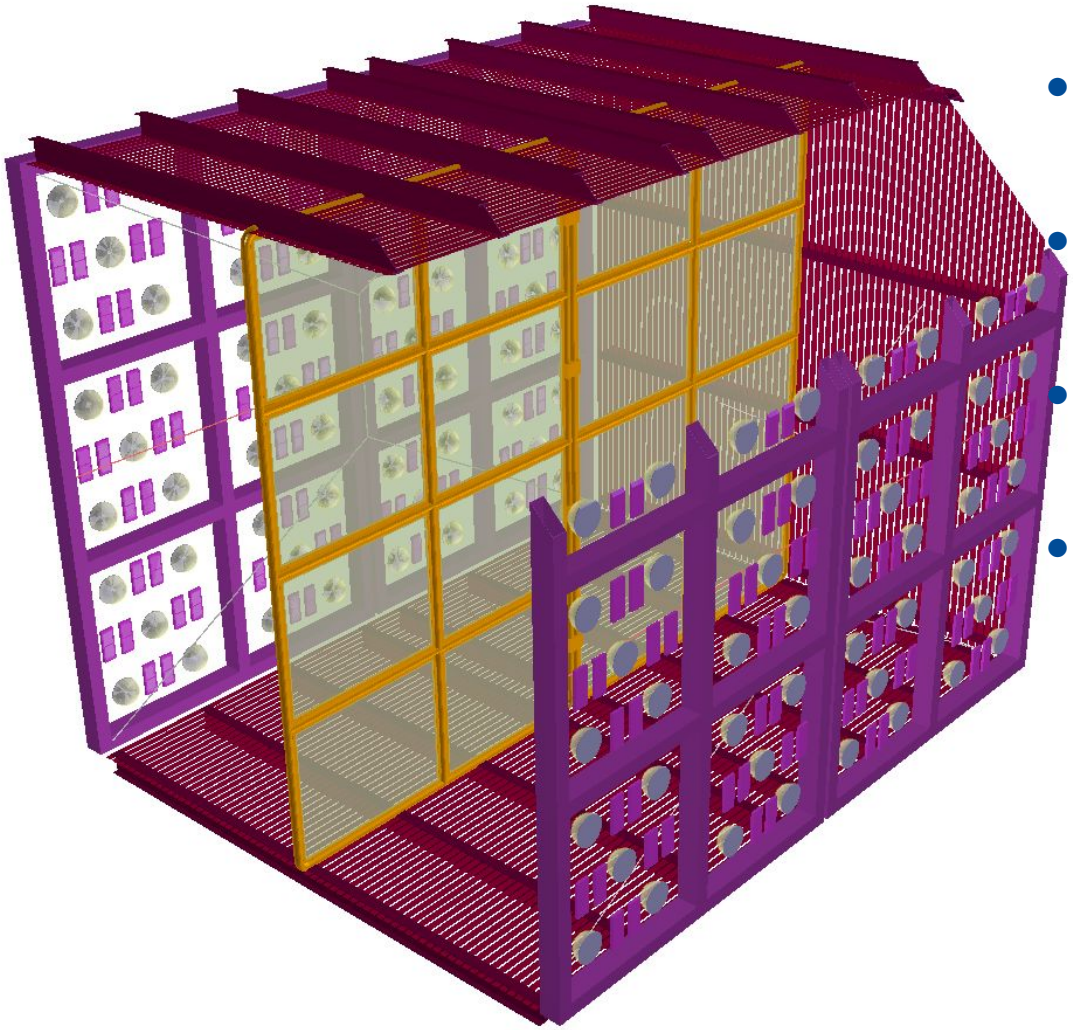


1.5M ν_μ CC events in 1 year



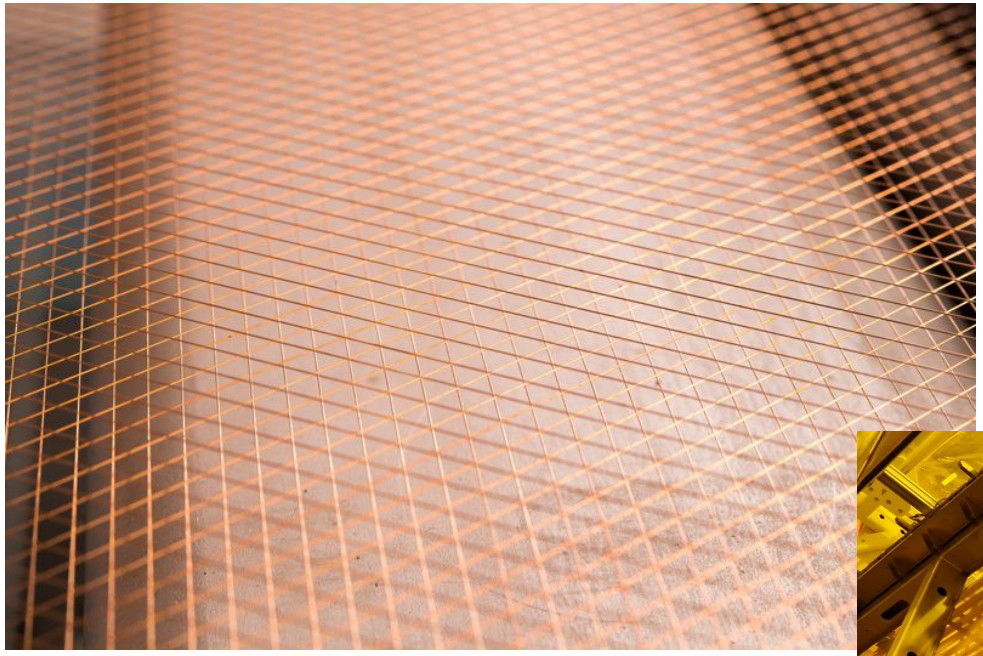
12k ν_e CC events in 1 year

SBND Structure

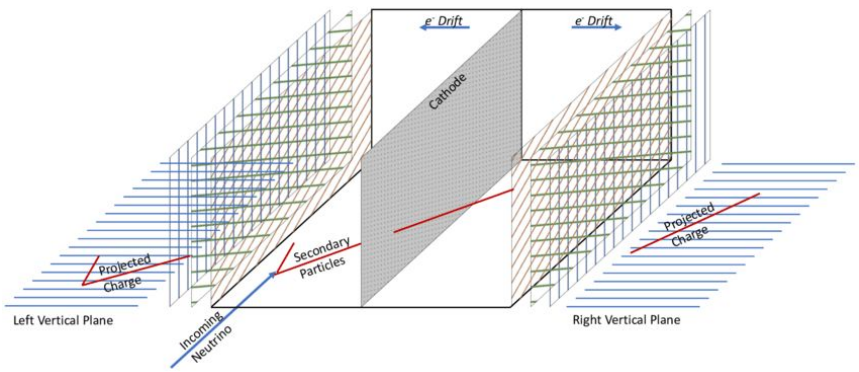


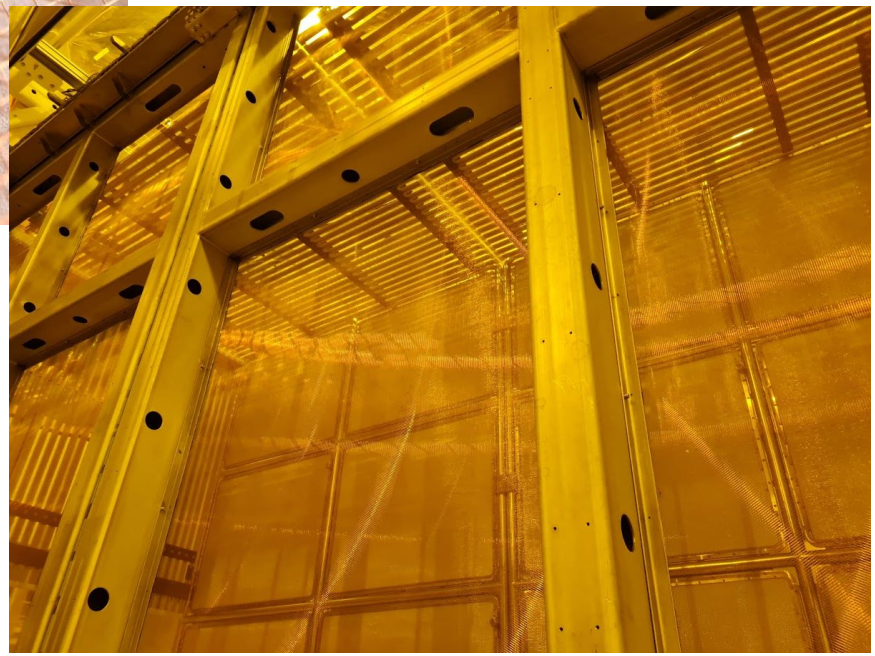
- 2 Time Projection Chambers for a total of 4m x 5m x 4m (2x2m);
- Containing 111.6×10^3 kg of liquid argon as a neutrino target.
- 3 readout wire planes ~11000 wires;
- Powerful Photon Detection System with 120 PMTs 192 X-Arapucas

SBND: APAs (Anode Planes Assemblies)

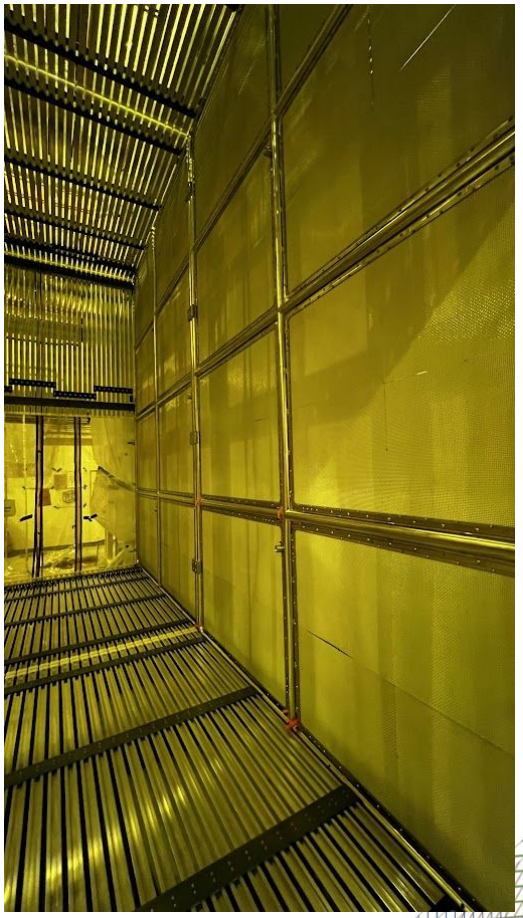


- Three Planes: Collection plane (Y) in the vertical, two induction planes +/- 60 degrees (U,V);
- Wire pitch and plane spacing of 3mm.

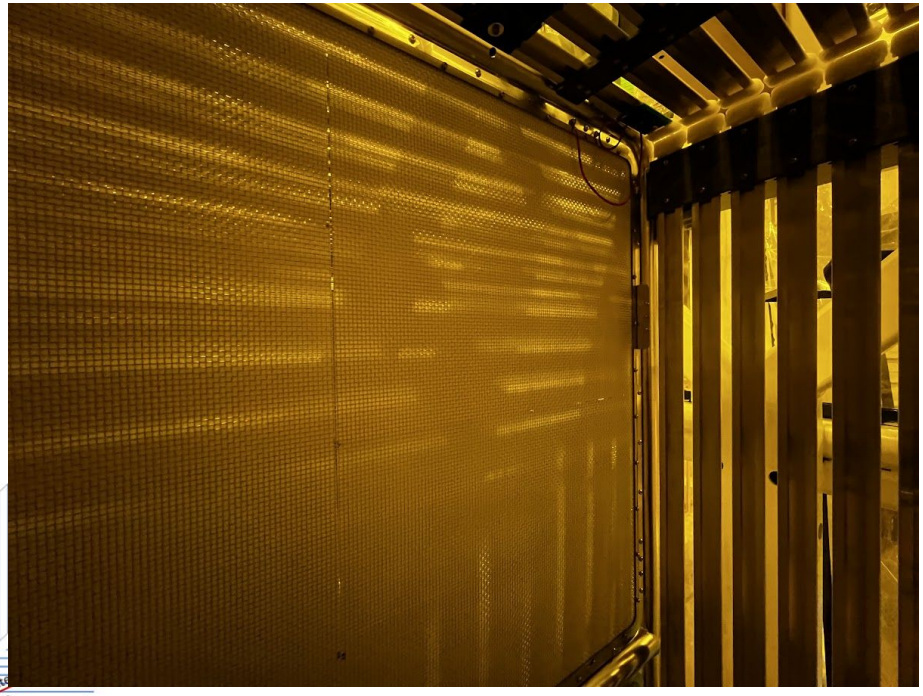


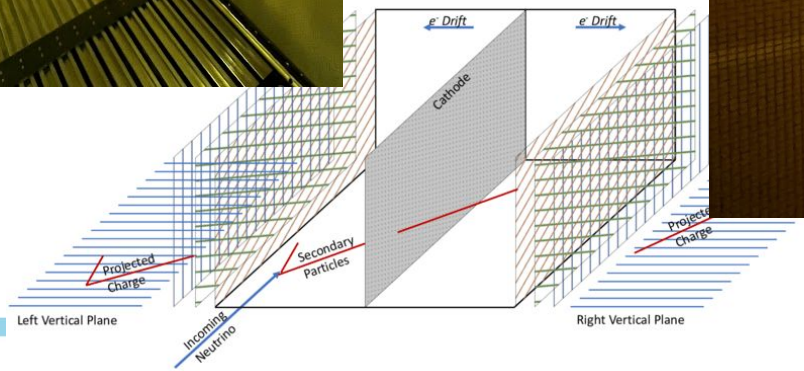


SBND: CPA (Cathode Plane Assembly)

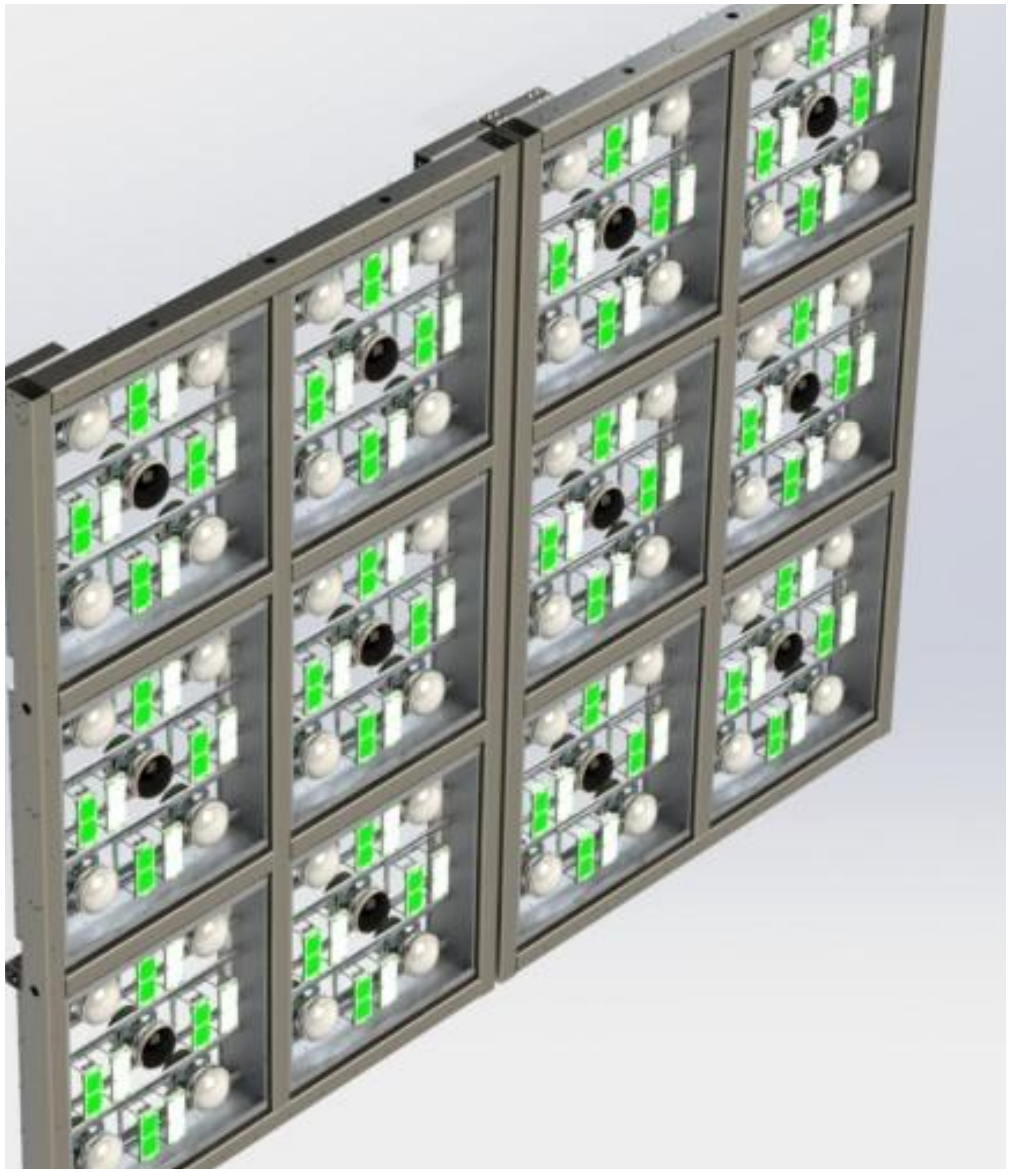


- A single central cathode dividing the TPC in two drift regions;
- Has reflective foils covered with wavelength shifter.

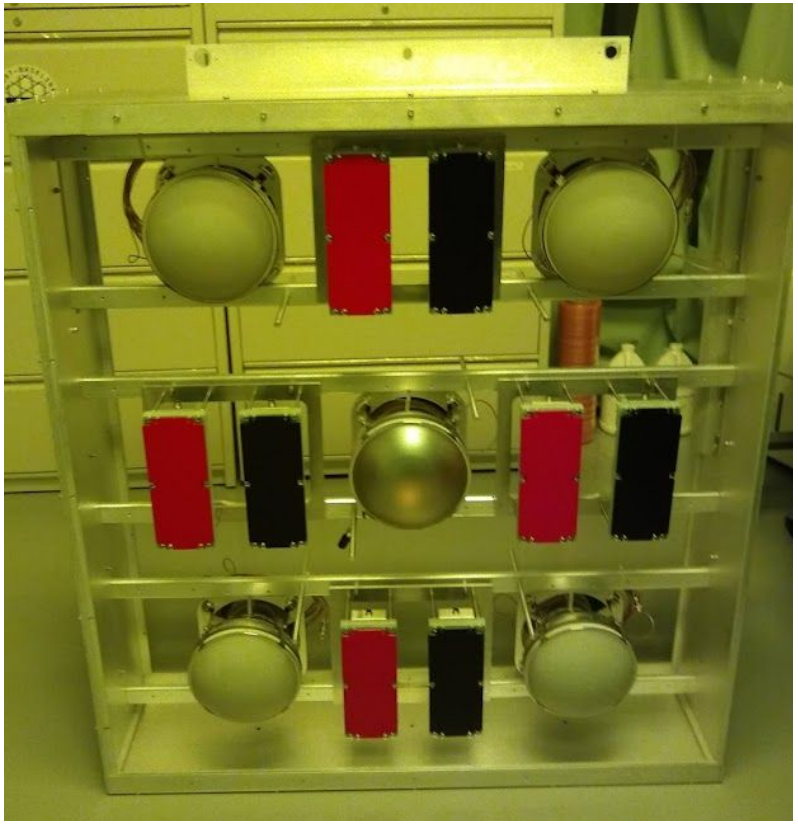




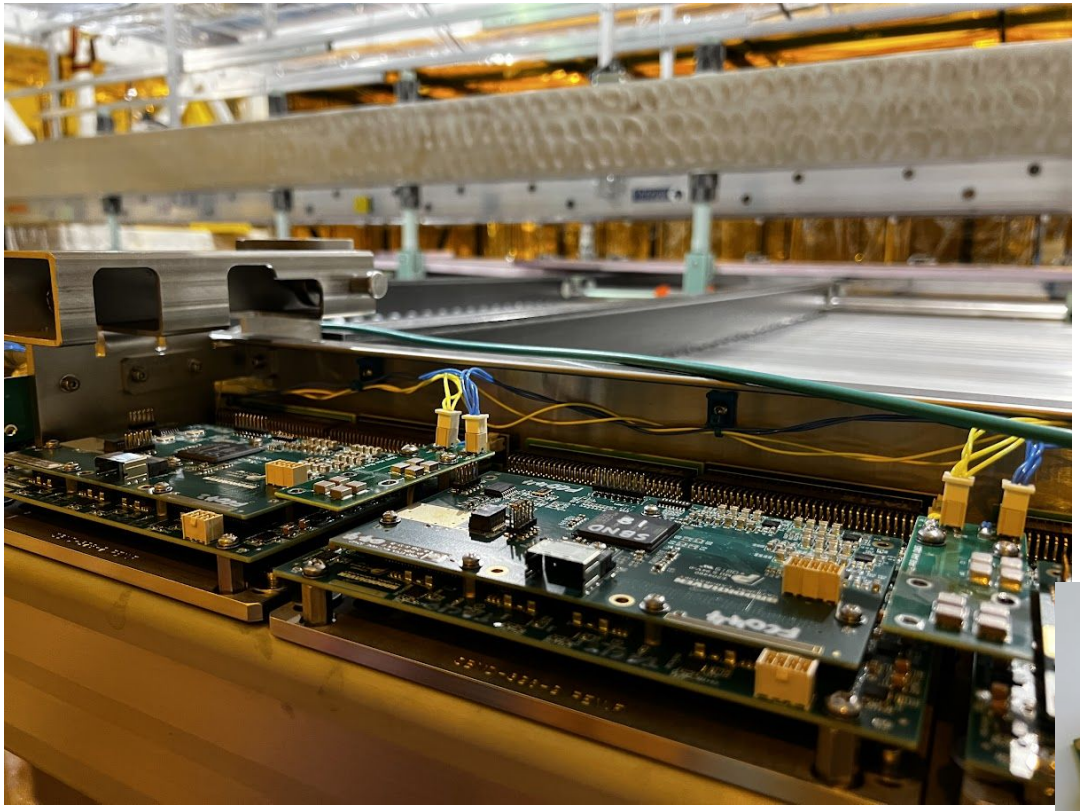
SBND: PDS (Photon Detection System)



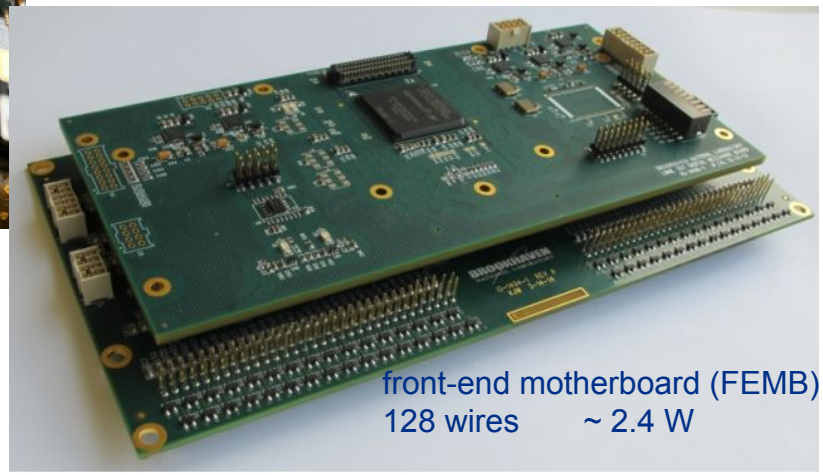
- Modular system behind the APAs: "looking" inside the TPC with 24 modules (12 per side);
- Each module have 5 8” PMTs and 8 X-ARAPUCAS;



SBND: Cold electronics

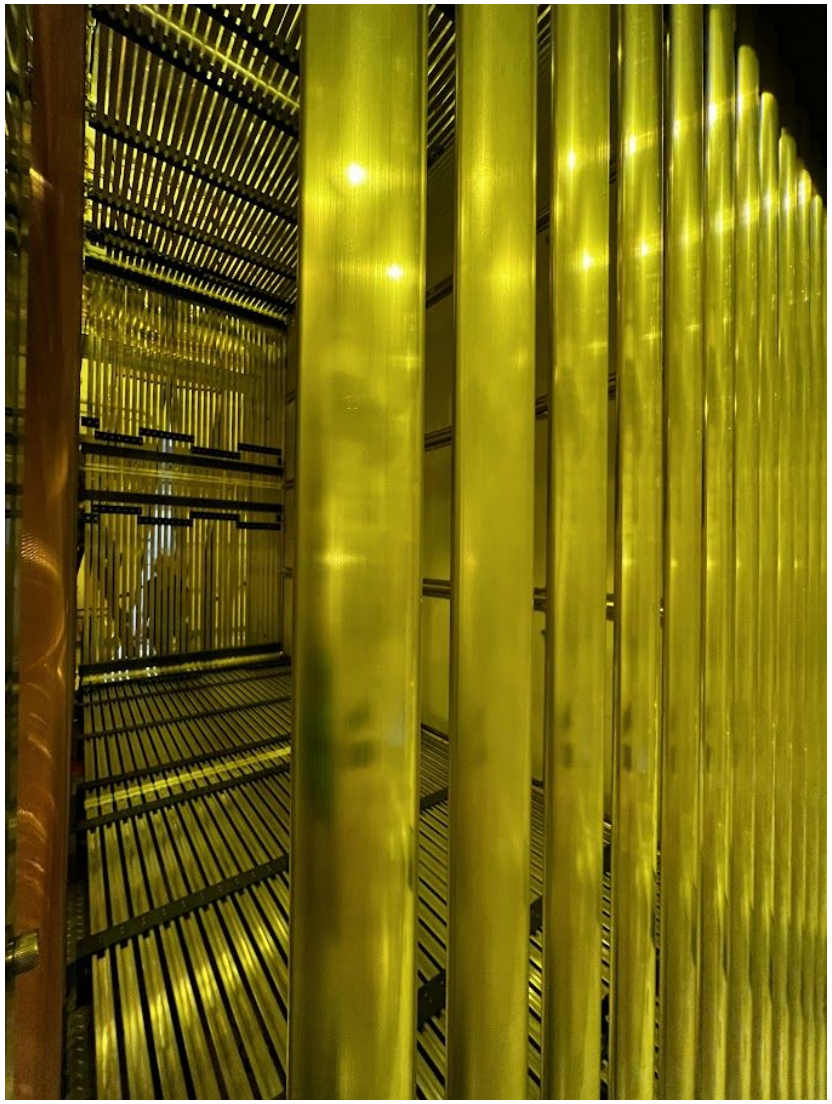


- Integrated front-end electronics close to detector electrodes yields the best SNR;
- 11,264 channels (sense wires);
- 88 cold mother boards FPGA based.

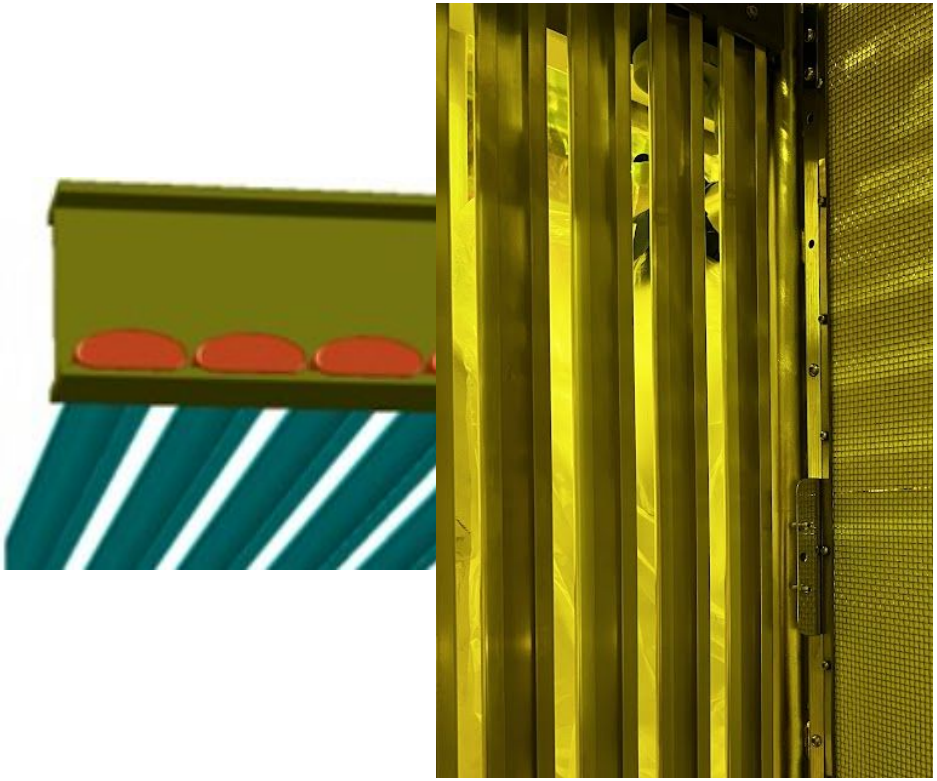


front-end motherboard (FEMB)
128 wires ~ 2.4 W

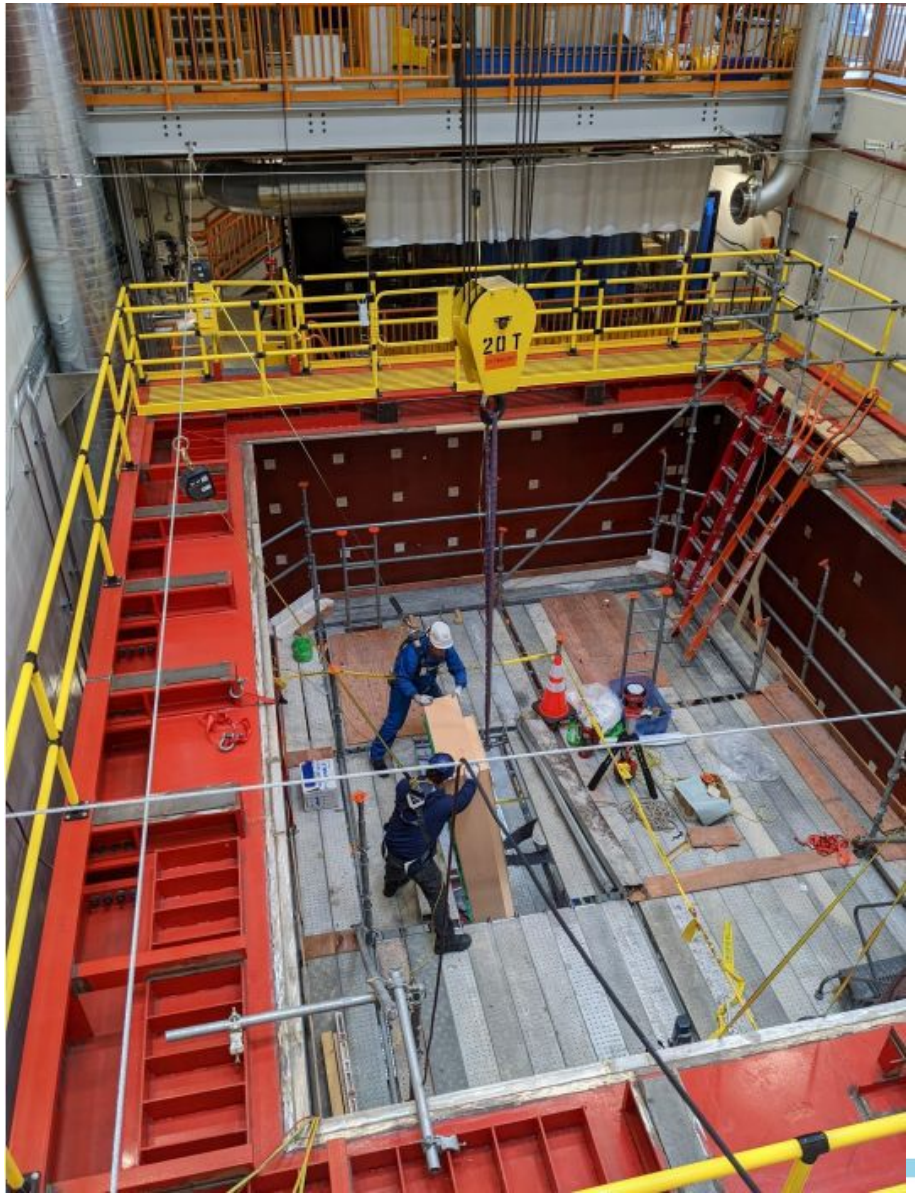
SBND: Field Cage



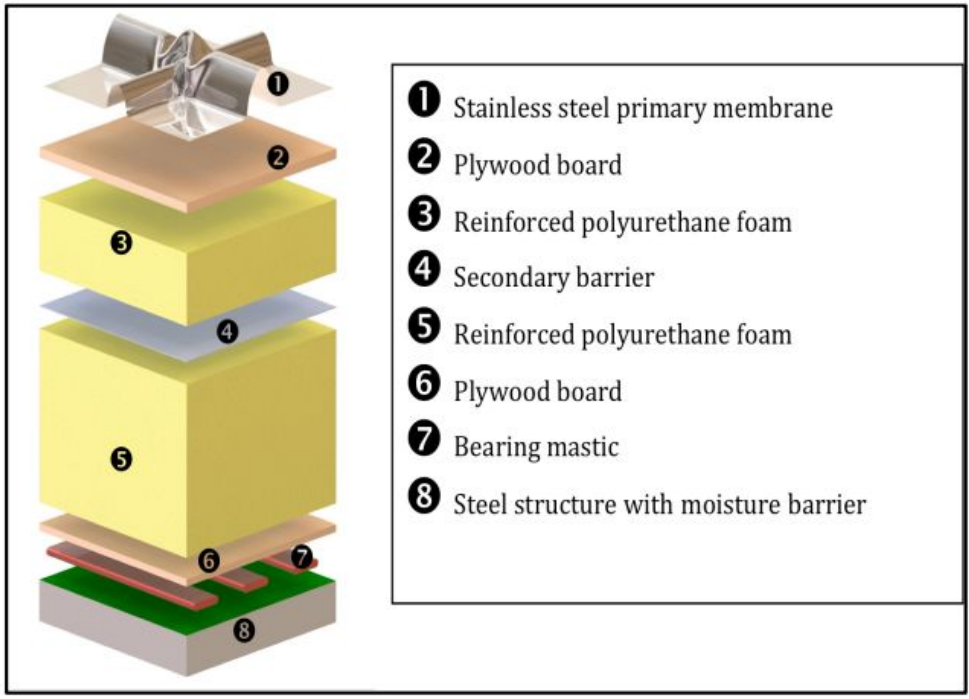
- Maintain 500 V/cm of drift field.;
- Constructed with roll-formed metallic profiles (C-shaped) makes it more robust and efficient to use in LAr;



SBND: Cryostat



- Membrane cryostat;
- Keeps the LAr in the temperature range of 86K-89K;
- Inner volume ~198 m³;



SBND: Status

- The APA and CPA are ready;
- Field Cages are installed;
- Cold electronics are installed;
- **SBND TPC completed this week!**
- We are now installing the PDS boxes.

Summary

- SBND have an extensive physics program including: search for eV mass-scale sterile neutrinos oscillations in the SBN program, neutrino cross-section measurements, and,search for new and exotic physics signals.

- SBND detector construction and installation are progressing very well.
- The SBND TPC completed this week!
- We expect to begin detector operations next year.
- Stay Tuned!

OBRIGADO!

(THANKS!)