# Status of APSAIA Installation in the SBND experiment

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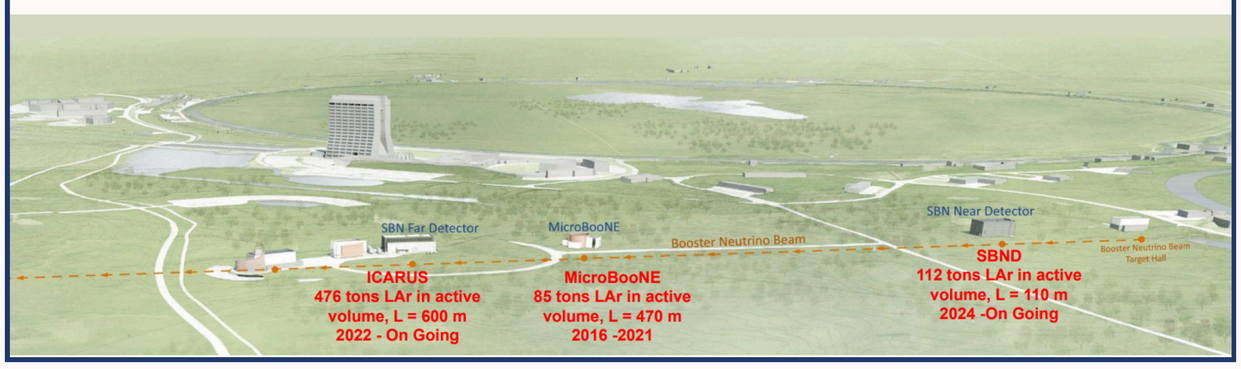
## Short-Baseline Near Detector (SBND)

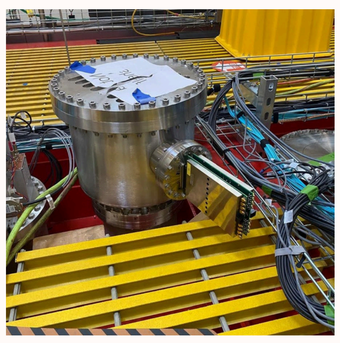
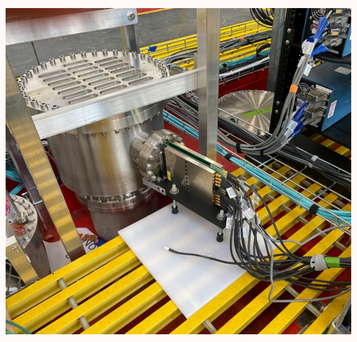
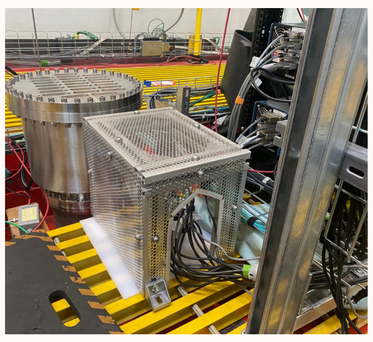
The Short-Baseline Near Detector (SBND), a 112 ton liquid argon time projection chamber (LArTPC), is the near detector of the Short-Baseline Neutrino Program [1] Located at only 110 m from the BNB target, it will precisely characterize the neutrino flux before oscillations take place.




## APSAIA Installation

When attached to the flange, the APSAIA exhibited instability in both vertical and horizontal orientations, creating potential risks to the connector over time.

A support was designed to protect the APSAIAs without the need to unscrew the flange. Due to their susceptibility to unforeseen impacts and kicks, a protective shield was developed for the APSAIA.

The proximity of the two APSAIA boards increased the probability of accidental contact due to horizontal instability, so a G10 piece with multiple holes to facilitate air passage was fixed between the two boards.



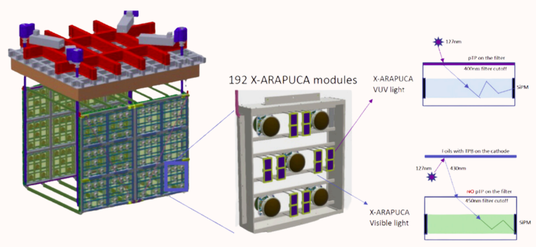

## X-Arapuca and PDS System

The Photon Detection System (PDS) its responsible for reading the scintillation light coming from the neutrinos interaction with the LAr in the interior of LArTPC. The system is made of 120 PMTs and 192 X-ARAPUCAs located behind the two anode planes. [2]



Front and back of X-ARAPUCA

The X-ARAPUCA is a photon trapping inside a highly reflective box while using a wavelength shifting slab inside the box to increase the probability of collecting trapped photons onto a silicon photomultiplier array [3].




## Readout Eletronics

16 X-Arapucas will be read by the APSAIA (Arapuca Power Supply and Input Amplifier) and 176 by the ARARA (Arapuca Analog Readout Amplifier)

### APSAIA

The APSAIAs, responsible for supplying power to the SiPMs and amplifying their output signals, were installed directly on the flanges of SBND's cryostat, on the warm side. Each board includes 8 channels, each containing one amplifier and one power supply for the SiPMs. Since each APSAIA ARAPUCA has 2 outputs, each APSAIA is responsible for 4 ARAPUCAs. Serial communication allows the possibility to control the level of the SiPMs bias and the gain of the amplifiers via an RS232 serial port.

### ARARA

The preamplifier board conditions and biases the signal between the X-ARAPUCA light collection hardware and the signal capture hardware The bias voltage must be programmed remotely using an RS232c. The power supply is available via a cable with a DSUB9 connector. The 352 signals from each flange are input to the ARARA boards. In the ARARA boards, the signals are ganged in groups of 4.

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**REFERENCES**

[1] ] P. A. Machado, O. Palamara, and D. W. Schmitz, Ann. Rev. Nucl. Part. Sci 69 (2019).
[2] G. Botogoske “Application of ARAPUCA technology for detection of scintillation light in liquid argon and Cherenkov radiation in water” (2023)
[3] A.A. Machado et al 2018 JINST 13 C04026 (2018)