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Reconstruction capabilities of the Photon Detection System of SBND

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SBND is a Liquid Argon Time Projection Chamber located 110 m from the neutrino source at Fermilab, serving as the near detector for the Short Baseline Neutrino program. With a 112-ton active mass, it enables high-precision studies of neutrino-argon interactions. The detector began data-taking in 2024. Its Photon Detection System (PDS) combines 120 PMTs and 192 X-ARAPUCA devices behind the anode, while reflective wavelength-shifting panels on the cathode enhance light collection especially in the regions furthest away from the detectors. This novel design provides high light yield, more uniform detection efficiency, excellent time resolution, and independent 3D position reconstruction using only scintillation light. This talk will detail the various calibration procedures implemented to optimize the reconstruction capabilities of the PDS. Among the system's many features, particular emphasis will be placed on the achieved timing resolution, which reaches the order of nanoseconds. This level of precision ultimately allows for the recovery of the pulse structure of the Booster Neutrino Beam.

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