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The SBND X-ARAPUCA system

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SBND is a time-projection chamber that collects ionisation electrons and scintillation photons from liquid argon (LArTPC). It is located 110 m downstream the Booster Neutrino Beam target at Fermilab and began taking data this year. The SBND physics program is focused on neutrino-argon cross-sections and beyond the Standard Model searches (sterile neutrinos, heavy neutral leptons, light dark matter...). The photodetection system (PDS) provides trigger capabilities, cosmic-rays rejection (a large background due to the near-surface detector location), and complementary calorimetry. The PDS includes PMTs and X-ARAPUCAs sensors, a novel technology that features single photo-electron resolution at cryogenic temperatures with large area coverage in a cost-effective fashion by trapping and guiding the light to arrays of SiPMs. SBND features two types of X-ARAPUCAs, one mostly sensitive to vacuum ultra-violet (VUV) scintillation and one sensitive to visible light produced in the detector by TPB-coated reflective foils. SBND is the only experiment currently testing the X-ARAPUCA technology in a neutrino beam over a period of several years, and will provide key lessons for future detectors like DUNE. In order to characterize the sensor it is essential to estimate its photon detection efficiency (PDE). In this talk, we present an overview of the SBND X-ARAPUCA system and the PDE measurements at cryogenic temperature carried out at the CIEMAT laboratory.

Abstract

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