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X-ARAPUCA Characterization and Large-Scale Assembly for DUNE

The Deep Underground Neutrino Experiment (DUNE) is a next-generation long-baseline experiment exploiting the liquid argon TPC technology. DUNE will employ a photon detection system based on X-ARAPUCA devices. These detectors capture incoming vacuum ultraviolet (VUV) photons via internal reflection within a wavelength-shifting light guide, enabling their detection by silicon photomultiplier (SiPM) arrays sensitive to visible light. The photon detection efficiency of the X-ARAPUCAs has been measured for several configurations in liquid argon at CIEMAT. These studies, carried out as part of an R&D optimization campaign, demonstrate significant improvements in detector performance for both the Vertical and Horizontal Drift designs for the DUNE Far Detector, ultimately leading to a baseline design without dichroic filters. The next step involves the large-scale assembly and characterization of 350 X-ARAPUCA devices at CIEMAT, which will be installed on the cryostat walls of the DUNE Far Detector Vertical Drift module.

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