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R&D and characterization of wavelength-shifting reflectors for LEGEND and for future LAr-based detectors

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Particle detectors based on liquid nobles, such as liquid argon (LAr), often require surfaces that shift the short vacuum ultraviolet (VUV) scintillation light towards the visible range and then reflect it. For the LAr instrumentation of the LEGEND-200 neutrinoless double-beta decay experiment, the wavelength shifter tetraphenyl butadiene (TPB) was in-situ evaporated on 14m2 of the reflector Tetratex. For even larger detectors, plastic films of polyethylene naphthalate (PEN) are investigated as an option to ease scalability. We have measured the light yield from combinations of reflectors with TPB or PEN in a LAr setup. The effective light yield in the setup was determined by using a reference sample and a VUV sensitive PMT. We thus obtained the comparative efficiency of the wavelength-shifting reflective combinations, and also estimated the quantum efficiency of TPB and PEN in LAr (at 87K) for the first time. We report on these results as well as on the current R&D on wavelength-shifting reflectors for LEGEND-1000 and other future LAr-based detectors.

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