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Determination of the photon detection efficiency, time and spatial resolution of the light collecting system of the near liquid argon detector (ND-LAr) of the DUNE experiment.

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DUNE is a long-baseline experiment for neutrino oscillation studies. Its near detector complex consists of three main parts. One of them is ND-LAr, the liquid argon time projection chamber (LAr-TPC). In this type of detectors, a light collecting system (LCS) is commonly used as a trigger system. In this work the ND-LAr LCS is considered. It consists of two different types of photodetectors: LCM and ArCLight. The data from ProtoDUNE Dual Phase and Module 0 LAr-TPC prototypes was used to obtain the correct parameters of scintillation in liquid argon for Geant4 simulation. Then, the response of the Module 0 LCS in events with cosmic muons was compared with the response of its Geant4 model in identical simulated events to estimate the photon detection efficiency of LCM and ArCLight modules. After that, two-particle events with different shifts in time and space between tracks were simulated to determine the time and spatial resolution of the ND-LAr LCS. The capabilities of LCM and ArCLight technologies are compared. Obtained results allow us to judge whether the characteristics of the ND-LAr LCS satisfy the experiment requirements.

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