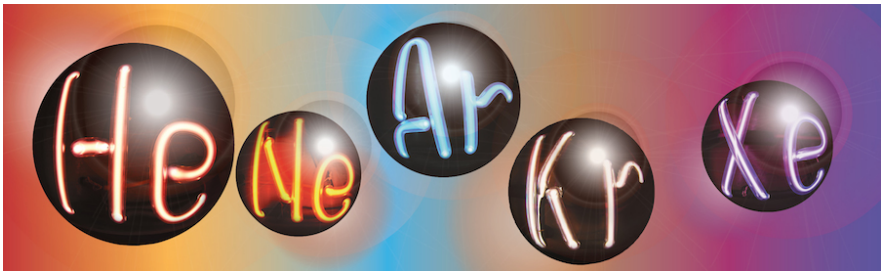

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Study of geometric efficiency of photon detection in LArTPC using Monte Carlo simulation

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Study of geometric efficiency of photon detection in LArTPC using Monte Carlo simulation

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Abstract

The Deep Underground Neutrino Experiment (DUNE) is a leading-edge international experiment, which aims to answer some of the open questions in neutrino physics and, consequently, contribute to the investigation of several fundamental questions about the nature of matter and the evolution of the universe. The DUNE far detector uses a liquid argon time projection chamber (LArTPC) to reconstruct neutrino interactions by detecting charged particles and light signals. Particularly, the light detection system is a fundamental part of the detector, responsible for triggering the detector and determination of initial time of events,and might also contribute to particle identification and calorimetric purposes. Computational simulations are important tools that can be used to investigate the mechanisms of production, detection, and propagation of photons in the LArTPC, helping in the prediction and optimization of photon detection efficiency in the detection system. In this work, Monte Carlo computer simulations were performed using the GEANT4 program to determine the detection efficiency of photons under different geometric conditions in the LArTPC. Simulations were carried out by varying the angular detection parameters as well as the distance between the emission point and the photo-detection system. The results allowed the estimation of photon detection efficiency under the investigated geometric conditions. Additionally, the angular and distance correction factors for theoretical attenuation model (based only on photon transmission) were determined.

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