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Study of the Photon Detection System in DUNE using simulation techniques

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The Deep Underground Neutrino Experiment (DUNE) is a long baseline neutrino experiment under construction that aims to address the main open questions in neutrino physics such as the ordering of the mass hierarchy and the precise measurement of the neutrino oscillation parameters, including the charge-parity violation phase to determine the existence (or not) of the CP-violation in the leptonic sector. It will consist of a Near Detector (ND) located at Fermilab (Chicago) and a Far Detector (FD) in South Dakota, 1300 km away. The FD will consist of four detector modules, the second of which will be instrumented with a 17 kton Vertical Drift Liquid Argon Time Projection Chamber (VD LAr TPC) which allows for excellent imaging capabilities for neutrino event reconstruction. The passage of charged particles through LAr produces both ionization electrons and scintillation photons. While the first are detected by the TPC, a dedicated Photon Detection System (PDS) recovers the light information.
Since the DUNE Far Detector is still under construction, simulation studies are a key instrument to study the future detector performance. In particular, I will be discussing studies related to the PDS performance, regarding light event simulation and reconstruction using clustering algorithms, and showing results on the efficiency of this method mainly towards spatial reconstruction for the neutrino events, and proposing the next steps in this method..

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