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Light detection in DUNE Dual Phase

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Summary

Proposed for construction 1.5km underground in the Sanford Underground Research Facility (South Dakota, US), the Deep Underground Neutrino Experiment (DUNE) will hold four 10 kton fiducial mass modules of liquid argon (LAr) to trap a beam of neutrinos sent from Fermilab, 1,300 km away. DUNE will perform precision measurements of the PMNS mixing parameters, determine unambiguously the MH and has the potential to discover leptonic CP violation. It also comprises a rich non-accelerator physics program as the detection of supernova neutrinos, nucleon decay and BSM physics.

In the first phase of DUNE, two LArTPC modules of different technologies are proposed to be built, with equivalent prototypes being assembled now at CERN (protoDUNEs): a first single-phase module, and a second dual-phase one with a gaseous argon phase to amplify the signal.

Inside the DUNE Dual Phase module, a light detection system (LDS) is being designed, consisting in an array of PMTs and a calibration system based in optical fibers. The LDS will be able to provide a trigger to non-beam events such as supernova neutrinos or proton decay candidates. It will also contribute to the calorimetric reconstruction, and will provide a t_0 to the non-beam events. To fulfill the physics program, the LDS is aimed to comply with certain physics requirements. Those are to provide a detection efficiency of more than 90% for a Supernova Burst within the Milky Way and a t_0 reconstruction efficiency of more than 90% across the active volume for proton decay event candidates, with a signal purity of 90%.

In this sense, simulation studies have been performed to ensure that the proposed design meets these requirements: A full simulation of the detector has been implemented, including the propagation of the light inside the detector, and the PMT response and digitization.

The proposed poster will summarize the status of the studies that are ongoing concerning the simulation of the light detection in DUNE Dual Phase, and the expected performance of the LDS, that will be part of the forthcoming Technical Design Report of DUNE.

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