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## Development of charge-based calibration systems for LAr-TPCs in the DUNE Experiment

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Large liquid argon time projection chambers (LAr-TPCs) are playing an increasingly important role in neutrino physics, with several past and present accelerator neutrino experiments choosing this technology for their designs. The upcoming DUNE experiment will supersede all its predecessors both in size and physics reach. The calibration of the DUNE detector will be an essential component of its capability to reach the required performance and precision. In the past experiments, natural sources have been extensively used, but for DUNE these present limitations, since natural radioactivity from Ar-39 is of low energy, and the rate of cosmic ray muons is low when the detectors are placed deep underground. Since several decades, argon gas TPCs have been calibrated with ionizing laser beams, and more recently the technique has been further developed for use in liquid TPCs. Other recent ideas include the use of external neutron generators creating pulses that propagate into the detector. This talk will outline the methods employed for the calibration of DUNE, as well as a description of the planned systems and their goals, including the plans for the upcoming runs of ProtoDUNE, the large scale prototypes deployed at CERN that will be running later this year.

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