

LArIAT - testing and simulating the light readout system on the way towards light - augmented calorimetric reconstruction and PID.

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With the ongoing construction, commissioning and proposals of new detectors and intensive R&D efforts, liquid argon Time Projection Chambers (TPCs) are starting to become a crucial technology in the US neutrino program. Their scope of use in the near and more distant future covers such urgent problems in weak interaction physics as the search for sterile neutrinos, the neutrino mass hierarchy or CP violation in the neutrino sector. If they are to be resolved, precise measurements are inevitable. To make them possible, the technology has to be calibrated in a controlled environment. As an answer to this demand, the LArIAT test beam experiment will operate the former ArgoNeuT LAr TPC in the Fermilab Testbeam Facility (FTBF). The detection capabilities of the chamber will be enhanced by a photomultiplier - based light readout system, composed of standard and high quantum efficiency PMTs, as well as SIPMs and the wavelength shifter covering walls. This novel approach to the light detection in LArTPCs will aim to implement a Dark Matter search-like system in order to use the scintillation light to augment the particle identification algorithms and a calorimetric reconstruction. To optimize its performance, detailed studies of light collection were performed using the improved version of the LArSOFT software package. The results of these simulation, including among others the necessary coverage of the TPB wavelength shifter on the full chamber walls as well as the light yield uniformity study will be presented. To assure the proper hardware functioning, before commissioning of the full detector, the PMT setup was tested in a small chamber at the University of Chicago. The results of these tests, also outlined in this talk, were then used to validate and refine simulations of the full detector.

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