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TPC Simulation and Signal Processing for LArTPCs

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The single-phase liquid argon time projection chamber (LArTPC) provides a large amount of detailed information in the form of fine-grained drifted ionization charge from particle traces. It has a great capability of identifying various particles and doing energy reconstruction. The Deep Underground Neutrino Experiment (DUNE) which is one of the biggest neutrino experiments in the following 10-20 years will utilize LArTPC technology for a rich assortment of physics. The ongoing Short Baseline Neutrino Program (SBN) also uses three LArTPCs at various baselines to search sterile neutrinos and do other precision physics. In this talk, I' ll focus on a robust signal processing technique that accurately converts the raw digitized TPC waveforms into the number of ionization electrons for induction and collection anode type wire planes. The long-range induction of ionization electrons passing through the wire planes is taken into account and the amplified equivalent noise charge in induction plane is mitigated. This work provides a solid foundation to fully utilize the capabilities of LArTPC and feed to all downstream event reconstruction paradigms. Technical issues and solutions will be discussed. Performance and applications will be shown.

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