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Reconstruction for Liquid Argon TPC Neutrino Detectors Using Parallel Architectures

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Neutrinos are particles that interact rarely, so identifying them requires large detectors which produce lots of data. Processing this data with the computing power available is becoming more difficult as the detectors increase in size to reach their physics goals. In liquid argon time projection chambers (TPCs) the charged particles from neutrino interactions produce ionization electrons which drift in an electric field towards a series of collection wires, and the signal on the wires is used to reconstruct the interaction. The MicroBooNE detector currently collecting data at Fermilab has 8000 wires, and planned future experiments like DUNE will have 100 times more, which means that the time required to reconstruct an event will scale accordingly. Modernization of liquid argon TPC reconstruction code, including vectorization, parallelization and code portability to GPUs, will help to mitigate these challenges. The liquid argon TPC hit finding algorithm within the LarSoft framework used across multiple experiments has been vectorized and parallelized. This increases the speed of the algorithm on the order of ten times within a stand alone version on Intel architectures. This new version has been incorporated back into LarSoft so that it can be generally used. These methods will also be applied to other low level reconstruction of the wire signals such as the deconvolution. The applications and performance of this modernized liquid argon TPC wire reconstruction will be presented.

Consider for promotion

Yes

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