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Highly-parallelized simulation of a 3D pixelated charge readout for liquid argon time projection chambers STEFANO ROBERTO SOLETI, Lawrence Berkeley National Laboratory — The rapid development of general-purpose computing on graphics processing units (GPGPU) is allowing the implementation of highly-parallelized Monte Carlo simulation chains for high-energy physics experiments. This technique is particularly suitable for the simulation of a 3D pixelated charge readout for liquid argon time projection chambers, given the large number of channels that this technology employs. This solution is actively being explored by the DUNE collaboration for the design of the near detector. Here we present the first implementation of a full Monte Carlo simulator for a 3D pixelated charge readout using a set of GPU-optimized algorithms. The algorithms have been written in Python and translated into CUDA kernels using Numba, a just-in-time compiler for a subset of Python and NumPy instructions. The results of the simulation are compared against data from prototype LArTPCs employing 3D pixelated charge readout. This implementation will also allow taking full advantage of Perlmutter, the next-generation NERSC supercomputer, which will feature dedicated NVIDIA GPU nodes.

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