

Evaluation of Portable Acceleration Solutions for LArTPC Simulation Using Wire-Cell Toolkit

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The Liquid Argon Time Projection Chamber (LArTPC) technology plays an essential role in many current and future neutrino experiments. Accurate and fast simulation is critical to developing efficient analysis algorithms and precise physics model projections. The speed of simulation becomes more important as Deep Learning algorithms are getting more widely used in LArTPC analysis and their training requires a large simulated dataset. Heterogeneous computing is an efficient way to delegate computing-heavy tasks to specialized hardware. However, as the landscape of the compute accelerators is evolving fast, it becomes more and more difficult to manually adapt the code constantly to the latest hardware or software environments. A solution which is portable to multiple hardware architectures while not substantially compromising performance would be very beneficial, especially for long-term projects such as the LArTPC simulations. In search of a portable, scalable and maintainable software solution for LArTPC simulations, we have started to explore high-level portable programming frameworks that support several hardware backends. In this paper, we will present our experience porting the LArTPC simulation code in the Wire-Cell toolkit to NVIDIA GPUs, first with the CUDA programming model and then with a portable library called Kokkos. Preliminary performance results on NVIDIA V100 GPUs and multi-core CPUs will be presented, followed by a discussion of the factors affecting the performance and plans for future improvements.

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