Contribution ID: **703** Contribution code: **contribution ID 703** Type: **Poster**

Evaluation of Portable Programming Models to Accelerate LArTPC Detector Simulations

The Liquid Argon Time Projection Chamber (LArTPC) technology is widely used in high energy physics experiments, including the upcoming Deep Underground Neutrino Experiment (DUNE). Accurately simulating LArTPC detector responses is essential for analysis algorithm development and physics model interpretations. But because of the highly diverse event topologies that can occur in LArTPCs, accurate detector response simulations are computationally demanding, and can become a bottleneck when Deep Learning algorithms trained on large simulated data sets become more widely adopted. Compute accelerators such as General-Purpose Graphics Processing Units (GPGPUs) have the potential to speed up the simulations significantly compared to the traditional CPU-only processing, often at the cost of specialized code refactorization and porting. With the rapid evolution and increased diversity of the computer architecture landscape, it is highly desirable to have a more sustainable solution that minimizes code changes for new architectures while maintaining reasonable performance.

In this presentation we will report our ongoing effort in evaluating different performance portable programming models for LArTPC simulations in the context of the Wire-Cell Toolkit, a new C++ library developed for LArTPC simulations, data analysis, reconstruction and visualization. We have implemented the signal simulations in LArTPC initially with the CUDA programming framework specialized for NVIDIA GPUs as a baseline, then with the more portable Kokkos abstraction layer. Preliminary results were presented at the vCHEP2021 conference. Since then we have made several improvements to the Kokkos implementation, which allow us to run the code on multicore CPUs, NVIDIA GPUs and AMD GPUs with substantial performance improvement compared to the original CPU code. We will report the lessons learned and the strategies we have developed to overcome some issues with using Kokkos in the Wire-Cell Toolkit.

Significance

References

vCHEP21 proceedings: https://www.epj-conferences.org/articles/epjconf/pdf/2021/05/epjconf_chep2021_03032.pdf
vCHEP21 slides and recording: https://indico.cern.ch/event/948465/contributions/4323675/

Speaker time zone

Compatible with America

Primary authors: DONG, Zhihua (Brookhaven National Laboratory); KNOEPFEL, Kyle (Fermi National Accelerator Laboratory); LIN, Meifeng (Brookhaven National Laboratory (US)); VIREN, Brett (Brookhaven National Laboratory); YU, Haiwang (Brookhaven National Laboratory); YU, Kwangmin (Brookhaven National Laboratory)

Presenter: LIN, Meifeng (Brookhaven National Laboratory (US))

Session Classification: Posters: Raspberry

Track Classification: Track 1: Computing Technology for Physics Research