Contribution ID: **149** Type: **Long talk**

Accelerating IceCube's Photon Propagation Code with CUDA

Wednesday, 19 May 2021 16:50 (30 minutes)

The IceCube Neutrino Observatory is a cubic kilometer neutrino detector located at the geographic South Pole designed to detect high-energy astrophysical neutrinos. To thoroughly understand the detected neutrinos and their properties, the detector response to signal and background has to be modeled using Monte Carlo techniques. An integral part of these studies are the optical properties of the ice the observatory is built into. The simulated propagation of individual photons from particles produced by neutrino interactions in the ice can be greatly accelerated using graphics processing units (GPUs). In this paper, we (a collaboration between NVIDIA and IceCube) reduced the propagation time per photon by a factor of 3. We achieved this by porting the OpenCL parts of the program to CUDA and optimizing the performance. This involved careful analysis and multiple changes to the algorithm. We also ported the code to NVIDIA OptiX to handle the collision detection. The hand-tuned CUDA algorithm turned out to be faster than OptiX. It exploits detector geometry and only a small fraction of photons ever travel close to one of the detectors.

Primary authors: RIEDEL, Benedikt (University of Wisconsin-Madison); SCHWANEKAMP, Hendrik (NVIDIA Corp); HOHL, Ramona (NVIDIA Corp)

Co-authors: GIBBS, Tom (NVIDIA Corp); CHIRKIN, Dmitry (UW-Madison); HARNISCH, Alexander (Michigan State University); MESSMER, Peter (NVIDIA Corp.); VAN SANTEN, Jakob (DESY-Zeuthen); SCHULTZ, David (UW-Madison); RONGEN, Martin (ohannes Gutenberg-Universitaet Mainz); OLIVAS, Alexander (UMD-College Park); MEHTA, Vishal (NVIDIA Corp.)

Presenter: RIEDEL, Benedikt (University of Wisconsin-Madison)

Session Classification: Weds PM Plenaries

Track Classification: Offline Computing