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Porting HEP Parameterized Calorimeter Simulation Code to GPUs

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The High Energy Physics (HEP) experiments, such as those at theLarge Hadron Collider (LHC), traditionally consume large amounts of CPUcycles for detector simulations and data analysis, but rarely use compute accelerators such as GPUs. As the LHC is upgraded to allow for higher luminosity,resulting in much higher data rates, purely relying on CPUs may not provideenough computing power to support the simulation and data analysis needs. Asa proof of concept, we investigate the feasibility of porting a HEP parameterized calorimeter simulation code to GPUs. We have chosen to use FastCaloSim,the ATLAS fast parametrized calorimeter simulation. While FastCaloSim issufficiently fast such that it does not impose a bottleneck in detector simula-tions overall, significant speed-ups in the processing of large samples can beachieved from GPU parallelization at both the particle (intra-event) and eventlevels; this is especially beneficial in conditions expected at the high-luminosityLHC, where an immense number of per-event particle multiplicities will resultfrom the many simultaneous proton-proton collisions. We report our experi-ence with porting FastCaloSim to NVIDIA GPUs using CUDA. A preliminaryKokkos implementation of FastCaloSim for portability to other parallel archi-tectures is also described

Primary authors: Dr LEGGETT, Charles (Lawrence Berkeley National Lab (US)); DONG, Zhihua (Brookhaven National Laboratory); LIN, Meifeng (Brookhaven National Laboratory (US)); GRAY, Heather (UC Berkeley/LBNL); PASCUZZI, Vincent (Lawrence Berkeley National Lab. (US)); YU, Kwangmin (Brookhaven National Laboratory)

Presenter: Dr LEGGETT, Charles (Lawrence Berkeley National Lab (US))

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