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Towards GPU Accelerated Full Simulation of Optical Calorimetry with Celeritas

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Dual readout calorimeters and noble gas time projection chambers require accurate modelling of Cerenkov photons to determine energy resolution and timing uncertainty of the detectors. Due to the high multiplicity of optical photons in a single event, fast parameterizations are often used to improve computational throughput at the cost of precision. Leveraging GPU hardware can make full optical photon simulations viable for characterizing detector response. The Celeritas Project is a GPU accelerated particle transport code optimized for High Performance Computing (HPC) systems. Currently Celeritas is capable of simulating electromagnetic showers and is currently being expanded to include optical photon physics, muon electromagnetic and decay physics, and neutron transport. In order to be easily integrated with existing Geant4 programs, Celeritas may be used as a drop-in replacement or as a target to off-load specified particle tracks to the GPU. Integration efforts into the CMS and Calvision software frameworks are currently proposed.

Primary author: Dr JOHNSON, Seth (ORNL)

Co-authors: LUND, Amanda; MORGAN, Benjamin (University of Warwick); BIONDO, Elliott; HOLLENBECK, Hayden (University of Virginia); LIMA, Jose Guilherme; ESSEIVA, Julien; CANAL, Philippe; JUN, SOON YUNG; CASTRO TOGNINI, Stefano; EVANS, Tom (Oak Ridge National Laboratory)

Presenter: HOLLENBECK, Hayden (University of Virginia)

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