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Accelerating detector simulations with Celeritas: performance improvements and new capabilities

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Celeritas is a rapidly developing GPU-enabled detector simulation code aimed at accelerating the most computationally intensive problems in high energy physics. This presentation will highlight exciting new performance results for complex subdetectors from the CMS and ATLAS experiments using EM secondaries from hadronic interactions. The performance will be compared on both Nvidia and AMD GPUs as well as multicore CPUs, made possible by a new native Celeritas geometry representation of Geant4 geometry objects. This new surface-based geometry, ORANGE, provides a robust and efficient navigation engine fundamentally different from existing detector simulation models. Finally, we introduce two new physics capabilities to Celeritas, optical photon tracking and extended EM models, that demonstrate the code's extensibility and promise potential applications beyond LHC detectors.

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