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Opticks : GPU ray trace accelerated optical photon simulation

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Opticks is an open source project that accelerates optical photon simulation by integrating NVIDIA GPU ray tracing, accessed via the NVIDIA OptiX API, with Geant4 toolkit based simulations.

Optical photon simulation times of 14 seconds per 100 million photons have been measured within a fully analytic JUNO GPU geometry auto-translated from the Geant4 geometry when using a single NVIDIA GPU from the first RTX generation.

Optical physics processes of scattering, absorption, scintillator reemission and boundary processes are implemented in CUDA based on Geant4. Wavelength-dependent material and surface

properties as well as inverse cumulative distribution functions for reemission are interleaved into GPU textures providing fast interpolated property lookup or wavelength generation. In this work we describe the application of Opticks to JUNO simulation including new Opticks features that improve performance for complex CSG shapes and torus solids.

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