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GGEMS - GPU Geant4-based Monte Carlo Simulations

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In medical physics, GPU-based Monte Carlo simulations (MCS) have been proposed for computational gains. However, they remain limited to specific applications and are not easily generalized.

GGEMS (GPU Geant4-based Monte Carlo Simulations) is advanced MCS software that uses OpenCL. Entirely written in C++, its software architecture allows flexibility and generality for numerous applications such as imaging and radiation therapy. It has been validated on architectures including NVIDIA and Intel graphics cards, as well as multi-core Intel processors on both Windows and Linux. A Python interface is provided for scripting, and an OpenGL graphical interface has been developed to assist users.

GGEMS was evaluated through various medical applications, demonstrating fast simulation. For example, for a CT projection simulating 10^9 particles, the computation times were: 112s on GeForce 1050Ti, 385s on Quadro P400, 421s on Xeon 16 threads, and 91s on 1050Ti+P400.

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