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Summary

This article discusses the usage of ray-tracing with the Monte-Carlo simulation of high energy photon transport for Positron Emission Tomography. This engine being used, known as GRAY, was improved upon to assist in solving the various issues and problems with the intersection test, accelerating said intensive task. On top of this, the High Energy Photon Ray Tracer (GRAY) was provided with Doppler broadening, X-ray escape, and coherent scattering in order to let the device provide a product able to reproduce the same physical accuracy as the GEANT4. Being able to accelerate the intersection tests allowed the Monte-Carlo ray tracer to reach a speed up to 5.2 times faster than before, and in doing so shortened those tests by 7.2 times. A future goal by the authors includes testing the simulation's capabilities to be used as the forward model in iterative image reconstruction algorithms.