GEANT4-Gamma Diffraction Code Based on Laue lens Modelling: Design Foundation and Implementation of the First Set of Models in GEANT4

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Background: Laue gamma diffraction has recently attracted considerable attention as a powerful method for developing a high energy rays focuser. Conducting physical experiments on Laue lens behaviour presents itself as a fundamental tool for elucidating the main concept in gamma diffraction. However, Laue lens manufacture is quite challenging as it requires high precision in positioning and aligning diffractive crystals of various elements. Readily feasible alternatives to physical experiments are computer simulations in stable state-of-the-art high-energy physics Monte Carlo simulation environments such as GEANT4. However, the Laue diffraction process hasn't been implemented so far in any of these available platforms.
Material and Methods: This paper presents the first attempt to model x-ray and gamma ray focusing based on Laue diffraction in the GEANT4 toolkit using an advanced example in its early conception. We discuss the critical aspects of the implemented advanced Laue lens example. The developed example models the wave-based properties of gamma rays and predicts the diffracted, transmitted, and absorbed gamma ray locations on the detector plane based on a Monte Carlo simulation.
Preliminary results: We will present the first successful simulations for the Laue lens diffraction example with the early version of our code.

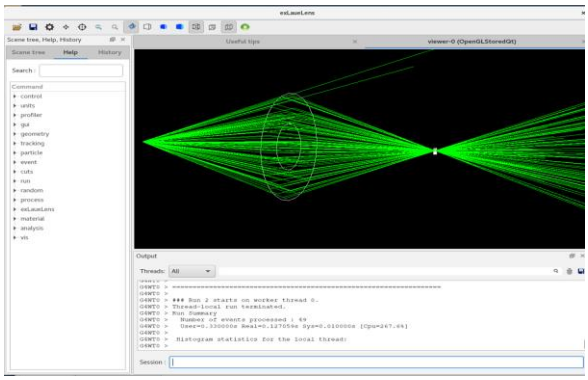

Figure 1. Simulation of the diffracted photons only on the detector plane for the proposed geometry and its visualization.