New Geant4 model of channeling in crystals and its potential applications in medical physics

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Background: Channeling radiation of charged particles in a crystal [1] is a promising source of highly focused intense X- and γ-rays for medical physics, nuclear physics, accelerator physics etc. Our goal is to implement this physics into Geant4 which is completely missing in this package by now.
Material and Methods: The main idea is the implementation of the methods of simulation of trajectories and radiation spectra by charged particles in oriented crystals developed in the CRYSTALRAD simulation code [1] into Geant4 using FastSim interface.
Preliminary results: We present the new simulation model of channeling of electrons and positrons implemented into Geant4. The preliminary comparison of Geant4 simulations of the deflection 855 MeV electrons at Mainz Mikrotron MAMI with both experimental data and CRYSTALRAD simulations is presented in Fig. 1. We also discuss the progress of radiation model implementation.

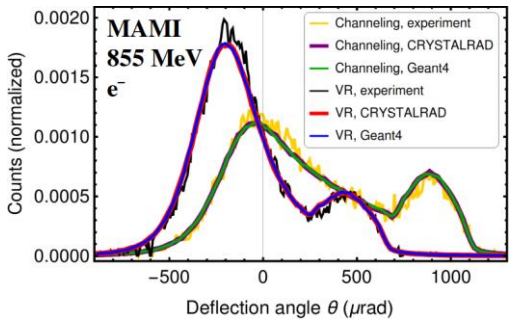

Figure 1: Comparison of Geant4 simulations with the experimental data and the CRYSTALRAD simulations for the deflection of 855 MeV electrons by a Si oriented crystal at the conditions of experiment at Mainz Mikrotron MAMI [2].

[1] A. I. Sytov, V. V. Tikhomirov, and L. Bandiera, PRAB 22 (2019) 064601 1-10.

[2] A. Mazzolari et al. Phys. Rev. Lett. 112 (2014) 135503 1-6.