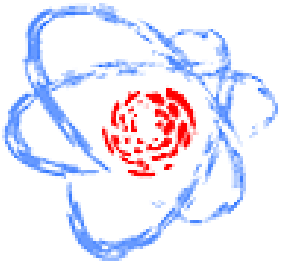

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The simulation of very cold neutron transport in nanodiamond reflectors using Geant4

Tuesday, 7 June 2022 12:45 (10 minutes)

Efficient neutron reflectors are a key ingredient for improving the performance of cold, very cold and ultracold neutron sources, needed for meeting the challenges placed by high precision fundamental physics experiments and existing experimental techniques. In order to significantly increase the flux of these neutrons, the reflectors made of nanodiamond powders were proposed, theoretically substantiated and experimentally implemented. An adequate model of low-energy neutron propagation in nanodiamond powders was implemented in the Wolfram Mathematica software system. The performance of such a solution is sufficient for describing simple experiments on the reflection of very cold neutrons (VCNs) from nanodiamond powders and predicting the properties of such reflectors. However, it is not enough for simulating the real installations for the directional extraction, delivering and focusing of VCNs. In this work, we discuss the possibility to increase the performance of the VCN transport simulation using Geant4, a powerful toolkit for the Monte Carlo simulation of the passage of particles through matter. The aim of this work is to simulate the extraction of VCNs with velocities between 40 and 100 m/s from different geometries of nanodiamond reflectors comparing with the experimental data and results obtained in Mathematica. In the future, we suppose to take into account Bragg's diffraction of neutrons up to 2200 m/s on the crystal structure of nanoparticles and to use the computing power of the "Govorun"supercomputer to significantly increase statistics in simulations.

Summary

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