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Reflection of low-energy neutrons in nanodiamonds using Geant4

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A study has been carried out in order to see the feasibility of Nanodiamond Particles (NDP) application as a reflector for Cold Neutrons (CN), Very Cold Neutrons (VCN) and Ultra Cold Neutrons (UCN) in Geant4. NDP has a large scattering angle probability against VCN and UCN compared to the other materials due to their high optical potential. This unique feature makes this powder a prominent candidate to be used as a reflector for VCN and UCN. Moreover, they can also be implemented for a quasi-specular reflection of CN at a small incidence angle due to multiple small-angle scattering of neutrons from nano-sized inhomogeneities in the scattering potential. A new process has been prepared in order to add NDP cross sections to the predefined processes. The Three-Dimensional geometry of previous experiments carried out in order to observe the NDP reflection has been developed in Geant4, in order to validate the implementation. The results show that there is a good agreement between the new method implemented in Geant4 and the experimental data.

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