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Calculation of self-shielding factor for neutron activation experiments using Geant4 and MCNP

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In this work we calculated the self-shielding factor, G, as a function of the neutron energy, which is important to consider in precise neutron activation experiments.
Twelve samples of pure metallic materials were simulated using the Geant4 Monte Carlo toolkit[1,2] and the MCNP[3] code.
The self-shielding factor is defined as the ratio between the neutron flux inside the sample volume and the flux in the surface of the sample,

G = $\left(\int_{E_1}^{E_2} dE\Phi_V\right) \div \left(\int_{E_1}^{E_2} dE\Phi_S\right)$.

We have simulated the behaviour of the self-shielding factor for neutron energies from 10^{-5} eV to 20 MeV. Results obtained by running 10^6 neutron events in MCNP6 using the ENDF-B/VII.1, JEFF 3.2 and TENDL2014 neutron cross section libraries, shows that the self-shielding factor is relevant to include in neutron activation analysis experiments for thermal neutron energies and for sample thickness greater than 10^{-4} m, as seen in the recent calculation of the neutron flux at the RECH-1 nuclear reactor[4].

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Authors: ROMERO BARRIENTOS, Jaime Alfonso (CCHEN Comision Chilena de Energia Nuclear, Chile.); Dr MOLINA PALACIOS, Francisco (CCHEN Comision Chilena de Energia Nuclear, Chile.); AGUILERA, Pablo (Universidad de Chile, Chile.); Dr ARELLANO SEPULVEDA, Hugo (Universidad de Chile, Chile.)

Presenter: ROMERO BARRIENTOS, Jaime Alfonso (CCHEN Comision Chilena de Energia Nuclear, Chile.)

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