CALCULATIONS OF ACCELERATOR-BASED NEUTRON SOURCES' CHARACTERISTICS

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Abstract

Accelerator-based quasi-monoenergetic neutron sources (*T(p,n), D(d,n),T(d,n)* and *Li (p,n)*– reactions) are widely used in experiments on measuring the interaction cross-sections of fast neutrons with nuclei. The spectrum of outgoing neutrons in such reactions depends on target characteristics (chemical structure and form – solid or gas) as well as target design and experimental setup around it being a source of scattered neutrons noticeably distorting the shape of the primary neutron spectrum and causing a low-energy "tail."

It is very important to have a correct estimation of a neutron spectrum at the researched sample in experiments with a small amount of investigated material when samples are placed in immediate proximity from the target generating neutrons. Such conditions result to the broadening of a neutron spectrum because of energy losses of incident ions in the target materials and angular scattering (cinematic broadening) connected with the geometry of the experiment. The practice has shown that simulation of neutrons histories from their birth in the accelerator target up to absorption is an effective enough method of the problem's solution.

The present work represents the code for calculation of the yields and spectra of neutrons generated in *(p,n)*– and *(d,n)*– reactions on some targets of light nuclei (*D, T, ^{7}Li*). The peculiarities of the stopping processes of charged particles (with incident energy up to 15 MeV) in multilayer and multicomponent targets are taken into account. The code version is made in terms of the *"SOURCE,"* a subroutine for the well-known *MCNP* code. Some calculation results for the most popular accelerator-based neutron sources are given.