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#10-178 Neutron field spatial distribution from the DD neutron source determined by the KOSTKA experimental device

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The presented work introduces the results from the KOSTKA experimental device, designed for the measurement of the spatial distribution of the ionizing radiation. KOSTKA consists of a 3D-printed holder of cubic shape, designed to surround the source of the particles of interest with PADC detectors (with maximum of 25 detectors per one side). Structure of KOSTKA allows adding of material (such as aluminum) between the source of the particles and the detectors. PADC detectors represent a passive method of measuring ions and fast neutrons. The response to the incidence of the particle is the creation of a latent track, which is subsequently enlarged by chemical etching. The etched tracks are visible under the optical microscope and can be further analyzed. The TASTRAK detectors of dimensions of 25x25x1.5 cm3 were used in the experiment, together with the TASLImage system for etching, scanning and analysis. The result of the analysis is the information about the number of etched tracks registered per 1 cm2 of the surface of the detector. The response of the detectors to the fast neutron radiation is linear and the energy range is between 0.1 and 10 MeV. The demonstration experiment was performed at the tandem electrostatic accelerator of the Tandetron type, and KOSTKA was used to monitor the spatial distribution of neutrons originating in the Deuteron-Deuteron (DD) reaction. The experiment was divided into two parts, one with bare PADC detectors and one where aluminum layer was inserted to shield the protons. To process the data, the detectors were etched and analyzed using the TASLImage system. The numbers of registered tracks per unit of area were assigned to the corresponding coordinates relative to the reaction center. The data were analyzed using an in-house developed software KOSTKACode, written in Python programming language. The code is based on the Monte Carlo simulation, and its purpose is to convert the data from the cubic arrangement to the spherical arrangement, and thus provide information about the angular distribution of the measured quantity. The results of the presented work are the description of the fast neutron field around the DD reaction, based on the two described measurements. This approach might be used also to other neutron sources.

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