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The Tagged Neutron Method and its Application for Nuclear Physics Studies and Applied Research

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The Tagged Neutron Method (TNM), sometimes also called Associated Particle Technique consists in irradiating the object of study with fast neutrons with an energy of about 14 MeV, which are formed in the reaction d+t→α+n [1]. Neutron tagging is carried out by registering an alpha particle with a special position sensitive detector built into the neutron generator. The use of TNM in experiments studying nuclear reactions with fast neutrons provides a number of important advantages, in particular, a decrease in the background due to the registration of events coinciding with α-particles. The study of the spectra of gamma rays produced in the reactions of inelastic neutron scattering makes it possible to carry out an elemental analysis of the irradiated object. Currently, TNM technology is widely used in various practical applications for remote non-destructive analysis of the elemental composition of a substance.

The TANGRA (TAgged Neutrons and Gamma Rays) project at JINR is aimed at investigations of the neutron-nuclear reactions using the tagged neutron method. An overview of recent activities in the framework of the project will be presented with an emphasis on the measurements of the gamma-ray emission cross sections and angular distributions from (n,xγ) reactions with 14.1 MeV neutrons using the tagged neutron method, as well as on the development and use of the TNM for non-destructive elemental analysis of various objects [2].

References:

1. V Valkovic. 14 MeV Neutrons. Physics and Applications. —CRC Press, New York. 2015.
2. Yu.N.Kopach, M.G.Sapozhnikov, Physics of Particles and Nuclei, 2024, Vol. 55, No. 1, pp. 55–102.

Section

Experimental and theoretical studies of nuclear reactions

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