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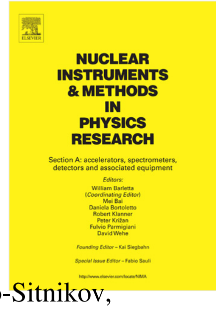


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# Characterization of a mixed high-energy spallation neutron–proton field using monoisotopic activation detectors

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**Abstract**

We used monoisotopic threshold activation detectors Co, Au, and Bi to characterize the high-energy (>5 MeV) portion of a mixed spallation neutron–proton (n/p) field. The field was produced by irradiating the natural uranium target-blanket subcritical assembly Quinta with 660-MeV protons from Phasotron accelerator at the Joint Institute for Nuclear Research (JINR) in Dubna. Experimental yields of the (n,x) and (p,x) reactions were compared to the calculated reaction rates, which represent the convolution of particle flux and reaction cross section. The flux was simulated using the radiation transport code MCNPX 2.7.0, and the cross sections were extracted from the following three sources: the intranuclear cascade model INCL4.2, the phenomenological spherical optical model from TALYS-1.8, and the evaluated nuclear data file TENDL-2015. We show that, in most cases, the evaluated data provide a closer agreement with the experimental data in comparison with INCL4.2 model, which is an integral part of MCNPX. Our results bring a contribution to those fields of physics research that utilize computer prediction of neutron generation in the energy range of tens to hundreds MeV, such as the medical radioisotope production, radiation shielding of spallation neutron sources, and nuclear transmutation in accelerator-driven systems.

*Keywords:* Spallation neutron generation, Threshold activation detectors, MCNPX simulation

## 1. Introduction

Advances in many physics applications that utilize high-energy neutrons depend on the reliability of computer codes to predict the yields of neutron-induced reactions. The most relevant applications include, in particular, the production of medical radioisotopes [1, 2], radiation

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[1]Experimental research carried out while affiliated at the Joint Institute for Nuclear Research, Dubna, and at the Czech Technical University, Prague.

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