

Joint seminar of the NPI of the CAS

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Ján Kozic (DA NPI): *Spectrometry of an external neutron source based on the $p(24\text{ MeV}) + \text{Be}$ reaction driven by the TR-24 accelerator*

Abstract:

Spectra of a neutron source driven by the TR-24 cyclotron and based on the $p(24\text{ MeV}) + \text{Be}$ reaction were measured as part of a program aimed at developing spectral density monitoring for intense cyclotron-driven fast neutron sources at the Nuclear Physics Institute of the Czech Academy of Sciences (NPI CAS). A series of irradiation experiments were performed at the TR-24–driven high-power neutron generator (HPNG) to analyze neutron spectra for various source-to-sample geometrical arrangements. Neutron spectrometry was carried out using the dosimetry foil technique with activation detectors made of different materials, including Al, Au, Co, Cu, Fe, In, Lu, Nb, Ni, Ti, and Y. Reaction rates were determined by gamma-ray spectrometry and used as input for neutron spectrum unfolding. The neutron flux density at source-to-sample distances of 32.5, 42.5, 172.5 and 322.5 mm reached values of $1.90 \cdot 10^9$, $1.31 \cdot 10^9$, $9.33 \cdot 10^7$ and $2.82 \cdot 10^7\text{ cm}^{-2}\mu\text{C}^{-1}$, respectively. The HPNG is intended for research applications such as integral nuclear data validation and irradiation hardness testing of materials and instrumentation, with relevance to future nuclear technologies including Generation IV reactors, accelerator-driven systems, and fusion technology, as well as interdisciplinary research based on fast neutron activation analysis and the production of radionuclides for medical applications.