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Abstract

This work is a preliminary step toward the study of physical properties of the ADS systems, in which a deeply subcritical active core is irradiated by a pulsed beam of relativistic deuterons.

This work analyzes a general direct method of calculating a neutron energy spectrum using efficiency of reactions of activation detectors. Our interest was focused on the study of the influence of input experimental errors and uncertainty of cross sections on output errors. The experimental data are taken from the KWINTA experiment in JINR Dubna. The obtained results of the neutron flux spectrum in range 0.7-200MeV are compared with calculation results from the MCNPX code.

Introduction

There is a wide assortment of methods which use threshold activation detectors (TAD) to calculate the neutron flux spectrum [1-14]. For instance, a method of approximation of fast neutrons spectrum using: step [6,10], polygonial [6], polymonial [6], exponential [5], general orthogonal function approximation; perturbation methods of fast neutron spectrum [6] as well as a method of effective threshold cross section [3] and iterative methods [7-10] and others. The iterative method well known as SAND II [7, 8] was used in the multiple activation detector applied to the neutron spectrum measurements of epithermal neutrons [11]. There are known unfolding code systems such as FERDO/FERD[12] and STAY-SL[13]. Three different unfolding methods such as BUNKI[14], FERDOR[12] and genetic algorithm (GA) are compared in the work[2]

All upper methods have a common feature – they use a priori neutron flux spectrum from other calculation methods and find parameters of fitting [1-11] or smooth final results[12]. This *a priori* neutron spectrum can be in the form of an analytical function or a table of numbers calculated by codes based on Monte Carlo method or a system of differential equations.

There is a direct method of calculating a neutron spectrum based on experimental data. A method of calculating an average of neutron flux density using the Y-89 detectors is presented in [16,17]. In this approach the average of the neutron density is calculated for three energy ranges calculated as differences of threshold energies of Y-89(n,2n), Y-89(n,3n), Y-89(n,4n) reactions [16,17].