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Multiplicity distributions of prompt neutrons from spontaneous fission. Restoring techniques: advantages and limitations.

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The spontaneous fission is a complicated process that still could not be described by sufficiently reliable theory because of varying of possible final configurations of the system. There are a several theoretical models of the process (for example, semi-empirical [1] or fully-theoretical [2]) but none of them can describe well all known nucleus that could decay by spontaneous fission. Therefore, experimental studies of such processes are high-interesting and important.

The experiments on study of the spontaneous fission properties of transfermium isotopes using the SHELS (Separator for Heavy Element Spectroscopy) [3] and the SFiNx (Spontaneous Fission, Neutrons and X-rays) detectors setup [4] that consists of more than 100 ^3He-filled counters were carried out at the Flerov Laboratory of Nuclear Reactions (JINR, Dubna, Russia). The main characteristic measured by setup is the multiplicity distribution of prompt neutrons. Since the registration efficiency of the SFiNx is far from 100% the measured distribution is heavily distorted in comparison with the original one. Many approaches could be used to restore the shape of original distribution. The most common one is to solving incorrect inverse problem by Tikhonov regularization technique [5]. The method is simple and reliable but it is possible to get over smoothed solution and lost the information about exotic fission modes. The Bayesian approach [6] could be more powerful technique that the previous one. The Bayesian method requires the properly chosen prior information and could be much more calculation expensive in some implementations.

The techniques for multiplicity distribution of prompt neutrons restoring will be discussed in the report. Calculations with generated and experimental data will be compared with theoretical model predictions. Advantages and limitation of restoring methods will be discussed either.

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