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Application of unfolding method for obtaining nuclear data

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The unfolding method is a well-known technique used in nuclear physics. This method is usually used to unfold the neutron spectrum based on a measurement of neutron activities in various energy ranges and known cross sections for reactions of interest. But it has also found application in various fields of nuclear physics. The basis of this method is that the activity measured in an experiment, when the activity is induced by nuclear reaction, is proportional to the product od the cross section for the reaction and the flux of the projectile particles. Then, combining the measurements of activities with the well known values of one of the spectrum involved, the other one can be determined from the set of initial assumptions about the spectrum (default), which can be a theoretical calculation or any other available source. This spectrum is then unfolded in order to better describe the experimentally obtained results.

This allows for various usage of the unfolding methods within the field of nuclear physics, which will be presented here. It can be used to approximate the presence of neutrons at the place of the HPGe detector based on the activities of activated Ge isotopes after the interaction of the neutrons with the nuclei of the detector. By using the theoretical spectrum for the neutron flux from cosmic rays at ground level, this spectrum can be unfolded to better describe the actual neutron spectrum at the position of HPGe detector[1]. In the case of photo-nuclear reactions, if the photon flux is well known, based on the measured activities, it is possible to test various theoretical values of cross section by inserting them as a default functions and comparing the unfolded spectrum with the theoretical spectrum [2]. In case of photo-nuclear reaction where the cross section is well known, it can be used to determine the photon flux, by using the theoretical bremsstrahlung spectrum as a default function.

In this work, we will present previously done work and possible future applications of the unfolding method in the field of nuclear physics.

1. D. Knežević, et al., Nucl. Instrum. Methods. A, 833, 23 (2016)
2. Medic, Z., et al., Eur. Phys. J., 57.8, 1 (2021)

The speaker is a student or young scientist

No

Section

1. Experimental and theoretical studies of nuclear reactions

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