Neutron spectrum deconvolution by Bayesian methods

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The accurate and robust reconstruction of neutron spectra is essential for various nuclear applications, ranging from reactor environments to other neutron fields [1,2]. Unlike gamma-ray spectroscopy, the deconvolution of a neutron spectrum relies on solving a complex inverse problem, which is generally addressed by using various unfolding algorithms [3,4,5]. Such algorithms often require some prior (or reference) spectrum as input, usually determined by simulation. In recent years, Bayesian approaches have been proposed as alternative methods in order to solve the deconvolution problem [6,7], while recent studies have implemented some of these approaches and have shown promising results even without the use of a reference spectrum [8]. Thus, the main objective of this work is to explore and apply Bayesian methodologies [6,8] in the unfolding procedure within the context of activation foil measurements. The performance and the limits of these methods in the field of reactor applications and most importantly, their ability to evaluate the reconstructed spectrum without a prior reference spectrum will be evaluated. A comparative evaluation of their performance against classical methods [5, 9] will also be carried out.

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