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Blind non-negative matrix factorization algorithms to estimate the neutron flux of fission chamber detector: Neutron-gamma discrimination

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We deal with the neutron flux monitoring inside the TRIGA Mark II reactor as one of the nonnegative matrix factorization problems. The fact that these methods of separating blind sources does not require any assumptions on the way the signal and noise were mixed has encouraged us to apply them to online neutron flux monitoring through neutron-gamma discrimination. We synthesize fission chambers output signals using the python-based Fission Chamber simulator (pyFC). These signals are analyzed through nonnegative algorithms known as the most popular blind source separation techniques to extract original sources signals. The obtained results show that the RLS algorithm is the most appropriate method for discriminating neutrons and gammas. Furthermore, the neutron-gamma discrimination is highlighted through the computation of the cross-correlation functions and time-frequency representation. The presented method provides a better characterization and discrimination of the neutron and gamma signals with very high accuracy.