Application of Nonnegative Matrix Factorization Algorithm for Neutron-Gamma Discrimination

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Inside a nuclear reactor; the gamma-rays emitted from nuclei together with the neutron introduce unwanted backgrounds in neutron spectra. For this reason, powerful extraction separating useful neutron signal from gamma-rays one is needed to obtain clearer neutron flux spectrum. Actually, several techniques have been developed to discriminate neutrons and gamma rays. Most of these techniques, tackle using analogue discrimination methods. Others propose to use some organic scintillators to achieve the discrimination task . Recently, systems based on digital processors are commercially available today to replace the analog systems. In this same perspective, we investigate the application of Nonnegative Matrix Factorization (NMF) algorithms to blind extract independent components (IC) from signals recorded at output of fission chamber which have been simulated through the Geant4 (version 4.10.02.p02).

To achieve our objective of obtaining the best possible neutron-gamma discrimination, we have applied the NMF algorithm (NMF-SMART), which is best suited for the processing of this kind of nuclear data. Indeed, its index of separability performance is the best among the algorithms implemented on NMFLab Toolbox. The separation task results in independent components which can be characterized trough the computation of spectrograms and/or the correlations with well-known neutron and gamma signals.