ID de Contribution: **84** Type: **Non spécifié**

Gamma-ray spectrometry of fission fragments: ML analysis of multi-dimensional spectra

mercredi 28 septembre 2022 14:40 (20 minutes)

The analysis of gamma radiation emitted by fission fragments has become an essential tool for studying the nuclear fission process. It allows to probe the intrinsic properties of the fragments or to explore effects little studied experimentally such as the sharing of excitation energy between fragments at nuclear fission. It also provides nuclear data directly useful for reactor simulation.
The analysis of experimental fission gamma-ray data by traditional techniques is time consuming and complex. The processing of the experimental data is done in two steps. The
first step aims at reducing the amount of measured data into two or three dimensional distributions of gammas emitted in coincidence. The second step, the actual analysis work, consists in identifying or finding the gamma rays emitted by the different fragments in these 2D or 3D distributions and extracting their intensity.
The difficulty of this last task is related to several factors. The distributions are filled with thousands of peaks of very variable amplitude and often overlapping, because the fission generates a few hundred different fragments and each fragment emits several gamma rays
during its de-excitation. The shape of the peaks is quasi-Gaussian but their width depends on the energy and the peaks have low energy tails which is superimposed on a rather important background noise.
Several points may be unlocked if prescriptive algorithms were developed using machine learning to assist the analysis and replace manual operations. We will present the project and the ML techniques we would like to apply.

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Classification de Session: Wed afternoon

Classification de thématique: 2 ML for analysis : event classification, statistical analysis and inference, including anomaly detectio