First results on $^{235}U(n_{th},f)$ independent isotopic fission yields using prompt gamma rays at FIPPS

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Abstract: Although nuclear fission has been known and studied for more than 80 years, it remains a very active field of research. Knowledge of the fission process can be improved by studying the prompt gamma-ray cascades emitted by fission fragments.

We will present the results of a measurement campaign with the FIPPS gamma-ray spectrometer and the use of fission prompt gamma rays for the determination of independent isotopic yields. The yield of a set of well-produced even-even nuclei for the $^{235}U(n_{th},f)$ reaction was extracted from the data. It includes the specific case of the doubly magic nucleus ^{132}Sn, for which an anomaly in the yield was observed for the $^{238}U(n_{fast},f)$ reaction.
The FIPPS gamma-ray spectrometer is installed at the end of a thermal neutron guide in the research reactor of the Institute Laue-Langevin (Grenoble). The neutron beam interacts with an active target consisting of a solution of ^{235}U diluted in a scintillating liquid. The active target allows us to discriminate fission events from fragment beta decays or (n,γ) reactions on the target support. It also allows us to determine precisely the total number of fissions that occurred during the experiment. The spectrometer consists in a set of 16 HPGe clovers that were placed around the target to detect the prompt and delayed gamma-ray cascades emitted by the fission fragments.

The obtained fission yields are compared with evaluated values from JEFF-3.3 and ENDF/B-VIII nuclear databases. The observed differences are interpreted with the FIFRELIN code, which simulates the fission process and the de-excitation of the fission fragments.