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Lifetime measurements after neutron-induced fission using the FIPPS instrument at ILL

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The FIssion Product Prompt gamma-ray spectrometer (FIPPS) [1] is the new nuclear physics instrument at the Institut Laue-Langevin (ILL). FIPPS takes advantage of an intense "pencil-like" neutron beam (flux $10^8 n \cdot s^{-1} cm^2$) for inducing neutron capture and neutron-induced fission reactions and study the nuclear structure via high-resolution gamma-ray spectroscopy. The array is composed by 8 Compton suppressed HPGe clover detectors. Ancillary devices are possible, as LaBr3 detectors for fast timing measurements or additional clover detectors (from the IFIN-HH collaboration) to increase efficiency and granularity.
The instrument performances will be shown with particular focus on the technique for correcting cross-talk effects affecting the energy resolution of the clover detector [2]. Using a recently developed Geant4 simulation code, angular correlation analyses using a hybrid gamma-ray array could be possible. Examples from (n,γ) and neutron-induced fission reactions will be shown.
The Geant4 simulations also allowed to analyze the scintillator-based active target data [3] in order to extract lifetimes in the sub-ps timescale in neutron-rich fission fragments, by analyzing the shape of the peaks in the energy spectrum. This method will be presented, as well as new results in Zr and Nb nuclei.
In order to extend the number of measurable lifetimes in fission fragments, a plunger device is under development. This device will be the first implementation of a system similar to the one described in [4,5] for lifetimes measurements in fission fragments produced at a neutron beam. The design of such a device, including a mass identification setup (3-5units mass resolution) will be shown and its implementation for a test with a 252Cf spontaneous fission source will be outlined. Finally, the results of the test at the LOHENGRIN spectrometer of the mass identification setup will be presented.
References
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