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Development of a Gas Filled Magnet within the FIPPS project

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The accurate knowledge of the fission product properties of actinides is important for the studies of innovative nuclear fuel cycles and also for the understanding of the fission process. Until now fission models cannot predict the fission yields with an acceptable accuracy. A collaboration between LPSC (Laboratoire de Physique Subatomique et de Cosmologie), ILL (Institut Laue-Langevin) and CEA (Commissariat à l'Energie Atomique et aux Energies Alternatives) is pursuing a measurement program performed at the LOHENGRIN spectrometer at ILL (Grenoble, France) that is dedicated to the thorough characterization of fission yields in mass A, nuclear charge Z, kinetic energy Ek and spin J. To assess this last quantity, so far only an indirect method through isomeric ratio measurements has been used at the LOHENGRIN spectrometer.
Nevertheless the evaluation of the fission fragment spin distributions can be done also directly via the measurement of prompt neutron and γ spectra per isotope. The FIPPS (FIssion Product Prompt γ-ray Spectroscopy) project at ILL aims at combining a powerful γ ray detection array with a gas-filled recoil separator for one of the fission products. The combined spectrometer will give access to new nuclear spectroscopy information of neutron-rich nuclides by tagging the complementary fragment and new insight into the fission process via combined measurements of mass A, nuclear charge Z, kinetic energy Ek and excited states.
To optimize the design of the gas-filled separator in terms of acceptance and resolving power, we performed preparatory experiments using the second dipole magnet of the LOHENGRIN fission fragment separator. Using mass and energy separated fission fragment beams we studied the transmission, energy acceptance, energy loss and resolving power in A and Z with helium and nitrogen gas filling at pressures ranging from 2 mbar to 40 mbar. For instance, with the given magnet properties the best separation was reached with He at pressures around 40 mbar, corresponding to an overall energy loss of 50% in the gas. In parallel we developed a Monte Carlo simulation code to reproduce the obtained results. This code is now used for the detailed design of the gas-filled separator of the FIPPS project. In this talk experimental and simulation results will be presented along with the current status of the FIPPS project.

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