

A MULTI-PARAMETER NUCLEAR-FISSION EXPERIMENT: WHY AND HOW TO MEASURE ALL AT ONCE?

Tsekhanovich I.A.¹, Matarranz J.¹, Murray L.², Pollitt A.J.³, Smith A.G.²,
Köster U.³, Soldner T.³

¹*Université de Bordeaux-I/CENBG, 33175 Gradignan Cedex, France;*

²*Department of Physics and Astronomy, The University of Manchester, UK;*

³*Institut Laue-Langevin, Grenoble, France*

E-mail : tsekhamo@cenbg.in2P3.fr

Since the time of the discovery of nuclear fission, much of experimental and theoretical efforts have been aimed at studying different aspects of this complicated phenomenon. Despite the very strong motivation given by the military and civil applications of the reaction, our comprehension of the fission process is still quite far to be complete. Putting aside the complexity of the nuclear force, this fact is also due to a certain lack of multi-parameter experimental data. An example here is the correlation between fractional independent yields of fission products and neutron and gamma-ray multiplicities. Fragment-gamma-neutron measurements, especially if correlated with fission-fragment kinetic energies, give the complete set of observables issue of the fission reaction and are therefore potentially of great interest from the point of view of modeling and understanding of the fission process.

Several years ago, a two-arm spectrometer of fission products (STEFF) has been built at the Manchester University. It uses double energy / double velocity measurement to identify masses of complementary fission products and is capable of delivering information on nuclear charge of lighter fission products, which is achieved from the analysis of the fragments pulse shapes and ranges in gaseous detectors. The spectrometer also comprises an array of efficient photon detectors and may house a further array of neutron detectors thus allowing correlation measurement of a large number of observables. The performances achieved during the test and $^{235}\text{U}(n_{\text{th}}, f)$ experiments will be demonstrated and discussed, along with the technical challenges linked to an efficient use of such a device. The future experimental program of the spectrometer will be shortly presented and the range of physical questions which can be addressed with STEFF will be outlined.