The main objectives of the project, related to modelings of the prompt fission, concern important aspects of the prompt neutron and γ-ray emission in fission as follows:

I. Even-odd effects in prompt emission in fission.

Only the even-odd effects in fission fragment distributions were extensively studied up to 2014 when a first paper about even-odd effects in prompt neutron and γ-ray emission was published by Tudora et al. [1], followed by other studies of the same authors published in 2015 and 2016, e.g. Refs.[2, 3, 4].

Investigations of both local and global even-odd effects (impacting on the charge polarization of fragments and the fissioning nucleus configuration near scission) are continued in the frame of this project.

II. Prediction of the prompt neutron distribution ν(A) at incident neutron energies where multiple fission chances are involved.

Measurements of the fission of major actinides ^{235}U, ^{238}U and ^{239}Pu induced by fast neutrons with energies up to about 200 MeV were recently performed at the LANSCE facility of the Los Alamos National Laboratory. To obtain the distributions of fission fragments (pre-neutron fragments) from the measured post-neutron fragment data, the prompt neutron distributions ν(A) are needed. Unfortunately experimental ν(A) data at high incident neutron energies where multi-chance fission occurs do not exist. The only way is to use ν(A) predicted by prompt emission models.

The project answers to this request, by the Point-by-Point (PbP) model of prompt emission which provides the individual ν(A) corresponding to the compound nuclei of the main and secondary nucleus chains which are undergoing fission at any incident neutron energy. The total ν(A), which is needed in the re-covering of the pre-neutron fragment distributions from the post-neutron fragment data, is obtained by averaging the predicted individual ν(A) over the fission probabilities expressed at total and partial fission cross-section ratios.

III. General form of the residual temperature distribution

The temperature distribution of residual fragments P(T) plays a crucial role in the frame of prompt emission models with a global treatment of sequential emission. A general simple analytical form of P(T), depending only on the properties of initial fragments, which is applicable to any fissioning nucleus at any energy is an important objective of this project.

The development of a deterministic modelling of the sequential emission of prompt neutron and γ-rays is foreseen. This modelling uses a fragmentation range constructed as in the PbP treatment and the same TXE partition based on modelling at scission as the PbP model. The basic feature of this sequential emission modelling consists of residual temperature equations for the emission sequences associated to each initial fragment at each kinetic energy.

To solve these residual temperature equations different prescriptions and approximations regarding the compound nucleus cross-section of the inverse process of neutron evaporation from initial and residual fragments and the level density parameters of initial and residual fragments are investigated.

[1] A.Tudora, F.-J.Hambsch, G.Giubega, I.Visan, "Even-odd effects in prompt emission in fission", Nucl.Phys.A 929 (2014) 260-292

[2] A.Tudora, F.-J.Hambsch, G.Giubega, I.Visan, "Even-odd effects in prompt emission of spontaneously fissioning even-even Pu isotopes", Nucl.Phys.A 933 (2015) 165-188

[3] A.Tudora, F.-J.Hambsch, G.Giubega, "Particular aspects related to the even-odd effects in prompt emission", Eur.Phys.J A 52 (2016) 182-192

[4] A.Tudora, F.-J.Hambsch, G.Giubega, „Local even-odd effect based on the number of configurations of pre-formed and formed fragmentations in a fissioning nucleus", Nucl.Phys.A 953 (2016) 96-116