Study of ν-ball response function

Laboratory / Team	Institute of Nuclear Physics, Orsay (IPNO) – Noyaux Exotiques Structure et Réactions (NESTER) http://ipnwww.in2p3.fr/NESTER-Noyaux-Exotiques-STructure-et-Reaction
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Main topics	Experimental nuclear physics
Objectives/context	Understanding of the response function of the ν-ball array through GEANT4 simulations
Equipment / resources / tools / software used	Good knowledge of C++ required LINUX environment – ROOT data analysis software
Level / Duration / Period **Number of trainees**	M1-M2 / 2 to 5 months / April 2019 - July 2019 1 student / course period

Course description / main tasks

In 2017-2018, the ALTO facility hosted an experimental campaign of gamma spectroscopy. It was based on the use of the ν-ball hybrid array that mixes the excellent energy resolution properties of high purity germanium detectors with high timing resolution of LaBr3 scintillators. During the campaign, ten different experiments were performed. Among them the N-SI-109 experiment was dedicated to the study of the fission process and the fission fragment structure. For five weeks, 232Th and 238U targets were irradiated with neutrons produced using the LICORNE neutron source.
However, no unambiguous fission identification (using fission chamber, …) was possible. Now the reconstruction of fission event relies on gamma emission properties of the fission process.
In order to improve the "event building" process, we need to better understand the response of the detection array to a gamma source. Preliminary simulations, using the GEANT4 C++ software, has been performed. This work must be pursued to get the best description of the array possible.
It is expected from the student, to learn and work with GEANT4 to produce a usable response function of the ν-ball array. In addition, we would like to simulate "realistic" fission events that will be tested within the event building algorithm to test the efficiency of the process.
If a good knowledge of GEANT4 is not required, programming skills will be a plus.

Skills acquired on completion of the course

- Detection of particles and their interaction with the material.
- Neutron/gamma discrimination experimental technique.
- Instrumentation for neutron/gamma detection.
- Understanding of the fission process properties.
- Understanding of the ROOT software for data analysis and identification of particles emitted during the fission process.
- Monte-Carlo simulations of particle interaction in matter.