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#11-249 Towards the experimental validation of a small Time-Projection-Chamber for the quasi-absolute measurement of the fission cross section

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Improvement in neutronics codes jointly with the advent of high performance computing systems made a deeper knowledge on nuclear data more sensitive. The latter is used both for solving the neutron transport equation together with nuclear instrumentation validation and operation. Hence, it becomes relevant to improve the knowledge of the fission cross section of fertile secondary actinides as the 242Pu one, which is fissile in a fast neutron flux. This isotope is, in particular, chosen as a deposit for the fission chamber for the online monitoring of the fast flux in the experimental irradiation reactor Jules Horowitz (RJH) at CEA Cadarache. The latter, as any nuclear thermal or fast neutron reactor, has a high neutron flux around 1 MeV. This motivates the improvement of the fission cross section for the fertile 242Pu isotope, whose the various observations show a dispersion of 10 to 15% around 1 MeV.

The standard measuring technique of a fission cross section is based on simultaneous comparison between the one measured and another one so-called reference nucleus and jointly located in the experimental fission chamber. With a fission cross section known within a few percent, this nucleus enters in the class of the [secondary standard], themselves calibrated to a primary standard of almost absolute precision. Our approach aims to bypass the secondary standard by performing the measurement directly with the primary standard. This is the reaction cross section H (n, n) p which was chosen to achieve our goal since the latter is known from 0.2 to 0.5% over the energy range [0-20 MeV]. Quantifying the neutron flux requires a precise count of the number of recoil protons emitted by a hydrogenated sample of chosen thickness irradiated by a neutron flux. It is therefore essential to use a recoil proton detector having a perfectly known intrinsic efficiency in all operating regimes and a linear response with respect to the input signal. Above 1 MeV, the use of one or two silicon junctions is fully adequate. However, this device is unsuitable at lower energies when a large number of gamma and electrons generate a crippling background noise. This presentation will therefore focus on the recent development and validation of a Recoil Proton Gas Detector (DGPR), insensitive to gamma/electrons noise. This one especially contains a double small time-projection chamber and will be used for the 242Pu fission cross section measurement from 200 keV.

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