Contribution ID: **10** Type: **Short contribution**

Anisotropy and detection efficiency effects in the measurement of fission cross section with PPAC detectors

Wednesday, 12 November 2014 13:40 (20 minutes)

Accurate values of the fission cross section of different isotopes are crucial for the development of new nuclear reactors. For that reason, the n_TOF facility at CERN is carrying out an extensive program on neutron-induced reactions. The high-intensity neutron beam covers an unprecedented neutron energy range, from less than 1 eV up to 1 GeV.
In order to study fission reactions, a chamber with up to ten Parallel Plate Avalanche Counters (PPAC) is used to identify, in time coincidence, both fission fragments emitted in the targets placed in between. The stripped cathodes used in the PPAC allow us to know the fragment position in each detector and, therefore, to determine their trajectory.
Because of the limited geometrical acceptance of the PPACs, the measured fission cross sections have to be corrected by means of the limited geometrical acceptance affecting the detector efficiency. This correction is particularly important for incident neutron energies close to the multiple-chance thresholds.
However, in the setup used at CERN - n_TOF Phase1 (2002-2003), the detectors and the targets were perpendicular to the beam and, as a result, the angular distribution could not be measured, forcing us to rely on previously available data on the anisotropy to correct for the detection efficiency [1].çTo solve that constraint, an improved geometrical configuration, where both detectors and targets were tilted 45o with respect to the neutron beam direction, was used during Phase2 (2010-2012) [2,3]. This new configuration makes possible to detect fission fragments at any angle between 0o and 90o so that the full angular distribution can be measured allowing, therefore, a properly self-correction of the detection efficiency.
This talk will focus on the advantages of the new geometrical configuration, and on how the efficiency correction is applied to data in both setups to measure the fission cross section in the wide neutron energy range of n_TOF. A comparison of the results obtained with both setups for the Th-232(n,f) reaction will be shown.

[1] C. Paradela et al., Phys. Rev. C82, 034601 (2010) [2] D. Tarrío, Nucl. Instr. And Meth. A743, 79-85 (2014)
[3] L.-S. Leong, PhD thesis, Université Paris-Sud (2013)

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Session Classification: SFS-KF

Track Classification: SFS-KF