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New detectors for capture (n, γ) cross section measurements at n_TOF: the Segmented Total Energy Detector (sTED) and the HIDALGO project

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The neutron time-of-flight facility n_TOF [1] is a pulsed neutron source for time-of-flight measurements mainly devoted to perform neutron cross section measurements. It is characterised by high instantaneous neutron intensity, high-resolution and broad neutron energy beams. Two time-of-flight experimental areas are available at the facility: Experimental ARea 1 (EAR1), located at the end of the 185 m horizontal flight path from the spallation target, and Experimental ARea 2 (EAR2) [2], placed at 20 m from the target in the vertical direction. The EAR2 was built in 2014 to carry out challenging cross-section measurements with low mass samples (<1 mg), reactions with small cross-sections or highly radioactive samples.

At n_TOF EAR1 more than 50 capture cross section measurements have been performed with big C6D6 liquid detectors (˜1 L)[3]. These detectors used at EAR1 were not optimised to perform capture measurements in EAR2, mainly due to the ˜300 times instantaneous neutron flux of EAR2 compared to EAR1. For this reason, the¬ Segmented Total Energy Detector (sTED) was developed. This detector consists of a physically segmented array of small C6D6 liquid detectors (0.05 L) with reduced size photosensors. The segmentation reduces the high counting rates and the saturation of high energy signals originated in the spallation process. The sTED has been validated to perform capture measurements, at least until 300 keV neutron energy at EAR2. At the moment, 9 sTED modules have been used to perform various capture measurements (94,95,96Mo, 79Se, 94Nb and 160Gd).

Apart from the sTED detector, the HIDALGO project will be presented, which is also focused in capture measurements. In this case, the project is a Spanish collaboration inside n_TOF with the objective to design and build innovative and highly-performing capture detectors for EAR1 and/or EAR2.

References

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