# Study of (n,α) reactions of interest for nuclear energy

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In reactors, oxygen is present in abundance in the form of water, and/or in the form of oxide in the fuel used (in the case of Pressurised Water Reactors and Fast Reactors). These oxygen nuclei are responsible for 25% of helium formation in nuclear reactors due to the reaction $^{16}O(n,\alpha)^{13}C$. However, this reaction still shows significant discrepancies between experimental and evaluated data that can go up to 30% for some energy ranges. This is why the NEA (Nuclear Energy Agency) has issued several requests included in the HPRL (High Priority Request List)[1] and confirmed by the WPEC 40 (CIELO, 2014)[2] for this reaction in the incident neutron energy range from threshold energy to 20 MeV. Sensitivity analyses conducted by the WPEC 26 (2008)[3] showed that these discrepancies induced significant uncertainties on some nuclear reactors parameters such as helium production (± 7%) and keff (± 100 pcm)[3].

Regarding other (n,α) reactions in light target nuclei, the $^{19}F(n,\alpha)^{16}N$ cross section is of great interest for the development of the next generation IV reactors that could potentially use molten salt mixtures. Significant differences (up to a factor of 3) have been observed for this nucleus with regards to the (n,α) channel.

In view of improving our knowledge on the (n,α) reactions, the GrACE group (Groupe Aval du Cycle Electronucléaire) of the LPC Caen has developed a new detector named SCALP[4] (Scintillating ionization Chamber for ALPha particle detection in neutron induced reactions). The first two experiments with this new detector carried out at the new NFS facility of GANIL in Caen and at the nELBE facility of HZDR in Dresden were successful.

During this conference, the operational principle of the SCALP detector will be presented and discussed, as well as the experiments that have been conducted using it. Furthermore, insights into the data acquired during this experiment, as well as the ongoing processing and multi-channel analysis of it, will be provided.

[1] E. Dupont et al., HPRL - *International cooperation to identify and monitor priority nuclear data needs for nuclear applications*, https://arxiv.org/abs/2004.06405

[2] M. B. Chadwick et al., *The CIELO collaboration*, Nuclear Data Sheets 118 (2014) and M.B Chadwick et al. *The CIELO collaboration : Progress,* EPJ Web of Conferences 146, 02001 (2017)

[3] M. Salvatores and R. Jacqmin, *Uncertainty and Target Accuracy assessment for innovative systems using recent covariance data evaluations* (International Evaluation Cooperation, NEA/WPEC-26, 2008)

[4] G. Lehaut et al., Nucl. Instrum. Meth. A 797 (2015), 57-63.