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First results of (n,alpha) measurements on F-19 with the SCALP detector

The (n,alpha) cross-sections on oxygen 16 and fluorine 19 are of great interest for the improvement and/or development of the nuclear reactors. Significant differences have been observed for those nuclei regarding the (n,alpha) channel:

- on oxygen 16, discrepancies up to 30% between experimental data and/or evaluation are observed and are responsible for an uncertainty of 100 pcm on the keff or reactor using either water and/or oxide fuel [1],
- on fluorine 19, discrepancies up to a factor 3 between experimental data and/or evaluation are observed. Estimated uncertainty on the total neutron interaction cross-section of F-19 bring up to 213 pcm uncertainty on the reactor keff value. The uncertainty on the cross-section of the reaction (n,alpha) alone is responsible for approximately 40 pcm to 130 pcm of uncertainty on keff depending on the type of MSR considered [2].

In view of improving our knowledge on (n,alpha) reactions, the ACE group (Groupe Aval du Cycle Electronucléaire) of the LPC Caen has developed a new detector named SCALP [3] (Scintillating ionization Chamber for ALPha particle detection in neutron induced reactions). This presentation deals with the first experiments carried out with this new detector at the new NFS facility (GANIL, Caen, France) and the nELBE facility (HZDR, Dresden, Germany).

After discussing the needs for new measurements of (n,alpha) reaction on 0-16 and F-19, the operating procedure of the SCALP detector will be presented, as well as the experiments that have been conducted using it. Furthermore, insights into the data acquired during our experiment, as well as the data processing will be provided. First results of the SCALP project will then be discussed and compared with available experimental data and the most recent evaluation of (n,alpha) reaction on F-19.

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

[2] –Sigfrid Stjarnholm, Nuclear Data Uncertainty Quantification for Reactor Physics Parameters in Fluorine-19 based Molten Salt Reactors (WONDER-2023, Aix-enProvence France, 2023)

[3] –B. Galhaut et al, SCALP: Scintillating ionization Chamber for ALPha particle production in neutron induced reactions, ND 2016, EPJ Web of Conferences 146, 03014 (2017)

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