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Recent updates of the NeuCBOT program for evaluation of neutron yields and spectra from (α, n) reactions

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Consideration of the (α, n) reactions is necessary for conducting precision experiments on detection and study of neutrinos and dark matter particles in modern ultra-low background detectors. As a result, computational tools that facilitate the evaluation of the background caused by the reactions, such as NeuCBOT \[1\], are emerging. The NeuCBOT utility originally use the TENDL database, obtained with the TALYS software package, to calculate the neutron yield and spectrum. However, using this approach for the light nuclides, the output (α, n) yields are often higher than those reported in literature and the spectra are likely to be distorted \[2–3\].
The NeuCBOT utility has been upgraded by adding an ability to use new input data obtained from the JENDL \[4\] database. Its advantage is that it contains evaluated experimental data for light isotopes. Consequently, a general algorithm for calculating the kinematics of the reactions and data processing for subsequent use within the NeuCBOT utility were created. Neutron yields and neutron spectra for (α, n) reactions based on JENDL data can be obtained now, including cases for individual channels of the reactions when the final nucleus is in an excited or ground state. This new option is available for the following target nuclei: $^{6-7}$Li, ^{9}Be, $^{10-11}$B, $^{12-13}$C, $^{14-15}$N, $^{17-18}$O, ^{19}F, ^{23}Na. Also a cross section of the ^{13}C$(\alpha, n)^{16}$O reaction measured by S. Harissopulos \[5\] and revised by P. Mohr \[6\] were implemented into NeuCBOT. A comparison of the neutron yields obtained by the following programs: NeuCBOT (separately for TENDL, JENDL and P. Mohr data), SaG4n, NEDIS, SOURCES, was made.
Another important part of the update is related to the release of web (online) version of NeuCBOT which makes usage of the utility more user friendly.

References:
1. S. Westerdale *et al.*, NIM A **875**, 57–64 (2017).
2. M.B. Gromov *et al.*, Nuclear Physics **86(2)**, 139691 (2023).
3. D. Cano-Ott *et al.*, 'White paper on (α, n) neutron yield calculations'.
4. O. Iwamoto *et al.,* JNST, **60(1)**, 1–60. (2023).
5. S. Harissopulos *et. al.,* Phys. Rev. C **72**, 062801(R) (2005).
6. P. Mohr, Phys. Rev. C **97**, 064613 (2018).

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