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Development of the NeuCBOT utility for evaluation of neutron yields and spectra from (α, n) reactions

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Consideration of (α, n) reactions is necessary for conducting precision experiments on detection and study of neutrinos and dark matter particles in modern ultra-low background installations. As a result, computational tools such as NeuCBOT are emerging that facilitate the evaluation of the background caused by (α, n) reactions. The NeuCBOT utility originally uses the TENDL database, obtained with the TALYS software package, to calculate the neutron yield and spectrum. However, using this approach, the output data seems to be overestimated and the spectra are likely to be distorted.

The NeuCBOT utility has been upgraded by adding an ability to use new input data obtained from the JENDL database. Its advantage is that it contains evaluated experimental data. As a result an universal algorithm for calculating the kinematics of (α, n) reactions and data processing for subsequent use in calculations 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 (α, n) reactions when the final nucleus is in an excited or ground state. This new option is available for the following target nuclei: ${}^6\text{--}7\text{Li}$, ${}^9\text{Be}$, ${}^{10\text{--}11}\text{B}$, ${}^{12\text{--}13}\text{C}$, ${}^{14\text{--}15}\text{N}$, ${}^{17\text{--}18}\text{O}$, ${}^{19}\text{F}$, ${}^{23}\text{Na}$.

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