

(α, n) and $(\alpha, n\gamma)$ yield calculations with a new version of NeuCBOT for low background experiments

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Uranium and thorium are distributed in all natural materials surrounding us and, in particular, in the construction materials of low background detectors. Therefore, the (α, n) and $(\alpha, n\gamma)$ reactions which occur as a result of α -decays of U, Th and their daughters generate intrinsic neutron and gamma backgrounds for the modern ultra-pure neutrino and dark matter detectors. To construct a low background experimental setup, selection of materials should be done on the basis of assays of the radionuclide relative concentrations and calculations of neutrons and gamma yields. The NeuCBOT program (Neutron Calculator Based On TALYS) can be used for the computation part. We present an updated version with new functionality namely use of partial cross sections for excited states of the daughter nucleus and calculation of the $(\alpha, n\gamma)$ reactions and the respective yields in addition to evaluation of the neutron yields in the (α, n) reactions. Also, a selection of different databases (TENDL, JENDL) and a graphical interface were added to the program. We repeated validation comparisons with other (α, n) data coming from measurements and calculations. A list of results of the neutron and gamma background estimations for many materials commonly used in low background detector was prepared. Among others the list includes plastics doped by gadolinium, structural plastics and construction titanium of various grades.

The speaker is a student or young scientist

Yes

Section

1. Neutrino physics and nuclear astrophysics

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