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Modeling proton-induced reactions at low energies in the MARS15 code*

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Correct predictions of secondary particles, both neutral and charged ones, generated in proton-nucleus interactions below a few tens of MeV is required for various applications. The latter include, e.g., radiation studies for front-end of many proton accelerators, energy deposition studies for detectors, radiation damage calculations, etc. Cascade models of various flavours fail to properly describe this energy region. Therefore, we opted to use the TENDL library developed by the Nuclear Research and Consultancy Group. The evaluated data is provided in the ENDF/B format in the energy range from 1 to 200 MeV, and the library is regularly updated since 2008. In addition, a much more time-consuming approach utilized in a modified code ALICE was also looked at. For both the options, the energy and angle distributions of all secondary particles are described with the Kalbach-Mann systematics. The following secondaries are taken into account: gammas, neutrons, protons, deuterons, tritons, He-3 and He-4. The energy and angular distributions of all generated residual nuclei—including unstable ones—are accounted for as well.
Various comparisons with experimental data for both the options are presented. The corresponding processing and modeling software is written in C++ which provides substantial flexibility with respect to the computer memory used. In addition, the initialization of required evaluated data is performed dynamically whenever the modeling code encounters a nuclide not accounted for yet. The latter feature enables us to significantly reduce the amount of requested memory for extended systems with large number of materials.
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Summary

Modeling proton-induced reactions at low energies using TENDL library of evaluated nuclear data is described. Comparisons with experimental data are presented as well.

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