ALICE 2021

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ALICE is a Monte Carlo(MC) code using the Weisskopf-Ewing evaporation and GDH precompound decay models(1,2). Required input are a title, mass and charge of target and projectile, and projectile energies. Other data are provided internally. Excitations to 200 Mev are dimensioned,projectiles from photons to 86Kr and targets above mass 1 including natural isotopic targets are accepted. Among 37 output files are product yields and SDCS, DDCS for ejectiles and recoils.The original analytic code was changed to MC to remove approximations for multiple precompound decay within a heirarchy in the analytic formulation, and because the MC approach is more versatile than the earlier analytic formulation (3).

A new manual outlines revised input choices,with some greater detail of code physics and models (4).

Fermi gas level density is default,with 4 structure dependent model options(5-8). The latter are preferred for yields at or near closed shells.Earlier work involving products near the f7/2 shell showed a strong preference for shell dependent level densities(9). Benchmarking of the LD models using available experimental excitation functions for yields near shell closures would be valuable in making recommendations for 'best choices' vs. shell proximity. Such a project might pinpoint regimes where additional data are needed. ALICE2021 has removed an internal LD selection routine,now requiring user selection of other than FG. An earlier error in the Kataria-Ramamurthy level density routine due to Blann has been corrected.

ALICE uses fission barriers due to Sierk(10). The fission LD parameters in ALICE (ratio of single particle level densities at ground state to saddle point, barrier height scaling vs Z),need to be benchmarked over the sub-actinide space of A/Z available in experimental data. These data should be fusion/fission excitation functions for which both evaporation residue and fission yields have been measured. Such a review might find areas where additional data are needed.

In the MC treatment, target and projectile spin and orbital angular momenta are coupled with emitted particle l and s to give residual angular momentum for each emission.This permits an estimate of isomer yields, and of spin dependent level density effects via a rotational energy correction. The group of Maiti(11) has begun testing the efficacy of different ways of making the rotational energy correction,comparing options with a large body of experimental data. A few preliminary examples are shown in figs. for 89Y(Li7,3n)93mMo(12) and 159Tb(13C,3n)169Lu(13) reactions.

Much of the methodology in ALICE was dictated by limits in computer technology,having begun in 1963.Blann suggests that more recent codes based on the Hauser-Feshbach(14) formulation be used both for the better physics of HF, and because these codes are currently maintained.This presentation is brief, and the authors welcome any questions be sent to their email addresses, in addition to those of today's discussion.

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