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LLNL-TR-471524

Towards Reliable Cross Sections for National Security Applications

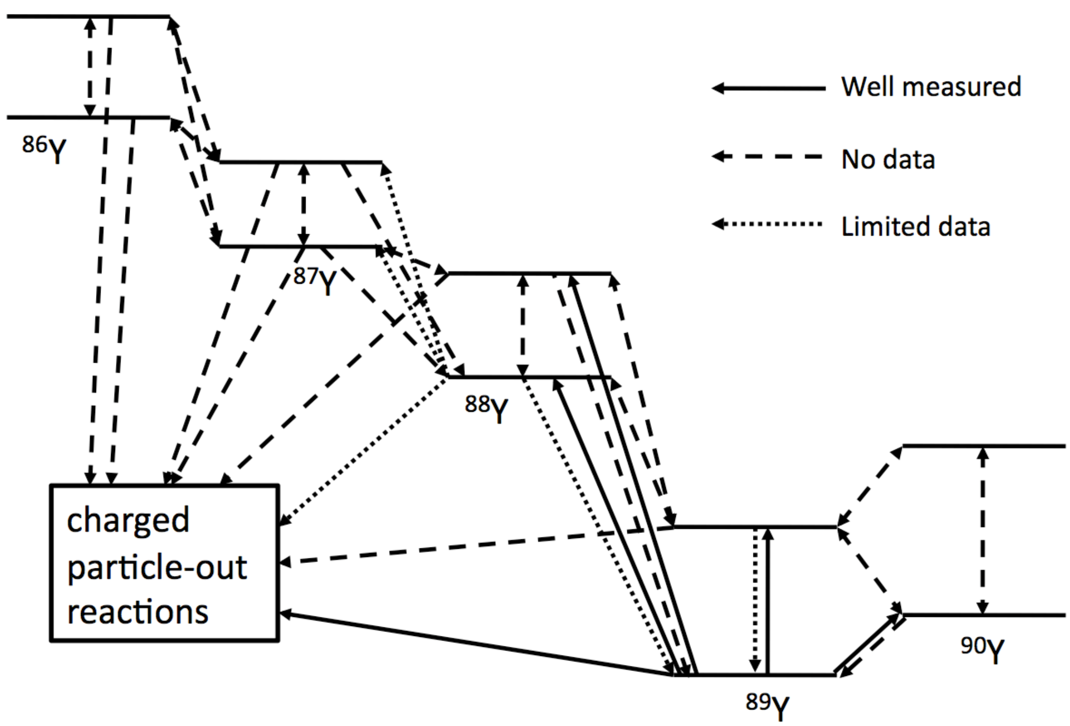
J. E. Escher, F. S. Dietrich, G. P. A. Nobre, I. J. Thompson

February 25, 2011

This work performed under the auspices of the U.S. Department of Energy by Lawrence Livermore National Laboratory under Contract DE-AC52-07NA27344.

SciDAC-II / UNEDF / Reaction Highlights
Towards reliable cross sections for national security applications*
J. E. Escher, F. S. Dietrich, G. P. A. Nobre, I. J. Thompson, LLNL

Stockpile stewardship requires the description of weapons performance without resorting to underground nuclear testing. In the earlier tests, selected isotopes were used as detectors, and recovered after irradiation. Aspects of nuclear device performance were inferred by comparing the measured isotopic ratios to those predicted from simulations. The reaction flows that produce the final isotopic distributions proceed through regions of the nuclear chart that include unstable nuclei. Presently, improved nuclear data input is required to reanalyze prior tests and to certify the stockpile's reliability and safety. Many important cross sections are unknown, as is shown in the example of the Yttrium reaction network (Figure 1). The relevant reactions include (n,2n), (n,n'), (n,gamma), (n,p) and other charged-particle emitting reactions. The cross sections have to be calculated or inferred from indirect measurements. In both cases, reliable optical models that are valid a few nucleons away from stability are needed. The UNEDF Nuclear Reaction activities address this need by combining nuclear-structure input from UNEDF structure calculations with modern reaction theory and large-scale computational capabilities to develop microscopic nucleon-nucleus optical potentials that can be extrapolated to unstable nuclei. In addition, the reaction calculation tools and optical models developed in this context are proving valuable for planning and interpreting indirect (surrogate) measurements of the required cross sections.



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