

III.E.6. Self-Indication Measurements

Self-indication experiments involve a combination of both capture and transmission measurements. Two samples are used: the one closer to the source is used for transmission and the other is used for capture. Both samples contain the nuclide of interest. Such an experiment preferentially removes neutrons near the peak of the resonances for this nuclide, thus focusing on the shoulders or wings of a resonance.

Analysis of a self-indication experiment requires both calculation of transmission through the first sample and calculation of capture yield with self-shielding and multiple-scattering corrections for the second sample. Transmission is calculated as described in Section III.E.1, using parameters appropriate for that sample (for thickness, nuclide abundances, contaminants, temperature, etc.). Essentially, transmission T is given by

$$T(E) = e^{-n_T \sigma_t} \quad , \quad (\text{III E6.1})$$

in which n_T represents the sample thickness and σ_t the total cross section (appropriately Doppler broadened). Subscript T indicates that the thickness is that of the transmission sample; subscript t refers to the total cross section. The capture yield $Y(E)$ is calculated as described in Section III.D, using parameters appropriate for the capture sample; note that any of the three normalizations (as cross section, as yield, or as yield times total cross section) described in that section may be applied to the capture “yield” calculation here. The self-indication result is the product of the transmission and the capture yield,

$$SI(E) = T(E)Y(E) \quad , \quad (\text{III E6.2})$$

followed by resolution broadening.

Parameters such as “isotopic” (nuclide) abundances, effective temperature, and thickness, which are input in the usual fashion into SAMMY, are assumed to be those of the capture sample. Input of parameters appropriate for the transmission sample is via card set 11, line 7 of the PARAmeter file (see Table VI B.2). The phrase “self-indication” must occur in the INPut file (card set 8).

Test case tr057 has examples, using artificial data, for self-indication experiments.

[Note that the option to calculate the self-indication *ratio* is not yet implemented into SAMMY. This quantity is defined as the resolution-broadened $SI(E)$ divided by the resolution-broadened capture yield $Y(E)$; implementation of this feature is one of many “on the drawing board” for future work.]