Derivation of experimental cross-sections for in-flight fission fragments from a ^{238}U beam

Our experimental cross sections of fission fragments are dependent on the abrasion-fission 3EER model [NIM B **266**, 4657 (2008)] in the LISE^{++} simulation because the transmission efficiencies in the BigRIPS separator are evaluated by the LISE^{++} simulation. In the 3EER model used in the LISE^{++} simulation, the cross sections of fission fragments are given by sums of cross sections via the 3 fissile nuclei in the LISE^{++} simulation.

$$Y^{LISE} = \left(\sigma_{R4}^{LISE} \times T_{R4} + \sigma_{R5}^{LISE} \times T_{R5} + \sigma_{R6}^{LISE} \times T_{R6}\right) \times N_b \times N_t$$

To deduce the experimental cross-sections based on the 3EER model, the followings are assumed.

1. The experimental ratio of the yields produced from the 3 fissile nuclei is the same with LISE^{++} simulation.
2. The experimental transmission efficiencies of fragments are the same with the LISE^{++} simulation.
3. The parameters of 3 EER model are used. (shown in Table. 1)

Thus,

$$\begin{aligned} Y^{exp} &= \left(\sigma_{R4}^{exp} \times T_{R4} + \sigma_{R5}^{exp} \times T_{R5} + \sigma_{R6}^{exp} \times T_{R6}\right) \times N_b \times N_t \\ &= \left(C \cdot \sigma_{R4}^{LISE} \times T_{R4} + C \cdot \sigma_{R5}^{LISE} \times T_{R5} + C \cdot \sigma_{R6}^{LISE} \times T_{R6}\right) \times N_b \times N_t \end{aligned}$$

are obtained.

Here,

$$C = {Y^{exp}}/{Y^{LISE}}$$

The experimental cross sections are given as,

$$\sigma_{R4}^{exp} = C \times \sigma_{R4}^{LISE}$$
$$\sigma_{R5}^{exp} = C \times \sigma_{R5}^{LISE}$$
$$\sigma_{R6}^{exp} = C \times \sigma_{R6}^{LISE}$$
$$\sigma^{exp} = \sigma_{R4}^{exp} + \sigma_{R5}^{exp} + \sigma_{R6}^{exp}$$

Y : the yield of fragment
σ : the cross section
T : the transmission efficiency
R : Reaction type
N_b : the total dose of ^{238}U
N_t : the number of target atoms per unit area

Table 1. The parameter of 3EER model.

	Low	Middle	High
Fissile	^{236}U	^{226}Th	^{220}Ra
E (MeV)	23.5	100	250
σ (mb)	200	500	350