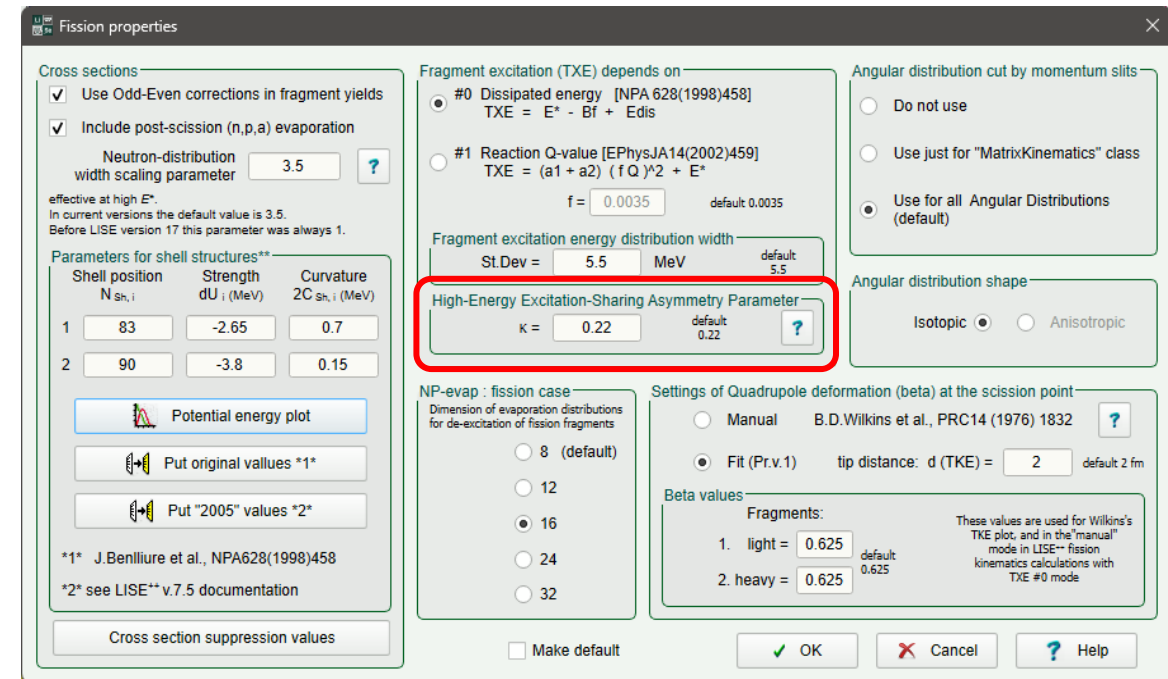


LISE++ : v.17.17.17

From 11/24/25

κ (Kappa): High-Energy Excitation-Sharing Asymmetry

- At high excitation energies ($E^* \gtrsim 40\text{--}100$ MeV), experiments and models show the LIGHT fragment receives extra excitation.
- Supported by ABLA07, GEF, FREYA, and high-energy abrasion–fission data.
- Cause: deformation-energy release, neck-rupture dynamics, thermal equilibration.
- Recommended for high-energy abrasion–fission (shell washout, broad Z/N distributions)
- κ controls the strength of this effect:
 - $\kappa = 0$: classical level-density sharing (LISE <17.17)
 - $\kappa \approx 0.2\text{--}0.3$: realistic high- E^* behavior for U, Th, Pu



Fission properties

Cross sections

- ☒ Use Odd-Even corrections in fragment yields
- ☒ Include post-scission (n,p,a) evaporation
- Neutron-distribution width scaling parameter: 3.5
- effective at high E^* . In current versions the default value is 3.5. Before LISE version 17 this parameter was always 1.

Parameters for shell structures**

Shell position	Strength	Curvature
$N_{Sh,i}$	dU_i (MeV)	$2C_{Sh,i}$ (MeV)
1	83	-2.65
2	90	-3.8

Buttons: Potential energy plot, Put original values *1*, Put "2005" values *2*

1 J. Benlliure et al., NPA628(1998)458
2 see LISE++ v.7.5 documentation

Fragment excitation (TXE) depends on

- ☒ #0 Dissipated energy [NPA 628(1998)458]
TXE = $E^* - B_f + E_{dis}$
- ☐ #1 Reaction Q-value [EPHYSJA14(2002)459]
TXE = $(a1 + a2) (f Q)^2 + E^*$
f = 0.0035 (default 0.0035)

Fragment excitation energy distribution width: St.Dev = 5.5 MeV (default 5.5)

High-Energy Excitation-Sharing Asymmetry Parameter

$\kappa = 0.22$ (default 0.22)

Angular distribution cut by momentum slits

- ☐ Do not use
- ☐ Use just for "MatrixKinematics" class
- ☒ Use for all Angular Distributions (default)

Angular distribution shape

Isotopic ☒ Anisotropic ☐

NP-evap : fission case

Dimension of evaporation distributions for de-excitation of fission fragments

- ☐ 8 (default)
- ☐ 12
- ☒ 16
- ☐ 24
- ☐ 32

Settings of Quadrupole deformation (beta) at the scission point

- ☐ Manual B.D. Wilkins et al., PRC14 (1976) 1832
- ☒ Fit (Pr.v.1) tip distance: d (TKE) = 2 (default 2 fm)

Beta values

Fragments:

- 1. light = 0.625 (default 0.625)
- 2. heavy = 0.625

These values are used for Wilkins's TXE plot, and in the "manual" mode in LISE++ fission kinematics calculations with TXE #0 mode

Buttons: Make default, OK, Cancel, Help

- Formula:

$$\Delta = |A_H - A_L| / A_{CN}$$

$$E_L^* = (a_L / (a_L + a_H)) \times E_{tot}^* \times (1 + \kappa \cdot \Delta)$$

$$E_H^* = E_{tot}^* - E_L^*$$

A_L — mass of the light fragment

A_H — mass of the heavy fragment

A_{CN} — total mass of the fissioning system

a_L — level-density parameter of the light fragment

a_H — level-density parameter of the heavy fragment

- LISE⁺⁺ implements a smooth, excitation-dependent κ -correction:

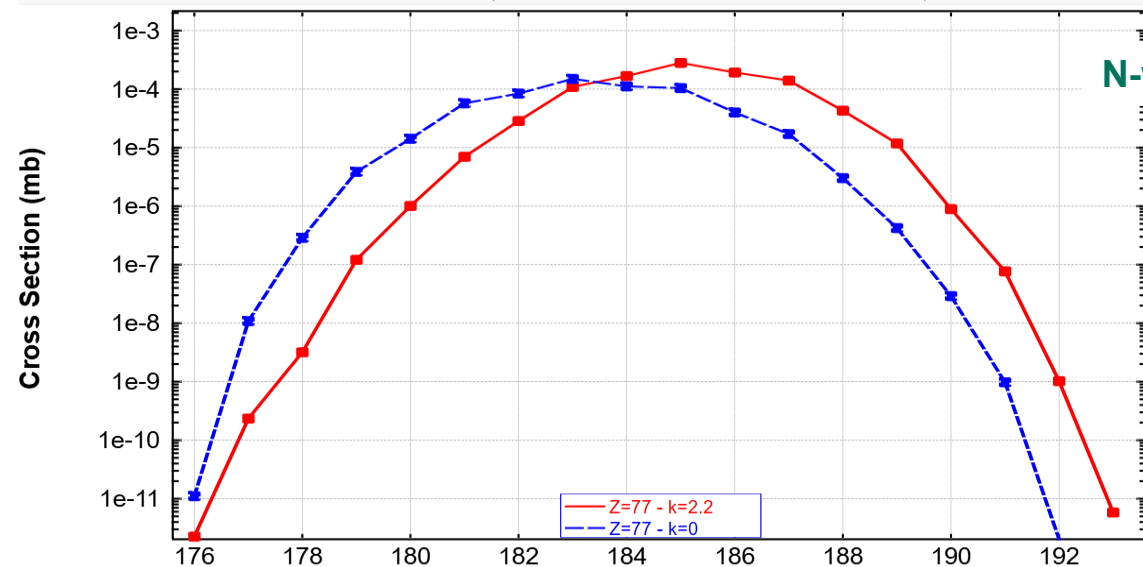
$$w(E^*) = 1 / (1 + \exp(-(E^* - 60 \text{ MeV})/20 \text{ MeV}))$$
 → activates asymmetry only at high TXE (40–80 MeV switch)
 - Light fragment receives tuned extra excitation conserving total TXE
 - Advantages:
 - Matches ABLA07/GEF 'hot light fragment' trend
 - Smooth transition between low- E^* and high- E^* regimes
 - Improves Z/N widths, especially for actinides
 - Default $\kappa = 0.22$ (under consideration)

Cross sections (Abrasion-Fission (High Ex))

Final CS >>> ^{238}U (177 MeV/u) + C (1.2 mm) $\rightarrow$ Z=77

$^{226}\text{Fr}^*$ $E_x=264\text{MeV}$ CS=3.7e+02 mb;

Fission $\rightarrow$ OE corr.: Yes; PostScission: Yes; $\text{NP}_{\text{evap}}^{\text{fission}}=16$; Shells: {83,-2.65,0.70} & {90,-3.80,0.15}; N-widthparameter: 1.00



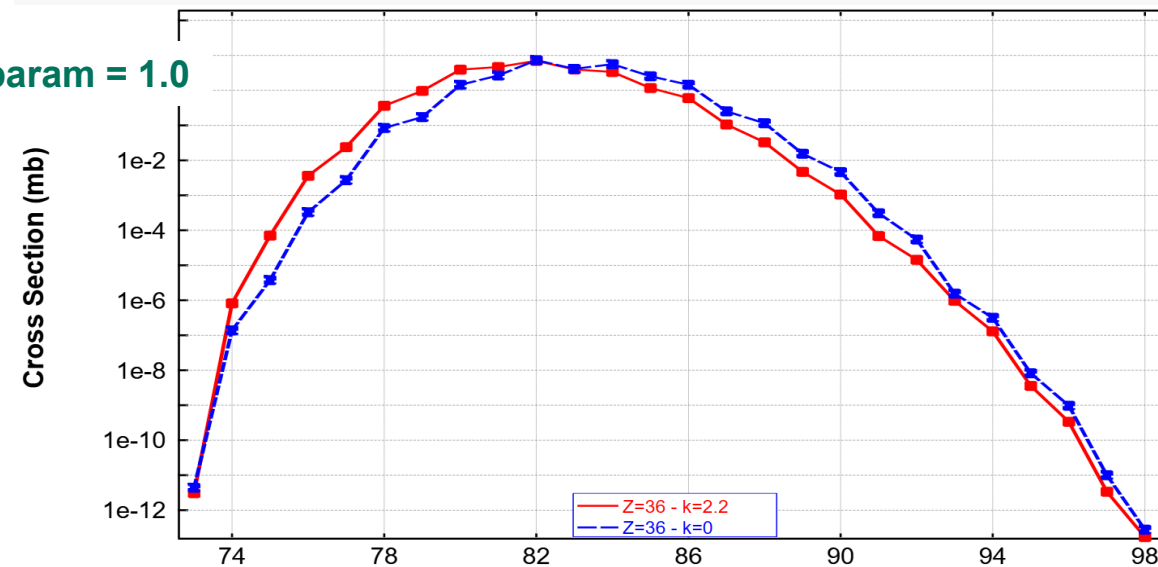
N-width param = 1.0

Cross sections (Abrasion-Fission (High Ex))

Final CS >>> ^{238}U (177 MeV/u) + C (1.2 mm) $\rightarrow$ Z=36

$^{226}\text{Fr}^*$ $E_x=264\text{MeV}$ CS=3.7e+02 mb;

Fission $\rightarrow$ OE corr.: Yes; PostScission: Yes; $\text{NP}_{\text{evap}}^{\text{fission}}=16$; Shells: {83,-2.65,0.70} & {90,-3.80,0.15}; N-widthparameter: 1.00

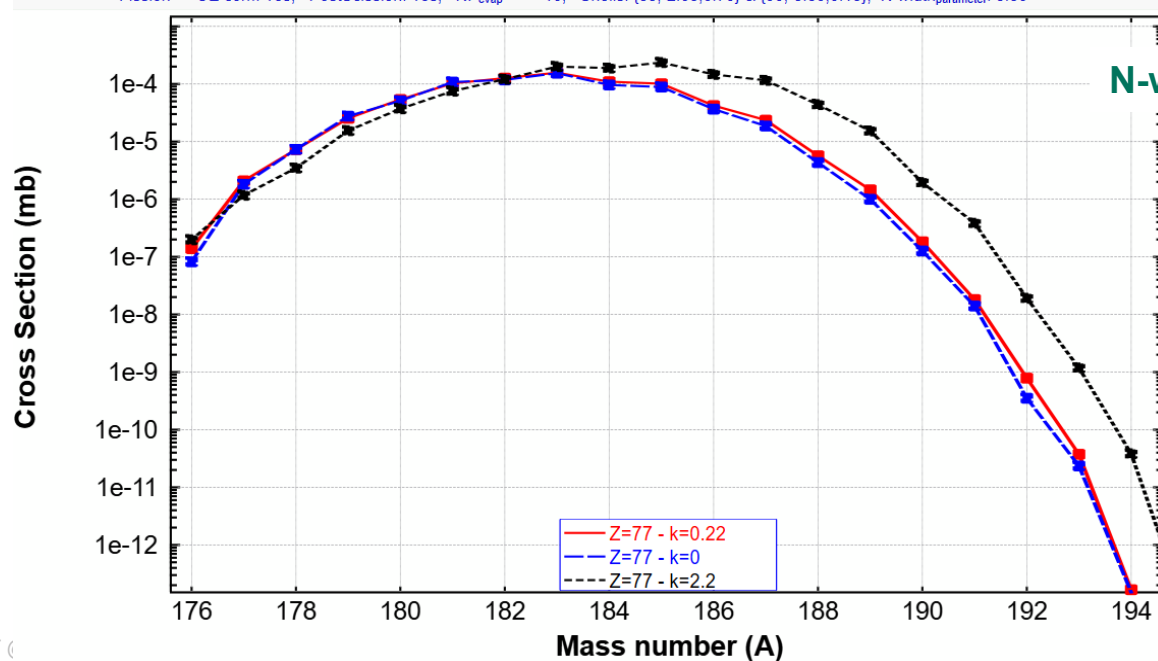


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N-width param = 3.5

Cross sections (Abrasion-Fission (High Ex))

Final CS >>> ^{238}U (177 MeV/u) + C (1.2 mm) $\rightarrow$ Z=36

$^{226}\text{Fr}^*$ $E_x=264\text{MeV}$ CS=3.7e+02 mb;

Fission $\rightarrow$ OE corr.: Yes; PostScission: Yes; $\text{NP}_{\text{evap}}^{\text{fission}}=16$; Shells: {83,-2.65,0.70} & {90,-3.80,0.15}; N-widthparameter: 3.50

