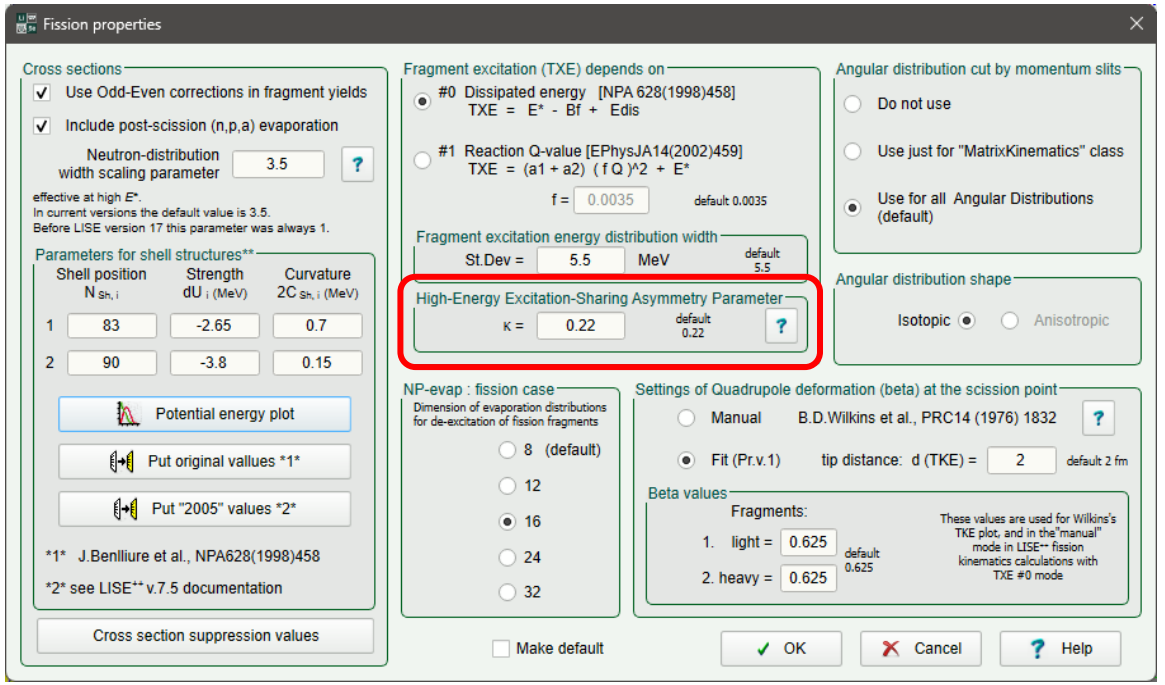
κ (Kappa) in High-Energy Abrasion–Fission

LISE$^{++}_{cute}$: v.17.17.17 **From 11/24/25**

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

- At high excitation energies (E* ≳ 40–100 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:
  - κ = 0 : classical level-density sharing (LISE <17.17)
  - κ ≈ 0.2–0.3 : realistic high-E* behavior for U, Th, Pu



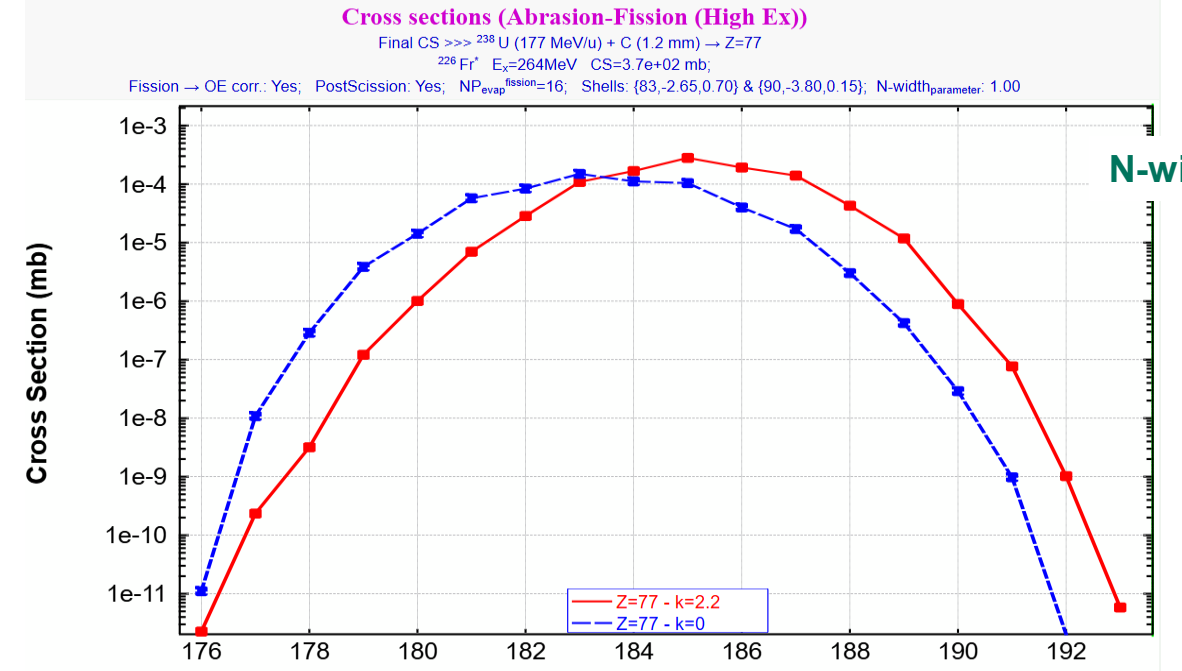
Energy-Sorting Behavior in LISE^{++} (High-E*)

- Formula:

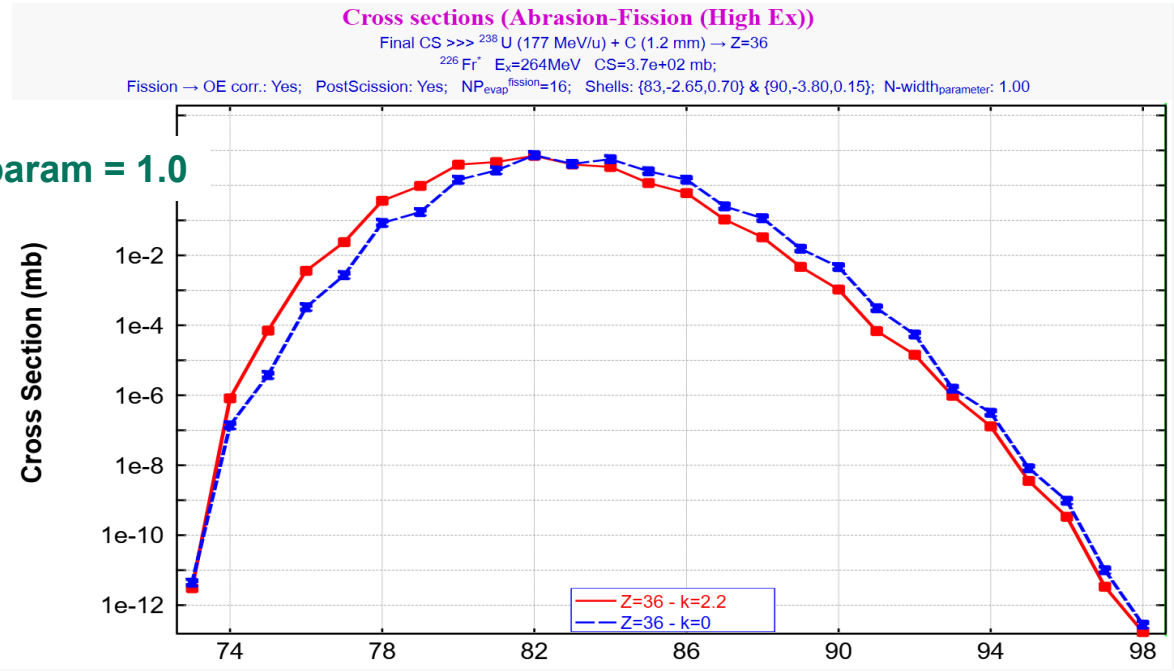
$$\Delta = |A_H - A_L| / A_{CN}$$
$$E_L^* = (a_L / (a_L + a_H)) \times E_{tot}^* \times (1 + \kappa \cdot \Delta)$$
$$E_H^* = E_{tot}^* - E_L^*$$

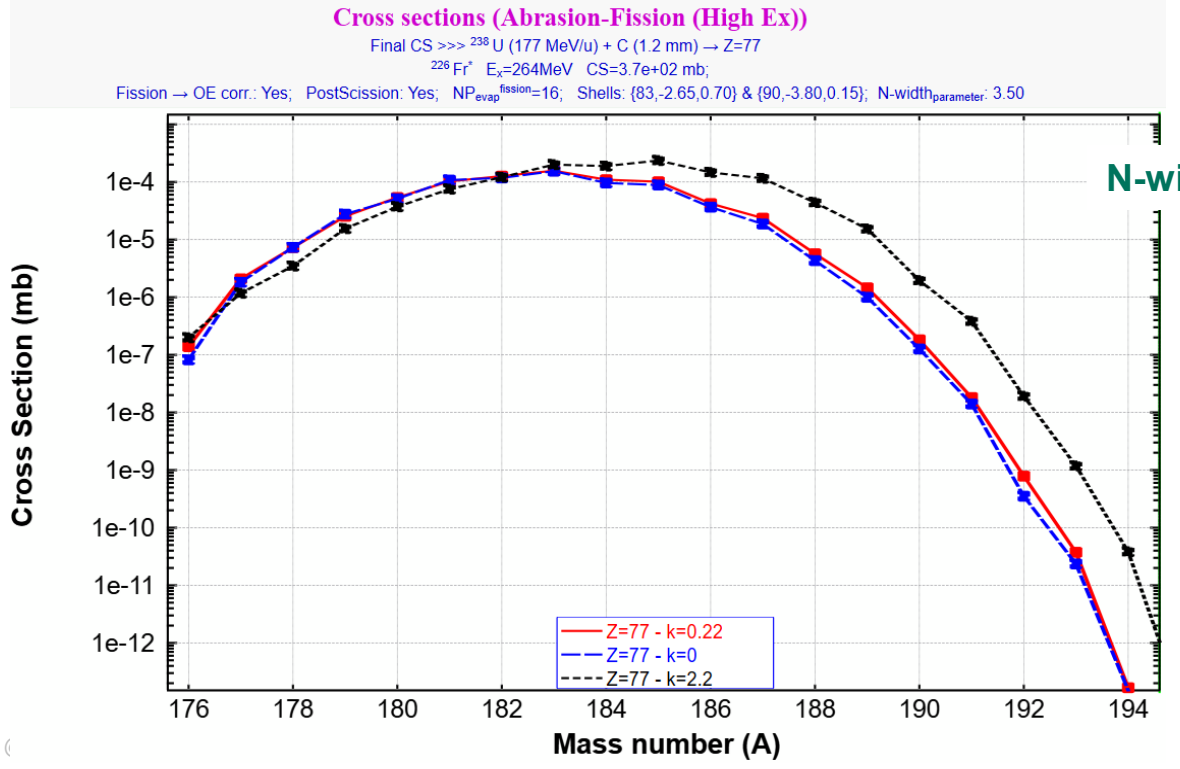
A_L — mass of the light fragment
A_H — mass of the heavy fragment
A_{CN} — total mass of the fissioning system
a_L — level-density parameter of the light fragment
a_H — level-density parameter of the heavy fragment

- 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)



N-width param = 1.0





N-width param = 3.5