

v.18.4
05/16/26

The main additions include PAC4 rate implementation, AA/dBE minimization corrections, generation of a gap-filled RIKEN fission cross-section table, FRIB PAC4 v4.1 rate updates, PACE4 development, and an important correction to analytical Distribution-mode transport for extended optics configurations.

The most significant technical correction in this sequence is the fix of Distribution-mode calculations for extended LISE optics files when wedge thickness defects are enabled. The analytical Distribution method now propagates momentum-dependent angular sidebands in addition to momentum-dependent position sidebands. This restores the missing wedge-defect contribution in extended optics and brings the results into agreement with segmented optics and Monte Carlo benchmarks.

- Generation of a gap-filled RIKEN fission cross-section table
- PAC4 rates were implemented in LISE⁺⁺
- Distribution-Mode Fix: Extended Optics with Wedge Thickness Defect
- Version notes

link to the main report:

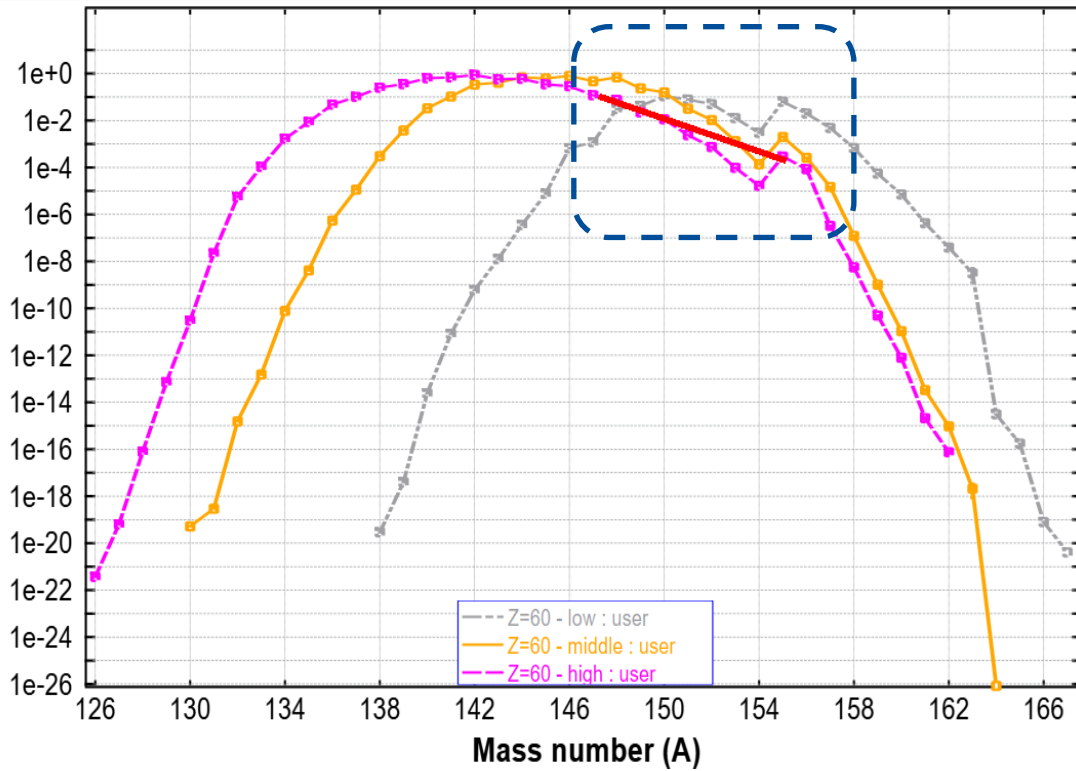
[DistributionExtendedOptics.pdf](#)

Cross sections (Abrasion-Fission (all regions))

Final CS >>> ^{238}U (203 MeV/u) + C (0.5 g/cm²) → Z=60

$^{238}\text{U}^*$ $E_x=32$ MeV $\sigma=3e+02$ mb; --- $^{232}\text{Th}^*$ $E_x=101$ MeV $\sigma=4e+02$ mb; --- $^{225}\text{Fr}^*$ $E_x=264$ MeV $\sigma=3.4e+02$ mb;

Fission → OE corr.: Yes; PostScission: Yes; NP_{evap}^{fission}=16; N-width_{parameter}: 2.50; κ: 0.22; Shells: {83,-2.65,0.70} & {90,-3.80,0.15}

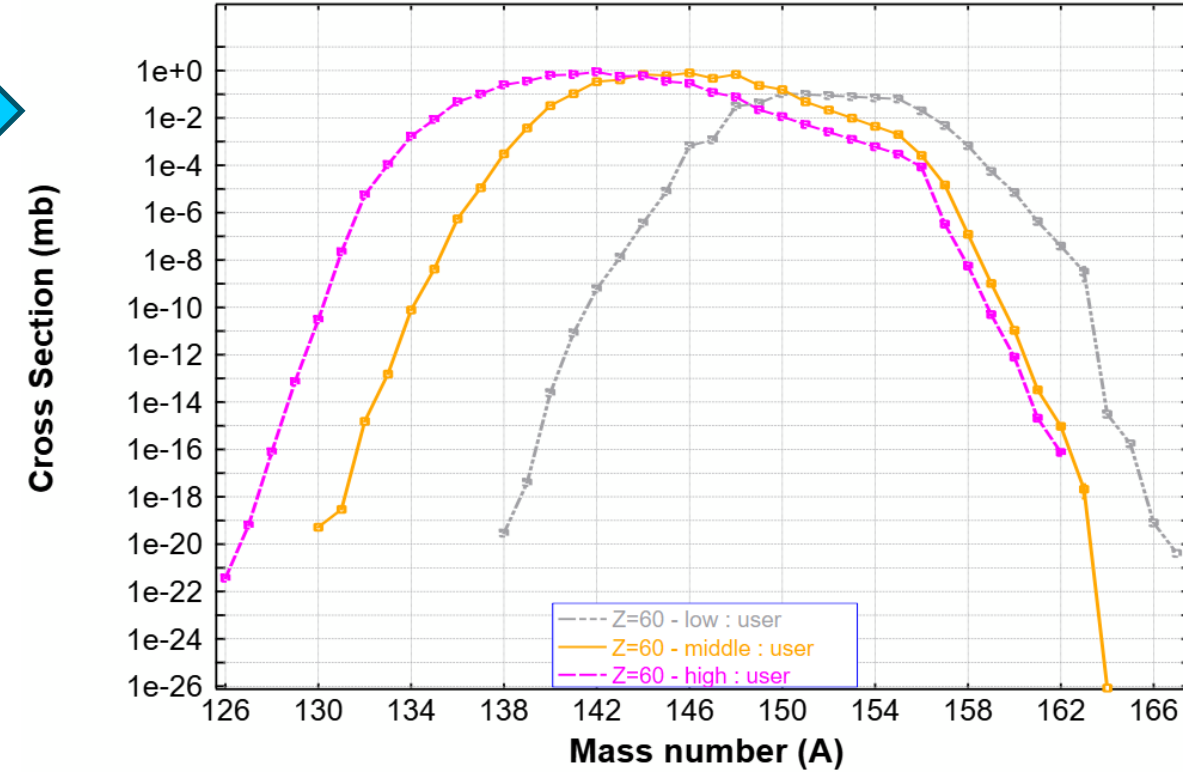


Cross sections (Abrasion-Fission (all regions))

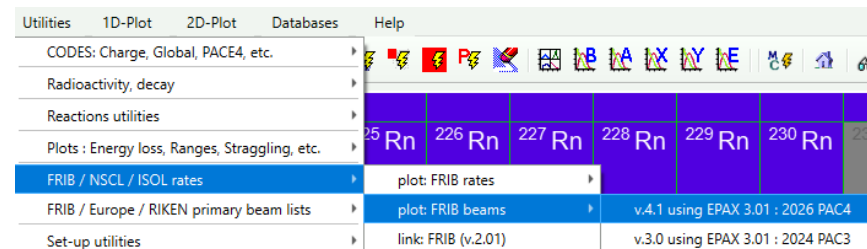
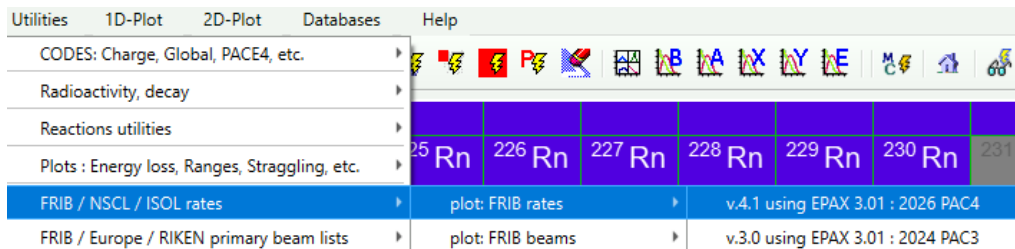
Final CS >>> ^{238}U (193.27 MeV/u) + C (2 mm) → Z=60

$^{238}\text{U}^*$ $E_x=28$ MeV $\sigma=1.8e+02$ mb; --- $^{232}\text{Th}^*$ $E_x=56$ MeV $\sigma=5e+02$ mb; --- $^{225}\text{Fr}^*$ $E_x=264$ MeV $\sigma=4.3e+02$ mb;

Fission → OE corr.: Yes; PostScission: Yes; NP_{evap}^{fission}=16; N-width_{parameter}: 2.50; κ: 0.22; Shells: {83,-2.65,0.70} & {90,-3.80,0.15}



- Generated a gap-filled RIKEN fission cross-section table: 238U_Be_fission_RIKEN_gapfilled.cs
- Location: PublishedData/238U
- The example abrasion-fission files in files/examples/afission/ were updated accordingly

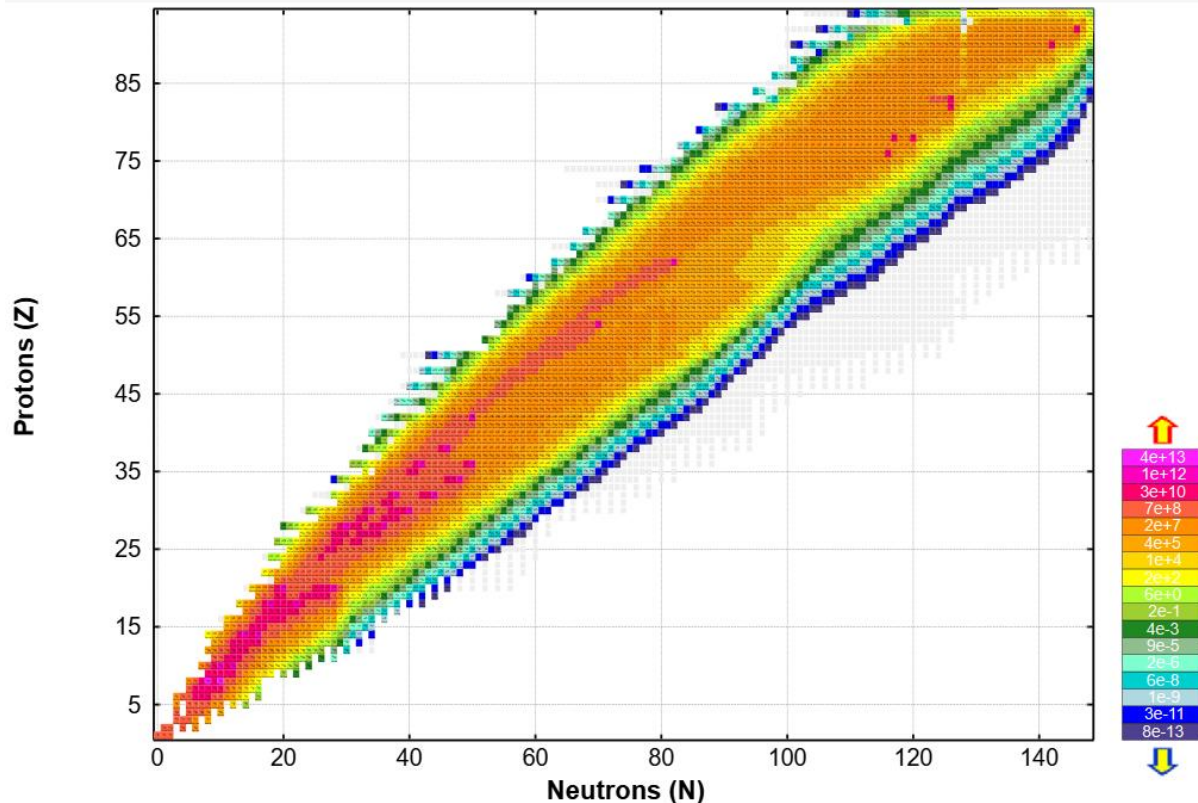


FRIB fast beam rates (v.4.1) : 2026 PAC4

2026 PAC4: 30 beams (23 beams @ 45 kW). 86-m flight is taken into account

The rates are estimated based on the EPAX 3.01 parameterization for fragmentation and the LISE++ 3EER model for in-flight fission.

Primary beam energies according the FRIB Beam PAC4 list

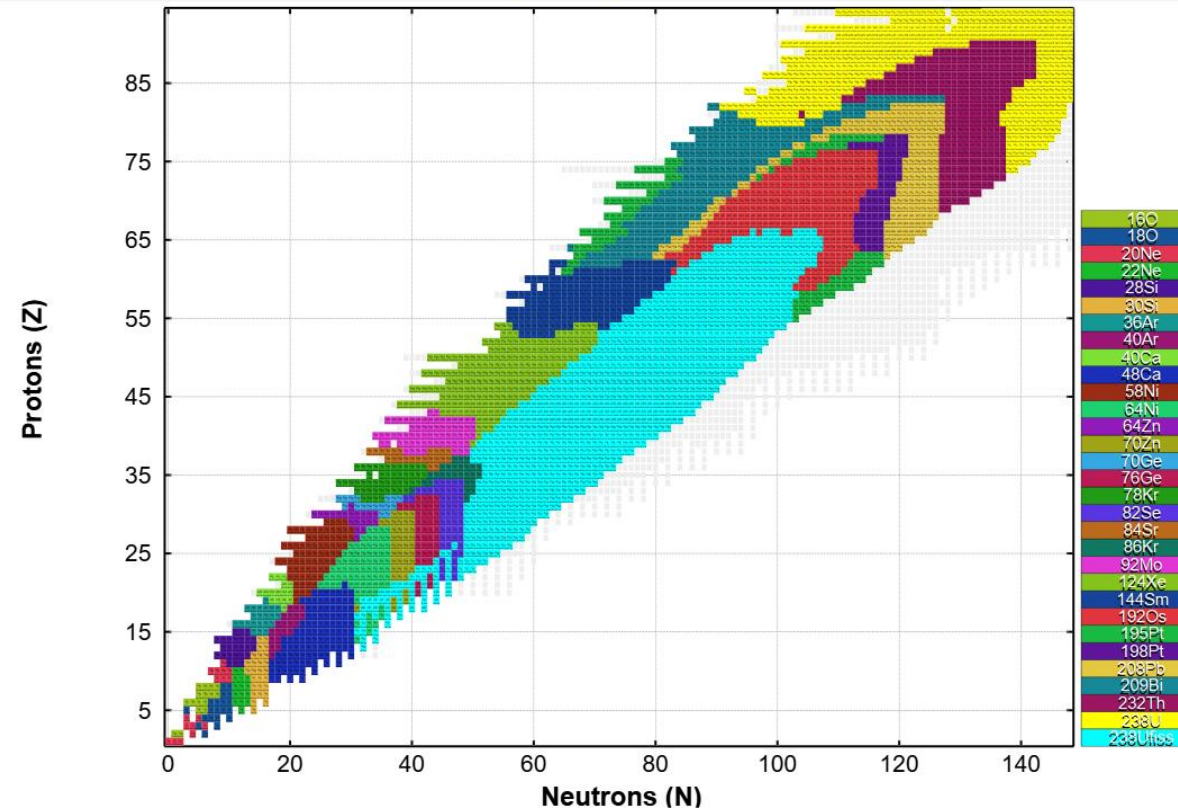


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Primary beam energies according the FRIB Beam PAC4 list



link to the main report: [DistributionExtendedOptics.pdf](#)

A discrepancy was found between segmented and extended LISE optics files in analytical Distribution mode when wedge thickness defect was enabled.

The same optics and physics settings produced consistent results in Monte Carlo mode, but analytical Distribution mode gave a strongly underestimated horizontal distribution width for the extended configuration.

The problem was traced to the treatment of the momentum-dependent wedge-defect contribution. The Distribution method propagated the momentum-dependent position sideband, $dX(P)$, but did not propagate the corresponding momentum-dependent angular sideband, $dA(P)$.

For segmented optics this issue was mostly hidden, because the full first-order transport effect was contained in a larger condensed matrix. In extended optics, however, the same effect is distributed over many smaller elements. The missing angular sideband caused the wedge-defect discrepancy was found between segmented and extended LISE optics files in analytical Distribution mode when wedge thickness defect was enabled.

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For segmented optics this issue was mostly hidden, because the full first-order transport effect was contained in a larger condensed matrix. In extended optics, however, the same effect is distributed over many smaller elements. The missing angular sideband caused the wedge-defect contribution to be lost during propagation.

The corrected transport now evaluates:

$$A_{\text{center}} = A(P); \quad A_{\text{down}} = A(P - dP); \quad A_{\text{up}} = A(P + dP)$$

$$dAXd = A_{\text{center}} - A_{\text{down}}; \quad dAXu = A_{\text{up}} - A_{\text{center}}$$

and similarly for the vertical plane.

The additional angular sideband components are stored in `distrFour`:

$$e4dAXd, e4dAXu, e4dAYd, e4dAYu$$

This gives the required first-order propagation:

$$dX_{\text{new}} = R11*dX_{\text{old}} + R12*dA_{\text{old}} + R16*dP$$

$$dA_{\text{new}} = R21*dX_{\text{old}} + R22*dA_{\text{old}} + R26*dP$$

After the correction, the extended Distribution-mode calculation gives the expected wedge-defect contribution at the focal plane: to FP:

$$-\text{delta}X(P) = 7.79 \text{ mm}$$

$$+\text{delta}X(P) = 7.80 \text{ mm}$$

This agrees with the segmented optics result and with the Monte Carlo benchmark.

18.3.1 — 05/07/26

PAC4 rates were implemented in LISE++

18.3.2 — 05/07/26

Added creation of the **Iso** command in the **Spectrometers-View** menu

18.3.3 — 05/07/26

PAC4 rates: color scheme revised

The **Iso** command in the **Spectrometers-View** menu is disabled after completion

18.3.4 — 05/07/26

Added link for **dBE Cross-Section Minimization**

18.3.5 — 05/08/26

AA minimization correction for nuclei that are particle-unbound according to the selected mass table but have measured experimental cross sections

This correction affects the **Local Line** treatment

18.3.6 — 05/08/26

Corrected combobox-index handling in the **Mass-formula calculation** dialog

18.3.7 — 05/08/26

Generated a gap-filled RIKEN fission cross-section table:

238U_Be_fission_RIKEN_gapfilled.cs

Location: PublishedData/238U

The example abrasion-fission files in files/examples/afission/ were updated accordingly

18.3.8 — 05/13/26

FRIB PAC4 rates were updated to version 4.1

18.3.9 — 05/15/26

Corrected the tweak value in the Brho dialog (Reported by Alex D.)

18.3.10 — 05/15/26

PACE4 updated to version 4.35.4

Work included comparison with PACE2 and development related to goto commands

18.3.11 — 05/16/26

Implemented new/updated e4d sideband components in the distrFour class:

e4dXd, e4dXu, e4dYd, e4dYu

These components store momentum-dependent position sidebands used by analytical Distribution-mode transport

18.3.12 — 05/16/26

Updated L_Trans_Optics and L_Trans_Angle to use the e4dX* and e4dY* components

This solved the first part of the issue with Distribution-mode calculations for extended optics files

18.3.13 — 05/16/26

Fixed analytical Distribution-mode transport for extended optics configurations when wedge thickness defect is enabled

Added momentum-dependent angular sideband propagation: The analytical transport now propagates both position and angular sidebands: dX(P), dA(P)

This correction preserves the wedge-defect contribution through extended optics blocks. Extended optics files now agree with segmented optics and Monte Carlo benchmarks

18.4.0 — 05/16/26

Middle version changed to **18.4.0**