

Abrasion Fission 3EER caching

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The three excitation-energy region model previously regenerated its shared FissionCS tables when they were first needed after reopening a LISE file. These releases persist the Low, Middle and High table sets and automatically restore matching results. The cache includes initial and final cross sections and evaporation data needed to reconstruct prefragment kinematics. [1]

1 Automatic reuse and input validation

When tables are loaded or calculated

Each region has an independent cache entry. When its tables are first needed, LISE checks for a compatible saved file. A valid match bypasses table generation and the legacy local EM evaporation warm-up. Missing, incompatible or invalid files trigger normal calculation. Another .lpp can use the same cache because the filename of the input file is not part of the key. [1, 4]

Opening a .lpp with saved isotope results may not request any table operation. Consequently, opening a file alone need not populate the cache indicator. If a new calculation is required, a cache hit restores the shared tables while isotope-specific transport continues as needed. [3]

Physics and data fingerprints

The SHA-256 key includes the region nucleus, excitation energy and width, cross section, beam and target, and relevant fission and evaporation settings. It also covers mass and shell data, barrier records, evaporation resolution, and the executable checksum. Exact AF settings signatures supplement the older in-memory comparison, and AF parameters are saved at full precision so save/reopen does not round the region inputs. [1, 4]

Before publishing loaded state, LISE checks file size, format version, expected key, payload checksum, matrix dimensions and numerical validity. A changed executable checksum produces a different key, even when its displayed version or physics settings remain the same. The first use of a new build can therefore require recalculation. [3, 4]

Shared storage

Default folder: Documents\LISEcute\Cache\3EER. LISE creates it when saving. Windows may redirect Documents, for example to OneDrive. An absolute LISE_AF_CACHE_DIR environment variable can override the folder for testing or portable deployment. Each 64-character SHA-256 filename ends in .afcache and stores one region; a full set uses three files. [3]

2 User controls and cache status

The AF 3EER cache group in the Abrasion-Fission dialog contains the Designer-defined checkbox and three buttons. Version 18.8.113 gives the excitation-region hints more vertical space while retaining these controls. [2, 3]

Use saved 3EER cache. Enabled by default. The integer preference is saved as Mechanism/AF_3EER_cache in lisepp.ini, rather than in individual .lpp or .lopt files. OK saves the choice; Cancel restores it. When disabled, automatic disk reads and writes are bypassed, including forced recalculation. Existing files are preserved and initialized tables can still be reused in memory. [2]

Recalculate 3EER tables. Applies current settings and rebuilds the three region tables without loading their saved entries. With caching enabled, a complete replacement is committed atomically. A failed or cancelled rebuild preserves the previous complete file. With caching disabled, recalculation does not save a disk cache. [2]

Clear 3EER cache. Removes generated 64-hex-digit .afcache files directly in the shared folder, across LISE inputs. It preserves unrelated files, subfolders and loaded tables, reports removals and failures, and does not change the preference. Clearing disk files alone does not force already loaded tables to be rebuilt. [1, 2]

3EER cache status. Reports Low/Mid/High status, elapsed times and whether files exist for the current inputs. Details show matching filenames and the shared directory; Open cache folder opens it. Status for other physics inputs is not presented as the current status. [2]

The screenshot shows the 'Abrasion-Fission' dialog box. It is divided into several sections:

- Energy region definitions:** Includes buttons for 'LOW', 'MIDDLE', and 'HIGH' excitation energy regions. It also has checkboxes for 'Choose a primary reaction', 'Perform transmission calculations for this energy region', and 'Choose FISSIONING nucleus' (with options 238U, 235Ac, 231At). Below these are fields for 'Z, N, N/Z', 'Excitation energy (MeV)', and 'Cross section (mb)'. A 'Restore previous settings' button is at the bottom.
- Reaction mechanism settings:** Includes a 'Load Fission, Evaporation, EE Region settings from file' button, 'Fission properties', 'Evaporation settings', and 'Prefragment excit energy' sections. There is also a 'Utility: Initial fissioning nucleus analysis for selected fragment' section.
- AF 3EER cache:** Contains a 'Use saved 3EER cache' checkbox, a '3EER cache status...' button, a 'Recalculate 3EER tables' button, and a 'Clear 3EER cache' button.
- LISE++ Abrasion-Ablation calculations to estimate excitation energy regions:** This section has a 'Calculate' button and a 'Plot' button. It shows a table of 'Hints' for 'LOW', 'MIDDLE', 'HIGH', and 'EM fission' regions, including 'LISE++ fissioning nucleus from the E_x - CS analysis', 'A-A fissioning nucleus E_x (MeV)', 'Weighted region E_x (MeV)', and 'Cross section (mb)'. There are also 'use in code' buttons for each hint.
- Region Boundaries:** Shows 'Fission barrier' values for 'LOW', 'MIDDLE', and 'HIGH' regions. It includes a text box explaining boundary energies for mean values of prefragment excitation energy distributions. Below this are fields for 'coef for Z_{beam}' and 'coef for N_{beam}', with recommendations and a 'Z_{stop}' value.

At the bottom, there are 'OK', 'Cancel', 'Help', and 'Make default' buttons.

Figure 1. Archived AF dialog from the normal MSVC 18.8.113.1 application. Cache controls are in the lower-left group. Source [3].

The permanent status-bar indicator reports the last regional operation, such as L:cache M:cache H:cache. Rebuilt means calculated and saved; off means calculated with disk caching disabled. Its tooltip gives timings and miss reasons. Silent runs with -log record regional hits, rebuilds, failures and unsaved results. [2]

3 Stored tables and kinematics scope

Restoring only final cross sections would be insufficient. FindPrefragments uses evaporation information to recover the initial prefragment and complementary partner before assigning excitation and kinetic energies. The cache therefore restores all six matrices and their auxiliary state. [1, 4]

Stored matrices	Role
mat_init and mat	Initial yields before evaporation and final yields after evaporation.
dA_mat and dN_mat	Mean evaporated nucleons and neutrons indexed by final isotope; supports prefragment reconstruction.
dA_mat_out and dN_mat_out	Mean emitted nucleons and neutrons indexed by initial isotope; supports diagnostics and plots.

The final normalized evaporation values are saved, rather than intermediate cross-section-weighted sums. Auxiliary state includes neutron, proton and mass yield totals, polarization, neutron energy information, mean emitted-particle quantities, counters and validity flags. No pointers or raw object memory are serialized. [3, 4]

Binary format and file size

The format is binary and uncompressed, version 1, with little-endian Qt QDataStream serialization configured for Qt 5.15 and double-precision floating-point values. A header, nucleus dimensions, physics key and SHA-256 payload checksum accompany the calculation state. [3]

The measured three-file set contained 587,828, 615,284 and 635,876 bytes: about 0.59 to 0.64 MB per file and 1.84 MB in total using decimal MB. These sizes describe the benchmark input; different nuclei can produce different sizes. Old entries remain until explicitly cleared; there is no automatic expiry. [3, 5]

Calculations that remain on demand

The inexpensive analytic initialization is retained for GetTXE and related properties. Per-isotope angular and energy transport matrices are still generated as needed because they depend on fragment, target energy, excitation offset, angular model, grid and acceptance. The separate AF region-estimation calculation that produces hints is also outside this cache. [1, 4]

Practical consequence. A cached run can still display calculation progress and take several seconds. A regional cache hit means shared CS and evaporation tables were restored; it does not mean every later transport calculation was skipped.

Recovery from invalid or interrupted work

Corrupt, truncated, incompatible or numerically invalid records are rejected. Normal calculation supplies replacement data, and QSaveFile commits only a complete replacement. Failed rebuilds keep the previous complete file. The final 18.8.112 behavior supersedes the earlier research note wording about removing an entry before a forced rebuild. [2, 4]

4 Validation and recorded benchmark

The archived MSVC unit tests cover exact six-matrix serialization, integrity and version rejection, atomic replacement and scoped cleanup. Production integration covers all three regions, reconstructed kinematics, settings/data invalidation, corrupt-file repair, forced rebuilds, preference round trips and the dialog/status controls. [1, 2, 5]

Normal MSVC 18 8 112 2 benchmark

The real application ran twice in separate processes against a fixed input snapshot and an isolated, initially empty cache. Saved isotope results were cleared in both runs; full input physics and grids were retained. No concurrent build or linker from the task ran during measurement. [2, 5]

Measurement	Recorded result
End-to-end cold calculation	67.7776062 s
End-to-end cached reopen	4.9915409 s
Observed speedup	13.5785 times
Regional cache loads	Low 11 ms; Middle 169 ms; High 10 ms

All three regions logged CS and evaporation-kinematics cache hits. Cache hashes and modification times were unchanged, and CS, transmission and energy outputs matched after excluding only File/Date report metadata. The input snapshot remained unchanged. These are measurements for that build, input and machine, not a general performance guarantee. [5]

The normal MSVC 18.8.113.1 application subsequently built successfully and its AF dialog was visually verified. No new timing benchmark was performed for 18.8.113. Its changed executable digest requires its own matching cache files. [3, 6]

5 Version and source references

LISE versions: 18.8.111-113. Version 18.8.111 adds persistence, kinematics state, validation and shared storage. Version 18.8.112 adds diagnostics, the persisted preference, Designer controls and safer replacement. Version 18.8.113 adjusts the dialog layout and archives build and cache-file details.

Release records below are in doc/3eer/2026-10-21/ relative to the repository root.

[1] RELEASE_18_8_111.txt. [2] RELEASE_18_8_112.txt. [3] RELEASE_18_8_113.txt and 3eer-af-dialog-113.png.

[4] doc/3EER_cache_research.txt, implementation and kinematics research; later release records govern superseded replacement behavior.

[5] release112-final-validation.json and release112-final-msvc-*.log. Executable SHA-256: fff9d8f37a4ef862fc67dbe166d5b49447828858f9268df8e2d0e1e3083297a6. Input snapshot SHA-256: 5d4f47e99fe61df9e8f60218630e3b2f2196b52ceb2a68c1f0902c2b3a0f8938.

[6] release113-msvc-validation.json and release113-msvc-build.log. Further release documentation: doc/RELEASE_18_8_113.docx. This subject report summarizes archived evidence; it introduces no new build or timing run.