ENDF/B-VIII.1-Beta4

Released June 28, 2024

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Updates since Beta3 - neutrons

- 3He: Added MF4/6 exit distributions to n+He3.
- 6Li: covariances from M. Paris. Minor Li6 fixes: switch total cross section to log-log for first few decades, and set MAT1=0 for cross-reaction covariance. Add unitbase interpolation flag to Li6 MT32 product distributions. Remove electrons from several light charged particle masses in Li6 MF6
- 13C: Covariance fixes from M. Paris
- 16O: Fixed NWD in the beginning of MF/MT = 1/451
- 50,52,53Cr: Removed legacy MF=33 MT=22 covariance as this reaction is now not present in MF=3. This inconsistency was causing processing issues.
- 56Fe: Restored covariances from VIII.0.
- 57Fe: Update by A. Trkov fixing two negative values in the elastic cross section (issue #539).
- **63,65Cu**: INDEN resonance evaluation
- 88Sr: Minor fixes to Sr88: change interpolation for background capture cross section, add same background to total, add missing unitbase interpolation flags
- **95Mo**: Retracting IRSN evaluation for 95Mo and reverting it back to VIII.0. Luiz Leal warned that there were criticality performance issues with the new evaluation and recommended to withdraw it; Update sent by I. Thompson on March 5, 2024, re-introducing the TENDL exit distribution (MF=6, MT=107) into the reverted VIII.0 file.
- 139La: Replace La139 covariances with TENDL2024, plus many fixes
- 181Ta: Add cross-reaction covariances with a slight modification of uncertainties
- 190,191,192,193,194,195,196,197,198Pt: Add covariances and expand descriptive part. Many other fixes
- **207,208Pb**: Update for 208,207Pb sent by Peter Brain by email on May 9, 2024, with lowered elastic thermal cross section, plus other fixes in 208Pb
- 233U: Added PFNS covariances for U233 done by Michael Rising and submitted by Denise Neudecker on December 20, 2023, reported on a NSE paper and LA-UR-15-26188; cross section covariances up to 2.5 keV by M. Pigni. Updates for nubar and nubar covariances from IAEA's u233e81b3B.
- 235U: Fixed nubar covariance up to 2.25 keV. Estimated 0.65% uncertainty with full correlation. Nubar covariances from IAEA's u235e81b3B.endf. Minor fixes.
- 239Pu: cross section covariance updates up to 5 keV, previously up 2.5 keV. Replace Pu239 (n,f) covariance from 5 keV to 30 MeV with version from G. Schnabel. Nubar covariances from IAEA's pu239e81b3B. Resonance covariances from M. Pigni.

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Updates since Beta3 - TSL

- 7Liin7LiD-mixed (fixes)
- 7Liin7LiH-mixed (fixes)
- BeinBe2C (fixes)
- CinBe2C (fixes)
- CinZrC (fixes):
  - tsl-CinZrC.endf
  - tsl-CinZrC_flassh-header.txt
- ZrinZrC (fixes):
  - tsl-ZrinZrC.endf
  - tsl-ZrinZrC_flassh-header.txt
- Din7LiD-mixed (fixes)
- Hin7LiH-mixed (fixes)
- HinUH3 (fixes)
- H in ZrH2 (typos and fixes):
  - tsl-HinZrH2.endf
  - tsl-HinZrH2_flassh-header.txt

- Zr in ZrH2 (typos and fixes):
  - tsl-ZrinZrH2.endf
  - tsl-ZrinZrH2_flassh-header.txt
- H in ZrHx (typos and fixes):
  - tsl-HinZrHx.endf
  - tsl-HinZrHx_flassh-header.txt
- Zr in ZrHx (typos):
  - tsl-ZrinZrHx.endf
  - tsl-ZrinZrHx_flassh-header.txt
- Y in YH2 and H in YH2, and auxiliary files. New coherent elastic from NNL
- New room temperature evaluations from University of Sharjah/ORNL (Iyad Al-Qasir)
  - Be in BeF2; F in BeF2
  - Mg in MgF2; F in MgF2
  - Mg in MgO; O in MgO

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Updates since Beta3 - Photonuclear

Common problem with high multiplicity and double counting for heavy residues:

- 89Y
- 103Rh
- 159Tb
- 165Ho
- 169Tm
- 181Ta

There were a few small issues in Beta4

Changes after Beta4 release

Neutrons:

- 208Pb: Photon multiplicity for MT=102 was 0 below 100 keV. Adopted the total photon multiplicity from VIII.0 below 100 keV, adjusted to be consistent with VIII.1-Beta4 spectra.
- 86Kr: Removed MT5 out of MF3,6,8,10 as it had negligible cross sections with weird multiplicities. This was not necessarily an issue for NJOY but it was raising flags.
- 192Pt: There were still gaps between fast and resonance regions. Fix domain mismatch between different L/J sections in Pt192 URR, moving lowest point in L>0 sections down to match L=0.

Deuterons:

- D+T: Add LAW=6 distributions back to d+t and push the first point for the MT=51 neutron distribution & multiplicity up to match cross section domain

Helions:

- 6Li: Restore CP elastic scattering from VIII.0 evaluation that went missing due to a GNDS to ENDF translation issue.
- 7Li: Add elastic scattering (Rutherford only) to h + Li7 evaluation that went missing due to a GNDS to ENDF translation issue.

Alphas:

- 6Li: Add elastic scattering (Rutherford only) to alpha + Li6 evaluation that went missing due to a GNDS to ENDF translation issue.

TSL:

- H in UH3: Minor straightforward fix: Removed the extra spurious SEND line ending MF=7 MT=451.

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Changes after Beta4 release

<u>dos2unix and removal of line numbers:</u>

- 1 file in deuterons sub library
- 2 files in neutrons sub library
- 1 file in nfy sub library
- 80 files in TSL sub library

<u>File headers</u>:

- ALL files in ALL sub libraries
- Checks and fixes for first line, NLIB, NVER, LREL, NSUB, NFOR, DDATE, RDATE, ENDATE, HSUB

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Release perspective

- We got validation feedback: No surprises!

- Aiming for an **AUGUST 30th** final release.

- ALL files are good to go, already with this target date in.

- Final processing tests with NJOY/ FUDGE/AMPX are underway.

- Unless recommended otherwise by CSEWG, we are ready to follow through with this timeline!

ENDF/B
VIII.1

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Big Paper

Big Paper

Missing parts or needing work:

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- Text on minor fixes to files: **Gustavo**
- Re-work of table on exit distributions adopted from TENDL: **Gustavo, Ian Thompson**
- Re-work of table on URR of fission products adopted from JENDL: **Gustavo**
- Text on evaluations/fixes in alphas sublibrary: **Caleb, Jason Thompson, Gustavo**
- Text on atomic sublibraries needs to be canibalized from Red's EPICS document: **Gustavo**
- Updates to validation plots and text: **Noah, Denise, Gustavo, ???**

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- Many, many small and medium "FIX-MEs": **EVERYONE!**

- Close reads of own parts and of the whole text: **EVERYONE!**

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For those without GitLab access, I will circulate again a shared OneDrive directory with frequently updated versions of the compiled .pdf.

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ENDF: The Future
What is already in for ENDF/B-IX

Why talk about ENDF/B-IX?

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ENDF release

ENDF release

BTW, there will be updates to standards, so

ENDF/B-VIII.2   ENDF/B-IX

Why talk about ENDF/B-IX?

ENDF release

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BTW, there will be updates to standards, so

ENDF-VIII.2   ENDF/B-IX

Why talk about ENDF/B-IX?

- With VIII.1 (practically) done, now is the perfect time to plan out the next cycle
- The lessons learned are still fresh, we can start off in better footing than before
- We received many contributions that could not be reviewed and tested in time to make it for VIII.1:
  - **saved_for_after_VIII.1** branch
  - There are many other planned contributions on the way
- Tools are in place for a relatively quick turnaround for a IX-Beta1

ENDF release

ENDF release

The King is dead, long live the King!

BTW, there will be updates to standards, so

ENDF-VIII.2   ENDF/B-IX

Evaluations already submitted

<u>Neutrons</u>:

- ^{35}Cl (LANL/Terrapower)

<u>TSL:</u>

- Polyethylene extended temperatures (NCSU)
- W, V, Pb, Ni, Mo, Cu (ORNL)

<u>Photonuclear:</u>

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Expected/planned submissions (That I know of…)

Neutrons:

- ^{95}Mo, Gd (ORNL)
- Zr (RPI/ORNL/BNL…)

Deuterons:

- D+T (LANL/LLNL)

Standards:

- ^{252}Cf sf

FPY

Decay

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Acknowledgements

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