NEA
NUCLEAR ENERGY AGENCY

JEFF-4.0 nuclear data library

CSEWG Nuclear Data Week 2025

6 January 2026

Antonio Jiménez-Carrascosa

OECD/NEA Data Bank, JEFF Secretariat

Contents

- JEFF-4.0 library contents
- JEFF-4.0 benchmarking
- NEA Data Bank infrastructure
- Next steps and synergies with ENDF/B-IX development activities

JEFF-4.0 nuclear data library

- JEFF-4.0 was released in June 2025 with new:
  - Neutron induced cross section evaluations
  - Thermal fission yields (U-233, U-235, Pu-239, Pu-241)
  - Thermal scattering law (TSL) libraries
  - Major contributions from TENDL-2023 (++)
  - A selection of proton-induced transport data
  - New TAGS data on top of JEFF-3.3 decay data

- Data publicly available at the NEA Data Bank website:
  - Joint Evaluated Fission and Fusion (JEFF) Library version 4.0 - NEA Data Bank GitLab platform

JEFF Nuclear Data Week April 2025

JEFF-4.0 nuclear data library - contents

Neutron-induced cross sections

- Transport subset: 593 files
- Full set: 2855 files

Thermal Scattering Law

- 123 files covering 24 elements and 60 compounds
- New evaluations for reactor materials (UO2, PuO2, ThO2, Zy4)
- Large integration of nCrystal and ENDF/B-VIII.1 TSLs

Fission yields sub-library

- JEFF-3.3
- New nth + U-233, U-235, Pu-239, Pu-241
- Updated correlation matrices

Decay data

- JEFF-3.3 data
- New TAGS data for 8 radionuclides
- Corrected files for 2 radionuclides

Proton-induced cross sections

- Transport subset: 288 files
- Full set: 2855 files
- Evaluations for 288 naturally abundant nuclides (TENDL-2023, JENDL-5, ENDF/B-VIII.1)

g, d, t, h, a-induced cross sections

- TENDL-2023 data
- g: 2825 files
- d: 2850 files
- t: 2865 files
- h: 2821 files
- a: 2835 files

JEFF-4.0 nuclear data library - contents

- **Neutron-induced cross sections**
  - New major actinides U-235, U-238, Pu-239:
    - Resolved resonance region.
    - Fast and unresolved resonance region based on new models.
  - New minor actinides U-236, Np-237/238, Pu-238/240/241/242, Am-241/243, Cm-244/246.
  - New C-12, O-16, Gd-155/156/158/160.
  - Modifications on Bi-209, U-234, Np-239 (JENDL-5), Hf-176/178, U-237; delayed neutron groups and gamma-emission.
  - TENDL-2023 (updates in August 2024 and February 2025).
    - 2855 files (full set).
    - Removal of legacy (single-purpose) JEFF-3.3 files in favour of TENDL.
    - Fission product updates via TENDL.
  - INDEN: B-10/11, O-18, F-19, Si-28/29/30, Cr-50/52/53/54, Mn-55, Fe-54/56/57, Co-59, Cu-63/65, Th-232, U-233.
  - JENDL-5: H-1, In-113/115, Pa-232, U-232, Np-235/236/239, Pu-236, Am-242/242m/244/244m, Cf-249/254, Es-253/255, Fm-255.
  - ENDF/B-VIII.0: He-4, Li-6/7, C-13, W-180/182/183/184/186, Ta-181 (ENDF/B-IX-beta1)

JEFF-4.0 nuclear data library - contents

- **Thermal scattering law sub-library**
  - JEFF-3.3 with 16 new files, 6 modified files, new H in H2O evaluation, ESS (nCrystal) and ENDF/B contributions.
  - 132 files for 84 materials (24 elements, 60 compounds).

JEFF4T5

tsl_4-Be.txt
tsl_83-Bi.txt
tsl_Al_Al2O3.txt
tsl_Ca_CaH2.txt
tsl_C_C5O2H8.txt
tsl_C_C8H8.txt
tsl_C_CH2.txt
tsl_D_D2O.txt
tsl_Graphite.txt
tsl_H_C5O2H8.txt
tsl_H_C8H8.txt
tsl_H_CaH2.txt
tsl_H_CH2.txt
tsl_H_H2O.txt
tsl_H_HF.txt
tsl_H_Ice.txt
tsl_H_ZrH15.txt
tsl_H_ZrH2.txt
tsl_H_ZrH.txt
tsl_Mesi-PhII.txt
tsl_Mg.txt
tsl_O_Al2O3.txt
tsl_O_C5O2H8.txt
tsl_O_D2O.txt
tsl_Ortho-D.txt
tsl_Ortho-H.txt
tsl_Para-D.txt
tsl_Para-H.txt
tsl_Si.txt
tsl_Tolue-PhII.txt
tsl_Zr_ZrH15.txt
tsl_Zr_ZrH2.txt
tsl_Zy4
tsl_ThO2
tsl_UO2
tsl_PuO2

ESS

tsl_Ag_sg225_Silver.ess
tsl_Al_sg225_Aluminum.ess
tsl_Au_sg225_Gold.ess
tsl_Ca_sg225_Calcium.ess
tsl_Ca_CaH2_sg62_CalciumHydride.ess
tsl_H_CaH2_sg62_CalciumHydride.ess
tsl_Ca_CaOH2_sg164_CalciumHydroxide.ess
tsl_H_CaOH2_sg164_CalciumHydroxide.ess
tsl_O_CaOH2_sg164_CalciumHydroxide.ess
tsl_C_C-diamond_sg227_Diamond.ess
tsl_Cr_sg229_Chromium.ess
tsl_Cu_sg225_Copper.ess
tsl_Fe_Fe-alpha_sg229_AlphaIron.ess
tsl_Fe_Fe-gamma_sg225_GammaIron.ess
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tsl_Se_GaSe_sg194_GalliumSelenide.ess
tsl_Ge_sg227_Germanium.ess
tsl_Bi_Ge3Bi4O12_sg220_BismuthGermanate.ess
tsl_Ge_Ge3Bi4O12_sg220_BismuthGermanate.ess
tsl_O_Ge3Bi4O12_sg220_BismuthGermanate.ess
tsl_Ge_GeTe_sg160_GermaniumTelluride.ess
tsl_Te_GeTe_sg160_GermaniumTelluride.ess
tsl_K_sg229_Potassium.ess
tsl_H_KOH_sg4_PotassiumHydroxide.ess
tsl_K_KOH_sg4_PotassiumHydroxide.ess
tsl_O_KOH_sg4_PotassiumHydroxide.ess
tsl_F_LiF_sg225_LithiumFlouride.ess
tsl_Li_LiF_sg225_LithiumFlouride.ess
tsl_H_LiH_sg225_LithiumHydride.ess
tsl_Li_LiH_sg225_LithiumHydride.ess
tsl_D_MgD2_sg136_MagnesiumDeuteride.ess
tsl_Mg_MgD2_sg136_MagnesiumDeuteride.ess
tsl_H_MgH2_sg136_MagnesiumHydride.ess
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tsl_Mo_sg229_Molybdenum.ess
tsl_Na_sg229_Sodium.ess
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tsl_Na_NaI_sg225_SodiumIodide.ess
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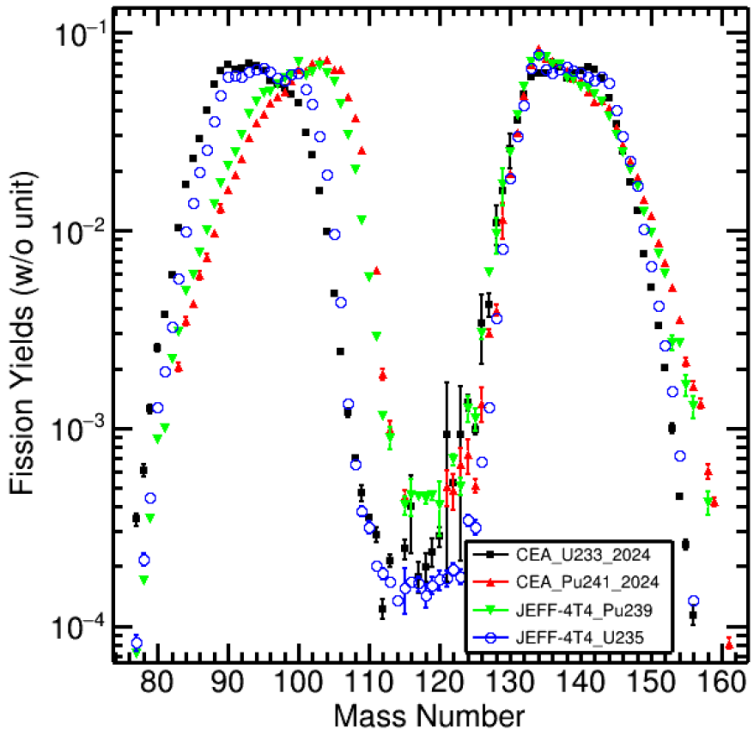
tsl_Mg_NaMgH3_sg62_SodiumMagnesiumHydride.ess
tsl_Na_NaMgH3_sg62_SodiumMagnesiumHydride.ess
tsl_H_NaOH_sg63_SodiumHydroxide.ess
tsl_Na_NaOH_sg63_SodiumHydroxide.ess
tsl_O_NaOH_sg63_SodiumHydroxide.ess
tsl_Nb_sg229_Niobium.ess
tsl_Ni_sg225_Nickel.ess
tsl_Pb_sg225_Lead.ess
tsl_Pd_sg225_Palladium.ess
tsl_Pt_sg225_Platinum.ess
tsl_Sn_sg141_Tin.ess
tsl_H_SrH2_sg62_StrontiumHydride.ess
tsl_Sr_SrH2_sg62_StrontiumHydride.ess
tsl_Ti_sg194_Titanium.ess
tsl_V_sg229_Vanadium.ess
tsl_W_sg229_Tungsten.ess
tsl_Al_Y3Al5O12_sg230_YttriumAluminiumGarnet.ess
tsl_O_Y3Al5O12_sg230_YttriumAluminiumGarnet.ess
tsl_Y_Y3Al5O12_sg230_YttriumAluminiumGarnet.ess
tsl_Zn_sg194_Zinc.ess
tsl_S_ZnS-sphalerite_sg216_ZincSulfide.ess
tsl_Zn_ZnS-sphalerite_sg216_ZincSulfide.ess
tsl_Zr_sg194_Zirconium.ess
...

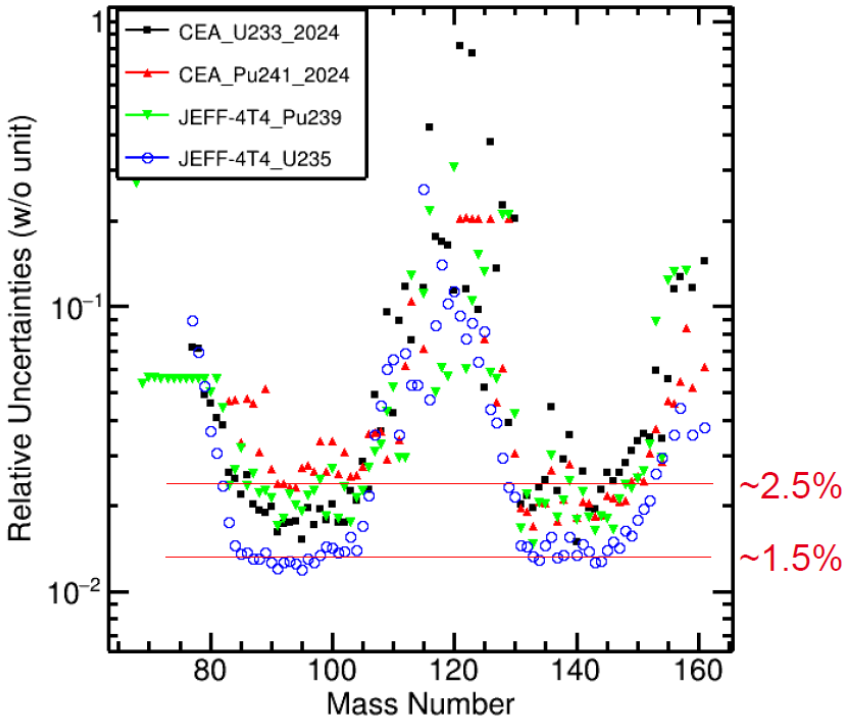
ENDF\B-VIII.1

tsl_7Li_7LiD.b81
tsl_Be_Be2C.b81
tsl_Be_BeF2.b81
tsl_Be_BeO.b81
tsl_Be_FLiBe.b81
tsl_benzene.b81
tsl_C_Be2C.b81
tsl_C_CF2.b81
tsl_C_UC.b81
tsl_C_ZrC.b81
tsl_D_7LiD.b81
tsl_F_BeF2.b81
tsl_F_CF2.b81
tsl_F_FLiBe.b81
tsl_F_MgF2.b81
tsl_H_ParaffinicOil.b81
tsl_H_UH3.b81
tsl_H_YH2.b81
tsl_CH4-liquid.b81
tsl_Li_FLiBe.b81
tsl_Mg_MgF2.b81
tsl_Mg_MgO.b81
tsl_N_UN.b81
tsl_O_BeO.b81
tsl_O_MgO.b81
tsl_CH4-solid.b81
tsl_U_UC.b81
tsl_U_UN.b81
tsl_U.b81
tsl_Y_YH2.b81
tsl_Zr_ZrC.b81
...

JEFF-4.0 nuclear data library - contents

- **Fission product yields sub-library**
  - JEFF-3.3 data with new thermal neutron-induced U-235, Pu-239, U-233, Pu-241.
  - New methodology at CEA, carefully using all experimental data and new ILL data.
  - Correlation matrices have been produced for the four new evaluations and are publicly available.





JEFF-4.0 nuclear data library - contents

- **Decay data sub-library**
  - JEFF-3.3 sub-library with new TAGS data for 8 radionuclides (Rb-93, Y-96, Y-96m, Y-99, Tc-103, Tc-108, I-138, Cs-142.
  - Tc-99 Q-value update.
  - Am-242 EC/B- branching and decay radiation.

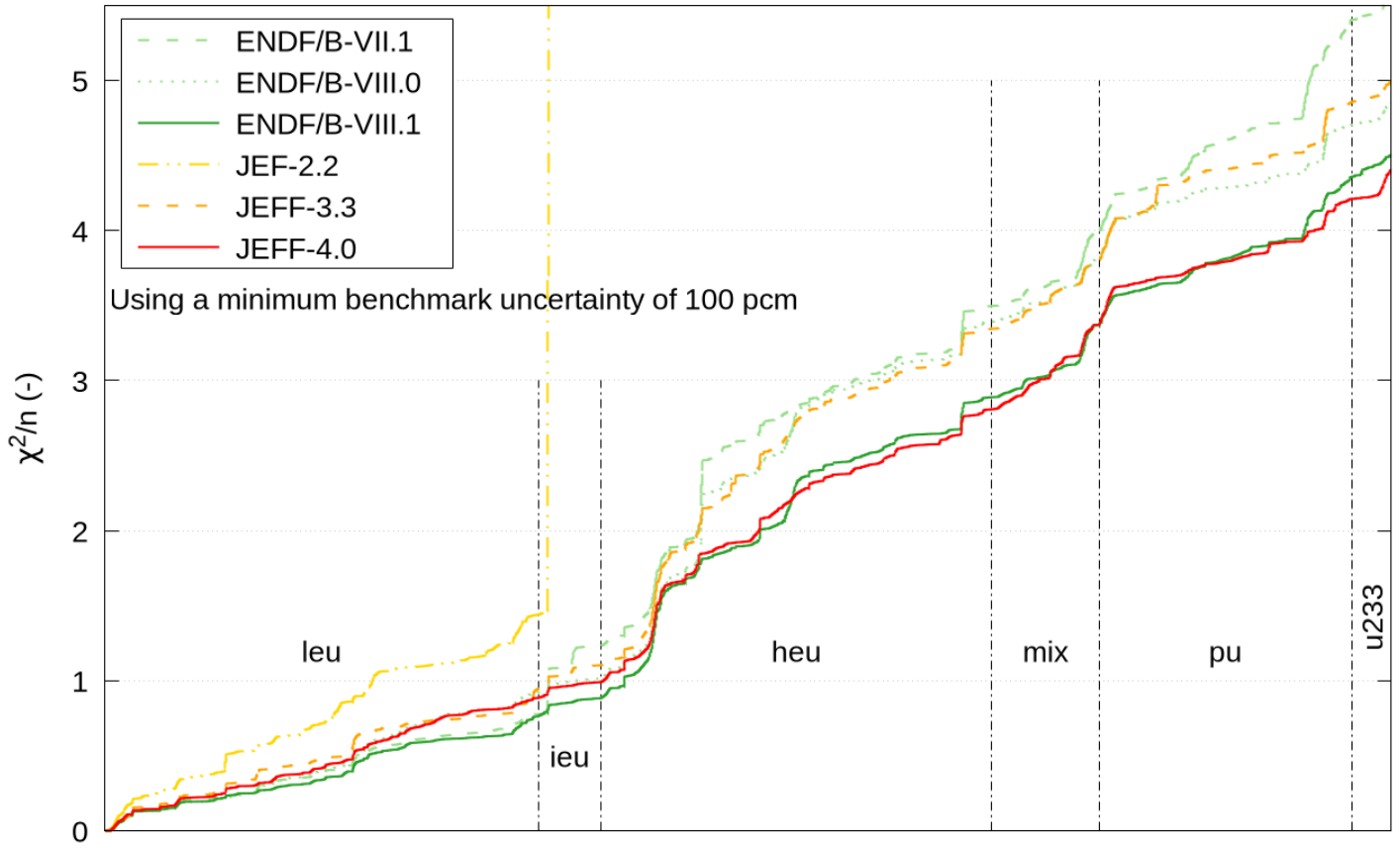
JEFF-4.0 nuclear data library - benchmarking

- Extensive feedback on JEFF-4.0 was provided at the latest JEFF Nuclear Data Week, November 2025.
  - Criticality benchmarking looks consistent.
  - Corrected reactivity vs. burnup.
  - Improved inventory estimations due to FP updates.
  - Improvements on fission and fusion decay heat.

Thursday, 20					
JEFDOC	Benchmarking		Welcome and Intro from the Chair (David BERNARD, Raphaelle ICHOU, Steven VAN DER MARCK)	9:00	0:05
2477	Antonio	JIMENEZ-CARRASCOSA	NEA presentation on JEFF-4.0 benchmarking	9:05	0:20
2478	Charles	BORY	NEA Shielding Integral Benchmark Archive and Database (SINBAD) - Status Update	9:25	0:20
2479	Juan Jose	GOMEZ RODRIGUEZ	Reactivity induced transients with JEFF3.3 and JEFF4.0 at a zero-power reactor with Serpent	9:45	0:20
2480	Juan Jose	GOMEZ RODRIGUEZ	Reactivity temperature feedback coefficient at the AKR-2 zero-power reactor	10:05	0:20
2481	Juan	GARCIA BUENO	Nuclear data benchmarking with subcritical measurement in a heavy-water systems	10:25	0:20
Coffee break				10:45	0:20
2482	Luca	FIORITO	JEFF-4.0 performances for SFCOMPO benchmark cases	11:05	0:20
2483	Vasilis	VLACHOUDIS	JEFF-4 benchmarking with the FLUKA Monte Carlo code	11:25	0:20
2484	Jessica	HOLLIS	Fusion decay heat benchmarking - JEFF-4	11:45	0:20
2485	Mariya	BROVCHENKO	Benchmark selection analysis using the JEFF4 nuclear data adjustment for uranium and plutonium isotopes	12:05	0:20
2486	Ivan Alexander	KODELI	Use of XSUN-2023 for shielding benchmark analysis	12:25	0:20
Lunch				12:45	1:00
2487	Steven	VAN DER MARCK	Discussion of selected benchmarking topics for the JEFF-4.0 paper	13:45	0:20
2488	Nemetan	TEIXEIRA RUA	PIE interpretation with the JEFF-4.0 library	14:05	0:20
2489	Raphaelle	ICHOU	Feedback on JEFF-4.0	14:25	0:20
2490	Kemal	RAMIC	Benchmarking of graphite TSLs with ICSBEP evaluations	14:45	0:20
2491	Gilles	NOGUERE	Feedback for BUC application	15:05	0:20
Coffee break				15:25	0:30
JEFDOC	Feedback from Industry		Welcome and Intro from the Chair (Robert JACQMIN)	15:55	0:05
2492	Bor	KOS	Additional Benchmark Cases for Gamma-Generating Cross Sections in Nuclear Well Logging	16:00	0:20
2493	Axel	HOEFER	Nuclear data libraries in neutron activation calculations	16:20	0:20
2494	Ronan	GOODWIN	Fission Event Using FISPACT-II, for JEFF-4 - U235, Pu239	16:40	0:20

JEFF-4.0 nuclear data library - benchmarking

- Criticality benchmarking for 3191 cases shows a clear improvement compared to JEFF-3.3.
- Similar performance as ENDF/B-VIII.1.



S. van der Marck, *Discussion of selected benchmarking topics for the JEFF-4.0 paper*, JEFDOC-2487, November 2025.

JEFF-4.0 nuclear data library - benchmarking

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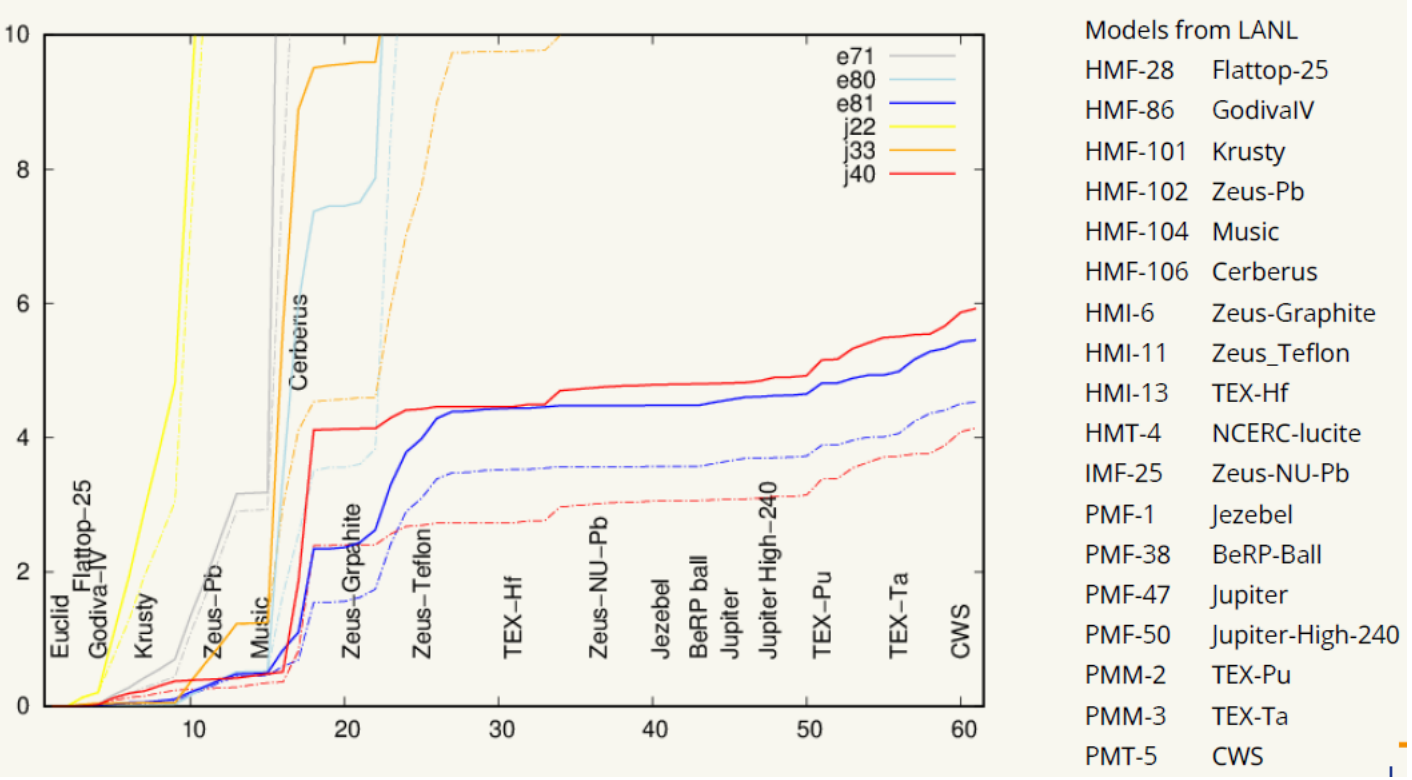
- Similar performance as ENDF/B-VIII.1.
- Modern validation suite with quite similar behavior between JEFF-4.0 and ENDF/B-VIII.1.



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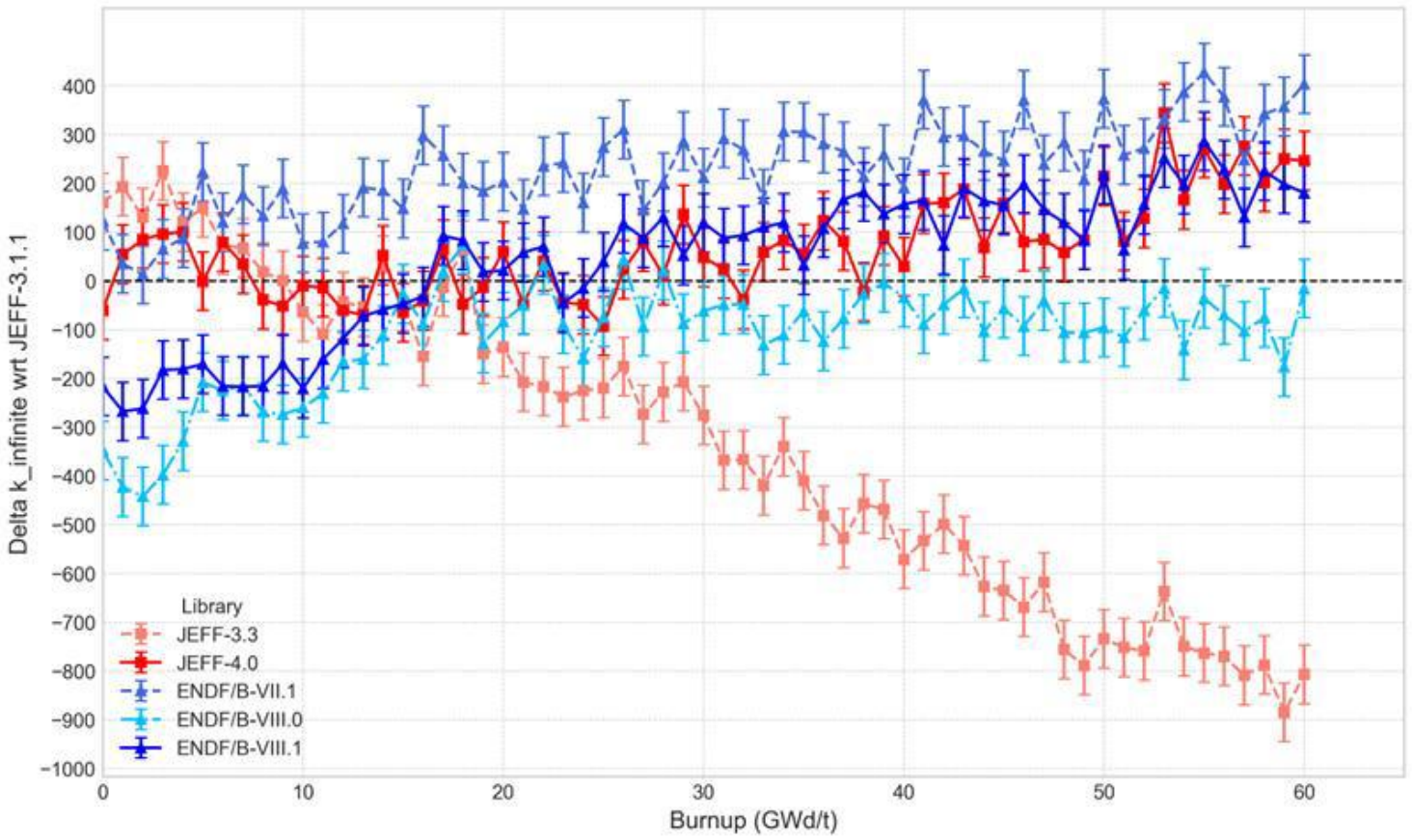
- Modern validation suite with quite similar behavior between JEFF-4.0 and ENDF/B-VIII.1.
- Reactivity curve was finally corrected, where JEFF-4.0 and ENDF/B-VIII.1 perform similarly.



R. Ichou, *Feedback on JEFF-4.0*, JEFDOC-2489, November 2025.

JEFF-4.0 nuclear data library - benchmarking

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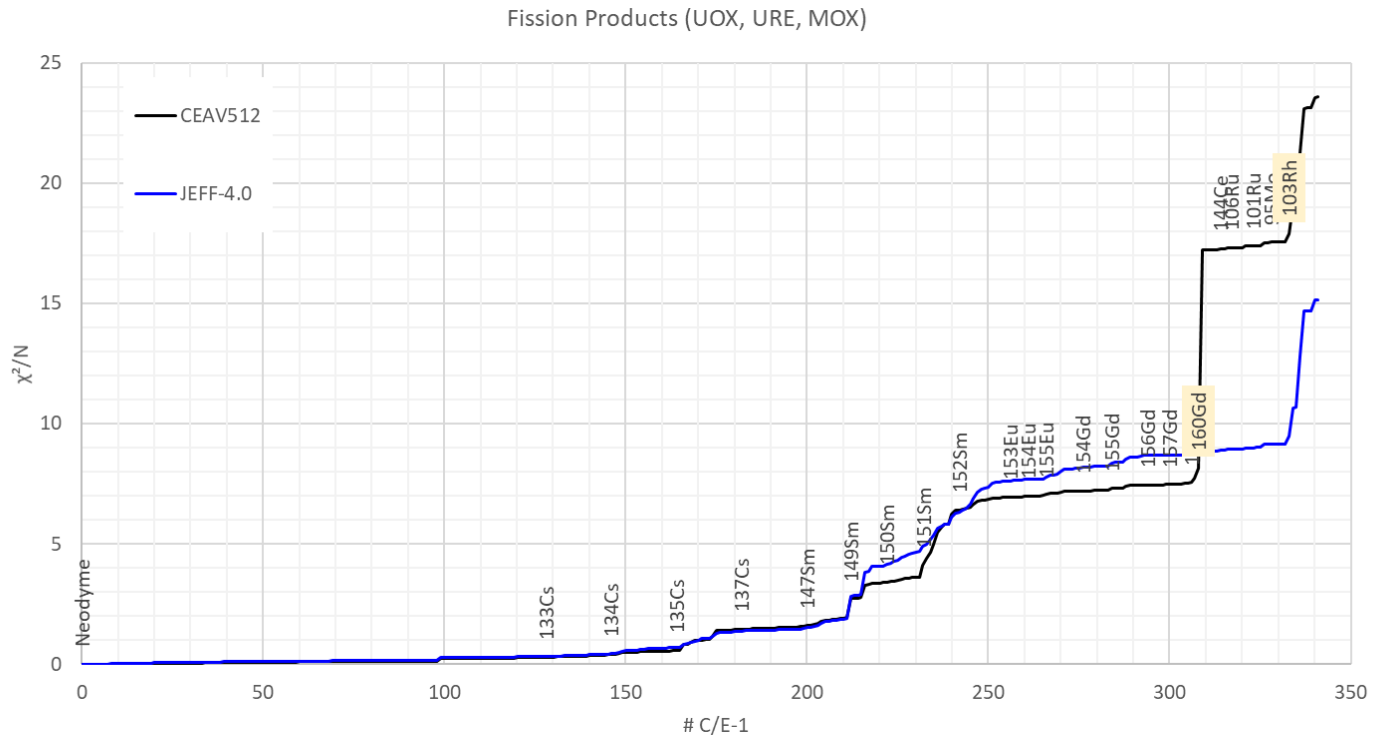
- Improved inventory estimation due to updates on fission products.



G. Noguere, *Feedback for BUC application*, JEFDOC-2491, November 2025.

JEFF-4.0 nuclear data library - benchmarking

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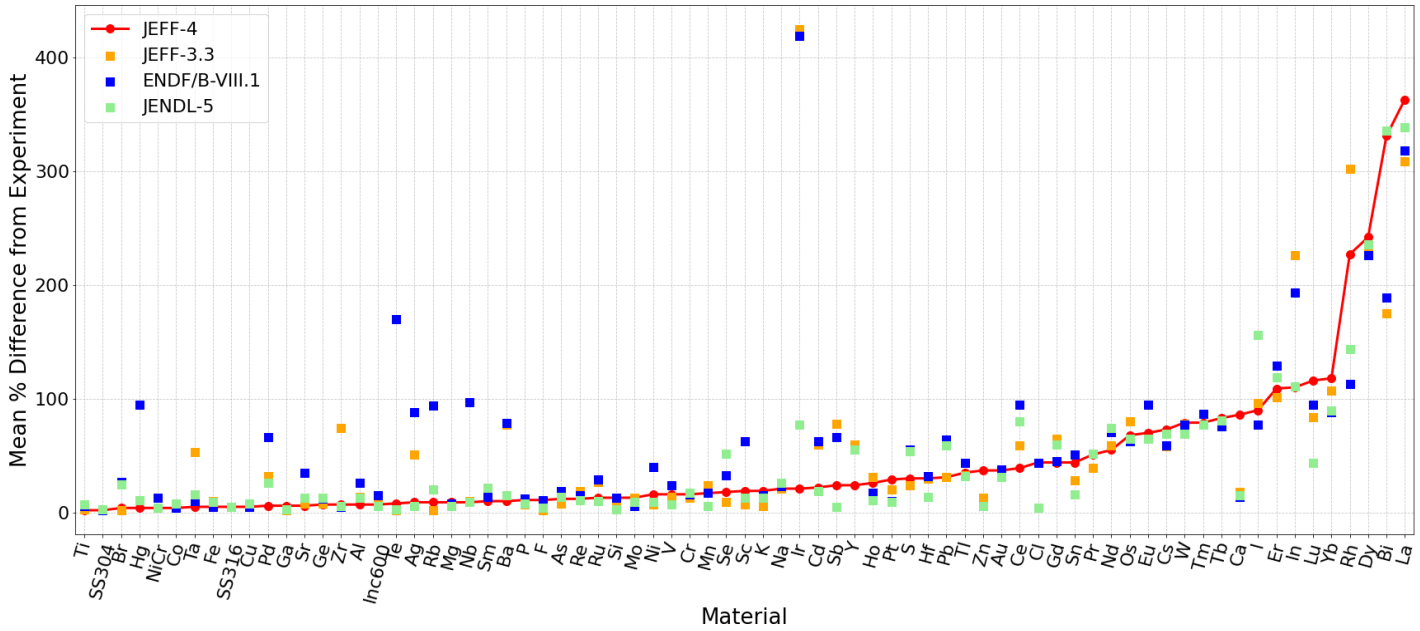
- Fusion decay heat shows improvements.



J. Hollis, *Fusion decay heat benchmarking - JEFF-4*, JEFDOC-2484, November 2025.

JEFF-4.0 nuclear data library - benchmarking

- Criticality benchmarking for 3191 cases shows a clear improvement compared to JEFF-3.3.
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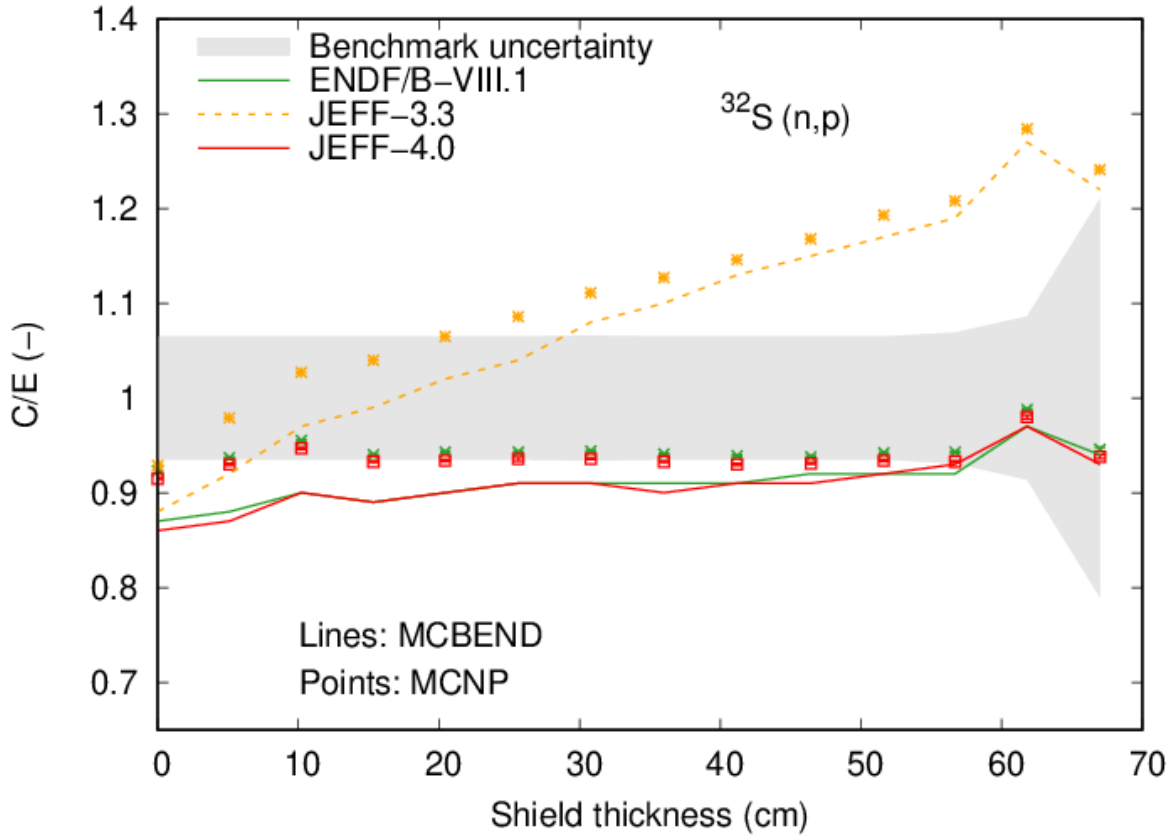
- Reactivity curve was finally corrected, where JEFF-4.0 and ENDF/B-VIII.1 perform similarly.
- Improved inventory estimation due to updates on fission products.
- Fusion decay heat shows improvements.
- Enhanced RPV shielding results.



S. van der Marck, *Discussion of selected benchmarking topics for the JEFF-4.0 paper*, JEFDOC-2487, November 2025.

NEA Data Bank infrastructure

- The JEFF project is supported by the NEA Data Bank, which aims at improving the infrastructure development for data management and code pipelines.
- JEFF library developments are coordinated through a collaborative GitLab repository.
- Tested nuclear data ready for use with software:
  - Complete, reproducible pipelines.
  - Reference calculation results.
  - Packaged within containers ready to be published.
- Access to repository (restricted to JEFF community at the moment): https://git.oecd-nea.org/databank/nds/jeff

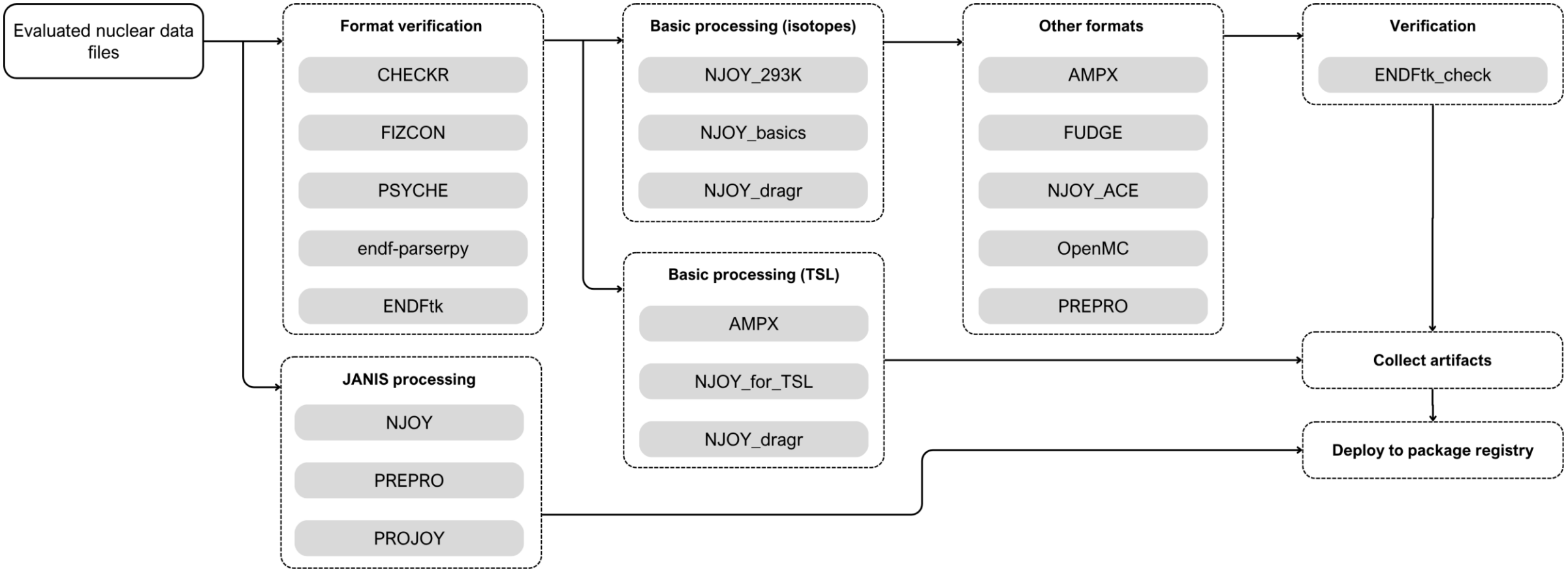
NEA Data Bank infrastructure

- An “open-core” software development and operations (DevOps) platform:
  - Can be hosted on-site or by GitLab, Inc. servers.
  - Can host git repositories.
  - Allows users to define continuous-integration (CI) and continuous-deployment (CD) infrastructure.
- NEA GitLab system uses:
  - Free GitLab core.
  - Self-hosted instance.
  - Self-hosted runners
    - Due to restrictions on software access, software use and software license.
- Service areas are interconnected and GitLab allows us to better integrate them:
  - Nuclear data (JEFF, JENDL, ENDF, etc.)
  - Software packages (Serpent, SCALE, NJOY, AMPX, etc.)
  - Integral experiment datasets (ICSBEP, IRPhE, SINBAD, etc.)

NEA Data Bank infrastructure – processing pipeline

- We use GitLab CI/CD infrastructure to:
  - Version-controlled updates on evaluated files.
  - Perform evaluated files consistency checks.
  - Process to different formats (with input templates for auto-generation):
    - ENDF utilities
    - NJOY (ACE format)
    - FUDGE (GNDS format)
    - PREPRO
    - AMPX
    - OpenMC
  - Track issues related to specific files (access to JEFF issue board).
  - Run verification suites (checks if the data is usable by the software).
  - Run validation suites (measures the quality of the data to predict a quantity of interest):
    - Criticality safety, reactor physics, spent fuel, others.

NEA Data Bank infrastructure – processing pipeline



NEA Data Bank infrastructure – JEFF-4.0 products

- Data publicly available at the NEA Data Bank website:
  - Joint Evaluated Fission and Fusion (JEFF) Library version 4.0 - NEA Data Bank GitLab platform
- ACE files for multiple temperature points (cross sections and TSLs) for Monte Carlo transport codes.
- PENDF 0K (e.g., for FLUKA code).
- HENDF resources (for JANIS).
- GENDF and SSF resources (for FISPACT).
- HDF-5 files (for OpenMC).
- Enhanced record registration and metadata.
- More to be released shortly (SCALE resources, GNDS format,…).

Release	Format	Code	Content	# files	Download
JEFF-4.0	ENDF6	-	Cross section evaluations (download all)	593	
JEFF-4.0	ENDF6	-	Cross section evaluations (download all)	2855	
JEFF-4.0	ACE	NJOY2016.78	Continuous-energy cross section data at 293.6, 300, 600, 900, 1200, 1500, 1800 K	593	
JEFF-4.0	PENDF0K	NJOY2016.78	Pointwise cross section data at 0 K	593	
JEFF-4.0	HDF5	NJOY2016.78 and OpenMC	Continuous-energy cross section data at 293.6, 300, 600, 900, 1200, 1500, 1800 K	593	
JEFF-4.0	GENDF-1102	NJOY2016.78 and PREPRO	Groupwise cross section data	593	

NEA Data Bank infrastructure – next steps

- We aim at expanding the capabilities of the processing pipeline:
  - Work on GNDS translation of JEFF-4.0 library.
  - Include covariance testing and verification (NJOY, AMPX).
  - Compare JEFF performance with ENDF and JENDL in an automatic way.
  - Add more formats to meet the user's community requirements
    - Open to suggestions (and specific users' needs) here ☺
  - Add more downstream testing products:
    - OpenMC
    - JANIS
  - Publication of legacy JEFF libraries following our current data management philosophy.
  - Add nuclear data adjustment tools to produce application-oriented libraries (in cooperation with WPEC/SG-52).

Next steps for JEFF-4 project

- JEFF-4.0 main paper and associated topic collection under preparation.
- JEFF Nuclear Data Week scheduled on 13-17 April 2026.
- Enhanced collaboration with experimentalists towards a more efficient interaction (JEFF Nuclear Data Week November 2025).
- Stakeholders' meeting postponed to fall 2026, dates to be announced.
  - Representatives from ENDF/B-IX project to establish synergies on identified industry needs.
- Call for new WPEC Subgroup proposals, please contact Dr. Anastasia Georgiadou (NEA Data Bank).
- Synergies with ENDF/B-IX project:
  - New Cl evaluations, to be improved in subsequent JEFF-4 releases.
  - Potential outcomes from WPEC/SG-51 on URR evaluations and treatment.
  - GNDS format conversion.
  - INDEN collaboration.

Thank you for your attention