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NUCLEAR ENERGY AGENCY

The JEFF Project Snapshot: Overview, Developments, and Status

Daniela FOLIGNO

CSEWG

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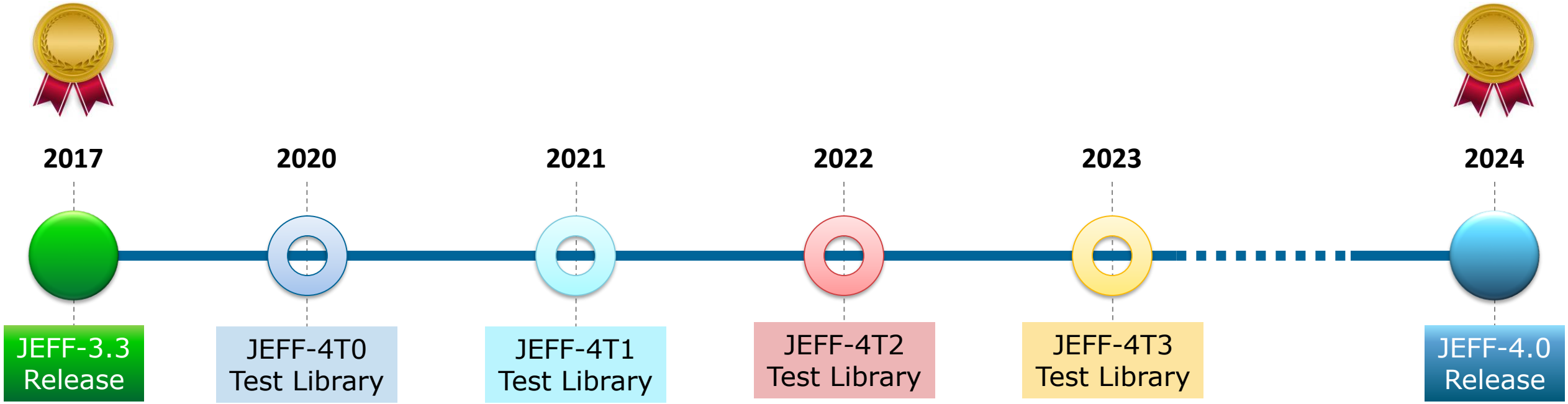
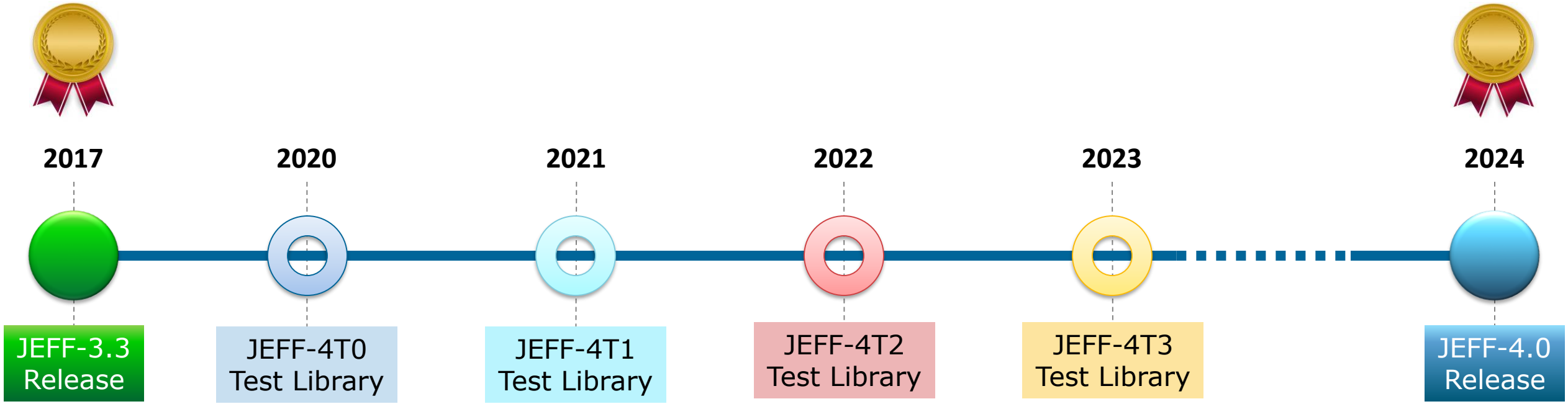
1) From JEFF-3.3 to JEFF-4.0

JEFF-4.0 Timeline

JEFF-4.0 Test versions



JEFF-4.0 Test versions



28 new evaluations
5 from JENDL-4u
9 from ENDF/B-VIII.0
6 from JEFF-3.1.1
100 from JEFF-3.3
414 from TENDL-2019
(of which 302 were TENDL-2015)

28 new evaluations
1 from JENDL-5
1 from ENDF/B-VIII.0
TENDL-19 --> TENDL-21

14 new evaluations
1 new FY
1 from JENDL-5
17 from INDEN
Minor corrections

7 new evaluations
2 new FY
1 from JENDL-5
6 restore 8 groups DN data
8 from ENDF/B-VIII.1
6 from INDEN
3 from TENDL-2023
Minor corrections

JEFF-4.0 New Evaluations

2017

JEFF-3.3 Release

43-Tc-99	45-Rh-103	45-Rh-105	47-Ag-107	47-Ag-109
54-Xe-124	54-Xe-126	54-Xe-128	54-Xe-129	54-Xe-130
54-Xe-131	54-Xe-132	54-Xe-134	54-Xe-135	54-Xe-135m
55-Cs-133	55-Cs-135	57-La-139	61-Pm-147	62-Sm-151
63-Eu-151	63-Eu-153	63-Eu-154	63-Eu-155	64-Gd-155
64-Gd-156	64-Gd-157	64-Gd-158	64-Gd-160	69-Tm-171
71-Lu-173	71-Lu-175	71-Lu-176	73-Ta-181	74-W-180
74-W-182	74-W-183	74-W-184	74-W-186	76-Os-186
76-Os-187	76-Os-188	83-Bi-209	92-U-235	92-U-238
93-Np-237	94-Pu-238	94-Pu-239	94-Pu-240	94-Pu-241
	94-Pu-242	95-Am-241	95-Am-241	

HinH2O
UO2
PuO2
HinCH2
CinCH2
HinC5O2H8
CinC5O2H8
OinC5O2H8
HinC8H8
CinC8H8

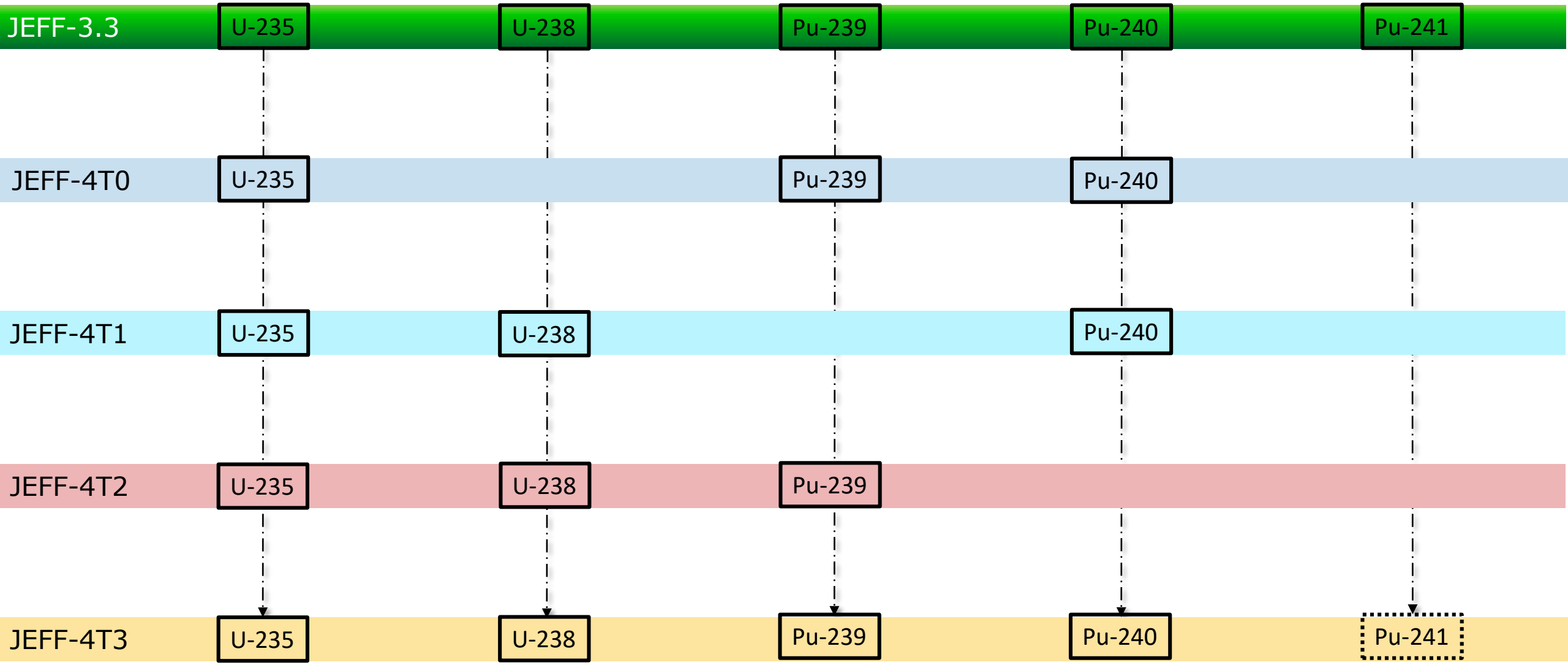
Provided by ORNL

2024

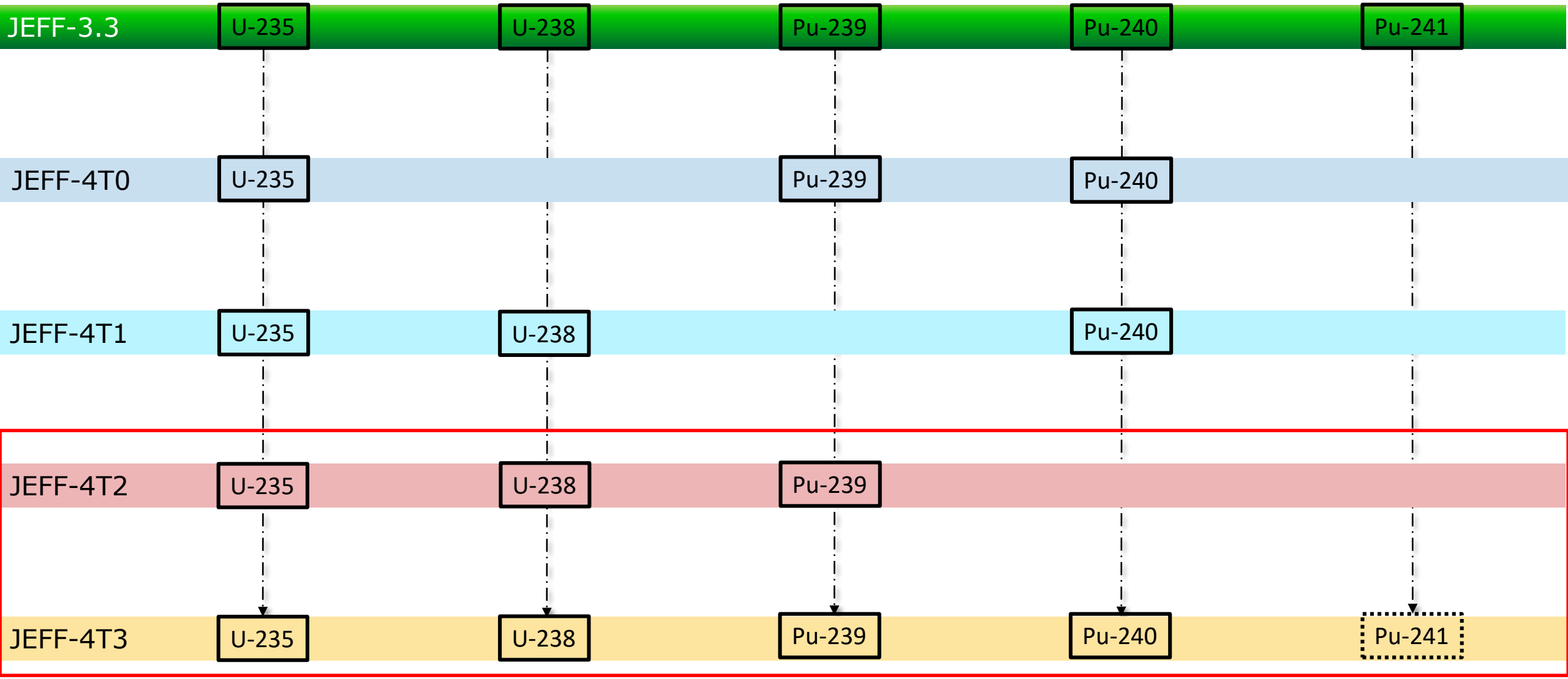
JEFF-4.0 Release

FYs U-235 thermal	FYs Pu-239 thermal

JEFF-4.0: The Big 5

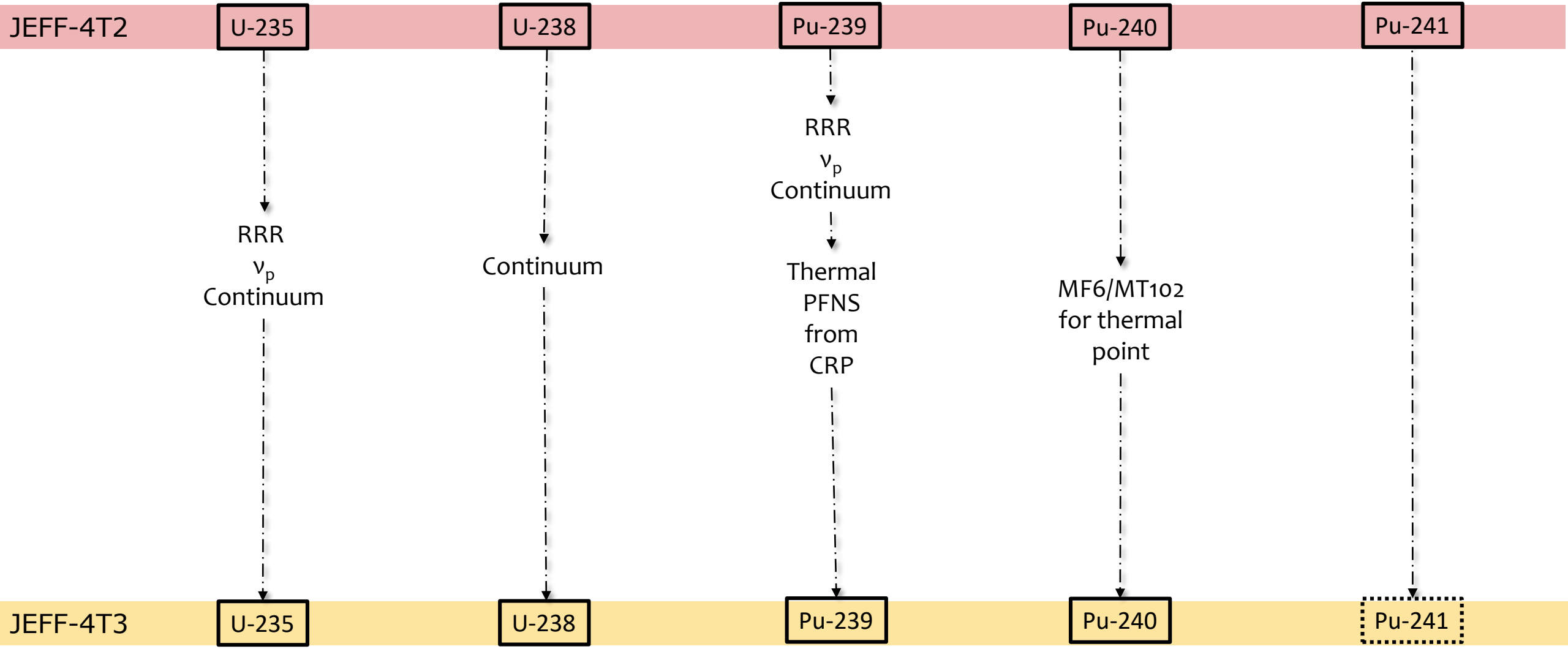


JEFF-4.0: The Big 5



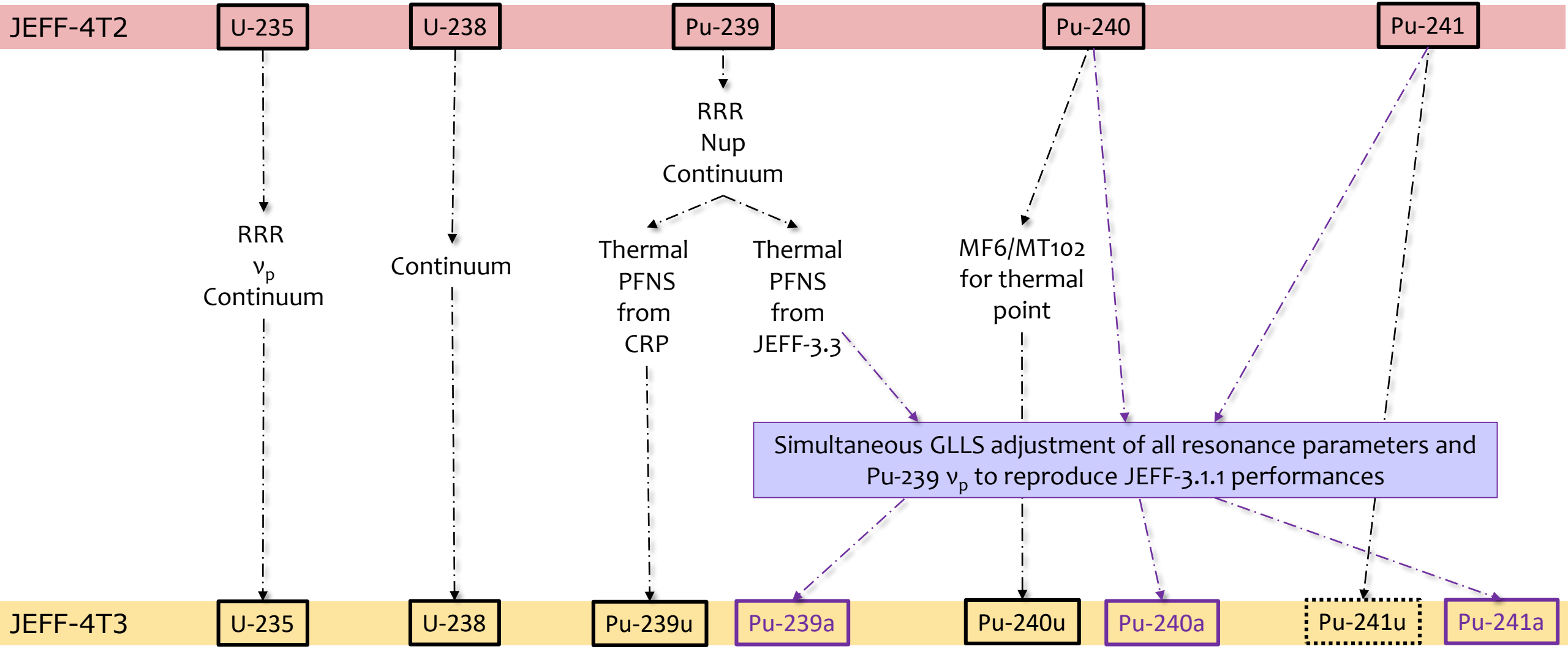
T2 to T3

For further information about the these evaluations, contact **gilles.noguere@cea.fr**



T2 to T3: an alternative path

For further information about the GLLS adjustment, contact **dimitri-alexandre.rochman@psi.ch**



JEFF-4.0 Fission Yields

Thermal neutron induced fission of U-235 and Pu-239

At each step of the evaluation process, correlations induced mainly by the conservation laws are given and the full variance-covariance matrix can then be determined

As data points from the experimental datasets (used for the isobaric fission yields evaluation) were not always compatible with each other, it was necessary to apply a "regularization" method

Conservative sorting (C)

All the datasets are used by adding 2.5% uncertainty to all data points, in order to make them compatible.

Strict sorting (S)

Instead of adding independent uncertainty, only consistent experiments are selected. Measurements that did not pass the tests per datasets and the tests per mass were excluded.

The main difference between the two methods is the uncertainty

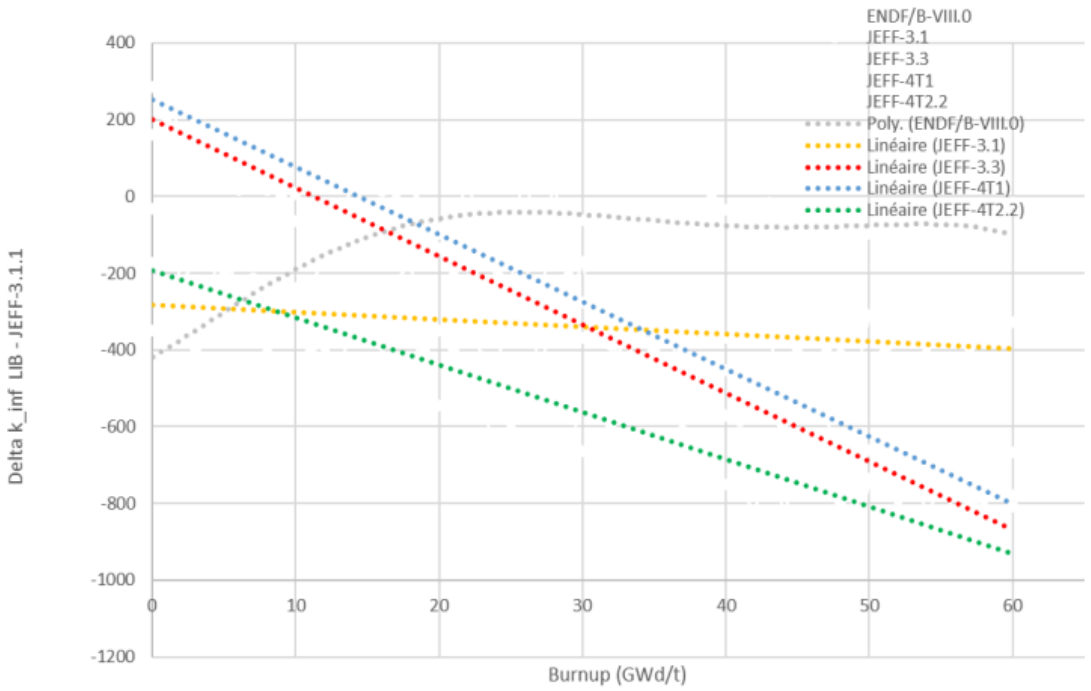
For further information about the FY evaluations, contact **olivier.serot@cea.fr**

JEFF-4Tx BU issue

IRSN
INSTITUT DE RADIOPROTECTION
ET DE SÛRETÉ NUCLÉAIRE

VESTA 2.2 UAM Pin cell calculation
PWR UOX fuel pin
Irradiated during 1 cycle
BU= 61.28 GWd/tHM
2D model

Unit cell pitch (mm)	14.427
Fuel pellet diameter (mm)	9.391
Fuel pellet material	UO_2
Fuel density (g/cm^3)	10.283
Fuel enrichment (w/o)	4.85
Cladding outside diameter (mm)	10.928
Cladding thickness (mm)	0.673
Cladding material	Zircaloy-4
Cladding density (g/cm^3)	6.55
Gap material	He
Moderator material	H_2O

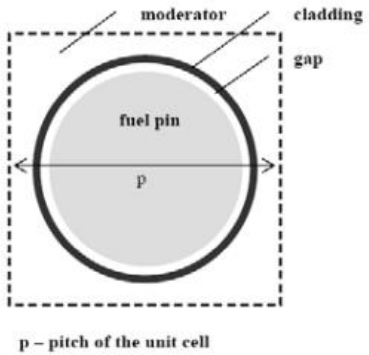


Compared to JEFF-3.1.1:

JEFF-3.3:
- BOL: +200 pcm
- EOL: -850 pcm

JEFF-4T1:
- BOL: +300 pcm
- EOL: -800 pcm

JEFF-4T2-2:
- BOL: -200 pcm
- EOL: -900 pcm



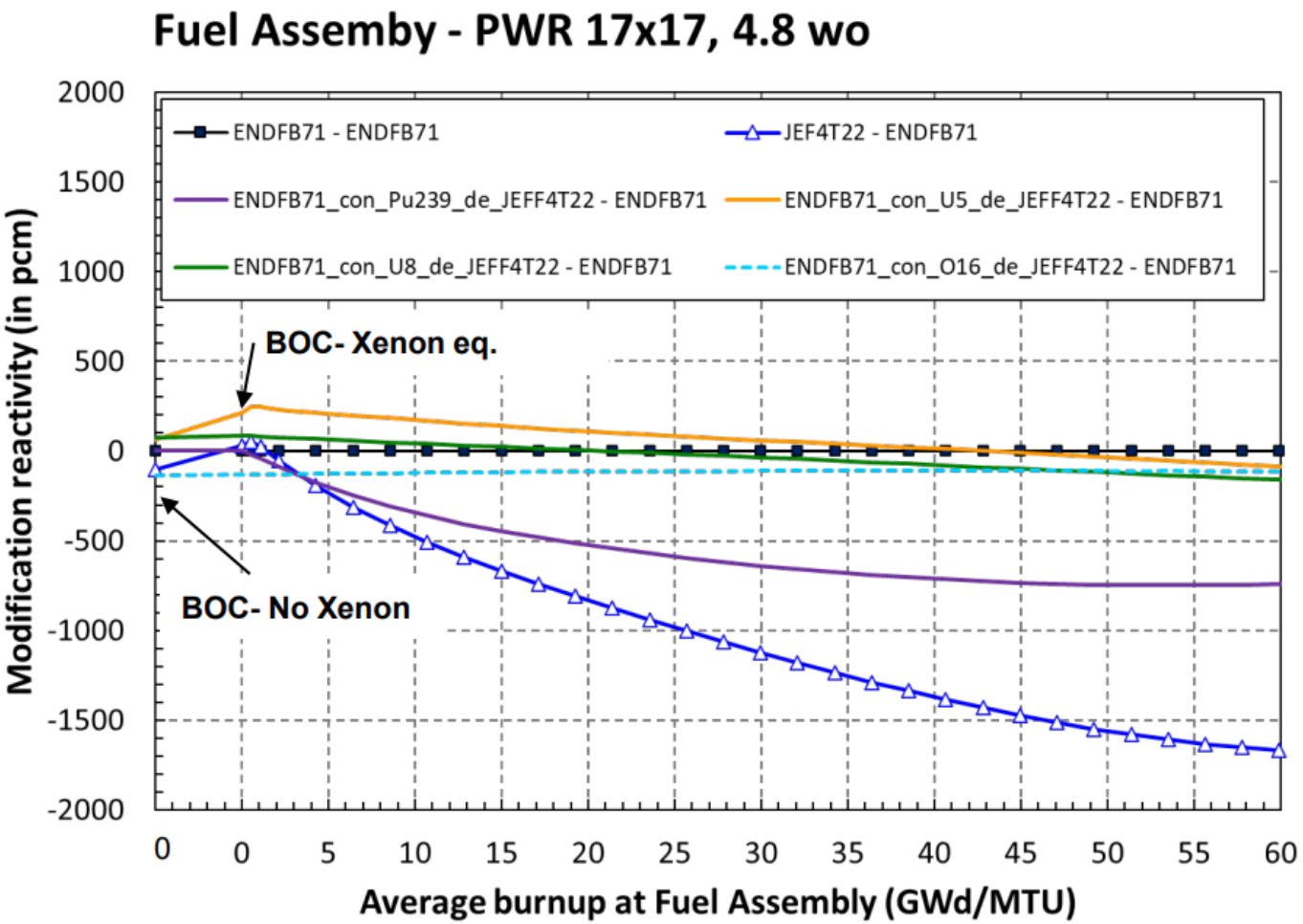
p – pitch of the unit cell

For further information about this work, contact **raphaelle.ichou@irsn.fr**

The strong k_inf bias with burn-up observed with JEFF-3.3 and JEFF-4.T0, JEFF-4.T1, is still present using new JEFF-4T2.2

https://www.oecd-nea.org/dbdata/nds_jefdoc/jefdoc-2233.pdf

JEFF-4Tx BU issue contributions



Contribution of different isotopes at high BU:

- Low contribution of U-238
- Large impact of Pu-239
- Large contribution of Fission Products

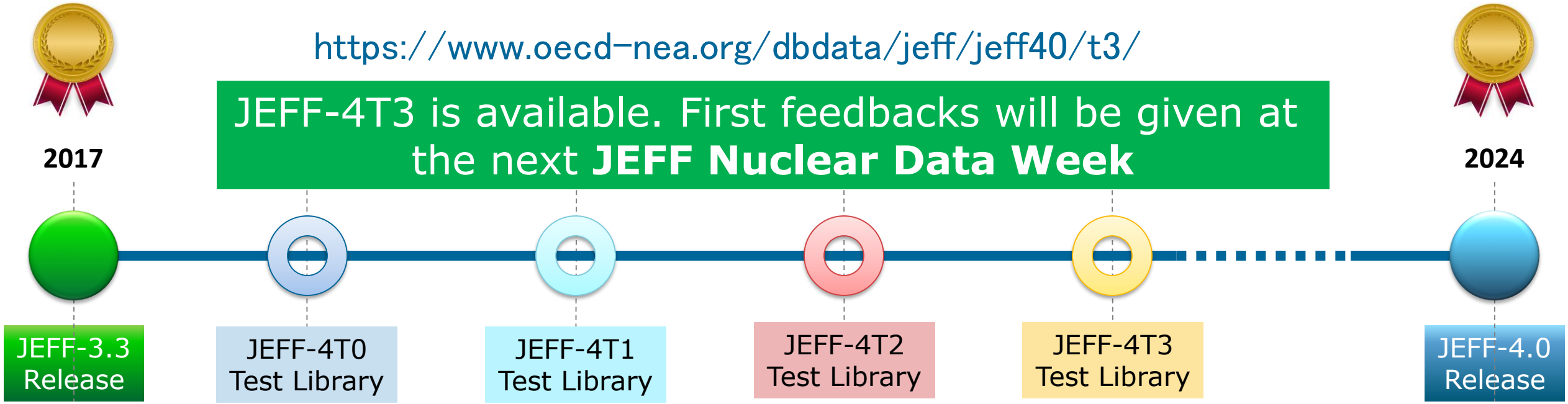
For further information about this work, contact **oscar.cabellos@upm.es**

https://www.oecd-nea.org/dbdata/nds_jefdoc/jefdoc-2239.pdf

JEFF-4.0 Timeline

https://www.oecd-nea.org/dbdata/jeff/jeff40/t3/

JEFF-4T3 is available. First feedbacks will be given at the next **JEFF Nuclear Data Week**




Joint Evaluated Fission and Fusion (JEFF)
Nuclear Data Library

JEFF-4T3 (TEST Library) Downloads

The majority of the content in the JEFF-4T3 nuclear data library was finalized in September 2023, although a few decisions were made at a later date.

The content and the evolution of the library can be found here: JEFF-4 Evolution.

Please note that this is a TEST library, and that the latest official release remains JEFF-3.3.

Test Libraries

JEFF-4T3 [2023]

JEFF-4T2 [2022]

JEFF-4T1 [2021]

JEFF-4T0 [2020]

Official Releases

JEFF-3.3 [Latest Release]

JEFF-3.2

JEFF-3.1.2

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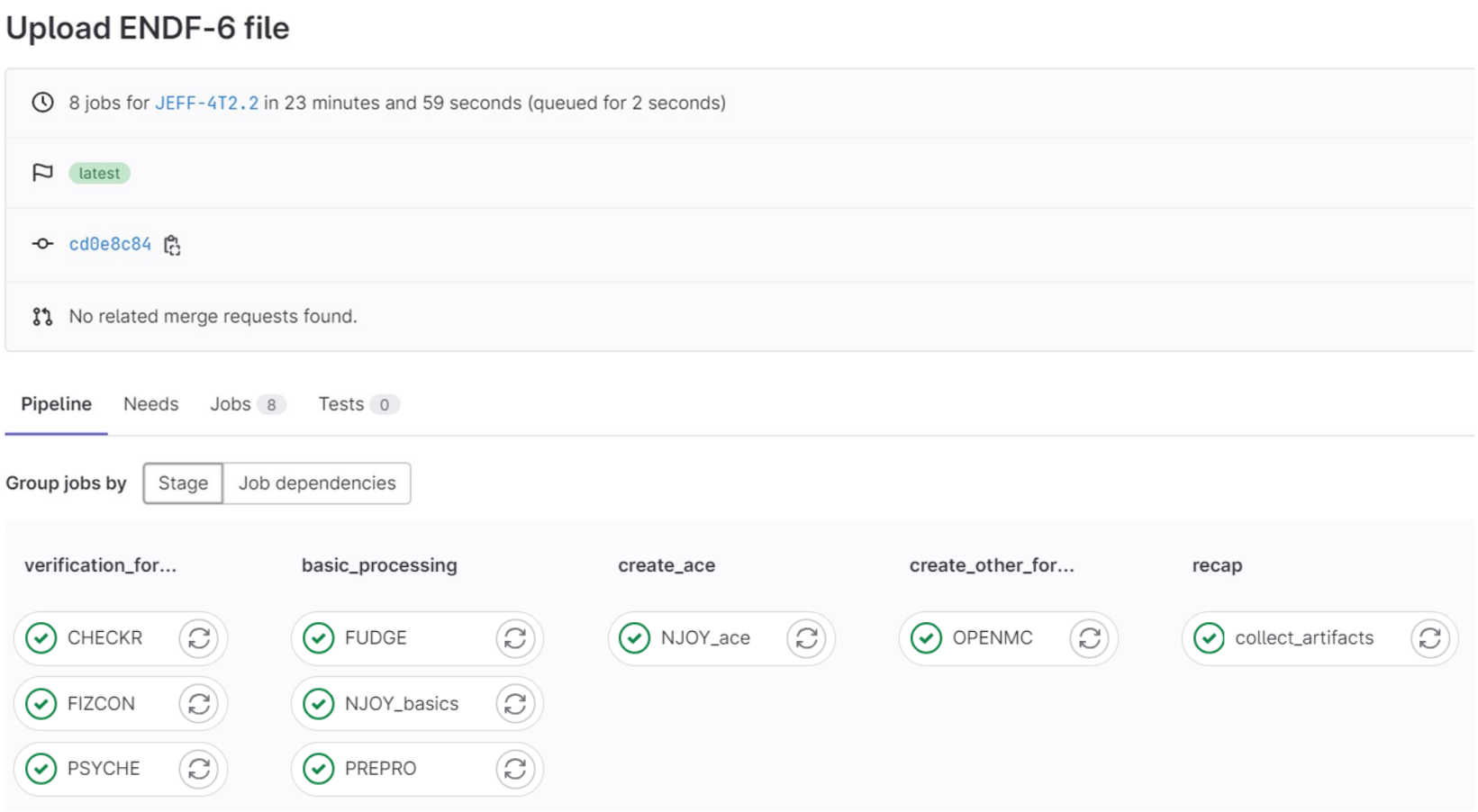
2) Integrated, Automated, and Reproducible Nuclear Data Processing at the NEA

The NEA Processing pipeline



The main YAML (pipeline definition) is maintained in its own repository

After every commit, the pipeline is automatically triggered

The pipeline is identical for all isotopes

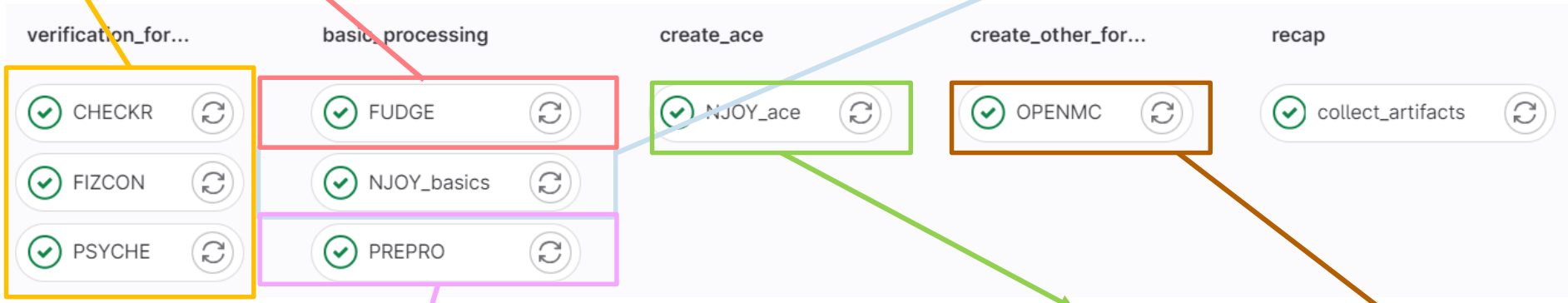
Codes are built into Docker images, stored in the Harbor, and pulled by the pipeline

The NEA Processing pipeline

- Format checks
- Internal consistency checks
- Additional checks

- ENDF → GNDS

- Reconstruction of cross sections from RP
- Creation of PENDF on a unionized energy grid
- Doppler-broadening of the cross sections in PENDF
- Self-shielding in the URR
- Generation of heat production XS and radiation damage energy production



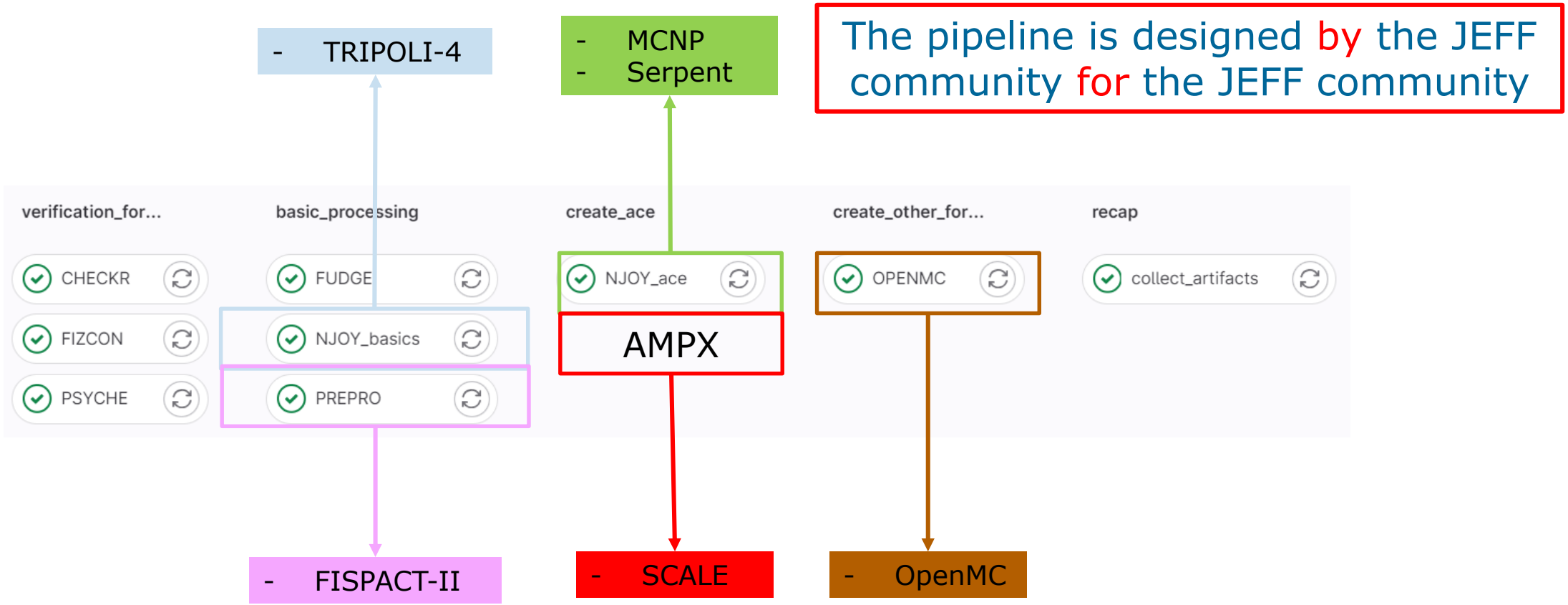
- Produce probability tables for the URR self-shielded XS
- Create the ACE file

- Reconstruction of cross sections from RP
- Doppler-broadening of the cross sections in ENDF-6
- Generation of activation cross sections (MF=10)
- Calculation of self-shielded, multigroup cross sections and multi-band parameters in the ENDF format

- Convert the ACE files into HDF5 format

Thanks to J-C Sublet for providing his processing routine

The NEA Processing pipeline



For further information about AMPX processing, contact **andrew.holcomb@oecd-nea.org**

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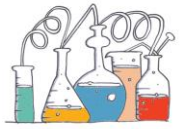
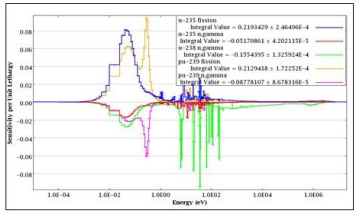
3) Past and future meetings

The current ND path

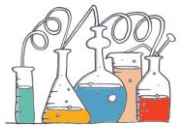


Experiments → New evaluations → Processing & Verification → Benchmarking & Validation → Release → USER

An alternative possibility



USER's needs → Identification of the problem → Nuclear data need (HPRL)



Processing & Verification ← New evaluations ← Experiments

Benchmarking & Validation → Release

Stakeholder meeting

September 20th, 2023

Nuclear Physics Needs for Nuclear Energy Technology

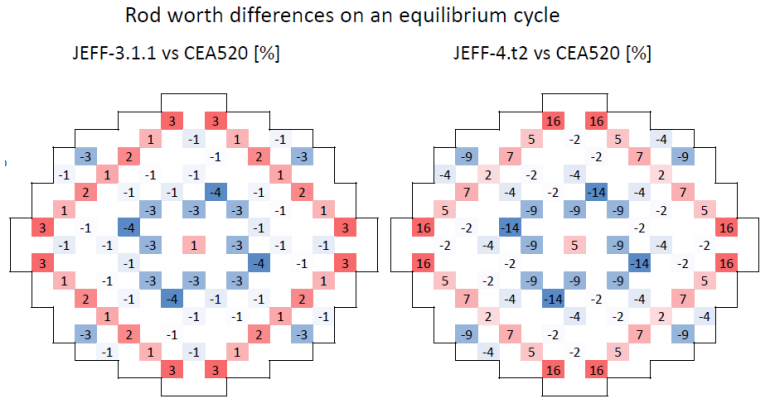
Goal: Listen to the nuclear data needs from a great variety of stakeholders

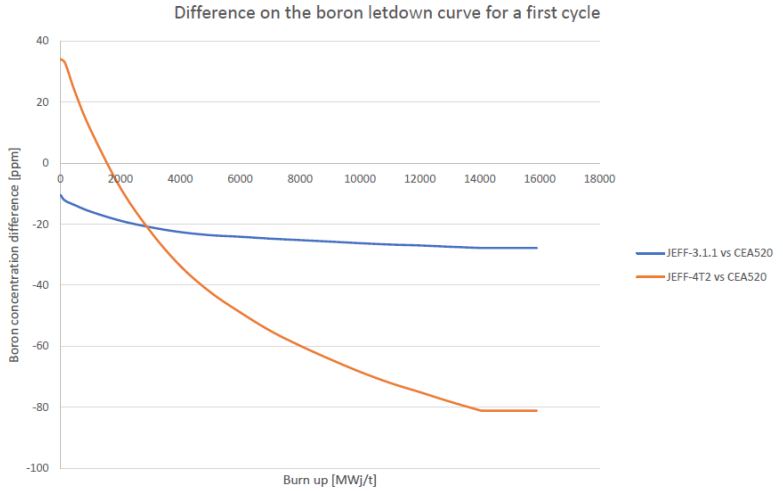
Stakeholder meeting

14 SPEAKERS
91 PARTICIPANTS
19 COUNTRIES

September 20, 2023		
Organization	**Speakers**	**Title**
	Breakfast	
OECD/NEA	Michael FLEMING	Welcome and introduction
EC	Arjan PLOMPEN	The JEFF nuclear data project, serving stakeholders
CRIEPI	Yasushi NAUCHI	Gamma ray emission data for characterization of nuclear material
CEA, IRSN	Christophe DESTOUCHES, Michael PETIT	Nuclear data for instrumentation applications
FANC	Kevin GOVERS	Challenges and Importance of Enhanced Nuclear Data in Belgium's Nuclear Sector
	Coffee	
STUDSVIK	Teodosi SIMEONOV, Charles WEMPLE	Nuclear Data Applications in Studsvik Scandpower Analysis Codes – Past, Present, and Future
EDF, FRAMATOME	Adrien WILLIEN, Simon RAVAUX	EDF latest activities on nuclear data and JEFF-4T2 impact on industrial simulations
TRACTEBEL	Nicolas SLOSSE	Summary of validation results using WIMS/PANTHER, highlighting the impact of the library choice (JEF-2.2 vs JEFF-3.1.2)
	Reception (Petit Salon)	
ESS	Günter MUHRER	ESS's perspective on Nuclear Data Needs
ORNL	Marco PIGNI	ORNL's perspective on Nuclear Data Needs
EPRI	Hatice AKKURT	EPRI's perspective on Nuclear Data Needs
FRAMATOME	Axel HOEFER	Nuclear data covariances in criticality safety validation
	Coffee	
NAGRA	Ahmed SHAMA	NAGRA's perspective on Nuclear Data Needs
BAKER HUGHES	Andreas VOGT	Nuclear Simulation Workflows and Nuclear Data Needs in Well Logging and Geoscience
WESTINGHOUSE	William WALTERS	Westinghouse's perspective on eVinci and LFR designs
OECD/NEA	Daniela FOLIGNO	Closing remarks
	Cocktail reception (BB Espace Terrasse)	

Unexpected achievment:
Industrial feedbacks on the quality of our test library





Involvement of the industry, who engaged to give us preliminary feedbacks at every test version and a more detailed feedback before the official JEFF-4.0 release !

JEFF Nuclear Data Week

	Monday 27	Tuesday 28	Wednesday 29	Thursday 30	Friday 1
09:00	Coffee	Coffee	Coffee	Coffee	
09:15					
09:30			Feedbacks industry		
09:45					
10:00				Fission Observables	
10:15					
10:30	Fusion	ND Uncertainties			
10:45			Benchmarking		
11:00					
11:15					
11:30					
11:45				Lunch	
12:00	Lunch	Lunch	Lunch		
12:15					
12:30					
12:45				Decay Data	
13:00					
13:15					
13:30		Experiments			
13:45					
14:00					
14:15					
14:30		Coffee	Depletion	Coffee	
14:45					
15:00	Coffee				
15:15			Coffee	Processing	
15:30					
15:45			Evaluation Methods		
16:00		TSL			
16:15					
16:30				JEFF-4 Status	
16:45					
17:00	EUROFusion				
17:15					
17:30					
17:45					
18:00					

November 27th to December 1st

115 participants

57 presentations

12 sessions

New session “Feedbacks from Industry”

Thank you for your attention

Please contact me (daniela.foligno@oecd-nea.org) if you have any questions or comments.

Title page photo: Dry storage facilities (Creative Commons, NRCgov)

Pu-adjustment

Generalized Linear Least-Squares Adjustment

The following quantities were adjusted:
- Pu-239: all resonance parameters up to (and including) 49.46 eV and nubar from 0 to 16 eV
- Pu-240: all resonance parameters up to (and including) 41.69 eV
- Pu-241: all resonance parameters up to (and including) 48.10 eV

During the GLLS adjustment, the following calculations were considered:
- Pincell burnup calculation (keff and Pu-239 concentration)
- Alpha ratio for Pu-239
- PST benchmarks (1, 4, 5, 6, 7, 9, 12, 34, 38)
- Kritz benchmark (LWR-RESR-001, case 1 and 2)
- Thermal standard values (fission, capture) for Pu-239 and Pu-240

The goal was to reproduce the performances of JEFF-3.1.1.

It was additionally checked with the DUKE-PWR-POWER-001 from IRPhE

For further questions, ask S. van der Marck (NRG), M. Hursin (EPFL), and D. Rochman (PSI)