

DE LA RECHERCHE À L'INDUSTRIE

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Status of the JEFF File Project

R. Jacqmin

- 1. The JEFF Project**
- 2. JEFF-3.1**
- 3. JEFF-3.2**
- 4. Conclusion and Outlook**

1. The JEFF project

■ Background

- Joint Evaluated Fission and Fusion (JEFF) File Project of NEA Data Bank

The objective of the Joint Evaluated Fusion and Fission (JEFF) file Project is to develop and promote the use of high quality evaluated nuclear data sets in standard formats for a wide range of scientific and technical applications.

The Project assesses the needs for nuclear data improvements and addresses those needs by initiating the necessary measurements, evaluation and benchmarking efforts.

- Latest file versions

- 2009 Release of JEFF-3.1.1
- 2012 Release of JEFF-3.1.2
- 2013 Release of JEFF-3.2 GP file
- ≥ 2014 Planned release of JEFF-3.2 FY&DD files

1. The JEFF project

■ Organization

- Scientific Co-ordination Group of ~ 12 members + chairman + NEA DB sec.
Since Dec. 2010, Korean representative
Since Jan. 2013, Russian representative

- Three-year work plan, approved by OECD/NSC
Called “Project”, but actually consists of volunteers’ contributions from many organizations and individuals → A **collective work**

- Technical activities
 - Measurements
 - Evaluation, processing & benchmarking
 - FY & DD
 - Fusion
 - Covariances (new)

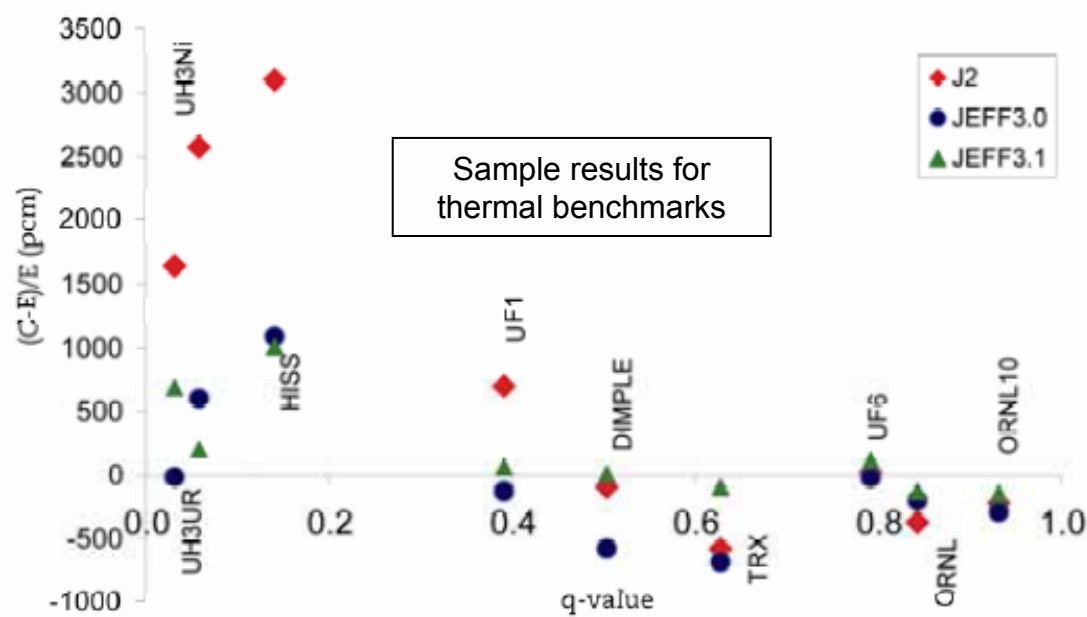
- Two meetings per year, 2.5 days

- JEF/DOC = working documents + JEFF Reports

2. JEFF-3.1

■ JEFF-3.1 files

- Used by many, feedback reported at JEFF meetings by different organizations, using different code systems
- **Evidence of improved C/E performance with respect to earlier file versions**
- Needs for further improvements identified
- More sensitivity and uncertainty studies of C/E's needed



3. JEFF-3.2

■ Preparation and motivation

■ Preparation and general motivation

- Preserve the performance of JEFF-3.1.1 (for LWRs) and take into account validation feedback → improve MOX-fuelled systems
- Address the needs of **fast reactors and transmutation applications**
- Planned several years ago already, to be released in **2013**

■ Improvements

- Improve FR systems predictions → improved major actinides in the fast range, in particular Pu-239, Pu-240, U-238
- Improve some structural materials, metallic coolant, absorbers
- Add more gamma-production data
- Integrate evaluations based on new high-quality measurements: Am-241
- Integrate progress in model developments and evaluation methods: TALYS, CONRAD, GEF, cov. production,...
- Increase internal consistency, in anticipation of future updates → U files
- Add covariance information
- Update the decay data and fission yields libraries
- Update the activation file (using EAF-2010)

■ Rationale for the JEFF-3.2 preparation

1. Improve

first, by adopting new evaluations from *within* the JEFF community, that have emerged since the release of JEFF-3.1, either because they yield **better or comparable performance**, as measured by consistent validation studies, or because they integrate better physics when validation data is lacking

2. Further improve

by replacing evaluations by data from *outside* the JEFF community.
When updates of earlier versions adopted in JEFF-3.1 are available, adopt these newer evaluations, unless there are reasons *not* to do so.
Choose source evaluations for JEFF-3.2 other than those of JEFF-3.1 if there are reasons to do so (same criteria as in 1)

3. Further improve

by *completing*, using other data.
Adopt data from other libraries that are still “missing” in JEFF-3.1.
Adopt recent TENDL files to fill the gaps and, in a few cases, to replace very old evaluations

■ Additional inputs

■ JANIS books by NEA/DB

- Plots and tables of cross sections, tables of integral data (Maxwell and fission spectrum averages, RI,...)
- *“Produced to help assess the quality of JEFF-3.2T1 data and to serve as guidance for the selection of the best evaluated data for JEFF-3.2, in complement to integral validation.”*

■ TENDL

- TALYS evaluated nuclear data library produced by NRG
- TENDL-2012: default global calculations, subsequently adjusted and normalized to experiments
- TENDL-2012 files considered as “candidates” for JEFF-3.2
→ TENDL4JEFF

3. JEFF-3.2

■ 472 evaluations in JEFF-3.2 GP 'Test 2' file, many with covariance data

- U-235, U-238 in RRR+URR and at high energies
- Pu-239, Pu-240 in RRR+URR and at high energies
- Am-241 in RRR+URR and at high energies
- Np-237 (*tbc*), Cm isotopes
- Th-232, Pa-231, Pa-233
- Pb and Bi isotopes
- Na-23
- Fe-56 + all isotopes of Cr, Mn, Ta-181 and W
- Cd isotopes, Ag-107, In-113
- Hf, Gd isotopes
- Sn-113, Xe-123, Ho-166m, U-239, U-240, U-241, Cf-253
- Cu, Zn isotopes
- Gd-152, Gd-154
- Au-197
- Os, Pt, Tl isotopes
- Adopted from ENDF/B-VII.1: H-1, H-2, H-3, He-3, Li-6, B-10, B-11, Si-29, Si-30, Nb-93, Ag-110m, Ag-111

built upon measurement, modelling, evaluation, processing, testing, validation efforts provided by many

3. JEFF-3.2

■ Complemented by evaluations obtained from TENDL

- Over 100 evaluations, to fill “holes” or replace old natural element evaluations: C-13, O-17, O-18, Ne (3), Mg-27, Si (2), P-31, S (4), Cl-36, Ar (2), K (3), Ca (2), Sc-46, V (2), Cr-51, Mn (2), Co-57, Co-60, Cu (4), Zn (5), Rb-88, Tc-98, Rh-104, Cd-109, Sn-122, Sn-124, Te (3), I (2), Ba (2), La (3), Ce (4), Eu-152M, Gd-148, Gd-153, Gd-161, Tb-160, Dy (4), Ho-166M, Er (7), Tm (3), Yb (8), Lu (3), Hf-181, Ta-180M, Re (3), Os (9), Ir-192, Pt (6), Hg-204, Tl (3), Po-209

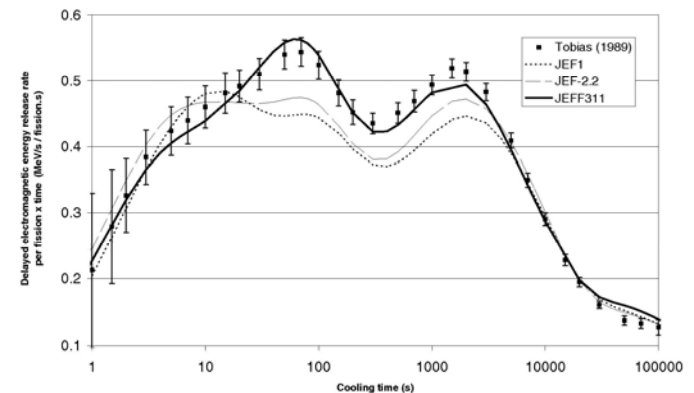
■ Also

- Gamma production for Gd-155,-157, In-113,-115, Cd-113, Ag-107,-109
- Minor FPs in range Kr-83 to Dy-163
- Improved thermal data for a dozen FPs
- Ga, Os, Pt, Tl, Zn elements removed
- 22 corrections

■ Update fission yields and decay data (≥ 2014)

■ Activation

+ Processed JEFF-3.2 T2 libraries in ACE and PENDF format



4. Conclusion and Outlook

■ JEFF Project

- 30+ years of volunteered contributions + NEA/DB support
- Guiding principles
 - Meet the users' needs
 - Use the best physics
 - Continuously improve
- The latest file releases capitalize on many years of continued investments in model and code developments, differential and integral measurements, processing, benchmarking, and expertise
- Broader collaboration in recent years

■ JEFF-3.2

- GP file to be released **in 2013**, SP files a bit later
- Contains updates of many important isotopes, with covariance data
- Expected performance: As good as JEFF-3.1 or better

4. Conclusion and Outlook

■ Beyond JEFF-3.2

- Aim for a “**qualitative step forward**”, while sticking to the basic principles of a needs-driven evolution and the preservation of performance
- Beginning of a “new cycle”
 1. Mid-term objective
 - **~2016**
 - JEFF-3.3
 - A step towards the longer-term goal
 2. Long-term objective
 - **~2019**
 - JEFF-4.0(?) GP and SP files, integrating substantial progress
- Continued efforts to reach out to a broader community of contributors, while keeping the activities sufficiently focussed

4. Conclusion and Outlook

■ Inputs from the JEFF community + others

- Application needs
 - Fission applications
 - LWRs incl. EPR, JHR
 - Fast systems: MYRRHA and ASTRID projects
 - “Reliable” covariance data for the above
- User feedback and requests for improvements
- Progress
 - New differential and integral measurements
 - New modelling capabilities
- Committed resources and trends
- International context and trends, other file projects, WPEC, EC projects
- NEA Data Bank + NSC

4. Conclusion and Outlook

■ The good news

- JEFF file track record + demonstrated performance (industry) + users feedback
- Regular participation and contributions at JEFF meetings
- Some support from EC and GEDEPEON→NEEDS
- Many new high-quality differential measurements coming
- Continued progress in nuclear models and codes: TALYS, CONRAD, GEF...
- Covariance data production capabilities

■ But... issues with

- Resources
- Different interests and priorities of contributing organizations
- “Business model”