

DE LA RECHERCHE À L'INDUSTRIE



# Status of the JEFF File Project

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- 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

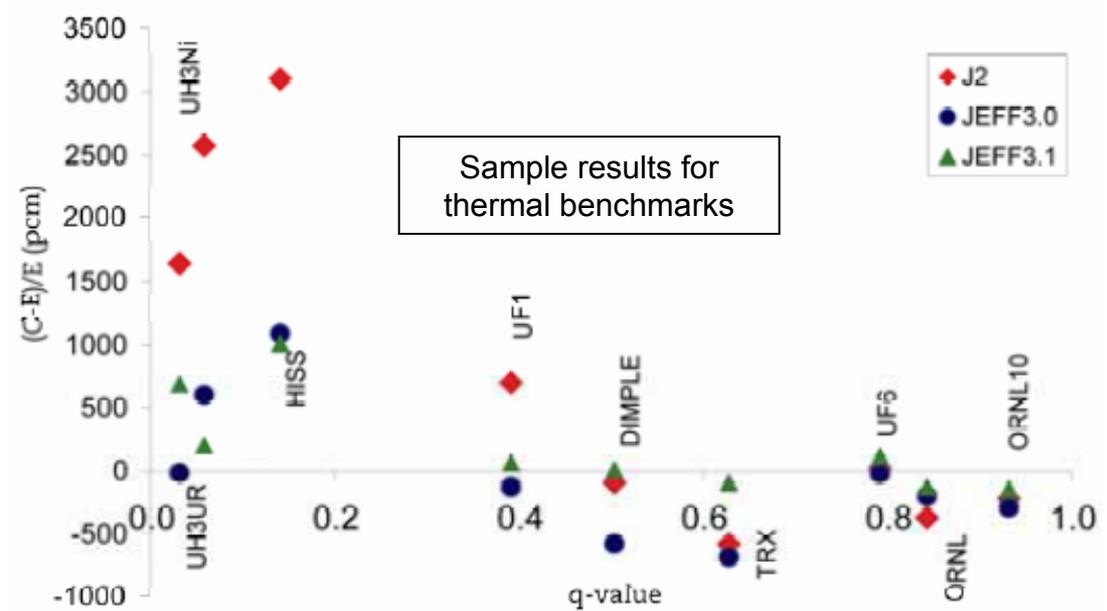
## ■ Organization

- 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)

## 3. JEFF-3.2

### ■ 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

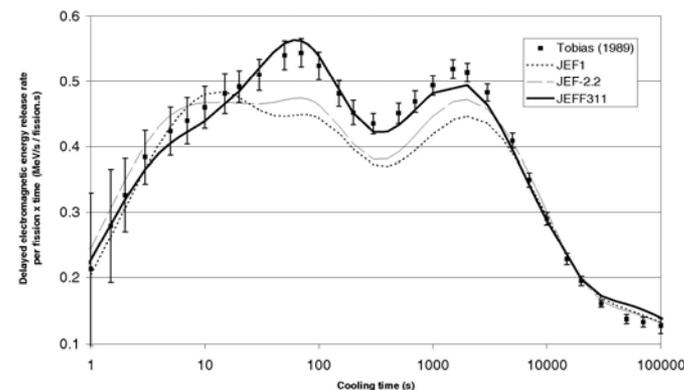
### ■ Also

- 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 ( $\geq 2014$ )

### ■ 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”