NEA Data Bank
Nuclear Data Services

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NEA Data Bank

WONDER Aix-en-Provence, October 12, 2018
IAEA, Vienna
The NEA: A Forum for Co-operation

- Founded in 1958
- 33 member countries
- 7 standing technical committees
- 71+ working parties and expert groups*
- 22 international joint projects*

*As of January 2018
**OECD members (35)**
- Chile
- Estonia
- Israel
- Latvia
- New Zealand

**NEA members (33)**
- Australia
- Canada*
- Iceland
- Ireland
- Luxembourg
- United States*

**NEADB members (27)**
- Argentina**
- Austria
- Belgium
- Czech Republic
- Denmark
- Finland
- France
- Germany
- Greece
- Hungary
- Italy
- Japan
- Mexico
- Netherlands
- Norway
- Poland
- Portugal
- Romania**
- Russia**
- Slovak Republic
- Slovenia
- Spain
- Republic of Korea
- Sweden
- Switzerland
- Turkey
- United Kingdom

* RSICC service area

** Argentina, Romania and Russia are not member countries of the OECD (2017)
Data Bank

• Founded in 1978, out of the merging of two historical functions of (E)NEA:
  • *Computer Programme Services at Ispra, Italy*
  • *Neutron Compilation Centre at Saclay, France*

• Still today, these two functions are embodied in the core mission of the DB, which is to provide
  • *Computer Programme Services (CPS)*
  • *Nuclear Data Services (NDS)*

• Today the DB has 27 participating countries, yearly budget of ~3 M EUR (Argentina and Romania joined in 2017)
Ancestry of (NEA) NDS

- DB Nuclear Data Services: A long history that goes back before the time of DB, to *CCDN: Neutron Data Compilation Centre in Saclay, France*

CCDN Staff, Saclay, 1966
What does NDS do?

- Co-ordination of data compilation:
  - Experimental nuclear data for the EXFOR database
  - Needs for the nuclear data community, the HPRL database
  - Evaluated nuclear data for the JEFF nuclear data library

- Development of Visualisation, Verification tools and processes:
  - ND Visualisation tools (JANIS)
  - ND testing and processing capabilities (NDEC)
  - Integral Benchmarking aspects (ongoing)
  - Developing infrastructure for collaboration (ongoing)
  - Targeted technical support to JEFF

- Secretariat of all Nuclear Data activities at NEA:
  - JEFF & Nuclear Data Weeks,
  - NSC/WPEC
Working Party on International Nuclear Data Evaluation Co-operation (WPEC)

- Established in 1989 under NEANDC (became NSC in 1992)
- Forum for the exchange of information between evaluation projects and co-operative activities

Objectives:

- Promote exchange of methods, experimental data, theory and validation related to nuclear data;
- Identify common nuclear data issues and establish subgroups (SG) to address these issues, with ~2 year deliverables;
JEFF & NDW participation 2013-2018
Number of received registrations per country per meeting in NEA system

- All
- ARGENTINA
- AUSTRIA
- BELGIUM
- CHINA
- CZECH REPUBLIC
- FINLAND
- FRANCE
- GERMANY
- GREECE
- ITALY
- JAPAN
- KOREA, REPUBLIC OF
- NETHERLANDS
- POLAND
- ROMANIA
- RUSSIA
- SLOVENIA
- SPAIN
- SWEDEN
- SWITZERLAND
- UNITED KINGDOM
- UNITED STATES OF AMERICA

EC/JRC-Geel under Belgium
IAEA under Austria

- April
- Nov
ND verification, processing and testing

NDS Objectives in this area:

- Automate processing, with different codes, based on best practices (JEFF PV&BV group);
- Help rapidly identify potential problems in files and track down where
- Provide organized online access to process outputs;
- Streamline links to existing NEA tools (JANIS, others in future);

- Provide a reproducible, standardized process for verification, testing and processing aimed at streamlining nuclear data benchmarking
- Distribute processed libraries
NDEC (Nuclear Data Evaluation Cycle)

Keywords: modular, flexible, parallel ... and online (soon)

NDEC modules:
- NJOY-2016, PREPRO-2017
- C&U tools
- MCNP/SERPENT tests
- NEA split and map

ENDF-6 seed
NDEC module
NDEC input/output
# NDEC - Verification and testing of Evaluated Nuclear data

Provides a systematic and automated process of ND libraries

## NDEC Modules

NDEC modules that are independent are run in parallel. NDEC modules that need the output of another module as their own input are launched automatically when the needed file becomes available.

List of modules integrated in the current version of NDEC.

<table>
<thead>
<tr>
<th>C&amp;U</th>
<th>NJOY-2016</th>
<th>PREPRO-2017</th>
<th>NEA</th>
</tr>
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<tbody>
<tr>
<td>checkr</td>
<td>moder</td>
<td>endf2c</td>
<td>relabel</td>
</tr>
<tr>
<td>psyche</td>
<td>reconr</td>
<td>linear</td>
<td>libcontent</td>
</tr>
<tr>
<td>fizcon</td>
<td>broadr</td>
<td>recent</td>
<td>splitting</td>
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<tr>
<td>inter</td>
<td>unresr</td>
<td>sigma1</td>
<td>mapping</td>
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<td>benchmarking</td>
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<tr>
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<td>activate</td>
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<td>fixup</td>
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<tr>
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<td>dictin</td>
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<tr>
<td>groupr</td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>covr</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**NEA DB – “QA” of Evaluated Nuclear data**

- NDEC output is available online, currently for the JEFF-3.3 neutron library release
- In the medium term, NDEC will process all major libraries


**NDEC Access**

Browse output of NDEC for all JEFF-3.3 files (562 files)

<table>
<thead>
<tr>
<th>Z</th>
<th>A</th>
<th>State</th>
<th>File</th>
<th>C&amp;U</th>
<th>NJOY-2016</th>
<th>PREPRO-2017</th>
<th>ENDF-6</th>
<th>ACE</th>
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<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>0</td>
<td>1-H-1g.jeff33</td>
<td>1 err</td>
<td>12 warn</td>
<td>79 warn</td>
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<td></td>
</tr>
<tr>
<td>1</td>
<td>2</td>
<td>0</td>
<td>1-H-2g.jeff33</td>
<td>1 warn/6 err</td>
<td>5 warn</td>
<td>402 warn</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>3</td>
<td>0</td>
<td>1-H-3g.jeff33</td>
<td>0 msg</td>
<td>5 warn</td>
<td>153 warn</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>3</td>
<td>0</td>
<td>2-He-3g.jeff33</td>
<td>0 msg</td>
<td>3 warn</td>
<td>7 warn</td>
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<tr>
<td>2</td>
<td>4</td>
<td>0</td>
<td>2-He-4g.jeff33</td>
<td>0 msg</td>
<td>3 warn</td>
<td>199 warn</td>
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</table>
**NDEC library content analysis (What has changed?)**

<table>
<thead>
<tr>
<th>MF TYPE</th>
<th>MT TYPE</th>
<th>MF</th>
<th>MT</th>
<th>JEFF-3.3 matching</th>
<th>JEFF-3.2 matching</th>
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<tbody>
<tr>
<td>General information</td>
<td>descriptive data and directory</td>
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<td>451</td>
<td>JEFF-3.3</td>
<td>JEFF-3.2</td>
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<tr>
<td>General information</td>
<td>total neutrons released per fission</td>
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<td>452</td>
<td>JEFF-3.3</td>
<td>JEFF-3.2</td>
</tr>
<tr>
<td>General information</td>
<td>delayed neutrons released per fission</td>
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<td>455</td>
<td>JEFF-3.1.1</td>
<td>JEFF-3.2</td>
</tr>
<tr>
<td>General information</td>
<td>prompt neutrons released per fission</td>
<td>1</td>
<td>456</td>
<td>JEFF-3.3</td>
<td>JEFF-3.2</td>
</tr>
<tr>
<td>General information</td>
<td>components of energy release due to fission</td>
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<td>ENDFB-7.0</td>
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<td>resonance parameters</td>
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<td>JEFF-3.1.1</td>
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<tr>
<td>Reaction cross sections</td>
<td>total</td>
<td>3</td>
<td>1</td>
<td>JEFF-3.3</td>
<td>JEFF-3.2</td>
</tr>
<tr>
<td>Reaction cross sections</td>
<td>elastic scattering</td>
<td>3</td>
<td>2</td>
<td>JEFF-3.3</td>
<td>JEFF-3.2</td>
</tr>
<tr>
<td>Reaction cross sections</td>
<td>total inelastic scattering</td>
<td>3</td>
<td>4</td>
<td>JEFF-3.3</td>
<td>JEFF-3.2</td>
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<tr>
<td>Reaction cross sections</td>
<td>anything</td>
<td>3</td>
<td>5</td>
<td>JEFF-3.3</td>
<td>JEFF-3.2</td>
</tr>
</tbody>
</table>
NDEC isotope files “mapping”

JEFF-3.3
Released in 2017

U-235-g
Neutron File

203
Sections in file
Nuclear Data deluge?
How is all this data validated?
NDS – criticality benchmarking
123 ICSBEP cases consistent comparison of performance

Major NDLs agreement on IE seems to be converging.

What about other metrics? Other aspects?

- Extended benchmarking for General Purpose libraries is needed
JEFF-3.3 library released December 2017

JEFF-3.3

The Joint Evaluated Fission and Fusion File (JEFF) is an evaluated library produced via an international collaboration of NEA Data Bank participating countries. JEFF-3.3 was officially released on November 20, 2017.

NDEC analysis

NDEC is the Data Bank’s Nuclear Data Service platform for the automated verification, processing and content analysis of evaluated nuclear data files and libraries.

JEFF-3.3 Downloads

JEFF-3.3 is a thorough update of the neutron, decay data, fission yields and dpa libraries, and includes new thermal scattering files for some compounds.

Special sub-libraries for incident alphas, deuterons, gammas, helium-3, protons, tritons and activation files in the FAE format have been contributed by the TENDL-2017 library and adopted.
JEFF-4 development (2018-2021)

OECD official Mandate for the JEFF Co-ordination Group
Approved September 2018

- Definition of a system for generation of a complete nuclear data library combining best available scientific and technical knowhow in a reproducible process; produce a test library to demonstrate feasibility.

- Definition of an enlarged suite of benchmarks covering physics interests of the community.

- Specifications for the quality assurance system that is desired for the new library.
Nuclear Data Services : looking further

Nuclear Data Services at DB, for all DB members
- Ensure pertinence of present and future Nuclear Data Services
- How to strengthen our communication to stakeholders
  - From industry and national labs
  - From regulatory bodies and safety authorities

Ambitious long term path which has been started :
- Implementation of a QA process for nuclear data libraries (NDL)
- Must enlarge the scope towards an extended validation of NDL
- A trend that is of use to JEFF in particular, but of interest to all NDL projects
- How to create the conditions for DB to play leading role
NEA / NDS co-sponsored or supported events

- **WONDER-2018** in Aix-en-Provence, France, *8-12 October 2018*
  - International workshop for nuclear data evaluation for reactor applications
  - [https://indico.cern.ch/event/701026/](https://indico.cern.ch/event/701026/)
  - Co-sponsored by NEA

- **JEFF** at the NEA Headquarters, France, *26-30 November 2018*

- **ND-2019** in Beijing, China, *19-24 May 2019*
  - International Conference on Nuclear Data for Science and Technology
  - Co-sponsored by NEA

- Next **WPEC** will be held at the NEA Headquarters, *24-28 June 2019*
NEA DB – Training

- **DB**: 11 training courses organized in 2017
  

- **NJOY-2016 now open source**
  - 1️⃣ NJOY-2016 training took place in December 2017
  - 2️⃣ NJOY-2016 training scheduled for October 29-31, 2018
  
  Registration: [www.oecd-nea.org/dbdata/trainings/](http://www.oecd-nea.org/dbdata/trainings/)
NDS – Central to the ND community
db-nds@oecd-nea.org

Thank you for your attention
Spare slides
Who we are

CPS
- Alice Dufresne
  Head of CPS

NDS
- Franco Michel-Sendis
  Head of NDS
- Luca Fiorito
- Michael Fleming

TDB
- Maria Eleni Ragoussi
- Jesus Gonzalez

(as of October 2018)