Nuclear Data Newsletter

Contents

From the Section Head

Greetings from Vienna, and all the best for 2024!

I feel that the Section has been extra productive in the past half year and therefore this Newsletter is thicker (to use a term from the paper era) than usual. All I mention below can be found more detailed in this Newsletter.

You will find news about the release of several new databases, computer programs and web interfaces: the IDB database for gamma-ray reference spectra, different retrieval and plotting systems for the EXFOR database, TENDL-2023, the Stopping Power database, new python-based ENDF read/write software on GitHub and a new version of TALYS with all the satellite software around it for nuclear data evaluation and other applications.

I want to thank Arjan Plompen and my colleague Vivian Dimitriou for the effort they put into the organisation of the nuclear data side event at IAEA's annual General Conference, where the importance of nuclear data, in particular nuclear data evaluation, was presented to non-specialists.

You may go through all the meetings we organised in the past semester yourself. We organized a FENDL meeting on nuclear data for fusion, and the participants also produced a publication of the entire FENDL library project in the Nuclear Data Sheets.

We will also have our usual large list of meetings in the coming year. I want to mention two in particular: the Decennial IAEA Technical Meeting on Atomic, Molecular and Plasma–Material Interaction Data for Fusion Science and Technology, and CNR*24 on Compound Nuclear Reactions and Related Topics, to be held in July. In both cases we expect a lot of participants.

The past semester saw two retirements from the Section, Viktor Zerkin and Jean-Christophe Sublet, and we are currently looking for people to fill the gaps they left behind. Unfortunately, we have to close this newsletter with three obituaries.

I will end with a few personal remarks. In October we organised the Joint ICTP-IAEA Workshop on Simulation of Nuclear Reaction Data with the TALYS Code, which for me was a good opportunity to again train and test my lecturing capabilities. Next, for me it is good to see that if a Section Head retires from the IAEA he can still get awards, more about that on the next page. Finally, the accompanying photo here has nothing to do with my age but with the fact that in 2024 the Nuclear Data Section exists for 60 years.

Arjan Koning, SH-NDS

Announcement

JARI Award 2023 for Alan L. Nichols

Alan Nichols has been awarded the JARI medal for his outstanding life-time contributions to radiation and isotope applications and instrumentation. The award was presented to him at the 23rd International Conference on Radionuclide Metrology and its Applications (ICRM 2023) in Bucharest, 26-31 March 2023.

In addition to almost 50 years of studies identified with in-depth evaluations of atomic and nuclear decay data, Alan also held various managerial roles within the UK Atomic Energy Authority/AEA Technology at the Harwell, Culham and Winfrith research laboratories from 1974 to 2001, before being appointed Section Head of the IAEA Nuclear Data Section in Vienna from early October 2001 to the end of April 2009. After his retirement from the IAEA in 2009, he became a Visiting Professor affiliated to the Department of Physics, University of Surrey, Guildford, UK, from November 2009 until April 2020, and an Adjunct Professor affiliated to the Manipal Academy of Higher Education (MAHE), Karnataka, India. Throughout his working career in the UK, he has been the UK representative to and Secretary of the International Nuclear Data Committee (INDC), Coordinator of the Non-Neutron Nuclear Data Working Group of the International Committee for Radionuclide Metrology, and Chairman of the Chemical Nuclear Data Committee (UKCNDC) and UK Nuclear Science Forum (UKNSF).

Since 2009 he has regularly rendered consultancy services to the IAEA Nuclear Data Section. At various times he has also served as advisor to the US Nuclear Regulatory Commission and the American Chemical Society, and more recently as a member of the US Nuclear Data Advisory Committee. His cooperation with the scientific community continues as he maintains technical contacts and remains involved in, for example, specific IAEA coordinated research projects related to operational reactors, medical isotope production and other specialized nuclear data applications.

Decennial IAEA Technical Meeting on Atomic, Molecular and Plasma-Material Interaction Data for Fusion Science and Technology

JET interior with superimposed plasma
Credit: UKAEA

The 2024 Decennial meeting will be held from 15 to 19 July 2024 in Helsinki, Finland and serve as a forum between the fusion data users and the data providers with an aim to advance the fruitful communication between these two communities for finding gaps and needs in fusion data.

Main topics of the event are:
– Recommend fusion data for various plasma-particle processes and plasma-material interactions
– Experiments and data collection with fusion and linear plasma devices
– Validation of plasma-particle processes data with collisional-radiative models
– Fundamental calculations of plasma-particle collisions
– Plasma-surface process properties, trends and underlying effects
– Fast ion and neutron irradiation-induced damage creation, evolution and dynamics
– Fuel retention and release as well as diffusion and transport properties in fusion materials
– Data needs for ITER, DEMO and private sector.

For registration and more details please visit the dedicated website: https://conferences.iaea.org/e/AMPMI24.

Compound Nuclear Reactions and Related Topics (CNR*24)

The 7th international workshop on Compound-Nuclear Reactions and Related Topics will be held from 8 to 12 July 2024 at the International Atomic Energy Agency. The main objective is to create a platform for scientific exchanges on experimental and theoretical advancements in compound-nuclear reactions and related topics, including discussions on recent developments and their integration into practical applications.

Topics to be covered:
– Nuclear reaction mechanisms
– Nuclear fission
– Statistical Hauser-Feshbach theory
– Surrogate methods
– Optical model
– Level densities and photon strength functions
– R-matrix theory
– Nuclear structure for nuclear reactions
– Measurements relevant to compound-nuclear reactions (direct and indirect)
– Nuclear data evaluation and dissemination
– Applications in nuclear astrophysics, energy, waste management, non-proliferation, medical physics, etc.
– Experimental facilities

For registration and abstract submission please visit the website: https://conferences.iaea.org/event/368/.

Computer Codes, Data Libraries and Web News

EXFOR-2023 (EXFOR Master File Ver.2023)

The International Network of Nuclear Reaction Data Centres (NRDC) agreed in the NRDC 2023 meeting to support releasing the EXFOR Master File as Open Data with DOI (document object identifier) and an open data license (CC-BY-4.0 or similar). The 2023 version of the EXFOR Master File (EXFOR-2023) was released and is available on https://nds.iaea.org/nrdc/exfor-master/exfor-2023/. This is an official snapshot of the EXFOR library collecting all EXFOR entries and EXFOR/CINDA dictionary at the end of 2023.

TALYS and related Software

A new release of the TALYS software system for nuclear reaction models is available at https://nds.iaea.org/talys/.
The various codes and databases are all available as tar packages while links to GitHub are provided for further development of all the software.

The current collection consists of:
TALYS-2.0 - the nuclear reaction model code.
TALYS has been rewritten in more modern Fortran, and the output is given in more consistent format, opening the door to more efficient processing and AI/ML applications. The updates regarding the physics, which among others improved fission fragment decay and optimal parameters from automated fitting, can be found in the introduction of the entirely revised tutorial.
Video links to TALYS lectures from the ICTP course (see page 10) are also available.
The package also contains TALYS-1.97 (old-style Fortran) which has been tested at length and gives the same answers as TALYS-2.0. The plan is to only develop TALYS-2 further.

TALYSworld - an online TALYS interface.
The user now has access to a GUI at https://nds.iaea.org/relnsd/talys/talys.html, where a TALYS calculation can be started, after which the resulting curves are directly compared with experimental data from the EXFOR database. More than half of the TALYS keywords and model parameters have been implemented in this version. After online changing the value of nuclear model parameters, another calculation is started and the comparison with the first run is shown.

TASMAN-2.0 - Statistical software for TALYS: uncertainties, sensitivities, and optimization.

This is the first open release of the code responsible for the complete covariance information that is delivered with the TENDL data libraries. In addition, TASMAN can automatically optimize TALYS nuclear model parameters to experimental data from the EXFOR database. There are many options and they all are described in the tutorial.

TEFAL-2.0 - Code to make ENDF-6 nuclear data libraries from TALYS.
TEFAL is a software package to produce nuclear data libraries. Its main task is to process the output files of the TALYS nuclear reaction code, but also data from other sources such as resonance tables and other nuclear data libraries, into a data library in ENDF-6 format.

EXFORtables - Experimental nuclear reaction database based on EXFOR.
This database is entirely based on the international experimental nuclear reaction database EXFOR and contains the data in an easily accessible projectile/element/mass/reaction directory structure.

ENDFtables - Code to translate ENDF nuclear data libraries into tabular format.
This code reads one ENDF formatted data library and produces a large collection of data tables, with one data file per reaction channel, in x-y or x-y-dy format and a header containing the basic information about the reaction.

Resonancetables - Database for thermal cross sections, MACS and average resonance parameters.

Isotopia - Simulation of medical isotope production with accelerators.
The isotope yields for any production route with incident protons, deuterons, tritons, helions or alpha particles, and for natural or enriched targets, can be calculated.
Isotopia is the engine behind the Medical Isotope Browser, https://nds.iaea.org/mib, which allows to analyze production routes in an efficient way via a GUI.

Libraries-2023 - Evaluated nuclear data libraries and EXFOR in tabular format.
Libraries-2023 is a very large collection of simple x-y-(dy) data files from the major nuclear data libraries in the world.

TENDL-2023

A new release of the TALYS Evaluated Nuclear Data Library, TENDL-2023, is now available at https://tendl.web.psi.ch/tendl_2023/tendl2023.html and succeeds the TENDL-2021 library.
The library contains complete ENDF-6 formatted data files, including covariance data and energies up to 200 MeV, for 2854 isotopes (all stable or with half-life >1sec) for incident neutrons, photons, protons, deuterons, tritons, Helium-3, and alpha particles.

Stopping Powers Database

In November 2023, the revamped Stopping Power Database was launched, offering enhanced accessibility via its familiar URL: https://nds.iaea.org/stopping

The upgraded interface streamlines data retrieval, plotting, and downloading, accommodating even datasets with only one measurement available.

Key enhancements include:

- A user-friendly search engine for ions, targets, and publications;
- Dynamic on-the-fly plotting capabilities;
- Convenient data and metadata downloads in .csv and .txt formats;
- Seamless data retrieval in JSON format through APIs;
- Integration of DOI links for the majority of cited references;
- A comprehensive Target Glossary detailing all database targets alongside their respective names and symbols.

The modernization effort, building upon Helmut Paul's original work from the 1990s, facilitates efficient exploration and analysis of the database's extensive content, and enables the identification of gaps in collisional systems where new measurements are needed.

The legacy version will remain accessible for a limited period, serving as a reference point for effortless comparison with the latest iteration.

IDB - The International Database of Reference Gamma Spectrum

In January 2024, the NDS introduced the IDB - The International Database of Reference Gamma Spectra of uranium (U), plutonium (Pu), and mixed oxide (MOX) samples, accessible at https://nds.iaea.org/idb. This collaborative effort, led by the IAEA (Nuclear Applications and Safeguards Departments) in partnership with the United States (US SP), French (FRESPAS), and European Commission (EC SP) Support Programmes, aligns with Member States' objectives of ensuring the sustainability and maintenance of software for Pu-isotopics and U-Enrichments.

The database offers a wealth of well-characterized gamma spectra datasets, each accompanied by comprehensive metadata detailing sample specifics, measurement configurations, and detector specifications.

Key highlights include:

- Robust metadata-driven search and filtering capabilities;
- Seamless data retrieval through an application programming interface (API);
- Intuitive data visualization tools;
- Access to certificate files;
- Retrieval of data and metadata in versatile formats (SPE, JSON, CSV), ensuring compatibility with

analysis code standards and promoting long-term sustainability and maintenance;
- Support resources for spectroscopists, including the Random Spectrum Selector and the Downgraded Spectra Generator.

Presently, the database contains 1,591 datasets from two primary contributors: the US Support Program and the IAEA. Expectations are high for the continuous expansion of the repository with the addition of further datasets in the foreseeable future.
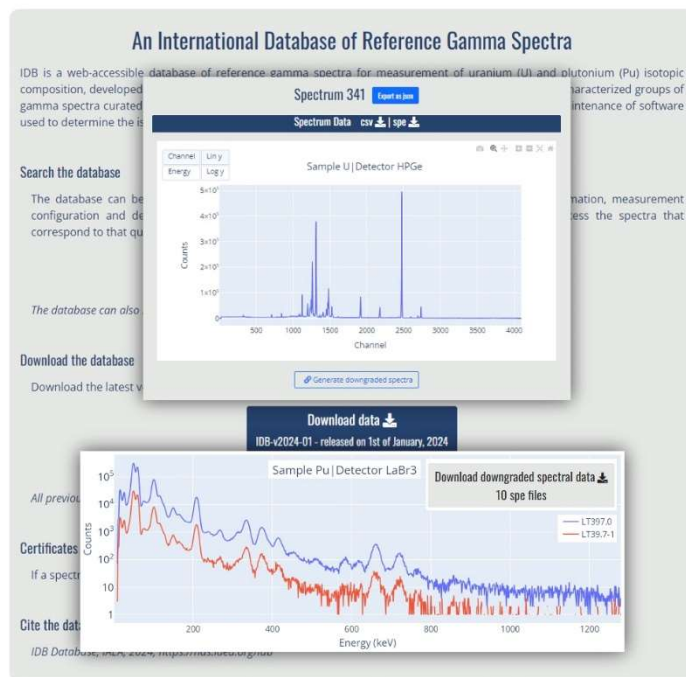
New nuclear data development tool for ENDF-6 files

The ENDF-6 format is adopted world-wide for storing and disseminating evaluated nuclear data. While several established and well-documented software packages exist to read and verify ENDF-6 files and to process these files to file formats that can be understood by Monte Carlo transport codes, the situation is less developed regarding publicly available software tools that support researchers in the creation of ENDF-6 files, making it difficult for newcomers who want to contribute to nuclear data development efforts efficiently and meaningfully. To improve this situation, the Nuclear Data Section has recently developed a Python package named "endf-parserpy" that provides comprehensive support for the ENDF-6 format and facilitates common tasks encountered during nuclear data development, such as creating ENDF-6 files and comparing ENDF-6 files in a meaningful way. Notably, also the creation of ENDF-6 files from scratch is possible. The package development followed best practices, such as unit testing and continuous integration, and was validated on the data of various major nuclear data library projects. This package is available on the Python Package Index (PyPI) and

can hence be conveniently installed via pip. More details about the package and access to comprehensive documentation can be found on its GitHub repository: https://github.com/iaea-nds/endf-parserpy.

Web-API for EXFOR, ENDF, IBANDL

Web-API (Application Programming Interface) is available via NDS Web Retrieval system and provides a tool for remote access to data by user's programs. Data are sent through Internet using http connection.

EXFOR-API provides search and downloading data in EXFOR, C4, X5 and C5 with options: automatic re-normalization and generation of correlation matrix as plain text, CSV, XML and JSON files.

ENDF-API provides data search and retrieval mostly in JSON: cross sections, angular distributions, fission yield decay and other data. The ENDF-API is used in X4Pro/Python with a lot of examples for different data types and in EE-Viewer.

IBANDL-API provides database list, individual datasets and grouped data. Data can be converted (Rutherford Ratio to barn per steradian and vice versa) and recalculated to inverse kinematics and finally sent to user as text, CSV, R33, JSON files.
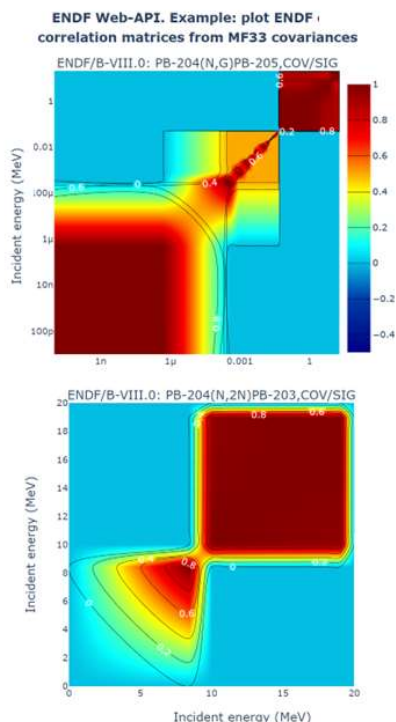
Code example using Web-API in Python:
1. Retrieve cross section covariance data from ENDF in JSON and plot by Plotly (Fig.1)
2. Plot cumulative fission product yield from EXFOR and ENDF as a function of energy
3. Retrieve IBANDL data and plot by Plotly
4. Retrieve and plot IBANDL and Sigmacalc data

5. Retrieve and plot IBANDL and Sigmacalc data in direct and inverse kinematics

Short description, examples, and codes are available from: https://nds.iaea.org/exfor/x4guide/API/

FENDL reference paper published

The Fusion Evaluated Nuclear Data Library (FENDL) is a comprehensive and validated collection of nuclear cross section data to support fusion research and development, in particular serving as the reference library for the ITER project. The FENDL project was initiated in the late 80s and has, since then, been continuously developed by an international collaboration under the auspices of the IAEA to meet the evolving data needs encountered in fusion research. The general approach of the FENDL project is to adopt and combine the best performing evaluations from the various major library projects. More recently, evaluations produced by the International Nuclear Data Evaluation Network (INDEN) have also been included in FENDL.

In view of the increasing traction in fusion research, as witnessed by several experimental milestones over the last couple of years, the FENDL collaboration deemed it pertinent to produce a comprehensive reference paper for FENDL that 1) traces the history of the library, 2) summarizes the content of the current version, FENDL-3.2b, 3) gives detailed indications on the library performance, as determined in a recent extensive validation exercise, and 4) provides an outlook on planned future developments. This reference paper, the result of an international collaboration of 31 researchers from ten Member States, has been recently published in the Nuclear Data Sheets and is available at: https://www.sciencedirect.com/science/article/pii/S009037 5224000012.

Staff
Internship Risa Kunitomo

Risa joined the Nuclear Data Section as an intern from August 2023 to February 2024. During her first part of internship, Risa participated in making a comprehensive literature and neutronics data review needed for safety, security and safeguarding aspects in nuclear fusion energy production. Data sources used for this work were the ENDF/B-VIII.0 and FENDL-3.2b databases. Risa focused on areas of fusion reaction neutronics, magnetic confinement technologies, neutron wall loads, neutron-induced processes, activation and damage in reactor components, neutron multiplication and breeding of tritium fuel in first wall components. A summary presentation of her findings was given for the staff of NDS.

Motivated by the rapid proliferation of Machine Learning (ML) frameworks, backed by major software companies, in the second part of her internship, Risa explored the suitability of TensorFlow in combination with TensorFlow Probability for performing nuclear data evaluations. Starting from the basic mathematical assumptions, Risa developed TensorFlow programs of increasing complexity that gradually approached more and more realistic nuclear data evaluation scenarios. The work of Risa showed that TensorFlow can indeed be used for nuclear data evaluation, and that TensorFlow may also help in the future to advance evaluation methodology.

An IAEA-NDS report with more details is available at https://nds.iaea.org/publications/iaea-nds/iaea-nds-0245.pdf

NDS Meeting Reports
(TM = Technical Meeting, RCM = Research Coordination Meeting, CM = Consultants' Meeting, WS = Workshop, CRP = Coordinated Research Project)

Consultancy Meeting on Inter-comparison of PIGE Analysis Codes (II)
16-18 January 2024, Vienna, Austria
Scientific Secretary: P. Dimitriou
5 participants and IAEA staff

At this Consultancy Meeting participants performed a detailed comparison of the performance of Particle-Induced Gamma-ray Emission (PIGE) data analysis codes in simulations of multi-layered samples. Seven exercises were defined to investigate how the codes perform in simulations of: one thin film plus substrate (substrate can be heavy or light element) and two to three films plus substrate (substrate can be heavy or light element) with different, well-defined conditions on the cross sections, film thickness and incident beam. Participating codes: ERYA-profiling, NDF, SIMNRA, and SPACES. The outcome of the comparison and conclusions will be published in a peer-reviewed journal. The minutes of the meeting and results of the inter-comparison are available on the meeting website: https://conferences.iaea.org/event/382/.

Consultancy Meeting on Information Exchange on Developments and Operations of Nuclear Data Dissemination Services
15-18 January 2024, Vienna, Austria
Scientific Secretary: S. Okumura
10 participants and IAEA staff

The main aim of this Consultants' Meeting was to facilitate the exchange of technical information and discussions on the development and implementation of DevOps methods for swift and efficient dissemination of nuclear data services to

users, particularly focusing on computational methodologies. A summary of the meeting will be available in INDC(NDS)-0899.
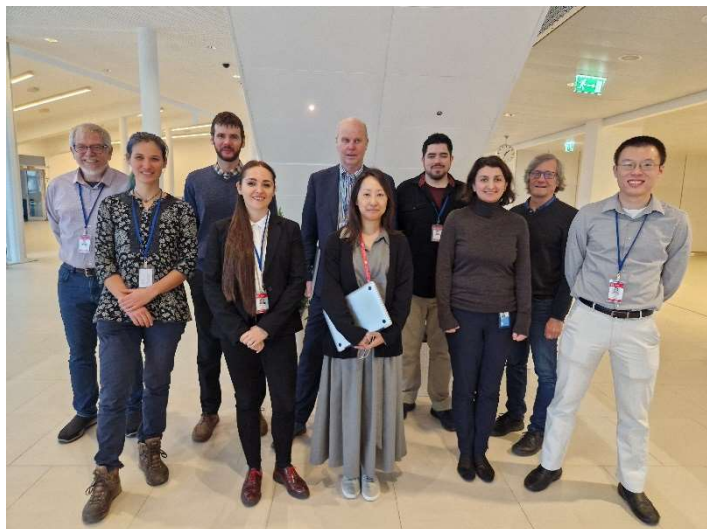
Consultancy Meeting of the INDEN on the Evaluated Data of Structural Materials
18-21 December 2023, Vienna, Austria
7 participants and IAEA staff
Scientific Secretary: G. Schnabel

The objective of the CM on Structural Materials, an annual meeting within the framework of the International Nuclear Data Evaluation Network (INDEN), is to provide a platform for information exchange and collaboration to improve the quality of nuclear data evaluations of structural materials. Owing to the upcoming releases of the major library projects ENDF/B and JEFF, evaluations produced within INDEN, anticipated to be included in these library releases, were discussed in detail. This meeting also had an additional focus on advances in evaluation methodology enabled by leveraging modern compute infrastructure, computational tools and numerical algorithms from statistics and machine learning. 18 participants (4 on-site) from one International

Organization and 11 Member States took part in the meeting. The presentations can be downloaded from the meeting website at https://conferences.iaea.org/event/375 and a summary will be published as INDC(NDS)-0898.

First RCM of the Edge Plasmas CRP
6-8 December 2023, Vienna, Austria
Scientific Secretary: C. Hill
11 participants and IAEA staff

The first Research Coordination Meeting of the AMD Unit's most recent CRP on The Formation and Properties of Molecules in Edge Plasmas was held, in-person, at IAEA HQ. 11 participants from 10 Member States described their workplans for the project and formulated coordinated research tasks in the areas of: 1. Data for molecular hydrogen, known to be important for modelling the physics of divertor detachment; 2. Data for boron-containing species, which will be increasingly important as beryllium is less-used as a first-wall material; 3. Data for water-derived species in glow discharges for leak detection.
The summary report will be published as INDC(NDS)-0896.

Technical Meeting on Tungsten and Hydrogen in Edge Plasmas
28 November – 1 December 2023, Vienna, Austria
31 participants and IAEA staff
Scientific Secretary: K. Heinola

The 2nd Technical Meeting on Collisional-Radiative Properties of Tungsten (W) and Hydrogen Isotopes in Edge Plasmas of Fusion Devices was attended by over 30 participants representing 14 Member States and the ITER Organization, and was a continuation of the previous meeting organized in 2021. The topic is gaining significant interest as ITER is considering of converting its concept to a full-W machine (decision pending until 2024), and all the major DEMO reactor-sized designs are full-W concepts. The meeting series is setting up co-ordination through three

Working Groups focusing to i) atomic and molecular data validation with CR models, ii) plasma experiments and comparison with CR models, and iii) plasma-surface processes. The latter is a new and required topic as the W plasma-facing surface acts as a source for the W impurity in the edge plasma region. The mechanisms of W emission rate from a bulk target into the edge and e.g., the corresponding charge states are needed for reliable CR models to optimize the fusion plasma performance.

Technical Meeting on (alpha,n) Reaction Nuclear Data Evaluation and Data Needs
27 November – 1 December 2023, Virtual
Scientific Secretary: P. Dimitriou
50 registered participants and IAEA staff

This follow-up meeting assessed the progress in addressing the priorities outlined in the preceding meeting report (INDC(NDS)-0836) and made further recommendations. The focus was on (alpha,n) reactions at low energies up to 10 MeV relevant for applications in (i) nuclear fuel cycle (with emphasis on ^{17}O compound system), (ii) spent fuel management, non-proliferation, (iii) low background experiments, (iv) nuclear astrophysics, and (v) fusion applications. Participants also reviewed the status of model and applications codes and evaluated libraries. More information is available on the meeting website: https://conferences.iaea.org/event/366/. The summary report will be published as INDC(NDS)-0894.

Technical Meeting of the INDEN on Nuclear Data Evaluation of Fissile Actinides
20-23 November 2023, Vienna, Austria
Scientific Secretary: R. Capote Noy
7 participants and IAEA staff

Participants of this Technical Meeting discussed and exchanged evaluation methodologies for fissile actinides, and discussed currently available evaluated files.
A summary of the discussions as well as the list of recommendations and actions will be included in the report of the meeting as INDC(NDS)-0893.

8th Meeting of the International Atomic and Molecular Code Centres Network
13-17 November 2023, Vienna, Austria
Scientific Secretary: C. Hill
34 participants and IAEA staff

The 8th Meeting of the Code Centres Network was held in hybrid form and was attended by 34 experts in atomic and molecular data. The current status of the Virtual Atomic and Molecular Data Centres consortium was reviewed, and proposals were discussed for new data standards and services to facilitate machine learning on the 32 databases it links. The AMD Unit's own CollisionDB database has already adopted these standards and will see its second public release in early 2024.
Meeting report is published as INDC(NDS)-0897 https://nds.iaea.org/publications/indc/indc-nds-0897/.

Consultancy Meeting on Further Development of the Fusion Evaluated Nuclear Data Library (FENDL)
30 October - 2 November 2023, Vienna, Austria
Scientific Secretary: G. Schnabel
14 participants and IAEA staff

Recently, collaborators in the FENDL project joined forces to draft a comprehensive reference paper for FENDL. This hybrid CM was a follow-up activity to discuss and coordinate future activities to further improve the library. 23 participants (13 on-site) from 10 member states engaged in productive discussions and provided updates on fusion-related activities and progress in nuclear data-related

activities of interest for the FENDL project. The 18 presentations given are available on the meeting website at https://conferences.iaea.org/event/373. The outcomes of the meeting will be published in the summary report INDC(NDS)-0892.

Consultancy Meeting on Thermal Capture and Gamma Emission
23-25 October 2023, Vienna, Austria
Scientific Secretary: R. Capote Noy
9 participants and IAEA staff

As a follow-up meeting to the Technical Meeting held in 2022, the main purpose of this CM was to review available experimental data and evaluations of thermal capture cross sections and associated gamma emission spectra, with the aim of producing a set of recommended data. A roadmap for the revision of the EGAF library was defined: new measurements at the Munich FRM-II reactor will be combined with measurements at the Budapest reactor.
More details can be found on the dedicated webpage: https://nds.iaea.org/index-meeting-crp/CM%20Thermal%20GAMMA%202023/
and the summary report will be published as INDC(NDS)-0891.

Technical Meeting on Decay Data for Monitoring Applications
23-25 October 2023, Vienna, Austria
Scientific Secretary: P. Dimitriou
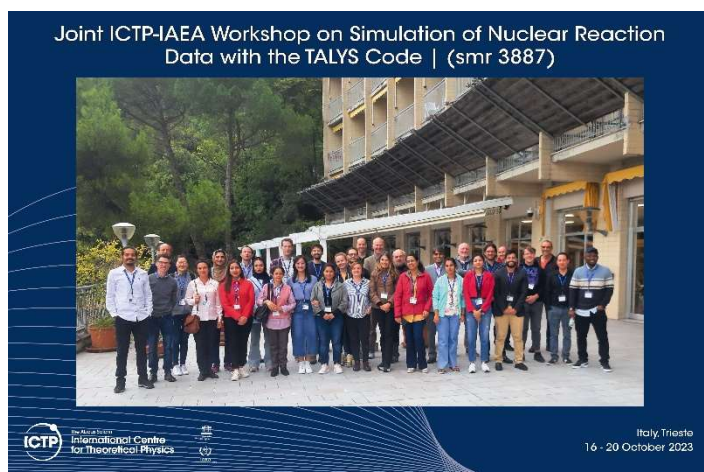9 participants and IAEA staff

The participants of this TM reviewed the progress in the evaluations and reviews of the decay data that are to form the new adopted decay data library for monitoring applications. A timeline for the finalization of all the evaluations, reviews, derivation of the atomic radiation data, and final publications was agreed. The meeting was attended by 7 in-person and 2 remote participants. The summary report of the meeting will be published as INDC(NDS)-0890.
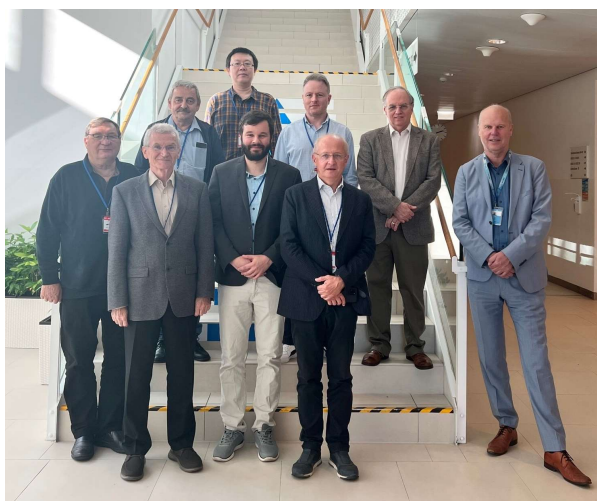
Joint ICTP-IAEA Workshop on TALYS
16-20 October 2023, Vienna, Austria
Director: A. Koning; Local Organizer: N. Binggeli (ICTP)
32 participants and IAEA staff

For a full week, five lecturers gave presentations about the TALYS nuclear model code and experiments which can be analyzed with TALYS. A few sessions were devoted to hands-on computer exercises to allow the participants to get practically acquainted with the code. Several participants were already TALYS user, and for those we focused on more

advanced options of the code, especially nuclear analyses. Two afternoons were reserved for presentations by the participants, to report on their experience with TALYS.

The Workshop was attended by 32 participants, of which 18 were female, a remarkable high score for the field of nuclear data.

Video material on the entire Workshop is available at https://indico.ictp.it/event/10221/other-view?view=ictptimetable.

Technical Meeting on Neutron Data Standards

9-13 October 2023, Vienna, Austria
Scientific Secretary: G. Schnabel
10 participants and IAEA staff

This TM is the fourth meeting dedicated to the further development of the Neutron Data Standards since the last release in 2017. 21 participants (7 on-site) from one International Organization and 8 Member States discussed recent experimental results, ongoing evaluation work, and advances in evaluation methodology and data analysis techniques. The current state of the Neutron Data Standards database has also been reviewed and actions and recommendations were issued regarding its further development. The presentations can be found online on the meeting website at https://conferences.iaea.org/event/372 and the results of the meeting will be summarized in a report with assigned identifier INDC(NDS)-0888.

Consultancy Meeting on Evaluation of Photon Strength Function Data

9-11 October 2023, Vienna, Austria
Scientific Secretary: P. Dimitriou
9 participants and IAEA staff

The main purpose of this Consultancy Meeting was to review the ongoing efforts to evaluate experimental photon strength function data for applied and basic research. New systematics of the photon strength function were discussed and a preliminary version of the new interface to the IAEA Photon Strength Function database was presented. The meeting was attended by 5 in-person and 4 remote participants. More information is available on the meeting website: https://conferences.iaea.org/event/365/. The outcomes of the meeting will be published as INDC(NDS)-0889.

Consultancy Meeting of the INDEN on the Evaluation of Light Elements

29 August– 1 September 2023, Vienna, Austria
Scientific Secretary: P. Dimitriou
5 participants and IAEA staff

The participants of this meeting discussed the progress in the evaluations of charged-particle and neutron-induced reactions of light elements at low energies relevant to energy and non-energy applications. The main topics covered were evaluations of: ^{7}Be produced by charged-particle reactions, n+^{9}Be, n+^{14,15}N, n+^{16}O, and (alpha,n) reactions on ^{13}C and ^{19}F. The meeting was attended by 5 in-person and 9 remote participants. More information is available on the meeting website: https://conferences.iaea.org/event/364/.

The summary report of the meeting will be published as INDC(NDS)-0885.

Technical Meeting on Nuclear Data for Medical Applications

28-31 August 2023, Vienna, Austria
Scientific Secretary: R. Capote Noy
12 participants and IAEA staff

The aim of this meeting was to review nuclear data needs for medical applications and discuss potential areas of interest. The meeting was attended by 12 in-person and 8 virtual participants.

A recommended cross-section database for charged-particle monitor reactions is available at:
https://nds.iaea.org/medical/monitor_reactions.html
A recommended cross-section database for the production of gamma emitters is available at:
https://nds.iaea.org/medical/gamma_emitters.html
A recommended cross-section database for the production of positron emitters is available at:
https://nds.iaea.org/medical/positron_emitters.html
A recommended cross-section database for the production of therapeutic isotopes is available at:
https://nds.iaea.org/medical/therapeutic.html
Presentations from the meeting can be obtained from the meeting webpage: https://nds.iaea.org/index-meeting-crp/TM-MedApps-Aug2023/, and the summary report with discussions and outcomes of the meeting is published as INDC(NDS)-0884 report.

# Side Event at the 67th IAEA General Conference
Partnership Agreement between Women in Nuclear Global and Women in Fusion

From left to right: WiN Global President Dominique Moullot, IAEA Director General Rafael Mariano Grossi, WiF Secretary Kalle Heinola, World Nuclear Association Director General Sama Bilbao y León

At the 67th IAEA General Conference, the president of Women in Nuclear Global (WiN Global) Dominique Moullot and the chair of Women in Fusion (WiF) Sehila Gonzalez signed a Partnership Agreement for formalizing and deepening the collaboration and co-operation on gender equity topics in fission and fusion sectors. IAEA Director General Rafael Mariano Grossi is the depository of this Partnership Agreement, and a copy of the document was handed over by Kalle Heinola, the WiF Scientific Secretary (Nuclear Data Section).

# Side Event at the 67th IAEA General Conference
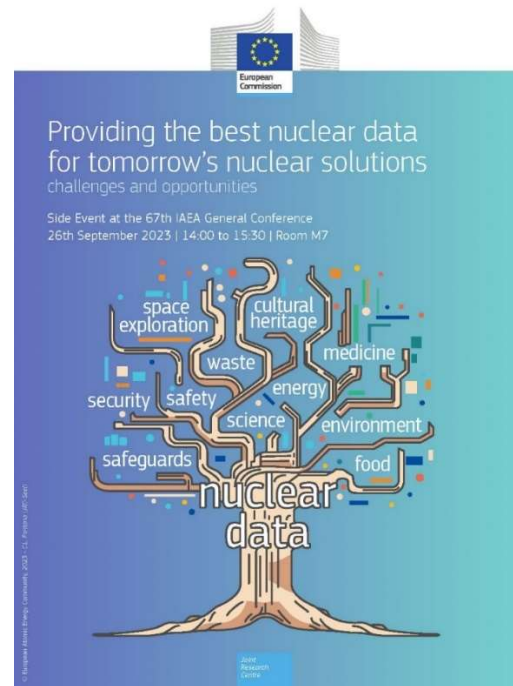
Description

Advances in nuclear technologies for energy, waste, medicine, environment, earth and space exploration, security, safeguards, and cultural heritage rely on quality-assured nuclear data characterizing nuclear reactions and decay radiation. Progress greatly depends on the latest scientific insights being promptly incorporated into the databases. The competencies, research infrastructures, and best practices required for data development transcend the resources of a single application, calling for a coordinated and concerted effort at national and international levels. A panel of experts presented the challenges and opportunities in transforming the best scientific knowledge to quality-assured nuclear data, ready for use in developing new nuclear solutions.

The event was moderated by Ulla Engelmann (Director, EC-JRC), attendees welcomed by Melissa Denecke (DIR-NAPC, IAEA) and attended by Yolanda Benito (Director General, CIEMAT), Héloïse Goutte (Scientific Director for Energy, CEA), Michael Fleming (on behalf of the DG, OECD-NEA), Arjan Koning (IAEA), Arjan Plompen (JRC), Keith Jankowski (US DOE), Tokio Fukahori (JAEA), Nengchuan Shu (CIAE).

The speakers presented the innovation, research and development for future nuclear solutions and talked about the opportunities, challenges, and ways forward for nuclear data from different perspectives. Round table discussions concentrated on available resources, competences, research infrastructures, new technology, organisation and cooperation.

Selected Charts, Reports and Documents

IAEA World Fusion Outlook 2023
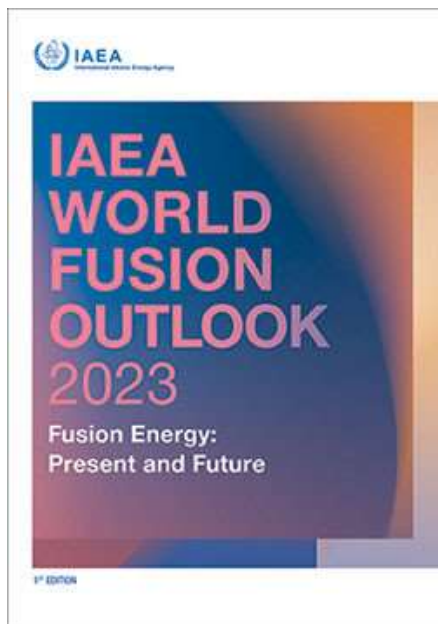
The new publication IAEA World Fusion Outlook was launched by the IAEA Director General Rafael Mariano Grossi at the 29th IAEA Fusion Energy Conference. This publication will serve as reference for authoritative information on fusion science and technology, safety and security, regulation and safeguards worldwide. The Nuclear Data Section provided input on fundamental data activities on neutronic processes and various fusion plasma processes and plasma-material interactions and provided expert input during the reviewing process of the document.
Press release:
https://www.iaea.org/newscenter/pressreleases/iaea-launches-world-fusion-outlook-2023
Link to World Fusion Outlook:
https://doi.org/10.61092/iaea.ehyw-jq1g.

INDC(NDS)-0871 International Nuclear Data Evaluation Network (INDEN) on the Evaluated Data of Structural Materials (5), Summary Report of the Consultants' Meeting, 6-9 December 2022, prepared by M. Kostal and G. Schnabel, December 2023.

INDC(NDS)-0875 Needs for a Comprehensive European Plan to Acquire and Curate Nuclear Data, Summary Report of the Consultants' Meeting, 25-27 April 2023, prepared by G.-E. Koerner, P. Dimitriou, et al., August 2023.

INDC(NDS)-0883 Nuclear Level Densities, Summary Report of the IAEA Consultants' Meeting, 26-28 June 2023, prepared by Mathis Wiedeking and Paraskevi Dimitriou, February 2024.

INDC(NDS)-0884 Nuclear Data for Medical Applications, Summary Report of the Technical Meeting, 28-31 August 2023, prepared by J.W. Engle, A. Hermanne, A.L. Nichols and R. Capote Noy, February 2024.

INDC(NDS)-0886 Thermal Neutron Capture in the Low Mass region, prepared by J. Kopecky, December 2023.

INDC(NDS)-0887 Evaluation of the Prompt Gamma-ray Spectrum from Spontaneous Fission of ^{252}Cf, prepared by S. Simakov, February 2024.

INDC(NDS)-0900 Updating of the ENDF/B-VIII.1b2 Candidate Evaluations with Reaction Cross sections from IRDFF-II, prepared by A. Trkov and R. Capote, February 2024.

INDC(EUR)-0039 Results of Time-of-Flight Transmission Measurements for ^{nat}Mo at a 50m Station of GELINA, prepared by R. Mucciola, et al., October 2023.

Available cost-free on request only for **teachers and scientists from developing countries:**

Chart of the Nuclides 2022 Japanese Nuclear Data Committee and Nuclear Data Center, Japan Atomic Energy Agency.

Karlsruher Nuklidkarte *Wall chart of the nuclides and folding chart with booklet, 10th edition (2018).*

In Memoriam

Balraj Singh

We regret to inform you that Balraj Singh passed away on 9 October 2023 at the age of 81.

For almost five decades Balraj worked tirelessly on mass chain evaluations and other horizontal evaluation projects. In addition to data evaluation, in 1998 he initiated the nuclear structure and decay compilation effort in the form of the well-known eXperimental Unevaluated Nuclear Data List (XUNDL). He also supervised the development of several of the analysis and utility codes that are currently used in ENSDF evaluations.

He trained numerous students at McMaster University and supervised compilation and evaluation exercises at several of the IAEA-ICTP Workshops in Trieste, Italy. His idea to introduce mass chain evaluation as an exercise at the workshop has led to five publications of mass chains in the Nuclear Data Sheets co-authored by the IAEA-ICTP workshop participants.

Balraj was a strong supporter of international cooperation and the NSDD network. He collaborated internationally and co-published mass chain evaluations with nuclear data evaluators from all around the world.

Balraj leaves a legacy that encompasses the entire spectrum of data compilation and evaluation. Through his legacy his work will continue to impact the nuclear data and nuclear physics communities for many years to come.

His loss will be greatly felt.

William (Liam) M. Costello

It is with great sorrow that we learned that Liam passed away unexpectedly on 19 October 2023.

Liam joined the NDS in May 1998 as System Analyst, and was responsible for software development, upgrades and troubleshooting until early retirement in 2013.

He was professional in his work, warmhearted and ready to help anytime. He was a good friend with a great sense of humor.

He will be greatly missed.

Olivier Bouland

With great sadness we inform you of the sudden tragic death of Olivier Bouland on 15 November 2023.

Olivier had been involved in the vast field of nuclear data evaluation for almost 30 years and was recognized for his many contributions.

He maintained close links with international colleagues and carried out expert work in close cooperation with CEA DAM, CNRS, the OECD/NEA for the JEFF library, and the IAEA. In recent years, he had been carrying out theoretical work to improve the modeling of nuclear reaction cross sections and their evaluations. He had extensive experience in fields ranging from experimental to theoretical nuclear physics to reactor physics. He was very active in the IAEA nuclear data networks, especially those on actinide evaluations for the INDEN network and (alpha,n) reactions. He will be greatly missed.

Nuclear Data Services – Contact Points

For services to customers in USA and Canada:
US National Nuclear Data Center, Bldg. 197D, Brookhaven National Laboratory, P.O. Box 5000,
Upton, NY 11973-5000, USA.
Tel. +1 631-344-2902; Fax +1 631-344-2806;
Website: http://www.nndc.bnl.gov/
Email: nndc@bnl.gov
For information regarding on-line services, contact: B. Pritychenko: pritychenko@bnl.gov
For information regarding general NNDC services, contact: Letty Krejci: lkrejci@bnl.gov

For services to customers in OECD/NEA Data Bank member countries:
NEA Data Bank, OECD Nuclear Energy Agency, 46, quai Alphonse Le Gallo
F-92100 Boulogne-Billancourt, France.
Tel. +33 1 7321 (plus extension);
Website: http://www.oecd-nea.org/databank/
Contact: M. Fleming, Tel.: +33 1 73 21 28 22, Email: michael.fleming@oecd-nea.org;.

For services to customers from the Russian Federation:
Neutron data: Russia Nuclear Data Center, Centr Jadernykh Dannykh (CJD), Fiziko-Energeticheskij Institut, Ploschad Bondarenko,1,
249033 Obninsk, Kaluga Region, Russian Federation.
Tel. +7 08439-9-5803; Fax +7 08439-68235;
Photonuclear data: Centre for Photonuclear Experiments Data, Centr Dannykh Fotoyadernykh Eksperimentov (CDFE),
Skobeltsyn Institute of Nuclear Physics, Lomonosov Moscow State University, Leninskie Gory, 119 922 Moscow, Russian Federation.
Tel. +7 495-939-3483; Fax +7 495-939-0896;
Website: http://cdfe.sinp.msu.ru/
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Computer codes of US origin to all countries (there are charges and release restrictions):
Radiation Safety Information Computational Center (RSICC), Oak Ridge National Laboratory,
P.O. Box 2008, Oak Ridge, TN 37831-6003, USA.
Tel. +1 865-574-6176; Fax +1 865-241-4046;
Email: pdc@ornl.gov

Computer codes of non-US origin to all countries (there may be release restrictions):
NEA Data Bank (see above)
Contact: A. Dufresne, Email: Alice.DUFRESNE@oecd.org, Tel.: +33 1 73 21 28 30

IAEA-NDS on-line services at Website https://nds.iaea.org/
Users in India, China, Russia and neighbouring countries may use
IAEA-NDS mirror websites:
http://www-nds.org.in (India); http://www-nds.ciae.ac.cn/ (China); http://www-nds.atomstandard.ru/ (Russia).