

Nuclear Data Newsletter



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From the Section Head

Greetings from Vienna, and a belated healthy and happy 2025 to you all!

As usual, here is a brief summary of the second half of 2024, more details can be found in this Newsletter.

We concluded the CRP on Fission Yield Data Evaluation with its final RCM which included the latest precise evaluated data libraries with uncertainty quantification. New computational methods to predict fission product yields and observables from Hauser-Feshbach fission neutron calculations were also presented.

We also held meetings for the INDEN network - light nuclides, structural materials and actinides. Recently we also held a meeting to prepare for the next version of the Neutron Standards.

Last year, we released the ENDF/B-VIII.1 nuclear data library, which has since been incorporated into our data dissemination systems.

Our Atomic and Molecular Data Unit held meetings on Data for Injected Impurities, Tungsten Ions and Hydrogen Permeation, for fusion plasma and materials, respectively.

A new type of Technical Meeting was held on Nuclear Data Retrieval, Dissemination and Data Portals. As the world is moving towards more automated, computational and non-GUI access to data, ready for direct use in AI/ML, the Section is in a transition phase to make this possible. This requires web APIs, parsers and other conversion tools and we organized this meeting to learn from other fields and organisations about the best way forward.

Capacity building has always been an important role for the Section, and in the past half year we organized an ICTP School on Monte Carlo Radiation Transport codes for medical applications and an EXFOR Workshop to train compilers of experimental nuclear reaction data.

Finally, I wish to introduce our new Divisional Director Prof. Dr. Tzany Kokalova Wheldon, from the University of Birmingham. With a background in nuclear structure physics, she is familiar with our nuclear data field. She started her term at the IAEA in August 2024, and you will have the opportunity to meet her whenever you visit Vienna for our meetings.



Prof. Dr. Tzany Kokalova Wheldon, Director, NAPC and Dr. Arjan Koning, Section Head, Nuclear Data Section

Announcements

ND2025-16th Nuclear Data for Science and Technology Conference

22-27 June 2025, Madrid, Spain

We would like to draw your attention to the 16th Nuclear Data for Science and Technology Conference (ND2025), to be held in Madrid (Spain) from 22-27 June 2025.

ND2025 will be the largest nuclear data event in 2025 and the 16th edition of a series of successful conferences held every three years since 1978, most recently in Bruges, Belgium (ND2016), Beijing, China (ND2019), and Lawrence Livermore National Laboratory, USA (ND2022). It will bring together international experts involved in measurements, validation, evaluation and uses of nuclear data for scientific and technological applications. All relevant information will be announced at <u>www.nd2025madrid.com</u>.

IAEA will co-sponsor the conference and provide limited number of grants for the participants from developing countries. The grant applications should be sent through the official channels (Permanent Missions) and include the received confirmation email of the abstract/paper acceptance.



7th International Workshop on Models and Data for Plasma-Material Interactions in Fusion Devices

26-28 May 2025, Vienna, Austria

The 2025 International Workshop on Models and Data for Plasma-Material Interactions in Fusion Devices (MoD-PMI) is organized in cooperation with the International Atomic Energy Agency (IAEA) for the seventh time. The event will discuss the underlying effects and related data on interactions between the fusion plasma fuel and reactor component materials. It brings together researchers and scientists from the areas of fusion energy and materials science to review advances in modelling of processes relevant to plasma-wall interactions (PWIs) and plasma-material interactions (PMIs) in fusion devices. The Mod-PMI workshop aims to provide a bridge between fundamental computations and interpretation of experimental PMI data; it will address a variety of processes spanning a wide range of scales including erosion, transport and trapping of fusion fuel species in the wall, changes and evolution in the material microstructure, composition and morphology.

The MoD-PMI 2025 workshop will continue to act as a forum between the fusion PMI data users and the data providers with an aim to advance the fruitful communication between these two communities for finding gaps and needs in PMI data and to review the recent activities and to recommend new ones.

As the private fusion companies and enterprises have entered the fusion sector in the recent few years, the MoD-PMI 2025 welcomes participation of the private sector and promotes for further private-public partnerships in fusion knowledge exchange.

MoD-PMI 2025 will take place at IAEA Headquarters (Vienna, Austria) and is a satellite workshop for the 20th International Conference on Plasma-Facing Materials and Components for Fusion Applications (<u>https://pfmc20.com/</u>).

All details of the Workshop can be found at dedicated webpage: https://conferences.iaea.org/event/403/



Computer Codes, Data Libraries and Web News

Photon Strength Functions

Photon Strength Functions (PSFs) are important sources of input information for modelling compound nuclear reactions and as such, they contribute to other databases including the <u>Photonuclear Data Library</u>, <u>Reference Input Parameter</u> <u>Library</u> (RIPL), and evaluated data files such as the <u>Evaluated Gamma Activation File</u> (EGAF), which are all integrated into the IAEA's data services.

In recent decades, the number of PSF data obtained using different experimental methods has increased significantly. The methods typically used are Nuclear Resonance Fluorescence, Oslo Method, Discrete Resonance Capture, Average Resonance Capture, Thermal Capture, Ratio Method, Shape Method, Proton Capture and Inelastic Proton Scattering. This data was compiled by an IAEA Coordinated Research Project (CRP) on <u>Generating a Reference Photon Strength Function Database</u> (2016-2019).

A new web application has been developed to manage, search, and display photon strength function (PSF) data compiled by the IAEA CRP. This application simplifies access and interaction with the data compared to the older platform. It utilizes a database for efficient data management and retrieval, built with the Django framework.



Fig. 1 (landing page)

The search interface allows users to query the database based on properties such as atomic number (Z), mass number (A), multipolarity, energy range, and experimental methods. Users can also search and sort data by author names or publication years.

A key feature is the interactive graph tool created with Plotly, which enables visualization of the retrieved data, comparisons, and a global overview.



Users can download the entire database or the results of their queries in various formats. The database also provides access to the Atlases of Giant Dipole Resonance (GDR) parameters, Average Resonances, and Discrete Resonances Strength Functions, as well as the recommended global calculated strength functions D1M+QRPA and SMLO.

The platform ensures easy access, traceability, and maintenance of the data through a comprehensive data processing system with clear version control capabilities. The new database can be found at: https://nds.iaea.org/PSFdatabase.

Future improvements will include the automatic display of model calculations in the plot for comparison when a specific nuclide (Z, A) is selected.

NDS Meeting Reports

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

Technical Meeting on Neutron Data Standards

27-31 January 2025, Vienna, Austria Scientific Secretary: G. Schnabel 17 participants and IAEA staff



The Neutron Data Standards (NDS) are a set of recommended cross sections used as references in experimental work, and therefore, for the conversion of relative cross section measurements to absolute cross sections. The activities in the NDS project are coordinated since 2001 by the IAEA Nuclear Data Section via a series of technical meetings. Since the last release of the NDS in 2017, preparatory work is ongoing towards the next release. This TM was especially important as the next version of the NDS is planned to be released in early 2026, necessitating a precise coordination of activities and assessment of the current status of evaluation work, experimental campaigns with anticipated data publication, statistical method improvement and code modernization. The meeting was attended by 17 participants (six on-site) from eight Member States and two International Organizations. A summary report will be published as INDC(NDS)-0917. It was assessed that many new experimental data are available, and we are on good track for the next standard release.

Technical Meeting on the Compilation and Evaluation of Nuclear Charge Radii

27-30 January 2025, Vienna, Austria Scientific Secretary: P. Dimitriou 18 participants and IAEA staff



The purpose of the meeting was to discuss the revision of the table of recommended nuclear charge radii by Angeli and Marinova, <u>ADNDT 99 (2013) 69-95</u>, that is accessible from Nuclear Data Services: <u>https://nds.iaea.org/radii/</u>.

Topics included:

- New experimental techniques and measurements
- Evaluation methods and uncertainty quantification
- The role of atomic and nuclear theory
- Emerging needs and priorities
- Revision and future maintenance of the nuclear charge radii tables.

More information can be found at <u>https://conferences.iaea.org/event/401/</u>.

Summary report of the meeting will be published as INDC(NDS)-0918 and is in preparation

Second Research Coordination Meeting on Atomic Data for Injected Impurities in Fusion Plasmas

18-20 December 2024, Vienna, Austria Scientific Secretary: C. Hill14 participants and IAEA staff



Impurity ions are deliberately seeded into the plasmas of fusion devices to improve plasma control and to reduce the amplitude of so-called edge-localized modes (ELMs), disruptions and other transient events. The spectroscopy of species derived from injected impurities is also used as an important diagnostic technique. However, in many cases the currently available data needed to model the behaviour of such impurities are incomplete, missing, or of uncertain quality.

The CRP "Atomic Data for Injected Impurities in Fusion Plasmas" aims to improve this data coverage and quality, with a focus on first-row and noble gas atoms in edge and divertor plasmas. The second RCM of this CRP was attended by 11 experts from 10 Member States. After a review of the participants' work plans, collaborative projects were initiated (a) to calculate the structure and spectra of Ar II – IV and (b) to compare theoretical approaches for calculating charge exchange cross sections for collisions between argon ions and hydrogen atoms and ions.

Further details are available at

https://amdis.iaea.org/meetings/injected-impurities-rcm2/. Summary report of the meeting is published as INDC(NDS)-0914.

Consultants' Meeting of the International Nuclear Data Evaluation Network (INDEN) on the Evaluated Data for Structural Materials

16-20 December 2024, Vienna, Austria Scientific Secretary: G. Schnabel 22 participants and IAEA staff



The objective of this consultants meeting is to discuss evaluation methodology, review experimental data and investigate the performance of proposed evaluations, focusing on structural materials.

This meeting is an activity organised within the International Nuclear Data Evaluation Network (INDEN), promoting knowledge exchange and collaboration with the aim of improving the quality of evaluated nuclear data. More information can be found at

https://conferences.jaea.org/event/407.

Summary report of the meeting will be published as INDC(NDS)-0913 and is in preparation.

Technical Meeting of the International Nuclear Data Evaluation Network (INDEN) on Nuclear Data Evaluation of Fissile Actinides

9-13 December 2024, Vienna, Austria Scientific Secretary: R. Capote Noy 15 participants and IAEA staff



Participants of this Technical Meeting gathered to discuss and exchange evaluation methodologies, and to further coordinate activities across different laboratories. The goal was to obtain consistent evaluated data files for fissile actinides that respect differential data (particularly the thermal constants from the 2017 Standards), softer Prompt Fission Neutron Spectra, and new cross-section measurements, while maintaining good performance in criticality benchmarks.

Summary report of the meeting will be published as INDC(NDS)-0912 and is in preparation.

Workshop on Compilation of Experimental Nuclear Reaction Data

3-6 December 2024, Vienna, Austria Scientific Secretary: N. Otsuka 21 participants and IAEA staff



The main purpose of this workshop was to learn and discuss usage of the tools (e.g., editors, digitizers, retrieval systems) for EXFOR compilation and dissemination. A. Konobeyev opened the workshop by presenting his experiences on use of proton activation cross sections in EXFOR, especially about indication of the precursor decay contribution. We started discussion on JSON as a possible format for EXFOR dissemination, and two participants presented production and dissemination of the EXFOR information in JSON. Two presentations discussed quality of the numerical data which may be influenced by digitization procedure and database management, and the participants discussed how to preserve and restore the quality of the original numerical data. An attempt to automatize indexing for updating a bibliographical database for INIS (International Nuclear Information System) was introduced by a staff member from the IAEA Library.

The presentations are available online from the workshop website (https://nds.iaea.org/nrdc/wksp_2024/) and the meeting summary is available as INDC(NDS)-0911.

Third Research Coordination Meeting on Hydrogen Permeation in Fusion Relevant Materials

3-5 December 2024, Vienna, Austria Scientific Secretary: K. Heinola 21 participants and IAEA staff



The CRP on Hydrogen Permeation in Fusion-relevant Materials focuses on the provision of fundamental and evaluated data on hydrogen isotopes from the nuclear fusion fuel permeating in fusion reactor in-vessel materials and components. The 3rd Research Coordination Meeting was attended by 22 participants representing 13 Member States and four IAEA staff members. Meeting participants presented their progress reports with topics ranging from first-principles calculations of hydrogen properties on surfaces and at metallic interfaces to experiments using gas, plasma and ion loading of fusion materials for retention, transport and permeation studies. The round-robin activity on Gas-driven Permeation (GDP) has shown good progress and results from four participating institutes have been collected. Discussion took place on the publication of these findings as a scientific peer-reviewed article. The second round-robin activity focusing to irradiation of fusion materials with neutrons, has proceeded successfully with having the irradiation campaign finished in end of 2023 and after cooling down the samples, they are ready to be shipped to the four participating institutes in 2025.

More information can be found at

https://amdis.iaea.org/meetings/hydrogen-permeationrcm3/.

Summary report of the meeting will be published as INDC(NDS)-0910 and is in preparation.

Third Research Coordination Meeting on Updating Fission Yield Data for Applications

2-6 December 2024, Vienna, Austria Scientific Secretary: R. Capote Noy 30 participants and IAEA staff



This third and last meeting of the CRP aimed to finalize actions and deadlines for the timely delivery of the coordinated research project (CRP) outputs. The participants reported on fission theory studies and fission yield evaluations including preliminary results thereof performed at individual participating centres and laboratories. Presentations also included benchmarking and validation of ²³⁵U(nth,f) and ²³⁹Pu(nth,f) JEFF-4 fission yield evaluations with uncertainty quantification using new correlation matrices, measurement of mass and charge distributions in low-energy fission, compilation and decay data corrections for experimental fission product yields, as well as status of fission yield compilations. In addition, the outline of the final CRP report was also discussed.

A final technical paper summarizing all the work undertaken is in preparation and expected to be published in 2026.

Consultants' Meeting of the International Nuclear Data Evaluation Network (INDEN) on the Evaluation of Light Elements

18-22 November 2024, Vienna, Austria Scientific Secretary: P. Dimitriou17 participants and IAEA staff



Main goal of this Consultants' Meeting was to monitor progress and update the work plan for evaluating light compound systems. (Be-7, O-17, Be-10, N-15,16, Ne-22, Na-23) relevant for reactor operation, nonproliferation, nuclear astrophysics, and other applications. The meeting was hybrid and included practical exercises for the in-person participants.

More information is available at:

https://conferences.iaea.org/event/400/.

Summary report of the meeting will be published as INDC(NDS)-0908 and is in preparation.

Technical Meeting on Nuclear Data Retrieval, Dissemination and Data Portals

11-15 November 2024, Vienna, AustriaScientific Secretary: S. Okumura27 participants and IAEA staff

This Technical Meeting aimed to evaluate and assess the capabilities of existing tools within various nuclear data retrieval systems, including APIs and data format conversion tools. The agenda included reviewing relevant use cases, such as machine learning applications for nuclear data evaluation, and addressing challenges related to data format conversion and nuclear data pipelines. Additionally, the meeting focused on collaboratively developing strategies to implement recommendations for the efficient advancement and development of the Nuclear Data Portal. More information can be found at

https://conferences.iaea.org/event/395 .

Summary report of the meeting will be published as INDC(NDS)-0909 and is in preparation.



Joint ICTP-IAEA Workshop on Monte Carlo Radiation Transport Codes and Associated Data Needs for Medical Applications

28 October – 8 November 2024, Vienna, Austria Directors: Luciano Bertocchi (ICTP, Italy), Roberto Capote (IAEA, Austria), David W.O. Rogers (Carleton University, Canada), Frédéric Tessier (NRC, Canada Local organizer: Marco Esposito (ICTP) 18 participants and IAEA staff

The Workshop provided an exceptional opportunity for scientists, engineers, and medical physicists to gain in-depth and up-to-date training on Monte Carlo methods pertinent to medical applications in therapy and diagnostics. The training emphasized the advanced BEAMnrc/EGSnrc Monte Carlo code. Furthermore, participants learned about online data retrieval for medical applications. The workshop lectures covered a range of topics, including Photon Physics, Data, Transport, Parameters, and Electron Physics, BEAMnrc and Variance Reduction, Phase-space Files and BEAMnrc, introduction to egs++, egs++ Applications: egs_chamber, egs++ Applications: egscbct, egskerma, egs_brachy, fundamental quantities and other research topics. All the lectures were followed by practical sessions in labs.

More information about the event can be found at and <u>https://indico.ictp.it/event/10516/</u>.

Consultants' Meeting on Thermal Capture and Gamma Emission

7-11 October 2024, Vienna, Austria Scientific Secretary: R. Capote Noy 18 participants and IAEA staff



Participants of this CM highlighted the need for new evaluators and an upcoming initiative by the US Department of Energy (DOE) Office of Science (SC) Program Manager, Keith Jankowski. This initiative, to be proposed in a future Funding Opportunity Announcement (FOA) in FY24 with funding starting in FY25, aims to train younger researchers to become full-time nuclear data evaluators. Current data evaluators and senior researchers will team up with younger researchers for this training.

The need for new Evaluated Gamma-ray Activation File (EGAF) applications and plans to develop a roadmap for this were discussed. Also emphasized was the need for new measurements of the total radiative thermal neutron capture cross section (σ 0).

More information including detailed agenda and presentations can be found at meeting webpage

https://nds.iaea.org/index-meeting-

crp/CM%20Thermal%20GAMMA%202023/.

Summary report of the meeting was published as INDC(NDS)-0891.

Consultants' Meeting on Planning of the CRP on Tungsten Ions in Magnetic Confinement Fusion Plasmas

29-30 August 2024, Vienna,

Austria Scientific Secretary: C. Hill 9 participants and IAEA staff



The preparatory Consultancy Meeting took place in person at the IAEA headquarters, with seven participants from six Member States in attendance. The meeting focused on the current status and unknowns regarding the collisionalradiative properties and processes of tungsten (W) impurities in fusion plasmas. Priorities for topics to be addressed by this Coordinated Research Project (CRP) were established. In addition, potentially interested and relevant participants were identified and recommended for further contact. More information can be found at https://amdis.iaea.org/meetings/tungsten-ions-cm/. Summary report of the meeting is available as INDC(NDS)-0916.

Selected Charts, Reports and Documents

INDC(BLR)-0023 Neutron Data Evaluation of ²⁴¹Am, prepared by V.M. Maslov, V.G. Pronyaev, N.A. Tetereva, K.I. Zolotarev, T. Granier, F.-J. Hambsch, January 2025.

INDC(JPN)-0211 Proceedings of the Joint Symposium on Nuclear Data and PHITS in 2023, 15-17 November 2023, Tokai-mura, Ibaraki, Japan, Edited by N. Shigyo, T. Furuta and Y. Iwamoto, November 2024.

INDC(NDS)-0893 The International Nuclear Data Evaluation Network (INDEN) on Actinide Evaluation in the Resonance Region (5), Summary Report of the Technical Meeting, 20-23 November 2023, prepared by D. Rochman, M. Pigni and R. Capote Noy, November 2024.

INDC(NDS)-0894 (alpha,n) Nuclear Data Evaluations and Data Needs, Summary Report of the Technical Meeting, 27 November -1 December 2023, prepared by A. Junghans, S.S. Westerdale and P. Dimitriou, September 2024.

INDC(NDS)-0898 The International Nuclear Data Evaluation Network (INDEN) on the Evaluated Data of Structural Materials (6), Summary Report of the Consultants' Meeting, 18-21 December 2023, prepared by M. Diakaki and G. Schnabel, November 2024.

INDC(NDS)-0901 Summary Report of the 25th Technical Meeting on International Network of Nuclear Structure and Decay Data (NSDD) Evaluators, 15-19 April 2024, prepared by J. Chen, A. Negret and P. Dimitriou, December 2024.

INDC(NDS)-0904 Impact of Photonuclear Reactions on Neutron Dosimetry in 252 Cf(s.f.) and 235 U(n_{th},f) Neutron-Gamma Mixed Radiation Fields, prepared by S. Simakov, October 2024.

INDC(NDS)-0906 IFRC Subcommittee on Atomic and Molecular Data for Fusion: Report on the Activities of the Atomic and Molecular Data Unit, June 2022 - May 2024, 24th Meeting of the International Fusion Research Council Subcommittee on Atomic and Molecular Data for Fusion, Summary report of the Technical Meeting, 6-7 June 2024, prepared by C. Hill and K. Heinola, November 2024.

INDC(NDS)-0911 Summary report of the Workshop on Compilation of Experimental Nuclear Reaction Data, 3-6 December 2024, prepared by N. Otuka and V. Devi, January 2025.

INDC(NDS)-0914 Summary report of the Second Research Coordination Meeting on Atomic Data for Injected Impurities in Fusion Plasmas, 18-20 December 2024, prepared by C. Hill, December 2024.

INDC(NDS)-0916 Summary Report of a Consultancy Meeting in preparation of a Coordinated Research Project on Properties of Tungsten Ions in Fusion Plasmas, 29-30

August 2024, prepared by K. Heinola and C. Hill, January 2025.

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 booklet, 10th edition (2018).

In Memoriam

Rick Firestone



We are saddened by the news of Rick Firestone's passing on 9 September 2024.

Rick was a towering figure in the nuclear data community. His groundbreaking work on the 8th edition of the Table of Isotopes and his forward-thinking perspectives on neutron capture and scattering data were invaluable. He continually inspired the nuclear structure evaluation community to explore beyond traditional limits. Rick was also an exceptional mentor, celebrated for his boundless curiosity and sense of humour. He will be deeply missed.

Nuclear Data Services – Contact Points

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: <u>http://www.oecd-nea.org/databank/</u> Contact: M. Fleming, Tel.: +33 1 73 21 28 22, Email: <u>michael.fleming@oecd-nea.org</u>;.

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: <u>http://cdfe.sinp.msu.ru/</u> Contact: V.V. Varlamov, Email: <u>varlamov@depni.sinp.msu.ru;</u>.

For services to customers in China: China Nuclear Data Center, China Institute of Atomic Energy, P.O. Box 275(41), Beijing 102413, China. Tel. +86 10-6935-7275; Fax +86 10-6935-8119 Contact: Ge Zhigang, Email: <u>gezg@ciae.ac.cn</u>;

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

<u>Computer codes of non-US origin to all countries</u> (there may be release restrictions): NEA Data Bank (see above) Email: <u>programs@oecd-nea.org</u>, Tel.: +33 1 73 21 28 30

> IAEA-NDS on-line services at Website <u>https://nds.iaea.org/</u> 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).

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