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Nuclear Data Newsletter

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Contents

Greetings from Vienna, and a belated healthy and happy 2023 to you all!
The IAEA is going through more turbulent times than usual, with a financial budget that is tight due to inflation among others, and the expectation is that 2023 will be as tight as the past year.
One of the consequences for the Nuclear Data Section is that a few of our meetings for the coming year will be held entirely virtual. At the same time, fortunately, we observe that more participants are now willing and able to travel to Vienna, as in the pre-COVID days. Currently, we see that the in-person attendance of a typical meeting has returned to 60-70% of what it was before, while the number of online participants has increased. Various meeting photos in this Newsletter support this statement.

As usual, here a very short summary of the second half year of 2022, more details are found in this Newsletter. A workshop on EXFOR compilation was held. A significant part of the Workshop consisted of hands-on exercises on a new extension of EXFOR relational database, X4Pro developed by V. Zerkin, and retrieval tools based on low-level access to the EXFOR data by using SQL from Python, Fortran, etc. A detailed outline of this was given in the previous Newsletter, while the official release will soon be advertised.

At the 2nd RCM on fission yield data evaluation there was quite some emphasis on new computational methods to predict fission product yields and fission neutron observables from Hauser-Feshbach calculations. The aim of the CRP is to come to update high-quality evaluations for the most important actinides, and several excellent presentations to reach that goal were given.
The Nuclear Structure and Decay Data Network held its meeting in Canberra, which I mention here specifically to show that occasionally a meeting can be held outside Vienna, especially for the networks. Another large network, INDEN, held a general meeting in August to discuss the most pressing items in nuclear reaction data evaluation for the coming years.
Other meetings include an RCM of the Atomic + Molecular Unit and the usual technical meetings on Neutron Standards and nuclear data processing.

There are some new features in the Decay Data Portal as shown on the next page. Also, we advertise our GitHub page there, containing several software packages that are open source and ready for distribution.

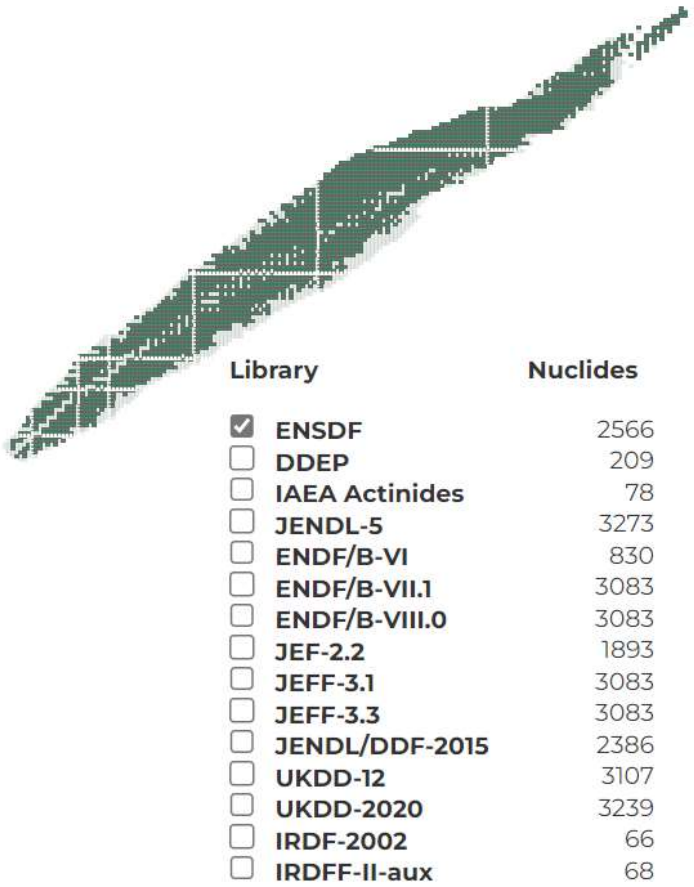
Finally, the official announcement is not there yet, but you may already keep in mind that from 16-20 October there the Joint ICTP-IAEA Workshop on Simulation of Nuclear Reaction Data with the TALYS Code will be held. This means among others that I must start preparing material for that!

All the best for the coming year.

Computer Codes, Data Libraries and Web News

Decay Data Portal

The ENDF Web application (https://nds.iaea.org/endf) has already introduced a page to compare, given a nuclide, the data available in all the decay data libraries. This page was also accessible in the decay radiation tab of the Livechart (https://nds.iaea.org/livechart).
To provide an overall view of which set of nuclides are included in each library, we developed a web application having a chart of nuclides that displays the information.



Selecting more than one library will show the nuclides they have in common. By clicking on one of the highlighted in green, the detailed comparison page can be accessed.
The decay data portal is available at https://nds.iaea.org/relnsd/vcharthtml/decay_libs.html

GitHub

The Nuclear Data Section is actively maintaining and contributing to the IAEA-NDS organization page on GitHub - https://github.com/IAEA-NDS.
This GitHub page includes open-source software programs, datasets, and tools that can be used to support the development of nuclear technology and applications. This page complements the NDS website, as an additional dissemination channel and collaboration platform. Currently, the IAEA-NDS GitHub page contains 23 public repositories, including EXFOR and ENDF parsers, docker and jupyter notebook-based tools to interact with the NDS data, and a selection of datasets. GitHub provides an effective way to collaborate and keep track of our code-related projects, thus, we expect the content of this page to grow over time. The IAEA-NDS GitHub page is a valuable resource for anyone interested in the source code and the progress of our open-source projects. If you are interested in collaborating to some of our projects that are not yet on GitHub, please get in touch with us and we will assess if the project development can be moved to GitHub.
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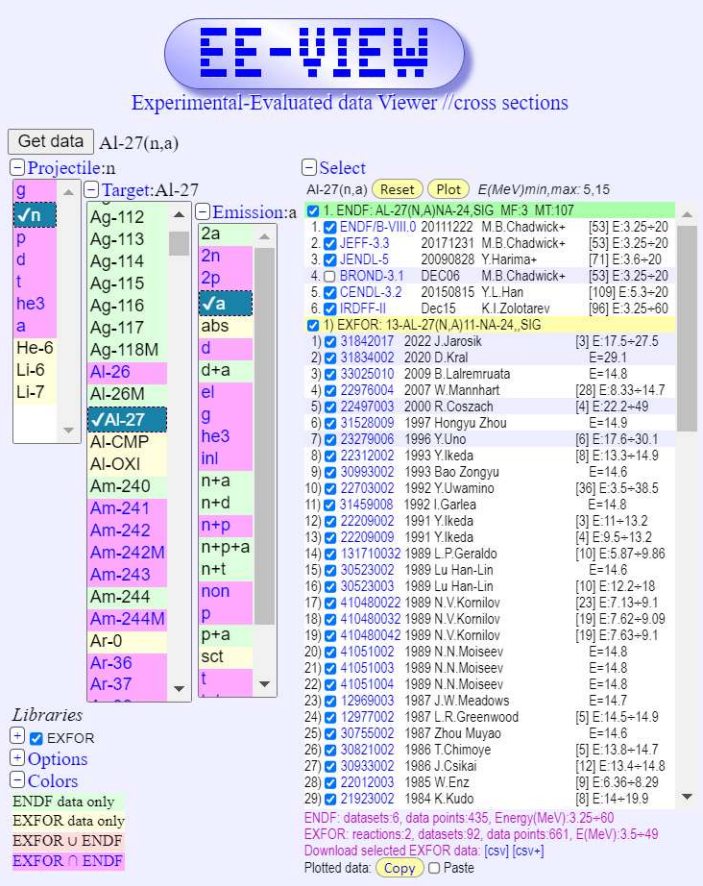
EE-View: Experimental-Evaluated data Viewer

EE-View presents an additional Web interface to existing EXFOR-ENDF Web system: experimental-evaluated data previewer. The main purpose is to quickly find and plot nuclear reactions data.

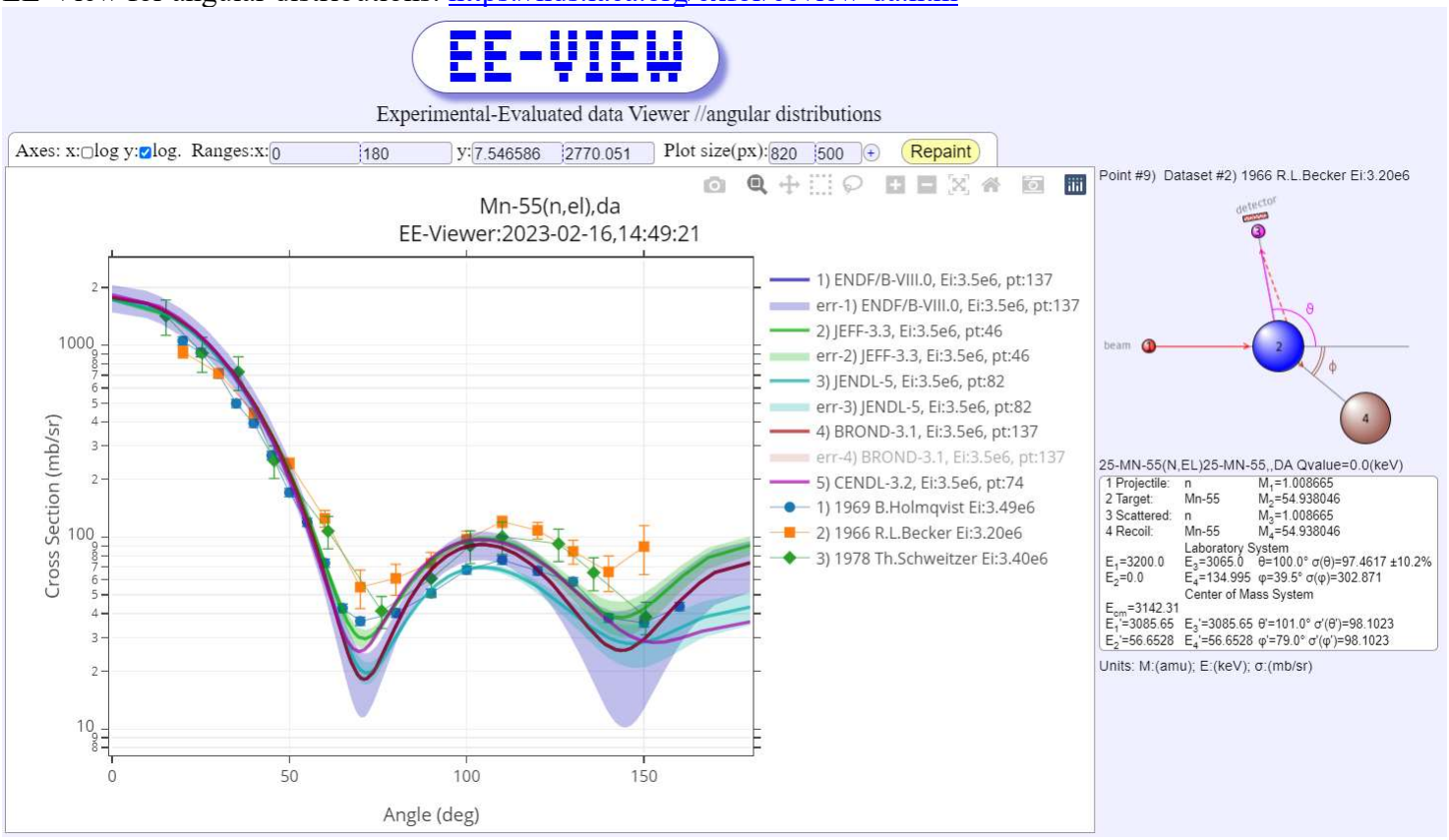
EE-View retrieves data from EXFOR/X4Pro and ENDF databases via Web-API and provides following functionality:

- quick plot of experimental and evaluated data with one click in a few seconds
- plot evaluated curves with error-band (MF33/MF34)
- colored items in data selection menu indicate existing experimental or/and evaluated data
- selection datasets by reaction-codes and energy range
- copy/paste data to the plot
- export data to CSV format for uploading to Excel
- output plot to PNG and SVG using package Plotly.js
- implemented for cross sections and angular distributions.

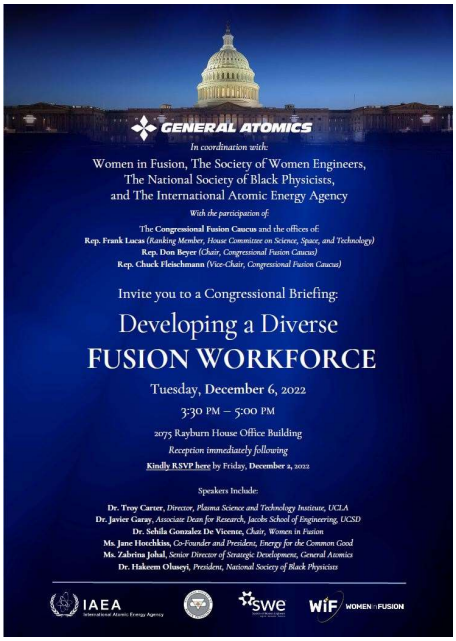
EE-View for cross sections:
https://nds.iaea.org/exfor/eeview.htm
https://nds.iaea.org/exfor/eeview1.htm



EE-View for angular distributions: https://nds.iaea.org/exfor/eeview-da.htm



Briefing on Fusion Workforce, 6 December 2022



The global nuclear fusion energy research has gained great attention in the recent few years through its significant achievements in terms of record-breaking controlled fusion energy production and long-pulse duration. An additional boost is gained from the private fusion enterprises as the investments in the private sector has increased by factor >10 in the last two years and in 2022 it was reaching 4.7 billion USD in US only. Consequently, the question of attracting and retaining new fusion workforce needs to be answered. For this, the IAEA through Nuclear Data Section was co-organizing a congressional briefing at US Congress on Capitol Hill, Washington DC, entitled “Developing a Diverse Fusion Workforce”. Briefing comprised of a panel discussion with members representing Women in Fusion, General Atomics, UCLA, UCSD, Energy for the Common Good and National Society of Black Physicists. The event included a statement given in-person by US Congressman Frank Lucas (Chairman of House Science, Space and Technology Committee). IAEA was represented by Kalle Heinola (AMD Unit-NDS).

Inauguration of Women in Fusion, 13 February 2023

(Photo credits: Dean Calma / IAEA)

The IAEA gender balance group Women in Nuclear IAEA (WiN IAEA) organized an inauguration event for Women in Fusion (WiF) at IAEA HQ. The event was co-organized by AMD Unit-NDS. The discussion panel comprised of IAEA DG Rafael Grossi, ITER Head of Communications Laban Coblentz, Ambassador of Spain HE Esther Monterrubio Villar, Ambassador of United Kingdom HE Corinne Kitsell, Ambassador of Finland HE Pirkko Hämäläinen, Director of LLNL (USA) Kim Budil, Chair of WiF Sehila Gonzalez De Vicent (Physics Section IAEA), Scientific Secretary of WiF Kalle Heinola (AMD Unit-NDS IAEA). The event was attended by 150 persons both offline and online. Kalle Heinola gave a presentation on nuclear fusion and on the need of increasing and retaining diverse and inclusive workforce in fusion. NDS SH Arjan Koning’s contributions for enabling various WiF activities were greatly acknowledged by WiN IAEA.

NDS Meeting Reports

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

Second Research Coordination Meeting on Updating Fission Yield Data for Applications

19-23 December 2022, Vienna, Austria
Scientific Secretary: R. Capote
27 participants and IAEA staff

In-person participants of the RCM

Total of 27 participants came together in-person and virtually to review the status of ongoing activities of the coordinated research project (CRP) and the execution of previously agreed tasks to ensure the timely delivery of outputs and achievement of objectives of the CRP. Recent experimental fission yields results were presented, and new evaluations of actinides at the thermal and higher incident neutron energies were discussed. The summary of the discussions, and further actions will be available in the meeting summary report which will be published as INDC(NDS)-0872.

Workshop on Compilation of Experimental Nuclear Reaction Data

13-16 December 2022, Vienna, Austria
Scientific Secretary: N. Otsuka
23 participants and IAEA staff

The purpose of this workshop was to learn news on the EXFOR compilation and dissemination tool developments as well as to discuss the EXFOR related nuclear data activities carried out by EXFOR compilers. A series of lectures on a newly developed portable extended EXFOR relational database (X4Pro/SQLite) were delivered including examples of programming in SQL, Fortran and Python, automatic renormalizations and user's data corrections, comparison EXFOR and ENDF data using modern plotting, etc. The participants studied its usage by constructing and executing various queries using "DB Browser for SQLite" and X4Pro examples. The X4Pro database has been used in analysis of experimental isomeric ratios at NDS, and development of a tool processing X4Pro output for isomeric ratio analysis was reported. Recently JAEA has started compilation of neutron induced reaction data measured at the J-PARC facility or measured by JAEA members, and we learned overview of the neutron capture measurements performed at the J-PARC ANNRI beam line from the first EXFOR workshop participant from JAEA. Another presentation from Japan covers measurements of medical isotopes including ^{211}Rn (generator of ^{211}At) performed at a RIKEN cyclotron. Reconstruction of excitation function of differential cross section from Legendre coefficients in EXFOR was also discussed in the relation with creation of data inputs to the IBANDL database. The summary report will be available as INDC(NDS)-0873.

Participants of the Workshop – in-person and virtual

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

6-9 December 2022, Vienna, Austria
Scientific Secretary: G. Schnabel
17 participants and IAEA staff

The goal of the INDEN network, which is coordinated by the IAEA, is to improve evaluation techniques and to produce new evaluated nuclear data files through a collaborative effort of experts from multiple institutions across the globe. The network is managed by a series of meetings, which are topically divided into meeting series for light elements, structural materials and actinides. The fifth consultants' meeting on structural materials under the umbrella of INDEN took place in hybrid format. Ten presentations were given that covered new evaluations, validation, theoretical model developments, developments in evaluation methods and the automation of the validation process. 15 participants from 10 member states and 2 international organizations took part at the meeting. The presentations will be made available on the IAEA-NDS meeting website and the meeting summary will be available as INDC(NDS)-0871.

Technical Meeting on Nuclear Data Processing

29 November -1 December 2022, Vienna, Austria
Scientific Secretary: R. Capote
34 participants and IAEA staff

The main aim of this meeting was to review the results of the processed library inter-comparison exercise as a follow-up to the previous meeting.
Participants presented the nuclear data managing, processing and validation at their individual centres. The main discussion topics were about the currently available processing codes, final analysis of the exercise on processing the thermal scattering law, as well as the results of the intercomparison on Doppler broadened cross sections. Furthermore, features needed for MC codes:
-anisotropic fission, dosimetry/production cross - sections MT numbers from MT5, mixed thermal scattering laws
-photo-atomic data with extended low-energy cut-off (< 1 keV) and photonuclear data with anisotropic energy-angle distributions were also discussed.
The meeting summary report will be published as INDC(NDS)-0870.

Consultants' Meeting on the Evaluation and Recommendation of Photon Strength Function Data

28 November – 1 December 2022, Vienna, Austria
Scientific Secretary: P. Dimitriou
10 participants and IAEA staff

Participants of the CM

The participants discussed existing and future evaluations of experimental photon strength function data for applied and basic research. Updates on the status of the Photon Strength Function (PSF) compilations, PSF methods, and model developments were presented, and the new PSF database interface was discussed. The CM participants used this opportunity to discuss possible new CRP on Nuclear Level Densities considering the goals, scope, work programme and potential participants. The detailed meeting report will be published as INDC(NDS)-0869.

Technical Meeting of the International Network of Nuclear Structure and Decay Data Evaluators

24-28 October 2022, Canberra, Australia
Scientific Secretary: P. Dimitriou
47 participants and IAEA staff

In-person participants of the TM

This meeting was held at the Physics Department of the Australia National University in Canberra. Representatives of the data centers and affiliated evaluators gathered in person and virtually to discuss the status of mass-chain evaluations, evaluation responsibilities, and analysis and checking code needs, as well as ENSDF formats and policies. Status reports of each centre reported on the current on-goings. New proposals were also presented (BetaShape code, Uncertainty Propagation, GABS, and Evaluation, tabulation and dissemination of nuclear data for applied use). Priority activities for the subsequent two years were agreed on.
Details about the meeting can be found at the meeting webpage https://conferences.iaea.org/event/323/.
The summary will be available as INDC(NDS)-0867.

Third Research Coordination Meeting on Atomic Data for Vapour Shielding in Fusion Devices

19-21 October 2022, Vienna, Austria
Scientific Secretary: K. Heinola
14 participants and IAEA staff

In-person participants of the RCM

The third and final Research Coordination Meeting of Vapour Shielding CRP brought together in-person eight participants representing Member States USA, The Netherlands, Spain, Italy, Syria, Australia and India. Discussions reviewed the final achievements both in the fundamental calculations and experimental work done within the CRP. Data already provided to the repositories curated by Atomic and Molecular Data Unit were summarized and any outstanding data to be submitted were acknowledged. As an outcome of the final discussions, it was concluded to organize a code comparison activity through the Unit's GNAMPP network with an aim to cross-compare results for p – H and p – Li collisional processes at fusion-relevant conditions. In addition to an INDC final report of the CRP, a report published as a scientific publication was decided.

Technical Meeting on Neutron Standards

18-22 October 2022, Vienna, Austria
Scientific Secretary: G. Schnabel
32 participants and IAEA staff

New experimental data were reviewed, changes in evaluation methodology and uncertainty quantification discussed as well as differences between new evaluations and the IAEA standards released in 2017 investigated in order to support the preparation of the next release of the neutron data standards. These topics were addressed in 16 presentations alternated with round-table discussions. The meeting was held in hybrid format with 32 participants in total and seven participants being present in-person. Eight member states and one international organization were represented. The presentations are available online from the IAEA-NDS meeting website https://nds.iaea.org/index-meeting-crp/TM-NDS-2022-materials/.

Participants of the TM – in person and virtual

Technical Meeting of the International Nuclear Data Evaluation Network on Actinide Evaluation in the Resonance Region

10-14 October 2022, Vienna, Austria
Scientific Secretary: R. Capote
14 participants and IAEA staff

Participants of the TM – in-person and virtual

This Technical Meeting of the INDEN Network brought together 11 scientific experts representing seven Member States and two International Organizations. Participants presented and discussed the evaluated data for fissile actinides in the resonance region, coupling to neutron multiplicities, the integral references for TOF (n,g) measurements, benchmark performance of new actinide evaluations and the status of the fissile evaluations.
The presentations from the meeting are available from the meeting webpage: https://nds.iaea.org/index-meeting-crp/CM%20INDEN-ACT5/ and the summary report will be published as INDC(NDS)-0862.

Technical Meeting on the Compilation of Nuclear Data Experiments for Radiation Characterization

10-14 October 2022, Vienna, Austria
Scientific Secretary: J.-Ch. Sublet
24 participants and IAEA staff

The purpose of this technical meeting is to transfer into technology the experimental integral radiation information to be used as part of the validation and verification processes of nuclear model and simulation code systems, to provide various schemas to perform validation and verification, and to deploy the numerical data streams to users though the open application programming interface.
To the delight and benefit of the participants ample time was devoted to the lively and fruitful discussions after each talk.

This 22 in-person and 2 virtual meeting held in the prestigious and spacious IAEA Press Room. The details of the meeting are available from the meeting webpage https://conferences.iaea.org/event/302/ and the summary report will be available as INDC(NDS)-0863.

Participants of the TM

Joint ICTP-IAEA Workshop on Nuclear Structure and Decay Data: Experiment, Theory and Evaluation (smr3740)

3-14 October 2022, Vienna, Austria
Directors:
P. Dimitriou (IAEA) and E.A. McCutchan (BNL)
17 participants and IAEA staff

The workshop offered an introduction to evaluated nuclear structure and decay data, by providing an overview of experimental and theoretical nuclear techniques and basic hands-on training in the evaluation procedures employed to produce the Evaluated Nuclear Structure Data File (ENSDF). Main topics of the workshop were: nuclear experimental techniques, nuclear structure theory, XUNDL

compilation, ENSDF evaluation methodology, procedures and formats, Analysis and utility codes, Editors and Web tools and databases and online retrieval software.

Technical Meeting on Long-term International Collaboration to Improve Nuclear Data Evaluation

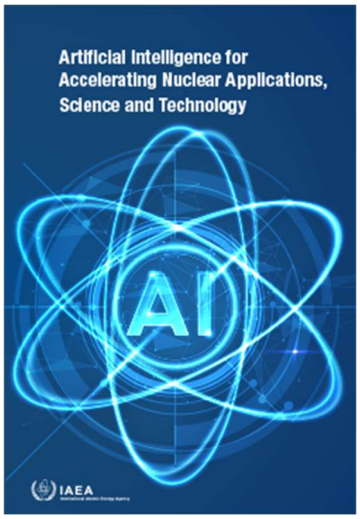
29-31 August 2022, Vienna, Austria
Scientific Secretary: R. Capote
30 participants and IAEA staff

Participants of the TM

This hybrid meeting was attended by 26 participants from 13 Member States and two international Organizations. The main aim of the meeting was to review the activities of the International Nuclear Data Evaluation Network and to discuss progress in evaluation methods and evaluated data.
The progress of the individual working groups of the INDEN network on light element evaluations and R-matrix, structural materials and resonance region evaluations of actinides was presented. In addition, nuclear data priorities, future directions and new integral experiments fin participating centers were also reported on. The technical discussion will be summarized in the meeting summary report and published as INDC(NDS)-0860.

Selected Charts, Reports and Documents

Artificial Intelligence for Accelerating Nuclear Applications, Science and Technology, Non-serial Publications, IAEA, Vienna (2022).



Artificial intelligence (AI) methods have had significant impacts in science and technology in recent years. These methods for generating models from datasets or logic-based algorithms that emulate aspects of human performance can similarly accelerate the fields of nuclear applications, science, and technology toward the IAEA goals of contributing to peace, health, and prosperity. This publication provides a review of the current state of the art, outlines challenges and identifies priorities for future AI activities in the nuclear field and the IAEA's role to support their accomplishment. The uses of AI in the fields of nuclear sciences and applications, nuclear power, nuclear safety and security and safeguards verification, are considered. There is also a dedicated chapter on ethics pertinent to AI in the nuclear field.

INDC(NDS)-0835 International Nuclear Data Evaluation Network (INDEN) on Actinide Evaluation in the Resonance Region (4), Summary Report of the Consultants' Meeting, 1-4 November 2021, Vienna, Austria, prepared by R. Capote Noy, et al., September 2022.

INDC(NDS)-0837 Neutron Data Standards, Summary Report of the Consultants' Meeting, 6-10 December 2021, prepared by G. Schnabel, D. Neudecker and V. Pronyaev, November 2022.

INDC(NDS)-0840 International Nuclear Data Evaluation Network (INDEN) on the Evaluated Data of Structural Materials, Summary Report of the Consultants' Meeting, 13-16 December 2021, prepared by G. Schnabel et al, November 2022.

INDC(NDS)-0850 ENSDF Evaluations, Policies and Procedures, codes and Dissemination Tools, Summary

Report of the Consultants' Meeting, 4-7 April 2022, virtual event, prepared by J. Chen, A. Negret, E. Ricard-McCutchan and P. Dimitriou, September 2022.

INDC(NDS)-0853 International Nuclear Data Evaluation Network (INDEN) on the Evaluation of Light Elements (4), Summary Report of the Consultants' Meeting, 20-23 June 2022, prepared by M. Pigni, R.J. deBoer and P. Dimitriou, February 2023.

INDC(NDS)-0859 Decay Data for Monitoring Applications, Summary Report of the Technical Meeting, 18-21 July 2022, prepared by J. Chen and P. Dimitriou, December 2022.

INDC(NDS)-0861 IFRC Subcommittee on Atomic and Molecular Data for Fusion: Report on the Activities of the Atomic and Molecular Data Unit, June 2021 - May 2022, prepared by C. Hill and K. Heinola, October 2022.

INDC(NDS)-0864 Observations on the Effects of ^{252}Cf Spontaneous-Fission Neutron Spectrum Uncertainties on Uncertainties in Calculated Spectrum-Average Cross Sections for Reactions in the Neutron Dosimetry Library IRDFF-II, prepared by D.L. Smith, November 2022.

INDC(NDS)-0868 Comparison of Photon Strength Functions from the OSLO Method with Neutron Capture Systematics, prepared by J. Kopecky and F. Becvar, November 2022.

INDC(NDS)-0873 Compilation of Experimental Nuclear Reaction Data, Summary report of the Workshop, prepared by N. Otuka and B. Pritychenko, February 2023.

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

Chart of the Nuclides 2014 JAEA Nuclear Data Centre.

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

Interns, Consultants

Alberto Rodrigo Sáenz de Santa María is one of the interns we had at NDS this year. Here is what he said about his internship:

"I am an Industrial engineer specialized in energy techniques who came for a 3-month internship to work on a tool that extracts isomeric ratios from EXFOR and other parameters such as the isomeric transition probability or the deviation factor from various libraries. In this internship I have met outstanding people from whom I have learned something new every day and have contributed to an exceptional environment which has motivated me to improve myself. Three months taught me more than I would have ever imagined thanks to my supervisor, Naohiko Otsuka who guided me through the internship. In this experience I have enhanced not only my engineering skills but also my social and communication skills after taking examples of how people behave in an international organization. "

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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://nds.org.in (India); http://nds.ciae.ac.cn/ (China); http://nds.atomstandard.ru/ (Russia).

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