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INDC International Nuclear Data Committee

Summary Report on

Technical Meeting of the

International Network of Nuclear Reaction Data Centres

IPPE, Obninsk
and
Moscow State University, Moscow
Russian Federation

22 – 25 September 2008

Prepared by

Svetlana Dunaeva, Alan L.Nichols
IAEA Nuclear Data Section, Vienna, Austria

and

Hans Henriksson
OECD Nuclear Data Bank, Issy-les-Moulineaux, France

December 2008

IAEA Nuclear Data Section, Wagramer Strasse 5, A-1400 Vienna, Austria

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Abstract

An IAEA Technical Meeting of the International Network of Nuclear Reaction Data Centres was held at the Institute for Power and Physics Engineering, Obninsk, Russia, from 22 to 24 September 2008, and Moscow State University on 25 September 2008. The meeting was attended by 24 participants from 12 cooperating data centres. A summary of the meeting is given in this report, along with the conclusions, actions, and status report of the participating data centres.

December 2008

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THE INTERNATIONAL NETWORK OF NUCLEAR REACTION DATA CENTRES

National, regional and specialized nuclear reaction data centres, coordinated by the International Atomic Energy Agency, cooperate in the compilation, exchange and dissemination of nuclear reaction data in order to meet the requirements of nuclear data users in all countries. At present, the following data centres participate in the network:

NNDC	US National Nuclear Data Center, Brookhaven, USA
NEA-DB	OECD/NEA Nuclear Data Bank, Issy-les-Moulineaux, France
NDS	IAEA Nuclear Data Section
CJD	Centr Jadernykh Dannykh (= Nuclear Data Centre), Obninsk, Russia
CAJAD	Russian Nuclear Structure and Reaction Data Centre, Moscow, Russia
CDFE	Centr Dannykh Fotojadernykh Eksperimentov (= Centre for Photonuclear Experiments Data), Moscow, Russia
CNDC	China Nuclear Data Center, Beijing, China
JAEA	Nuclear Data Center of the Japan Atomic Energy Agency (formerly Japan Atomic Energy Research Institute, JAERI), Tokai-Mura, Japan
JCPRG	Japan Charged-Particle Nuclear Reaction Data Group, Hokkaido University, Sapporo, Japan
ATOMKI	ATOMKI Charged-Particle Nuclear Reaction Data Group, Debrecen, Hungary
UKRNDC	Ukrainian Nuclear Data Center, Institute for Nuclear Research, Kyiv, Ukraine
CNPD	Center of Nuclear Physics Data, Russian Federal Nuclear Center, RFNC-VNIIEF, Sarov, Russia
KAERI/NDEL	Nuclear Data Evaluation Laboratory, Korea Atomic Energy Research Institute, Yusong, Taejon, Republic of Korea

A detailed description of the objectives of the network and the contributions of each Centre to these activities are given in INDC(NDS)-401 (Rev.4), "The Nuclear Reaction Data Centres Network".

PREVIOUS NRDC MEETINGS

Obninsk+Moscow 22-25 Sept. 2008	Centre Heads + Tech.	INDC(NDS)-0536
Vienna, 8-10 October 2007	Technical	INDC(NDS)-0519
Vienna, 25-28 September 2006	Centre Heads + Tech.	INDC(NDS)-0503
Vienna, 12-14 October 2005	Technical	INDC(NDS)-0480
Brookhaven, 4-7 October 2004	Centre Heads + Tech.	INDC(NDS)-464
Vienna, 17-19 June 2003	Technical	INDC(NDS)-446
Paris, 27-30 May 2002	Centre Heads + Tech.	INDC(NDS)-434
Vienna, 28-30 May 2001	Technical	INDC(NDS)-427
Obninsk, 15-19 May 2000	Centre Heads + Tech.	INDC(NDS)-418
Vienna, 18-20 May 1999	Technical	INDC(NDS)-407
Vienna, 11-15 May 1998	Centre Heads + Tech.	INDC(NDS)-383
Vienna, 26-28 May 1997	Technical	INDC(NDS)-374
Brookhaven, 3-7 June 1996	Center Heads + Tech.	INDC(NDS)-360
Vienna, 2-4 May 1995	Technical	INDC(NDS)-343
Paris, 25-27 April 1994	Center Heads + Tech.	INDC(NDS)-308
Vienna, 1-3 Sept 1992	Technical	INDC(NDS)-279
Obninsk, 7-11 Oct 1991	Center Heads + Tech.	INDC(NDS)-0262
Vienna, 13-15 Nov 1990	Technical	Memo CP-D/210
Vienna, 2-4 Oct 1989	Centre Heads + Tech.	Memo CP-D/200
Vienna, 4-6 Oct 1988	Technical	Memo CP-D/190
Brookhaven, 27-29 Oct 1987	Center Heads + Tech.	INDC(NDS)-204
Vienna, 7-9 Oct 1986	Technical	Memo CP-D/159
Saclay, 9-11 Oct 1985	Center Heads + Tech. = 8th NRDC Meeting	INDC(NDS)-178
Vienna, 19-21 Sept 1984	Technical	Memo CP-D/131
Obninsk+ Moscow, 17-21 Oct 1983	7th NRDC Meeting	INDC(NDS)-154
Vienna, 3-7 May 1982	6th NRDC Meeting	INDC(NDS)-141
Brookhaven, 29.9 - 2.10.1980	5th NRDC Meeting	INDC(NDS)-125
Karlsruhe, 8-13 Oct 1979	4th NRDC Meeting	INDC(NDS)-110
Paris, 19-23 June 1978	3rd NRDC Meeting	INDC(NDS)-99
Kiev, 11-16 April 1977	2nd NRDC Meeting = 3rd CPND + 13th 4-C	INDC(NDS)-90
Vienna, 28-30 April 1976	2nd CPND Meeting	INDC(NDS)-77
Vienna, 26-27 April 1976	12th 4C-Meeting	INDC(NDS)-78
Vienna, 8-12 Sept 1975	CPND Meeting	INDC(NDS)-69+71
Brookhaven, 10-14 March 1975	11th 4C-Meeting	INDC(NDS)-68
Paris, 6-10 May 1974	10th 4C Meeting	INDC(NDS)-58
Vienna, 24-26 April 1974	CPND + PhotoND	INDC(NDS)-59+61
Moscow/Obninsk, 4-8 June 1973	9th 4C Meeting	INDC(NDS)-54
Vienna, 16-20 Oct 1972	8th 4C Meeting	INDC(NDS)-51
Brookhaven, 25-29 Oct 1971	7th 4C Meeting	INDC(NDS)-41
Paris, 5-9 Oct 1970	6th 4C Meeting	INDC(NDS)-28
Moscow, 17-21 Nov 1969	5th 4C Meeting	INDC(NDS)-16

LIST OF ACRONYMS

ATOMKI	Nuclear Research Institute, Debrecen, Hungary
BibTeX	Program for formatting reference lists for LaTeX
BNL	Brookhaven National Laboratory, Upton, New York, USA
BROND-2	Russian evaluated neutron reaction data library, version 2
C4	Computational format for EXFOR data
CAJAD	Center for Nuclear Structure and Reaction Data, Kurchatov Institute, Moscow, Russia
CDFE	Centr Dannykh Fotojad. Eksp., Moscow State University, Russia
CENDL-2	Chinese evaluated neutron reaction data library, version 2
CHEX	EXFOR check program (originating from NNDC)
CINDA	A specialized bibliography and data index on nuclear cross section data operated by the NRDC
CJD	Russian Nuclear Data Center at FEI, Obninsk, Russia
CNDC	China Nuclear Data Center, Beijing, China
CNPD	Center of Nuclear Physics Data at RFNC-VNIIEF, Sarov, Russia
CP...	Numbering code for memos exchanged within the NRDC
CPND	Charged-particle nuclear reaction data
CRP	Coordinated Research Project (of the IAEA Nuclear Data Section)
CSEWG	US Cross Section Evaluation Working Group
CSISRS	Cross Section Information Storage and Retrieval System, the EXFOR-compatible internal system of NNDC
DOI	Digital Object Identifier, e.g. for bibliographic references
EFF	European evaluated nuclear data file for fusion applications
EMPIRE	A code system for nuclear reaction model calculations
ENDF-6	International format for evaluated data exchange, version 6
ENDF/B-VII	US Evaluated Nuclear Data File/B, version 7
ENDVER	ENDF File Verification support package
ENSDF	Evaluated Nuclear Structure Data File
EVA	Retrieval interface for evaluated data used at NEA-DB
EXFOR	Format for the international exchange of nuclear reaction data
FEI	Fiziko-Energeticheskij Institut, Obninsk, Russia
FENDL	Evaluated nuclear data file for fusion applications, developed by IAEA-NDS – Fusion Evaluated Nuclear Data Library

GSYS	Data digitizing system by JCPRG
IAEA	International Atomic Energy Agency
IBANDL	Ion Beam Analysis Nuclear Data Library maintained at IAEA
INDC	International Nuclear Data Committee
IPPE	Institute of Physics and Power Engineering, Obninsk, Russia
IRDF	International Reactor Dosimetry File, maintained by the IAEA-NDS
JAEA	Japan Atomic Energy Agency (from 1 October 2005)
JAERI	Japan Atomic Energy Research Institute (until 30 September 2005)
JANIS	Java Nuclear Information System of NEA-DB
JCPRG	Japan Charged-Particle Nuclear Reaction Data Group, Sapporo, Japan
JEF	Joint Evaluated File of neutron data, a collaboration of European NEA member countries and Japan
JEFF	Joint Evaluated Fission and Fusion Project coordinated by NEA-DB
JENDL-3	Japanese Evaluated Nuclear Data Library, version 3
KAERI/NDEL	Korea Atomic Energy Research Institute, Nuclear Data Evaluation Laboratory
KINR	Kiev Institute of Nuclear Research
LEXFOR	Part of the EXFOR manual containing physics information for compilers
MIRD	Medical Internal Radiation Dose, a database derived from ENSDF
NDS	IAEA Nuclear Data Section, Vienna, Austria
NDS	Nuclear Data Sheets
NEA	Nuclear Energy Agency of the OECD, Issy-les-Moulineaux, France
NEA-DB	NEA Data Bank, Issy-les-Moulineaux, France
NEANDC	NEA Nuclear Data Committee
NND	Neutron Nuclear Data
NNDC	National Nuclear Data Center, Brookhaven National Laboratory, USA
NNDEN	Neutron Nuclear Data Evaluation Newsletter
NRDC	Nuclear Reaction Data Centres
NRDF	Japanese Nuclear Reaction Data File
NSDD	Nuclear Structure and Decay Data
NSC	Nuclear Science Committee of the NEA
NSR	Nuclear structure references, a bibliographic system
NuDat	Database of Nuclear Structure and Decay Data based on ENSDF
OECD	Organization for Economic Cooperation and Development, Paris, France

PGAA	IAEA database for Prompt Gamma Activation Analysis
PhND	Photonuclear data
RIKEN	Nuclear Data Group, RIKEN Institute of Physics and Chemistry Research, Wako-Shi, Saitama, Japan
RIPL	IAEA Reference Input Parameter Library for reaction calculations
RNAL	IAEA Reference Neutron Activation Library
R33	Format used by ion beam analysis community for storing experimental cross-sections
TRANS	Name of transmission tapes for data exchange in the EXFOR system
UKRNDC	Ukraine Nuclear Data Center at KINR, Kyiv, Ukraine
VNIIEF	Russian Federal Nuclear Center, Sarov, Russia
WPEC	Working Party on international nuclear data Evaluation Cooperation
WPEC-SG30	WPEC Subgroup 30 on “Improvement of accessibility and quality of the EXFOR database”
XTRACT	EXFOR indexing program
X4TOC4	Conversion program from EXFOR to computational format “C4”
ZCHEX	Current version of CHEX, updated and maintained by NDS
4C...	Numbering code of memos exchanged among the four Neutron Data Centres

AGENDA

Working time: 09.00 - 18.00
Breakfast: 07.30 - 08.30
Lunch: 13.00 - 14.00
Coffee break: 10.30 - 10.50
15.30 - 15.50
Dinner: 19.00 - 20.00

Monday, 22 September 2008

Plenary: 10:00 - 13.00

1.	**General**			
1.1	Welcome address – IPPE:	15 min		Fursov B.I
1.2	Opening, election of chairperson, adoption of the agenda, announcements	10 min		
1.3	Brief status reports – all centres (new tasks, priorities), staff changes 1.3.1 Manokhin V.N. Nuclear Data Activity – a brief historical review 1.3.2. Manturov G.N. Nuclear data application for advanced nuclear systems 1.3.3. Petrov E.E. Activity of shielding benchmark experiment centre. 1.3.4. Ignatyuk A.V. Compilation of fission product data files for the BROND-3 library	3 hours	Progress reports	

Plenary: 14:00

1.4	Review of General Actions from the 2007 Meeting (A1-A5)	20 min	WP2008-01	S.Dunaeva
2.	**EXFOR General** (also Actions A6-A19)		WP2008-01	S.Dunaeva
2.1	Quality Control - errors			
2.1.1	Review of corrections since the 2007 NRDC meeting	10 min	WP2008-02	N.Otsuka
2.1.2	EXFOR entries corrections: important points	15 min	WP2008-31	M.Mikhaylyukova, V.Pronyaev
2.1.3	EXFOR DB errors report	10 min	WP2008-10	V.Zerkin
2.1.4	JANIS IMPORT LOG by NEA-DB (list of errors found in EXFOR loading to DB)	15 min	WP2008-18	N.Soppera
2.2	Compilation and Transmission Statistics	10 min	WP2008-04	S.Dunaeva
2.2.1	Statistics of checking Preliminary	10 min	WP2008-05	S.Dunaeva

	Transes			
2.2.2	Retrospective statistics of publication compilation (Action A6)	10 min	WP2008-15	S.Dunaeva
2.2.3	Revised list of missing EXFOR data of experimental works compiled in the CRP for “Cross-section data for the production of therapeutic radioisotopes” (actions A11,12)	10 min	WP2008-14	S.Dunaeva
2.2.4	EXFOR completeness for neutron data published in Phys. Rev. C	10 min	WP2008-13	N.Otsuka, A.Mengoni, V.Zerkin
2.2.5	List of Entries with incorrect reference on Phys. Rev. B	10 min	WP2008-17	S.Dunaeva
2.3	Revision of Actions A7-A9, A13-A19			
2.3.1	Public version of the "current compilation" webpage (Action A9)	10 min	WP 2008-26	V.Zerkin, S.Dunaeva
2.3.2	References in EXFOR and connection to other databases (Actions A14, A15, A31)	10 min	WP 2008-20	V.Zerkin
3.	**Manuals**	10 min	WP2008-08	N.Otsuka

Tuesday, 23 September 2008

Plenary: 09:00

4. **General Session**:
Status, problems, decisions

4.1	Full EXFOR in C4 format: delivery to WPEC Subgroup 30 What do we learn from the list of EXFOR outliers	20 min	WP2008-37 WP2008-03	N.Otsuka, V.Zerkin
4.2	EXFOR Evaluating System: reasons, ideas and proposals to WPEC SG-30	10 min	WP2008-30	V.Zerkin
4.3	Draft revision of NRDC Protocol (Memo CP-D/523)	30 min	WP2008-32	NDS
4.4	Proposal for a Common NRDC EXFOR Web Service	15 min	WP2008-38	V.Zerkin
4.5	Status of new compilation and procedure for creation CINDA reference	15 min	WP2008-12	S.Dunaeva, N.Otsuka, V.Zerkin
4.6	Future of compilation of neutron-induced reactions, charged-particle induced reactions (scope, progress in future)	20 min	WP2008-34	S.Dunaeva, N.Otsuka
4.6	Photonuclear reactions (scope, progress in future)	10 min		V.Varlamov
4.8	Web retrieval tool supporting citation of EXFOR data	10 min	WP2008-28	V.Zerkin

4.9	New IAEA-NDS front page	10 min	WP2008-29	V.Zerkin
4.10	New NRDC Webpage	10 min	WP2008-16	V.Zerkin, N.Otsuka
4.11	Other business			

Plenary: 14:00

5	**Common EXFOR/CINDA Dictionary System** (also Action A16)	10 min	WP2008-01	
5.1	Formats and exchange mechanisms *(only for dictionaries)*			
6	**CINDA** (also Actions A22-A23)	10 min	WP2008-01	
6.1	CINDA reader code updates and miscellaneous mistakes (CP-N/070)	10 min	WP2008-19	H.Henrikson
6.2	Procedure for creation of CINDA reference	10 min		
6.3	Split of Dictionary 144 (Data libraries for New CINDA) (CP-D/515).	10 min	WP2008-21	N.Otsuka, H.Henrikson
6.4	Coding mistakes in CINDA lines (Memo CP-E/136)	10 min	WP2008-33	H. Murakami, K. Kato
6.5	CINDA load errors and illegal format usage	10 min	WP2008-36	H.Henrikson
6.5	New CINDA manual	10 min		H.Henrikson
7	**EXFOR Software** (A40-A45)		WP2008-01	V.Zerkin
8	**EXFOR Technical** (also Actions A25-A39)	10 min	WP2008-01	
8.1	Reaction Product Field (SF4) for Quantities at Resonance (CP-D/509)	10 min	WP2008-27	N.Otsuka, S.Dunaeva
8.2	Tensor Polarization and Initial State Spin Correlation (Action A25, 2007)	10 min	WP2008-23	N.Otsuka,
8.3	Evaluated data library under MONIT-REF and REL-REF (CP-E/126)	10 min	WP2008-22	N.Otsuka, H.Henrikson
8.4	Total / elastic cross sections compiled in EXFOR CPND entries	10 min	WP2008-25	N.Otsuka, V.Pronyaev
8.5	4-momentum transfer squared (CP-E/125, action A29)	10 min	WP2008-24	N.Otsuka
8.6	Journal code JPR, JP/G and general format of page number (Memo CP-D/508)	10 min	WP2008-07	N.Otsuka

Wednesday, 24 September 2008

Plenary: 09:00

8.	**EXFOR technical** (continued)		WP2008-01	
8.7	Level density compilation Memo CP-D/512	10 min	WP2008-09	N.Otsuka, R. Capote Noy
8.8	Definition of uncertainties and their coding in EXFOR	10 min	WP2008-11	N.Otsuka, S.Dunaeva
8.9	Usage of alteration flag into column 11 of	10 min	WP2008-06	S.Dunaeva

	ENTRY and SUBENT records			
8.10	Institute code and Authors' list in EXFOR Entry	10 min	WP2008-35	S.Dunaeva, O.Schwerer, N.Otsuka

Other business

Plenary: 14:00

9 **EXFOR-Editor** S.Taova

10 **Other Programs**

11 **Closing Items**
11.1 Review of actions and conclusions
11.2 Date and place of next NRDC meeting

Thursday, 25 September 2008
(Moscow State University)

Plenary: 09:00

12. Welcome address from MSU
12.1 Final review of actions and conclusions

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MEETING REPORT

Introduction

An IAEA Technical Meeting on the Co-ordination of the International Network of Nuclear Reaction Data Centres was held in Obninsk and Moscow, Russia, from 22-25 September 2008. Twenty-four participants from twelve cooperating data centres in Hungary, Japan, Republic of Korea, the Russian Federation, Ukraine, USA, NEA and IAEA attended the meeting. S. Ganesan from BARC, India, attended the meeting as an observer.

Meetings of this network are held annually, with full meetings involving centre heads and technical staff, less frequently (last full meeting was held in September 2006 at IAEA Headquarters in Vienna). Main topics of the present meeting were the introduction of new staff at several data centres, updates to the EXFOR/CINDA dictionaries, intensified quality control in collaboration with the NEA WPEC Subgroup 30, as well as improved checking and correction procedures based on the feedback and taking into account the needs of data evaluators. The EXFOR Editor software was presented and was recommended for use in all compilations for EXFOR. Thirty-eight working papers were presented at the meeting. The results of the discussions were summarized by 26 Conclusions and 65 Actions (see pages 22-27).

Summary

A.L. Nichols, Head of the IAEA Nuclear Data Section, opened the meeting on behalf of the IAEA.
V.N. Manokhin introduced the nuclear physics studies within the IPPE, and G.N. Manturov discussed work on the RUSFOND library which will be released by the end of the year. E.E. Petrov presented the International Standards data and work on integral benchmarks. A.V. Ignatyuk described BROND-3 with examples from previous work within the Working Party of international nuclear data evaluation cooperation (WPEC) Subgroup 21 on 211 fission products, and Subgroup 23 on the production of a fission production library in ENDF-6 format.

The agenda was adopted without change. A.L. Nichols was elected chairman and progress reports from all twelve attending centres were presented, highlighting the overall as well as the staffing situation of the centres, their compilation activities, data services, other nuclear data activities of interest to the network, and relevant publications. A common issue is the turnover of staff at several data centres. For example, the NEA-DB will see many people leave during 2009. At NNDC the use of post-docs has shown a possible way forward in the flexible employment of staff for specific tasks on nuclear data. See also reports P1 – P12 for further details.

The actions of the previous meeting were reviewed. Those not yet fulfilled and others of continuing relevance were included in the new list of actions. Standing actions are those of importance for the general maintenance of EXFOR, and they are explicitly stated so that participants will be reminded at each NRDC meeting.

The general scope of the compilations and the distribution of responsibilities of the centres were reviewed and confirmed as agreed at the last meeting. Agreement was

reached, for a trial period of one year, to change the compilation scope so that the NNDC will be responsible for four journals published in the USA instead of the old rule to base compilation responsibilities on the geographical location at which the specific measurement was performed. These journals are Physical Review C (PR/C), Physical Review Letters (PRL), Canadian Journal of Physics (CJP), Nuclear Science and Engineering (NSE) and conference proceedings from the website of American Institute of Physics (AIP) http://www.aip.org/.

Feedback received by evaluators on real or apparent mistakes in the EXFOR database was discussed, noting that while in a minority of cases actual mistakes had been found, in many cases the problems were misunderstandings of the data definitions or in converting EXFOR to the C4 format and further conversions of the data in users' applications. A new database will be prepared that includes all suggested corrections for improvement of data, and this particular database will be used when generating the full C4 file for EXFOR users.

S. Dunaeva reported that the response of the EXFOR compilers to her weekly updates of the "EXFOR compilation status webpage" was very good. However, comments on preliminary EXFOR batches should be sent from all centres – as there are few members that provide feedback at present. A public web page with all publications for consideration for EXFOR will be made available, and the wording was discussed to make that page as user-friendly as possible.

At several points in the agenda the question of formats was discussed. A good EXFOR Editor would simplify the compilation work considerably. Therefore, all compilers were recommended to use the EXFOR Editor developed in Sarov, Russia. G. Pikulina presented the latest version with new enhancements, and the meeting acknowledged the excellent progress.

N. Otsuka reported on the situation with respect to manuals. All EXFOR/CINDA Manuals (including LEXFOR) have been updated since the last meeting, and they are all available on the new NRDC page at the NDS. The EXFOR Basics manual should be made available to all EXFOR users; the manual will be prepared in HTML format and placed on the EXFOR Web page at NDS.

The complete EXFOR file will be distributed every three months, together with all Dictionaries and the complete EXFOR database in C4 format.

H. Henriksson reported on the new CINDA master file agreed upon in June 2008. The exchange of new data to CINDA has been re-established and new compilations are being received, mainly on evaluated and theoretical data.

Several technical issues concerning EXFOR quantities, dictionary codes and compilation rules were discussed; all results are reflected in Conclusions C19-C25 and Actions A47-A61.

Questions on other EXFOR-related software were discussed, along with better information exchange about software being used and developed. Feedback on the CHEX checking program, the digitizing program GSYS and the EXFOR Editor were requested from all users. NDS will organize workshops dedicated to the EXFOR Editor in

connection with the next NRDC meeting and also in India during 2009.

Close cooperation between NRDC and NEA WPEC Subgroup 30 has been established, and the NRDC is analyzing and correcting several of the suspicious EXFOR data the SG30 group has highlighted.

The next NRDC meeting - which will be a technical meeting including an EXFOR Editor Workshop - will take place from 25 to 29 May 2009, in Vienna, Austria.

Conclusions and Actions
Conclusions

General

C1 Next year's technical meeting will be held in the second half of May 2009 in Vienna *(Note added after the meeting: Preliminary dates for the next meeting are 25-29 or 18-22 May 2009).*

C2 Next full NRDC meeting in May 2010 will be held in Sapporo, Japan, preferable, after ND2010.

C3 BARC, India, was approved a full member of the NRDC with effect from September 2008.

C4 Agreed and declared a common EXFOR Web Service that will provide access to the central EXFOR database located at the IAEA-NDS.

C5 Establish a standard Web address for the citation of EXFOR entries as proposed in WP2008-38 (with one correction (if possible) - instead of "?" use "+" or "#").

C6 All proposed changes in NRDC Protocol were accepted.

C7 EXFOR-Editor workshops will be organised for compilers in Vienna and India, 2009

C8 Fruitful interactions exist between NRDC and OECD-NEA WPEC Sub-Group 30 that are aiding in the resolution of misunderstandings and errors within EXFOR.

EXFOR, General

C9 The scope of compilation has been changed on trial basis for one year according to WP2008-34: NNDC will take responsibility for all relevant articles in agreed journals (and set aside their geographical area of responsibility).

C10 A new database will be prepared that encompasses correction factors and relevant comments for suspect/erroneous data.

C11 Re-emphasis was placed on the need for regular feedback on preliminary EXFOR batches be sent to the responsible centres and NDS (latter for checking and archiving).

C12 NDS has established a data-exchange connection with *Radiochimica Acta* which permits easier preparation of data compilation before final publication – this approach needs to be promulgated with other journals.

C13 A Guide for EXFOR compilers will be prepared.

C14 Proof copy of EXFOR entry for all compilations from new literature should be sent to the author, and author approval or "no reply from author" should be included under STATUS.

C15 Public version of "current compilation" webpage will be released after modifications based on NRDC comments.

C16 EXFOR backup-file and Dictionaries will be distributed every three months.

C17 EXFOR compilations will be prepared for which no data have yet been made available (e.g. beneficial in the preparation of CINDA).

Common EXFOR/CINDA dictionaries

C18 Split of Dictionary 144 (Data Libraries for New CINDA) was accepted.

EXFOR, technical

C19 Nuclear level densities will be included in EXFOR compilation.
C20 When available, DOI will be included in EXFOR files.
C21 Paper number can be coded for reports.
C22 Evaluation library code can be coded under MONIT-REF and REL-REF.
C23 Any characters permitted in the EXFOR Formats manual can be adopted in the page number field of the REFERENCE code to reflect the correct use in the citation.
C24 Certain larger collaborations and research groups can now be coded with an INSTITUTE code (e.g. 2ZZZNTF for the n_TOF collaboration at CERN).
C25 Certain larger collaborations and research groups can now be coded with an AUTHOR code (e.g. "ntof" abbreviation for majority of authors' names if used in journal article).

EXFOR software

C26 EXFOR Editor is viewed and recommended as a valuable tool for all EXFOR data compilation activities and is to be encouraged by all NRDC centres in their current compilation work. This software will also continue to be developed as planned.

Actions

General

A1	All	Standing Action – All recognized policy papers for consideration by the NRDC members need to be prepared and distributed four weeks before the annual NRDC meeting. This will ensure adequate thought and discussion prior to the meeting.
A2	All	Standing Action – Keep CP memo distribution up-to-date.
A3	All	Standing Action – In e-mails with attached CP memos, put the subject in the body of the e-mail so that recipients can decide whether it is relevant for them.
A4	All	Standing Action – Only one memo should be sent per e-mail.
A5	All	Standing Action – Send comments on all preliminary batches within one month of transmission.
A6	NDS	Organise EXFOR-Editor workshop for NRDC compilers to be held in Vienna, 2009.
A7	NDS, BARC	Organise EXFOR-Editor workshop for potential compilers: most likely venue, BARC, 2009.
A8	All	Contact details of BARC India should be included on NRDC MEMO - distribution list.

EXFOR, General

A9	All	Standing Action – All Centres should give highest priority to compiling new publications.
A10	NDS	Continuing Action – Continue to develop sensible means of data communication between laboratories and the network via the major journals.
A11	All	Cite EXFOR Entry in the following manner: first author, full reference, EXFOR DB version, Web-address.
A12	Zerkin	Consider replacement of question mark in citation of EXFOR Entry.
A13	All	Continuing Action – Give priority to compilation of remaining papers from the ND2007 Nice conference.
A14	All	Continuing Action) Make efforts to change all remaining upper case entries to lower and upper case. On retransmission, the old entries must be checked and any other necessary corrections must be done.
A15	Zerkin	Continuing Action - Develop EXFOR+ (interpreted/ extended EXFOR format).
A16	CJD	Prepare a short Guide for EXFOR compilers on the basis of WP2008-31.
A17	All	Send comments on the Guide for EXFOR compilers to CJD.
A18	Otsuka	Update Dictionaries every three months.
A19	Zerkin	Synchronize every three months EXFOR backup-file distribution with (a) full Dictionary distribution; (b) EXFOR in C4 format; (c) Dictionaries in MS Access.
A20	Dunaeva, Zerkin	Send list of found errors to NRDC after every new EXFOR/CINDA dictionary transmission.
A21	All	Correct errors within own area (see also list in WP2008-10); all mistakes from such lists should be corrected in the next transmission (although mistakes which remain from 2007 may take longer).
A22	All	If a title cannot be found for an entry, this entry should be entitled “No title”, and an explanation should be given as a comment.
A23	Zerkin	Include DOI in EXFOR as defined in option 2 of WP2008-20.
A24	All	If available, include DOI in all new entries.
A25	Zerkin	Introduce on public NRDC webpage the “current compilation” after changing the following labels: “reserved” to “allocated”; “prelim” to “being compiled”; “not reserved” to “not allocated”.
A26	Dunaeva	Send modified NRDC Protocol to centres.
A27	All	Provide feedback on modified NRDC Protocol before the end of 2008.
A28	Otsuka	Provide access to final version of modified NRDC Protocol by end of January 2009.
A29	NNDC	For a trial period of one year (2009), NNDC will be fully

		responsible only for the compilation of articles from four journals (PR/C, PRL, NSE, CJP) and AIP conference proceedings (see modified WP2008-34).
A30	NNDC, NDS	Prepare report for the next full NRDC meeting describing the advantages and disadvantages of compilation on the basis of full journal contents (see Action A29).
A31	Otsuka	Create EXFOR Basics manual in HTML.
A32	Zerkin	Add hyperlink on the main EXFOR page to the EXFOR Basics manual.
A33	All	Compile parameters (decay data – especially half-lives in activation measurements – and monitor data) and description of technique (method, analysis etc.) used by authors (see WP2008-03).
A34	All	Source of data should be clarified under `STATUS` ("Table x", "Fig. x", "sent from author" etc.).
A35	Otsuka	Send list of recognised errors, based on analysis of the list formulated by OECD-NEA WPEC Subgroup 30, to responsible centres.
A36	NDS	Coordinate compilations according to journal distribution defined in revised WP2008-34.

Common EXFOR/CINDA dictionaries

A37	NDS	Update Dictionary 144 (data libraries) according to WP2008-21.
A38	NNDC, NDS	Investigate Dictionary 25 for differences in labels and units (e.g.: MUB, MU-B and MICRO-B used for 'μb'), with the aim of achieving consistency.
A39	All	Correct all references according to the list given in WP2008-07.
A40	Otsuka, Hlavac	Assess and add to Dictionary 23 an appropriate description of the level density extraction methods.
A41	Otsuka	Add level densities (LD) to Dictionary 32 (SF6).
A42	All	Use adopted new institute code for n_TOF, and use "ntof" abbreviation for majority of authors' names if used in journal article.

CINDA

A43	Henriksson	Continuing Action – Search for experimental and mixed entries in which the target is coded by MNY, and replace with individual isotope/compound entries as outlined in WP2008-36.
A44	NEA-DB	Correct errors detected during CINDA loading procedure, as described in WP2008-36.
A45	JCPRG	Send NEA-DB the list of 638 entry errors in CINDA.
A46	NEA-DB	Correct all CINDA lines, as described in WP2008-33 (see Action A45).

EXFOR, technical

A47	Otsuka	Continuing Action – Review the various types of gamma spectra in EXFOR, and the related quantities and units.
A48	All	Standing Action – When coming across report codes in Dictionary 6 which differ significantly from what is shown on the cover, submit additional explanation to NDS for inclusion.
A49	All	Standing Action – Run CHEX in TRANS mode (not DATA mode) when checking new entries or TRANS files, to make sure that all important errors are found.
A50	All	Check error lists available on the NRDC web page, and correct as soon as possible (see also WP2008-02).
A51	Dunaeva	Continuing Action – Distribute list of duplications for action.
A52	NDS	Standing Action – Assess the need for undertaking both trivial and non-trivial compilation corrections, and inform responsible centres.
A53	All	Respond within two months concerning nature of correction (trivial or non-trivial) and whether correction(s) will be carried out by responsible centre - based on Action A52.
A54	Zerkin	Prepare a new database encompassing correction factors and relevant comments for suspect/erroneous data (X4-evaluated). Specify the format and issue an appropriate manual.
A55	All	Provide EXFOR compilations, according to option 1 in WP2008-12, even when there are no data ready for compilation.
A56	All	Send comments to NDS about the reaction code proposal on resonance quantities (WP2008-27) before the end of 2008.
A57	All	Compile level densities, as described in revised Memo CP-D/512 (WP2008-09).
A58	All	Standing Action – Follow rules on uncertainty coding as described in WP2008-11 for compilations.
A59	All	Standing Action – Use alteration flags in col. 11 of ENTRY and SUBENT lines in re-transmission (also optional for all corrected lines in col. 80).
A60	All	Correct total/elastic cross sections compiled in EXFOR CPND entries according to the list in WP2008-25.
A61	Dunaeva	Correct all references from the list of WP2008-17 in next transmission (Conclusion C12 of NRDC-2007).

EXFOR software

A62	All centres	Inform each other about EXFOR-related software being used and/or developed. NDS may add this information to the NRDC internal web page.
A63	All	Standing Action – Provide feedback on the digitizing GSYS software to JCPRG.

A64	All	Standing Action – Provide feedback to NDS on the existing CHEX version (on bugs as well as desired refinements)
A65	Sarov, NDS	Continue development and testing of the EXFOR-Editor in cooperation with NDS and other data centres, taking into account compilers' remarks.

(Extract from WP-2008-32)

Changes in PROTOCOL (all additions are in bold letters):

1. Front page – all previous editions deleted.

2. INTRODUCTION**:**

- **be responsible for the maintenance and development of the central EXFOR Web Service and EXFOR-master file central storage**

3. Data Compilation Responsibility

If a center has a need for a particular data set to be compiled immediately, the center should send a request to the responsible center, with a copy to NDS. If the responsible center cannot compile the data in the time needed to meet the requirements of the center making the request, the center making the request can compile the data after informing both the coordinating centre and the responsible centre. ~~as an area Z entry. The entry will then be sent to both the responsible center and NDS. If the responsible center does not intend to enter the data in a timely fashion, the NDS may then transmit the Z entry to all centers. The responsible center would then be responsible for deleting the Z entry if they replace it with an entry for their area.~~

All corrections to entries must start from the version of the common master file (rather than from local versions)

Recompilations or improvements of existing entries should result in an update of the old entry (rather than deletion of the old entry and creation of a new entry).

~~Each center~~ NDS shall keep an archival copy of the latest version of each of the EXFOR entries ~~which it originated~~ and shall be ready to provide the data to any center should the data be required.

Following sentences were moved from "Charged-Particle Reaction Data Compilation" to common section "Data Compilation Responsibility":

If two institutions from different service areas are involved, the primary institution defines the center responsible (see LEXFOR, Institutes, for definition of primary institution).

A center wishing to compile data (C1) will contact the center in whose area of responsibility the data were produced (C2), with copy to NDS, with a list of the data sets to be compiled. C2 will inform C1, as quickly as possible, with copy to NDS, whether the data either have been compiled or are in the process of being compiled by another center. If the data are not compiled or being compiled, C2 will either agree to compile them with

priority, or ask that C1 compile the data and to and include it in the next regular C1 transmission file.

1) The center wishing to compile data should notify NDS of the data sets that they intend to compile.
2) NDS will check that the data set has not been compiled, and is not being compiled by another center, and will let the originating center know if they may go ahead with the compilation. All centers are responsible for checking that the data sets transmitted by them do not duplicate existing data.

4. Neutron Reaction Data Compilation

~~Although each center may compile data measured outside its service area, regular transmission of EXFOR data from any one center shall include data only from its own service area~~.

5. Procedure for files received with errors

NDS can make trivial corrections directly on the common master file (along information of originating centre).

6. CINDA PROTOCOL – can be changed only after NRDC-meeting (decision concerning EXFOR-dummy)

7. CHANGES TO SCOPE, FORMAT AND CODING RULES OF CINDA OR EXFOR – only Dictionary numbers need corrections.

8. all Appendices were changed according to the WP2006-13 (Rev. “Review of Compilation Scope”.

(Reproduced from WP2008-34, Rev.)

Nuclear Data Section
International Atomic Energy Agency
P.O.Box 100, A-1400 Vienna, Austria

Memo CP-D/525 (Rev.)

Date: 8 October, 2008
To: Distribution
From: S. Dunaeva

Subject:

Change NRDC compilation responsibilities to dedicated journal coverage

Two years ago, NNDC proposed significant changes to EXFOR compilation responsibilities on a geographical basis through their replacement with full journal coverage by individual centres (see Memo CP-C/380, WP2006-6). However, this suggestion was set aside by the NRDC at their 2006 and 2007 meetings. The biennial INDC meeting of the International Nuclear Data Committee (INDC) in 2008 has requested the NRDC to re-consider this position, and urged that the original proposal be given a trial test period by the NRDC.

NDS staff proposed the following changes in compilation responsibilities for 2008-09, that will be primarily based on important existing journals (rather than geographical areas):

PR/C	NNDC
PRL	NNDC
NSE	NNDC
CJP	NNDC
AIP	conference series

If an article from USA authors is published in another journal, NDS will take responsibility to coordinate compilation.

We would like to remind you of the following points of note:

1. 2005 decision (WP2005-31)

“The references relevant to EXFOR have to be included in EXFOR within six months after publication. If there is no possibility to receive data from the author (if he keeps silence on e-mail) the compiler can digitize curves and point out under STATUS that there was no response from the author. Compiler has to mention the name of the author

and his e-mail address."

After this period of six months, NDS will take responsibility for the compilation of such papers (this means NDS staff will re-assign to another centre).

2. NRDC Protocol states

"…..… If a center has a need for a particular data set to be compiled immediately, the center should send a request to the responsible center, with a copy to NDS. If the responsible center cannot compile the data in the time needed to meet the requirements of the center making the request, the center making the request can compile the data after informing both the coordinating centre and the responsible centre. ……."

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Memo CP-C/380

DATE: September 21, 2006
TO: Distribution
FROM: D. Rochman, P. Oblozinsky
SUBJECT: Proposal to change the geographic compilation responsibility to full journal coverage

Proposal

We propose to replace the current geographic compilation responsibility of refereed journals and nuclear data conference proceedings by their full coverage as follows, starting on January 2007, for neutron, charged particle and photon –induced reactions:

- NNDC – all refereed journals published in US (Physical Review C, Nuclear Science and Engineering, Physical Review Letters, etc) irrespective of the geographic origin of the paper.
- NEA DB - all refereed journals published in EU (Nuclear Physics A, Nuclear Instruments & Methods, etc.)
- IPPE Obninsk – all refereed journals published in Russia (Yadernaya Fizika, etc.)
- NDS – all remaining refereed journals

Justification

The process of searching in the literature for relevant publications for the CSISRS database requires lot of efforts and time, mainly because of the geographic distribution of journal coverage. The proposed change, from the geographic journal coverage to editor-related journal coverage, would require less searching time and will speed up the compilation process.

Up to now, a compiler needs to screen all the nuclear physics literature in order to find relevant publication that she/he is allowed to compile following the "geographic distribution" rule. **(1)** It requires lot of searching time to go through about 20 main journals. The potential danger is that a compiler will focus on some major journals (like Physical Review, Nuclear Physics) and will neglect to carefully study other source of publications where relevant articles occasionally occur. **(2)** Another drawback is the repetition of work performed between centers. For instance, all compilers need to go through the APS journals to find articles that should be compiled. This implies that a compiler in the USA is looking at Elsevier journals, a compiler at the IAEA is also

looking at the same journals and a third compiler working for the NEA Data Bank is checking for the third time the same journals. **(3)** A hypothetical advantage of this process (that a compiler will contact another center to inform it about potential article of interest) is actually not working because of additional amount of work that it requires.
(4) A common argument in favor of the "geographic distribution" is that it is easier to compile a publication from an experimental work performed in the vicinity of the data center. This might be true at a time when communications were not as fast as today, when laboratories did not exchange information so that an experimental procedure was used at a single place, or when communications between countries were minimized for political reasons. None of these reasons do apply today. Because of he wide e-mail access, data can be sent from China to Europe in a minute; with extensive laboratory collaborations, common experimental methods are universally used; all published information is widely shared between countries.

Thus, we propose "publisher distribution" rule instead of the "geographic distribution" rule for article publication and conference proceedings. As an example, the NNDC would be responsible for APS journals and Canadian journals. The advantages will be:

- Faster literature search for the compilers
- No search repetition between centers
- No dependence on other centers to find relevant publications
- **Possible contact between compilation centers and publishers in order to perform less manual intervention in the compilation process**.

This last possibility will bring another dimension to the compilation process. With the current technology, it is possible to have a more automatic compilation process where a publisher could provide a compilation center with already formatted information directly from the published paper. By the "geographical distribution", the application of this idea becomes more complicated because it would involve a broader agreement between institutions, compilation centers and publishers.

In summary, we propose a modification of the geographic journal coverage to publisher journal coverage to speed up the compilation process, avoid redundant work and use modern technology to automatize compilation procedures.

PROGRESS REPORTS

MSU SINP CDFE 2007/2008 progress report

I.N.Boboshin, V.V.Varlamov, S.Yu.Komarov, N.N.Peskov,
M.E.Stepanov, R.I.Sultanov

Progress Report to
the IAEA Technical Meeting of the International Network of Nuclear Reaction Data Centers
22 – 25 September 2008, Obninsk, Russia.

The Report contains the short review of the works carried out by the Lomonosov Moscow State University Skobeltsyn Institute of Nuclear Physics Centre for Photonuclear Experiments Data (Centr Dannykh Fotoyadernykh Eksperimentov – CDFE) concern the IAEA Nuclear Reaction Data Centres Network activities for the period of time from the 2007 Technical Meeting of the Network of Nuclear Reaction Data Centres (8 – 10 October, IAEA NDS, Vienna, Austria) till the fall of 2008 and main results obtained.

EXFOR Compilations

Three new CDFE EXFOR **TRANSes M044, M045 and M046** have been produced and transmitted to the IAEA NDS. Two old data SUBENTs have been corrected in accordance with comments of Drs. Naohiko Otsuka and Svetlana Dunaeva and many new data were compiled. On the whole three CDFE TRANSes mentioned contain (**Annex 1**) 14 retransmitted and 37 new ENTRYs with 294 new data SUBENTs.
In accordance with Conclusions of previous NRDC Meetings many photonuclear reaction cross section data were included.

Photonuclear Data Evaluations

As an continuation of CDFE program of consistent analysis and evaluation of total and partial photonuclear reactions cross sections joint combined evaluation of total (γ,xn) and (γ,sn) and partial (γ,n), (γ,2n) and (γ,3n) photoneutron reactions cross sections was carried out for many tin isotopes ^{112,114,116,117,118,119,120,122,124}Sn. Those were based on the results of investigation of various photonuclear reactions in experiments used the bremsstrahlung and quasimonoenergetic annihilation photon beams. The reasons of data disagreements were analyzed; the values of renormalization factors for putting all data in consistency [1] to each other were obtained. The evaluated cross sections energy dependencies were obtained, integrated cross section values have been calculated.
Many previously evaluated photoneutron reaction cross sections together with photoproton reaction cross section data were used in join analysis of GDR isospin splitting for several sets of isotopes – ^{56,58,60,62}Ni, $^{40,42,44,46.48}$Ca.

Nuclear Structure Data Evaluations

Investigations of so-called new magic nuclei were continued using possibilities of the CDFE Complete Nuclear Spectroscopy Database "Relational ENSDF". Before many such kind nuclei (^{14}C, ^{14,16,24,28,40,48}O, ^{26,28,30}Si, ^{30,32}S, ^{52,54}Ca, ^{90,92,94,96}Sr, ^{92,94,96,98}Zr) were found out [2]. All of them have the same characteristic structure of upper shells (two closed proton and neutron subshells with identical total moment j (phenomenon named “j = j”-connection) and in some special cases - closed subshell with j = ½ above one of them).

Application of that "j = j"- connection to various nuclear subshells gave to one possibility to find out one more new magic nuclei pair: ^{68}Zn - ^{70}Ge.

New Databases Development

1) The previously developed electronic Chart (relational database) of Nuclear Quadrupole Deformations (http://cdfe.sinp.msu.ru/services/defchart/defmain.html) [3] has been added by modern mean-root-square charge radii data [4 – 6] for many nuclei (900 isotopes of 90 elements (Z = 1 – 96, N = 0 – 152)).
Because the new database contains now data on quadrupole moments, quadrupole deformation parameters and nuclear radii it has been transformed into the "Chart of Nucleus Shape and Size Parameters"
(http://cdfe.sinp.msu.ru/services/radchart/radmain.html).
2) Using the data of previously developed database "Giant Dipole Resonance Parameters, Photonuclear Reaction Cross Sections" and special system data transportation from EXFOR database the test version of new electronic Chart of main Giant Dipole Resonance containing data on several main GDR parameters was produced
(http://cdfe.sinp.msu.ru/services/gdrchart/gdrmain.html).
The data on the GDR energy, amplitude, width and integrated cross section are included. Data were obtained from cross sections of all total ((γ,abs), (γ,xn) and (γ,sn)) and many partial ((γ,n), (γ,2n), (γ,3n), (γ,p), (γ,d), (γ,t), (γ,α)) reactions.
Access to data and data presentations are similar to those of the Chart of Nucleus Shape and Size Parameters.

Upgrading of Databases

The main CDFE relational nuclear data databases

- Nuclear Reaction Database (EXFOR) - http://cdfe.sinp.msu.ru/exfor/index.php;
- Complete Nuclear Spectroscopy Database "Relational ENSDF" - http://cdfe.sinp.msu.ru/services/ensdfr.html;
- Nuclear Physics Publications ("NSR" Database) - http://cdfe.sinp.msu.ru/services/nsr/Search_form.shtml;
- Giant Dipole Resonance Parameters, Photonuclear Reaction Cross Sections - http://cdfe.sinp.msu.ru/services/gdrsearch.html;
- Photonuclear Data Index from 1955 - http://cdfe.sinp.msu.ru/services/pnisearch.html

have been upgraded significantly – needed corrections, many additions.

Short-term (2007/2008) Program

The main items of CDFE future short-term one-year program, main priorities and several most important new tasks in fields both photonuclear reaction and nuclear structure data are listed in the **Annex 2**.

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Annex 1. The new CDFE's EXFOR TRANSes M044, M045 and M046 contents (*old corrected* and **new** ENTRYs)

TRANS M044		**TRANS M045**		**TRANS M046**	
ENTRY N	Amount of SUBENTs	ENTRY N	Amount of SUBENTs	ENTRY N	Amount of SUBENTs
L0005	*1*	**M0731**	**14**	*M0635*	*2*
L0006	*1*	**M0732**	**8**	*M0656*	*2*
L0007	*1*	**M0733**	**6**	**M0742**	**4**
L0031	*17*	**M0734**	**3**	**M0743**	**2**
L0050	*5*	**M0735**	**3**	**M0744**	**19**
L0058	*16*	**M0736**	**2**	**M0745**	**13**
M0273	*13*	**M0737**	**5**	**M0746**	**33**
M0322	*8*	**M0738**	**3**	**M0747**	**15**
M0349	*2*	**M0739**	**2**	**M0748**	**6**
M0469	*3*	**M0740**	**5**	**M0749**	**2**
M0470	*3*	**M0741**	**10**	**M0750**	**6**
M0686	*3*			**M0751**	**2**
M0722	**21**			**M0752**	**19**
M0723	**7**			**M0753**	**3**
M0724	**3**			**M0754**	**3**
M0725	**9**			**M0755**	**10**
M0726	**5**			**M0756**	**2**
M0727	**4**			**M0757**	**2**
M0728	**10**			**M0760**	**3**
M0729	**13**				
M0730	**2**				
Total new: 9	**Total new: 84**	**Total new: 11**	**Total new: 61**	**Total new: 17**	**Total new: 149**
Sum of new ENTRYs: 37 **Sum of new SUBENTs: 294**					

Annex 2. The main items of the CDFE future short-term program.

The following traditional CDFE nuclear data compilation and procession activities will be continued:

1. Continuation of photonuclear data compilation using EXFOR format, new TRANSes (M047, M048, etc.) production.
2. Continuation of joint analysis and evaluation of photonuclear reaction cross sections obtained using various methods, first of all in experiments with bremsstrahlung and quasimonoenergetic annihilation photons, with the aim of definition and excluding of systematical discrepancies and obtaining of more accurate and reliable data on photonuclear reaction cross sections.
3. Checking and improvement of the test version of new electronic Chart of main Giant Dipole Resonance containing data on several main GDR parameters and their preparation for putting on the CDFE Web-site (http://cdfe.sinp.msu.ru).
4. Upgrading (corrections and additions) of all databases put upon the CDFE Web-site (http://cdfe.sinp.msu.ru).
5. Investigation of possibilities of production of new photonuclear databases, containing data for energies higher GDR, first of all for meson photoproduction reaction data.
6. Investigations of new non-traditional magic nuclei properties and of their existence conditions using the search possibilities of the CDFE database "Relational ENSDF".

IAEA Nuclear Data Section: Progress Report, 2007/08

Summary of Nuclear Data Studies by Staff of the IAEA Nuclear Data Section
1 October 2007 – 9 September 2008
Editors: S. Dunaeva, N. Otsuka, V. Zerkin

IAEA Technical Meeting, 22-25 September 2008
Obninsk, Russia

Web: http://www-nds.iaea.org/

e-mail: services@iaeand.iaea.org

1. Staff

The authorized staff level of the Nuclear Data Section consists of a total of 17 professionals and support staff. One new staff member joined during the reported period: Naohiko Otsuka (effective from 2 February 2008) has replaced Otto Schwerer (retirement).

2. Data Compilations

2.1 EXFOR and Dictionaries

Over the previous year, NDS staff have distributed 7 CPND TRANS files (D057 - D063) containing 114 new entries (63 compiled at NDS, 7 at ATOMKI, 9 at UkrNDC and 27 in India) and 61 revised entries, 7 neutron TRANS files (3124 - 3130) containing 53 new entries (38 compiled at NDS, 2 at UkrNDC and 13 in India) and 266 revised entries, 1 PhND TRANS files (G017), containing 4 new entries (1 compiled in India and 3 at UkrNDC), and 6 TRANS files (Y001-Y006) with 121 corrected Entries from different areas of responsibility. The compilations consist of new literature as well as many important old references. Also, four topics (mostly lists of "old" papers) are still monitored for completeness of compilation:

1. Ion Beam Analysis,
2. Reference Input Parameter Library (RIPL),
3. Medical CRP,
4. PR/C neutron studies.

NDS staff have finished the format revision of all old Entries from China (S0001-S0044) -originated from CPND, including conversion to new date format (4-digit years), revised text (upper and lower case characters) and continued revision of neutron entries.

As of 10 September 2008, 72 TRANS files were received, checked (with feedback to the originating centres) and processed, of which 69 were final versions that were added to the master file. These final transmissions contained 743 neutron entries (171 new, 572 revised), 886 CPND entries (577 new, 309 revised) and 57 photonuclear entries (43 new, 14 revised).

NDS staff have produced and distributed two regular transmissions of the EXFOR/CINDA dictionaries (TRANS.9096-9097) in EXFOR, DANIEL (backup) and archive format.
Three lists of "EXFOR outliers" submitted by Emmeric Dupont (CEA) to WPEC SG-30 were reviewed and a number of mistakes were identified. Feedbacks to EXFOR from users, database administrators and WPEC SG-30 have been accumulated on the NRDC web page:
(**http://www-nds.iaea.org/nrdc/error/exfor_err1.html**,
http://www-nds.iaea.org/nrdc/error/exfor_err2.html,
http://www-nds.iaea.org/nrdc/error/exfor_err3.html, respectively).
The correction process for these mistakes is being monitored by NDS staff.

2.2 CINDA

CINDA Master file

The up-to-date CINDA Master File is available via the NDS compilers' Web site. An automatic update using the EXFOR database has been carried out once (June 2008). A Sybase-dump of the complete CINDA database was sent to NNDC. A few new CINDA lines have been prepared manually for new non-EXFOR experimental studies. Corrections to CINDA lines have also been carried out according to various feedback from users (http://www-nds.iaea.org/nrdc/error/cinda_err.html).

Coverage control

Under the CINDA coverage control system, NDS staff scan over 80 journal titles (mainly through the Internet) for the purpose of compilation coverage control. The current status of these compilation activities has been made available to EXFOR compilers on the NDS Web site during the course of this year.

Over 1210 journal issues from 1990 to 2008 were added to the database for CINDA coverage control in late 2007/2008. Journal references that should be compiled elsewhere were also dispatched to the relevant centres (Japan, Russia, Hungary and NEADB).

All references absent from EXFOR were sent to the responsible centres for compilation, along with pdf copies of the papers, if necessary.

Other EXFOR database statistics are also available from the NDS Web site:
- contributions to EXFOR according to individual centres,
- history (Preliminary, TRANS files, database updates),
- general statistics (contents by Quantities, Targets, Reactions, etc.).

NDS continues to save articles in pdf format. Articles stored previously on the shelf at NDS are now held in electronic form. All articles compiled during this year in the other centres have been scanned and stored in pdf-format by NDS. More that 3500 files were saved in pdf-format during the year.

2.3 Evaluated data libraries, files and programs

Various new or revised evaluated data libraries, files and programs for data checking, processing and graphical presentation were added to the NDS Web site and distributed on CD-ROM:

- EXFOR - CINDA Database and Retrieval System, Version 1.98, data updated June 2008 (CD-ROM);

- ENDVER/GUI and EXFOR-CINDA package; Integrated Tools for ENDF-Evaluators, Version 1.46, June 2008;
- ENDF archive for simple downloading of old and new libraries, range of versions and single evaluations with short description and list of evaluations; this software will also be used for data which are not available via the Web ENDF retrieval system, such as data in old ENDF-4 and 5 formats and non-ENDF formats. Currently contains 25 libraries at Web-address: http://www-nds.iaea.org/ndspub/download-endf/.

3. Services

Web Services

New NDS and NRDC home-pages: dynamic, intuitive, clear, and oriented to different categories of users.

Further improvements have been implemented in the EXFOR-CINDA-ENDF retrieval systems since the previous NRDC meeting:

- new criteria in EXFOR Web retrieval system: by Title, Header, Units, number of data points;
- handling of "large" requests in EXFOR and ENDF Web through new type of request: "Listing of Entries/Evaluations";
- output of EXFOR data in R33-IBANDL format (angular distributions): significantly improved, agreed with IBANDL community, tested and released;
- several new evaluated libraries are included in the ENDF database:
  - JENDL/HE-2007: High Energy File 2007
  - Medical radioisotope production: extended by 10 (n,γ) evaluations
  - JENDL/AC-2008: JENDL Actinoid File 2008
  - JENDL/AN-2005: (α,n) Reaction Data File 2005
  - JENDL/PD-2004: Photoreaction Data File 2004
  - JENDL/HE-2004: High Energy File 2004
  - MENDL-2: Medium Energy Nuclear Data Library, 1995-1998
  - MINKS-ACT: Minsk Actinides Library (Maslov et al.)
  - Wind: Library for U, Np, Pu and Pu-239, Obninsk, Russia
  - Yavshits: neutron-, proton-induced fission for Pb-Pu (20-200 MeV), St. Petersburg, Russia
  - IBA-Eval: extended
  - PADF-2007 Proton Activation Data File, FZK.DE
- ENDF Flexible Database Explorer released: http://nds121.iaea.org/exfor2/e4explorer.htm

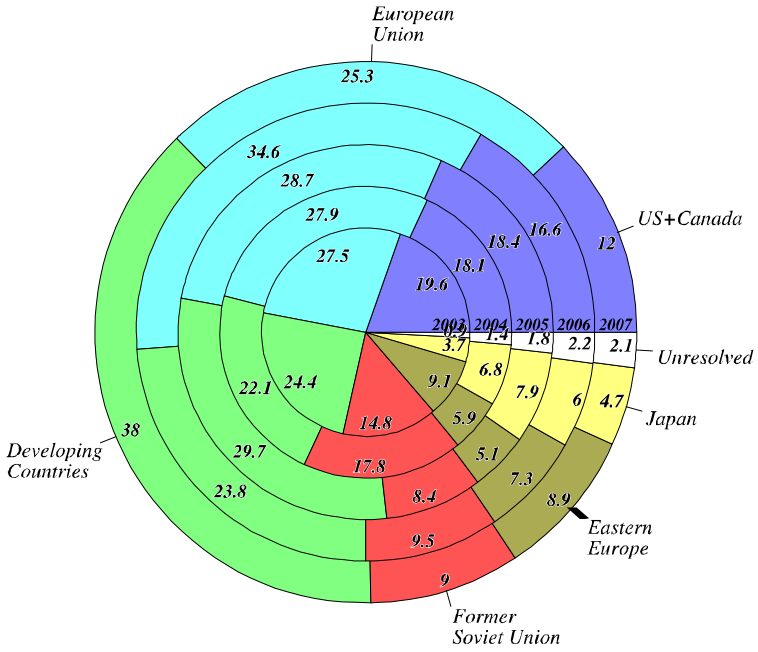
The system is functioning well at NNDC, BARC (India) and IPEN (Brazil). Statistics for usage of the Web retrieval system are presented in Fig. 1.

CD-ROMs

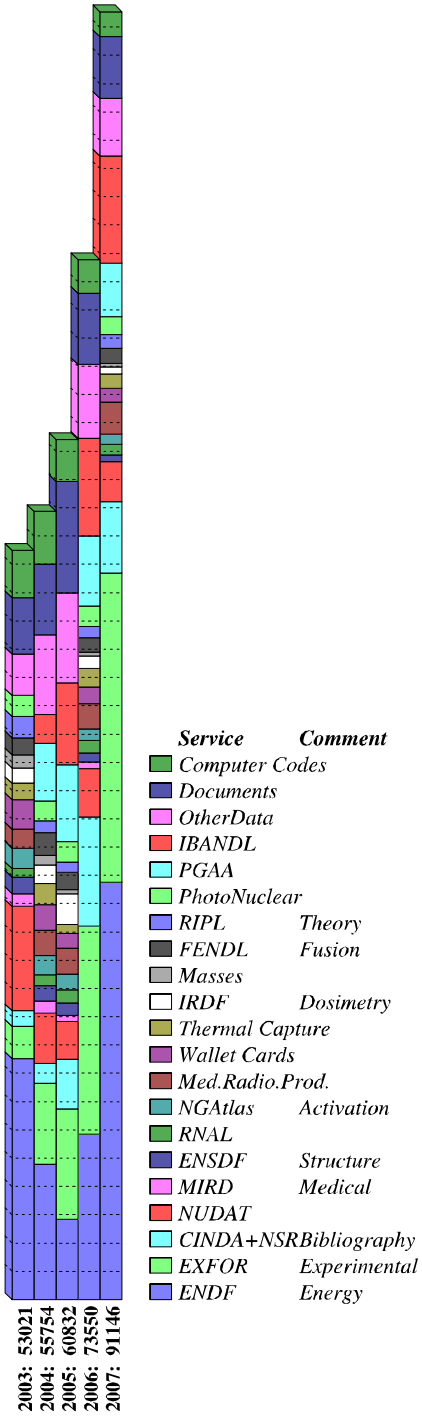
- "EXFOR/CINDA for Windows" CD issued twice;
- "EXFOR/CINDA for Applications" for Linux, Windows and Macintosh (MacOSX) issued twice; also distributed together as part of EndVer/GUI-CD and Empire-package.

NDS+IPEN+BARC
Nuclear Data Services: Web Statistics

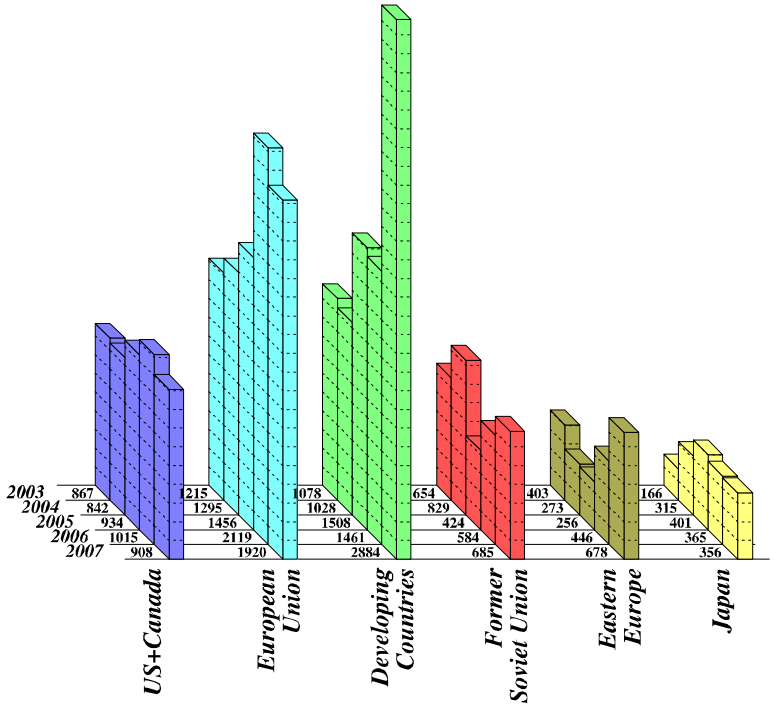
Geographical Distribution (%)



Total per Year
(Number of accesses + retrievals)



Average per Month
(Number of accesses + retrievals)



4. Software

CINDA software

A program to import information from the ENDF database has been discussed, improved and checked with Henriksson (NEA- Nuclear Data Bank) and Otsuka (JCPRG and NDS).

EXFOR software

Program developed for automatic extension of wild-cards (*) in dictionary-236 according to dictionaries 7 and 33.

Full EXFOR in C4 format

Programs have been developed further to produce the full EXFOR database in extended C4 format (also discussed within WPEC SG-30). New feature: along with C4 file, full EXFOR in a directory structure (one ENTRY in one file) is created. Full C4/X4 files were regularly produced and released (five times).

Flexible ENDF database explorer

Implements a sequential search/scan/view the data; allows the user to select the sequence of data observation "on the fly" and provides additional convenient service. Implemented only for ENDF, but will include EXFOR at a future date.

5. Nuclear Data Developments

Although direct nuclear data developments are outside the immediate operations of the NRDC, we give a brief summary below.

Co-ordinated Research Projects (CRPs):

- *Reference Input Parameter Library for Non-Energy Applications: (RIPL-III):* completed; technical report in preparation; database will be available at the end of this year on the Web
- *Development of a Reference Database for Ion Beam Analysis:* on-going; preliminary database available on the Web
- *Updated Decay Data Library for Actinides:* on-going
- *Reference Base for Neutron Activation Analysis:* on-going
- *Evaluated Nuclear Data Files of Charged Particle Interactions for Medical Therapy Applications:* started in 2007
- *Minor Actinide Neutron Reaction Data (MANREAD):* started in 2007
- *Nuclear Data Library for Advanced Systems – Fusion Devices (FENDL-3):* started in 2008

6. Publications

6.1 Journals

Measurement of the neutron capture cross section of the s-only isotope ^{204}Pb from 1 eV to 440 keV
by C. Domingo-Pardo, U. Abbondanno, G. Aerts, *et al*. (the n_TOF collaboration),
Phys. Rev. **C 75** (2007) 015806.

Angular distributions of protons scattered by ^{40}Ar nuclei with excitation of the 2+(1.46 MeV) and 3-(3.68 MeV) collective levels for incident energies of 25.1, 32.5 and 40.7 MeV
by N.T. Okumusoglu, F. Korkmaz Gorur, E.Sh. Soukhovitskii, R. Capote, J.M. Quesada, S. Chiba, Phys. Rev**. C 75** (2007) 034616.

The ^{139}La(n,γ) cross section: Key for the onset of the s-process
by R. Terlizzi, U. Abbondanno, G. Aerts, *et al*. (the n_TOF collaboration),
Phys. Rev. **C 75** (2007) 035807.

Measurement of the radiative neutron capture cross section of Pb-206 and its astrophysical implications
by C. Domingo Pardo, A. Mengoni, *et al*. (the n_TOF collaboration),
Phys. Rev. **C 76** (2007) 045805.

Approximate Lane consistency of the dispersive coupled-channels potential for actinides
by J.M. Quesada, R. Capote, E.Sh. Soukhovitskii, S. Chiba,
Phys. Rev. **C 76** (2007) 057602.

Neutron reactions and nuclear cosmo-chronology
by M. Mosconi, M. Heil, F. Käppeler, R. Capote, A. Mengoni, *et al*.,
Prog. Part. Nucl. Phys. **59** (2007) 165-173.

Uncertainty estimation in intensity-modulated radiotherapy absolute dosimetry verification
by F. Sanchez-Doblado, G.H. Hartmann, J. Pena, R. Capote, M. Paiusco, B. Rhein, A. Lea, J.I. Lagares, Int. J. Radiation Oncology Biol. Phys. **68** (2007) 301-310.

Measurement of the ^{240}Pu half-life
by I. Ahmad, F.G. Kondev, J.P. Green, M.A. Kellett, A.L. Nichols,
Nucl. Instrum. Methods Phys. Res. **A579** (2007) 459-460.

Status and outlook of the neutron time-of-flight facility n_TOF at CERN
by F. Gunsing, R. Capote, A. Mengoni, *et al*.,
Nucl. Instrum. Methods Phys. Res. **B261** (2007) 925-929.

Measurements of the half-life of ^{246}Cm and the α-decay emission probabilities of ^{246}Cm and ^{250}Cf
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Appl. Radiat. Isot. **65** (2007) 335-340.

Exploring the reactor heat problem: Study of the beta decay of ^{104,105}Tc using the TAS technique
by A. Algora, A.L. Nichols, *et al*., Eur. Phys. J. Special Topics **150** (2007) 383-384.

EMPIRE: Nuclear Reaction Model Code System for Data Evaluation
by M. Herman, R. Capote, B.V. Carlson, P. Obložinský, M. Sin, A. Trkov, H. Wienke, V. Zerkin, Nucl. Data Sheets **108** (2007) 2655-2715.

Mass chain evaluations for the Evaluated Nuclear Structure Data File (ENSDF) – An urgent appeal for European participation
by F.G. Kondev, A.L. Nichols, J.K. Tuli (invited paper), Nuclear Physics News, **17**, No. 4 (2007) 19-23, published on behalf of the Nuclear Physics European Collaboration Committee (NuPECC).

Nuclear physics for the Re/Os clock
by M. Mosconi, R. Capote, A. Mengoni, *et al*.,
J. Phys. G: Nucl. Part Phys. **35** (2008) 014015.

The ^{14}C(n,γ) cross section between 10 keV and 1 MeV
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Neutron capture cross section of ^{90}Zr: Bottleneck in the s-process reaction flow
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Phys. Rev. **C 77** (2008) 035802.

Transmission thorough multi-humped fission barriers with absorption: A recursive approach
by M. Sin, R. Capote,
Phys. Rev. **C 77** (2008) 054601.

Covariance analyses of self-shielding factor and its temperature gradient for Uranium-238 neutron capture reaction
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J. Nucl. Sci. Technol. **45** (2008) 195.

A global dispersive coupled-channel optical model potential for actinides
by R. Capote, S. Chiba, E.Sh. Soukhovitskii, J.M. Quesada, E. Bauge,
J. Nucl. Sci. Technol. **45** (2008) 333-340.

An ENDF-6 compatible evaluation for neutron induced reactions of 232Th in the unresolved resonance region
by I. Sirakov, R. Capote, F. Gunsing, P. Schillebeeckx, A. Trkov,
Ann. Nucl. Energy, **35** (2008), 1223-1231.

Nuclear physics of the *s* process
by I. Dillmann, C. Domingo Pardo, F. Käppeler, A. Mengoni, K. Sonnabend,
Pub. Astro. Soc. of Australia, **25** (2008) 18–29; www.publish.csiro.au/journals/pasa

IAEA Coordinated Research Project: Updated decay data library for actinides
by M.A. Kellett, F.G. Kondev, A.L. Nichols,
Appl. Radiat. Isot. **66** (2008) 694-700.

Cross sections of the reaction ^{232}Th(p,3n)^{230}Pa for production of ^{230}U for targeted alpha therapy
A. Morgenstern, C. Apostolidis, F. Bruchertseifer, R. Capote, T. Goudera, F. Simonelli, M. Sin, K. Abbas,
Appl. Radiat. Isot. **66** (2008) 1275-1280.

6.2 Conference Presentations and Proceedings

The aims and activities of the International Network of Nuclear Structure and Decay Data Evaluators
by A.L. Nichols, J.K. Tuli (invited paper), Proc. Int. Conf. on Nuclear Data for Science and Technology, Editors: O. Bersillon, F. Gunsing, E. Bauge, R. Jacqmin and S. Leray, Vol. 1 (2008) pp. 37-42, EDP Sciences, Les Ulis, France, ISBN 978-2-7598-0090-2.

β-decay data requirements for reactor decay heat calculations: Study of the possible source of the gamma-ray discrepancy in reactor heat summation calculations
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Lane consistency of the dispersive coupled channel optical model potential
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Extension of the nuclear reaction model code EMPIRE to actinides nuclear data evaluation
by R. Capote, M. Sin, A. Trkov, *et al*., Proc. Int. Conf. on Nuclear Data for Science and Technology, Editors: O. Bersillon, F. Gunsing, E. Bauge, R. Jacqmin and S. Leray, Vol. 1 (2008) pp. 255-258, EDP Sciences, Les Ulis, France, ISBN 978-2-7598-0090-2.

Neutron-induced fission cross section on actinides using microscopic fission energy surfaces
by M. Sin, R. Capote, S. Goriely, S. Hilaire, *et al*., Proc. Int. Conf. on Nuclear Data for Science and Technology, Editors: O. Bersillon, F. Gunsing, E. Bauge, R. Jacqmin ,S. Leray, Vol. 1 (2008) pp. 313-316, EDP Sciences, Les Ulis, France, ISBN 978-2-7598-0090-2.

Measurement of neutron induced fission of ^{235}U, ^{233}U and ^{245}Cm with the FIC detector at the CERN n_TOF facility
by M. Calviani, R. Capote, A. Mengoni, *et al*. (the n_TOF collaboration), Proc. Int. Conf. on Nuclear Data for Science and Technology, Editors: O. Bersillon, F. Gunsing, E. Bauge, R. Jacqmin and S. Leray, Vol. 1 (2008) pp. 335-338, EDP Sciences, Les Ulis, France, ISBN 978-2-7598-0090-2.

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New cross section measurements for neutron-induced reactions on Cr, Ni, Cu, Ta and W isotopes obtained with the activation technique
By V. Semkova, R. Capote, R. Jaime Tornin, A.J. Koning, A. Moens, A.J.M. Plompen, Proc. Int. Conf. on Nuclear Data for Science and Technology, Editors: O. Bersillon, F. Gunsing, E. Bauge, R. Jacqmin and S. Leray, Vol. 1 (2008) pp. 559-562, EDP Sciences, Les Ulis, France, ISBN 978-2-7598-0090-2.

Simultaneous measurement of the neutron capture and fission yields of ^{233}U
by E. Berthoumieux, R. Capote, A. Mengoni, *et al*. (the n_TOF collaboration), Proc. Int. Conf. on Nuclear Data for Science and Technology, Editors: O. Bersillon, F. Gunsing, E. Bauge, R. Jacqmin and S. Leray, Vol. 1 (2008) pp. 571-574, EDP Sciences, Les Ulis, France, ISBN 978-2-7598-0090-2.

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978-2-7598-0090-2.

Capture cross section measurements of ^{186,187,188}Os at n_TOF: the resolved resonance region
by K. Fujii, R. Capote, A. Mengoni, *et al*. (the n_TOF collaboration), Proc. Int. Conf. on Nuclear Data for Science and Technology, Editors: O. Bersillon, F. Gunsing, E. Bauge, R. Jacqmin and S. Leray, Vol. 1 (2008) pp. 599-602 48, EDP Sciences, Les Ulis, France, ISBN 978-2-7598-0090-2.

The neutron capture cross sections of ^{237}Np and ^{240}Pu and its relevance in the transmutation of nuclear waste
by C. Guerrero, R. Capote, A. Mengoni, *et al*. (the n_TOF collaboration), Proc. Int. Conf. on Nuclear Data for Science and Technology, Editors: O. Bersillon, F. Gunsing, E. Bauge, R. Jacqmin and S. Leray, Vol. 1 (2008) pp. 627-630, EDP Sciences, Les Ulis, France, ISBN 978-2-7598-0090-2.

Evaluation of the ^{103}Rh neutron cross-section data in the unresolved resonance region for improved criticality safety
by L.C. Mihailescu, I. Sirakov, R. Capote, *et al*., Proc. Int. Conf. on Nuclear Data for Science and Technology, Editors: O. Bersillon, F. Gunsing, E. Bauge, R. Jacqmin, S. Leray, Vol. 1 (2008) pp. 649-652, EDP Sciences, Les Ulis, France, ISBN 978-2-7598-0090-2.

Evaluation of tungsten isotopes in the fast neutron range including cross-section covariance estimation
by R. Capote, A. Trkov, I. Kodeli, *et al*., Proc. Int. Conf. on Nuclear Data for Science and Technology, Editors: O. Bersillon, F. Gunsing, E. Bauge, R. Jacqmin and S. Leray, Vol. 1 (2008) pp. 689-692, EDP Sciences, Les Ulis, France, ISBN 978-2-7598-0090-2.

The Global Assessment of Nuclear Data, GANDR
by D.W. Muir, A. Trkov, I. Kodeli, R. Capote, V. Zerkin, Proc. Int. Conf. on Nuclear Data for Science and Technology, Editors: O. Bersillon, F. Gunsing, E. Bauge, R. Jacqmin, S. Leray, Vol. 1 (2008) pp. 717-720, EDP Sciences, Les Ulis, France, ISBN 978-2-7598-0090-2.

The JEFF Evaluated Nuclear Data Project
by A.J. Koning, R.A. Forrest, M.A. Kellett, A.L. Nichols, *et al.* (invited paper),
Proc. Int. Conf. on Nuclear Data for Science and Technology, Editors: O. Bersillon,
F. Gunsing, E. Bauge, R. Jacqmin and S. Leray, Vol. 2 (2008) pp. 721-726, EDP Sciences, Les Ulis, France, ISBN 978-2-7598-0091-9.

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by K. Shibata, T. Nakagawa, T. Fukahori, O. Iwamoto, A. Ichihara, N. Iwamoto,
S. Kunieda, N. Otuka, J. Katakura, Y. Watanabe, K. Kosako, Proc. Int. Conf. on Nuclear Data for Science and Technology, Editors: O. Bersillon, F. Gunsing, E. Bauge, R. Jacqmin and S. Leray, Vol. 2 (2008) pp. 727-732, EDP Sciences, Les Ulis, France, ISBN 978-2-7598-0091-9.

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by H. Henriksson, O. Schwerer, D. Rochman, M.V. Mikhaylyukova, N. Otuka, Proc. Int. Conf. on Nuclear Data for Science and Technology, Editors: O. Bersillon, F. Gunsing, E.

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Measurement of the ^{197}Au(n,γ) cross section at n_TOF: towards a new standard
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by G. Tagliente, R. Capote, A. Mengoni, *et al*. (the n_TOF collaboration), Proc. Int. Conf. on Nuclear Data for Science and Technology, Editors: O. Bersillon, F. Gunsing, E. Bauge, R. Jacqmin and S. Leray, Vol. 2 (2008) pp. 1303-1306, EDP Sciences, Les Ulis, France, ISBN 978-2-7598-0091-9.

Inelastic neutron scattering cross section of ^{187}Os at 30 keV
by M. Mosconi, M. Heil, F. Kappeler, A. Mengoni, R. Plag, Proc. Int. Conf. on Nuclear Data for Science and Technology, Editors: O. Bersillon, F. Gunsing, E. Bauge, R. Jacqmin and S. Leray, Vol. 2 (2008) pp. 1307-1310, EDP Sciences, Les Ulis, France, ISBN 978-2-7598-0091-9.

Improved lead and bismuth (n,γ) cross sections and their astrophysical impact
by C. Domingo-Pardo, R. Capote, A. Mengoni, *et al*. (the n_TOF collaboration), Proc. Int. Conf. on Nuclear Data for Science and Technology, Editors: O. Bersillon, F. Gunsing, E. Bauge, R. Jacqmin and S. Leray, Vol. 2 (2008) pp. 1311-1314, EDP Sciences, Les Ulis, France, ISBN 978-2-7598-0091-9**.**

IAEA coordinated research programme: Nuclear data for the production of therapeutic radionuclides
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The n_TOF facility at CERN
by D. Cano-Ott, R. Capote, A. Mengoni, *et al*., Proc. 8th Int. Topical Meeting Nucl. Applications and Utilization of Accelerators (ACCAPP '07 2007) pp. 821-826, American Nuclear Society, La Grange Park, USA.

Investigation of new reaction cross-section evaluations in order to update and extend the IRDF-2002 reactor dosimetry library
by E.M. Zsolnay, H.J. Nolthenius, A.L. Nichols, 13th Int. Symp. Reactor Dosimetry, 25-30 May 2008, Akersloot, near Alkmaar, the Netherlands.

EXFOR: maintaining the quality and credibility of a large nuclear database through an extended multinational initiative (invited)
by A.L. Nichols, S. Dunaeva, O. Schwerer, V. Zerkin, 2nd Int. Conf Current Problems of Nuclear Physics and Atomic Energy (NPAE-Kyiv2008), 9-15 June 2008, Kiev, Ukraine.

Studies of nuclear structure and decay data properties of actinide nuclei
By F.G. Kondev, A.L. Nichols, M. A. Kellett, *et al*., 13th Int. Symp. Capture Gamma-ray Spectroscopy and Related Topics, 25 – 29 August 2008, Cologne, Germany.

Applications of the total absorption technique to reactor decay heat calculations: Study of the beta decay of ^{102,104,105}Tc
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by S. Goriely, S. Hillaire, A.J. Koning, M. Sin, R. Capote, 13th Int. Symp. Capture Gamma-ray Spectroscopy and Related Topics, 25 – 29 August 2008, Cologne, Germany.

Decay studies of minor actinide nuclides, and future opportunities for improving the decay data of neutron-rich fission products
by F.G. Kondev, I. Ahmad, M.P. Carpenter, C.J. Chiara, J.P. Greene, R.V.F. Janssens, M.A. Kellett, C.J. Lister, A.L. Nichols, G. Savard, D. Seweryniak, S. Zhu, Int. Conf. Reactor Physics, Nuclear Power: a Sustainable Resource, PHYSOR-2008, 14-19 September 2008, Interlaken, Switzerland.

International efforts to measure, model and evaluate nuclear data for minor actinides
by A. Mengoni, R. Capote, M.A. Kellett, A.L. Nichols, Int. Conf. Reactor Physics, Nuclear Power: a Sustainable Resource, PHYSOR-2008, 14-19 September 2008, Interlaken, Switzerland.

Evaluation of the covariance matrix of the ^{235}U neutron-induced prompt fission spectrum
by I. Kodeli, A. Trkov, R. Capote, Int. Conf. Reactor Physics, Nuclear Power: a Sustainable Resource, PHYSOR-2008, 14-19 September 2008, Interlaken, Switzerland.

Progress in evaluated nuclear data for Tungsten with covariances
by A. Trkov, R. Capote, I. Kodeli, L. Leal, Int. Conf. Reactor Physics, Nuclear Power: a Sustainable Resource, PHYSOR-2008, 14-19 September 2008, Interlaken, Switzerland.

Development of JENDL actinoid file
by O. Iwamoto, T. Nakagawa, N. Otuka, S. Chiba, K. Okamura, G. Chiba, Int. Conf. Reactor Physics, Nuclear Power: a Sustainable Resource, PHYSOR-2008, 14-19 September 2008, Interlaken, Switzerland.

6.3 Reports

Handbook of nuclear data for safeguards
by A.L. Nichols, D.L. Aldama, M. Verpelli, IAEA report INDC(NDS)-0502, IAEA, Vienna, Austria, January 2007.

Update of X ray and gamma ray decay data standards for detector calibration and other applications
by M.-M. Be, A.L. Nichols, *et al*., STI/PUB/1287, May 2007, International Atomic Energy Agency, Vienna, Austria, ISBN 92-0-113606-4 (2 volumes).

International evaluation of neutron cross-section standards
by S.A. Badikov, *et al*., STI/PUB/1291, November 2007, International Atomic Energy Agency, Vienna, Austria, ISBN 92-0-100807-4.

Fission product yield data for the transmutation of minor actinide nuclear waste
by J.-O. Denschlag, *et al*., STI/PUB/1286, April 2008, International Atomic Energy Agency, Vienna, Austria, ISBN 92-0-115306-6.

ERRORF – A code to calculate covariance of self-shielding factor and its temperature gradient
By N. Otuka, *et al*., JAEA-DATA/Code 2008-012, JAEA, Tokai-mura, Japan, June 2008.

7. Workshops 2007/2008

- Workshop on Nuclear Structure and Decay Data - Theory and Data Evaluation, ICTP Trieste, Italy, 28 April to 9 May 2008, IAEA report INDC(NDS)-0533, IAEA, Vienna, Austria, June 2008, IAEA Workshop Director: A.L. Nichols; available at Web site:

  http://www-nds.iaea.org/reports-new/indc-reports/indc-nds/indc-nds-0533.pdf

- Workshop on Nuclear Reaction Theory and Evaluation, ICTP Trieste, Italy, 19-30 May 2008, IAEA Workshop Directors: A. Mengoni and A. Stanculescu.

8. Visits and Inter-centre Cooperation

- S. Dunaeva (IAEA/NDS) to BARC, Mumbai, India, 26 October – 4 November 2007: EXFOR compilation in India.
- V. Zerkin (IAEA/NDS) to NNDC, BNL, USA,13-23 November 2007: EXFOR and ENDF Web and database software deployment.

P3

Center of Nuclear Physical Data (CNPD), RFNC-VNIIEF

Technical paper for the NRDC Meeting, September 22-25, 2008
Obninsk, Russia

S.M. Taova
Russian Federal Nuclear Center-VNIIEF
Russia, 607188, Sarov, Nizhni Novgorod region, pr. Mira, 37

Compilation activity

Within the period under report four transmission files TRANS (F029, F030, F031, F032) were prepared and included into the EXFOR data library (99 new and 9 corrected entries).
Scanning of home journals “Yadernaya Fizika”, “Izvestiya Academii Nauk” was continued.

CNPD members take part in the works on development of a Reference Database for Ion Beam Analysis. This year 346 files including the sets of experimental data on charged particle interaction with nuclei up to A=50 were introduced into the library.

EXFOR - Editor software

The work on software development (EXFOR-Editor) for processing and introduction of experimental data to the EXFOR library was continued. A new version of the program 1.4 was released. A possibility of introducing the whole Subentry to the EXFOR library is available in the current version.

Input of information basing on the Keywords DECAY-DATA, FLAG, HALF-LIFE, HISTORY, MONITOR was implemented.

A window of graphic data presentation was updated. The change was made both in the EXFOR-Editor code and in the program for working with data tables – EXFOR-Table. The following possibilities are now available for graphic data processing:

- graphic zoom:
- presenting the current plot values when clicking a mouse on a chosen point of a curve;
- presenting the statistical information for each curve;
- printing plot and its import to a separate file of graphic format.

Within the present software a program code for creation of the EXFOR file pattern (EXFOR-Dummy) was developed. This pattern may be used in future for data input to the CINDA library.

Database development

The development of the library of evaluated and experimental data on charged particle interaction with light nuclei SaBa was continued. In terms of the newly arisen experimental data new evaluated data sets have been obtained for the following reactions:

$Li^6 + t -> Li^7 + d$
$Li^7 + t -> Li^9 + p$
$Li^7 + d -> Be^8 + n$
$Li^7 + t -> Be^9 + n$
$Li^7 + p -> 2He^4$
$He^3 + He^3 -> He^4 + 2p$

A procedure of comparison of evaluated data presented in SaBa with those from the ENDF/B7 library was implemented.

A report containing information on all the changes in the SaBa library undertaken within the last period will be presented at the Fifth Eurasian Conference "Nuclear Science and its Application" in October this year in Turkey.

Model Calculations

Using the EMPIRE 2.19 program code the calculations for some reactions on neutron interaction with nuclei were carried out. To present data in a graphic form there was developed a program code RsltEmpire under Windows operating system. This code provides a possibility of presenting calculation results separately for different processes.

Publications

Abramovich S.N., Karpeshin F.F., LaRana G., Vardachi E., Brondi A., Moro R., Serov V.I., *Resonances in alpha-nuclei interaction*, J. Phys. G: Nucl. Part. Phys. 2007, V. 34, P. 587.

Abramovich S.N., Il'kaev R.I., Punin V.T., *Fundamental Nuclear Physics Research at RFNC VNIIEF over 60 Years*, Bulletin of the Russian Academy of Sciences. Physics, 2007, V. 71, № 3, P. 299-313.

Abramovich S.N., Kolesov V.F., Intyapina E.V., Shmarov A.E., *Calculation methodology of hypothetical isomeric gamma reactors by the example of $^{178m2}Hf$.*, Vopr. At. Nauk. F. Reak, 2, 2007, P.59-86.

Abramovich S.N., Generalov L.N., Vinogradov Yu.I., *Measurement of Excitation Function $^7Li(t,p)^9Li$ Reaction by Registration of Delayed Neutron*, Book of Abstracts, 58 International Meeting on Nuclear Spectroscopy and Nuclear Structure, Moscow, 2008, P.142.

Lazarev L.M. *Theory of the threshold phenomena and spectroscopy of the light nuclei*, Sarov, RFNC-VNIIEF, 2007, 98.

Burtebaev N.T., Burtebaeva D.T., Abramovich S.N., Zvenigorodskij A.G., Zherebtsov V.A., Taova S.M., *Development of the library of evaluated and experimental data SaBa. Input of data on differential cross sections of nuclear reactions*. (to be submitted to the 5-th Eurasian Conference "Nuclear Science and its Application", October 14-17, 2008, Turkey).

Ukrainian Nuclear Data Centre Progress Report, 2007/08

Summary of Nuclear Data Studies by Staff of the Ukrainian Nuclear Data Centre
1 October 2007 – 11 September 2008
Editor: O. Gritzay

IAEA Technical Meeting, 22-25 September 2008
Obninsk, Russia

Web: http://ukrndc.kinr.kiev.ua/

e-mail: ogritzay@kinr.kiev.ua

Introduction

Ukrainian Nuclear Data Centre (UkrNDC) is subdivision within the Neutron Physics Department at the Institute for Nuclear Research of the National Academy of Sciences of Ukraine. UkrNDC has 5 permanent researchers. During year under review three members of the staff were involved in an implementation of the STCU contract UZ-25 "Creation of modern manufacturing technologies and certification methods for radioisotope production needed in science, medicine and industrial applications in Ukraine and Uzbekistan Republic".

Compilation

We continue collection and compilation of experimental neutron, charged particle and photonuclear data. Number of the EXFOR entries sent to NDS IAEA by UkrNDC are:

- for neutron data –6 entries;
- for charged particle data –8 entries;
- for photonuclear data –5 entries.

The list is presented in Table.

We realize review of compilation scope in home journals:

- "Nuclear Physics and Atomic Energy";
- "Ukrainian Journal of Physics"

and in the journal "Bulletin of the Russian Academy of Sciences: Physics".

Collaboration

We continue our collaboration with the Physics Department of the Taras Shevchenko National University of Kyiv.

- The teaching courses "*Nuclear Data for Science and Technology*" (36 hours per year) and *"Modern computer codes for nuclear data processing"* (36 hours per year) are lectured in 2007-2008 for graduate course students of NPD KNU. These courses include the following items: ENDF/B libraries, EXROR system, ENSDF library, the use of the PREPRO code in work with the ENDF libraries, the introduction to NJOY code system, the Network of Nuclear Reaction Data Centers and the use of the on-line services.

- The teaching courses "*Neutron Physics at the Kyiv Research Reactor*" (36 hours per year) are lectured in 2007-2008 for fourth-year students of NPD KNU.

Table. EXFOR's entries sent to NDS IAEA by UKRNDC.

#	EXFOR's entry	Reference	Author
Neutron data			
1	**32217**	W, 2008 NPAE-Kyiv2006, ISRD13, NPAE-Kyiv2008,ID# 86-95	O.Gritzay, V.Libman
2	**32218**	J,ZNJD,,(4),68,2007 R,AIP-958,211,2007	N.R.Dzysiuk, I.M.Kadenko, V.K.Maydanyuk, G.I.Primenko, A.M.Berlizov
3	**32219**	J,ZNJD,,(2),...,2008 NPAE-Kyiv2008 ID#253-260	N.R.Dzysiuk, I.M.Kadenko, V.K.Maydanyuk, G.I.Primenko, R.V.Yermolenko
4	**32220**	J,ZNJD,,(3),42,2007	S.V.Begun, N.R.Dzysiuk, I.M.Kadenko, V.K.Maidanyuk, G.S.Primenko
5	**32221**	J,ZNJD,,(4),61,2007	O.O.Gritzay, M.L.Gnidak, V.V.Kolotyi, O.I.Korol, V.F.Razbudey, V.M.Venedyktov, J.Richardson, K.Sale
6	**32222**	W, NPAE-Kyiv2008, ID# 87-96	P.N. Vorona, O.I.Kalchenko, V.G.Krivenko
Charged particle data			
1	**D5049**	J,PR/C,8,(6),2072,1973	L.F.Hansen, S.M.Grimes, J.L.Kammerdiener, V.A.Madsen
2	**D5050**	J,ZNJD,,(1),36,2007	O.F.Nemets, Yu.N.Pavlenko, V.L.Shablov, F.I.Karmanov, V.O.Kyva, V.N.Dobrikov, O.K.Gorpinich, I.N.Kolomiets, B.A.Rudenko, Yu.Y.Karlyshev, A.P.Voiter, I.A.Mazny, V.V.Ostashko, S.E.Omelchuk, Yu.S.Roznuk
3	**D5051**	J,ZNJD,,(2),65,2007	Yu.N.Pavlenko, V.L.Shablov, O.S.Bondarenko, O.K.Gorpinich, V.N.Dobrikov, N.L.Doroshko, Yu.Y.Karlyshev, F.I.Karmanov, V.O.Kyva, I.N.Kolomiets, S.E.Omelchuk, V.V.Ostashko, Yu.S.Roznuk, B.A.Rudenko, I.A.Tyras
4	**D5052**	J,EPJ/A,33,317,2007 J,ZNJD,,(1),72,2007	A.T.Rudchik, V.O.Romanyshyn, E.I.Koshchy, A.Budzanowski, K.W.Kemper, K.Rusek, V.D.Chesnokova, J.Choinski, B.Czech, L.Glowacka, S.Kliczewski, V.M.Kyryanchuk, S.Yu.Mezhevych, A.V.Mokhnach, O.A.Momotyuk, O.A.Ponkratenko, R.Siudak, I.Skwirczynska, A.Szczurek
5	**D5053**	J,ZNJD,,(2),131,2007	O.M.Povoroznyk
6	**D5055**	J,NP/A,165,19,1971	T.H.Curtis, H.F.Lutz, D.W.Heikkinen, W.Bartolini
7	**D5056**	J,NP/A,198,257,1972	H.F.Lutz, D.W.Heikkinen, W.Bartolini
8	**D5057**	J,ARI,66,653,2008	Ye.Skakun, S.M.Qaim

Photonuclear data			
1	**G4013**	J,UFZ,52,(8),744,2007	V.M. Mazur, Z.M.Bigan, V.L.Lyamayev, D.M.Symochko
2	**G4014**	J,UFZ,52,(9),823,2007	I.G.Goncharov, A.M.Dovbnya, Yu.M.Ranyuk, O.S.Shevchenko
3	**G4015**	J,VAT/I,5,(48),22,2007	I.G.Goncharov,A.M.Dovbnya,Yu.M.Ranyuk,O.S .Shevchenko
4	**G4016**	J,VAT/I,5,(48),48,2007	O.S.Shevchenko, Yu.M. Ranyuk, A.M.Dovbnya, E.L.Kuplennikov, A.A.Nemashkalo, I.G.Goncharov, V.N.Borysenko, V.I.Noga
5	**G4017**	J,ZNJD,,(1),37,2008	I.M.Vyshnevskyi, O.I.Davidovskaya, V.A.Zheltonozhsky, E.V.Kulich, A.N.Savrasov, N.V.Strilchuk

Customer Services

- During 2006-2007 the data for users requests were prepared and adapted (from ENDF, ENSDF and EXFOR libraries) for our institute researchers and for ones from other institutes. The organizations, whose requests on nuclear data have arrived and were executed in the accounting period:
  1. Center of Environmental Problems INR of NASU.
  2. Department of Nuclear Physics of Kyiv National University.
  3. Department of Nuclear Physics of the Institute for Nuclear Research (INR) of NASU.
  4. Department of the Theory of Nuclear Reactions INR of NASU.
  5. Department of Nuclear Reactions INR of NASU.

- The UkrNDC site is operating. Ukrainian customers, especially students and those physicists, who wish to prepare the pointwise and multigroup cross sections self-dependently, but do not have a good experience in it, use this site very often. Address of the UkrNDC site: *http://ukrndc.kinr.kiev.ua.*

Calculation

The ACE-format libraries for the isotopes needed for calculations of the maximum specific activity of the irradiated products at the INR WWR-M reactor, namely, $^{50, 52, 53, 54}$Cr, $^{54, 56, 57, 58}$Fe, $^{92, 94, 95, 96, 97, 98, 100}$Mo, $^{58, 59}$Co, ^{89}Y, $^{96, 98, 99, 100, 101, 102, 103, 104, 105, 106}$Ru, $^{107, 109, 111}$Ag, $^{106, 108, 110, 111, 113, 114, 115m, 116}$Cd, $^{112, 113, 114, 115, 116, 114, 117, 118, 119, 120, 122, 123, 124, 125, 126}$Sn, $^{120, 122, 123, 124, 125, 126, 128, 130, 132}$Te, $^{133, 134, 135, 136, 137}$Cs, $^{136, 138, 140, 141, 142, 143, 144}$Ce, $^{141, 142, 143}$Pr, $^{142, 143, 144, 145, 146, 147, 148, 150}$Nd, $^{144, 147, 148, 149, 150, 151, 152, 153, 154}$Sm, $^{151, 152g, 153, 154, 155}$Eu, $^{152, 153, 154, 155, 156, 157, 158, 160}$Gd, ^{159}Tb, $^{175, 176}$Lu, ^{181}Ta, $^{180, 182, 183, 184, 186}$W, $^{185, 187}$Re, $^{191, 193}$Ir, $^{84, 86, 87, 88, 89, 90}$Sr, ^{197}Au, $^{196, 198, 199, 200, 201, 202, 204}$Hg, were prepared. The input data were taken from the nuclear data libraries: BROND-2.2, ENDF/B-VI (rel. 8), ENDF/B-VII,

JEFF-3.1, JENDL-3.3, CENDL-2. Calculations were doing by NJOY99.90 code at the computer ESCALA S120 with RISC/6000 processor under AIX operating system.

Visits and Conferences

- O. Gritzay took part in the 13-th International Symposium on Reactor Dosimetry (ISRD'13), which was held from 25-30 May 2008 in Alkmaar in the Netherlands
- All of the UkrNDC staff took part in the second International Conference on Current Problems in Nuclear Physics and Atomic Energy (NPAE-Kyiv2008) , which was held from 9-15 June 2008 in Kyiv, Ukraine

Progress Report
ATOMKI NUCLEAR REACTION DATA GROUP

ATOMKI, Debrecen, Hungary

Tárkányi F., Takács S., Király B., Ditrói F., Szelecsényi F., Kovács Z., Csikai J.
(September 2008)

Introduction

The main task and profile of the Atomki Nuclear Reaction Data Group did not change: measurement, compilation, evaluation and application of low and medium energy charged particle nuclear reaction data. The activity is done in the frame of international collaborations. Measurement, compilation and evaluation are connected to international projects and to the every day applications at the home institute and at institutes of collaborating partners.

Collaborating partners (nuclear data)

- Cyclotron Laboratory, Vrije Universiteit Brussels (VUB), Brussel, Belgium
- Cyclotron Radioisotope Centre, Tohoku University, Sendai, Japan
- Nuklearchemie (INB-4) für Neurowissenschaften und Biophysik , Fochungzentrum Jülich, Jülich, Germany
- Institute of Theoretical Physics, Institute of Physics and of Power Engineering (IPPE), Obninsk, Russia
- Nuclear Data Section, Division of Physics and Chemistry, IAEA, Vienna, Austria
- Division of Advanced Technology for Medical Imaging of the National Institute of Radiological Sciences (Chiba, Japan)
- Radionuclide Production Laboratory of the iThemba Laboratory for Accelerator Based Sciences (Somerset West, South Africa).

Experimental works

During the last years we have continued the systematic measurement of excitation functions of charged particle reactions for many different applications (see list of references):

- Production of medical radioisotopes for diagnostic and for therapy.
- Excitation functions of monitor reactions.
- Activation cross sections for accelerator technology (waste transmutation, IFMIF, target technology).
- Activation cross sections for Thin layer Activation (TLA).
- Activation cross sections for charged particle activation analysis.

Compilations and evaluations

EXFOR compilations

During the August 2006 – A 2008 period practically all new works from Debrecen,

Brussels and Jülich were compiled.

Upgrading the charged particle cross-section database for medical radioisotope production: monitor reactions

The Debrecen group is participating in the upgrading process of the IAEA recommended cross-section data base for charged particle induced reactions relevant to production of radioisotopes used for medical diagnostics and the related reactions to monitor beam parameters. During 2006 - 2008 the upgrade of the database of charged particle monitor reactions was completed. The upgraded version is available on web. The preparation of the paper on the upgrading and on the status is in progress.

Development of database for production of therapeutic radionuclides

The IAEA – Coordinated Research Project (CRP) for development of a standard database for production of therapeutic radionuclide was completed. The database will be available on the web from October 2008. The draft of the TECDOC is ready.
The main contributions of the Debrecen group to the development of the database are new measurements and compilation of the cross section data of selected charged particle reactions (compilation, critical selection, comparison with integral data). Significant work was devoted to the preparation of the final database and of the TECDOC.

Database for fusion evaluated nuclear data library

The Debrecen group will participate in extension of FENDL library with p-and d-activation libraries in the frame of a new IAEA CRP.

Nuclear data service

The ATOMKI group continues to distribute compiled or evaluated cross section/thick target yield data for low and medium energy charged particle nuclear reactions mainly for cyclotron applications according to the requirements.

Staff

The staffs connected to the experimental nuclear reaction data measurement consist of six physicists and two chemists. Out of them three (B. Király, S. Takács, F. Tárkányi) physicists are working in part time on data compilation and evaluation. All are engaged in practical application of the ATOMKI cyclotron.

Future plans

Continuation of the present activity.

Remarks and recommendations to the NRDC Meeting (key words)

- Publication of experimental data (limitations).
- Lack of experimental data.
- Status of the databases (extensions).
- Support of new databases.

- Errors in EXFOR.
- Missing link at BNL homepage to medical isotopes.
- Nuclear data related FP7 projects.
- Parallel nuclear data activities at Division of Physics and Chemistry (IAEA).
- Importance of the theory for measurements.
- Compilation of preliminary or submitted data.

Nuclear reaction data related works from ATOMKI

(References: October 2006 - September 2008)

Hermanne A., Tárkányi F., Takács S., Shubin Yu. N., Kovalev S. F., *Experimental determination of activation cross section of alpha-induced nuclear reactions on ^{nat}Pt,* Nuclear Instruments and Methods in Physics Research Section B: Beam Interactions with Materials and Atoms 251 (2006) 333.

Király B., Tárkányi F., Takács S., Kovács Z., *Excitation functions' of proton induced nuclear reactions on natural tellurium up to 18 MeV for validation of isotopic cross sections,* Journal of Radioanalytical and Nuclear Chemistry 270 (2006) 369.

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A brief summary report on selected Indian nuclear data physics activities: A status report submitted to the NRDC Meeting-2008[1]

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1. Introductory Remarks

Until 2004, both at BARC and IGCAR, the Indian nuclear data activities were confined to processing of ENDF/B files and thus generically encompassed the user-oriented reactor physics approach starting from the basic evaluated nuclear data files available from the IAEA. The nuclear data physics activities in the last 4 years have expanded considerably beyond this perspective to initiate and include R & D activities on our own nuclear data evaluation, processing and integral testing. Experimental basic neutron data measurements using accelerator and reactor based neutron sources and also a programme of critical facility for integral validation of reactor physics data of Advanced Heavy Water Reactor at BARC have been initiated.

This document provides a brief account of Indian nuclear data physics activities in the last 2 years with stress on aspects of interest to this Meeting of International Network of Nuclear Reaction Data Centres (NRDC) which India is attending for the first time.

All the reactor physics applications oriented processing tasks at BARC and IGCAR have been covered in the INDC report presented in the 27th International Nuclear Data Committee (INDC) Meeting, April 21-25, 2008, IAEA, Vienna, Austria, Europe and are not repeated here to save space.

2. Indian EXFOR compilation activities

India successfully contributed 10 new entries in 2006 and 31 new entries in 2007 and many more new EXFOR entries are continuing to be made. Thus far, in all more than 50 new Indian EXFOR entries based upon experimental data generated in Indian nuclear physics experiments have been successfully made into the IAEA-EXFOR database. The identification for coding into EXFOR of all the suitable Indian articles published in the literature was done by the IAEA-NDS staff.

The details of new Indian EXFOR entries are, for instance, available in "Full EXFOR Compilation Statistics", in the IAEA-NDS site: http://www-nds.iaea.org/exfor-master/x4compil/exfor_input.htm

[1] *IAEA Technical Committee Meeting of International Network of Nuclear Reaction Data Centres (NRDC) from 22 to 25 September 2008 at the Institute of Physics and Power Engineering in Obninsk, Russian Federation*

The EXFOR activity in India got a boost with BARC successfully organizing two EXFOR national training workshops sponsored by the DAE-BRNS (department of Atomic Energy-Board of Research in Nuclear Sciences) mechanism, one in 2006 and another in 2007. In each of these two workshops, more than 40 delegates (experimental nuclear scientists, University faculty, Ph. D. and M.Sc., students) took active part and got a "first time" exposure to a classical nuclear data physics activity of EXFOR compilation culture. India appreciates the initiative by the IAEA-NDS in deputing Dr. Otto Schwerer during September 4-8, 2006 period and Dr. Ms. Svetlana DUNAEVA during October 29-November 2, 2007 period as faculty in these Indian training workshops on EXFOR. India offers to collaborate with other net work of reaction data centres and help host more such training workshops on international co-ordination of EXFOR compilation activity in the coming years.

Presently, BARC plans to continue the EXFOR compilation activity and take up more responsibilities. After the two IAEA-EXFOR training workshops, a Ph. D. student (Paresh Prajapati from MS University, Vadodara) is continuing to work with us. Thus far, he has made nine new Indian EXFOR entries (Reference: EXFOR entry with no: 33003, D6007, 33011, 33016, 33017, 33018, 33019, G0014 and D6016 and accepted by the IAEA).

3. Efforts towards evolving a strong and sustainable Indian nuclear data centre.

BARC is in the process of initiating the formation of a strong and sustainable Indian nuclear data centre. The nuclear data physics activities have significantly been enlarged in scope in the last 4 years in India.

Presently the nuclear data physics activities in India encompass already the following activities:

- Basic nuclear data physics measurements.
- EXFOR compilations.
- Nuclear model based calculations.
- Processing of evaluated nuclear data files to produce plug-in libraries for discrete ordinates and Monte Carlo codes.
- Efforts to digest the status of covariance error methodology in nuclear data and its applications
- Preparation of integral Indian experimental criticality benchmarks for integral nuclear data validation studies

In the last four years, as a result of increased nuclear data physics activities in India, several professional meetings on nuclear data physics were encouraged and successfully conducted by BARC/DAE. See Appendix-1.

In India, we are locating interested faculty in the Universities using the DAE-BRNS mechanisms in order to evolve a streamlined and coherent activity of nuclear data for all our applications that will be sustainable. See Appendix-2.

Recruitment of permanent manpower to compile and co-ordinate EXFOR activity in India and with network of centres abroad will be one of the urgent tasks under the proposed Indian nuclear data centre

4. The online nuclear data services

The online nuclear data services (http://www-nds.indcentre.org.in/) mirror the nuclear data website of the Nuclear Data Section of the International Atomic Energy Agency (IAEA), Vienna (http://www-nds.iaea.org).

Presented below for May 2008, as an illustration, is the monthly statistics of the use of online services, as retrieved by C. S. R. C. Murthy, Computer Division, BARC. Total hits were 113437 with a 10144068 Kbytes with more than 3600 hits per day during this month.

Table-1: Monthly Statistics for May 2008 (http://www-nds.indcentre.org.in/)		
Total Hits		**113437**
Total Files		**108189**
Total Pages		**99936**
Total Visits		**2268**
Total KBytes		**10144068**
Total Unique Sites		**1741**
Total Unique URLs		**9955**
Total Unique Referrers		**231**
Total Unique User Agents		**253**
	Avg	**Max**
Hits per Hour	**152**	**594**
Hits per Day	**3659**	**9509**
Files per Day	**3489**	**9269**
Pages per Day	**3223**	**8576**
Visits per Day	**73**	**127**
KBytes per Day	**327228**	**1067693**

The Mumbai mirror nuclear data website is fully functional since Nov. 2004 when a 5 year MOU arrangement was made. Under this arrangement, online-updating every 12 hours is performed in the mirror with the IAEA website through a 2MB direct link. The server is being maintained by BARC Computer Division - with manpower and machinery. *The MOU between DAE/BARC and the IAEA is expected to be continued beyond 2010.*

India offers to collaborate with other net work of reaction data centres and help in promoting the online nuclear data services in the coming years.

5. Experimental generation of nuclear data

- Determination of the ^{233}Pa(n, f) reaction cross-section from 11.5 to 16.5 MeV neutron energy by surrogate ratio method.

- Experimental 14MeV nuclear activation data generation at the University of Pune, Pune, India.
- Experimental Studies on fast neutron and bremsstrahlung induced reaction and fission of actinides and preactinides.
- Measurements of MeV range neutron activation cross sections using 14 MV BARC-TIFR Pelletron machine.

6. CERN n_TOF international collaboration-Phase-2

After a Letter of Intent was signed by all member teams in the n_TOF Collaboration participating in Phase-1, the CERN management and the n_TOF Collaboration started in 2005 a negotiation for the definition of the Memorandum of Understanding (MoU) for the execution of experiments at the CERN n_TOF facility for Phase-2. CERN has accepted the LoI signed by the Director of BARC.

A. Mengoni (IAEA-NDS) visited BARC during May 30 – June 2, 2007 and delivered a lecture on "Experimental activities at the CERN neutron time-of-flight facility (n_TOF): Results and perspective for the future". The lecture and discussions were all well received. Soon, in 2008, a formal MOU between BARC and CERN is expected to be signed.

7. The informal collaboration with the Pohang 100MeV electron LINAC

The informal collaboration with the Pohang 100MeV electron LINAC facility is continuing since 2003 for nuclear resonance data measurements. For instance, Dr. H. Naik, BARC will be visiting Pohang as a visiting scientist for 3 months during the last quarter of 2008 to continue generation experimental data of photo-fission yields and photon induced neutron emission cross sections.

8. ENSDF Evaluation Activities

The ENSDF evaluation activities are being continued by Ashok Jain (IIT Rourkee), M. Gupta (Manipal), Gopal Mukherjee (VECC, Kolkata) and others. For the interested reader, details are available in the INDC report presented in the 27th International Nuclear Data Committee (INDC) Meeting, April 21-25, 2008, IAEA, Vienna, Austria, Europe.

9. Integral nuclear data validation studies

India is formally listed as a contributor since 2005 in the International Handbook of Evaluated Criticality Safety Benchmark (ICSBEP) Experiments published by the USDOE-NEA for integral nuclear data validation studies (hhtp://icsbep.inl.gov). India was admitted to this project in the year 2005 following our submission of the KAMINI experimental bench mark In the last 2 years, a document on PURNIMA-II (the ^{233}U nitrate solution) criticality experimental Indian benchmark prepared by T. K. Basu. C. P. Reddy, E.Radha, K. K. Rasheed and S. Ganesan has successfully gone through a critical international peer-review by the ICSBEP and accepted for publication in the 2008 ICSBEP DVD handbook for nuclear data validation studies.

10. Software Packages developed by BARC and contributed to the IAEA

- **The XnWlup software:** The XnWLUP developed at BARC has been designed to view the histogram of 69/172 multi-group cross sections as a function of neutron energy is used by WIMS-D users / thermal reactor physicists extensively around the world. Thiyagarajan et al., successfully developed this software for MS-WINDOWS environment. This program has been designed using Microsoft Visual C++. Microsoft Internet Explorer is required to view the online help topics. The XnWLUP code that has been tested with several WIMSD libraries in 2008 is available:
    - http://www-nds.indcentre.org.in/wimsd/downloads.htm
    -
- **The SIGACE software**: Collaboration between the Institute for Plasma Research, BARC and the IAEA NDS resulted in the successful development of the SIGACE software for use in the Monte Carlo simulations of nuclear systems. In this software, a new recipe has been evolved for generating high-temperature ACE files for use with the MCNP code. The SIGACE code that has been tested with several FENDL/MC files (endorsed for ITER and fusion reactor applications) is available:
    - http://www-nds.indcentre.org.in/fendl21/downloads/

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Appendix-1: Professional Meetings in India (2006-2008) on nuclear data physics

1. DAE-BRNS Theme Meeting on EXFOR Compilation for Indian Scientists during September 4-8, 2006 (IAEA Faculty: Dr. Otto Schwerer, NDS)
2. BARC Golden Jubilee DAE-BRNS National Workshop on Nuclear Data for Advanced Nuclear Systems, Nuclear Databases and Applications, 8-11 November 2006, NWND-2006, hosted by Mangalore University. (Dr. Alan Nichols, Head, NDS, IAEA, Dr. Georges Audi (France), Prof. A. Takahashi (Japan) and Prof. G. N. Kim (Republic of South Korea) were among those who delivered invited talks on ND Activities)
3. Manipal (M. Gupta) hosted discussion Meeting, 12-13 November 2006, following NWND-2006, Mangalore, 8-11 November 2006, on "Atomic and Nuclear Data for Next Generation Medicine and Technologies," MAHE, Manipal, Karnataka (Dr. Alan Nichols, Head, NDS, IAEA, Dr. G. Audi and Prof. G. N. KIM and DAE scientists, S. Kailas, R. Srivenkatesan and S. Ganesan) gave special invited talks on ND Activities)
4. Supplementary Meeting to the DAE-BRNS Theme Meeting on EXFOR Compilation for Indian Scientists, December 7, 2006
5. DAE-BRNS Theme Meeting on EXFOR Compilation for Indian Scientists during Oct. 29 – Nov. 2, 2007. (IAEA Faculty: Dr. Svetlana Dunaeva, NDS).
6. DAE-BRNS Nuclear Data Meeting on Accelerator Driven System at VECC, Kolkata, November 13, 2007.
7. DAE-BRNS Theme Meeting on "Covariance Error Matrix and its Applications in Reactor Fuel Cycle and Technology," February 25 – 28, 2008, hosted by Manipal University, Manipal – 576104, India. (Prof. Dr. H. Leeb, Technical University, Vienna, delivered a series of lectures on fundamentals of covariance error matrix, features and nuclear data evaluations. Prof. Sreekumaran Nair and Prof. K. Manjunatha Prasad, Manipal University served as local conveners with S. Ganesan as the Technical convener).

Appendix-2: DAE-BRNS projects on nuclear data physics topics in Indian Universities

The roadmap in nuclear data for the wide range of power and non-power applications in the Indian context encompasses a wide range of activities in the field of experimental generation of basic physics data, compilations, computerized visualizations and large data files information management, evaluations which include nuclear model based predictions, creating of computerized ENDF/B files, physics laws based nuclear data processing for multi-group and Monte Carlo applications, integral measurements and validations by use of experimental critical facilities. These voluminous numerical databases and activities include not only interactions with neutrons but also with gammas and charged particles as incident beams.

In India, we are including all the national laboratories and university teams using the DAE-BRNS mechanisms in order to evolve a streamlined and coherent activity of nuclear data for all our applications that will be sustainable.

Examples of such DAE-BRNS projects under active implementation include the following:

a. Ongoing 14MeV neutron data physics project in Pune University.
b. Ongoing nuclear data physics activities at Jaipur University.
c. Ongoing measurements using the Microtron facility in Mangalore University.
d. Covariance error matrix in nuclear data physics, a project that has been initiated in 2007 at Manipal University.
e. Ongoing project, "Nuclear model based calculations of particle-nuclear interaction cross sections," at the Department of Physics, G.B. Pant University, Pantnagar, India.
f. The Maharaja Sayajirao University of Baroda, Vadodara proposed DAE-BRNS Project on nuclear data physics entitled, "Studies for 14 MeV and fast neutron induced fission/reaction for AHWR and ADS applications".
g. Nuclear data physics project proposal from Bharathiar University, Coinbatore, Tamilnadu.

PROGRESS REPORT FROM THE

OECD/NEA DATA BANK

For the NRDC meeting, Obninsk, Russia

22-25 September 2008

Akira Hasegawa, Hans Henriksson

NEA Web page: www.nea.fr
Contact: db@nea.fr

General overview

The NEA will celebrate its 50th anniversary in October; the Secretary General of the OECD and the Director General of the IAEA will participate. The first issue of "Nuclear Energy Outlook" will be published for this occasion. The NEA, which is already the technical secretariat for Generation IV International Forum (GIF), will provide the same services to the Multinational Design Evaluation Programme (MDEP). MDEP aims at developing a common approach to safety criteria for future reactors and to streamline licensing worldwide. New staff members at the Data Bank include Roopa Chauhan (assistant to the head of the Data Bank) and Mireille Defranceschi (TDB project leader) replacing Federico Mompean.
Several staff members of the Data Bank are in 2009 coming to the end of their contracts, or reaching retirement, such as I. Kodeli, E. Sartori, H. Henriksson, Y. Rugama, P. Nagel and C. Morris.

Nuclear data services

Experimental (EXFOR) data compilations
The Data Bank is compiling and exchanging experimental neutron and charged particle induced data, as one of the nuclear data centres in the NRDC network coordinated by the IAEA.
In 2007, 82 new and 137 corrected neutron-induced data sets were entered into the EXFOR database. The number of new entries of charged-particle induced data was 114 new entries and 22 corrected data sets. The compilation effort in 2008 is well underway with several new and corrected experimental data sets. The emphasis has recently been on corrections, as this is strongly linked to recent activities in WPEC subgroup 30 on EXFOR's quality (see below).

Bibliographic (CINDA) data
The Data Bank has, together with the IAEA, revised the entire CINDA database covering bibliographic neutron, photonuclear and charged particle data. CINDA is mainly updated with information from EXFOR regarding experimental data, but bibliographic information on theoretical work and nuclear data evaluations are also included, mainly in the NEA member countries. Several formatting mistakes and incoherencies with the EXFOR database have been discovered and a process of correcting both CINDA and EXFOR is in progress.

Several references to theoretical work and nuclear evaluations in the Data Bank member

countries are to be included in 2008. References to experimental data from all countries are taken from EXFOR.

Status of the JEFF project

A revised version of the Joint Evaluated Fission and Fusion (JEFF) radioactive decay data library, JEFF-3.1.1/RDD, was released in November 2007and is available on the NEA website. A full report on the decay data library is planned for publication in 2008. A complete validation report of JEFF-3.1 is being prepared at the moment. The outline of the report covers: 1) thermal systems, 2) fast systems, 3) fuel cycle, storage and reprocessing, 4) fusion systems and 5) other applications.

The Data Bank also offers a set of processed libraries based on JEFF-3.1 to assist scientists wanting to use JEFF-3.1 in application calculations, such as group cross-section and Monte Carlo libraries. Experts from the JEFF project are investigating the possibility of developing new processing tools; the first phases are already underway and the progress made thus far is promising. An emphasis has been placed on updating the NJOY extensions required for JEFF processing. NJOY user meetings are regularly held in conjunction with the JEFF meetings. The last meeting was held in November 2007, and the next is planned to be held 21 November.

In 2007, feedback to the JEFF library (JEFF-3.1) was collected and several new evaluations are being considered for future releases. The feedback web pages make user comments available to evaluators. New and reviewed evaluations are also made available for JEFF working group members. Although the results from JEFF-3.1 results are encouraging, it has been noted that a number of key isotopes could be further improved. The objective is to develop and issue an updated and extended version, which will be called JEFF-3.2, in 2009-2010 along with the corresponding documentation.

Specific neutron evaluations that will be renewed and/or updated are given below:

- Revise and validate ^{235,238}U to solve remaining deficiencies, especially for fast reactor systems of highly-enriched uranium.
- A new evaluation for ^{239}Pu to improve the analysis of MOX systems. One has already been proposed and a preliminary file is available from the JEFF-3.2β website for the JEFF working group.
- New evaluations of Cr, Mn, Ta and W isotopes are required for the European Fusion File (EFF) project. The tungsten evaluation has already been examined and compared to other new tungsten evaluations available.
- Revised evaluations of Pb, Bi and Am using recent measurements from IRMM, Geel, and the optical model code TALYS. Several Pb and Bi evaluations are already available from NRG for the JEFF working group.
- A new evaluation for ^{232}Th, ^{233}Pa based on TOF and IRMM measurements.
- New evaluations for ^{2}H, ^{16}O, ^{56}Fe, ^{151}Sm, ^{237}Np, Zr and Hf isotopes (many have already been prepared by the CEA).

Web services to nuclear data users

The main Web pages regarding Nuclear Data have evolved to better adapt to users' needs and be more accessible to both experts in the field and laymen (see Fig. 1), e.g. work related to the processing of nuclear data collected can be found on: www.nea.fr/html/dbdata/process. Other nuclear data services are provided through direct on-line access to the different databases (CINDA, EXFOR and EVA).

In 2007 and early 2008, the evaluated nuclear data libraries IRDF-2002, International

Standards 2006, PADF-2007, UKHEDD-2.6, UKPADD-6.8 and JEFF-3.1.1/RDD were added to the EVA database. There has been a dramatic increase in the EVA-JEFF-JANIS area's access and traffic, see Table 1. The other online services are relatively stable.

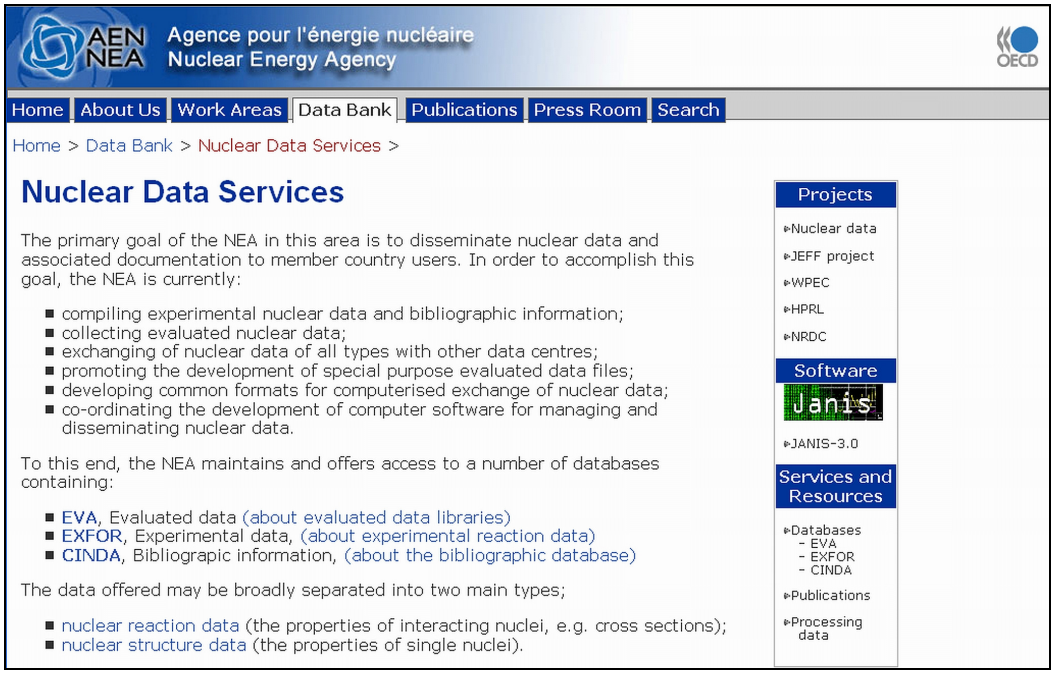

Fig. 1. The nuclear data web page of the NEA (www.nea.fr/html/dbdata/) with short links on the right-hand side to main activities (such as the JEFF project), software development (JANIS-3) and services and resources (databases related to nuclear data, publications and information on the processing of evaluated nuclear data libraries).

Table 1. Web retrievals (number of accesses) 2006 from the NEA Data Bank. (Note, JEFF documents are password protected)

Web page	2007	2006
EVA searches	7 410	8 017
EVA downloads	227 313	56 150
JEFF documents*	148 365	30 242
EXFOR searches	10 712	11 563
EXFOR downloads	22 761	18 698
JANIS	486 247	361 770
CINDA	1 852	1 388
Other web pages at the Data Bank	165 602	139 471

The JANIS software

The third version of JANIS was released in June 2007. Several improvements were included, for example, the inclusion of the EXFOR database in its original format, the customisation of plots and extended possibilities to access tabular data in EXFOR. Now, it is also possible to

save plots in vectorial formats (e.g. EMF/WMF). An update, JANIS-3.0.1, was made available in February 2008 with a few corrections related to the handling of the ENDF and EXFOR formats and improvements, such as viewing calculation results as a table and using the nuclide chart browser with user's inputs. The popularity of the program has increased steadily and is now also being used in many university courses around the world as an easy introduction to nuclear data manipulation. The number of JANIS users is growing. They are now making over 35 000 accesses per month to the NEA on-line databases, see Fig. 2. The users are mainly requesting the databases JEFF-3.1 and ENDF/B-VII.0, followed by experimental data in EXFOR and ENDF/B-VI.8 as shown in Fig. 3. More than half of the requests are for neutron-induced data, and a third of the requests concern decay data. The requests for specific data types are shown in Fig.4. Users request JANIS mainly for fission applications, but also for basic research and educational purposes.

The work on a JANIS web application with minimum client side requirements (an Internet connection and a web browser) is under way, as well as the integration of JANIS as a tool for the NRDC in verifying and testing EXFOR and CINDA data. The next release will also place an emphasis on the ENDF format coverage by implementing views of covariance data and photon interaction data. The program is free of charge and can be downloaded or launched using 'JAVA Web Start' from the JANIS home page at http://www.nea.fr/janis, where the complete manual can be found as well. A DVD with JANIS and the most important nuclear data libraries can also be requested from the NEA.

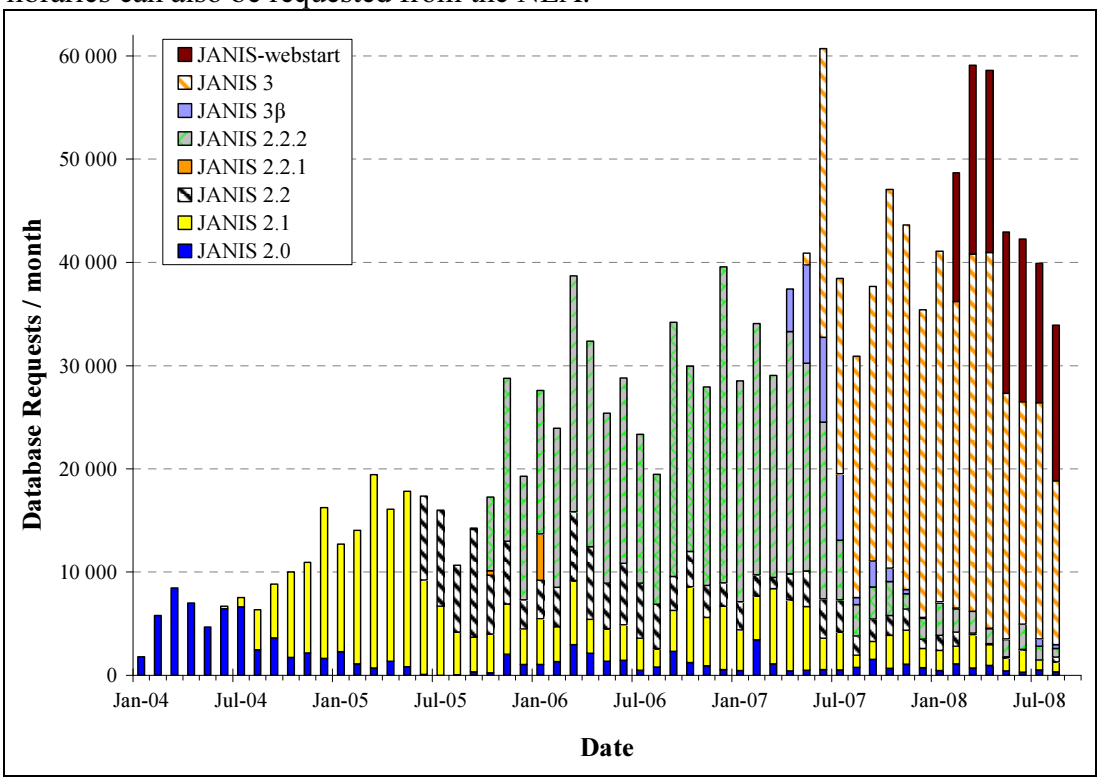

Fig. 2. Number of accesses to the JANIS database per month since the JANIS-2 release in 2004. Since February 2008, users launching JANIS from the web (webstart) will be directed to the latest version of the software automatically (not necessarily released on DVD).

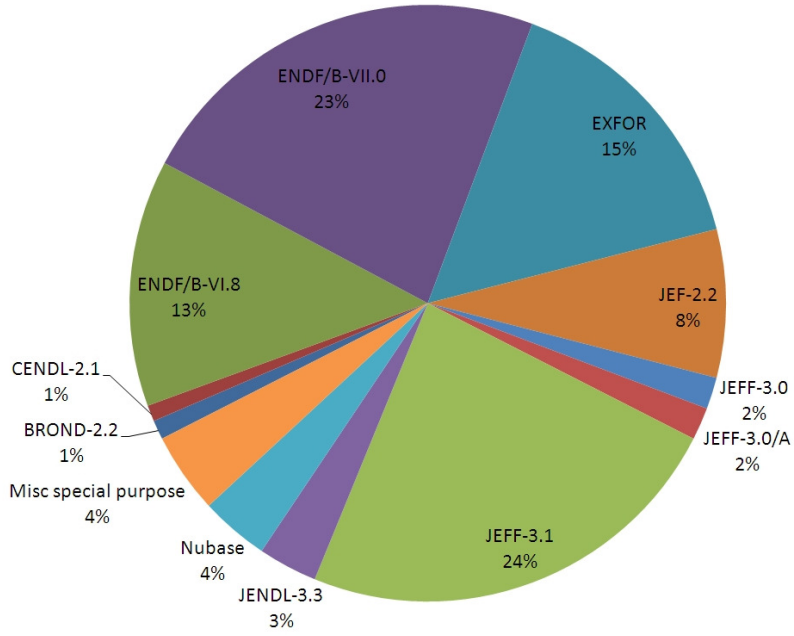

Fig. 3. Requested databases in JANIS for 2007-2008.

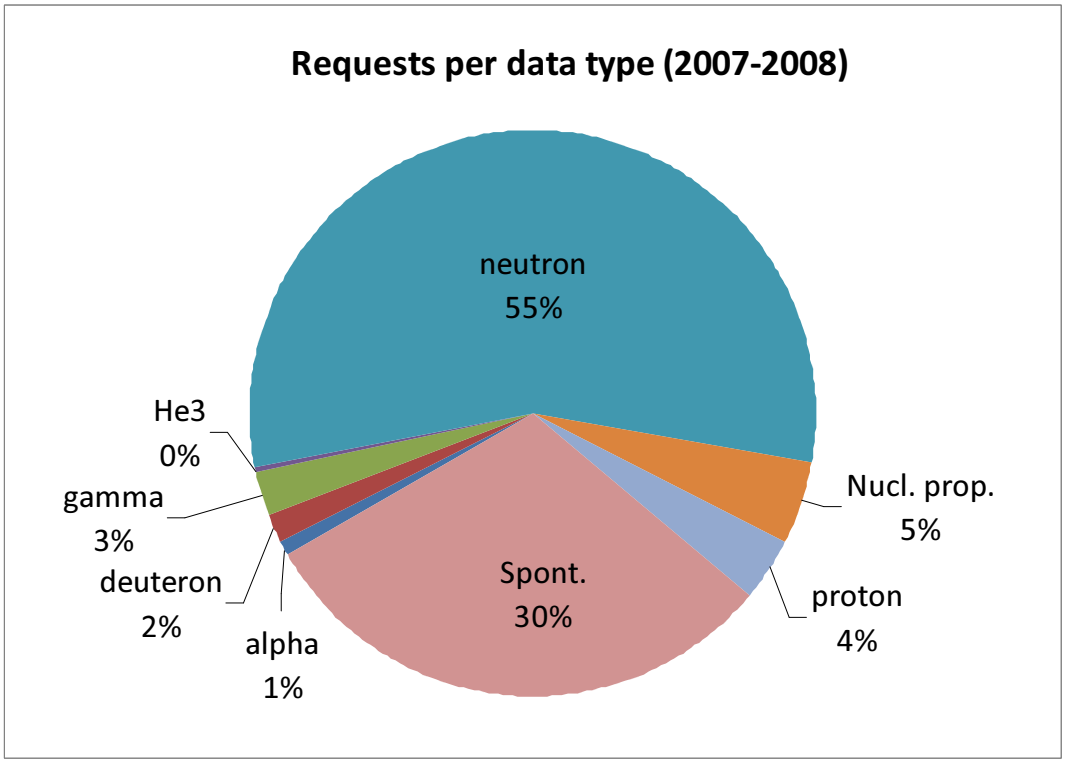

Fig. 4. Users' requests since 2007, divided by the various data types.

The Databank is closely linked to the activities in the NSC Working Party on International Nuclear Data Evaluation Co-operation (WPEC). One publication (Vol. 25) was issued in 2007 on the *Assessment of Fission Product Decay Data for Decay Heat Calculations*, and Vol. 26 on *Uncertainty and Target Accuracy Assessment for Innovative Systems Using Recent Covariance Data Evaluations* was recently published (Aug 2008). Two new WPEC activities were started in 2007, one on ^{235}U *Capture Cross-Section in the keV to MeV Energy Region* (subgroup 29), and the other on *Improvement of Accessibility and Quality of the EXFOR*

Database (subgroup 30). Two more activities were proposed in 2008 and are about to start:

- WPEC Subgroup 31: *Meeting Nuclear Data Needs for Advanced Reactor Systems*, with the co-ordinator H. Harada,
- WPEC Subgroup 32: *Unresolved resonance treatment for cross section and covariance representation,* with the co-ordinator L. Leal.

A long-term activity within WPEC is the High Priority Request List (HPRL), containing specific nuclear data requests from data users. The content is reviewed on a regular basis by external referees. At the moment, HPRL contains ten general and 32 high priority requests, of which over twenty requests were proposed by the WPEC Subgroup 26.

Computer program services

During 2007, a total of 94 codes were acquired and 54 were tested, of which 25 originated from non-OECD countries. Also 19 new or revised compilations of integral measurements were included in the databases SINBAD (Shielding Integral Benchmark and Database), IFPE (International Fuel Performance Experiments) and IRPhE (International Reactor Physics Experiments). About 3,800 codes and benchmark experiments were distributed in 2007; about 50 % of these were integral experiment packages. In total, 360 packages were distributed to 26 non-OECD member states and the IAEA in 2007. Several training courses have been carried out, and are planned, concerning computer codes such as PENELOPE, TRIPOLI and MCNP5/MCNPX.

Several legacy books important in radiation transport and reactor physics for which publishers reverted the copyrights to the authors have been made available and distributed to over 1,000 audiences at 43 establishments, mainly to students. A collaboration with the International Nuclear Information System (INIS) of the IAEA has been reinforced to increase visibility of results from work carried out at NEA.

Thermochemical data (the TDB project)

There are now ten volumes in the series of reviews in the Thermochemical Database (TDB) project since the beginning. The book *"Chemical Thermodynamics of Solid Solutions of interest in Nuclear Waste Management"* was published in August 2007. The work in phase III of the TDB project, which was officially finalised in February 2008, will continue in phase IV with the publication of iron (stage 1), tin and thorium. Phase IV of the TDB project started in February 2008 and will carry on with a review on iron (stage 2) and auxiliary data.

Other database projects maintained by the Data Bank

SCAP: *OECD Stress Corrosion Cracking (SCC) and Cable Aging Project*
In support of the NEA Nuclear Safety Division, a third server-side database and web-based interface, SCAP, was developed and opened in October 2007. The first one was OPDE, developed in 2005, and the second one, FIRE, in 2006. The development of SCAP has been shortened by reusing the common parts defined by OPDE and FIRE applications.

DICE: *Database for the International Handbook of Evaluated Criticality Safety Benchmark Experiments* (Support to the Nuclear Science section). A new web interface for data entry has

been developed. This new interface allows users to edit or view more data on the same screen (all cases of a given evaluation), speeding up data entry and allowing eye-checking of data consistency between cases.

***ISOE**: Information System on Occupational Exposure (Support to Radiation Protection)*
The second phase of the project involving the development of a data entry web interface, was carried out. The possibility of creating a Microsoft-Access database from the master Oracle database content was added. The testing phase initially planned in summer 2007 was postponed to spring 2008.

Below are some other projects listed, where the NEA Data Bank carries out the development of the services:

- *GIF Generation Four International Forum collaborative web server*
- *NEA Publications data base*
- *NEA Contacts database*
- *SFCOMPO Database of Spent Fuel Composition*
- *TDB Chemical Thermodynamics Database*
- *FIRE OECD Fire Incidents Records Exchange*
- *OPDE OECD Piping Failure Data Exchange*
- *STRESA Storage of Thermal Reactor Safety Analysis data: no change*
- *RBO Database for the Uranium resources (Red Book)*
- *BBO Database for the Nuclear Electricity statistics (Brown Book)*

LIST OF DATA BANK PUBLICATIONS

Publications in 2007

- International Handbook of Evaluated Reactor Physics Benchmark Experiments (IRPhE), Second Edition (DVD)
- Nuclear Program Abstracts (November 2007) (CD-ROM)
- CINDA 2006 The Comprehensive Index to Nuclear Reaction Data (Archive 1935-2006), seven volumes.
- International Evaluation Co-operation: Vol. 25: *Assessment of Fission Product Decay Data for Decay Heat Calculations*
- Chemical thermodynamics of solid solutions of interest in nuclear waste management

Publications in 2008 and planned for 2009

- International Evaluation Co-operation: Vol. 26: *Uncertainty and Target Accuracy Assessment for Innovative Systems Using Recent Covariance Data Evaluations*
- International Handbook of Evaluated Reactor Physics Benchmark Experiments (IRPhE) Third and Fourth Editions
- 2008 Editions of Computer Program Abstracts (CD-ROM)
- PENELOPE-2008 Report on electron-photon transport
- Documentation of the JEFF-3.1 Radioactive and Decay Data Library (JEFF Report 20)
- JEFF-3.1 Library Benchmarking and validation (JEFF Report 22)
- Radiation Transport Handbook
- Chemical Thermodynamics of Thorium
- Chemical Thermodynamics of Tin
- Chemical Thermodynamics of Iron (Stage I)

- New Editions of Computer Program Abstracts (CD-ROM))
- Proceedings of the 8th meeting on Shielding Aspects of Accelerators, Targets and Irradiation Facilities (SATIF-8)
- One edition of the nuclear program abstracts on CD-ROM was issued in November 2007 for distribution to 'liaison officers'.
- During 2007, four electronic newsletters were issued covering announcements of new computer codes, computer code specific and project oriented data libraries, integral experiments, training courses, workshops and meetings.
- In 2008, **The Data Bank e-newsletter**, with coverage of all Data Bank activities (including computer program services) was initiated. Two issues have been sent out to over 1200 recipients.

List of recently held training courses and workshops with participation of the Data Bank

- 26 November 2007, NJOY User Group Meeting, Issy-les-Moulineaux.
- 30 January - 1 February 2008, Course on Analytical Benchmarks (Case Studies in Neutron Transport Theory).
- 25-29 February 2008, Sensitivity and Uncertainty Analysis Training Course using SCALE TSUNAMI, Issy-les-Moulineaux.
- 7-11 April 2008, Training course on the Monte Carlo code TRIPOLI-4.
- 12-16 May 2008, Introductory/intermediate MCNP/MCNPX training course, Lisbon.
- 2-6 June 2008, REFIT-2007 Training course, EC-JRC-IRMM, Geel.
- 1-12 September 2008, Training course on EXperiment, Theory and Evaluation of Nuclear Data (EXTEND), Budapest.

ACTIVITY of CAJAD

S.Babykina

Nuclear Structure and Reaction Data Center,

Kurchatov Institute,

Moscow

Two main **EXFOR activities** at CAJAD are:

1. Compilation A -Library.

After meeting in 2007 trans files **A063 and A064** were prepared. These trans files contain astrophysical, fission and monitor reaction data. Trans A063 includes 112 old corrected entries. These entries were updated according to new EXFOR rules and last meeting conclusions. Trans A064 contains only new entries.

TRANS	TRANS Status	ENTRIES Total	ENTRIES New	ENTRIES Revised
A063	Final	112		112
A064	Prelim	19	19	

2. NEA DATA-BANK Team-work

During 2007 and 2008 more than 150 new and some old entries were prepared and included in O-library. These entries mainly contain differential data for elastic and inelastic scattering, proton-induced fission and spallation cross-sections and proton-induced residual production data.

TRANS	TRANS Status	ENTRIES Total	ENTRIES NEW	ENTRIES Revised
O031	Final	42	40	2
O032	Final	20	20	
O033	Final	22		22
O034	Final	56	50	6
O035	Final	37	25	12
O036	Final	40	25	15

3. Checking Codes

In order to check ENTRIES and TRANSES we use checking codes-CHEX.

4. Duplications and EXFOR Coverage Control System

EXFOR Coverage Control System created by S.Dunaeva prevents duplication of entry numbers which is one of main EXFOR problems.

Japan Nuclear Reaction Data Center (JCPRG)

Faculty of Science, Hokkaido University
Steering Committee

Progress Report to the
IAEA Technical Meeting on the Network of Nuclear Reaction Data Centres
22-25 September, 2008

0. General

The "Japan Nuclear Reaction Data center (JCPRG)" started at April1, 2007. At the beginning of 2008, N. Otsuka who has been the most active member of our group moved to IAEA. We engaged three young colleagues to cover the activities of N. Otsuka. However, they are not regular staffs, and are limited by three years. To order to establish the activity of JCPRG, we are hoping to have regular staff positions and submitted our plan of the new center to Hokkaido University and the Japanese Government.

Since the last NRDC meeting (October 2007, Vienna), we have worked on the following activities:

1. Reaction data compilation (NRDF and EXFOR)
2. Conversion of old NRDF to EXFOR
3. Bibliography compilation (CINDA)
4. Database maintenance and services (NRDF, EXFOR/ENDF and CINDA)
5. Digitization system (GSYS)
6. Customer services

0.1 Staff

Our activities have been carried out by 6 members (4 postdoctoral researchers, 2 graduate students and 1 technical staff). They have been supervised by the NRDF Steering Committee, which consists of 10 senior researchers (9 nuclear physicists and 1 information scientist). All activities have been coordinated by 1 secretary. Prof. A. Ohnishi moved to Yukawa Institute of Theoretical Physics, Kyoto University in April 2008. Dr. N. Otsuka moved to IAEA Nuclear Data Section in February 2008. Three researchers in the JAEA Nuclear Data Center (Drs. J. Katakura, K. Shibata and S. Chiba) are invited to become the visiting professors of the Faculty.

0.2 Budget

Since the regular JCPRG budget ended at March 2001, we have no regular budget. In 2008, 6 million JPY was allocated for Astrophysical nuclear data by Japan Society for the Promotion of Science (JSPS).

1. Data Compilation (NRDF and EXFOR)

We are continuing data compilation for charged-particle nuclear reaction data obtained in Japan.

1.1 Scope

We are scanning 16 journals for Japanese charged-particle and photo-nuclear nuclear reaction data compilation: PR/C, PRL, NP/A, PL/B, EPJ/A, NST, JP/G, NIM/A, NIM/B, PTP, JPJ,

NSE, ARI, RCA, JRN and JNRS.

1.2 NRDF

From April 2007 to March 2008, CPND and PhND in **75 references (1530 records, 8.06MB)** have been newly compiled for NRDF. Usually new data are released at the JCPRG web site several months prior to EXFOR.

1.3 EXFOR

Since the 2007 NRDC meeting, we have made **148 new entries** and have revised or deleted **37 old entries**. These were transmitted as 10 trans files (E049-E055, J007, K003-K004) to the NDS open area. JCPRG is grateful for valuable comments from Svetlana Dunaeva and Otto Schwerer (NDS), Stanislav Maev (CJD) and Vladimir Varlamov (CDFE) on our transmissions as always.

All Japanese CPND entries which mistakes were identified by NDS according to Emmeric Dupont's list were corrected in TRANS.E053.

Compilation of neutron reaction data is outside our compilation scope in principle. But many corrections to neutron entries were proposed by JCPRG in collaboration with JAEA, and revised by the four neutron centres.

1.4 NRDF/EXFOR editor

Entries after 2001 have been compiled and revised by our NRDF/EXFOR editor system (HENDEL) including CHEX.

2. Bibliography Compilation (CINDA)

We have prepared CINDA batches for CPND published in Japan every half year. Each batch covers 6 issues of each of 4 Japanese journals JPJ, PTP, NST and JNRS. Since the 2007 NRDC meeting, two regular batches (**27 added lines and 0 deleted lines**) were prepared and sent to NEA-DB (Reader code J).

Many possible mistakes were found in bibliographic information (volume, page etc.) of the CINDA master file. This year mistakes were identified for totally **638 CINDA lines** for major journals.

3. Database Maintenance (NRDF, EXFOR/ENDF and CINDA)

We are continuing database updates and services for NRDF, EXFOR/ENDF and CINDA.

3.1 NRDF (http://www.jcprg.org/nrdf/)

New compilation, which has been finalized for NRDF, but not for EXFOR, can be obtained from this site. DARPE (another NRDF search and plot system written in Perl) is also available at http://www.jcprg.org/darpe/.

3.2 EXFOR/ENDF (http://www.jcprg.org/exfor/)

EXFOR/ENDF search and plot system is available. This system covers EXFOR as well as major evaluated reaction data libraries.

3.3 CINDA (http://www.jcprg.org/cinda/)

We are developing a new search system of CINDA. This is an extension of EXFOR/ENDF search system mentioned above. A preliminary version of the system is available at http://www.jcprg.org/cinda/.

4. Digitization System – GSYS (http://www.jcprg.org/gsys/)

A Java-based digitizing system "GSYS Ver.2.2" is available in free of charge.

5. XML format for nuclear reaction data

We are interested in describing nuclear reaction data in XML (Extensible Markup Language), which might be a common (meta-) format of nuclear reaction data for various libraries (NRDF, EXFOR, ENDF etc.) and enable us to have common bases of software. Although we do not have any development in this year unfortunately, we carry out this project.

6. Customer services

We provide Japanese researchers in the fields of nuclear physics and nuclear engineering with nuclear reaction data. For more information, we published "Annual Report of Japan Nuclear Reaction Data Centre Vol.1" in March 2008 (Japanese + English abstract, http://www.jcprg.org/annual/annual-e.html). We have also issued a list of newly added data into EXFOR every month (http://www.jcprg.org/exfor/info/recentdata.html) in a CINDA like format.

We have received many comments on EXFOR compilation from Japanese users (mainly JENDL evaluators). These comments have been listed to a table (http://www.jcprg.org/exfor/info/feedbacks.html), and forwarded to other centres.

ANNEX: Organization and members of JCPRG

NRDF Advisory Committee

Yasuhisa ABE (*Research Center for Nuclear Physics, Osaka Univ., Suita, Osaka*)
Yoshinori AKAISHI (*RIKEN, Wako, Saitama*)
Yasuo AOKI (*Univ. of Tsukuba, Tsukuba*)
Mamoru BABA (C*yclotron and Radioisotope Center, Tohoku Univ., Sendai*)
Junsei CHIBA (*Tokyo Univ. of Science, Noda, Chiba*)
Akira HASEGAWA (*NEA Data Bank, Paris*)
Kichiji HATANAKA (*Research Center for Nuclear Physics, Osaka Univ., Suita, Osaka*)
Masayasu ISHIHARA (*RIKEN Nishina Center, Wako, Saitama*)
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Mitsuji KAWAI (*Kyushu Univ., Fukuoka*)
Shigeru KUBONO (*Center for Nuclear Study, Univ. of Tokyo, Tokyo*)
Shunpei MORINOBU (*Research Center for Nuclear Physics, Osaka Univ., Suita, Osaka*)
Hiroyoshi SAKURAI (*RIKEN Nishina Center, Wako, Saitama*)
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Hajime OHNUMA (*Tokyo Institute of Technology, Meguro, Tokyo*)
Koichi OKAMOTO (*Japan Atomic Industrial Forum Inc., Tokyo*)
Hikonojo ORIHARA (*Tohoku Institute of Technology, Sendai*)
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Hajime TANAKA (*Hokkaido Univ., Sapporo*)
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Hiroshi MASUI (*Kitami Institute of Technology, Kitami*)
Hiroshi NOTO (*Hokusei-Gakuen Univ., Sapporo*)
Shigeto OKABE (*Hokkaido Univ., Sapporo*)
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E-mail: services@jcprg.org Internet: http://www.jcprg.org/

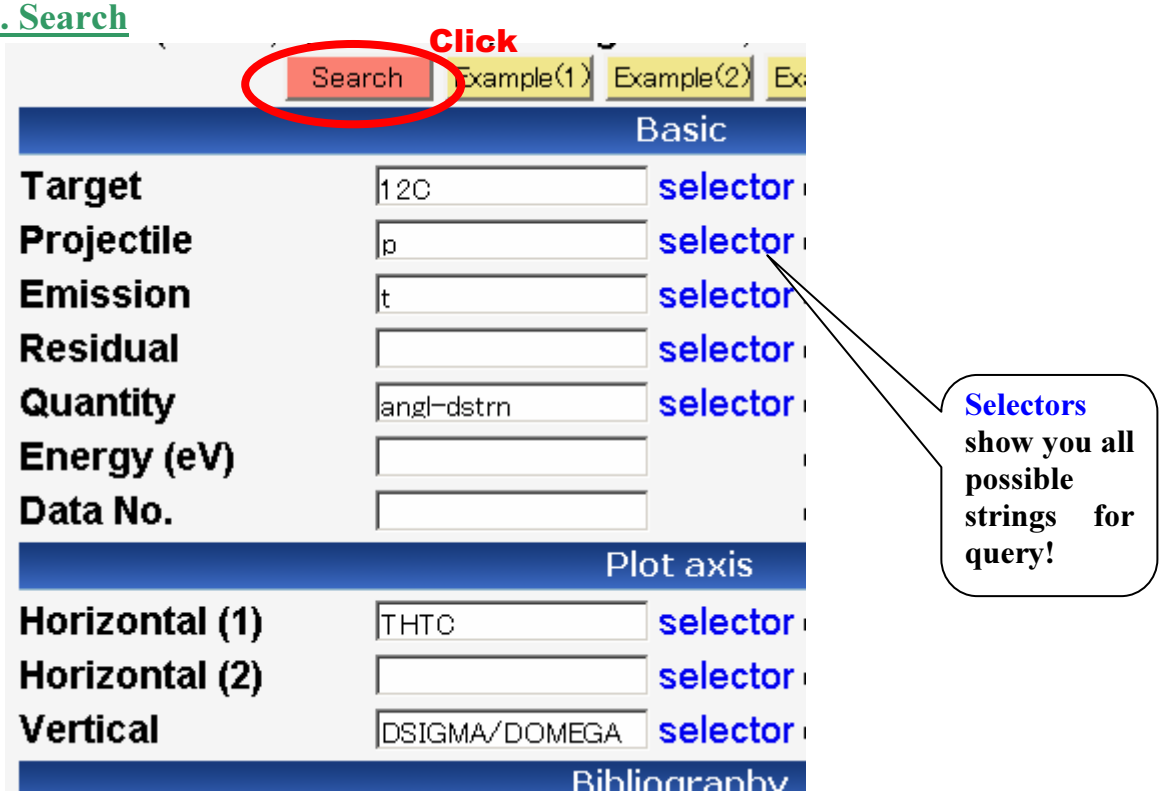
Our product

NRDF search quick guide

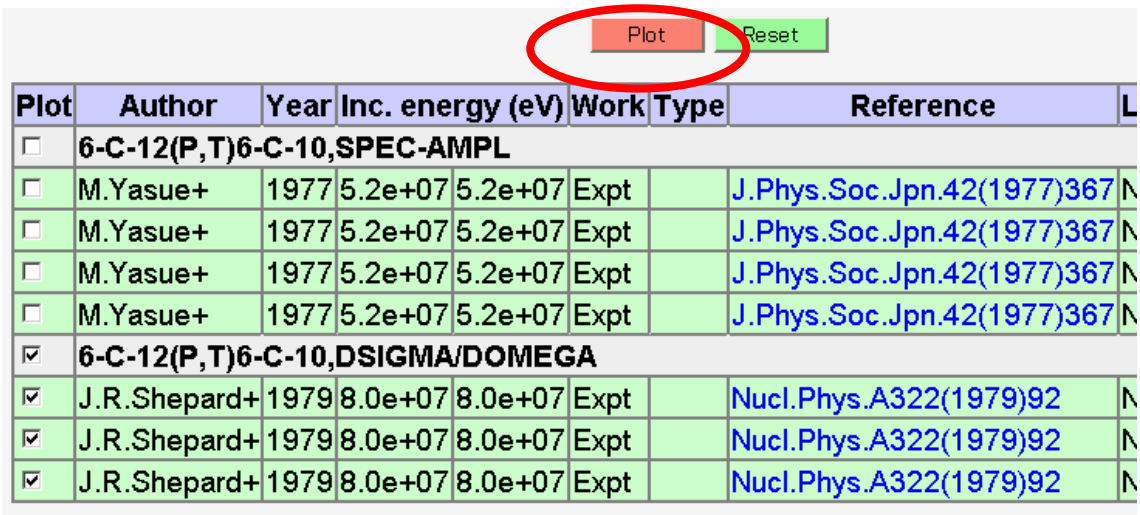
http://www.jcprg.org/nrdf/

(as of June, 2008)

1. Search

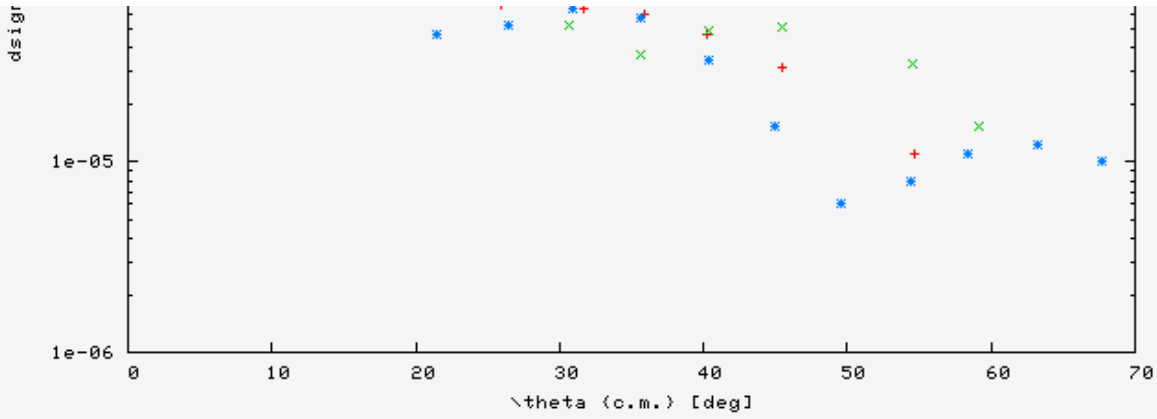


2. Check and plot



Plot	Author	Year	Inc. energy (eV)		Work	Type	Reference	L
☐	6-C-12(P,T)6-C-10,SPEC-AMPL							
☐	M.Yasue+	1977	5.2e+07	5.2e+07	Expt		J.Phys.Soc.Jpn.42(1977)367	N
☐	M.Yasue+	1977	5.2e+07	5.2e+07	Expt		J.Phys.Soc.Jpn.42(1977)367	N
☐	M.Yasue+	1977	5.2e+07	5.2e+07	Expt		J.Phys.Soc.Jpn.42(1977)367	N
☐	M.Yasue+	1977	5.2e+07	5.2e+07	Expt		J.Phys.Soc.Jpn.42(1977)367	N
☑	6-C-12(P,T)6-C-10,DSIGMA/DOMEGA							
☑	J.R.Shepard+	1979	8.0e+07	8.0e+07	Expt		Nucl.Phys.A322(1979)92	N
☑	J.R.Shepard+	1979	8.0e+07	8.0e+07	Expt		Nucl.Phys.A322(1979)92	N
☑	J.R.Shepard+	1979	8.0e+07	8.0e+07	Expt		Nucl.Phys.A322(1979)92	N

3. Customize and replot



Replot

Plot options

point and line type: [color] [monochrome]

Title ^12;6C)C(o.t)

Label x ¥theta [c.m.][deg]
y dsigma/dOmega
z

Legend 1 J.R.Shepard et al.(1979) 1
2 J.R.Shepard et al.(1979) 2
3 J.R.Shepard et al.(1979) 3

Legend ○ left-top ◉ right-top
○ left-bottom ○ right-bottom
○ below ○ not shown

Scale x ◉ linear ○ log
y ○ linear ◉ log
z ○ linear ○ log

Range x -
y -
z -

Angle (3D) θ
φ

Multiplier x 1.0
y 1.0
z

Format ☐ pdf ☐ ps
☐ eps ☐ tgz

Color ◉ color ○ monochrome

(TeX like expression acceptable (e.g. "\theta_{\rm c.m.}" for $\theta_{c.m.}$)

- **You can customize output (title, label, legend, range etc.).**
- **Some TeX symbols can be used.**
- **pdf version is available on your request.**

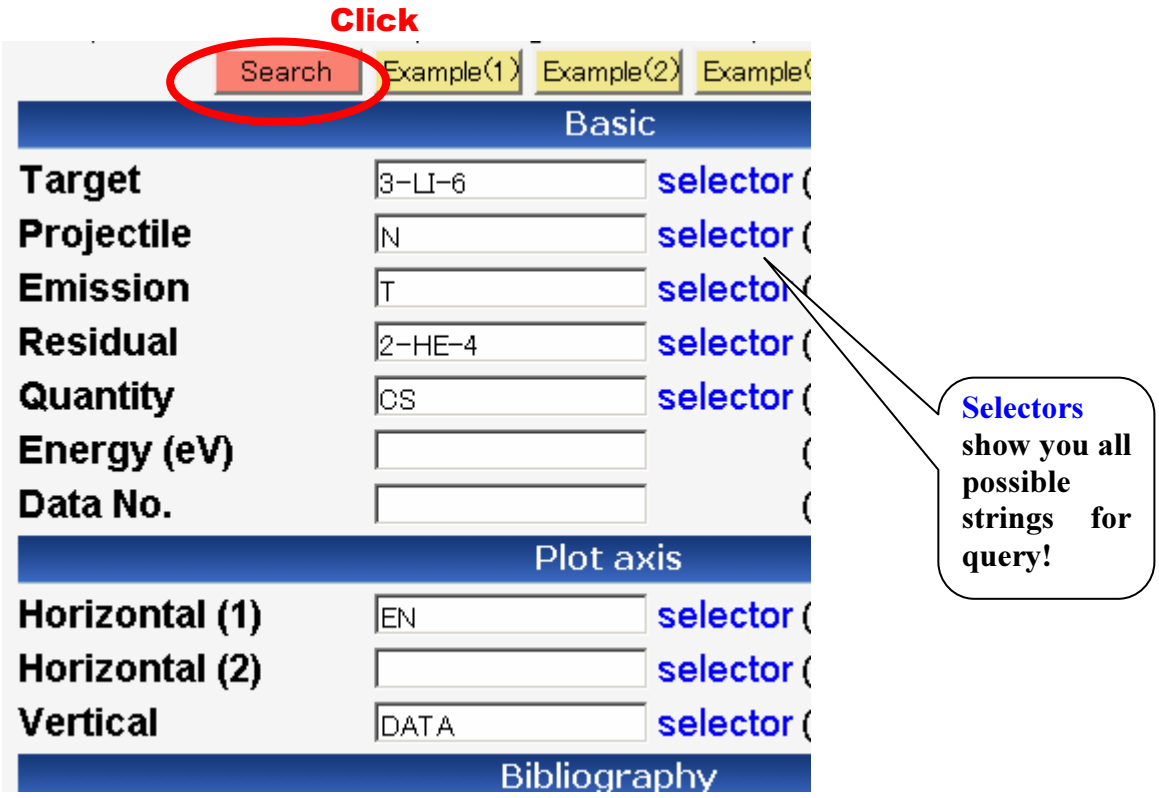
Our product

EXFOR/ENDF search quick guide

http://www.jcprg.org/exfor/

(as of June, 2008)

1. Search



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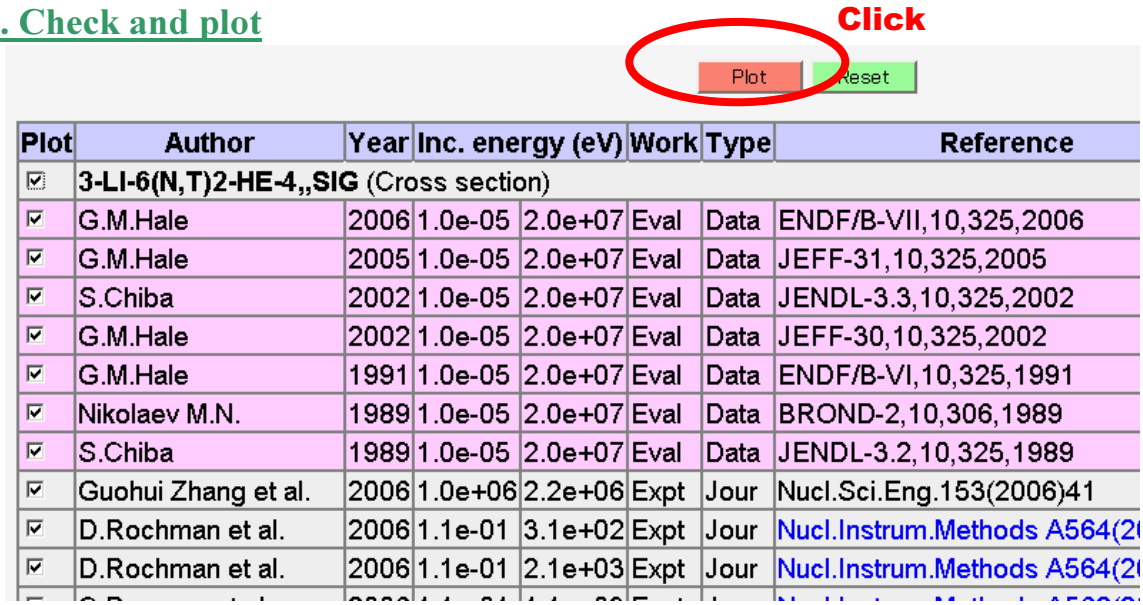
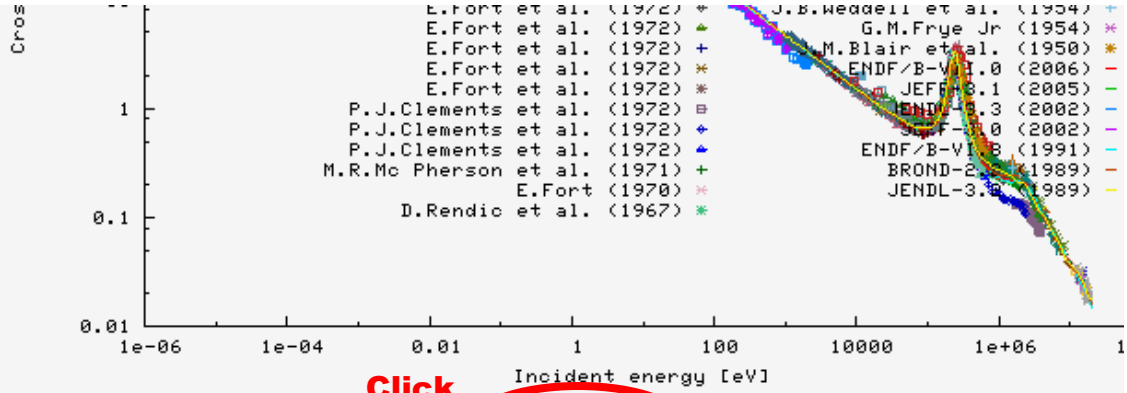


Plot	Author	Year	Inc. energy (eV)		Work	Type	Reference
☑	**3-LI-6(N,T)2-HE-4,,SIG** (Cross section)						
☑	G.M.Hale	2006	1.0e-05	2.0e+07	Eval	Data	ENDF/B-VII,10,325,2006
☑	G.M.Hale	2005	1.0e-05	2.0e+07	Eval	Data	JEFF-31,10,325,2005
☑	S.Chiba	2002	1.0e-05	2.0e+07	Eval	Data	JENDL-3.3,10,325,2002
☑	G.M.Hale	2002	1.0e-05	2.0e+07	Eval	Data	JEFF-30,10,325,2002
☑	G.M.Hale	1991	1.0e-05	2.0e+07	Eval	Data	ENDF/B-VI,10,325,1991
☑	Nikolaev M.N.	1989	1.0e-05	2.0e+07	Eval	Data	BROND-2,10,306,1989
☑	S.Chiba	1989	1.0e-05	2.0e+07	Eval	Data	JENDL-3.2,10,325,1989
☑	Guohui Zhang et al.	2006	1.0e+06	2.2e+06	Expt	Jour	Nucl.Sci.Eng.153(2006)41
☑	D.Rochman et al.	2006	1.1e-01	3.1e+02	Expt	Jour	Nucl.Instrum.Methods A564(2
☑	D.Rochman et al.	2006	1.1e-01	2.1e+03	Expt	Jour	Nucl.Instrum.Methods A564(2

3. Customize and replot



Click

Replot

Plot options

point and line type: [color] [monochrome]

Title ^6Li(n,t)^4He

Label x Incident energy [eV]
y Cross section [b]
z

Legend left-top right-top left-bottom right-bottom below not shown

Scale x linear log
y linear log
z linear log

Range x - y - z -

Angle (3D) θ 50
φ 130

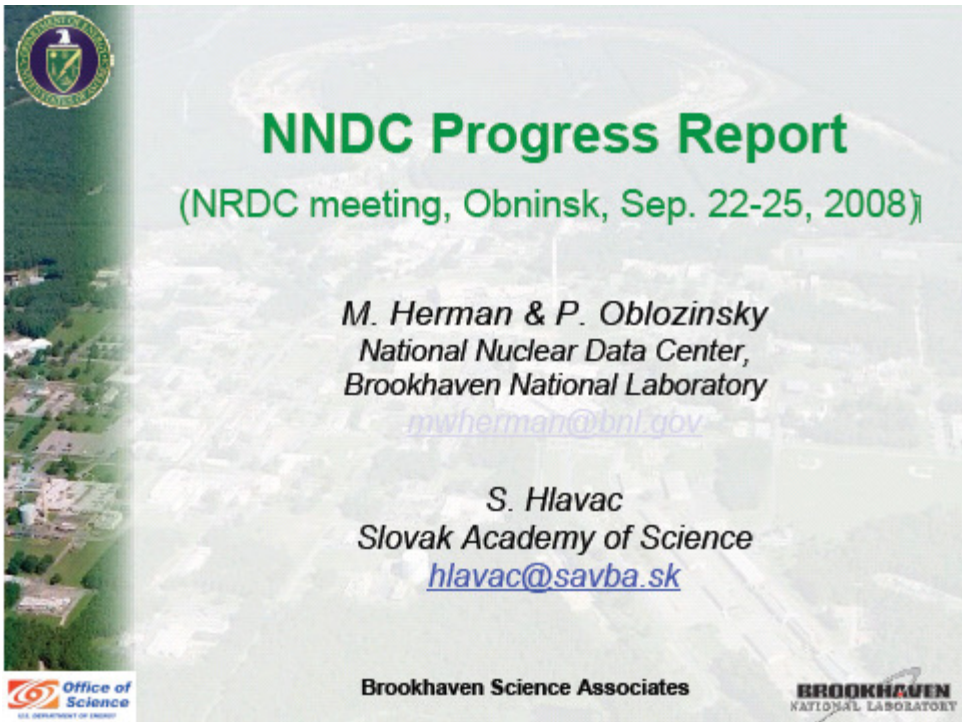
Multiplier x 1.0
y 1.0
z 1.0

Format pdf ps eps tgz

Color color monochrome

Legend

1	ENDF/B-VII.0 (2006)	1
2	JEFF-3.1 (2005)	2
3	JENDL-3.3 (2002)	3
4	JEFF-3.0 (2002)	4
5	ENDF/B-VI.8 (1991)	5
6	BROND-2.2 (1989)	6
7	JENDL-3.2 (1989)	7
8	Guohui Zhang et al. (2006)	8
9	D.Rochman et al. (2006)	9
10	D.Rochman et al. (2006)	10
11	C.Romano et al. (2006)	11
12	Guohui Zhang et al. (2003)	12
13	Guohui Zhang et al. (2000)	13
14	M.Drosg et al. (1994)	14
15	E.Goldberg et al. (1985)	15
16	C.M.Bartle et al. (1983)	16



NNDC Staff Changes

- Reaction data
  - Marco Pigni (covariances, ENDF evaluation) joined in January 2007 as a postdoc
  - Dimitri Rochman (EXFOR compilation, covariances, ENDF evaluations) left NNDC in August 2007
  - Stanislav Hlavac & Otto Schwerer joined EXFOR compilation effort as external contractors
  - Caleb Mattoon (covariances, ENDF evaluation) joined in August 2008 as a postdoc
- Structure data
  - David Winchell (NSR, ENSDF database) left NNDC in May 2007
  - Manojeet Bhattacharya (NSR) joined NNDC in April 2007
  - Thomas Burrows (ENSDF evaluation) passed away on July 1, 2008 (replacement in progress)
  - New postdoc (ENSDF evaluation) expected in January 2008

ENDF/B-VII.0 Library

Major contributors

- LANL (actinides, light nuclei, thermal neutron scattering)
- BNL (fission products resonances & fast, decay data)
- ORNL (resonances)

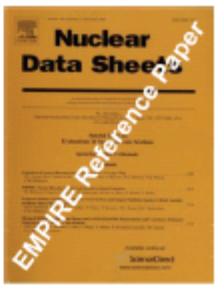
44 citations (SCOPUS)

ENDF/B-VII.0 Contents

No.	Sublibrary	Materials in B-VII	Materials in B-VI	Comment
1	Photonuclear reactions	163	-	**New sublibrary**
2	Photo-atomic	100	100	Taken from VI.8
3	Radioactive decay	3830	979	**New evaluations**
4	Spontaneous fission yields	9	9	Taken from VI.8
5	Atomic relaxation	100	100	Taken from VI.8
6	**Neutron reactions**	387	328	**Many new evaluations**
7	Neutron fission yields	31	31	Taken from VI.8
8	Thermal neutron scattering	20	15	**Some new evaluations**
9	Standards	8	8	**New evaluations**
10	Electro-atomic	100	100	Taken from VI.8
11	Proton reactions	48	35	Some new evaluations
12	Deuteron reactions	5	2	Some new evaluations
13	Triton reactions	3	1	Some new evaluations
14	He-3 reactions	2	1	Some new evaluations
	Full library	4812	1709	

EMPIRE Code
(extensive changes in EMPIRE-3.0)

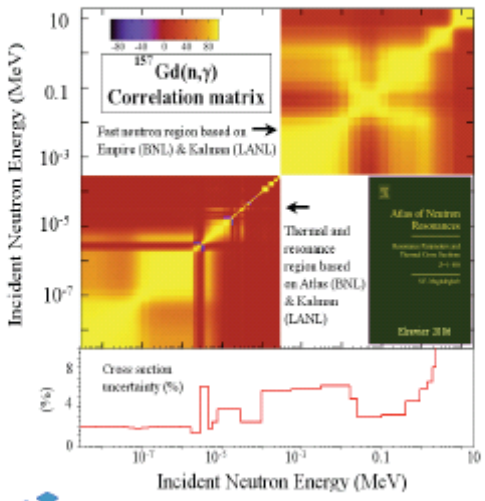
- new model for multi-modal fission through multi-hump barrier
- new parameterization of EMPIRE-specific level densities (RIPL-3)
- parity dependent microscopic HFB level densities (RIPL-3)
- deformed Multistep Direct
- prompt fission neutron spectra
- optical model database updated (RIPL-3)
- discrete level database updated (RIPL-3)
- ECIS updated to the 2006 version
- **KALMAN and Monte Carlo methods for covariances in fast neutron range**
- **resonance module including covariances (Atlas => MF2, MF32)**
- ENDF-6 formating of radionuclide production
- publication quality ZVView plots



Nucl. Data Sheets
Vol. 108, p. 2665 (2007)
8 citations (SCOPUS)

Next release:
EMPIRE-3.0 (Arcola)

Covariances:
full energy range capacity of EMPIRE

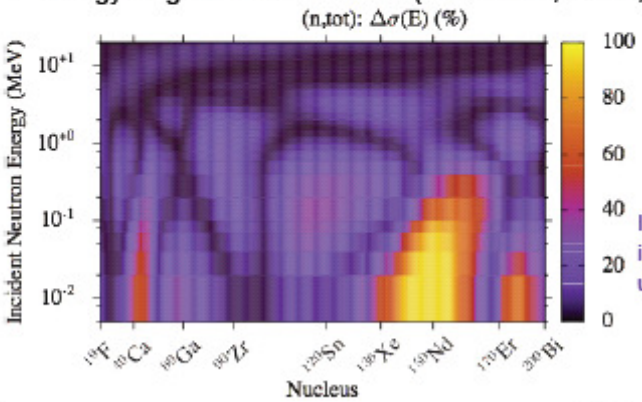


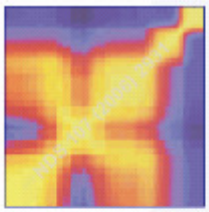
BNL methodology

- Resonance region
  - Atlas of Neutron Resonances - parameters and uncertainties for 381 isotopes
  - Adjustment to thermal uncertainties with Kalman filter
  - Resonance module to produces MF32
- Fast neutron region
  - RIPL library of model parameters
  - EMPIRE code calculates sensitivity of cross sections to the parameters
  - KALMAN code propagates parameter uncertainties onto cross sections and combines them with the experiment
  - MF33 is produced

Covariances: 'low-fidelity' project

- Simple estimates of cross section covariance data generated at NNDC and LANL for **all materials** in the neutron sublibrary of ENDF/B-VII.0
- Energy range of 5 keV - 20 MeV (M. Williams, ORNL, estimates below)





Workshop on Neutron Cross Section Covariances

June 24-27, 2008 – Port Jefferson, New York, USA

Organized by NNDC (Oblozinsky, Songzoni, Herman)

Oral talks: 35 Posters: 8

Topics

- *Covariance evaluation methodology*
- *Recent covariance evaluations*
- *User's perspective*

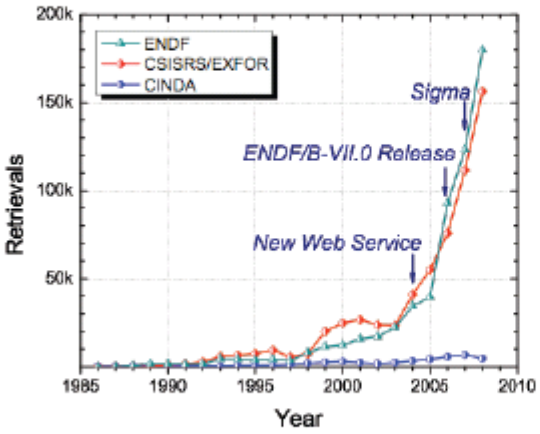
Results

- *The strong interaction between data producer and data user communities*
- *Great progress in developing and applying new evaluation methodologies*
- *Newer evaluations are including covariances*

Proceedings to be published in Nucl. Data Sheets, December 2008 (35 papers, about 200 pages)

NNDC reaction data services

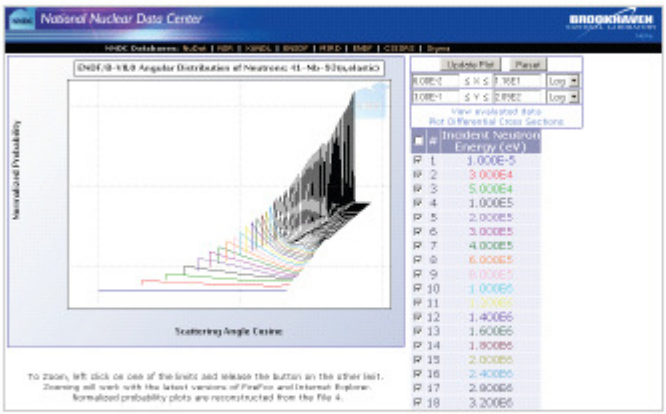
Nuclear Reaction Web Services at NNDC



- Strong increase for ENDF and CSISRS/EXFOR (~35% in FY2008)
- CINDA is marginal
- Comparable number of retrievals for ENDF and EXFOR
- New products boost retrievals
- Total number of retrievals from NNDC databases = 1.8M in FY2008

SIGMA: new ENDF retrieval & plotting system

Developed by A. Songzoni and B. Pritychenko (NNDC)



Recent release April 2008

- Plots of angular distributions

SIGMA: new ENDF retrieval & plotting system

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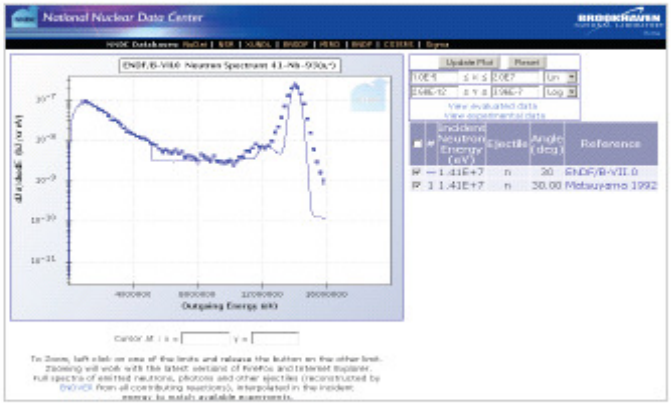
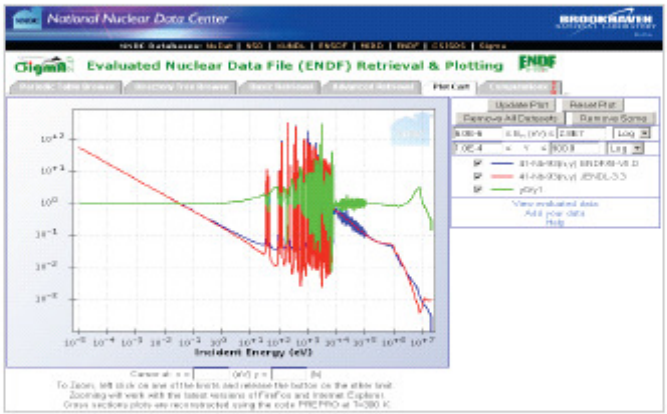


Recent release April 2008

- Plots of angular distributions
- Plots of neutron and photon spectra (ENDVER package)

SIGMA: new ENDF retrieval & plotting system

Developed by A. Songzoni and B. Pritychenko (NNDC)



Recent release April 2008

- Plots of angular distributions
- Plots of neutron and photon spectra (ENDVER package)
- Mathematical operations on MF3

EXFOR compilation at NNDC

- NNDC EXFOR compiler has not been replaced with a permanent staff member
- Compilation effort outsourced
  - Stanislav Hlavac (Institute of Physics, Slovak Academy of Sciences, Bratislava, Slovakia) compiles EXFOR entries since Nov. 1, 2007
  - Otto Schwerer, (retired from NDS, IAEA, Vienna, Austria) reviews new entries since April 1, 2008
- NNDC is planning to follow this arrangement for the next few years

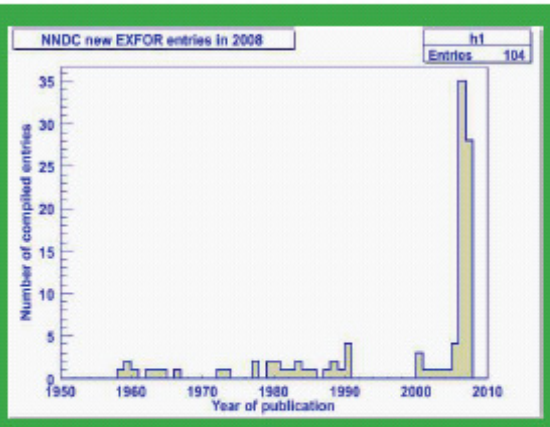
CSISRS/EXFOR data compilation at NNDC 2007/2008

- Staff
  - S. Hlavac from Nov. 1 2007 (compilation)
  - O. Schwerer from April 1, 2008 (checking, consulting)
  - Additional help from NNDC, IAEA NDS
- Compilation
  - EXFOR editor, standard editor for editing entries
  - Gsys2.2 used for digitalization of data in figures
- Papers compiled
  - Recent publications
  - Old publications

Number of compilations

Incident partic	TRANS/PRELIM	No. of Entries	No. of Subentrie
N	Trans.1345	4	38
N	Trans.1346	6	138
N	Trans.1346	3	41
N	Trans.1346	5	27
N	Prelim.1349	4	23
N	(Prelim.1350)	9	49
N	**Subtotal**	**31**	**316**
CP	Trans.c082	5	15
CP	Trans.c083	6	37
CP	Trans.c084	10	72
CP	Trans.c085	6	68
CP	Trans.c086	11	156
CP	Trans.c087	8	109
CP	Prelim.c088	17	160
CP	(Prelim.c089)	7	105
CP	**Subtotal**	**70**	**722**
G	Prelim.L011	2	6
G	(Prelim.L012)	1	12
G	**Subtotal**	**3**	**18**
	TOTAL	**104**	**1056**

Year of experimental data publication



Approximately 1/3 of compiled entries were published before 2007

Comparison with previous period

Reaction	2006/7	2007/8
(*,*)	145	104
(n,*)	36	31
(p,*)	30	18
(d,*)	23	7
(a,*)	13	9
(He3,*)	7	10
(t,*)	4	2
(Hl,*)	32	24
(g,*)	0	3
No of subentries	638	1056
No of digitized subs		621

Nuclear Data Evaluation Lab. (NDEL) of Korea Atomic Energy Research Institute (KAERI)

Progress Report of 2007/2008 to the

IAEA Technical Meeting on the Network of Nuclear Reaction Data Centres

22-25 September, 2008

Young-Ouk LEE (yolee@kaeri.re.kr)

Web: http://www.atom.kaeri.re.kr

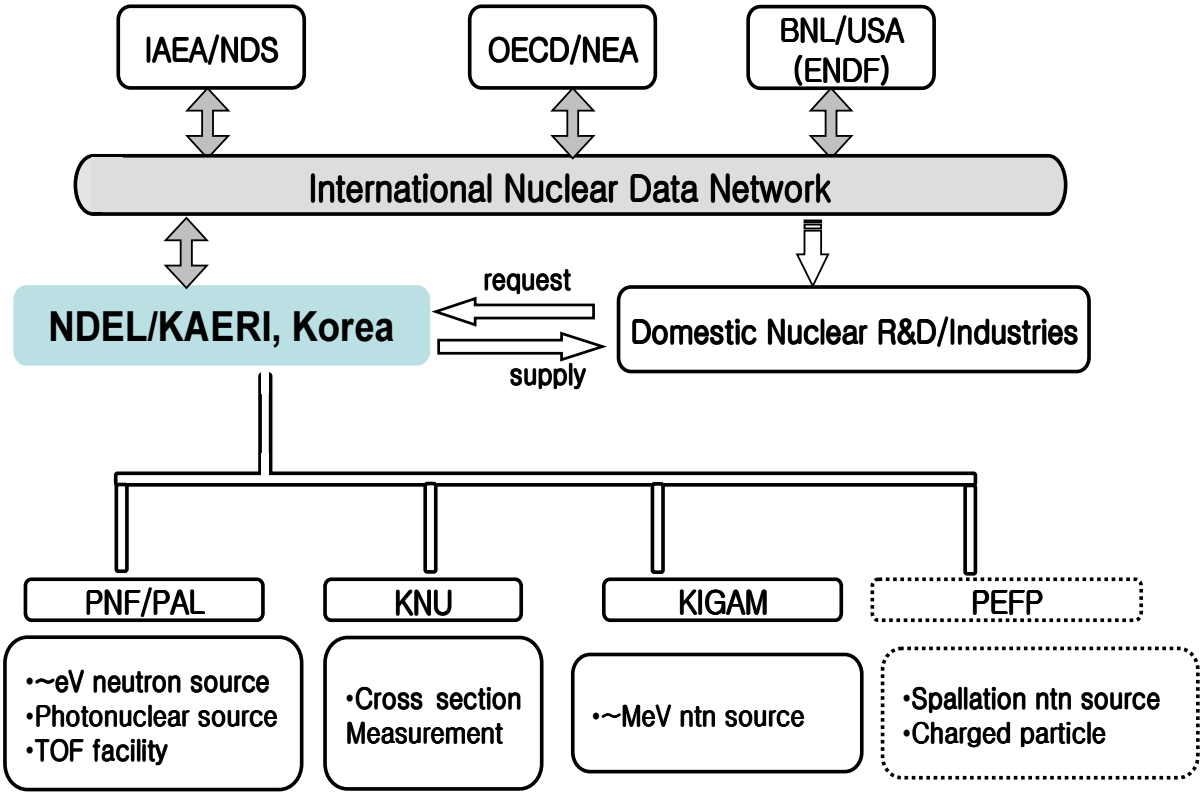
0. General

Nuclear Data Evaluation Laboratory (NDEL) of Korea Atomic Energy Research Institute (KAERI) has 7 staffs and 1 Secretary (Evaluation 3, Processing and Benchmark 4). Mission of NDEL includes disseminating outcomes of international network as well as promoting domestic activities related to nuclear data.
KAERI/NDEL has been established in 1997, and has been funded by government as one of the nuclear energy development program. It was recently decided by Korean government that **KAERI/NDEL be funded by a more stable and steady source of budget from the fiscal year of 2009. This decision will secure and expand activities of KAERI/NDEL, and lead to more contribution to the international nuclear data network.**

Nuclear data needs are mainly from following major nuclear R&D programs:

- **Advanced Reactor Development** (Liquid Metal Fast Reactor and High Temperature Gas Cooled reactor Supercritical Water Reactor) requires quantification of cross section uncertainties in their reactor designs.
- **Advanced Fuel Cycle** needs up-to-date neutron cross sections of MA and fission products.
- **Proton accelerator development** requires high energy neutron and proton nuclear data relevant to the radiological safety and beam application of the accelerator
- Usual activities for **the nuclear power plant operation, medical isotope production and the radioisotope applications**, are requesting up-to-date nuclear data

KAERI/NDEL is performing nuclear data evaluation, multi-group library processing, and validation which are required by the above mentioned R&D program in Korea. For measurement of nuclear reaction data, KAERI/NDEL is coordinating measurements of Pohang Neutron Facility (PNF) of Pohang Accelerator Laboratory (PAL), Van de Graff laboratory of Korea Institute of Geosciences and Mineral Resources (KIGAM), and MC-50 Cyclotron at Korea Institute of Radiological and Medical Sciences (KIRAMS)


IAEA/NDS
OECD/NEA
BNL/USA
(ENDF)
International Nuclear Data Network
NDEL/KAERI, Korea
request
supply
Domestic Nuclear R&D/Industries
PNF/PAL
KNU
KIGAM
PEFP
•~eV neutron source
•Photonuclear source
•TOF facility
•Cross section
Measurement
•~MeV ntn source
•Spallation ntn source
•Charged particle

2. Facilities and Measurements

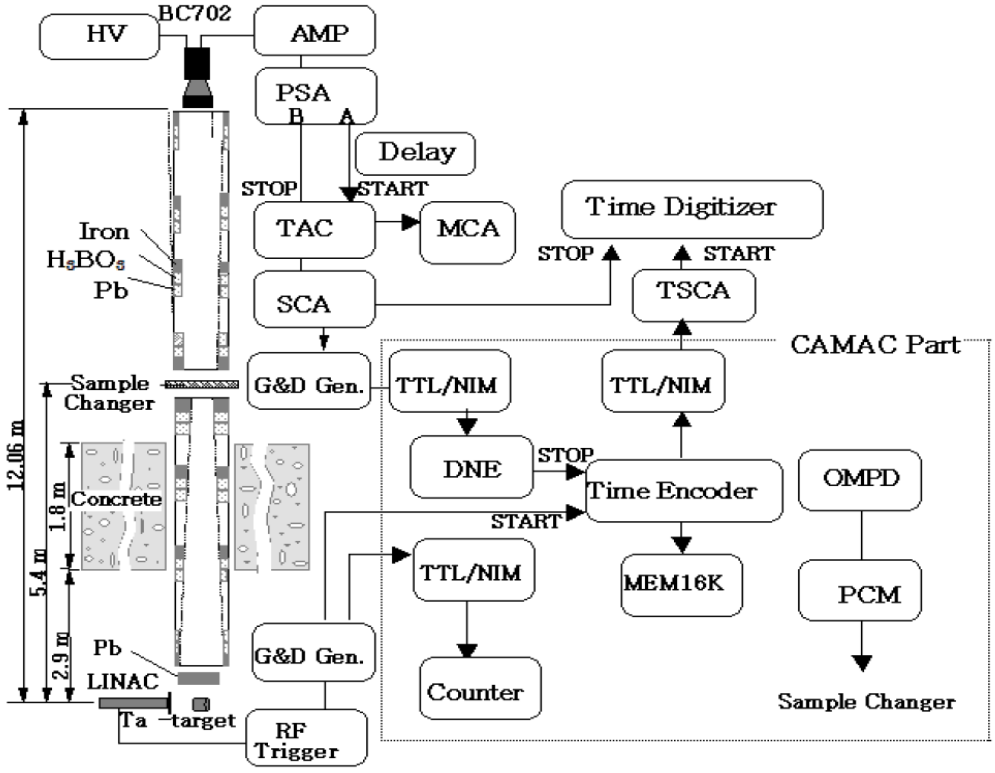
2.1 Pohang Neutron Facility of PAL (Y.D. Oh, ydoh@postech.ac.kr)

Specifications:

- electron energy = 50 - 75 MeV
- repetition rate = 10 ~ 15Hz, pulse width = 1 ~ 2 μs
- peak beam current = 30 ~ 50 mA
- TOF flight length = 12m
- Target + water moderator to produce neutron pulse
- Ta plates + cooling system
- Detector : scintillator + PM tube
- BC702 [6Li-ZnS(Ag)]Thickness 1.6cm , diameter 12.5cm
- Sample changer consisting of remotely controlled 4 sample holders.

Measurements:

- The total cross sections of natural Pd, Nb, Mo, Er , Fe using TOF method.
- The resonance parameters of Pd, Nb, Mo , Er were determined using SAMMY code
- Nuclear spectroscopic data for Fe, Zr, Y, Bi, Cu with 50, 60, 70 MeV bremsstrahlung



2.2 Van der Graaf of KIGAM (G.D. Kim, gdkim@kigam.re.kr)

Specifications:

-monoenergetic pulsed neutron beam for energies 500 keV ~ 2.2 MeV with TOF system

-based on Van den Graaf with bunching and pulsing

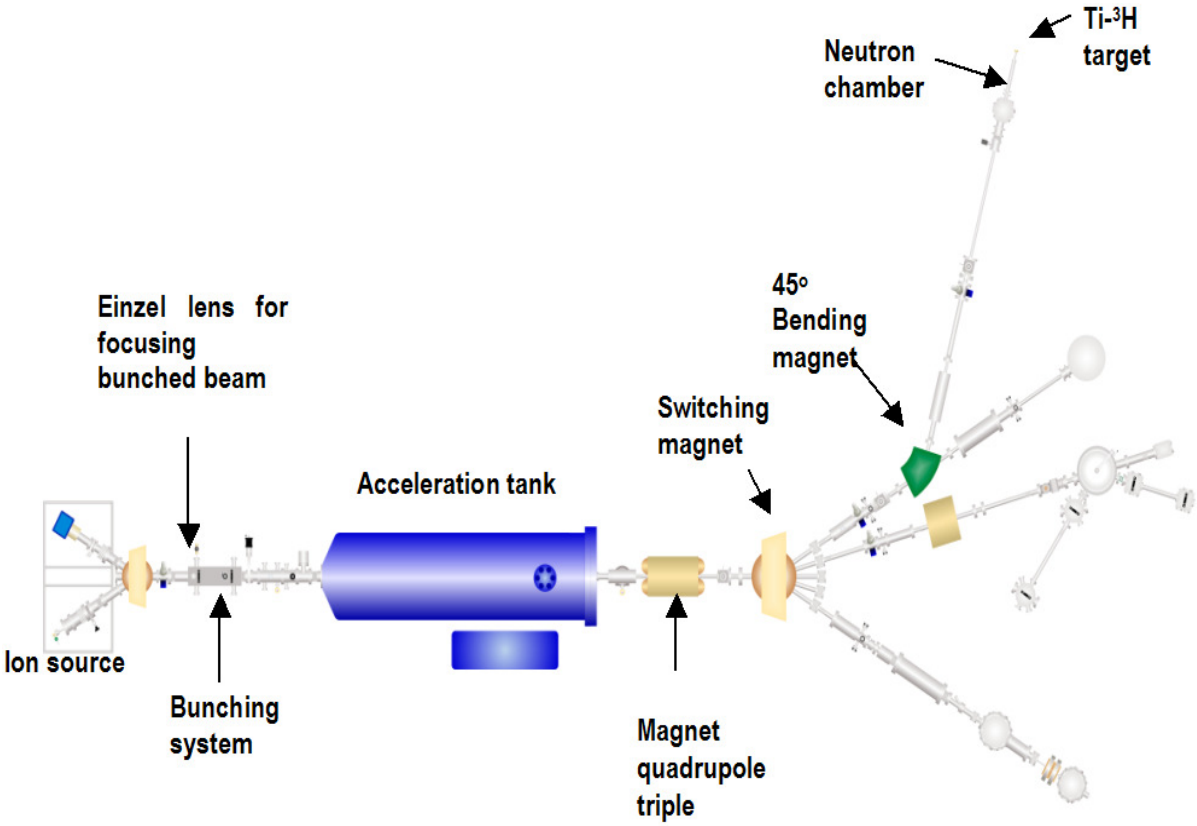
-^{7}Li(p,n) reaction with 10^{6}~10^{7} neutrons/sec and FWHM < 5 %

-pulsed beam with period 125 ns, width 1-2ns, Time Pick up detecting system

-two plastic detectors (3"x 1 cm).

Measurements:

-neutron total cross sections on ^{197}Au, ^{28}Si, and ^{27}Al are measured and being analyzed for neutron energies below 1 MeV



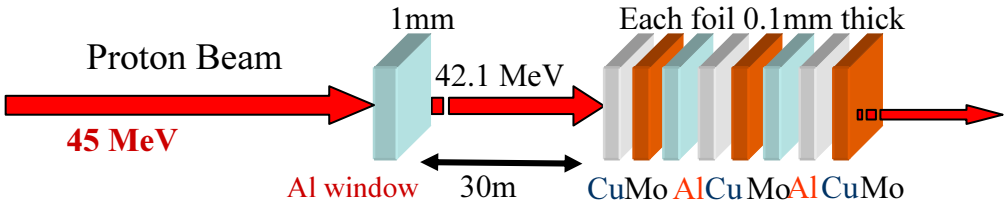
2.3 MC-50 of KIRAMS (GN Kim, gnkim@knu.ac.kr)

Specifications:

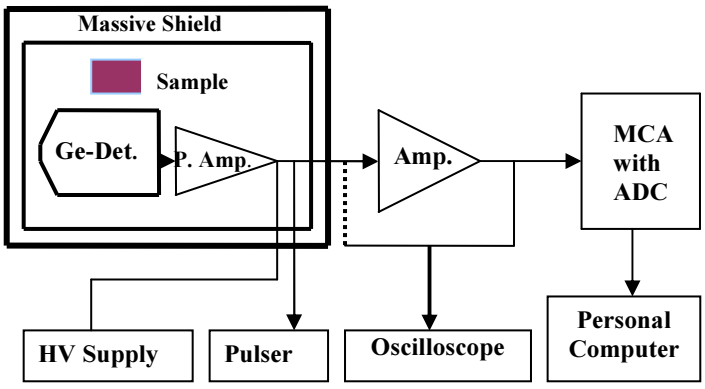
-azimuthally-Varying Field-Type MC-50 cyclotron
-proton beam Energy : ~ 45 MeV, Beam current : < ~ 50 nA
-used for neutron therapy with Be(p,n) reaction and radioisotope production.

Measurements

-Proton induced reaction cross-sections on ^{nat}Sn, ^{nat}Cd, ^{nat}Zr, ^{nat}Ag and ^{nat}Pd



Schematic diagram of stacked-foil activation technique



Electronic block diagram of γ-ray spectrometry

3. Evaluation and Benchmark (Y.-O. Lee, yolee@kaeri.re.kr)

Tungsten is considered as a prime candidate of plasma facing materials (PFM) in fusion environment. However the neutronics calculations using the existing libraries show large discrepancies with measurements of several benchmarks such as SINBAD fusion benchmarks (Oktavian, FNS, FNG) and ICSBEP fast reactor ones. In response to this situation, neutron cross sections for $^{180,\ 182,183,184,186}$W were evaluated in the neutron-incident energy range from 0.1 MeV to 100 MeV using the nuclear reaction model code EMPIRE-2.19 with a consistent set of input parameters for all tungsten isotopes.

Validation of tungsten cross sections in ENDF-6 format was performed through shielding and criticality safety benchmarks with the MCNPX code. The calculation results based on the new evaluations have been compared with those based on the ENDF/B-VII.0, JEFF-3.1, JENDL-3.3, and FENDL-2.1 as well as the benchmark experiments.

Resonance Module in EMPIRE has been improved to allow the evaluation of covariance data in cooperation with BNL/NNDC. The updated module has a capability of writing the MF32 covariances in the compact format. It first generates the sensitivity matrix for the resonance parameters. The sensitivity matrix is obtained by repeatedly adjusting parameters and calculating the variances of the resultant cross sections. Then, KALMAN code is jointly used for the calculation of the correlation coefficients based on the sensitivity matrix. These steps are automatically processed and controlled by the resonance module.

MATXS-format 150-group neutron libraries for fast reactors have been generated and updated based on the ENDF/B-VII.0, JEFF-3.1, and JENDL-3.3. The libraries have been validated through the 18 fast benchmark experiments from the CSEWG benchmark specifications and BFS critical assemblies. Now, the libraries named as KAFAX-E70, KAFAX-F31, and KAFAX-J33 are being distributed from the NEA Data Bank.

ANISN-format neutron library was provided for the design the conceptual design of a DEMO Tokamak reactor system. It is based on the FENDL-2.1 and incorporated into a one-dimensional neutronics code to optimize various reactor parameters such as the TBR, nuclear heating, radiation damage, etc.

CJD: Progress Report, 2007/2008

A.I.Blokhin, A.V.Ignatyuk, V.N.Manokhin, M.V.Mikhaylyukova,
V.G.Pronyaev, K.I.Zolotarev,

1. Staff

Total number of staff in the CJD is 9.
This is divided into 6 professional staff and three support staff.

2. Data Compilation

2.1. EXFOR activity

New and revised entries / subentries since the 2006/2007 NRDC meeting

Trans number	Date/status	# Entries	# Subents total	# Subents new
4144	2008-09-15/ prelim	11	118	18
4143	2008-07-21	29	244	36
4142	2008-02-08	20	100	35
4141	2007-09-29 final	23	118	26
Sum		**83**	**580**	**115**

2.2. CINDA activity.

New issue of CINDA (CD-disks) was distributed through the users in different institutes (Rosatom).

3. Publications

In during 2006-2007 two issues of the journal "Yadernye Konstanty" were prepared and printed. The 2008 issue of YK is in compilation.

4. Nuclear Data Services

The nuclear data services are provided through direct contact with the users from the Russian organizations. Mainly the compilation of the evaluated data of the different types is needed.

5. NUCLEAR DATA EVALUATION Activity

1. BROND-3 – preparation of new evaluated data files, compilation and processing and integral testing. A proposal for the fission product data library is done and data are in analysis and compilation.

A paper with a description of this activity is prepared for a publication in YK-2008.

2. BROND-3/FPYLD including evaluated neutron data files for 28 fissile systems was prepared.

A description of these data is prepared for a publication in YK-2008..

3. New version of the Russian Reactor Dosimetry File is prepared and now it is under the compilation and benchmark testing. Evaluated data files were made for the 42 reactions with the covariance matrices. Some of them were included into the IRDF-2002/2005 compiled by the NDS. New evaluated data sets were prepared in during 2007-2008. A latest development includes files for ^{139}La(n,g) and ^{197}Au(n,g) with full covariance matrices of uncertainties and files of ^{235}U(n,f), ^{238}U(n,g), ^{238}U(n,f) and ^{239}Pu(n,f) with covariance matrices obtained from the ORNL evaluation in resonance region and standards evaluation at high energy. A complete list of data required for a practical application in fission power and research reactors is compiled. It includes a required data set for 86 element/reactions.

4. CJD was engaged in re-evaluation and preparation of evaluated neutron data for minor actinides and fission products for the RUSFOND Library which is a base for the ABBN group constant system. The correction, processing and testing of modified evaluated data files is under way.

A paper with a description of this activity is prepared for a publication in YK-2008.

5. New evaluated data for ACDAM library for the activation/damage calculations is compiled in the Russian Nuclear Data Center and consists from three parts:
    a. *Activation/transmutation neutron cross-section base (*From the element H (A=1) to Po (A=210), in the neutron energy range 10^{-5} to 20- MeV and it includes 704 target isotopes with data presentation: in ENDF-6 format. New data for ~1200 neutron reaction data sets.
    b. *Decay Data Library (DeDaL)*
    c. *Damage Data Library (DDL)* (74 elements/isotopes in the neutron energy range 10^{-5} to 20- MeV. The data for main structural elements and basic impurities involved in alloys and steels are included in the DDL in ENDF-6 format.

A paper with a description of this activity is prepared for a publication in VANT, series "New materials", 2008 (Moscow, VNIINM named by Bochvar).

6. Evaluated data files for actinides from the ENDF/B-VI, ENDF/B-VII< JEFF-3.1, BROND, EAF libraries were analyzed and the recommendations for a transmutation calculations were made.

The paper "ATLAS of nuclear neutron cross sections for actinides" including ~400 plots with intercomparison was prepared and will be printed as a special issue.

Working Papers for the 2008 NRDC Meeting in Obninsk and Moscow, September, 2008

WP2008-1		Conclusions and Actions of the 2007 NRDC Meeting
WP2008-2	N.Otsuka	Review of corrections since the 2007 NRDC meeting
WP2008-3	N.Otsuka	NRDC action to the list of EXFOR outliers
WP2008-4	S.Dunaeva	New and revised entries / subentries since the 2007 NRDC meeting (9 September 2008)
WP2008-5	S.Dunaeva	Statistics of checking preliminary transes
WP2008-6	S.Dunaeva	Usage of alteration flag into column 11 of ENTRY and SUBENT records
WP2008-7	N.Otsuka, S.Dunaeva H.Henriksson	REFERENCE coding (JPR/C, JP/S, JP/GL) and revision of of page format rule for report (Memo CP-D/508, CP-N/069)
WP2008-8	N.Otsuka O.Schwerer	Revised EXFOR Basics, EXFOR Formats, LEXFOR, EXFOR/CINDA Dictionary (CP-D/498, CP-D/505)
WP2008-9(Rev.)	R.Capote Noy, N.Otsuka	Level density compilation (CP-D/512 Rev.)
WP2008-10	V.Zerkin, S.Dunaeva	Short analysis of IAEA-NDS EXFOR DB errors report
WP2008-11	N.Otsuka, S.Dunaeva	Usage and explanation of uncertainty headings
WP2008-12	S.Dunaeva, N.Otsuka	Status of new compilation and procedure for creation CINDA reference
WP2008-13	N.Otsuka A.Mengoni	EXFOR completeness for neutron data published in Phys. Rev. C (CP-D/513)
WP2008-14	S.Dunaeva	Status of list of missing EXFOR data for medical CRP
WP2008-15	S.Dunaeva, V.Zerkin	Statistics of compilation 2006-2008
WP2008-16	N.Otsuka, V.Zerkin	New NRDC Webpage
WP2008-17	S.Dunaeva	List of Entries with incorrect reference on Phys. Rev. B
WP2008-18	N.Soppera	EXFOR-2008-05-16JANIS Import Log
WP2008-19	H.Henriksson	CINDA reader code updates and miscellaneous mistakes (CP-N/070)
WP2008-20	V.Zerkin	References in EXFOR and connection to other databases (actions A14, A15)
WP2008-21	N.Otsuka, H.Henriksson	Split of Dictionary 144 (Data libraries for New CINDA) (CP-D/515)
WP2008-22	N.Otsuka, H.Henriksson	Evaluated data library under MONIT-REF and REL-REF (CP-E/126)
WP2008-23	N.Otsuka	Tensor polarization and initial state spin correlation (Action A25, CP-D/520)
WP2008-24	N.Otsuka	4-momentum transfer squared (Action A29, CP-E/125,)

WP2008-25	N.Otsuka, V.Pronyaev	Total/Elastic cross sections compiled in EXFOR CPND entries (CP-D/521)
WP2008-26	S.Dunaeva, V.Zerkin	Public version of the "current compilation" webpage (Action A9)
WP2008-27	N.Otsuka, S.Dunaeva	Reaction Product Field (SF4) for Quantities at Resonance (CP-D/509)
WP2008-28	V.Zerkin	Web retrieval tool supporting citation of EXFOR data
WP2008-29	V.Zerkin	New IAEA-NDS front page
WP2008-30	V.Zerkin	EXFOR Evaluating System: reasons, ideas and proposals to WPEC SG-30
WP2008-31	M.Mikhaylyukova, V.Pronyaev	EXFOR entries corrections: important points
WP2008-32	NDS	Draft revision of NRDC Protocol (Memo CP-D/523)
WP2008-33	H. Murakami, K. Kato	Coding mistakes in CINDA lines (Memo CP-E/136)
WP2008-34(Rev.)	S.Dunaeva	Change NRDC compilation responsibilities to dedicated journal coverage (CP-D/525)
WP2008-35(Rev.)	S.Dunaeva, O.Schwerer, N.Otsuka	INSTITUTE code and Author's list in EXFOR entry (CP-D/524)
WP2008-36	H.Henrikson	CINDA load errors and illegal format usage
WP2008-37	V.Zerkin	Full EXFOR in C4 format: delivery to WPEC group SG-30
WP2008-38	V.Zerkin	Proposal for a Common NRDC EXFOR Web Service

Note: The working papers are available online from http://www-nds.iaea.org/nrdc/nrdc_2008.

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