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INDC International Nuclear Data Committee

Summary Report on

Technical Meeting of the

International Network of Nuclear Reaction Data Centres

IAEA, Vienna

25 - 26 May 2009

Prepared by

Svetlana Dunaeva, Naohiko Otsuka
IAEA Nuclear Data Section, Vienna, Austria

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Otto Schwerer, Vienna, Austria

August 2009

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Abstract

An IAEA Technical Meeting of the International Network of Nuclear Reaction Data Centres was held at the IAEA Headquarters in Vienna from 25 to 26 May 2009. The meeting was attended by 23 participants from 13 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.

August 2009

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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 Nuclear Reaction Data Centre, 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
BARC	Bhabha Atomic Research Centre, Trombay, Mumbai, India

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), "Nuclear Reaction Data Centres Network".

PREVIOUS NRDC MEETINGS

Vienna, 25-26 May 2009	Technical	INDC(NDS)-0558
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
BARC	Bhabha Atomic Research Centre, Mumbai,India
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 Nuclear Reaction Data Centre (formerly 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

ORDER	EXFOR program for addition of record identification and bookkeeping information
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

Monday, 25 May 2009

Plenary: 10:00 - 13.00

1. General

1.1	Welcome address	10 min		
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	3 hours		

Plenary: 14:00

1.4	Review of General Actions from the 2007 Meeting (A1-A8)	20 min	WP2009-1	S. Dunaeva
2.	**EXFOR General (also Actions A9-A36)**		WP2009-1	S. Dunaeva
2.1	Quality Control - errors			
2.1.1	Review of corrections since the 2008 NRDC meeting (Action A50, A60)	10 min	WP2009-2	N. Otsuka
2.1.2	EXFOR DB errors report	10 min	WP2009-3	V. Zerkin, S. Dunaeva
2.1.3	JANIS import log Action A14)	15 min	WP2009-4	C. Nordborg, N. Soppera
2.1.4	JANIS TRANS checker	15 min	WP2009-5	N. Soppera
2.2	Compilation and Transmission Statistics (Action A14)	10 min	WP2009-7	S. Dunaeva
2.2.1	Statistics of checking Preliminary Transes (Action A5)	10 min	WP2009-8	S. Dunaeva
2.2.2	Retrospective statistics of publication compilation (Action A9, A13)	10 min	WP2009-9	S. Dunaeva
2.2.3	EXFOR completeness for neutron data published in Phys. Rev. C (Memo CP-D/562)	10 min	WP2009-10	N. Otsuka, S. Dunaeva, A. Mengoni
2.3	Status of compilation			
2.3.1	Public version of the "current compilation" webpage (Action A9,A25)	10 min	WP2009-11	V. Zerkin, S. Dunaeva
2.3.2	Status of new compilation rules (Action A29, A30)	10 min	WP2009-12, WP2009-2**6**	S. Dunaeva, NNDC, H. Noto
3.	**Manuals**	10 min		N. Otsuka

3.1	EXFOR Basic Manual in html (Actions A31, A32)	10 min	WP2009-27	N. Otsuka
4	**Common EXFOR/CINDA Dictionary System (also Actions A37-A42)**	10 min	WP2009-1	
4.1	Formats and exchange mechanisms *(only for dictionaries)*			
5	**CINDA (also Actions A43-A46)**	10 min	WP2009-1	
5.1	Coding mistake in EXFOR REFFERENCE lines converted to CINDA (Memo CP-D/561, Action A45, A46)	10 min	WP2009-18	H. Henriksson, N. Otsuka

Tuesday, 26 May 2009

Plenary: 09:00

6	**EXFOR Technical (also Actions A47-A61)**	10 min	WP2009-1	
6.1	Uncertainty Propagation in TOF-data (Memo CP-D/564 rev)	20 min	WP2009-6	S. Kopecky, P. Schillebeeckx, N. Otsuka
6.2	Ranged uncertainty values (Memo CP-D/530rev, Memo 4C-4/176)	10 min	WP2009-15	N. Otsuka, S. Dunaeva, O. Schwerer, M. Mikhaylyukova
6.3	Coding of elemental cross section divided by isotopic abundance (Memo CP-D/546)	10 min	WP2009-14	N. Otsuka, O. Schwerer
6.4	Correction of obsolete code SIG/SUM (Memo 4C-4/175 rev)	10 min	WP2009-20	M. Mikhaylyukova
6.5	Institute code under INSTITUTE and FACILITY (Memo CP-D/557)	10 min	WP2009-17	N. Otsuka, S. Dunaeva
6.6	Coding of REFERENCE and REL-REF (Memo CP-D/565 rev)	10 min	WP2009-19	N. Otsuka, S. Dunaeva
6.7	Author's name coding (Memo CP-N/080)	10 min	WP2009-21	C. Nordborg
6.8	TITLE coding (Memo CP-N/081)	10 min	WP2009-22	C. Nordborg
6.9	HISTORY coding (Memo CP-D/537 rev)	10 min	WP2009-16	N. Otsuka, S. Dunaeva
6.10	Data type code EXP (Memo CP-D/552)	10 min	WP2009-13	N. Otsuka, S. Dunaeva
6.11	Level density compilation (Action A40, A41,A57; Memo CP-D/558)	10 min	WP2009-23	N. Otsuka
6.12	DOI line under REFERENCE (Actions A23, A24, Memo CP-D/566 rev)	10 min	WP2009-25	N. Otsuka, S. Dunaeva, V. Zerkin
6.13	Energy coding for Spectrum Average	10 min	WP2009-31	O. Schwerer, P. Oblozinsky, N. Otsuka

Plenary: 14.00

7	**EXFOR Software (A62-A65)**		WP2009-1	V. Zerkin, S. Dunaeva
8	**Other Programs**			
8.1	Development of software package for input and editing of experimental data: Exfor-Wizard – an application for creation of Exfor files with patterns	15 min	WP2009-24	G. Pikulina
8.2	Code for digitizing figures created in Japan	15 min	WP2009-28	N. Furutachi
9	**Closing Items**			
9.1	Review of actions and conclusions			
9.2	Date and place of next NRDC meeting		WP2009-29	S. Dunaeva

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MEETING REPORT

Introduction

The IAEA Technical Meeting of the Nuclear Reaction Data Centres International Network was held at the IAEA Headquarters, Vienna, Austria, from 25 to 26 May 2009. Twenty-three participants of thirteen cooperating data centres from China, Hungary, India, Japan, Korea, the Russian Federation, Ukraine, USA, NEA and IAEA attended the meeting. S. Kopecky from EC-JRC-IRMM Geel, Belgium, attended the meeting as an observer.

Meetings of this network are held annually, with full meetings, involving Centre heads and technical staff, every two years (the last full meeting was held in September 2008 in Obninsk and Moscow, Russia). Main topics of the present meeting included: EXFOR quality control, with additional input from NEA-DB's JANIS system; EXFOR compilation completeness and transmission statistics and first experiences with modified distribution of compilation responsibilities; updates to the EXFOR/CINDA dictionaries; new formats for reporting experimental uncertainties and covariance information and for bibliographic information; compilation software, including a new EXFOR Wizard and digitizing software. Thirty-one working papers were presented at the meeting. The results of the discussions were summarized in 19 Conclusions and 57 Actions (see pages 19-20).

Summary

D. Abriola, Acting Head of the IAEA Nuclear Data Section, opened the meeting on behalf of the IAEA. A. Mengoni was elected as chairman for the general session and S. Dunaeva for the technical sessions.

The agenda was adopted without changes. Short progress reports of all attending centres were presented. At NDS, section head Alan Nichols retired at the end of April 2009 and his replacement is expected to take up duties in July. Significant changes of staff are taking place in 2009, also at NEA-DB.

The progress reports concentrated, apart from the staffing situation, on compilation activities, nuclear data services, and other nuclear data activities of interest to the network. See papers P1 – P13 for the progress reports of all participating centres.

The actions of the 2008 meeting were reviewed, and those not yet fulfilled were included in the new list of actions.

In a session on general EXFOR topics, quality control issues and corrections in the database were discussed. Progress in corrections requested earlier was presented as well as an analysis of formal errors detected on every database update done at NDS. N. Soppera presented a checking method developed at NEA-DB, the JANIS EXFOR TRANS checker and a list of formal errors found in this way.

S. Dunaeva presented statistics on the numbers of new and revised EXFOR entries submitted to the NRDC since the last meeting. 584 new entries containing 10560 new subentries (data sets) were added to the database. In addition, more than 1100 revisions of existing entries were performed. Furthermore, she presented summaries of the checking

of preliminary TRANS files and retrospective statistics of compiled articles (compilation year vs. compiling centre). N. Otsuka presented a review of the compilation progress of neutron data published in Physical Review C. The total number of missing articles, published between 1970 and 2009, could be reduced in the past year and is currently 53. This includes also data types which were previously not compiled or only with low priority.

S. Dunaeva reported on the status of a "public" version (for all NRDC centres) of the NDS "current compilation" web page. Then, the status of the new compilation responsibilities introduced on a trial basis for 2009, with NNDC responsible for all works published in four specific journals, was discussed. S. Dunaeva reported that as of now, no improvement of compilation speed or efficiency could be seen. P. Oblozinsky expressed his disagreement with this statement, mentioning that, considering realistic delays between journal publication and finishing compilations, no valid conclusions could be drawn at this time of the year, as the new system has been in force only since January. Dunaeva explained that anyway this was only a preliminary picture and a decision on the new system would be taken only at the next meeting in 2010.

H. Noto presented a summary on the compilation responsibilities and policies in Japan. Major experimental groups and facilities in Japan have issued guidelines saying that their data are to be delivered to JCPRG. Moreover, communications and exchanges with authors are mainly happening in Japanese. Therefore, and because compilation of data produced in Japan is the main objective and raison d'etre of JCPRG, and for reasons of efficiency, JCPRG should keep the responsibility for all data produced in Japan.

Another item discussed were the attempts of the NRDC to establish direct connections with journal publishers to facilitate obtaining data from authors, which had, in spite of various efforts during the last several years, so far been successful only with one journal. Oblozinsky emphasized that this idea is still valid and should be pursued further.

In the session on technical EXFOR matters, S. Kopecky of IRMM Geel gave a presentation on the uncertainty propagation in Time-of-Flight data, in particular on a new method to reduce the required storage space for covariance information using a Cholesky decomposition technique. This was further elaborated in a presentation of N. Otsuka on a proposal of how to code such covariances in EXFOR without any major format changes.

Several other technical EXFOR items were presented and some new dictionary codes and revised formats for some keywords were approved. All these changes are included in detail in the list of Conclusions and Actions.

In a session on EXFOR-related software, G. Pikulina presented the "EXFOR Wizard", a new application developed in Sarov. Its uses are for novice compilers, for scientists to easily put their data in EXFOR format, or for experienced compilers to create patterns of EXFOR files for further editing by the EXFOR Editor. N. Furutachi presented the current status of GSYS, a general purpose digitizing software usable for EXFOR compilation as well as other applications.

The meeting finished with a closing session, where the Actions and Conclusions were reviewed. The date and place of the next, full NRDC meeting, was set to Sapporo, Japan, 20 – 23 April 2010.

Conclusions and Actions
Conclusions

General

C1 The next full NRDC meeting will be held in Sapporo, Japan, 20-23 April 2010.

EXFOR, General

C2 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.

C3 It is emphasized that parameters, such as decay data (especially half-lives in activation measurements), and monitor data, as well as the description of the experimental technique (method, analysis etc.) as used by authors, must be properly compiled. The importance of this information was confirmed in the follow-up of EXFOR “outliers” found by WPEC subgroup 30.

C4 It is emphasized that the source of numerical data must clearly be specified under STATUS (“Table x”, “Fig. x”, “sent from author”, etc.)

C5 For works published by the n_TOF collaboration, the new institute code 2ZZZNTF, and the abbreviation nTOF to be used under AUTHOR for the majority of authors’ names, should be used.

EXFOR, technical

C6 The proposal on resonance quantities (WP2008-27) is now accepted:
The resonance parameter flag in dictionary 236 is kept only for actual resonance parameters but not for quantities “at resonance” such as “cross section at resonance”, because for these quantities a product should be coded in REACTION SF4 (which is not allowed for quantities with the resonance parameter flag). New Reaction Types CSR and CRP are introduced for “cross section at resonance” and “partial cross section at resonance”.

C7 The proposal of WP2009-14 on coding of natural isotopic abundances is approved:
1. The value of the abundance used by authors may be given in coded form under SAMPLE, as described in WP2009-14
2. The new modifier RAB is introduced for a cross section times natural isotopic abundance, divided by abundance of target of the first term of a REACTION sum.

C8 The first proposal on institutes coded in INSTITUTE (WP2009-17) is approved:
The keyword INSTITUTE will contain only the laboratories, institutes, or universities with which all authors are affiliated.

C9 If the location of FACILITY is unknown, this has to be mentioned in free text.

C10 A reference in which only the facility or general method is described should be coded under REL-REF with new code I or M. However, references describing the specific experiment continue to be coded under the keyword REFERENCE even when they contain no data.

C11 All changes of any subentry must be reported in HISTORY of subent 001. If there are changes in coded information, they must be reported also in the affected subentry.

C12 It is recommended to include DOI number in entries, when available through

Internet, according to WP2009-25

C13 Whenever kT is given to characterize an incident spectrum, the heading KT should be used instead of energy, with appropriate numerical value.

C14 Covariance information in AGS format is useful for EXFOR compilation.

C15 It is recommended to give ranges of partial uncertainties as coded information under ERR-ANALYS (see Memo CP-D/530 Rev.)

C16 It is recommended to describe in free text any additional important information related to partial uncertainties, which cannot be given in coded form.

C17 The REACTION SF9 code EXP is made obsolete, as the data type 'experimental' is anyway the default for all REACTIONs and the use of EXP in some but not all cases is confusing.

EXFOR software

C18 Exfor Editor Workshops are very important for compilers, as they give them an opportunity to fully test and familiarize them with the program and help in its further development

C19 It is recommended to hold workshops on EXFOR related software every two years in connection with the technical NRDC meetings. This will enable the participants to gain practice in the use of different software packages and will facilitate the software exchange among the centres and the collaboration in its design and development.

C20 Concerning digitizing software, it is recommended to use *GSYS* for figures with good quality, and to use *Graf_new* for figures with bad quality.

C21 NDS will assist programmers from Sarov when they need expertise of EXFOR/CINDA dictionary designing the Exfor-Wizard application.

Actions

General

A1	Dunaeva	Add Actions A1 – A5 of last year's meeting (see WP2009-01) to NRDC Protocol

EXFOR, General

A2	All	(Standing Action) All Centres should give highest priority to compiling new publications.
A3	NDS	(Continuing Action) Continue to develop sensible means of data communication between laboratories and the network via the major journals.
A4	Zerkin	Add link from EXFOR DB website on how to cite EXFOR entry (first author, full reference, EXFOR DB version, Web-address).
A5	All	(Continuing Action) Give priority to compilation of remaining papers from the 2007NICE conference.
A6	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.
A7	Zerkin	(Continuing Action) Further develop EXFOR+ (interpreted/extended

		EXFOR format).
A8	CJD	Add information about JANIS Checker code to "Short Guide for EXFOR compilers"
A9	Otsuka	(Continuing Action) Update Dictionaries every three months.
A10	Zerkin	(Continuing Action) Synchronize every three months EXFOR backup-file distribution with (a) full Dictionary distribution; (b) EXFOR in C4 format; (c) Dictionaries in MS Access.
A11	Dunaeva, Zerkin	(Continuing Action) Send list of found errors to NRDC after every new EXFOR/CINDA dictionary transmission.
A12	All	(Continuing Action) Correct errors within own area (see also list in WP2009-03); all mistakes from such lists (produced according to Action A11) should be corrected in the next transmission (although mistakes which still remain from 2007 may take longer).
A13	Zerkin	Include DOI in EXFOR DB as defined in WP2009-25.
A14	All	If DOI is found through Internet, include DOI in all new entries, starting with symbol "#" in a new line after the relevant reference
A15	Zerkin	(Continuing Action) 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".
A16	NNDC	(Continuing Action) 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).
A17	NNDC, NDS	(Continuing Action) Prepare report for the next full NRDC meeting describing the advantages and disadvantages of compilation on the basis of full journal contents (see Action A16).
A18	Zerkin	(Continuing Action) Add hyperlink on the main EXFOR page to the EXFOR Basics manual.
A19	Otsuka	(Continuing Action) Send list of recognised errors, based on analysis of the list formulated by OECD-NEA WPEC subgroup 30, to responsible centres.
A20	NDS	(Continuing Action) Coordinate compilations according to journal distribution as agreed at the 2008 NRDC meeting.
A21	All	Correct all mistakes from WP2009-04 till October 2009
A22	NEA DB	Distribute JANIS –TRANS Checker Log list on every preliminary TRANS-file.

Common EXFOR/CINDA dictionaries

A23	NNDC, NDS	(Continuing Action) 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.

CINDA

A24	NEA DB	(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.
A25	NEA-DB	(Continuing Action) Correct errors detected during CINDA loading procedure, as described in WP2008-36.
A26	NEA-DB	(Continuing Action) Correct all CINDA lines, as described in WP2008-33

EXFOR, technical

A27	All	Correct all mistakes listed in WP2009-18
A28	Otsuka	(Continuing Action) Review the various types of gamma spectra in EXFOR, and the related quantities and units.
A29	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.
A30	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.
A31	All	(Continuing Action) Check error lists available on the NRDC web page, and correct as soon as possible (see also WP2009-02).
A32	NDS	(Standing Action) Assess the need for undertaking both trivial and non-trivial compilation corrections, and inform responsible centres.
A33	All	(Standing Action) 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 A32.
A34	Zerkin	(Continuing Action) Prepare a new database encompassing correction factors and relevant comments for suspect/erroneous data (X4-evaluated). Specify the format and issue an appropriate manual.
A35	All	If data are still not available from authors within three months after publication, provide full EXFOR compilation of the article without numerical data.
A36	All	(Continuing Action) Use alteration flags in col. 11 of ENTRY and SUBENT lines in re-transmission (also optional for all corrected lines in col. 80).
A37	Zerkin	Check the situation with distribution of dictionaries in MS Access format
A38	Otsuka	Prepare final version of memo “Uncertainty propagation in TOF-data”
A39	Otsuka	Add to Dictionary 34 new quantity modifier RAB (Times natural isotopic abundance, divided by abundance of target of first term of REACTION sum)
A40	Otsuka	Add to Dictionary 236 new combination: SIG,,RAB (Cross section times natural isotopic abundance, divided by abundance of target of first term of REACTION sum)
A41	NDS	Correct LEXFOR and EXFOR formats manual according to WP2009-17 for keyword INSTITUTE
A42	Otsuka	Add new codes I and M to REL-REF Dictionary according to WP2009-19
A43	NEA DB	Send list with incorrect authors names and Titles to NRDC participants
A44	NDS	Make corrections (trivial) according to the list from Action A43 in

		agreement with responsible centre
A45	NDS	Update LEXFOR according to proposals from WP2009-21, WP2009-22
A46	NEA DB	Prepare full list of recommendations for spelling of nuclides and mathematical expressions in free text of EXFOR entries
A47	Otsuka	Change flag of EXP (SF9) to Obsolete
A48	NDS	Prepare the list of existing entries with "NODATA" and add it to NRDC webpage
A49	Zerkin	Report about conclusions of discussion about new database encompassing correction factors and relevant comments for suspect/erroneous data (X4-evaluated).
A50	All	In retransmissions change obsolete code SIG/SUM (Memo 4C-4/175 rev) to SIG
A51	Otsuka	Update LEXFOR according to the first proposal from WP2009-17

EXFOR software

A52	All centres	(Standing Action) Inform each other about EXFOR-related software being used and/or developed.
A53	Otsuka	Organise internal NRDC webpage "Tools for compilation" for all software that can be useful to compilers
A54	All	(Standing Action) Provide feedback on the digitizing software GSYS to JCPRG.
A55	All	(Standing Action) Provide feedback to NDS on the existing CHEX version (on bugs as well as desired refinements)
A56	Sarov, NDS	Continue development and testing of the EXFOR-Editor in cooperation with NDS and other data centres, taking into account compilers' remarks.
A57	NEA DB	Make available JANIS –TRANS Checker code to NRDC community
A58	All	Provide feedback on the JANIS –TRANS Checker code

PROGRESS REPORTS

2008/2009 Progress Report of the MSU SINP Centre for Photonuclear Experiments Data (CDFE)

V.V.Varlamov, V.V.Vyazovsky, S.Yu.Komarov, N.N.Peskov, M.E.Stepanov

Progress Report to the IAEA Technical Meeting of Nuclear Reaction Data Centers (NRDC), 25 – 26 May 2009, IAEA, Vienna, Austria.

The presented report contains the short review of the main items of 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 2008 Technical Meeting of the International Network of Nuclear Reaction Data Centers (22 – 25 September, Obninsk, Russia) till the spring of 2009 and main results obtained.

EXFOR Compilations

Three new CDFE EXFOR **TRANSes: TRANS M047, TRANS M048 and PRELIM M049** have been produced and transmitted to the IAEA NDS.
In accordance with recommendations of the previous Technical Meeting (Obninsk) many of old ENTRYs were corrected following the comments of N. Otsuka, S. Dunaeva, V. Zerkin and N. Soppera. Therefore the first mentioned TRANS.M047 was devoted completely to those corrections.
On the whole three CDFE 2008/2009 TRANSes contain (**Annex 1**) 21 retransmitted and 11 new ENTRYs with 134 new data SUBENTs.

Photonuclear Data Evaluations

The CDFE program of consistent analysis and evaluation of total ((γ,xn) and (γ,sn)) and partial ((γ,n) and (γ,2n)) photonuclear reactions cross sections was continued. For 9 tin isotopes ^{112,114,116,117,118,119,120,122,124}Sn the combined analysis was carried out previously [1] for experimental data for cross sections of both total and partial photo neutron reactions obtained at MSU SINP using bremsstrahlung and at Livermore (USA) and Saclay (France) using quasimonoenergetic photons obtained at annihilation of relativistic positrons. The systematic disagreements between the various experiments data were analyzed and the method for their taking into account was carried out.
Now the modern model of photonuclear reaction based on the Fermi gas densities equations [2] was used for evaluation [3] for 9 Sn isotopes of partial photo neutron reaction cross sections $\sigma(\gamma,n)$ and $\sigma(\gamma,2n)$ from the experimental data for cross section of total photo neutron reaction $\sigma(\gamma,xn) = \sigma(\gamma,n) + 2\sigma(\gamma,2n)$. Theoretically calculated function $F(E) = \sigma_{(\gamma,2n)}(E)/\sigma_{(\gamma,xn)}(E)$ was used for evaluation of partial reaction cross sections $\sigma^{eval}_{(\gamma,2n)}(E_\gamma) = F(E_\gamma)\cdot\sigma^{exp}_{(\gamma,xn)}(E_\gamma)$ and $\sigma^{eval.}_{(\gamma,n)}(E_\gamma) = \sigma^{exp}_{(\gamma,xn)}(E_\gamma) - 2\sigma^{eval}_{(\gamma,2n)}(E_\gamma) = \sigma^{exp}_{(\gamma,xn)}(E_\gamma) - 2F(E_\gamma)\cdot\sigma^{exp}_{(\gamma,xn)}(E_\gamma) = = (1 - 2F(E_\gamma))\cdot\sigma^{exp}_{(\gamma,xn)}(E_\gamma)$.
With those the total photo neutron reaction cross sections $\sigma(\gamma,sn)$ were evaluated for all 9 Sn isotopes under discussion, the regularities of the giant dipole resonance main parameters were analyzed in dependence of their mass number A. Data are published as the MSU SINP Preprint [2] and included into the CDFE trans PRELIM.M049 (ENTRY M0768).

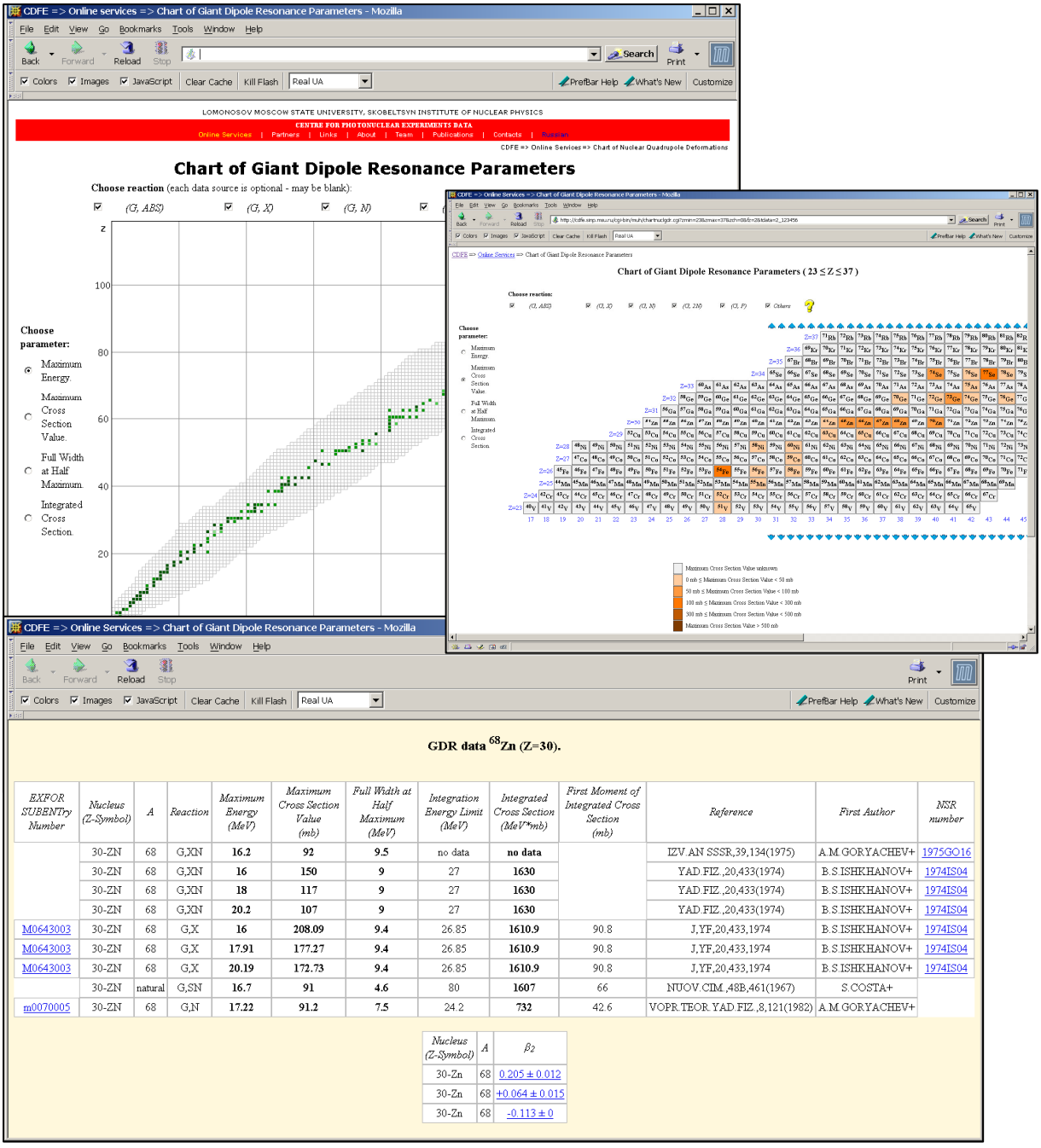
In addition the same approach was used for partial photo neutron reaction cross sections σ(γ,n) and σ(γ,2n) evaluation for ^{63}Cu, ^{115}In, ^{169}Tm, ^{197}Au, ^{209}Bi and some other medium and heavy weight nuclei.

Upgrading of Databases

The main CDFE relational nuclear data databases put upon the CDFE Web-site (http://cdfe.sinp.msu.ru) have been upgraded significantly – needed corrections, many additions.

New Databases Development

Using the CDFE experience of previously producing of relational database "Giant Dipole Resonance Parameters, Photonuclear Reaction Cross Sections" (http://cdfe.sinp.msu.ru/services/gdrsearch.html) and electronic Chart ("Chart of Nucleus Shape and Size Parameters" - (http://cdfe.sinp.msu.ru/services/radchart/radmain.html)) new electronic Chart ((http://cdfe.sinp.msu.ru/services/gdrchart/gdrmain.html)) of main parameters of Giant Dipole Resonance was developed and now is available as testing version.



EXFOR SUBENTry Number	Nucleus (Z-Symbol)	A	Reaction	Maximum Energy (MeV)	Maximum Cross Section Value (mb)	Full Width at Half Maximum (MeV)	Integration Energy Limit (MeV)	Integrated Cross Section (MeV*mb)	First Moment of Integrated Cross Section (mb)	Reference	First Author	NSR number
	30-ZN	68	G,XN	**16.2**	**92**	**9.5**	no data	**no data**		IZV.AN SSSR,39,134(1975)	A.M.GORYACHEV+	1975GO16
	30-ZN	68	G,XN	**16**	**150**	**9**	27	**1630**		YAD.FIZ.,20,433(1974)	B.S.ISHKHANOV+	1974IS04
	30-ZN	68	G,XN	**18**	**117**	**9**	27	**1630**		YAD.FIZ.,20,433(1974)	B.S.ISHKHANOV+	1974IS04
	30-ZN	68	G,XN	**20.2**	**107**	**9**	27	**1630**		YAD.FIZ.,20,433(1974)	B.S.ISHKHANOV+	1974IS04
M0643003	30-ZN	68	G,X	**16**	**208.09**	**9.4**	26.85	**1610.9**	90.8	J,YF,20,433,1974	B.S.ISHKHANOV+	1974IS04
M0643003	30-ZN	68	G,X	**17.91**	**177.27**	**9.4**	26.85	**1610.9**	90.8	J,YF,20,433,1974	B.S.ISHKHANOV+	1974IS04
M0643003	30-ZN	68	G,X	**20.19**	**172.73**	**9.4**	26.85	**1610.9**	90.8	J,YF,20,433,1974	B.S.ISHKHANOV+	1974IS04
	30-ZN	natural	G,SN	**16.7**	**91**	**4.6**	80	**1607**	66	NUOV.CIM.,48B,461(1967)	S.COSTA+	
m0070005	30-ZN	68	G,N	**17.22**	**91.2**	**7.5**	24.2	**732**	42.6	VOPR.TEOR.YAD.FIZ.,8,121(1982)	A.M.GORYACHEV+	

Nucleus (Z-Symbol)	A	β_2
30-Zn	68	0.205 ± 0.012
30-Zn	68	+0.064 ± 0.015
30-Zn	68	-0.113 ± 0

New electronic Chart contains data on several main GDR parameters - energy, amplitude, width and integrated cross section. Data were obtained from cross sections of many total ((γ,abs), (γ,xn) and (γ,sn)) and partial ((γ,n), (γ,2n), (γ,3n), (γ,p), (γ,d), (γ,t), (γ,α)) reactions using both many available original and comprehensible [4] publications and EXFOR database.

Nuclear Structure Data Evaluations

Investigations of traditional and new magic and near magic nuclei were continued using possibilities of the CDFE Complete Nuclear Spectroscopy Database "Relational ENSDF" and ("Chart of Nucleus Shape and Size Parameters" [5 - 7]. Single-particle both proton and neutron states energies and occupation probabilities were evaluated using joint analysis of data from nucleon stripping and pick-up reactions for many of nuclei from the middle of the 1f-2p shell (mainly for ^{56,58,60,62,64,66,68,70,72}Ni). Evaluated data were compared with calculations in the frame of dispersive optical model.

Short-term (2009/2010) 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 the following:

1. Continuation of photonuclear data compilation using EXFOR format, new TRANSes (M050, M051, etc.) production.
2. Continuation of joint analysis and evaluation of total and partial photonuclear reaction cross sections obtained using various methods, first of all in experiments with bremsstrahlung and quasimonoenergetic annihilation.
3. Upgrading (corrections and additions) of all databases put upon the CDFE Web-site (http://cdfe.sinp.msu.ru).
4. Continuation of efforts concern investigation of possibilities of production of new photonuclear databases, containing data for energies higher GDR, first of all for meson photoproduction reaction data.

References

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5. I.N.Boboshin, V.V.Varlamov, B.S.Ishkhanov, S.Yu.Komarov, E.A.Romanovsky. Shell Structure of New Magic Nuclei: Systematics of Features. Bull.Rus.Acad.Sci.Phys. 72 (2008) 283.
6. O.V.Bespalova, I.N.Boboshin, V.V.Varlamov, T.A.Ermakova, B.S.Ishkhanov, S.Yu.Komarov, E.A.Romanovsky, T.I.Spasskaya, T.P.Timokhina,. Analysis of the New Data on Single-Particle Structure of Nuclei from the Middle of the 1f-2p Shell within the Dispersive Optical Model. Bull.Rus.Acad.Sci.Phys., 72 (2008) 847.
7. I.N.Boboshin, B.S.Ishkhanov, E.A.Romanovsky, V.V.Varlamov. New Magic Nuclei ^{96}Zr, ^{54}Ca, ^{30}S, ^{30}Si, ^{14}O, ^{14}C, and Other Existence Conditions. The 2-nd International Conference “Current Problems in Nuclear Physics and Atomic Energy (NPAE-Kyiv2008)”, June 9 – 15, 2008. Book of Abstracts. Institute of Nuclear Research, 2008, p. 101.

Annex 1.

The contents of new 2008/2009 CDFE's EXFOR transes (*old corrected* and **new** ENTRYs)

TRANS.M047		**TRANS.M048**		**PRELIM.M049**	
ENTRY N	Amount of SUBENTs	ENTRY N	Amount of SUBENTs	ENTRY N	Amount of SUBENTs
M0241	*3*	*M0179*	*2*	**M0761**	**3**
M0271	*3*	*M0184*	*5*	**M0762**	**10**
M0283	*22*	*M0191*	*2*	**M0763**	**9**
M0346	*10*	**M0765**	**2**	**M0764**	**13**
M0536	*4*	**M0766**	**23**	**M0768**	**46**
M0546	*1*	**M0767**	**3**	**M0771**	**8**
M0592	*2*	**M0769**	**14**		
M0673	*3*	**M0770**	**3**		
M0725	*2*				
M0733	*2*				
M0736	*2*				
M0738	*2*				
M0740	*5*				
M0744	*4*				
M0745	*3*				
M0746	*6*				
M0758	*5*				
M0759	*3*				
Total new: 0 Total corr.: 18	**Total new: 0 Total corr.: 82**	**Total new: 5 Total corr.: 3**	**Total new: 45 Total corr.: 9**	**Total new: 6**	**Total new: 89**
Sum of new ENTRYs: 11 Sum of new SUBENTs: 134					

ACTIVITY of CAJAD

for the

IAEA Meeting:

Vienna, Austria, 25-26 May 2009

S.Babykina
Nuclear Structure and Reaction Data Center,
Kurchatov Institute, Moscow

Our **EXFOR activity** main directions are:

1. Compilation A -Library

After the last meeting 2008 **A065 Trans file** was prepared. The number of new entries of charged-particles induced data was 17 and 6 corrected entries, which were updated according to the new EXFOR rules and the last meeting's conclusion. Basically, the new entries contain the experimental data on elastic and inelastic scattering, measured at our Institute together with Jyvaskyla University, Finland and Hahn-Meitner Institute, Berlin.

TRANS	TRANS-Status	ENTRIES Total	ENTRIES NEW	ENTRIES Revised
A065	Final	23	17	6

2. Team-work with NEA DATA-BANK

During 2008 and 2009 100 new and 37 old entries were prepared and included in O-library. These entries contain mainly 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
O037	Final	65	45	20
O038	Final	37	30	7
O039	Prelim	35	25	10

3. Additional EXFOR activity

Two B020 and B021 transes were prepared and transmitted to NDS.

TRANS	TRANS-Status	ENTRIES Total	ENTRIES NEW	ENTRIES Revised
B020	Final	1		1
B021	**Final**	**1**		**1**

4. Checking Codes

Codes we use to check our TRANS and ENTRIES:

- CHEX

5. About duplication and EXFOR compilation Database

I would like to note that EXFOR compilation Database was created by NDS excluded the number duplication entries and so decided one of main problems of EXFOR.

6. Future plans

Compilation of our Institute reports for A-library and new papers.

Progress Report of
NUCLEAR REACTION DATA GROUP at ATOMKI

(NRDC Meeting 25-26 May 2009)

S. Takács, F. Tárkányi, B. Király

Introduction

The general profile of the Atomki Nuclear Reaction Data Group consists of measurement, compilation, evaluation and application of low and medium energy charged particle induced nuclear reaction data. The work is done in international collaborations. The experiments, data compilation and data evaluation are mainly connected to running international projects. Every day applications at the home and collaborating institutes also initiate the required data measurements.

Experimental works

The main task of our research group is to measure experimental cross section data of reactions induced by low and medium energy charged particles. We have continued the systematic investigation of excitation functions of reactions for different applications during the last year.
The investigated reactions can be grouped as:

- Excitation functions of monitor reactions.
- Cross section data for production of medical radioisotopes for diagnostic and for therapy.
- Activation cross sections for charged particle activation analysis (CPAA).
- Activation cross sections for accelerator and target technology.
- Activation cross sections for Thin Layer Activation (TLA).

Results are reported in scientific journals or relevant conferences.

Data compilations and evaluations

EXFOR compilations

In the last period all publications on charged particle induced nuclear reactions with experimental data reported from Debrecen, Brussels and Jülich were compiled in EXFOR format in collaboration with IAEA NDS.

CRP participations

- Charged particle cross-section database for medical radioisotope production: diagnostic radioisotopes and monitor reactions
- Development of database for production of therapeutic radionuclides
- Database for fusion evaluated nuclear data library

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.

Collaborating laboratories

- Cyclotron Laboratory, Vrije Universiteit Brussels (VUB), Brussel, Belgium
- Cyclotron Radioisotope Centre, Tohoku University, Sendai, Japan
- Nuklearchemie (INB-4) für Neurowissenschaften und Biophysik, Forschungzentrum 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).

Publications

Papers published in 2008 and 2009 in which our group was involved containing experimental cross section data measured on different target materials bombarded by proton, deuteron, helium-3 and/or alpha particles are 29.

Agence pour l'énergie nucléaire
Nuclear Energy Agency

OECD

NEA Data Bank Progress Report

Akira Hasegawa, Claes Nordborg,
Nicolas Soppera, Manuel Bossant

Agence pour l'énergie nucléaire
Nuclear Energy Agency

OECD

Content

- ✓ NEA Data Bank staff situation
- ✓ EXFOR compilations
- ✓ Statistics
- ✓ What's new in JANIS?
- ✓ Other projects: WPEC, JEFF, computer programs,...

NEA Data Bank staff situation

- ✓ DB employs 19 staff (9 professionals and 10 support staff)
- ✓ 4 professionals and 3 support staff work for other parts of the NEA
- ✓ 1 ½ professionals and 1 ½ support staff work on nuclear data
- ✓ Very large staff turnover in 2009:
  - ✓ Hans Henriksson left in Jan. (to be replaced in Sept.)
  - ✓ Pierre Nagel retired in March (post open)
  - ✓ Enrico Sartori will retire in May (post open)
  - ✓ Akira Hasegawa will leave in July
  - ✓ Yolanda Rugama will leave in Oct.

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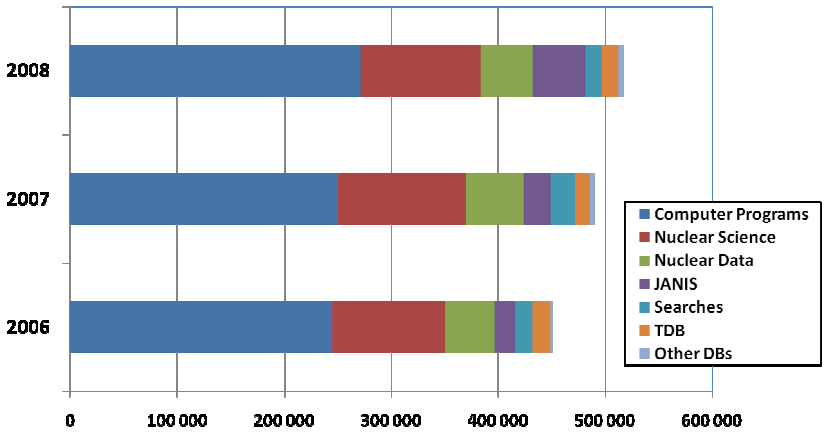
Data compilation

- ✓ Performed using consultants (S. Maev, M. Mikhaylyukova, S. Babykina…)
- ✓ Area 2:
  - ✓ 78 new and 340 re-transmitted neutron data experiments entered into EXFOR in 2008 and 2009
- ✓ Area O:
  - ✓ 201 new and 76 re-transmitted charged-particle data experiments entered into EXFOR in 2008 and 2009
- ✓ Large number of re-transmissions to help WPEC subgroup 30
- ✓ 784 CINDA entries transmitted in 2009.

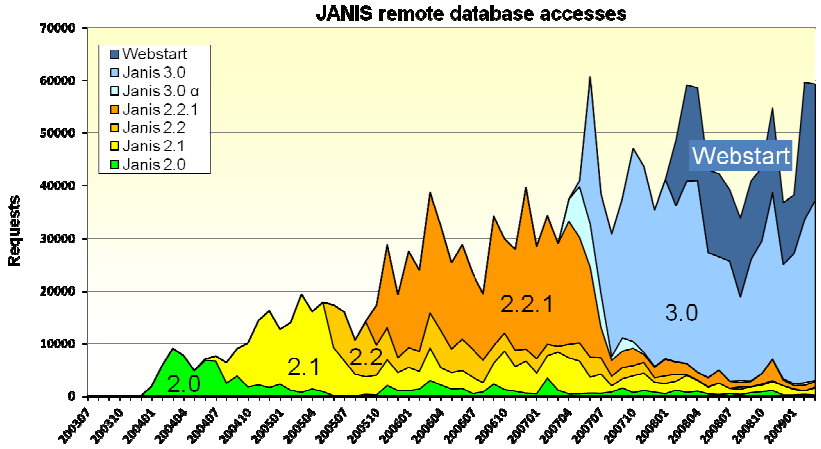
On-line service statistics



What's new in JANIS?

- ✓ ENDF support
  - files MF 12, 13, 14, 15 (photon data)
  - Plotting of Beta decay ray shapes with integration of code BTSPEC (A. Tobias, UK)
- ✓ EXFOR support
  - Format checks added
  - Cleanup of dictionary 24 in cooperation with NDS
  - EXFOR/EXFOR and EXFOR/ENDF comparison tools
  - EXFOR TRANS checker
- ✓ Work on JANIS Web ongoing

JANIS statistics



NEA International Nuclear Data Evaluation Co-operation (WPEC)

- Subgroup 30 on "Improvement of Accessibility and Quality of the EXFOR Database" completed.
- Three new activities:
  - Meeting Nuclear Data Needs for Advanced Reactor Systems "
  - Methods and issues for the combined use of integral experiments and covariance data"
  - Unresolved resonance treatment for cross section and covariance representation
- Many subgroups devoted to covariance data.

The Joint Evaluated Fission and Fusion (JEFF) file project

- The JEFF-3.1.1 general purpose file was released in Feb. 2009.
- The documentation associated with the JEFF-3.1.1 library was published in May 2009 as JEFF report 22.
- The Data Bank offers a set of processed group cross-section and Monte Carlo libraries based on JEFF3.1 and on JEFF-3.1.1 to assist scientists wanting to use the data in application calculations.

Data Bank computer program services

- Collection, verification and distribution of computer codes to Data Bank member countries and to IAEA countries through a special agreement.
- Compilation and dissemination of measured integral data in:
  - Criticality safety (ICSBEP)
  - Reactor physics (IRPhE)
  - Nuclear fuel behaviour (IFPE)
  - Radiation shielding (SINBAD)
- Organisation of training courses and workshops

Ukrainian Nuclear Data Centre Progress Report, 2008/09

Summary of Nuclear Data Studies by Staff of the Ukrainian Nuclear Data Centre
Editor: O. Gritzay

The IAEA Technical Meeting of Nuclear Reaction Data Centers (NRDC), 25 – 26 May 2009, IAEA, Vienna, Austria

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 – 2 entries;
- for charged particle data – 11 entries;
- for photonuclear data – 11 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";
- "Problems of Atomic Science and Technology", Series "Nuclear Physics Investigations".

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 2008-2009 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 2008-2009 for fourth-year students of NPD KNU.

Table. EXFOR entries sent to NDS IAEA by UKRNDC.

#	EXFOR 's entry	Reference	Author
Neutron data			
1	**32223 (3)**	J,YFE,1/23,16,2008 NPAE-Kyiv2008,ID# 245-252	V. M. Bondar, I. M. Kadenko, B. Yu. Leshchenko, Yu. M. Onishchuk, V. A. Plujko
2	**32224 (3)**	T,Yermolenko,,2006	R.Yermolenko
Charged particle data			
1	**D5045 (3)**	J,YF,63,1581,2000 J,PAN,63,1497,2000	S.S.Ratkevich, I.D.Fedorets, B.A.Nemashkalo, V.E.Storizhko
2	**D5054 (2)**	J,YFE,1/19,53,2007	O.K.Gorpinich,O.M.Povoroznyk
3	**D5058 (3)**	J,IZV,72,(3),402,2008 J,BAS,72,376,2008	E.A.Skakun, S.N.Utenkov, V.N.Bondarenko, A.V.Goncharov, V.M.Mishchenko, V.I.Sukhostavets, K.V.Shebeko
4	**D5059 (3)**	J,IZV,72,(3),413,2008 J,BAS,72,385,2008	A.N.Vodin, I.V.Ushakov, G.E.Tuller, L.P.Korda, V.T.Bykov, A.O.Rastrepina
5	**D5060 (2)**	J,IZV,72,(3),430,2008 J,BAS,72,403,2008	A.S.Kachan, I.V.Kurguz, I.S.Kovtunenko, V.M.Mischenko
6	**D5061 (2)**	J,IZV,72,(6),808,2008 J,BAS,72,761,2008	A.N.Vodin, L.P.Korda, A.O.Rastrepina, G.E.Tuller, I.V.Ushakov
7	**D5062 (6)**	J,YFE,2/24,24,2008	V.O.Romanyshyn, A.T.Rudchik, E.I.Koshchy, O.A.Ponkratenko, S.Kliczewski, A.Budzanowski, K.Rusek, L.Glowacka, S.Yu.Mezhevych, Val.M.Pirnak, A.A.Rudchik, I.Skwirczynska, R.Siudak, J.Choinski, B.Czech, A.Szczurek
8	**D5063 (5)**	J,NP/A,98,529,1967	E.C.Booth, J.Brownson
9	**D5064 (11)**	J,VAT/I,50,(5),174,2008	V.A.Voronko, V.V. Sotnikov, V.V.Sidorenko, V.V.Zhuk, I.V.Zhuk, A.S.Potapenko, M.S.Krivopustov, P.S.Kizim
10	**D5065 (2)**	J,YF,71,1325,2008 J,PAN,71,1353,2008	I.D.Fedorets, S.S.Ratkevich
11	**D5066 (6)**	NPAE-Kyiv2008 ID# 249-256	Yu.N.Pavlenko, K.O.Terenetsky, V.P.Verbitsky, I.P.Dryapachenko, E.M.Mozhzhukhin, V.M.Dobrikov, Yu.Ya.Karlyshev, O.K.Gorpinich, O.I.Rundel, V.O.Kyva, T.O.Korzyna, O.V.Oboznova
Photonuclear data			

1	**G4012 (2)**	J,UFZ,51,(2),115,2006	O.S.Shevchenko,Yu.N.Ranyuk,A.N.Dovbnja, V.N.Borisenko, I.G.Goncharov, V.N.Gostishchev, E.L.Kuplennikov, A.A.Nemashkalo, V.I.Noga, I.I.Shapoval
2	**G4018 (3)**	NPAE-Kyiv2008 ID#60-65	O.A.Bezshyyko, A.N.Vodin, L.O.Golinka-Bezshyyko, A.N.Dovbnya, I.M.Kadenko, I.S.Kulakov, V.A.Kushnir, V.V.Mitrochenko, S.N.Olejnik, G.E.Tuller
3	**G4019 (11)**	J,UFZ,52,(10),925,2007	S.N.Afanas'ev, E.S.Gorbenko, A.F.Khodyachikh
4	**G4020 (20)**	J,PR/C,43,(3),1238,1991	J.J.Carroll,M.J.Byrd,D.G.Richmond,T.W.Sinor, K.N.Taylor,W.L.Hodge,Y.Paiss,C.D.Eberhard,J. A.Anderson, C.B.Collins, E.C.Scarbrough, P.P.Antich,F.J.Agee,D.Davis, G.A.Huttlin, K.G.Kerris,M.S.Litz,D.A.Whittaker
5	**G4021 (10)**	J,NP/A,98,529,1967	E.C.Booth, J.Brownson
6	**G4022 (5)**	J,YFE,2/24,13,2008	V.A.Zheltonozhsky, V.M.Mazur, Z.M.Bigan, D.M.Symochko
7	**G4023 (7)**	J,VAT/I,45,(6),3,2005	S.N.Afanas'ev, A.S.Kachan, A.F.Khodyachikh,I.V.Kurguz, R.P.Slabospitsky, I.V.Ushakov, A.N.Vodin
8	**G4024 (3)**	J,FCY,146,(4),634,2008 J,FCY/L,5,(4),374,2008	V.M.Mazur, Z.M.Bigan, D.M.Symochko
9	**G4025 (14)**	J,YF,70,873,2007	S.N.Afanas'ev, E.S.Gorbenko, A.F.Khodyachikh
10	**G4026 (15)**	J,YF,71,(11),1859,2008 J,PAN,71,(11),1827,2008	S.N.Afanas'ev, A.F.Khodyachikh
11	**G4027 (4)**	J,YFE,4/22,56,2007 J,IZV,72,(11),1655,2008 J,BAS,72,(11),1569,2008	I.M.Vyshnevskyi, V.A.Zheltonozhskyi, V.M.Mazur, E.V.Kulich, A.N.Savrasov, N.V.Strilchuk

Customer Services

- During 2008-2009 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. Institute of Magnetism of NASU, Kyiv.
  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 point wise 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.*

Experimental Neutron Data Measurements

The total neutron cross sections for natural hafnium were measured using neutron filtered beams at the average energies 2 and 54 keV with accuracy better than 2%.

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 were prepared and tested. 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 DAE-BRNS meeting 'Applications of Monte-Carlo methods in nuclear science&engineering', which was held 21 - 24 April 2009 in Mumbai, India.

IAEA Nuclear Data Section: Progress Report, 2008/09

Summary of Nuclear Data Studies by Staff of the IAEA Nuclear Data Section
1 October 2008 – 10 May 2009
Editors: S. Dunaeva, N. Otsuka, V. Zerkin

IAEA Technical Meeting, 25-26 May 2009
Vienna, Austria

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. Alan Nichols retired and Robin Forrest - new Section Head will come in July 2009.

2. Data Compilations

2.1 EXFOR and Dictionaries

Over the previous year, NDS staff have distributed 5 CPND TRANS files (D063 - D067) containing 110 new entries (78 compiled at NDS, 20 at ATOMKI, 10 at UkrNDC and 2 in India) and 46 revised entries, 8 neutron TRANS files (3130 - 3137) containing 44 new entries (32 compiled at NDS, 6 at UkrNDC, 2 entries in KAERI and 4 in India) and 431 revised entries, 1 PhND TRANS files (G018), containing 12 new entries (all compiled at UkrNDC) and 1 revised entry. 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.

KAERI Nuclear Data Evaluation Group (KAERI-NDEL) started EXFOR compilation for neutron, charged-particle and photon induced reaction data measured in Korea on a trial basis. So far two neutron entries (31666 and 31668) have been finalized.

As of 15 May 2009, 59 TRANS files were received, checked (with feedback to the originating centres) and processed, of which 57 were final versions that were added to the master file. These final transmissions contained 582 neutron entries (89 new, 493 revised), 501 CPND entries (329 new, 172 revised) and 33 photonuclear entries (13 new, 20 revised).

NDS staff have produced and distributed two regular transmissions of the EXFOR/CINDA dictionaries (TRANS.9098-9099) in EXFOR, DANIEL (backup) and archive format.

Three lists of compilation mistakes have been updated:
- Mistakes in contents: http://www-nds.iaea.org/nrdc/exfor_err.html ;
- Mistakes in formats: http://www-nds.iaea.org/nrdc/exfor_err2.html ;
- Feedback from WPEC SG-30: http://www-nds.iaea.org/nrdc/exfor_err3.htm .

The correction process of the mistake is being monitored by NDS staff.
Almost all corrections have been finished for the 3rd list (except 6 subentries from area 1)

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 twice (November 2008, April 2009). 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/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 350 journal issues from 1990 to 2009 were added to the database for CINDA coverage control in late 2008/2009. 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 900 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 (see below).

- EXFOR - CINDA Database and Retrieval System, data updated April 2009 (CD-ROM);
- ENDVER/GUI and EXFOR-CINDA package; Integrated Tools for ENDF-Evaluators, reproduced at April 2009.

3. Services

Web Services

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

- ENDF:
  - Plotting production cross section coded via MF6/MF5/sub-sections in Web
  - new evaluated libraries included in the ENDF database:
    - TENDL-2008 TALYS-based Evaluated Nuclear Data Library [page]
    - FENDL-2.1 Fusion Evaluated Nuclear Data Library, 2004
    - JEFF3.1.1 Radiactive Decay Data Sub-Library, 2007
- EXFOR:
  - Advanced plot: ratios, ratios converted to cross sections using IAEA-2006 Standards
  - Dynamic request page combining Standard, Extended and Advanced requests in one page
  - Prompt-Help system
  - Extensions on Selection-page and EXFOR+: search by Author, Reaction, ENTRY
  - Search by full Reaction-code and Trans-ID
  - New Web output format X4± presenting EXFOR file as an interpreted interactive tree
  - New tools for EXFOR compilers: uploading EXFOR file and comparison with existing data in EXFOR database (includes plotting with other data and previous version of the same Entry)
- Video guide for EXFOR-ENDF

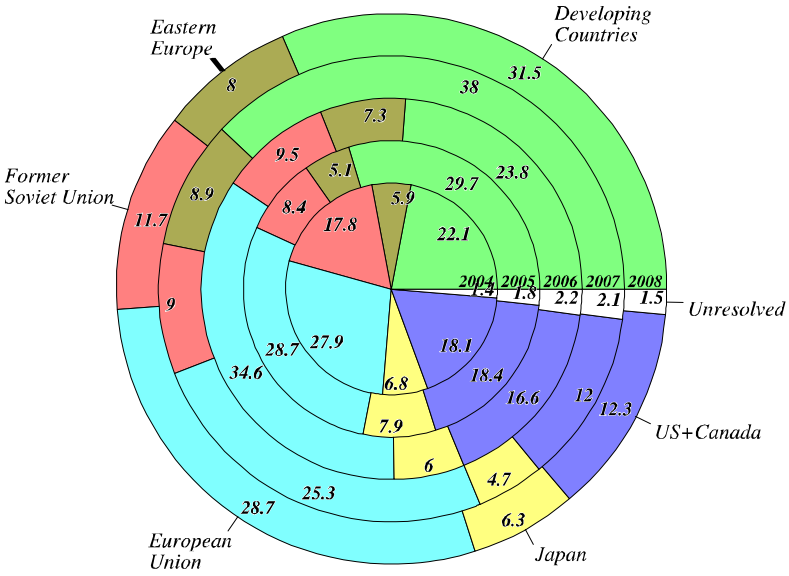
The system is functioning at NNDC, BARC (India) and IPEN (Brazil). Statistics for usage of the Web retrieval system are presented in Fig. 1.

CD-ROMs

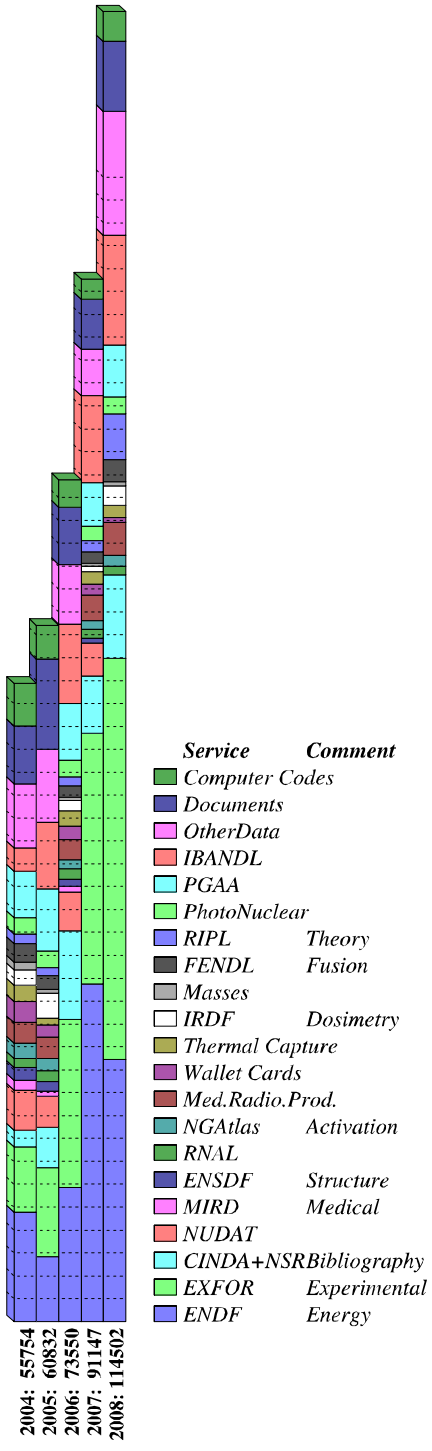
- "EXFOR/CINDA for Windows" CD issued twice;
- "EXFOR/CINDA for Applications" for Linux, Windows and Macintosh (MacOSX) issued twice; also distributed together as part of EndVer/GUI-CD and Empire-package.

NDS+IPEN+BARC
Nuclear Data Services: Web Statistics

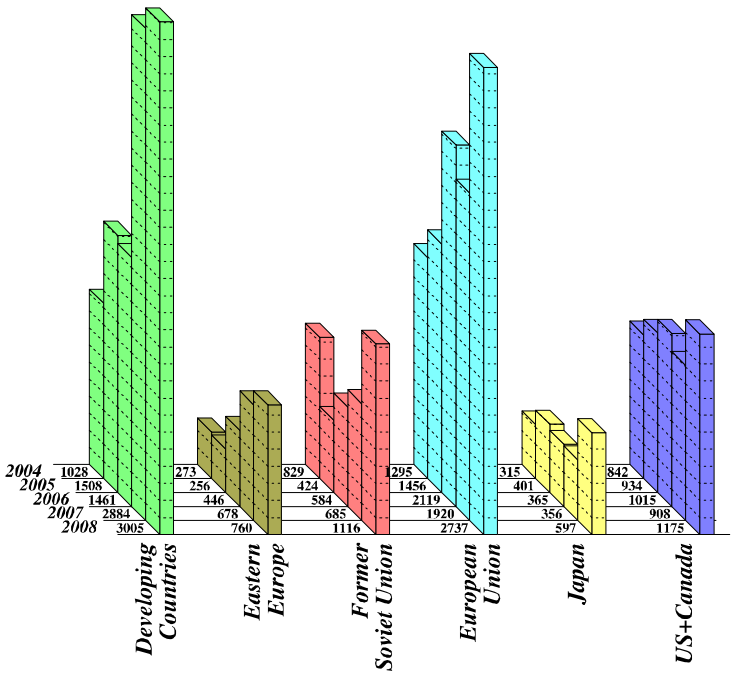
Geographical Distribution (%)



Total per Year
(Number of accesses + retrievals)



Average per Month
(Number of accesses + retrievals)



Service	*Comment*
Computer Codes	
Documents	
OtherData	
IBANDL	
PGAA	
PhotoNuclear	
RIPL	*Theory*
FENDL	*Fusion*
Masses	
IRDF	*Dosimetry*
Thermal Capture	
Wallet Cards	
Med.Radio.Prod.	
NGAtlas	*Activation*
RNAL	
ENSDF	*Structure*
MIRD	*Medical*
NUDAT	
CINDA+NSR	*Bibliography*
EXFOR	*Experimental*
ENDF	*Energy*

4. Software

CINDA software

A new version of the program to import information from the ENDF database has been discussed, improved and checked with Henriksson (NEA- Data Bank).

EXFOR software

New EXFOR Java tools (basic classes) were created. On the basis of this tool, several new pilot programs were created: production of new output formats (X4±, XML, X4Tab), new checking code. Some of these programs are already used in EXFOR Web interface.

Full EXFOR in C4 format

Full C4/X4 files were regularly produced and released (three 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. Public release at the end of 2008.

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 Database for Ion Beam Analysis:* on-going.
- *Updated Decay Data Library for Actinides:* on-going.
- *Reference Database for Neutron Activation Analysis:* on-going.
- *Heavy Charged-Particle Interaction Data for Radiotherapy:* on-going.
- *Minor Actinide Neutron Reaction Data (MANREAD):* on-going.
- *Nuclear Data Library for Advanced Systems – Fusion Devices (FENDL-3):* on-going.

6. Publications

6.1 Journals

Measurement of the stellar cross sections for the reactions ^{9}Be(n,γ)^{10}Be and ^{13}C(n,γ)^{14}C via AMS
by A. Wallner, A. Mengoni *et al.,*
J. Phys. G: Nucl. Part. Phys. **35** (2008) 014018.164.

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

Production of ^{230}U/^{226}Th for Targeted Alpha therapy via Proton Irradiation of ^{231}Pa
by A. Morgenstern, O. Lebeda, J. Stursa, F. Bruchertseifer, R. Capote, J. McGinley, G. Rasmussen, M. Sin, B. Zielinska and C. Apostolidis,
Anal. Chem. **80** (2008) 8763-8770.

Development of Covariance Capabilities in EMPIRE Code
by M. Herman, M.T. Pigni, P. Oblozinsky, S.F. Mughabghab, C.M. Mattoon, R. Capote, Young-Sik Cho and A. Trkov,
Nucl. Data Sheets **109** (12) (2008) 2752 – 2761.

An Investigation of the Performance of the Unified Monte Carlo Method of Neutron Cross Section Data Evaluation
by R. Capote and D.L. Smith,
Nucl. Data Sheets **109** (12) (2008) 2768 – 2773.

Covariances of Prompt Fission Neutron Spectra
by I. Kodeli, R. Capote and A. Trkov,
Nucl. Data Sheets **109** (12) (2008) 2840 – 2845.

Evaluation of Tungsten Nuclear Reaction Data with Covariances
by A. Trkov, R. Capote, I. Kodeli, L. Leal,
Nucl. Data Sheets **109** (12) (2008) 2905 – 2909.

A new formalism for reference dosimetry of small and nonstandard fields
by R. Alfonso, P. Andreo, R. Capote, M. Saiful Huq, W. Kilby, P. Kjall, T.R Mackie, H. Palmans, K. Rosser, J. Seuntjens, W. Ullrich and S. Vatnitsky,
Med Phys. **35** (11) (November 2008) 5179 – 5186.

Experimental study of the ^{91}Zr(n, γ) reaction up to 26 keV
by G. Tagliente, R. Capote, A. Mengoni, *et al*.,
Phys. Rev. **C78** (2008) 045804.

The measurement of the ^{206}Pb(n, γ) cross section and stellar implications
by C Domingo-Pardo, R Capote, A Mengoni, *et al.*,
J. Phys. G: Nucl. Part. Phys. **35** (2008) 014020.

Neutron capture cross section of ^{14}C of astrophysical interest studied by Coulomb breakup of ^{15}C
by T. Nakamura, N. Fukuda, N. Aoi, N. Imai, M. Ishihara, H. Iwasaki, T. Kobayashi, T. Kubo, A. Mengoni, T. Motobayashi, M. Notani, H. Otsu, H. Sakurai, S. Shimoura, T. Teranishi, Y.X. Watanabe and K. Yoneda
Phys. Rev. **C79** (2009) 035805.

Covariance analyses of self-shielding factor and its temperature gradient for Uranium-238 neutron capture reaction
by N. Otuka, A. Zukeran, H. Takano, G. Chiba, M. Ishikawa,
J. Nucl. Sci. Technol. 45 (2008) 195.

JENDL Actinoide File 2008 and Plan of Covariance Evaluation
by O. Iwamoto, T. Nakagawa, N. Otuka, S. Chiba, K. Okumura,
Nucl. Data Sheets 109 (2008) 2885.

JENDL Actinoid File 2008
by O.Iwamoto, T.Nakagawa, N.Otuka, S.Chiba, K.Okumura, G.Chiba, T.Ohsawa, K.Furutaka,
J.Nucl.Sci.Technol.46 (2009) 510-528

Nuclear Data Sheets for A=96
by D. Abriola and A.A. Sonzogni,
Nucl. Data Sheets **109** (2008) 2501 – 2655.

Towards a prediction of fission cross sections on the basis of microscopic nuclear inputs
By S. Goriely, S. Hilaire, A.J. Koning, M. Sin and R. Capote
Phys. Rev. **C79** (2009) 024612.

Deformation-dependent Tamura-Udagawa-Lenske multistep direct model
By H. Wienke, R. Capote, M. Herman and M. Sin
Phys. Rev. **C78** (2008) 064611.

An investigation of the performance of the unified Monte Carlo method of neutron cross section data evaluation
By R. Capote and D.L. Smith
Nucl. Data Sheets **109** (2008) 2768 – 2773

6.2 Conference Presentations and Proceedings

Applications of the total absorption technique to reactor decay heat calculations: Study of the beta decay of ^{102,104,105}Tc
by A. Algora, D. Jordan, J.L. Tain, B. Rubio, J. Agramunt, A.B. Perez-Cerdan, L. Caballero, E. Nácher, A. Krasznahorkay, M.D. Hunyadi, J. Gulyás, A. Vitéz, M. Czatlós, L. Csige, J. Äystö, H. Penttilä, S. Rinta-Antila, I. Moore, T. Eronen, A. Jokinen, A. Nieminen, J. Hakala, P. Karvonen, A. Kankainen, U. Hager, T. Sonoda, A. Saastamoinen, J. Rissanen, T. Kessler, C. Weber, J. Ronkainen, S. Rahaman, V. Elomaa, K. Burkard, W. Hüller, L. Batist, W. Gelletly, T. Yoshida, A.L. Nichols, A. Sonzogni and K. Peräjärvi

(invited paper), presented at 13th International Symposium on Capture Gamma-ray Spectroscopy and Related Topics (CGS-13), 25 – 29 August 2008, Cologne, Germany; Proc. 13th Int. Symp. Capture Gamma-ray Spectroscopy and Related Topics, J. Jolie, A. Zilges, N. Warr and A. Blazhev (Eds), AIP Conference Proceedings Vol. 1090 (2009) pp. 207-214, American Institute of Physics, Melville, New York, ISBN 978-0-7354-0623-0.

M**aintaining the quality and credibility of a large nuclear database through extended multinational initiatives**
by A.L. Nichols, S. Dunaeva, A. Trkov and V. Zerkin, to be published in proceedings of 2nd International Conference, Current Problems in Nuclear Physics and Atomic Energy (NPAE-Kyiv2008), 9 – 15 June 2009, Kiev, Ukraine.

Nuclear Data Activities at the International Atomic Energy Agency
by M.A. Kellett, published in book prepared for 50th Anniversary of the Karlsruhe Nuclide Chart, pp. 214-220, European Commission JRC Report, Eds: G. Pfennig, C. Normand, J. Magill, Th. Fanghänel, EUR 23420 EN - 2008.

Measurements of fission cross-sections of actinides at n_TOF
by N. Colonna, A. Mengoni, *et al.,* published in proceedings CANDIDE workshop, 16-18 October 2007, NEMEA-4 Conference: Neutron Measurements, Evaluations and Applications, Nuclear data needs for Generation –IV and accelerator driven systems, 65 – 70, Ed: A. Plompen, EUR 23235 EN – 2008.

Nuclear Structure activities at the IAEA-NDS
by D. Abriola,
Poster presentation at Nuclear Structure Conference 2008, East Lansing, Michigan, USA, 3 – 6 June 2008.

Evaluation of tungsten isotopes in the fast neutron range including cross section covariance estimation
By R. Capote, A. Trkov, I. Kodeli, E. Soukhovitskii, L.C. Leal, M. Herman and D.W. Muir,
in proceedings of Int. Conference on Nuclear Data for Science and Technology (ND 2007), Nice, France, Apr. 22-27, 2007.Les Ulis Cedex A, France, EDP Science, 2008, p.689-692.

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 T,ornin, A.J. Koning, A. Moens and A.J.M. Plompen
in proceedings of Int. Conference on Nuclear Data for Science and Technology (ND 2007), Nice, France, Apr. 22-27, 2007.Les Ulis Cedex A, France, EDP Science, 2008, p.559-562.

7. Workshops 2008/2009

- Workshop on A&M Data for Fusion Applications, ICTP Trieste, Italy, 20 to 30 April 2009, IAEA Workshop Director: R.E.H. Clark.

8. Visits and Inter-centre Cooperation

- V. Zerkin and N. Otsuka (IAEA/NDS) to JCPRG, Hokkaido University, Japan, 14-30 March 2009: Utilization of EXFOR.

CJD PROGRESS REPORT
NRDC Technical Meeting
(25 - 26 May 2009, Vienna)

M.Mikhaylyukova

Russian Nuclear Data Center

(CJD, IPPE, Obninsk)

Introduction

During the period passed after previous Meeting the current work was continued concerning EXFOR compilation and fulfillment of NRDC-2008 Conclusions and Actions. A large part of activity was related to the nuclear data evaluation.

1. Staff

At present moment the number of CJD staff is 9: 4 leading scientists, 2 senior scientists and 3 engineers.

2. EXFOR activity

After the NRDC2008 Meeting:

Exfor Trans 4144 was transmitted to NDS as final.

Exfor Trans 4145 was transmitted and declared as final.

Exfor Trans 4146 is transmitted as preliminary.

Compilation statistics

TRANS	Date/status	Entries Total	Entries New	Entries Revised	Subents Total	Subents New	Subents Revised
4144	2008/11/10Final	12	2	10	124	26	99
4145	2009/02/18Final	12	7	5	62	35	27
4146	2009/05/07Prelim.	47	0	47	465	35	430
Total		**71**	**9**	**62**	**651**	**96**	**556**

The efforts were made to get numerical data from authors. Good cooperation was established with authors O. Shcherbakov, A.Vorobiev (4RUSLIN), L.Bondarenko (4RUSKUR).

The guide for EXFOR compilers was prepared in CJD according to Conclusion C13 and Action A16 of NRDC2008 and was sent in all Centers.

3. Computer and software matters. WEB-site service

- CJD web-site http://www.ippe.ru/podr/cjd/ is the part of IPPE web-site (mainly in Russian), which is in improvement now.
- New versions of CHEX and EXFOR dictionaries were copied from NDS open area and used in compilation.
- The digitizing program of Sarov is used to digitize graphical data for EXFOR.
- New tool of web-service for compilers (http://nds121.iaea.org/exfor2/x4up1.htm , under improvement , developed by V.Zerkin) was tested.
- The information from developed by N.Otsuka web-sites:
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

was found to be useful for correction of the old Entries.

- http://www-nds.iaea.org/exfor-master/x4compil/ - EXFOR status compilation web-page was used to found the articles for compilation.

4. Nuclear data evaluation activity

The main efforts of CJD in the data evaluation activity are directed to the analysis of available evaluated data files and selection of the best ones with point of view of microscopic and integral experimental data and nuclear theory model calculations. This work is being done mainly by A.Ignatyuk, V.Manokhin and V.Pronyaev.

A.Blokhin's group continues activity in nuclear data evaluation and practical calculation of the activation and radiation damage of structural materials for fission and fusion reactors.

The dosimetry reactions evaluation was continued by K.Zolotarev.

5. Publications

The issue of journal "Yadernye Konstanty" was prepared for publishing in 2008, but is not printed yet. The issue of 2009 is in preparation for publication.
YK 1999 – 2007 issues of are available to read from the IPPE web-site http://www.ippe.ru/ninf/pub.php.

6. Acknowledgments

The assistance of Naohiko Otsuka and Svetlana Dunaeva is greatly appreciated.

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

Technical paper for the NRDC Meeting, May 25-26, 2009
IAEA, Austria, Vienna
S.M. Taova
Russian Federal Nuclear Center-VNIIEF
Russia, 607188, Sarov, Nizhni Novgorod region, pr. Mira, 37

Compilation activity

Within the period under report three transmission files TRANS (F033, F034, F035) were prepared and included into the EXFOR data library. Much attention was paid to the work on error correction in EXFOR library. TRANS F033 contained the corrected entries only (11). F034 and F035 included 9 corrected and 41 new entries.
Scanning of home journals "Yadernaya Fizika", "Izvestiya Academii Nauk" was continued. List of articles from "Izvestiya Academii Nauk" relevant for compilation is regularly made up and sent to the section.

CNPD members take part in the works on development of a Reference Database for Ion Beam Analysis (IBANDL). During the last period 238 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 works on software development (EXFOR-Editor) intended to process and introduce experimental data to the EXFOR library were continued.
Creation of EXFOR – Editor was generally completed.

1. All dialog windows have been designed.
2. All the modes of data processing (creation of a new entry, data input, data editing and data checking) were implemented.
3. New EXFOR-LEXFOR help system (version February, 2008) is provided now.
4. Help system for EXFOR-Editor was updated according to the last modifications.

It is planned in future to provide some small additions and error corrections only. The final version of EXFOR-Editor was presented to NDS members in November last year. It was recommended to distribute the program among the centers of nuclear data.

Within the framework of existing software a new application was developed - EXFOR – Wizard. It is intended for non-advanced users. Using specially designed patterns one can create a file in the EXFOR format by forming consequently bibliographical part and a numerical data section. While creating the program some principles and procedures implemented in EXFOR-Editor were used. Designing in a form of a separate application will allow more effective use of the program for training purposes.

Progress Report of CNDC to NRDC Meeting
(25 - 26 May 2009, Vienna, Austria)

Yu Hongwei
China Nuclear Data Center
China Institute of Atomic Energy

1. General

CENDL is carried out by China Nuclear Data Center and China Nuclear Data Network, China Nuclear Data Committee assumes responsibility the management of CENDL project. China Nuclear Data Center serves as the secretariat of Chinese Nuclear Data Committee. Four young staffs has joined in CNDC in the past two years, the staffs of CNDC are 24 now. The CNDC consists of the following four groups:

- Nuclear Data Evaluation Group
- Nuclear Theory Group
- Macroscopic Data Group
- Data Library Group

2. Nuclear Data Evaluation

CENDL-3.1:

CENDL-3.1 includes comprehensive data evaluations for all neutron reactions in the energy range from 10^{-5}eV to 20MeV for 200 nuclides. The ENDF-6 format is adopted, the files 1, 2, 3, 4, 6, 12~15 are included for major fissile nuclide, structure material and light nuclide, files 1, 2, 3, 4, 5 are given for minor fissile and fission production nuclides.

New evaluations:

During past two years, more than 30 new neutron data evaluations have been performed in CNDC, The range of nuclei contains light nuclides, structure material nuclides, fission product nuclides and actinides (^{12}C,^{14}N,^{16}O,^{23}Na,Mg,Al,^{46,47,48,49,50,nat}Ti,$^{58,\ 60,\ 61,\ 62,\ 64}$Ni,^{63}Cu, ^{85}Y,^{95}Zr, ^{99}Mo,^{129,131,132,134}Xe,^{169}Tm,^{181}Ta, ^{240}Pu et al.). These new evaluations will be collected by CENDL future edition.

Nuclear data for ADS:

This work is a part of the project of ADS system of China, and is supported by China Ministry of science and technology. The theoretical models code MEND has been improved, and the calculation and evaluation of n and p+^{54,56,57,58}Fe reactions for incident nucleon energy below 250 MeV were carried out based on the new MEND code. The calculation and evaluation of n+^{233,234,235,236,238}U reactions for incident neutron energy below 20 MeV were also done, and the benchmark test calculations were done for the neutron data.

Structure and decay data

The nuclear structure and decay data evaluations in CNDC has permanent responsibility for evaluating and updating NSDD for A=51, and 195-198; temporary for A=67.

About 40 new decay data evaluations were finished in past 2 years. The range of nuclides is from^{37}Ar to ^{153}Gd. These evaluations included the half-life, γ –ray intensity, branch ratio and decay schemes *et al.* Two evaluation methods ENSDF and DDEP were used in

our new evaluations.

Fission yield

Based on the experimental data, the systematic on mass distribution of fission product nuclides and independent yield data were studied. Cumulative yield data from ^{235}U and ^{238}U fission were evaluated for each about 50 fission product nuclides as a base of updating CENDL/FY and for some practical applications.

3. Nuclear reaction model code

The code system LUNF series used for light nuclei model calculations were developed. This code system can be used for the model calculation for neutron introduced reaction with targets ^{6,7}Li, ^{9}Be, ^{10}B, ^{12}C, ^{14}N and^{16}O. LUNF system can also provide the energy-angular spectra (MF6 in ENDF format) model calculations.

The theoretical model code MEND of nucleon-induced reaction has been improved. In the new version of MEND code, the gamma-production cross sections and ENDF format are included.

4. International Co-operation:

At present, the scientists of CNDC participate in two IAEA Coordinated Research Projects:

- Minor Actinide Neutron Reaction Data
- Updated Decay Data Library for Actinides.

The following foreign scientists have visited CNDC/CIAE:

- A.J. Koning, NRG, October 2008.
- S. G. Yavshits, S.V.Khlebnikov and O. T. Grudzevich, Khlopin Radium Institute and Obninsk State University, October 2008.
- T.V. Golashvili, V.P. Chechev and S. Badikov, ATOMINFORM and Khlopin Radium Institute, October 2008.

5. The meeting and symposium

- The symposium on Nuclear Data Future needed, 16 December 2008, Beijing
- The Technical Meeting of fission yield, 15-18 May 2009, Guilin
- The Meetings of China Nuclear Data Committee，14 May 2009, Beijing

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
25-26 May, 2009

0. General

The "Japan Nuclear Reaction Data center (JCPRG)" started at Apri1, 2007. The center has three main tasks: 1) database activities, 2) data evaluations and 3) Asian network activities. Since the last NRDC meeting (September 2008, 22-25), we have worked on the following main tasks: we had a workshop on a development of EXFOR, inviting V. Zerkin and N. Otsuka to Hokkaido University in Sapporo. In order to proceed the evaluation of the light-nuclear reactions, we made a new database (NRDF/A) of experimental data for astrophysical nuclear reactions with the support of Japan Society for the Promotion of Science (JSPS). As one of Asian network activities, we invited a young researcher from Mongolia to have a chance of training for the nuclear data compilation in EXFOR.

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 staff, and their contracts are limited to three years. In 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.

We are writing the manuscripts of "NRDF Annual Report 2009" which will be published in June.

0.1 Staff

Our activities have been carried out by 9 members (3 postdoctoral researchers, 4 graduate students and 2 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. 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. One of the graduate students is a visiting trainee from the Nuclear Research Center, National University of Mongolia. We have trained her on the data compiling since November 2008 and she has got a certain skill.

0.2 Budget

Since the regular JCPRG budget ended at March 2001, we have no regular budget. In 2009, 9 million JPY was allocated for Astrophysical nuclear data by Japan Society for the Promotion of Science (JSPS).

1. Data Compilation

We are continuing data compilation for charged-particle nuclear reaction data obtained in Japan. We are scanning 17 journals for Japanese charged-particle and photo-nuclear nuclear reaction data compilation: PR/C, PRL, PL/B, EPJ/A, NST, NIM/A, NIM/B, JPJ, ARI, RCA, JRN, KPS, NSTS, CPL, ZP/A, PAN and JNRS.

1.1 NRDF

From April 2008 to March 2009, CPND and PhND in **49 references (343 records, 1.29MB)** have been newly compiled for NRDF. Usually new data are released at the JCPRG web site several months prior to EXFOR.

1.2 NRDF/A

Construction of a new database for the evaluations of astrophysical nuclear reactions based on theoretical calculations is in progress. We call this database as Nuclear Reaction Data Files for Astrophysics (NRDF/A). In the previous version of NRDF/A (2006), we have assembled only 31 reactions for nuclei from C to Mg. In the present new version (2008), the astrophysical important light nuclei up to Si are included to achieve the coverage for NACRE. As a result, the number of reactions to be compiled is about 200. At the present stage, the bibliographic information of these reactions has been compiled.

1.3 EXFOR

Since the 2008 NRDC meeting, we have made **33 new entries** and have revised or deleted **11 old entries**. These were transmitted as **5** trans files (E056-E058, K005, R023) to the NDS open area. JCPRG is grateful for valuable comments from Svetlana Dunaeva (NDS), Stanislav Maev and Marina Mikhaylyukova (CJD), Vladimir Varlamov (CDFE) and many members of the international nuclear data centers on our transmissions as always.

1.4 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 2008 NRDC meeting, one regular batch (7 added lines and 0 deleted lines) were prepared and sent to NEA-DB (Reader code J).

2. Data Correction

After Memo CP-E No.136, we newly found up 6 mistakes (Memo CP-E No.137) of the CINDA master file in bibliographic information. These 2 memos were reviewed at NEA Data Bank (A45, NRDC 2008). Cooperating with them, we verified error propagation from EXFOR to CINDA. Actually that had happened in the 34 lines (Memo CP-D No.561).

3. Data services and Software

3.1 Database Search System

- NRDF (http://www.jcprg.org/nrdf/)
- EXFOR/ENDF (http://www.jcprg.org/exfor/)
- CINDA (http://www.jcprg.org/cinda/)

3.2 Cording Software

- NRDF/EXFOR editor – HENDEL (http://www.jcprg.org/manuals/hendel/)
- Digitization System – GSYS (http://www.jcprg.org/gsys/)

4. System Development

4.1 XML format for nuclear reaction data

Current EXFOR or NRDF Format is specific to itself. We suppose that a nuclear data exchange format of the next generation should be defined based on XML. If the exchange format was redefined based on XML, the data available from libraries (EXFOR, NRDF, etc.) would enable us to have wider common bases for our various software applications.

We highly appreciate the presentation of Viktor Zerkin and discussions held in Sapporo, on March, 2009. To achieve an exchange format agreed, we will continue to gain various experiences with using XML and to apply the IntelligentPad technology for EXFOR systems.

4.2 New version of the digitization system GSYS (http://www.jcprg.org/gsys/)

User-friendliness is a notable advantage of the GSYS system. Strengthening this advantage, we are now developing the new version of GSYS.

5. Meetings and Public Relation

1. Sapporo-IAEA Nuclear Data Meeting 2009

Inviting Viktor Zerkin and Naohiko Otsuka from IAEA, we had a workshop on the development of EXFOR and future exchange formats in Sapporo, March 16-19, 2009. (http://www.jcprg.org/symposium/viktor-2009.html/)

2. Other meetings and publications

The first international Ulaanbaatar conference on nuclear physics and application was held in Ulaanbaatar, Mongolia on September 8-11, 2008. Kato had a talk on “Nuclear Reaction Data Network; International and Asia”, which was published as a paper in the AIP Conference Proceedings, Volume 1109 (2009).

Kimura had a poster presentation of “Recent Activity in JCPRG” at Nuclear Data Conference which was held at JAEA (Tokai, Japan) on November 20-21, 2008. The proceedings will be published.

From 25-26 March, 2009, the workshop on nuclear data and nuclear physics was held at RIKEN (Wako, Japan). Kato presented a talk about the recent activities of Hokkaido Nuclear Data Center, and Otsuka had a report on the international nuclear data activities.

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*)
Kiyoshi KATŌ (*Hokkaido Univ., Sapporo*)
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Mitsuji KAWAI (*Kyushu Univ., Fukuoka*)
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Hajime TANAKA (*Hokkaido Univ., Sapporo*)
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NRDF Steering Committee

Kiyoshi KATŌ (*Center Head, Hokkaido Univ., Sapporo*)
Shigeyoshi AOYAMA (*Niigata Univ., Niigata*)
Masaki CHIBA (S*apporo-Gakuin Univ. Ebetsu*)
Yoshiharu HIRABAYASHI (*Hokkaido Univ., Sapporo*)
Toshiyuki KATAYAMA (*Hokusei-Gakuen Univ., Sapporo, now at Universität Humburg*, *Hamburg*)
Hiroshi MASUI (*Kitami Institute of Technology, Kitami*)
Hiroshi NOTO (*Hokusei-Gakuen Univ., Sapporo*)
Shigeto OKABE (*Hokkaido Univ., Sapporo*)
Hiroyoshi SAKURAI (*RIKEN Nishina Center, Wako, Saitama*)

NRDF Annual Report Editorial Committee

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Hiroshi NOTO (*Hokusei-Gakuen Univ., Sapporo*)

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Takaomi MURAKAMI (*Hokkaido Univ., Sapporo*)
Tooru YOSHIDA (*Hokkaido Univ., Sapporo*)

2) Bibliography Compilation (CINDA):

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Naoya FURUTACHI (*Hokkaido Univ., Sapporo*)
Tooru YOSHIDA (*Hokkaido Univ., Sapporo*)
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A brief status report on selected Indian nuclear data physics activities submitted to the NRDC Meeting-20091

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Mumbai-400085 India

1. Introductory Remarks

Presently the nuclear data physics activities in India encompass already the following activities to meet the design needs of thermal, fast, fusion and accelerator driven subcritical systems. The nuclear data physics activities are making steady progress and are part of a declared thrust area in the programmes of the Department of Atomic Energy.

- Basic nuclear data physics measurements using facilities in India and abroad. The neutron induced fission cross sections of Pa-233 has been measured and published. Attempts to measure the neutron induced fission cross sections of Pa- using Surrogate technique are underway.
- EXFOR compilations. An EXFOR training Workshop with faculty from the IAEA is planned for the period, November 9-13, 2009. The venue is Mumbai.
- Nuclear model based calculations using codes such as TALYS and EMPIRE are being continued.
- Processing of evaluated nuclear data files to produce plug-in libraries for discrete ordinates and Monte Carlo codes. Updating of ORIGEN nuclear data for radio-toxicity estimations.
- Efforts to digest the status of covariance error methodology in nuclear data and its applications. The concept of evaluation of nuclear data and ENDF/B technology is becoming popular. Evaluation of nuclear data, a new activity to India as such, is expected to be taken up with the formation of the Indian Nuclear Data Centre.
- Preparation of integral Indian experimental criticality benchmarks for integral nuclear data validation studies

This report presents an update over our previous 2008 progress report that India presented at the IAEA Technical Committee Meeting of International Network of Nuclear Reaction Data Centres (NRDC), 22-25 September 2008 at the Institute of Physics and Power Engineering in Obninsk, Russian Federation. *The 2008* progress report from India is available electronically at the website: http://www-nds.iaea.org/nrdc/nrdc_2008/ .
All the reactor physics applications oriented processing tasks at BARC and IGCAR have been actively continuing. The ENDF/B-VII.0 files are preprocessed by the PREPRO and processing by indigenous processing codes to produce our plug-in libraries for neutronic codes for a number of actinides, structural materials and fission products for applications to India's nuclear programme for energy and non-energy applications.

[1] *IAEA Technical Committee Meeting of International Network of Nuclear Reaction Data Centres (NRDC, 25-26 May 2009, IAEA Headquarters, Vienna, Austria, Europe.*

2. Indian EXFOR compilation activities

The details of IAEA accepted Indian EXFOR entries are available in "Full EXFOR Compilation Statistics", in the IAEA-NDS site as communicated by the NDS staff at the IAEA, S. Dunaeva:
http://www-nds.iaea.org/exfor-master/x4compil/progress_stat.htm

At the time of writing this report, the official count for the IAEA accepted EXFOR entries are as follows: 10 new entries in 2006, 33 in 2007, 9 in 2008 and 1 in 2009. The identification for coding into EXFOR of all the suitable Indian articles published in the literature was done by the IAEA-NDS staff.
India gratefully acknowledges and 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 the Indian training workshops on EXFOR. India will be hosting the 2009 Workshop in Mumbai during November 9-13, 2009.

India considers the classical nuclear data physics activity of EXFOR compilation as an important activity of the Indian Nuclear Data Centre under formation. India Nuclear Data Centre offers to collaborate with other network of reaction data centres and help host more such training workshops on international co-ordination of EXFOR compilation activity in the coming years.

Presently, India Nuclear Data Centre has a responsibility to continue the EXFOR compilation activity and take up more classical nuclear data physics responsibilities. After the above-mentioned two IAEA-EXFOR training workshops, a Ph. D. student (Paresh Prajapati from MS University, Vadodara) is continuing to work with us in Reactor Physics Design Division. Thus far, this year, he, Dr. H. Naik, Dr. S. Singh (Radio Chemistry Division) together collaborated in the Indian Nuclear Data Centre's activity and have made 6 new Indian EXFOR entries (Reference: EXFOR entry with no: D6064, D6067, 33020, 33021, 33022 and 33023.

3. 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). The mirror site is becoming popular among researchers, students and other users of nuclear data in India.

Presented below for April 2009, 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 52471 with a 17051247 Kbytes with a maximum of 14239 hits in one day during this month.
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.*

Monthly Statistics for April 2009		
Total Hits		**52471**
Total Files		**36223**
Total Pages		**17724**
Total Visits		**1478**
Total KBytes		**17051247**
Total Unique Sites		**548**
Total Unique URLs		**17791**
Total Unique Referrers		**206**
Total Unique User Agents		**214**
	Avg	**Max**
Hits per Hour	**72**	**13304**
Hits per Day	**1749**	**14239**
Files per Day	**1207**	**2719**
Pages per Day	**590**	**6126**
Visits per Day	**49**	**218**
KBytes per Day	**568375**	**1980491**

India Nuclear Data Centre which is under formation offers to collaborate with other network of reaction data centres and help in promoting the online nuclear data services in the coming years.

4. Experimental generation of nuclear data

Measurements of nuclear data of relevance to advanced reactor applications such as Advanced Heavy water Reactors, Compact High temperature reactors, thorium fuel cycle studies, fusion reactors, Accelerator driven systems are encouraged in India. Some selected examples of activities in this regard are mentioned below briefly.

- Determination of the ^{233}Pa (n, f) reaction cross-section from 11.5 to 16.5 MeV neutron energy by surrogate ratio method.
- Experimental 14 MeV 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.

<u>Determination of the neutron induced cross sections without using the neutrons and without using the target by surrogate ratio method.</u>

Recently BARC measured ^{233}Pa (n, f) reaction cross-section from 11.5 to 16.5 MeV neutron energy using Li-6 beam hitting a Th-232 target. ^{233}Pa has a half-life of 26.967 days.

See for example:

B. Nayak, A. Saxena, D. C. Biswas, E. T. Mirgule, B. V. John, S. Santra, R. P. Vind, R. K. Choudhury and S. Ganesan,
"Determination of the ^{233}Pa(n,f) reaction cross-section from 11.5 MeV to 16.5 MeV neutron energy by surrogate ratio method,"
Physical Review C 78, 061602(R) (2008).

Presently, an attempt is being made by BARC to perform experiments in order to measure ^{234}Pa (n, f) reaction cross-section in tens of MeV neutron energy using Li-7 beam hitting a Th-232 target. ^{234}Pa has half-life of 6.7 hours.

Experimental 14MeV nuclear activation data generation at the University of Pune, Pune, India.

See for example:

B. Lalremruataa, S.D. Dholea, S. Ganesanb and V.N. Bhoraskara,
"Double differential cross-sections of (n,α) reactions in aluminum and nickel at 14.77 MeV neutrons,"
Nuclear Physics A Volume 821, Issues 1-4, 15 April 2009, Pages 23-35.

F.M.D. Attar, R. Mandal, S.D. Dhole, A. Saxena, Ashokkumar, S. Ganesan, S. Kailas and V.N. Bhoraskar,
"Cross-sections for formation of ^{89m}Zr through 90Zr(n,2n)^{89m}Zr reaction over neutron energy range 13.73 MeV to 14.77 MeV,"
Nuclear Physics A802, 1-11 (2008).

The 14 MeV data generation is continuing.

Experimental Studies on fast neutron and bremsstrahlung induced reaction and fission of actinides and preactinides.

See for example:

Haladhara Naik, Annareddy Venkatramann Reddy, Srinivasan Ganesan, Devesh Raj, Kwangsoo Kim,Guinyun Kim, Young Do Oh, Due Khue Pham, Moo-Hyun Cho,In Soo Ko and Won Namkung

"Post-neutron mass yield distribution and Photo-neutron cross-section measurements in 209-Bi with 65-MeV bremsstrahlung,"

Journal of the Korean Physical Society, Vol. 52, No. 3, March 2008, pp. 934-939 2008.

Measurements of MeV range neutron activation cross-sections using 14 MV BARC-TIFR Pelletron machine by using ^{7}Li(P,n) reactions as neutron source below 5MeV neutron energy.

See for example:

Megha Bhike, A. Saxena, B. K. Roy, R. K. Choudhury, S. Kailas and S. Ganesan, "Measurement of $^{67}Zn(n,p)^{67}Cu$, $^{92}Mo(n,p)^{92m}Nb$ and $^{98}Mo(n,\gamma)^{99}Mo$ reaction cross sections at neutron incident energies of E_n = 1.6 and 3.7MeV"

Accepted for publication in Nuclear Science and Engineering (2009).

It is planned to compliment these data below 5 MeV with measurements at 14 MeV using the D-T neutron generator.

5. 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.

In 2008, a formal MOU between BARC and CERN was signed. The annual O & M fee (100% for 2008 and 50% for 2009) has also been paid by BARC in May 2009.

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

Dr. H. Naik, BARC visited Pohang as a visiting scientist for 3 months during the last quarter of 2008 and continued generation experimental data of photo-fission yields and photon induced neutron emission cross sections.

7. ENSDF Evaluation Activities.

The ENSDF evaluation activities and research work are being actively continued by Ashok Jain (IIT Rourkee), M. Gupta (Manipal), Gopal Mukherjee (VECC, Kolkata) and others. The Indian Nuclear Data Centre under formation will factor into account the continuation of these important nuclear data physics activities.

8. 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). A document on PURNIMA-II (the ^{233}U nitrate solution) criticality experimental Indian benchmark has been published in the 2008 ICSBEP DVD handbook for nuclear data validation studies.

Reference: T.K. Basu, E. Radha, C.P. Reddy, K.K. Rasheed and S. Ganesan, "PURNIMA-II: U-233 Uranyl Nitrate Solution Reactor with Beryllium Oxide Reflector," International handbook of Criticality Safety Evaluation Project Organized by US-DOE (USA) and NEA-DB (France). ICSBEP Reference: U233-SOL-THERM-007, (2008).

9. 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:

- Ongoing project: 14MeV neutron data physics project in Pune University.
- Ongoing project: Nuclear data physics activities at Jaipur University.
- Ongoing project: Measurements using the Microtron facility in Mangalore University.
- Ongoing project: Covariance error matrix in nuclear data physics at the Department of Statistics, Manipal University, Karnataka.
- Ongoing project, "Nuclear model based calculations of particle-nuclear interaction cross sections," at the Department of Physics, G.B. Pant University, Pantnagar, India.
- Ongoing project: "Studies for 14 MeV and fast neutron induced fission/reaction for AHWR and ADS applications", at the Maharaja Sayajirao University of Baroda, Vadodara.
- Project Proposal under review: Nuclear data physics project at Bharathiar University, Coimbatore, Tamilnadu. The project is entitled, ""Studies on nuclear fission reaction process with orientation to nuclear data needs of India's advanced reactor programme".

10. Efforts towards evolving a strong and sustainable Indian Nuclear Data Centre.

BARC is in the process of formally announcing the formation of a strong and sustainable Indian Nuclear Data Centre. This announcement is expected to be made formally. An EXFOR training Workshop with faculty from the IAEA that is planned for the period, November 9-13, 2009 will be conducted under the auspices of the proposed India Nuclear Data Centre.

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

A rather strong consensus that evolved from the various DAE-BRNS meetings during the last 5 years in India on nuclear data physics was the following: India with its serious nuclear programme needs establishing her own national nuclear data centre. The delegates also stressed that as a general rule, the generation of new nuclear data by the international and national communities should continue to be encouraged as more intense neutron sources, purer elemental / isotopic target samples and/or more efficient detectors and better electronics evolve. Required scientific activities also are extensive follow up of experimental data generation with a comprehensive compilation, critical evaluation, production of new ENDF/B formatted libraries extending to higher energies, and quality assured nuclear data processing activities to provide the designers/users/ of innovative systems with "ready to plug-in" processed data, that are integrally validated, for use in applications.

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

Progress Report of 2008/2009 to the

IAEA Technical Meeting on the Network of Nuclear Reaction Data Centres

25-26 May, 2008

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

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

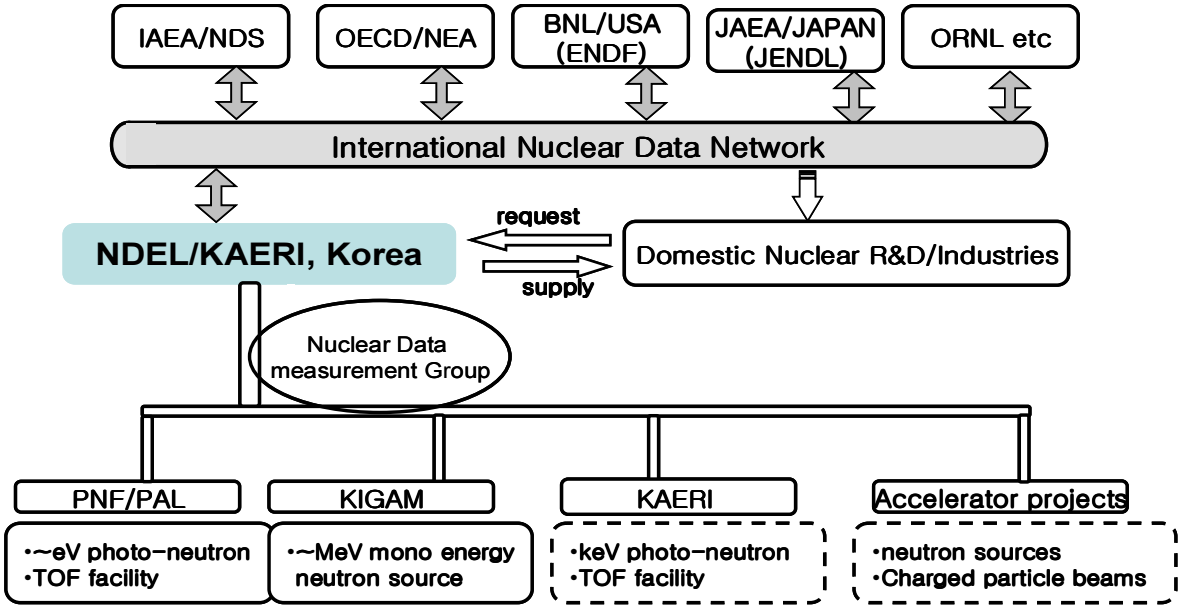
0. General

Nuclear Data Evaluation Laboratory (NDEL) of Korea Atomic Energy Research Institute (KAERI) has 7 staffs (evaluation 3, processing and benchmark 2, applications 2) and 1 secretary. 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 funded by a stable and steady source of budget from the fiscal year of 2009.

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

- **Advanced Reactor Development** (Liquid Metal Fast Reactor, High Temperature Gas Cooled reactor and 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
- **Accelerator projects** requires high energy neutron and charged particle nuclear data relevant to the radiological safety and beam application of the accelerators
- 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)



2. Nuclear data compiled and measured

- The EXFOR compilation activity for the domestic nuclear reaction data is on going since 2009 in the KAERI/NDEL under the guidance of IAEA/NDS. As a part of this work, two EXPOR entries were produced and listed in Table 1. Another entry compiled will be updated by the next compilation control data base.

#	ENTRY	Title	Author
1	31666	The neutron total cross sections of natural palladium	Y.D. Oh
2	D0569	Investigations of the ^{nat}Ti(p,x)^{43,44m,44g,46,47,48}Sc, ^{48}V	M.U. Khandaker
3	checking	The total neutron cross sections and resonance parameters of natural Niobium	T.F. Wang

- The nuclear data which were measured but not yet be published are listed in the Table 2, which KAERI/NDEL is going to compile into EXFOR with the support of NDS and in collaboration of authors.

#	Title	Author
1	Measurement of some isomeric yield ratios by photonuclear reactions in ^{nat}In, ^{nat}Sn, and ^{197}Au with bremsstrahlung beam	RAHMAN Md. Shakilur
2	The total cross section of ^{nat}W by neutron energies between 800 keV and 1 MeV	Gidong Kim
3	Production cross section of residual radionuclides by proton-induced reactions on natural nickel	Kwangsoo Kim
4	Measurements of maxwellian averaged neutron capture cross sections for ^{56,57}Fe	WANG Taofeng
5	Neutron resonance parameter measurements of Gadolinium isotopes	Yeong-rok Kang

3. Facilities

3.1 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

3.2 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 der 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)

3.3 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

NNDC update: staff and budget

Staff

- P. Oblozinsky stepped down as the NNDC head, Mike Herman took over since the middle of January 2009
- Staff status: 11 regular staff members + 3 postdocs
- Nuclear reaction effort: 2 staff + 2 postdocs (M. Pigni, C. Mattoon)

Budget

- DOE Office of Science: support for the NNDC as the national facility
  - represents ~85% of the NNDC budget
  - we feel that we have solid support and prospect is stable
  - more emphasize on applications
  - new US Government: more money for science
- Other funding: developed over last several years as additional funding
  - DOE Nuclear Energy (advanced reactors)
  - DOE National Nuclear Security Agency (nuclear criticality safety)

NNDC update: nuclear reaction data

CSEWG coordination

- ENDF/B-VII.0 library released in 2006, continues to be tested
- ENDF/B-VII.1 library will be released in ~2010

Evaluations

- Criticality safety - covariance estimates for large number of materials
- Advanced fuel cycle - covariance library for advanced burner reactors

Compilations

- Done by two external collaborators (S. Hlavac, O. Schwerer)
- This arrangement works pretty well, will continue for next ~5 years

Web service

- Sigma retrieval system, version 3.0 released in March 2009
- Overall service continues to grow rapidly (~40% growth in 2008)

Computer upgrade

- 130,000 US$ for upgrade and modernization of the NNDC computers
- Migration to MySQL (Sybase increased the cost drastically)

NNDC compilation statistics since October 2008

Compilations are done by Stanislav

PRELIM	NEW		CORRECTED	
	Entries	Subentries	Entries	Subentries
C088	16	158		
C090	19	277		
C091	13	87		
L012	6	19		
1351	19	155	12	13
1353	12	122	35	35
TOTAL	**85**	**818**	**47**	**48**

Type of entries

Neutron entries	CP entries	Photon entries
31	48	6

Compilation of papers from APS journals since January 2009

Journal	Published	Compiled	Prepared*	To do
Phys. Rev. C	33	21	7	5
Phys. Rev. Lett.	9	2	1	6
Total	42	23	8	11

* Compiled and checked (locally), not yet in PRELIM

Type of entries

Neutron entries	CP entries	Photon entries
5	37	0

Data gathering

Tables	From author	Scanned	Waiting
14	18	0	8

NNDC quality assurance process

Otto checks what Stanislav compiled

Checking EXFOR compilations

- „4-eyes“ principle: double-check by experienced 2-nd person
- Also still a training component
- Mainly manual checking: CHEX is useful & necessary tool but not perfect
- Check for duplications: may occur with the same or different reference
- Check for related articles: cross-reference, 2nd reference for same entry

Details of checking

- Completeness of data reported in article
- Data types within compilation scope
- REACTION coding and correct use of independent variables and units
- Dictionary codes, pointers
- Quantity definitions according to LEXFOR
- Uncertainties, ERR-ANALYS
- Free text wording and spelling

WORKING PAPERS FOR THE 2009 NRDC MEETING IN VIENNA, MAY, 2009

WP2009-1		Conclusions and Actions of the 2008 NRDC Meeting
WP2009-2	N. Otsuka	Review of corrections since the 2008 NRDC meeting (Action A50, A60)
WP2009-3	S. Dunaeva, V. Zerkin	Short analysis of IAEA-NDS EXFOR DB errors report
WP2009-4	M. Bossant, C. Nordborg, N.Soppera	EXFOR-2009-05-08 JANIS Import Log
WP2009-5	N. Soppera, M. Bossant	JANIS EXFOR TRANS Checker
WP2009-6	S. Kopecky, P. Schillebeeckx, N. Otsuka	Uncertainty propagation in TOF-data (Memo CP-D/564rev)
WP2009-7	S. Dunaeva	Compilation and transmission statistics
WP2009-8	S. Dunaeva	Statistics of checking preliminary transes
WP2009-9	S. Dunaeva	Retrospective statistics of publication compilation (Action A9, A13)
WP2009-10	N. Otsuka, S. Dunaeva, A. Mengoni	EXFOR completeness for neutron data published I Phys. Rev. C (Memo CP-D/562)
WP2009-11	V. Zerkin, S. Dunaeva	Public version of the "current compilation" Webpage (Action A9)
WP2009-12	S. Dunaeva	Status of new compilation rule (Action A29, A30)
WP2009-13	N.Otsuka, S. Dunaeva	Data type code EXP (Memo CP-D/552)
WP2009-14	N.Otsuka, O. Schwerer	Coding of elemental cross section divided by istotopic abundance (Memo CP-D/546)
WP2009-15	N. Otsuka, S. Dunaeva, O. Schwerer, M. Mikhaylyukova	Ranged uncertainty values (Memo CP-D/530rev, 4C-4/176)
WP2009-16	N. Otsuka, S. Dunaeva	History coding (Memo CP-D/537rev)
WP2009-17	N. Otsuka, S. Dunaeva	Institute code under INSTITUTE and FACILITY (Memo CP-D/557)
WP2009-18	H. Henriksson, N. Otsuka	Coding mistakes in EXFOR REFERENCE lines converted to CINDA (Memo CP-D/561, Action A45, A46)
WP2009-19	N.Otsuka, S. Dunaeva	Coding of REFERENCE and REL-REF (Memo CP-D/565rev)
WP2009-20	M. Mikhaylyukova	SIG/SUM correction for NRDC2009 discussion (Memo 4C-4/175rev)
WP2009-21	C. Nordborg	Proposals related to the EXFOR keyword AUTHOR
WP2009-22	C. Nordborg	Proposals related to the EXFOR keyword

		TITLE
WP2009-23	N. Otsuka	Level Density Compilation since the last meeting (Action A40, A41, A57)
WP2009-24	G. Pikulina	Development of software package for input and editing of experimental data in EXFOR format: Exfor-Wizard as an application for creation of Exfor files with patterns
WP2009-25	N. Otsuka, S. Dunaeva, V. Zerkin	DOI line under REFERENCE (Memo CP-D/566rev, Action A23, A24)
WP2009-26	H. Noto	JCPRG has responsibility for the compilation of the nuclear reaction data produced in Japan
WP2009-27	N. Otsuka	EXFOR Basic Manual in html (Action A31, A32)
WP2009-28	N. Furutachi	Current status of Japanese digitizer (GSYS)
WP2009-29	H. Noto	The Schedule of the NRDC2010 Meeting in Sapporo
WP2009-30	S. Dunaeva	Status of new compilation and procedure for creation CINDA reference (extraction from WP2008-12)
WP2009-31	O. Schwerer, P. Oblozinsky, N. Otsuka	Energy coding for Spectrum Average

Note: The working papers are available online from http://www-nds.iaea.org/nrdc/nrdc_2009.

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