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INDC International Nuclear Data Committee

Report on the

IAEA Technical Meeting of the International Network of Nuclear Reaction Data Centres

IAEA Headquarters, Vienna, Austria
8 – 10 October 2007

Prepared by

O. Schwerer and S. Dunaeva

IAEA Nuclear Data Section, Vienna, Austria

November 2007

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Abstract

An IAEA Technical Meeting of the International Network of Nuclear Reaction Data Centres was held at IAEA Headquarters, Vienna, Austria, from 8 to 10 October 2007. The meeting was attended by 19 participants from 11 cooperating data centres of six Member States and two international organizations. A summary of the meeting is given in this report, along with the conclusions, actions, and status reports of the participating data centres.

November 2007

TABLE OF CONTENTS

THE INTERNATIONAL NETWORK OF NUCLEAR REACTION DATA CENTRES .. 7

PREVIOUS NRDC MEETINGS 8

LIST OF ACRONYMS 9

AGENDA 12

LIST OF PARTICIPANTS 15

MEETING SUMMARY 17

Introduction 17

Brief Minutes 17

Conclusions and Actions 20

Review of Compilation Scope and Responsibilities 26

PROGRESS REPORTS 33

P1 NEA-DB / NEA Data Bank, Issy-les-Moulineaux, France 35

P2 ATOMKI / Nuclear Research Institute, Debrecen, Hungary 45

P3 CNPD / Center of Nuclear Physics Data at RFNC-VNIIEF, Sarov, Russia 49

P4 CDFE / Centr Dannykh Fotojad. Eksp., Moscow State University, Moscow, Russia 51

P5 NDS / IAEA Nuclear Data Section, Vienna, Austria 57

P6 UKRNDC / Ukraine Nuclear Data Center at KINR, Kyiv, Ukraine 67

P7 JCPRG / Japan Charged-Particle Nuclear Reaction Data Group, Sapporo, Japan 73

P8 CAJAD/ Center for Nuclear Structure and Reaction Data, Kurchatov Institute, Moscow, Russia 79

P9 CJD / Russian Nuclear Data Center at F.E.I., Obninsk, Russia 81

P10 KAERI / NDEL / Korea Atomic Energy Research Institute, Nuclear Data Evaluation Laboratory, Yusong, Taejon, Republic of Korea 83

P11 NNDC / National Nuclear Data Center, Upton, NY, USA 87

LIST OF WORKING PAPERS PRESENTED AT THE MEETING 93

THE INTERNATIONAL NETWORK OF NUCLEAR REACTION DATA CENTRES

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

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

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

PREVIOUS NRDC MEETINGS

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

LIST OF ACRONYMS

ATOMKI	Nuclear Research Institute, Debrecen, Hungary
BibTeX	Program for formatting reference lists for LaTeX
BNL	Brookhaven National Laboratory, Upton, New York, USA
BROND-2	Russian evaluated neutron reaction data library, version 2
C4	A 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 F.E.I., 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, 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

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

PGAA	IAEA database for Prompt Gamma Activation Analysis
PhND	Photonuclear data
RIKEN	Nuclear Data Group, RIKEN Institute of Physics and Chemistry Research, Wako-Shi, Saitama, Japan
RIPL	IAEA Reference Input Parameter Library for reaction calculations
RNAL	IAEA Reference Neutron Activation Library
R33	Format used by ion beam analysis community for storing experimental cross sections
TRANS	Name of transmission tapes for data exchange in the EXFOR system
UKRNDC	Ukraine Nuclear Data Center at KINR, Kyiv, Ukraine
VNIIEF	Russian Federal Nuclear Center, Sarov, Russia
WPEC	Working Party on international nuclear data Evaluation Cooperation
WPEC-SG30	WPEC Subgroup 30 on “Improvement of accessibility and quality of the EXFOR database”
XTRACT	EXFOR indexing program
X4TOC4	A 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, 8 October 2007

Plenary: 09:30

1.	**General**		
1.1	Welcome address from NDS		*Nichols*
1.2	Opening, election of chairperson, Adoption of the agenda, announcements		
1.3	Brief status reports – all centres (new tasks, priorities)		
1.4	General situation of centres, staff changes etc.		*Nichols*
1.5	Review of General Actions from the 2006 Meeting (Actions A1-A3)	WP2007-1	*Dunaeva*
1.6	Date and place of next NRDC meeting		

Plenary: 14:00

2.	**EXFOR General** (also Actions A4-A15)	WP2007-1	*Dunaeva*
2.1	Common master file and exchange mechanism		*Schwerer*
2.2	Mistakes and quality control		
2.2.1	Procedure for correcting mistakes in the common EXFOR master file	WP2007-3	*Dunaeva, Zerkin*
2.2.2	Proposal to update old entries instead of creating new	WP2007-7	*Dunaeva*
2.2.3	Proposal to move alteration flag into column 11 of ENTRY and SUBENT records	WP2007-8	*Zerkin, Dunaeva*
2.2.4	Review of compilation scope, distribution of responsibilities, EXFOR status webpage	WP2007-5	*Dunaeva*
2.2.5	Result of checking A. Koning's "List of suspicious EXFOR data"	WP2007-9	*Schwerer*
3.	**Compilation and Transmission statistics**	WP2007-4	*Dunaeva*
4.	**Manuals**		*Schwerer*

Tuesday, 9 October 2007

Plenary: 09:00

5.	**Common EXFOR/CINDA dictionary system (also Action A16)**	WP2007-1	*Zerkin*
5.1	Formats and exchange mechanisms		*Zerkin*
6.	**CINDA** (also Actions A34-A41)	WP2007-1	*Zerkin*
6.1	CINDA-book		*Henrikson*
6.2	Procedure for creation CINDA reference	WP2007-17	*Dunaeva*
7.	**EXFOR software** (A17-A25)	WP2007-1	*Zerkin*
7.1	CHEX, XTRACT, ORDER		*Zerkin*
8.	**EXFOR technical** (also Actions A17-A25)	WP2007-1	*Dunaeva*
8.1	EXFOR+ Interpreted (extended) EXFOR format	WP2007-10	*Zerkin*
8.2	Plotting flags in Archive Dictionary 24 (Data headings)	WP2007-2	*Otsuka, Henriksson*
8.3	Definition of spectrum averaged cross section	WP2007-11	*Otsuka, Schwerer*
8.4	Bibliographical information (TITLE, AUTHOR) from several references	WP2007-12	*Otsuka, Schwerer*
8.5	Journal code PR and general format of page number	WP2007-13	*Schwerer*
8.6	"Proliferation" of Institute codes		*Schwerer*

Plenary: 14:00

8.	**EXFOR technical** (continued)	WP2007-1	
8.7	Reference frame of analyzing power	WP2007-14	*Otsuka*
8.8	Review of corrections since the 2006 NRDC meeting	WP2007-18	*Otsuka*
8.9	Multiplicity of prompt gamma in capture reaction (22960.005-006)	WP2007-19	*Otsuka*
8.10	4-momentum transfer distribution		*Otsuka*
8.11	Conversion of remaining upper case text entries		*Schwerer*
8.12	List of missing EXFOR data of experimental works compiled in the CRP for "Recommended data for production of therapeutic radioisotopes"	WP2007-20	

Wednesday, 10 October 2007

Plenary: 09:00

9.	**Computational and other output formats (discussion leader: V.Zerkin)**	*Zerkin*
9.1	X4toC4	
10.	**EXFOR-Editor (discussion leader: S.Taova)**	
11.	**Other programs**	
12.	**Closing items**	
12.1	Review of actions and conclusions	

Plenary: 14:00

13.	**Quality control & assessment, SG30 issues**	*Mengoni, Koning*

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MEETING SUMMARY

Introduction

The IAEA Technical Meeting on the Co-ordination of the International Network of Nuclear Reaction Data Centres was held at the IAEA Headquarters, Vienna, Austria, from 8 to 10 October 2007. Nineteen participants of eleven cooperating data centres from Hungary, Japan, Korea, the Russian Federation, Ukraine, USA, NEA and IAEA attended the meeting.

Meetings of this network are held annually, with full meetings, involving centre heads and technical staff, every two years (last full meeting was held in September 2006 at IAEA Headquarters in Vienna). Main topics of the present meeting were intensified quality control, systematic and streamlined checking and correction procedures using the feedback and taking into account the needs of data evaluators, EXFOR related software including the EXFOR editor, questions of upgrading output formats and/or the exchange format, timeliness and completeness of EXFOR compilations, questions of the CINDA bibliography, and technical details on the EXFOR/CINDA dictionaries and quantities. Twenty-three working papers were presented at the meeting. The results of the discussions were summarized in 16 Conclusions and 45 Actions (see p 20 ff).

Brief Minutes

A. L. Nichols, Head of the IAEA Nuclear Data Section, opened the meeting on behalf of the IAEA. He started by paying tribute to Feliks Evgen'evich Chukreev, head of the CAJAD data centre, who died on 29 June 2007. Feliks Chukreev contributed much to the worldwide nuclear physics/nuclear data community for over forty years. He was involved in the extension of the EXFOR library to charged particle data in the 1970s and continued to contribute to this database on a regular basis. His expertise in this field and his nuclear structure activities were well recognized by his many colleagues. He will be remembered by the NRDC members as an extremely competent nuclear physicist and friend.

The agenda was adopted without change. Nichols was elected chairman for the general sessions, while Dunaeva chaired the technical sessions.

Participants from the eleven attending Centres presented brief status reports, highlighting the general as well as staff situation of the centres, their compilation activities, data services, other nuclear data activities (such as data evaluation) of interest to the network, and relevant publications. See reports P1 – P11 for details.

The actions of the previous meeting were reviewed. Those not yet fulfilled and others of continuing relevance were included in the new list of actions.

In a session on general EXFOR topics, the general compilation scope and the distribution of responsibilities of the centres were reviewed and confirmed as agreed at the last meeting. A streamlined procedure for straightforward corrections in the master file was agreed, making full use of the common master file being maintained by NDS.

Feedback received by evaluators on real or apparent mistakes in the EXFOR database was discussed, noting that while in a minority of cases actual mistakes had been found, in many cases the problem was misunderstanding the data definitions or in converting EXFOR to the computational format.

Dunaeva reported that the response of the EXFOR compilers to her weekly updates of the "EXFOR compilation status webpage" was generally very good. Most delays in the compilation of new publications are due to the unavailability of numerical data from authors, or due to temporary staff problems in some of the major centres. Dunaeva will in future insist that in the latter case, other network centres fill in the gaps to avoid unnecessary long delays.

Concerning the completeness of photonuclear data, it was said that for several decades the compilation of photonuclear data relies solely on voluntary contributions by CDFE, leaving the setting of compilation priorities to this centre. While the request for completeness is rather new (was first explicitly mentioned at the 2006 NRDC meeting), the increased emphasis on this data type is also reflected in a number of photonuclear data compilations undertaken by D. Rochman at NNDC, the start of such activity by JCPRG (EXFOR K-series) last year, and several compilations carried out at UkrNDC. Dunaeva noted that the completeness of coverage of new photonuclear literature is comparable to the coverage for CPND.

At several points in the agenda the question of formats was discussed. Oblozinsky stressed that, while he agrees that maintaining a database such as EXFOR is partly a conservative activity, we must modernize. While everybody agrees that the original EXFOR format (defined as an EXchange FORmat) was designed more than 30 years ago and is "oldfashioned", most, or all, requests for a modern appearance vis-a-vis the user can be achieved by clever output formats which can make the exchange format completely transparent to the user. Similarly, a good EXFOR editor can simplify the job of dealing with format restrictions for the compilers. After various discussions, there was a consensus that changes of the exchange format will be introduced only very cautiously and requests for better user output and easier ways of compilation will be taken care of by improved "human readable" and computational formats on one hand, and a good EXFOR editor on the other.

Schwerer reported on the situation with respect to manuals. A first version of the EXFOR/CINDA Dictionary Manual was issued in August and further feedback from the users is requested. New updates of the formats manual and LEXFOR are on the NDS work plan for the near future.

The EXFOR/CINDA dictionaries are now always distributed together with the current version of CHEX. The EXFOR master file is also now available in C4 format.

Henriksson reported on the new CINDA book which was issued earlier this year. This is an important archival publication since the future of CINDA as a hardcopy book is not known.

Zerkin presented the latest version of the "EXFOR+" interpreted (extended) EXFOR format. This is an easy-to-understand output format which has been available as an option from the NDS EXFOR Web retrieval system since October 2006.

Several technical issues concerning EXFOR quantities, dictionary codes and compilation rules were discussed; the results are reflected in Conclusions C9 – C16 and Actions A25 – A39.

Zerkin presented the various output options available from the NDS EXFOR Web retrieval system, including EXFOR+, Bibliographic output, formats T4, C4, R33, and various plotting options.

Taova presented the latest version of the EXFOR editor with new enhancements, such as import of data from Text, Word and Excel files, possibility to set data precision, and inserting constant values into a data column. The meeting acknowledged the progress and requested further updating of the editor according to users' feedback. It was also noted that the editor software needs installation on the user's PC and that its free distribution needs to be explored.

Questions on other EXFOR-related software were discussed, along with better information exchange about software being used and developed. Feedback on the checking program CHEX and the digitizing program GSYS and the EXFOR editor were requested from all users. NDS will investigate the possibility of organizing a workshop on the EXFOR editor and digitizing programs.

On Wednesday afternoon, the meeting was joined by A. Koning, NRG Petten, the Netherlands, for a special session. Koning informed the NRDC about the newly formed Subgroup 30 of WPEC (Working Party on international nuclear data Evaluation Cooperation) on "Improvement of accessibility and quality of the EXFOR database". The goal is to make EXFOR a database which is both free of errors and easily accessible to evaluators. Close cooperation between NRDC and SG30 will be needed to achieve these goals. Since several members of the NRDC are also members of WPEC-SG30, this cooperation should be possible, and the NRDC requested to be kept informed on the subgroup's activities.

The next NRDC meeting, which will be a full meeting including centre heads, will take place in the second half of September 2008 in Obninsk, Russia. *Note added after the meeting: a preliminary date for the next meeting was set for 22 – 25 September 2008.*

Conclusions and Actions

Conclusions

General

C1 Next year's meeting will be held in the second half of September 2008 in Obninsk. *(Note added after the meeting: preliminary date for the next meeting was set for 22 – 25 September 2008)*

EXFOR, General

C2 The general compilation scope is kept unchanged as agreed last year and given in WP 2006-13 Rev.2 (see page 26).

C3 The proposal that NDS can make trivial corrections directly on the common master file (with information of originating centre) is agreed (WP 2007-3).

C4 All corrections of entries must start from the version of the common master file (rather than from local versions).

C5 Recompilations or improvements of existing entries by another centre should result in an update of the old entry (rather than a new entry with deletion of the old one), in consultation between both centres (WP 2007-7).

C6 The NRDC recommends to WPEC-SG30:

a) to keep the NRDC informed about its activity and data formats development
b) to provide full documentation of used computational formats
c) to provide internal files (dictionaries) to NRDC

Common EXFOR/CINDA dictionaries

C7 NDS will distribute an extended form of the quantity dictionary 236 which will introduce all occurrences of SF7 (particle considered) codes which were replaced by wildcards, for use in various application programs. This dictionary will be distributed together with the EXFOR backup (Also Action A21).

CINDA

C8 Dunaeva will on a trial basis produce EXFOR dummy entries from her scanned references (as described in WP 2007-17) which can be used for CINDA input (Action A24).

EXFOR, technical

C9 The proposal of WP 2007-8 (Move of alteration flags to col.11 in ENTRY and SUBENT records) is accepted. From the new year (2008), the new format must be used. The flags to be used are:
Blank = new
C = changed
I = inserted (SUBENT only)
Deletion of subentry is done by NOSUBENT with blank col. 11.
Alter flags in col. 80 will no longer be used

C10 The definition of modifier BRA (bremsstrahlung spectrum average) as given in WP 2007-11 (CP-E/117) is correct (no change in the definition); data headings EN-MAX or EN-MIN, EN-MAX are used with it.
Modifier BRS is used for "good resolution" spectra (<500 keV); data heading EN is used with EN-RSL.

C11 The meeting adopted Option 1 of WP 2007-2: In dictionary 24, the flag for "one of multiple variables" is removed, so that the appropriate flags for minimum, maximum, errors and resolution of such variables can be inserted.

C12 The proposal for a revised coding of certain *Phys. Rev. B* references is approved; consequently, it is decided that page numbers can now be alphanumeric. Example:
J,PR,B136,1632,196412 must be changed to
J,PR,133,B1632,196412
See WP 2007-13 for complete list of necessary changes (Action A36).
This concerns only publications before 1970. From 1970, the new subseries of Phys. Rev. are coded with journal codes PR/A, PR/B etc.

C13 It is agreed that for institutes not likely to produce several experimental works, it is preferable not to introduce a new institute code but to use the country code (e.g. 3INDIND) with free text explanation, in order to avoid the introduction of too many unimportant codes.

C14 Compilers should remember that for *Analyzing Power* and other polarization quantities always the heading DATA should be used (never DATA-CM), together with the appropriate angle heading ANG or ANG-CM (WP 2007-14).

C15 The proposal of WP 2007-19 on coding of *multiplicity of prompt capture gammas* is agreed:
Reaction coding: …..(N,G)…,MLT/DE with new units PT/RCT/MEV
(See also Action A28)

EXFOR software

C16 Compilers started to use the EXFOR editor for compilation and found to be very useful; it needs further updating according to compilers' remarks.

Actions

General

A1	All	(Standing Action) All recognized policy papers for consideration by the NRDC members need to be prepared and distributed four weeks before the annual NRDC meeting. This will ensure adequate thought and discussion prior to the meeting.
A2	All	Keep CP memo distribution up-to-date.
A3	All	In e-mails with attached CP memos, put the subject in the body of the e-mail so that recipients can decide whether it is relevant for them.
A4	All	Only one memo should be sent per e-mail
A5	All	(continuing) Review the Citation Guidelines (2004 version from NRDC internal webpage) and send updates to NDS.

EXFOR, General

A6	All	(Standing Action) All Centres should give high priority to compiling new compilations.
A7	NDS	(continuing) Continue to try developing sensible means of data communication between laboratories and the network via the major journals.
A8	All	(Standing Action) Follow the procedures agreed earlier for journal coverage and compilation of new publications, as summarized in WP 2006-13 (see page 26).
A9	NDS	Develop a draft for a public version of the "current compilation" webpage.
A10	All	Give priority to compile papers from the 2007NICE conference (from the available papers; no need to wait for proceedings)

A11	Dunaeva	Check list of needed compilations for CRP on "Recommended data for production of therapeutic radionuclides" (WP 2007-20) and inform responsible centers.
A12	All	With high priority compile these works from WP2007-20.
A13	Zerkin	Check on next visit to NNDC possibility of downloading old *Nucl.Phys.* articles relevant for EXFOR, for addition to the NDS archive
A14	Zerkin	Investigate ways to include DOI in EXFOR
A15	Zerkin	Investigate possibility to exchange additional "Reference" files containing references, DOI, NSR key and send to others for comments.
A16	NDS	(continuing) Review the EXFOR Basics Manual and submit revision when time permits. Also include (optionally) the "C4" computational format (taking into account further developments together with WPEC SG30).
A17	NDS	Update LEXFOR and EXFOR Systems Manual
A18	All	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. Even though this will absorb some fraction of the manpower, this exercise is very worthwhile since it will improve the quality and user-friendliness of the database as a whole. Care must be taken with automatic conversions because (in at least one case) serious mistakes even in the DATA table were introduced.
A19	Zerkin	Continue development of EXFOR+ (interpreted/extended EXFOR format)

Common EXFOR/CINDA dictionaries

A20	All	Send feedback on the Dictionary Manual to NDS
A21	Zerkin	Write program to produce extended dictionary 236 (see Conclusion C7) and distribute the new dictionary to centres as part of EXFOR backup.

CINDA

A22	Henriksson	(continuing) Search for illegal experimental entries for MANY and replace them with individual entries.
A23	Henriksson	(continuing) Distribute final version of CINDA manual including latest corrections.
A24	Dunaeva	On a weekly basis, collect in a new directory "CINDA-Dummy" (in the NDS open area) entries in the "dummy EXFOR" format (described in WP 2007-17) of all relevant scanned publications.

EXFOR, technical

A25	Otsuka	(continuing) Submit summary on tensor polarization data as a memo to remove inconsistencies in dictionary expansions.
A26	NDS	(continuing) Clarify quantities KE (Kinetic energy) and AKE (Average kinetic energy) in LEXFOR.
A27	All	(continuing) Check KE and AKE EXFOR entries compiled in their area and correct if necessary.
A28	Otsuka	Review the various types of gamma spectra in EXFOR and the related quantities and units.
A29	Otsuka	Review the quantities and units dimension for data differential with respect to 4-momentum transfer and submit a LEXFOR entry on it.
A30	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 in dictionary 6.
A31	Zerkin	Correct BibTeX output in the NDS system to take correct authors list from NSR when available.

A32	NDS	Update dictionary 24 according to Option 1 of WP 2007-2 and test impact on EXFOR programs, and report to network about the results. (Conclusion C11).
A33	All	Run CHEX in TRANS mode (not DATA mode) when checking new entries or TRANS files, to make sure that all important errors are found.
A34	All	Check WP 2007-18 for remaining corrections to be transmitted. Centres should report on fulfilled Action by the end of 2007.
A35	Dunaeva	(continuing) Distribute list of duplications for action.
A36	All	Make remaining reference corrections from WP 2007-13 (change of coding for PR/B). (Conclusion C12)
A37	NEA-DB	Check old entries 61151, 61227, 67252 (were they converted to area 2 entries?).
A38	All	Go through WP 2007-15 and 18 and retransmit the requested corrections asap, or check and request any necessary dictionary updates.
A39	NDS	Make the correction on entry 1333 listed in WP 2007-16.

EXFOR software

A40	All centres	Keep each other informed about EXFOR-related software being used and/or developed. NDS may add this information to the NRDC internal web page.
A41	All	(Standing Action) Give feedback on the digitizing software GSYS to JCPRG.
A42	All	(Standing Action) Give feedback to NDS on the existing CHEX version (on bugs as well as desired refinements).
A43	NDS	Check possibility of organising a workshop on the EXFOR editor and digitizing programs.
A44	Sarov, NDS	Continue development and testing the EXFOR editor in cooperation with NDS and other data centres, taking into account compilers' remarks.
A45	Sarov	Find ways of free distribution of the EXFOR editor.

(Reproduced from WP 2006-13, **Rev. 2**)

Review of Compilation Scope and Responsibilities

Review of Compilation Scope

(as updated at the 2006 NRDC Meeting and finalized on 30 November 2006)

General categories

Category	Data type
A - Compulsory compilation	All experimental data for incident projectile energy ≤ 1 GeV and projectiles with A ≤ 12, unless listed in Cat. B; and data measured in inverse kinematics, which fulfill these criteria when target and projectile are exchanged**.**
	For photonuclear data compilation is highly recommended**.** Completeness should be achieved in particular for photoneutron and photofission data.
B - Voluntary compilation	Neutron- or charged-particle data with E_{in} > 1 GeV; Heavy ion data for projectiles with A > 12; Vector and tensor polarization data; Kerma factors (integral data only)
C - Separate transmission	Other data types, as specified in the table below

Separate Transmission Series

CIC *)	Centre	Data types
J	JCPRG	Charged-particle nuclear data for projectiles with nonpositive baryon number from all parts of the world.
V (extinct)	NDS	Evaluated neutron data

*) Centre Identification Character

Review of Compilation Responsibilities
(as updated at the 2006 NRDC Meeting)

Centre	Basic responsibility	Additional compilation
NNDC	Neutron data and CPND from USA and Canada	Photonuclear data (coordinated by CDFE)
NEA-DB	Neutron data from NEA countries	CPND (coordinated by NDS)
NDS	Neutron data and CPND from "rest of the world" (areas not covered otherwise)	
CJD	Neutron data from former Soviet Union (except Ukraine)	
CAJAD	CPND from former Soviet Union (except Ukraine)	CPND from "rest of the world" (coordinated by NDS)
CDFE	Photonuclear data	
CNDC	Neutron data and CPND from China (entries submitted through NDS)	
JCPRG	CPND and photonuclear data from Japan	CPND for projectiles with nonpositive baryon number from all parts of the world.
ATOMKI	CPND from ATOMKI and data measured in cooperation with Juelich or with Free Univ. Brussels (entries submitted through NDS)	
UkrNDC	Neutron data and CPND from Ukraine (entries submitted through NDS)	Photonuclear data (coordinated by CDFE)
RFNC	CPND on light nuclei, coordinated with other centers	
Indian compilation activity *	Neutron data and CPND from India, coordinated and assisted by NDS	

Special case: **Two or more institutions from different service areas:**
*If two institutions from different service areas are involved, the primary institution defines the responsible centre. See **LEXFOR, Institutes** for definition of primary institution.*

LEXFOR / Institutes /Compilation Responsibility
If two or more institutions of different service areas are involved, the following rules shall determine the centre responsible.

1. The institute containing the facility used, if at least one of the authors belongs to that facility, should determine the center responsible.
2. If an itinerant group uses the facility of another institution, the institute of the primary investigator of the itinerant group shall determine the centre responsible.

*coordinated by Dr. S. Ganesan, BARC., Mumbai, India

3. In an ambiguous case, the institution from which one is most likely to obtain further information on the experiment should be used to determine the centre responsible.

If a publication reports the results of different experiments undertaken at different laboratories or measured at one laboratory and subsequently analyzed at another laboratory, and either the laboratories are in different areas, or the incident-projectile is of a different type (*i.e.*, neutron, charged particle, or photon), the results are compiled in separate entries by the centre responsible for the data. The entries may be linked using the STATUS code COREL; see **Status** (Interdependent Data).

2004 NRDC Meeting, Conclusion C17:
If several institutes and several experimental facilities are involved in an experiment, the first author of the paper will determine the Centre responsible for the EXFOR compilation.

Consolidated Summary:

If several institutes of different service areas are involved, the following rules determine the compilation responsibility:

1) The institute of the facility used, if at least one author is from this institute. If an itinerant group used the facility, the main investigator of this group determines the centre responsible.
2) If facilities of different laboratories from different service areas are used, the institution from which it is most likely to obtain further information on the experiment should determine the centre responsible. This will normally be the corresponding author, or, if there is some doubt, the first author of the publication. In all such cases the other affected centre and NDS must be contacted before compilation to avoid duplication.
3) If separate experiments from different service areas with clearly separated results are reported in the same paper, the results should be compiled as separate entries. This separation is obligatory for different projectile types (neutron, charged particle, photon). In all such cases cross references to the other entry must be given.

Coverage of conferences (added at 2006 NRDC meeting)

To speed up the coverage of conference proceedings, the following steps are taken:

- If the proceedings were published in a scanned journal, they will be scanned by NDS;
- If the proceedings are published in a separate book, the responsibility for scanning will be as follows:
  - if a staff member of one of the NRDC Centres is among the participants, this Centre will send to NDS a list of references relevant to EXFOR within two months after the conference;
  - if no data centre participates in the conference, NDS takes the responsibility to check once per month the AIP website and NDS can ask any Centre to scan these proceedings.

Coverage of major journals

Coverage of major journals by data centre (as updated November 2006):

PR/C	NNDC
PRL	NNDC
NSE	NNDC
ARI	NDS
NP/A	NDS
CNP	NDS
NIM/A and B	NDS
PL/B	NDS
YF	CAJAD
EPJ	CAJAD
IZV	CNPD
YK	CJD
ANE	NEA
RCA	NEA
AEJ	JCPRG
NST	JCPRG
NSTS	JCPRG
AHP	ATOMKI
JRN	ATOMKI
JRN/L	ATOMKI

Each responsible Centre will rapidly assess the contents of an issue of the above journals, and communicate rapidly with relevant compilation centres and NDS to point out their need to compile as soon as possible. Each responsible Centre will check this list on the Compilation Status website.

These lists of references must be written in a way that makes it clear which Centre is responsible for compilation. Therefore, we propose the following form for the Coverage control system:

1. Journal name, volume, issue, page, year, laboratory. Or it can be NSR code and laboratory, data type (neutron / charged particle / Photonuclear), CINDA code from dictionary 45 and representation of the data (table or graphic).

2. NDS should receive these lists within one month after issue of publication.

Coverage of Chinese journals by CNDC *(added at 2006 NRDC meeting)*

CNDC agreed to cover the following Chinese journals on a regular basis, and to compile all relevant papers in EXFOR:

Dictionary 5 code	**Journal title**	**Language**
CST	Atomic Energy Science and Technology	Chinese
NPR (to be added)	Nuclear Physics Review	Chinese
PHE	High Energy Physics and Nuclear Physics	Chinese
HFH	Journal of Nuclear and Radiochemistry	Chinese
NTC	Nuclear Techniques	Chinese
CPL	Chinese Physics Letters	English
CNDP	Communication of Nuclear Data Progress	English
CNST	Nuclear Science and Techniques	English
ASI	Acta Physica Sinica	English
CPH	Chinese Physics	English

Speeding up compilation of new publications

1. Neutron data: responsibility for compilation in areas 1, 2, 3, 4 should be clear (remember that neutron data from Japan belong to area 2). Nevertheless, the responsible centres should inform NDS about their compilation plans.

2. CPND: reference has to be booked for compilation by the responsible Centre within one month after publication (or after the centre was informed by another centre covering the particular journal). Usually, NDS sends the list of publications that are relevant for compilation within two weeks after publication.

3. To avoid duplications, it is preferable to send the plan of compilations to NDS in the form: reference, EXFOR number, laboratory where experiment was done.

4. The references relevant to EXFOR have to be included in EXFOR within six months after publication. If there is no possibility to receive data from the author (no reply to e-mail), the compiler can digitize curves and point out under STATUS that there was no response from the author.

5. After this period, NDS will take the responsibility for compilation of such papers (or assign to another centre). Any nuclear data centre is free to send their own compilation proposals about the list of delayed articles after six months. This list is available from the EXFOR compilation control webpage (see column "Any").

6. Photonuclear data are coordinated by CDFE. At present, apart from CDFE, only NNDC, NDS and JCPRG have photonuclear data series (L, G, and K, respectively). All correspondence about compilation of photonuclear data should go to CDFE with copies to NDS.

PROGRESS REPORTS

PROGRESS REPORT FROM THE
OECD/NEA DATA BANK
At the NRDC meeting at IAEA, Vienna, Austria
8-10 October2007

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

General overview

The Data Bank's primary role is to provide scientists in member countries with reliable differential and integral nuclear data and computer programs for use in different nuclear applications. The services include also thermochemical data for radioactive waste management applications. The Data Bank organises seminars and workshops to present computer programs or groups of programs that are of special interest to users. Training courses on widely used computer programs are organised a few times a year to ensure a correct and effective use of these programs. The Data Bank member countries are: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Italy, Japan, Republic of Korea, Mexico, Netherlands, Norway, Portugal, Slovak Republic, Spain, Sweden, Switzerland, Turkey, and United Kingdom. Users of the Data Bank services include governmental research institutes, industry and universities.

The total number of full time staff in the NEA Data Bank is 15. This is divided into 8 professional staff and 7 support staff. However, only 5 professional and 6 support staff work with the Data Bank services. The remaining staff is allocated to work in other activities in the NEA.

The annual meeting of the Data Bank management committee (the NEA Nuclear Science Committee Executive Group) was held in June 2007. The main discussion concerned future directions of the NEA Data Bank and general views on how to maintain high quality services to member countries. A secretary for the head of the Data Bank, Roopa Chauhan, has been appointed, while Federico Mompean has left the TDB project and the NEA.

The compilation of experimental data into the EXFOR database has progressed as planned with 58 new neutron induced data sets and 67 new charged-particle induced data sets entered since the last NRDC meeting. The CINDA database, containing bibliographic information, has been updated and was published in 7 volumes (in total 5400 pages) as an archival book in September 2007. It was distributed worldwide to about 250 libraries, research facilities and nuclear data centres.

The JANIS nuclear data display software has been upgraded and a beta version was released in April 2007. The official version of JANIS-3 was released in June 2007 after further checking of the software. It is now a much appreciated tool for nuclear data users, with over 25 000 accesses per month to the NEA databases containing nuclear data.

The high priority request list for nuclear data, within the Working Party on international nuclear data Evaluation Cooperation (WPEC), has been updated and contains now 5 high priority requests and 6 general requests. The requests are divided into 'general' and 'high priority', and the rules for 'general' requests to be accepted have been relaxed so as to admit more of this type. A new WPEC subgroup (number 30 in the series) was formed to deal with the "Quality assessment and improvement of usability of the experimental database EXFOR" in collaboration with the NRDC.

A validation report of JEFF-3.1, JEFF Report 22, is being prepared and the structure of the report has been decided. The plan for the next nuclear data library, JEFF-3.2, was outlined, with new evaluations being prepared on ^{235,238}U, ^{239}Pu, Cr, Mn, Ta and W, as well as a new activation data library. The new library is planned to include more covariance data as well as photonuclear data. A revision of the decay data library, JEFF-3.1.1, was also agreed for release in autumn 2007.

The current phase of the Thermochemical Database (TDB) project has been prolonged until 31 January 2008, and a fourth phase, TDB IV, will start on February 1, 2008. Ten volumes have so far been published in the series of reviews and the work in present phase of the TDB project is concentrating on finalising the three reviews on Thorium, Tin and Iron. The first of these reviews is planned for publication in 2007, the latter two in 2008.

The collaboration with the US-DOE on computer code exchange was recently restarted with 20 codes received and 62 codes distributed. Several training courses have been carried out and recently, courses on MCNPX and SCALE-5 (TRITON) were organised at the NEA.

Nuclear Data Services

The nuclear data services are mainly provided through direct on-line access to the CINDA, EXFOR and EVA databases containing bibliographic, experimental and evaluated nuclear data respectively. Access to all the databases is open and free of charge. See Table 1 for the numbers of retrievals of some services from the web pages during 2006. Figure 1 shows what kind of reaction data users are requesting. Data in the figure is based on the use of the display tool JANIS.

In addition to these on-line services, the Data Bank also answers specific requests from customers. Normally, this concerns requests for very large datasets, which are too large for direct Internet download. The very large datasets are normally distributed on CD-ROM or DVD. Providing advice to nuclear data users is another important part of the nuclear data services.

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

Web page	2006
EVA searches	8 017
EVA downloads	56 150
JEFF documents*	30 242
EXFOR searches	11 563
EXFOR downloads	18 698
JANIS	361 770
CINDA	1 388
Other web pages at the Data Bank	139 471

EXFOR and CINDA compilation

More than 100 new neutron reaction experiments and about 160 charged particle experiments have been entered by the Data Bank into the EXFOR database since the beginning of 2006 (see Table 2). The database is updated continuously and the delay between article publication and inclusion in EXFOR has been reduced.

Table 2 EXFOR compilations from the NEA (area 2 and O) during 2006 and Jan-Aug 2007

AREA 2	Trans	No of works
2006	2174	17
	2175	18
	2176	11
	2177	10
	2178	6
	2179	6
	2180	11
2007	2181	11
	2182	12
	2183	3
	2184	6
	2185	3
	Total	**114**

AREA O	Trans	No of works
2006	o024	9
	o025	17
	o026	69
	o027	13
2007	o028	19
	o029	15
	o030	20
	Total	**162**

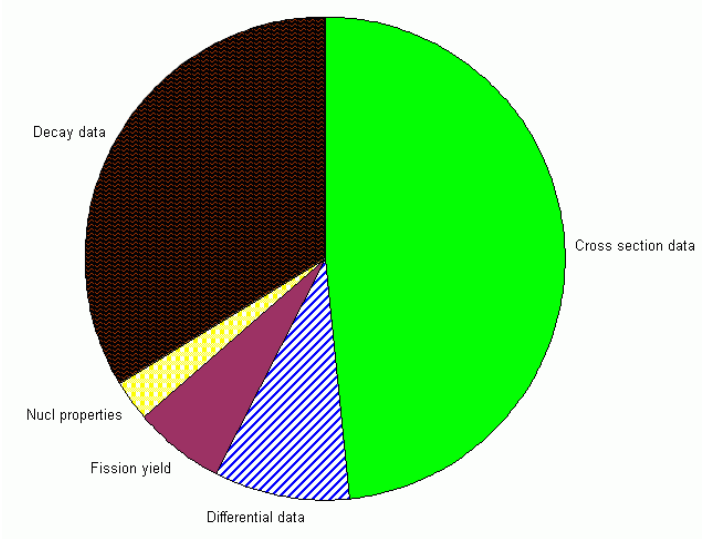

Fig 1. Requested data categories in JANIS. Cross section data is for example total cross sections and ENDF, MF=3 data, differential data is angular or energy distributions, and nuclear properties are data from Nubase.

The CINDA database has been subject to a major extension due to the new format, including the insertion of charged particle references from the EXFOR database. The new CINDA database has been tested and adopted at the NEA.

The CINDA database is available on DVD as part of the JANIS package, and also on-line through the Web. Due to a certain demand and the extension of CINDA to include charged particle data, the NEA has decided to produce an archive version of the CINDA Book, last issued in 1990. The new CINDA 2006 archive version was printed in September 2007.

The data display tool JANIS

The nuclear data display software, JANIS (JAva Nuclear Information System), developed at the NEA Data Bank, has been available for all interested users free of charge since its first release in 2001. JANIS accesses locally stored, as well as remote, ENDF formatted evaluated data and experimental data from the EXFOR database. A new version of JANIS (JANIS-3.0) was released in June 2007. That version incorporates the full CINDA database as well as the complete EXFOR database read in the original EXFOR format. Many features related to the plotting of data have also been added and ameliorated since the previous version, such as the possibility to use dotted lines or different line thickness in the graphs. The plots and nuclide charts can easily be exported as image files (or Windows Meta-files).

The program is free of charge and can be downloaded or launched using 'JAVA Web Start' from the JANIS home page: http://www.nea.fr/janis, where the complete manual can be found as well. Over 25 000 JANIS requests per month for data from the NEA databases are registered in the log files. One such request can cover one EXFOR subentry, or a full evaluated library. See Fig. 2 for the evolution of JANIS retrievals over time since January 2004.

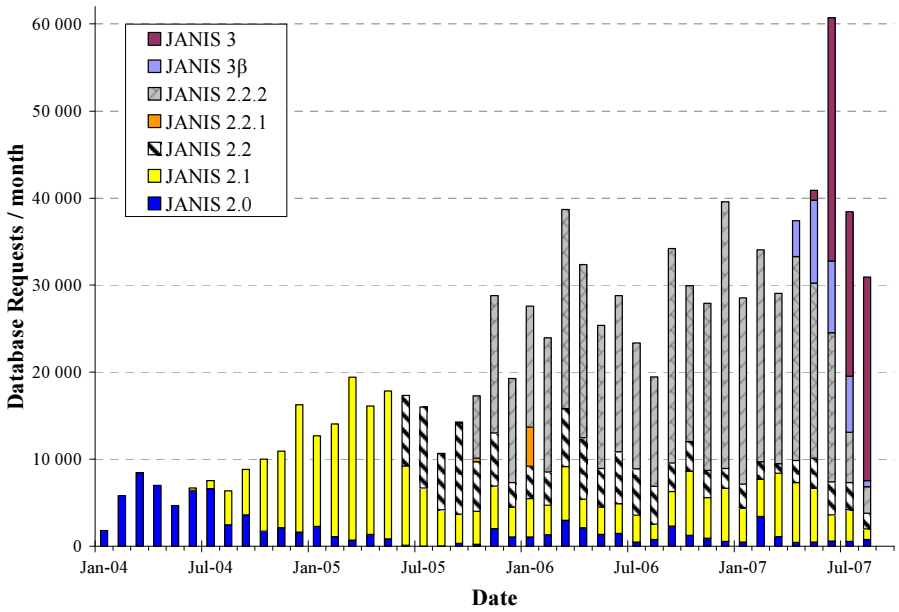

Figure 2 JANIS statistics, January 2004 – April 2007, with the different versions indicated as well. From version 2.2.1 JANIS includes the Web retrieval plotting facility. JANIS-3β was a test version released for the nuclear data conference ND-2007 in Nice, France in April 2007.

The Joint Evaluated Fission and Fusion (JEFF) Project and JEFF-3.1

The JEFF-3.1 Nuclear Data Library is the latest version of the Joint Evaluated Fission and Fusion Library. The complete suite of data was released in May 2005, and contains general purpose nuclear data evaluations compiled at the NEA Data Bank in co-operation with several laboratories in the Data Bank member countries. Processed data for Monte Carlo code applications was made available in spring 2006, and the full documentation of JEFF-3.1, JEFF Report 21, was published in November 2006.

The NEA High Priority Request List (HPRL)

The NEA Data Bank is assisting the Nuclear Science section Working Party on international nuclear data Evaluation Cooperation (WPEC) to manage the High Priority Request List (HPRL), which is a compilation of the highest priority nuclear data requirements, primarily for application in the nuclear industry. The purpose of the list is to provide a guide for those planning measurements, exploring nuclear theory, and requesting high precision evaluated data for the projects. The HPRL is a place where data users meet data producers. Five high priority requests have been accepted after peer review by the HPRL reviewing procedure, and six general requests were also accepted. All requests need to be tied to a certain project. The list is maintained by the NEA Data Bank and is presented at: http://www.nea.fr/html/dbdata/hprl/

Computer Program Services

A large set of computer programs shared by member countries has been acquired, It covers a wide scope from basic nuclear cross section calculations to full nuclear power plant analysis. Every year about 60 new or revised versions of computer codes are added. The computer

program services distributes more than 2000 documented software packages and group cross-section data sets per year. The activity includes collection of programs, compilation and verification, using quality assurance methods, in an appropriate computer environment, and the verification that the computer program package is complete and adequately documented (see www.nea.fr/html/dbprog).

Data from Integral Experiments

Under the guidance of the NEA Nuclear Science Committee (NSC), the Data Bank preserves data from integral experiments to assist users in having well documented information available for benchmark testing, especially in the context of the development of future nuclear energy systems. Integral experimental data with benchmark quality have been compiled, reviewed and published. The most relevant ones for nuclear data are:

- International Criticality Safety Benchmark Experiments (ICSBEP)
- Radiation Shielding and Dosimetry Benchmark Experiments (SINBAD)
- International Reactor Physics Experiments Evaluations (IRPhE).

A large number of these evaluated experiments were distributed in recent years in support of nuclear data and computer code validation.

NEA Data Bank workshops, training courses & tutorials 2006-2007

The NEA Data Bank organises and participates in seminars and workshops to present information on computer programs or groups of programs that are considered to be of special interest to users. Training courses on widely used computer programs are organised a few times a year to ensure a correct and effective use of them. Training courses are organised in the context of the Data Bank knowledge transfer and preservation effort. Each course is attended by between 15 and 30 participants and is financially self-supporting through the fees paid by them. The classes are taught by the authors of the computer codes. Participants gain hands on-experience and acquire competence in the use of the codes for problem solving. Such classes can be at three different levels: introductory, intermediate and advanced. The training courses and workshops held recently are listed below.

September 2006, PHYSOR-2006-Topical Meeting on Advances in Nuclear Analysis and Simulation, Hyatt Regency Vancouver

September 2006, Workshop on Use of Monte Carlo Techniques for Design and Analysis of Radiation Detectors, University of Coimbra, Coimbra, Portugal

September 2006, 9th Information Exchange Meeting on Actinide and Fission Product Partitioning and Transmutation (co-organised NSC/NDC), Nîmes, France

October 2006, Training Course on MCNP5 Coupled Neutron, Electron Gamma 3-D Time-Dependent Monte Carlo Transport Calculations, ITN Sacavém, Lisbon, Portugal

November 2006, Journées "codes de calcul en radioprotection, radiophysique et dosimétrie", INSTN, Saclay, France

November 2006, NJOY users group meeting, NEA Headquarters, Issy-les-Moulineaux, France

November 2006, Training Course on Monte Carlo Simulation, Universidad Internacional de Andalucía, Baeza (Jaén), Spain

March 2007, MCNP5 Introductory Class, with additional topics in advanced geometry & criticality, University of Pisa, Italy,

September 2007, MCNPX Intermediate Class, OECD NEA Data Bank, Issy-les-Moulineaux, France

September 2007, SCALE / TRITON - Multidimensional Transport and Depletion Course, OECD NEA Data Bank, Issy-les-Moulineaux, France

Data Bank Publications

Some of the publications produced by the Data Bank relate to the Nuclear Science Programme, and are presented in the progress report for that committee. Only those related to the Data Bank programme of work are listed below. Periodic news bulletins are also sent monthly by e-mail, or can be retrieved via the Web.

Recent publications from the NEA Data Bank:

- JEFF-3.1 Nuclear Data Library (The) :JEFF Report 21
- International Handbook of Evaluated Reactor Physics Benchmark Experiments (IRPhE)
- Radiation Shielding and Dosimetry Database (SINBAD) (CD-ROM)
- International Fuel Performance Database (IFPE) (CD-ROM)
- New Editions of Computer Program Abstracts (CD-ROM))
- International Evaluation Co-operation:
  - Vol. 7: Nuclear Data Standards
  - Vol. 20: Covariance Matrix Evaluation and Processing in the Resolved/Unresolved Resonance Regions
  - Vol. 22: Nuclear Data for Improved LEU-LWR Reactivity Predictions
- Chemical Thermodynamics of Solid Solutions of Interest in Nuclear Waste Management - Volume 10 A State-of-the-art Report (2007)

Data Bank cooperation with other NEA divisions

Nuclear Science

The collaboration between the NEA Nuclear Science section and Data Bank is mainly in the areas of:

- Reactor and fuel cycle physics, including reactor stability and transient calculations, utilisation of MOX fuel and reactor-based disposition disposal of weapon-grade Pu, nuclear criticality safety, nuclear waste transmutation studies and radiation shielding.
- Fuel cycle chemistry covering chemical partitioning, fuel cycle flowsheet studies and separation criteria

The Data Bank has also developed a database, called DICE, for the International Handbook of Evaluated Criticality Safety Experiments. The most recent version of DICE was released in September 2007.

RTFDB: Research and Test Facilities Data Base
This project is in support of the NEA Nuclear Science Section and development by a Japanese software engineering company is essentially completed. The content of the database describes the various R&D projects in member countries. Additional authentication according to end-user category is being implemented.

Radioactive Waste Management

The Thermochemical Database (TDB) project is a co-operative effort between the NEA Data Bank and the NEA Radioactive Waste Management Committee to produce internationally recommended chemical thermodynamic data needed for the safety assessment of radioactive waste disposal systems. The Project is currently supported by 17 organisations from 12 OECD member countries. The TDB project focuses on the need to meet the specialised modelling requirements for safety assessments of radioactive waste disposal sites. Chemical thermodynamic data are collected and critically evaluated by review teams of experts. In 2006, work continued on the reviews of thorium, tin and iron. The thorium report is under peer review and is scheduled for publication in 2007. The tin and iron reports are scheduled for peer review during 2007. A state-of-the-art report on chemical thermodynamics of solid solutions was recently published.

During the meeting held on 26-27 October 2006 at OECD Headquarters in Paris, France, the TDB III Management Board approved a one-year extension (from 1 February 2007 to 31 January 2008) of the current agreement and for planning to begin during 2007 for a new phase of the TDB project and organised an ad-hoc group to study possible follow-up activities. A new agreement for a new phase of the TDB project (TDB-IV) has now been prepared by the NEA Secretariat, incorporating the conclusions of the ad-hoc group, and, following discussion with potential participants in member countries, was presented and endorsed by the NSC Executive Group, prior to the endorsement by the NEA Steering Committee in Autumn 2007. On 16 March 2007, the RWMC endorsed the proposed programme of work for TDB IV. The tentative start date for the new phase of the project is 1 February 2008.

Radiation Protection

The Information System on Occupational Exposure (ISOE) is a database managed at the NEA jointly with the IAEA. ISOE provides the world's largest database on occupational exposure at 478 commercial reactor units in 29 countries, covering some 91% of the world's operating commercial power reactors. Occupational exposure data collected annually from participants is made available to ISOE members through the database. In addition to the detailed data provided directly by participating utilities, participating authorities also contribute official national data in cases where some of their licensees may not yet be ISOE members. The NEA Data Bank is developing a new Internet-based system for ISOE.

Nuclear Safety

The Data Bank is safeguarding information from a number of projects within the NEA Nuclear Safety division, such as the OECD Piping Failure Data Exchange (OPDE) Project. The goal of this project is to collect and analyse piping failure event data to promote a better understanding of underlying causes, the impact on operations and safety, as well as to generate qualitative insights into the root causes of piping failure events. The OPDE project also aims at

establishing a mechanism for efficient feedback of experience gained in connection with piping failure phenomena, including the development of defence against their occurrence.

Changes to the NEA computer system

Upgrade to Oracle version 10g is completed. The new installation was done with Unicode settings, allowing storage of multinational character sets required by the ISOE project. The general structure was kept: one primary instance serving clients and one instance in standby for failover; but the failover configuration is now provided by Oracle Dataguard. The new installation takes also advantage of Oracle Enterprise Manager for monitoring, controlling database instances and Dataguard operations.

Upgrades were carried out on the dual internet server system. This included both a hardware replacement of the Dell units and the migration to the open source CENTOS which is the publicly available version of the equivalent Red Hat Enterprise Linux operating system.

The equipment used to backup the user and system files was replaced in February 2007. The new system is composed of a cassette based backup robot for the monthly full backups and a disk based system for the daily incremental backups. Both are managed by the same software (EMC Networker) and Linux server as before.

The main Network Attached Storage (NetApp NAS) was replaced in May 2007 and consolidation of the user and application files were subsequently consolidated on this single file store. It is operated with a second identical system for the NEA's office automation file services and they both mutually act as failover backups for one another. The current size of the storage is 1.3 TB. A further increase in storage was done in June 2007 in order to accommodate the present and future computer programme master file storage requirements.

The Data Bank as well as the rest of the NEA uses an open source software called 'Soupermail' which helps set up web forms for a variety of applications. It is used for submitting papers to conferences, soliciting feedback, ordering products (such as JANIS), etc… Because of the lack of robustness of this tool and the need to integrate the application into the Data Bank's other administrative databases, a replacement for the current software is being developed. The new tool will enable NEA users to make up their own customized forms and collect information as needed from external users for all the situations envisaged.

Progress Report of Nuclear Data Group

at Atomki, Debrecen,
Hungary

S. Takács, F. Tárkányi, B. Király
(2007)

I. Data evaluation work

1. *Charged-particle cross section database for medical radioisotope production Diagnostic radioisotopes and monitor reactions*

A Co-ordinated Research Project (CRP) on "Charged Particle cross-section database for medical radioisotope production: diagnostic radioisotopes and monitor reactions" was completed successfully in 2001. The result was summarized in the final report of the CRP and published in IAEA-TECDOC-1211 and on web address http://www-nds.iaea.or.at/medical/. The database includes recommended cross-section data and the corresponding yields calculated from the recommended cross sections.
This year update and upgrade of the 22 charged particle induced reactions can be used for monitoring were completed (Chapter 4).

The list of reactions:

^{27}Al(p,x)^{22}Na
^{27}Al(p,x)^{24}Na
^{nat}Ti(p,x)^{48}V
^{nat}Ni(p,x)^{57}Ni
^{nat}Cu(p,x)^{56}Co
^{nat}Cu(p,x)^{62}Zn
^{nat}Cu(p,x)^{63}Zn
^{nat}Cu(p,x)^{65}Zn

^{27}Al(d,x)^{22}Na
^{27}Al(d,x)^{24}Na
^{nat}Ti(d,x)^{48}V
^{nat}Fe(d,x)^{56}Co
^{nat}Ni(d,x)^{61}Cu

^{27}Al(^{3}He,x)^{22}Na
^{27}Al(^{3}He,x)^{24}Na
^{nat}Ti(^{3}He,x)^{48}V

^{27}Al(a,x)^{22}Na
^{27}Al(a,x)^{24}Na
^{nat}Ti(a,x)^{51}Cr
^{nat}Cu(a,x)^{66}Ga
^{nat}Cu(a,x)^{67}Ga
^{nat}Cu(a,x)^{65}Zn

Experimental microscopic cross section data published earlier and not yet included in the previous evaluation work or new data measured recently were collected and added to the primary database in order to improve the quality of the recommended data. The newly compiled experimental data influenced the decision made earlier and resulted in new selected cross-section data sets. A spline fitting method was applied to the selected data sets and updated recommended data were produced in those cases. Thick target yield was calculated for each of the investigated reactions, which was not given in the first version of the database.
A validation test of the upgraded recommended cross section database was also performed by collecting experimental integral thick target yields reported in literature and/or measuring new data for critical comparison with yields deduced from the new recommended cross sections. The upgraded data, figures and tables were sent to NDS to update the web version (http://www-nds.iaea.org/medical/) of the database regarding the monitor reactions part.

2. *Nuclear Data for Production of Therapeutic Radionuclides*

The Atomki group also participate in a CRP which was started in 2003 with the aim of improving the accuracy and completeness of the data needed for the optimum production of therapeutic radioisotopes, to undertake new measurements, to compile and evaluate all experimental data available on this area, to determine optimum conditions for the production of the selected radioisotopes and to produce accurate cross sections and comprehensive decay schemes for the investigated radionuclides.

II. EXFOR compilation

We continued the compilation work of charged particle induced nuclear reactions in EXFOR format. During the last period 18 new entries were produced with 97 subentries containing data. Data were compiled measured in Debrecen Hungary, in Brussels Belgium, in Juelich Germany and partly in Sendai Japan.

III. Experimental work

We continued to measure experimental cross sections of light charged particles (proton, deuteron, ^{3}He and alpha) induced reactions on various targets Ti, Ni, Pd, Nb Er, Tm. Data are assessed or under process. Results were reported in scientific journals or relevant conferences. See list of publications.

IV. List of publications in 2007

Takács S., Tárkányi F., Király B., Hermanne A., Sonck M., *Evaluated activation cross sections of longer-lived radionuclides produced by deuteron induced reactions on natural nickel,* NIMB 260 (2007) 495.

Takács S., Király B., Tárkányi F., Hermanne A., *Evaluated activation cross sections of longer-lived radionuclides produced by deuteron induced reactions on natural titanium,* NIMB 262 (2007) 7.

Tárkányi F., Hermanne A., Takács S., Ditrói F., Spahn I., Kovalev S.F., Ignatyuk A., Qaim S.M., *Activation cross sections of the 169Tm(d,2n) reaction for production of the therapeutic radionuclide 169Yb,* ARI 65 (2007) 663.

Tárkányi F., Hermanne A., Takács S., Ditrói F., Király B., Kovalev S.F., Ignatyuk A., *Investigation of new routes for production of the therapeutic radionuclides 169Yb and 165Er,* Journal of Labeled Compounds and Radiopharmaceuticals, Supplement 50 (2007) 99.

Tárkányi F., Hermanne A., Takács S., Ditrói F., Király B., Baba M., Ohtsuki T., Kovalev S.F., Ignatyuk A., *Study of activation cross sections of deuteron-induced reactions on erbium for applications,* Journal of Labelled Compounds and Radiopharmaceuticals 50 (2007) 487.

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Tárkányi F., Király B., Ditrói F., Takács S., Csikai Gy., Hermanne A., Uddin M.S., Hagiwara M., Baba M., Ido T., Shubin Yu.N., Kovalev S.F., *Activation cross sections on cadmium: Deuteron induced nuclear reactions up to 40 MeV,* NIMB259 (2007) 817.

Tárkányi F., Hermanne A., Király B., Takács S., Ditrói F., Baba M., Ohtsuki T., Kovalev S.F., Ignatyuk A., *Study of activation cross-section of deuteron induced reactions on erbium: Production of radioisotopes for practical applications,* NIMB259 (2007) 829.

Ditrói F., Tárkányi F., Takács S., Mahunka I., Csikai Gy., Hermanne A., Uddin M.S., Hagiwara M., Baba M., Ido T., Shubin Yu.N., Dityuk A.I.: *Measurement of activation cross sections of the proton induced nuclear reactions on palladium,* Journal of Radioanalytical and Nuclear Chemistry 272 (2007) 231.

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

Technical paper for the NRDC Meeting, October 8-10, 2007
IAEA, Austria, Vienna

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Compilation activity

Within the period under report three transmission files TRANS (F026, F027, F028) were prepared and included into the EXFOR data library (72 new and 14 corrected entries).

EXFOR - Editor software

There were continued the works on software development (EXFOR-Editor) for processing and introduction of experimental data to the EXFOR library.
A major part of work has been already done. The package will include four separate applications: EXFOR – Editor, EXFOR – Master, application for working with data tables - Data – Editor and a program for data digitizing - InpGraph.

This year the work on creation of EXFOR – Master application designed for the beginners was started. Exfor file is formed using the appropriate patterns containing information on the keywords.
S. Taova and G. Pikulina, experts from CNPD visited Nuclear Data Section in May 2007 and reported on the development of EXFOR – Editor. During the visit the up-dated version of EXFOR – Editor and application Data – Editor was presented.

The main changers refer to the work on data table editing. Some new functions of data processing were added:

- data import from TEXT , WORD and EXCEL files is provided;
- user can paste data from the Clipboard into a table;
- desired data presentation precision can be set when transferring data from a table to EXFOR file;
- insertion of a constant value into a data column can be carried out;
- CHART and SORT modes are included to the Data – Editor;
- user interface of some windows was improved.

The window of reaction input was essentially changed. Some new possibilities of reaction, quantity and data-type search appeared.

The window for input of keyword information has been modified.
The following buttons were added:

- CLEAR button – delete text in the edit field.
- COMPRESS button – delete unwanted blanks and service characters from text.

Clicking the right mouse button creates pop-up menu with the edit functions. COPY, CUT, PASTE and UNDO procedures are available.

The following functions were added:

- automatic filling of the DICTIONARY field when entering a code;
- repeated search of a code combination given in the DICTIONARY field.

Such possibilities are available to input information on the following keywords DETECTOR, METHOD, ANALYSIS, STATUS, ERR-ANALYS, INC-SOURCE, ADD-RES, AUTHOR, REFERNCE, TITLE, FACILITY and INSTITUTE.

When entering the new keywords, data tables, COMMON sections to the EXFOR file special check is carried out to control the possibility of input.

The work on development of EXFOR – Editor is being continued. Next year a final version of EXFOR – Master is planned to be prepared.

MSU SINP CDFE Nuclear Data Processing Activity

in 2006 – 2007

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

Progress Report to
the IAEA Coordination Meeting of the International Network
of Nuclear Reaction Data Centres
(8 – 10 October 2007, Vienna, Austria).

The folowing report contains the short review of the works carried out by the Lomonosov Moscow State University Skobeltsyn Institute of Nuclear Physics Centre for Photonuclear Experiments Data (Centr Dannykh Fotoyadernykh Eksperimentov – CDFE) concern the IAEA Nuclear Reaction Data Centres Network activities for the period of time from the Technical Co-ordination Meeting of the Network of Nuclear Reaction Data Centres (25 – 28 September 2006, IAEA NDS, Vienna, Austria) till the fall of 2007 and main results obtained.

EXFOR Compilations

Three new CDFE EXFOR **TRANSes M041, M042 and M043** have been produced and transmitted to the IAEA NDS. Many old data have been corrected in accordance with comments of O.Schwerer, D.Rochman, N.Otsuka, and S.Dunaeva. On the whole the CDFE TRANSes mentioned contain (**Annex 1**) 16 retransmitted and 28 new ENTRYs with 160 new data SUBENTs.
In accordance with C5 Conclusion of the previous 2006 NRDC Meeting ***"In particular, photoneutron and photofission data, as well as (γ,p) and (γ,α) cross sections, should be covered completely"*** 36 SUBENTs with such kind of data were prepared (**Annex 2**).

Upgrading of Databases

The main CDFE relational nuclear data databases

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

have been upgraded significantly – needed corrections, many additions.

Nuclear Structure Evaluations

The last one mentioned New Chart of Nuclear Quadrupole Deformations has been upgraded using new source of related information (quadrupole moments Q and parameters of quadrupole deformation β_2 obtained by Dr. N.J.Stone /1/ and sent to the CDFE directly as numerical data file).
Now the Chart contains about 2000 data sets for about 1500 nuclei.
New evaluated nuclear structure data on nuclear static and dynamic deformations have been obtained using new Chart of Nuclear Quadrupole Deformations - the clear systematical disagreements of those parameters obtained from nuclear quadrupole moments data (Q-type) and from reduced transition probability B(E2)↑ data (B-type).
The results obtained and version of their description were submitted as report to the International Conference on Nuclear Data for Science and Technology at Nice, France (ND-2007) /2/.
Many new non-traditional magic nuclei (^{14}C, ^{14,16,24,28,40,48}O, ^{26,28,30}Si, ^{30,32}S, ^{52,54}Ca, ^{90,92,94,96}Sr, ^{92,94,96,98}Zr) have been found out. It was revealed that near to Fermi energy all new magic nuclei mentioned have the same characteristic structure: there are two closed proton and neutron subshells with identical total moment j (phenomenon named "j = j"- connection) and in some special cases - closed subshell with j = ½ above one of them. Some additional neutron-proton interaction like a n-p pairing was used for description of new magic nuclei features investigated /3/.

Photonuclear Data Evaluations

As the result of the discussion of actinides nuclei photoneutron and photofission reaction cross section evaluations at Nice Conference /4/ the detailed systematical analysis of the (γ,xn), (γ,sn), (γ,n), (γ,2n) and (γ,f) reaction cross section data obtained by using quasimonoenergetic annihilation photon beams at Livermore (USA) and Saclay (France) was carried out for 4 actinides nuclei ^{232}Th, ^{238}U, ^{237}Np, and ^{239}Pu. For overcoming of significant disagreements between the data the special method proposed before for taking into account both laboratories neutron multiplicity sorting procedure features was applied to move the data into consistence. For all 4 nuclei the jointly corrected reaction cross sections were evaluated /5/.
Now data are in preparation for EXFOR (M044).

Short-term (2007 – 2008) Program

The main items of CDFE future short-term program, main riorities and several most important new tasks in fields both photonuclear reaction and nuclear structure data are listed in the **Annex 3**.

References

1. N.J. Stone, Atomic Data and Nuclear Data Tables, 90 (2005) 75.
2. I. Boboshin, B. Ishkhanov, S. Komarov, V. Orlin, N. Peskov, V. Varlamov, Investigation of Quadrupole Deformation of Nucleus and Its Surface Dynamic Vibrations, International Conference on Nuclear Data for Science and Technology, 22-27 April 2007, Nice, France, Book of Summaries, p. 39 (#103).
3. I.N. Boboshin, B.S. Ishkhanov, E.A. Romanovsky, V.V. Varlamov. New Magic Nuclei Shell Structure: Systematics of Features, LVII International Conference on Nuclear

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Annex 1. **The CDFE new EXFOR TRANSes M041, M042, and M043 contents**

(*old corrected* and new **ENTRYs)**

TRANS M041		**TRANS M042**		**TRANS M043**	
ENTRY N	Amount of SUBENTs	ENTRY N	Amount of SUBENTs	ENTRY N	Amount of SUBENTs
M0382	*4*	*M0626*	*6*	*M0420*	*4*
M0383	*5*	*M0632*	*22*	*M0670*	*1*
M0509	*2*	*M0646*	*2*	*M0711*	*5*
M0516	*3*	*M0656*	*2*	**M0712**	**3**
M0525	*30*	*M0683*	*1*	**M0713**	**6**
M0526	*7*	**M0704**	**3**	**M0714**	**4**
M0527	*33*	**M0705**	**2**	**M0715**	**4**
M0634	*3*	**M0706**	**4**	**M0716**	**5**
M0693	**11**	**M0707**	**3**	**M0717**	**3**
M0694	**6**	**M0708**	**17**	**M0718**	**6**
M0695	**3**	**M0709**	**33**	**M0719**	**7**
M0696	**3**	**M0710**	**7**	**M0721**	**3**
M0697	**3**	**M0711**	**5**		
M0698	**5**				
M0699	**3**				
M0700	**2**				
M0701	**2**				
M0702	**4**				
M0703	**3**				
Total new: 11	**Total new: 45**	**Total new: 8**	**Total new: 74**	**Total new: 9**	**Total new: 41**
Sum of new ENTRYs: 28 **Sum of new SUBENTs: 160**					

Annex 2. The cross section data compiled.

REACTION	ADDRESS
(53-I-127(G,X)0-NN-1,,SIG,,,EVAL)	M0693 2 3
(53-I-127(G,X)0-NN-1,UNW,SIG,,,EVAL)	M0693 3 3
(53-I-127(G,N)53-I-126,,SIG,,,EVAL)	M0693 4 3
(53-I-127(G,2N)53-I-125,,SIG,,,EVAL)	M0693 5 3
(53-I-127(G,3N)53-I-124,,SIG,,,EVAL)	M0693 6 3
(57-LA-139(G,N)57-LA-138,,SIG)	M0696 2 3
(59-PR-141(G,N)59-PR-140,,SIG)	M0696 3 3
(82-PB-208(G,X)0-NN-1,,SIG,,BRS)	M0700 2 3
(59-PR-141(G,X)0-NN-1,,SIG,,BRS)	M0701 2 3
(8-O-16(G,X)0-NN-1,UNW,SIG,,BRS)	M0702 2 3
(82-PB-208(G,X)0-NN-1,UNW,SIG,,BRS	M0702 3 3
(83-BI-209(G,X)0-NN-1,UNW,SIG,,BRS)	M0702 4 3
(49-IN-115(G,X)0-NN-1,,SIG,,BRS)	M0703 2 3
(53-I-115(G,X)0-NN-1,,SIG,,BRS)	M0703 3 3
(24-CR-52(G,X)0-NN-1,,SIG,,BRS)	M070500200003
(39-Y-89(G,X)0-NN-1,UNW,SIG,,BRS)	M070600200003
(49-IN-115(G,X)0-NN-1,UNW,SIG,,BRS)	M070600300003
(53-I-127(G,X)0-NN-1,UNW,SIG,,BRS)	M070600400003
(73-TA-181(G,X)0-NN-1,,SIG,,BRS)	M070700200003
(73-TA-181(G,X)0-NN-1,UNW,SIG,,BRS)	M070700300003
(2-HE-4(G,N)2-HE-3,,SIG)	M070801600003
((20-CA-40(G,N)20-CA-39,,SIG,,BRS)+	M071400200003
((20-CA-40(G,N)20-CA-39,,SIG,,BRS)+	M071400300003
((20-CA-40(G,N)20-CA-39,,SIG,,BRS)+	M071400400003
(14-SI-28(G,P)13-AL-27,PAR,SIG,,BRS)	M071700200003
(14-SI-28(G,P)13-AL-27,PAR,SIG,,BRS)	M071700300003
(20-CA-40(G,P)19-K-39,PAR,SIG,,BRS	M071800200003
(20-CA-40(G,P)19-K-39,PAR,SIG,,BRS)	M071800300003
(20-CA-40(G,P)19-K-39,PAR,SIG,,BRS)	M071800400003
(20-CA-40(G,P)19-K-39,PAR,SIG,,BRS)	M071800500003
(42-MO-92(G,X)0-NN-1,,SIG,,BRS)	M071900200003
(42-MO-92(G,X)0-NN-1,UNW,SIG,,BRS)	M071900300003
((42-MO-92(G,N)42-MO-91,,SIG,,BRS)+	M071900400003
(42-MO-98(G,X)0-NN-1,,SIG,,BRS)	M071900500003
(42-MO-98(G,X)0-NN-1,UNW,SIG,,BRS)	M071900600003
((42-MO-98(G,N)42-MO-97,,SIG,,BRS)+	M071900700003

Annex 3. The main items of the CDFE future short-term program.

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

1. Continuation of photonuclear data compilation using EXFOR format, new TRANSes (M044, M045, etc.) production.
2. Upgrading (corrections and additions) of all CDFE Web-site (http://cdfe.sinp.msu.ru) databases.
3. Continuation of joint analysis and evaluation of photonuclear reaction cross sections obtained using various methods, first of all in experiments with bremsstrahlung and quasimonoenergetic annihilation photons, with the aim of definition and excluding of systematical discrepancies.
4. Development of the structure and the testing version of the new Giant Dipole Resonance Chart (produced in analogy to the Chart of Nuclear Quadrupole Deformations) containing the main GDR parameters (energy, amplitude, width, integrated cross section data) for all total - (γ,abs), (γ,xn) and (γ,sn) - and many partial – (γ,n), (γ,2n), (γ,3n), (γ,p), (γ,d), (γ,t), (γ,α) - reactions.
5. Investigations of new non-traditional magic nuclei properties and of their existence conditions using the search possibilities of the CDFE database "Relational ENSDF".

IAEA Nuclear Data Section: Progress Report, 2006/07

Summary of Nuclear Data Studies by Staff of the IAEA Nuclear Data Section
1 October 2006 – 30 September 2007
Editors: S. Dunaeva, O. Schwerer, V. Zerkin

IAEA Technical Meeting, 8-10 October 2007
International Atomic Energy Agency, Headquarters
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 now of a total of 17 professionals and support staff, which means a reduction of one position (Mark O'Connell now only works part-time for our Section (25%)). One new staff member joined during the reported period: Daniel Abriola (effective from 1 January 2007) succeeded former staff member Andrej Trkov. Otto Schwerer retired in September 2007 after 31 years of service; hiring of his successor is currently under way.

2. Data Compilations

2.1 EXFOR and Dictionaries

Over the previous year, NDS staff have distributed 7 CPND TRANS files (D050 - D056), containing 99 new entries (33 compiled at NDS, 20 at ATOMKI, 42 at UkrNDC, 4 in India) and 36 revised entries, and 3 neutron TRANS files (3121 - 3123) containing 42 new entries (15 compiled at NDS, 1 at UkrNDC, 20 at CNDC and 6 in India) and 22 revised entries. The compilations consist of new literature as well as many important old references. Also, two lists of papers (mostly "old" literature) are still on control for completeness of compilation:

1. list for Ion Beam Analysis;
2. list for Reference Input Parameters Library (RIPL).

NDS staff finished the format revision of all old NDS-originated CPND and photonuclear entries, including conversion to the new date format (4-digit years) and revised text (using upper and lower case characters) and started to revise neutron entries.

As of 24 September, 71 TRANS files were received, checked (with feedback to the originating centres) and processed, of which 69 were final versions that were added to the master file. These final transmissions contained 656 neutron entries (199 new, 457 revised), 984 CPND entries (517 new, 467 revised) and 69 photonuclear entries (37 new, 32 revised).

NDS staff have produced and distributed three regular transmissions of the EXFOR/CINDA dictionaries (TRANS 9093-9095) in EXFOR, DANIEL (backup) and archive format. The dictionary revisions introduced in 2006/07 are now routinely in operation, and "wild cards" for REACTION SF7 have also been incorporated into the quantities dictionary 236.

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 was carried out once (January 2007). References for ENDF/B-VII.0 library were generated, discussed, agreed and introduced to CINDA.

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. From this year, the current status of compilation activities is available to EXFOR compilers on the NDS Web site. With the help of this Web site, 11 articles from the 2007 Nice conference are already compiled and available in EXFOR, and one additional compiled entry was transmitted in a preliminary TRANS file. For comparison, in the same period three years ago, no entries had been compiled from the previous ND conference (ND2004).

Over 1200 journal issues from 1990 to 2007 were added to the database for CINDA coverage control in late 2006/2007. Journal references that should be compiled elsewhere were also dispatched to the relevant centres (Japan, Russia, Hungary and NEADB).

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

EXFOR database statistics is also available from the NDS Web site:
- Contribution to EXFOR by Centres
- History (Preliminary, TRANS files, database updates)
- General statistics (contents by Quantities, Targets, Reactions, etc.)

NDS continues to save articles in pdf format. All articles previously stored on the shelf at NDS, are now stored electronically. All articles compiled during this year in the other centres have been scanned and stored in pdf format on NDS-computer. More that 2400 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:

- NuDat-2 for interactive searching and plotting of nuclear structure and decay data, updated to version 2.4
- PREPRO 2007. ENF/B Pre-Processing Codes, March 2007
- Stopping Power for light ions, compilation by H. Paul (Univ. Linz), updated twice
- EXFOR - CINDA Database and Retrieval System, Version 1.95, data updated January 2007 (CD-ROM)
- ENDVER/GUI and EXFOR-CINDA package; Integrated Tools for ENDF-Evaluators, Version 1.4, January 2007

3. Services

Web Services

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

- interactive Web plotting: zoom by mouse, actions by one click, extended functionality
- output EXFOR data in R33-IBANDL format: angular distributions; includes plotting
- several new evaluated libraries are included to ENDF database: ENDF/B-VII.0 (NNDC, 2006), IAEA-Standards, IAEA Thermal Scattering Law Nuclear Data Library (2006), IAEA charged-particle library for medical radioisotope production (2001); first materials from IBA-Eval (Differential charged-particle cross sections for ion beam analysis, Gurbich and Trkov);
- "EXFOR+" (extended EXFOR format) output was implemented on EXFOR Web-service
- "IRDF-2002 extension" project support: includes EXFOR-ENDF Web services for selected materials from the basic libraries and for new evaluations (not public).

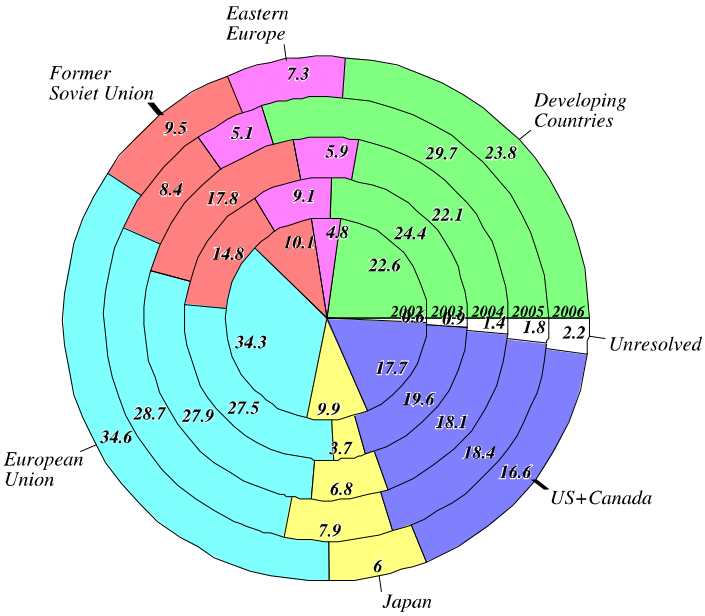
The system is successfully functioning at NNDC, in BARC (India) and IPEN (Brazil). Statistics of usage of the Web retrieval system are presented in Fig. 1.

CD-ROMs

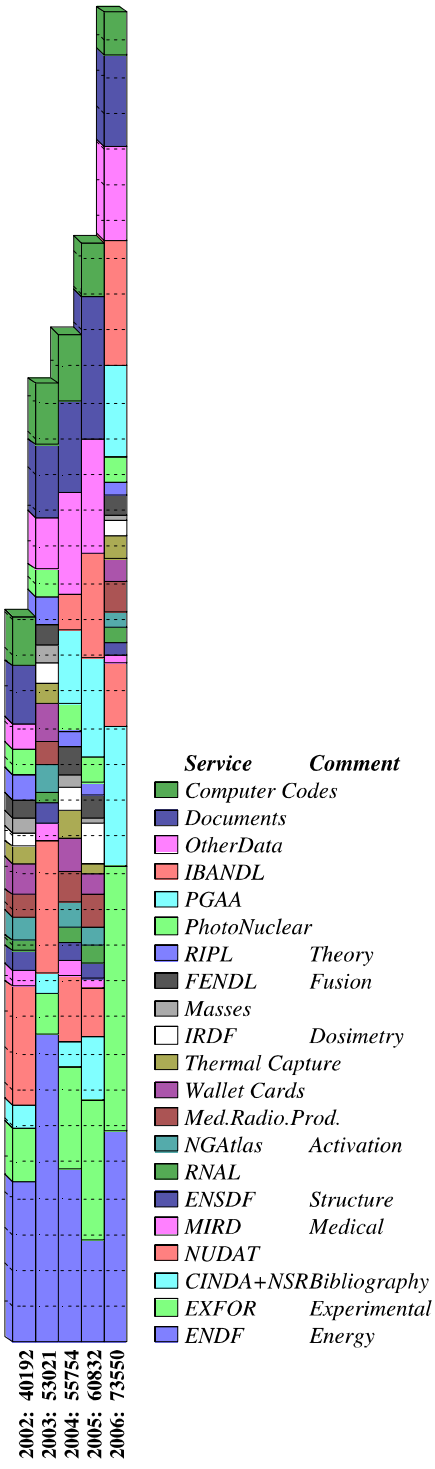
- "EXFOR/CINDA for Windows" CD was issued twice.
- "EXFOR/CINDA for Applications" for Linux and Windows was also issued twice; also distributed together as part of EndVer/GUI-CD and Empire-package. The package has also been adapted to Mac (using X-Windows support system).

NDS+IPEN+BARC
Nuclear Data Services: Web Statistics

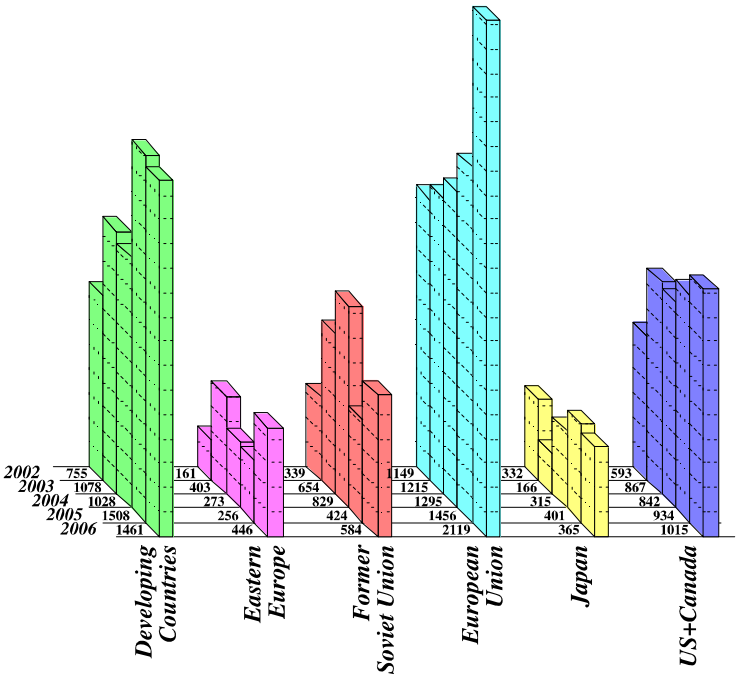
Geographical Distribution (%)



Total per Year
(Number of accesses + retrievals)



Average per Month
(Number of accesses + retrievals)



4. Software

CINDA software

A program to import information from ENDF database has been created and checked with Henriksson (NEA-DB) and Otsuka (JCPRG); ENDF/B-VII.0 was processed.

EXFOR software-tools

ZCHEX checking program was regularly updated. Executables for Windows and Linux with (complete set of dictionaries) are maintained on the NDS compilers' Web-site. Two new versions were released:

December 2006:

- Windows/Linux: EXFOR Dictionary 9093
- finds missing '(' in REACTION keyword
- allows isomer extensions "-L","-L1","-L2" in REACTION and DECAY codes
- Wildcards for SF7 during checking of SF5-8: done using Dictionary-33 (under testing)
- indication of SAN in the right column of error-message
- input file name is indicated in the error file and on the user's terminal
- length of input file name is expanded from 50 to 65

June 2007:

- Windows/Linux/Mac: EXFOR Dictionary 9094
- Wildcards for SF7 during checking of SF5-8: improved algorithm - now uses all Dictionary-33 and 227; (full test and Dict-236 having only wildcards)
- debugging (according to Maev, 2007-06-06 e-mail)
- adopted to Mac OS X (using g77 fortran compiler)

September 2007:

- Windows/Linux/Mac: EXFOR Dictionary 9095 (wildcards only)
- debugging: correct processing of N1,N2 in DATA and COMMON

XTRACT program (originally written in NNDC) was adapted to Linux and Windows and released on NDS Web site.

Full EXFOR in C4 format.

Programs producing full EXFOR database in extended C4 format were developed (discussed within WPEC SG30). Full C4 Master-file is maintained on EXFOR compiler's site. Two files were released.

Flexible ENDF database explorer.

New development - implements a sequential search/scan/view the data; allows the user to select the sequence of data observation "on the fly" and provides an additional convenient service. Now implemented only for ENDF, but will include EXFOR as well.

5. Nuclear Data Development

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

Co-ordinated Research Projects (CRPs):

- *Improvement of the Standard Cross Sections:* completed, all materials with IAEA Publishing Section
- *Nuclear Data for the Production of Therapeutic Radioisotopes:* database completed, report in preparation
- *Reference Input Parameter Library for Non-Energy Applications: (RIPL-III):* on-going
- *Development of a Reference Database for Ion Beam Analysis:* on-going
- *Updated Decay Data Library for Actinides:* on-going
- *Reference Base for Neutron Activation Analysis:* on-going
- *Evaluated Nuclear Data Files of Charged Particle Interactions for Medical Therapy Applications* started in 2007
- *Minor Actinide Neutron Reaction Data (MANREAD)* started in 2007

Data development projects:

- **Phase-Space Database for External Beam Radiotherapy (2006-2008)**

A new IAEA phase-space (*phsp*) format has been established. The new *phsp* database is designed to disseminate phase-space data of those accelerators and ^{60}Co units used in radiotherapy through the compilation of existing data that have been properly validated.

- **IRDF-2002 dosimetry library**

Evaluated data files have been assembled, checked and uploaded onto the NDS Web server http://www-nds.iaea.org/irdf2002/, complete with draft documentation. The results were published as Technical Reports Series No. 452, IAEA, Vienna, Austria, 2006. A Consultants' Meeting was held in January 2007 to discuss the needs for new data for reactor dosimetry and possible extensions to other higher neutron energy applications (including the problem of adequate covariance data).

- **Updates to the WIMS-D library package**

An updated version of the XnWlup package for display and intercomparison of the library data has been provided by Indian researchers. The new WIMS-D library package is available on Web site http://www-nds.iaea.org/wimsd/, on CDROM, and as a publication: WIMS-D library update, F. Leszczynski, D. López Aldama, A.Trkov, STI/PUB/1264, IAEA, Vienna, Austria, 2007, ISBN 92-105006-2.

- **Neutron data file for Cd in the resolved resonance region**

Work is on-going to produce an updated and evaluated nuclear data file of resonance parameters in ENDF-6 format for the cadmium isotopes.

- **Nuclear model parameter sets for the RIPL-2 database**

Database maintenance tools and several new nuclear model parameter sets were included in the RIPL-II database through consultancy visits and service agreements. The extended database is available on Web site http://www-nds.iaea.org/RIPL-2/.

- **Ion Beam Analysis Nuclear Data Library (IBANDL)**

The database was created in spring 2004 and has been extended on a continuous basis since that time.

- **Input to JEFF project**

Original NDS staff interest and technical expertise in the formulation of JEFF-3.1 has resulted in some limited studies for the JEFF project. Over 60 well-defined decay scheme evaluations were undertaken in preparation for the release of the JEFF-3.1 decay data library from 2003 to 2006, and continue as support to the European Fusion programme (approximately 20 radionuclides per year). NDS staff have also actively participated at the JEFF Sub-Group on Decay Data and Fission Yields.

- **TM on Nuclear data for the International Fusion Material Irradiation Facility (IFMIF)**

A TM on "Nuclear data for the International Fusion Materials Irradiation Facility (IFMIF)" was held on 4-6 October 2005 (for a summary see INDC(NDS)-0478). The overall objective of the meeting was to review the status of the nuclear databases used to assess radiation damage to the structural components of the IFMIF test facility. Participants have identified and agreed on a proposal to be submitted to the Agency for the creation of an appropriate CRP.

6. Publications

a) Papers presented at the Nice Nuclear Data Conference (ND2007)

International Conference on Nuclear Data for Science and Technology, April 22-27 2007 Nice, France.

The art of collecting experimental data internationally: EXFOR, CINDA and the NRDC network
by H. Henriksson, O. Schwerer, S. Maev, N. Otsuka

Status and future work of the NEA Working Party on International Nuclear Data Evaluation Cooperation
by A.J. Koning, Jun-ichi Katakura, P. Obložinsky, A.L. Nichols, C. Nordborg

The aims and activities of the International Network of Nuclear Structure and Decay Data evaluators
by A.L. Nichols, J.K. Tuli

Experimental studies to improve specific actinide decay data
by F.G. Kondev, M.A. Kellett, I. Ahmad, J.P. Greene and A.L. Nichols

Inelastic neutron scattering cross section of ^{187}Os at 30 keV
by M. Mosconi, M. Heil, F. Kaeppeler, A. Mengoni and R. Plag

Design study for a new spallation target of the n_TOF facility at CERN
by C. Carrapico, S. Andriamonje, E. Berthoumieux, I. Goncalves, F. Gunsing, A. Mengoni, P. Vaz, V. Vlachoudis and the n_TOF Collaboration

CANDIDE – Cooordination action on nuclear data for industrial development in Europe
by I. Blomgren, E. Bauge, D.C. Ott, S. Czifrus, E. Gonzalez, H. Henriksson, R. Jacqmin, A. Koning, D. Lecarpentier, E. Malambu, A. Mengoni, R. Mills, A. Plompen and G. Rimpault

Capture cross section measurements of ^{186,187,188}0s at n-TOF: The resolved resonance region
by K. Fujii, M. Mosconi, P.M. Milazzo, F. Kappeter, A. Mengoni, and the n-TOF Collaboration

EMPIRE ultimate expansion: resonances and covariances
by M. Herman, S.F. Mughabghab, P. Oblozinsky, D. Rochman, M.T. Pigni, T. Kawano, R. Capote, V. Zerkin, A. Trkov, M. Sin, B.V. Carlson, H. Wienke and Young-Sik Cho

Development of IAEA nuclear reaction databases and services
by V. Zerkin and A. Trkov

The Global Assessment of Nuclear Data, GANDR
by D.W. Muir, A. Trkov, I. Kodeli, R. Capote and V. Zerkin

Evaluation of the 103Rh neutron cross-section data in the unresolved resonance region for improved criticality safety
by L.C. Mihailescu, I. Sirakov, R. Capote, et al.

Deformation dependent TUL multi-step direct model
by H. Wienke, R. Capote, M. Herman, et al.

Lane consistency of the dispersive coupled channel optical model potential
R. Capote, E. Soukhovitskii, et al.

Extension of the nuclear reaction model code EMPIRE to actinides' nuclear data evaluation
by R. Capote, M. Sin, A. Trkov, et al.

New cross section measurements for neutron-induced reactions on Cr, Ni, Cu, Ta and W isotopes obtained with the activation technique by V. Semkova, R Capote, R. Jaime Tornin, et al

Improved lead and bismuth (n,γ) cross sections and their astrophysical impact
by C. Domingo-Pardo, A. Mengoni, R. Capote, et al. (n_TOF Collaboration).

The neutron capture cross sections of ^{237}Np and ^{240}Pu and its relevance in the transmutation of nuclear waste
by C. Guerrero, A. Mengoni, R. Capote, et al. (n_TOF Collaboration)

Measurements of the Au(n,γ) cross section at n_TOF toward a new standard
by C. Massimi, A. Mengoni, R. Capote, et al. (n_TOF Collaboration).

Simultaneous measurement of the neutron capture and fission cross section of ^{233}U
by E. Berthoumieux, A. Mengoni, R. Capote, et al. (n_TOF Collaboration).

Neutron-induced fission of actinides from resonant reactions to spallation
by L. Audouin, A. Mengoni, R. Capote, et al. (n_TOF Collaboration).

Measurement of the ^{90,91,92,93,94,96}Zr(n,γ) and ^{139}La cross sections at n_TOF
by G. Tagliente, A. Mengoni, R. Capote, et al. (n_TOF Collaboration).

Measurement of the neutron induced fission of ^{235}U, ^{233}U and ^{245}Cm with the FIC detector at CERN n_TOF facility
by M. Calviani, A. Mengoni, R. Capote, et al. (n_TOF Collaboration).

b) Other publications

New measurement of neutron capture resonances in Bi-209 by C. Domingo-Pardo, R. Capote, A. Mengoni, et al., *Phys. Rev.* ***C74*** (2006) 025807:1-10.

Uncertainty estimation in IMRT absolute dosimetry verification by F. Sánchez-Doblado, G.H. Hartmann, J. Pena, R. Capote, et al. (to be submitted to *Int. J. Radiation Oncology, Biology and Physics*).

Fission of light actinides: Th-232(n,f) and Pa-231(n,f) reactions by M. Sin, R. Capote, A. Ventura, M. Herman and P. Obložinský, *Phys. Rev.* ***C74*** (2006) 014608 1-13.

Resonance capture cross section of ^{207}Pb by C. Domingo-Pardo, R. Capote, A. Mengoni *et al.* (n_TOF Collaboration), *Phys. Rev.* ***C 74*** (2006) 055802.

Measurement of the neutron capture cross section of the s-only isotope ^{204}Pb from 1 eV to 440 keV by C. Domingo-Pardo, R. Capote, A. Mengoni, et al. (n_TOF Collaboration), *Phys. Rev.* ***C 75*** (2007) 015806.

The ^{139}La(n,γ) cross section: Key for the onset of the s-process by R. Terlizzi, by C. Domingo-Pardo, R. Capote, A. Mengoni et al. (n_TOF Collaboration), *Phys. Rev.* ***C 75*** (2007) 035807.

7. Network Meetings

- 17th Meeting of the **Nuclear Structure and Decay Data (NSDD) Evaluators' Network,** June 11-15, 2007, Petersburg Nuclear Physics Institute, Saint-Petersburg, Russia
- **CMs on XML**
  The IFRC Subcommittee on Atomic and Molecular Data and the Data Centres Network (DCN) have both recommended that the IAEA encourage the use of XML for exchange of data among the DCN members. To fulfil this goal the IAEA NDS has organized a number of Consultants' Meetings attended by researchers in fusion and astrophysics with experience in both data issues and XML schema. Recent meetings include 11-13 October 2006 in Paris, 2-3 April 2007 in Vienna and 1-2 October 2007 in Vienna. A preliminary version of a schema is scheduled to be made available by the end of 2007.

8. Workshops 2007/2008

- Workshop on N**uclear Data for Science and Technology: Medical Applications.** ICTP Trieste, Italy, 12 - 23 November 2007
- Workshop on N**uclear Structure and Decay Data: Theory and Evaluation.** ICTP Trieste, Italy, 28 April – 9 May 2008
- Workshop on N**uclear Reaction Data for Advanced Reactor Technologies.** ICTP Trieste, Italy, 19 - 30 May 2008

9. Visits and Inter-centre Cooperation

- G. Pikulina and S. Taova (Sarov) to NDS, 16-23 May 2007: Development of EXFOR-Editor.
- V. Varlamov and S. Taova (Sarov) to NDS, 8-10 October 2007: Development and deployment of EXFOR-Editor.
- S. Dunaeva (IAEA/NDS) to BARC, Mumbai, India, 26 October – 4 November 2007: EXFOR compilation in India

Ukrainian Nuclear Data Centre (UKRNDC)

Progress Report to the
IAEA Technical Meeting on the Network of Nuclear Reaction Data Centres,
8 - 10 October 2007, IAEA, Vienna, Austria

Summary of nuclear data activity by staff of the UKRNDC
October 2006 –September 2007

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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 published by Ukrainian researchers. Number of the EXFOR's entries sent to NDS IAEA by UKRNDC are:

- for neutron data –3 entries;
- for charged particle data –41 entries;
- for photonuclear data –7 entries.

The list is presented in Table.

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 2006-2007 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 NJOY99 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 2006-2007 for fourth-year students of NPD KNU.

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

#	EXFOR's entry	Reference	Author
Neutron data			
1	**32211**	C,2004SANTA,1,(1),762,2004	S.A. Kravchenko, M.F. Vlasov, O.O.Gritzay
2	**32215**	J,JAI,3,(8),(JAI13424),2006	O.Gritzay, V.Kolotyi, N.Klimova, O.Kalchenko, M.Gnidak, P.Vorona
3	**32216**	C,2007NICE,(#228),2007	O. Gritzay , V. Kolotyi, N. Klimova, O.Kalchenko, M. Gnidak and P. Vorona
Charged particle data			
1	**D5007**	J,IZV,68,(2),238,2004 J,BAS,68,266,2004	E.P.Kadkin,S.N.Kondratyev,S.E.Omelchuk, L.S.Saltikov, V.D.Sklyarenko,L.I.Slusarenko, N.P.Yurkuts
2	**D5008**	J,YF,67,899,2004	V.A.Zheltonozhcky, V.M.Mazur, Z.M.Bigan
3	**D5009**	J,IZV,68,(2),188,2004) (J,BAS,68,210,2004	A.N.Vodin,A.S.Kachan,L.P.Korda, V.M.Mishchenko,R.P.Slabospitsky,I.V.Ushakov, G.K.Khomyakov
4	**D5010**	J,IZV,68,(2),195,2004 J,BAS,68,218,2004	A.N.Vodin,A.S.Kachan,L.P.Korda, V.M.Mishchenko,R.P.Slabospitsky,I.V.Ushakov, G.K.Khomyakov
5	**D5011**	J,IZV,68,(11),1577,2004 J,BAS,68,1761,2004	A.N.Vodin,A.S.Kachan,L.P.Korda, O.A.Lepeshkina,R.P.Slabospitsky, S.A.Trotsenko,I.V.Ushakov
6	**D5012**	J,IZV,65,(5),695,2001 J,BAS,65,746,2001	A.N.Vodin,A.S.Kachan,V.M.Mishchenko
7	**D5013**	J,IZV,69,(5),742,2005 J,BAS,69,838,2005	O.K.Gorpinich,O.M.Povoroznyk, A.A.Jachmenjov
8	**D5014**	J,IZV,63,(5),1027,1999 J,BAS,63,821,1999	A.S.Kachan, A.N.Vodin, V.M.Mishchenko, R.P.Slabospitsky
9	**D5015**	J,IZV,69,(5),745,2005 J,BAS,69,841,2005	O.K.Gorpinich,O.M.Povoroznyk, A.A.Jachmenjov
10	**D5016**	J,IZV,70,(5),751,2006	A.S.Kachan,I.S.Kovtunenko,I.V.Kurguz, V.M.Mishchenko,R.P.Slabospitsky
11	**D5017**	J,IZV,69,(11),1613,2005 J,BAS,69,1802,2005	A.N.Vodin,L.P.Korda,V.M.Mishchenko, O.A.Lepeshkina, S.A.Trotsenko,I.V.Ushakov
12	**D5018**	J,IZV,69,(11),1619,2005 J,BAS,69,1809,2005	B.A. Nemashkalo,K.B. Shebeko, S.N.Utenkov
13	**D5019**	J,IZV,65,(5),692,2001 J,BAS,65,742,2001	O.K.Gorpinich,Vit.M.Pirnak,O.M.PovoroznykY u.S.Roznyuk, B.G.Struzhko
14	**D5020**	J,IZV,66,(5),743,2002 J,BAS,66,818,2002	O.K.Gorpinich, O.M.Povoroznyk, Yu.N.Pavlenko, Yu.S.Roznyuk, B.G.Struzhko
15	**D5021**	J,IZV,67,(11),1556,2003) (J,BAS,67,1717,2003	B.A.Nemashkalo,S.N.Utenkov,S.S.Ratkevich, I.D.Fedorets
16	**D5022**	J,IZV,67,(11),1561,2003 J,BAS,67,1723,2003	B.A.Nemashkalo,K.v.Shebeko,S.S.Ratkevich, I.D.Fedorets
17	**D5023**	J,VAT/I,44,(5),31,2004	O.K.Gorpinich,O.M.Povoroznyk, A.A.Jachmenjov
18	**D5024**	J,UFZ,50,(4),327,2005	O.K.Gorpinich, O.M.Povoroznyk
19	**D5025**	J,UFZ,49,(1),16,2004	O.K.Gorpinich,O.M.Povoroznyk, O.O.Yachmenov

20	**D5026**	J,NP/A,700,(1-2),25,2002	A.T.Rudchik,Val.M.Pirnak,A.Budzanowski, A.Szczurek,V.K.Chernievsky,L.Gowacka, S.Kliczewski,E.I.Koshchy,A.V.Mokhnach, R.Siudak,I.Skwirczynska,J.Turkiewicz, V.A.Ziman
21	**D5027**	J,NP/A,602,211,1996	A.T.Rudchik,A.Budzanowski,E.I.Koshchy, L.Glowacka,Yu.G.Mashkarov,M.Makowska-Rzeszutko,Val.M.Pirnak,R.Siudak,A.Szczurek, J.Turkiewicz,V.V.Uleshchenko,V.A.Ziman
22	**D5028**	J,NP/A,639,599,1998	S.B.Sakuta,Yu.A.Glukhov,A.T.Rudchik, Val.M.Pirnak,A.Budzanowski,S.Kliczewski, R.Siudak, I.Skwirczynska,A.Szczurek
23	**D5029**	J,ZNJD,,(2),16,2006	Yu.Pavlenko,O.K.Gorpinich,V.N.Dobrikov, N.L.Doroshko,V.O.Kiva,I.N.Kolomiets, V.I.Medvedev,Val.M.Pirnak
24	**D5030**	J,IZV,67,(11),1583,2003 J,BAS,67,1743,2003	O.K.Gorpinich, O.M.Povoroznyk, Yu.S.Roznyuk, B.G.Struzhko, A.A.Yachmenev
25	**D5031**	J,IZV,63,(5),1021,1999 J,BAS,63,816,1999	A.N.Vodin,A.S.Kachan,V.M.Mishchenko
26	**D5032**	J,PR/C,15,(2),579,1977	J.Keinonen, M.Riihonen, A.Anttila
27	**D5033**	J,NP/A,313,251,1979	M.Riihonen, J.Keinonen, A.Anttila
28	**D5034**	J,NP/A,318,111,1979	J.J.A.Smit, M.A.Meyer, J.P.L.Reinecke, D.Reitmann
29	**D5035**	J,NP/A,341,345,1980	J.Keinonen, S.Brandenburg
30	**D5036**	J,IZV,66,(1),40,2002 J,BAS,66,40,2002	A.N.Vodin, A.S.Kachan, V.M.Mishchenko
31	**D5037**	J,UFZ,45,(7),795,2000	Grantsev V.I., Dryapachenko I.P., Pirnak Vit.M., Povoroznyk O.M., Pshedzjal A.P., Roznyuk Yu.S., Rudenko B.A., Struzhko B.G.
32	**D5038**	J,UFZ,48,(10),1035,2003	GorpinichO.K.,PovoroznykO.M.,YachmejovO.
33	**D5039**	J,VAT/I,40,(2),33,2002	A.S.Kachan, A.N.Vodin, V.Yu.Korda, V.M.Mishchenko, R.P.Slabospitsky
34	**D5040**	J,VAT/F,45,(6),40,2005 J,IZV,70,(11),1623,2006	S.N.Utenkov, K.V.Shebeko
35	**D5041**	J,VAT/I,40,(2),30,2002	A.N.Vodin, I.V.Ushakov, A.S.Kachan, I.P.Korda, V.M.Mischenko, B.A.Nemashkalo
36	**D5042**	J,VAT/I,44,(5),39,2004	A.S.Kachan, A.N.Vodin, I.V.Kurguz, O.A.Lepyoshkina, S.A.Trotsenko, I.V.Ushakov
37	**D5044**	J,UFZ,45,(3),270,2000	Gorpinich O.K., Grantzev V.I., Dryapachenko I.P., Pirnak Vit.M., Povoroznyk O.M., Pshedzjal A.P., Roznyuk Yu.S., Struzhko B.G.
38	**D5046**	J,NP/A,785,293,2007	A.A. Rudchik,A.T. Rudchik,S.Kliczewski, E.I. Koshchyc, O.A. Ponkratenko, K.W. Kemper,K. Ruseke,A.Budzanowski, J. Choinski, B. Czech, T. Czosnyka, V.D. Chesnokova, L. Glowacka,E. Kozik, V.M. Kyryanchuk,S.Yu. Mezhevych, A.V. Mokhnach,O.A. Momotyuk, I. Skwirczynska,R. Siudak, A.Szczurek
39	**D5047**	J,UFZ,45,(10),1154,2000 J,BAS,64,370,2000	B.Struzhko
40	**D5048**	C,2007NICE,(#279),2007	Ye.Skakun, S.M.Qaim
41	**D5049**	C,2006CERN,1,204,2006	Ye. Skakun, T. Rauscher.

Photonuclear data			
1	**G4005**	J,ZNJD,8,(2),46,2002	O.A.Bezsheyko, V.A.Zheltonozhsky, I.M.Kadenko, N.A.Strilchuk
2	**G4006**	J,YF,62,(5),941,1999 J,PAN,62,880,1999	I.N.Vishnevsky,V.A.Zheltonozhsky,V.M.Mazur, M.V.Hoshovsky
3	**G4007**	J,YF,54,(3),609,1991	I.Z.Beseda,A.I.Guty,Ya.E.Kostyu,A.P.Osipenko, N.T.Sabolchy, I.V.Khimich, I.A.Shabalina
4	**G4008**	J,UFZ,46,(5-6),529,2001	Mazur V.M., Bigan Z.M.
5	**G4009**	J,UFZ,50,(7),649,2005	Hoshovsky M.V., Mazur V.M., Bigan Z.M., Lyamayev V.I., Marynets T.Yo.
6	**G4010**	J,UFZ,50,(7),649,2005	Bokhinyuk V.S., Guthy A.I., Parlag A.M., Sabolchy M.T., Sokolyuk I.V., Khimich I.V.
7	**G4011**	J,UZHV,19,90,2006	O.O.Parlag

Customer Services

- During 2006-2007 the data for users requests were prepared and adapted (from ENDF, ENSDF and EXFOR libraries) for our institute researchers and for ones from other institutes. The organizations, whose requests on nuclear data have arrived and were executed in the accounting period:

  1. Center of Environmental Problems INR of NASU.
  2. Department of Nuclear Physics of Kyiv National University.
  3. Department of Nuclear Physics of the Institute for Nuclear Research (INR) of NASU.
  4. Department of Physics of Biological Systems of the Institute of Physics of NASU.
  5. Department of the Theory of Nuclear Reactions INR of NASU.
  6. Department of Nuclear Reactions INR of NASU.
  7. Uzhgorod Institute of Nuclear Physics of NASU.

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

Calculation

The ACE-format libraries for the isotopes needed for calculations of the maximum specific activity of the irradiated products at the INR WWR-M reactor, namely, $^{50, 52, 53, 54}$Cr, $^{54, 56, 57, 58}$Fe, $^{92, 94, 95, 96, 97, 98, 100}$Mo, $^{58, 59}$Co, ^{89}Y, $^{96, 98, 99, 100, 101, 102, 103, 104, 105, 106}$Ru, $^{107, 109, 111}$Ag, $^{106, 108, 110, 111, 113, 114, 115m, 116}$Cd, $^{112, 113, 114, 115, 116, 114, 117, 118, 119, 120, 122, 123, 124, 125, 126}$Sn, $^{120, 122, 123, 124, 125, 126, 128, 130, 132}$Te, $^{133, 134, 135, 136, 137}$Cs, $^{136, 138, 140, 141, 142, 143, 144}$Ce, $^{141, 142, 143}$Pr, $^{142, 143, 144, 145, 146, 147, 148, 150}$Nd, $^{144, 147, 148, 149, 150, 151, 152, 153, 154}$Sm, $^{151, 152g, 153, 154, 155}$Eu, $^{152, 153, 154, 155, 156, 157, 158, 160}$Gd, ^{159}Tb, $^{175, 176}$Lu, ^{181}Ta, $^{180, 182, 183, 184, 186}$W, $^{185, 187}$Re, $^{191, 193}$Ir, $^{84, 86, 87, 88, 89, 90}$Sr, ^{197}Au, $^{196, 198, 199, 200, 201, 202, 204}$Hg, are in preparation. The input data are 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 are doing by NJOY99.81 code at the computer ESCALA S120 with RISC/6000 processor under AIX operating system.

Visits and Conferences

- O. Gritzay and O. Kalchenko took part in the International conference on Nuclear Data for Science and Technology" (ND2007), which was held in Nice, France from April 22 to April 27, 2007.
- N. Klimova took part in the First French-Ukrainian Summer School of Particle Physics, which was held in Mukachevo in the Carpathian region of Ukraine from July 9th to July 14th, 2007.

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
8-10 October, 2007

0. General

The "Japan Nuclear Reaction Data Center (JCPRG)" was approved as an organisation of Faculty of Science, Hokkaido University and established on April 1, 2007. In addition to nuclear data activities carried out by JCPRG (Japan-Charged Particle Nuclear Reaction Data Group), the center is concerned with the evaluation of nuclear reaction data in nucleosynthesis in the universe. In order efficiently to compile reaction data obtained by using radioactive ion beam, the center signed a research contract with RIKEN Nishina Center. Education in nuclear data physics is also included in the scope of the center activities. Two researchers in the JAEA Nuclear Data Center are invited to become the visiting professors of the Faculty.

Since the last NRDC meeting (September 2006, Vienna), we have worked on the following activities:

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

0.1 Staff

Our activities have been carried out by 13 members (7 postdoctoral researchers, 3 graduate students, 2 undergraduate students and 1 technical staff). They have been supervised by the NRDF Steering Committee, which consists of 10 senior researchers (9 nuclear physicists and 1 information scientist). All activities have been coordinated by 1 secretary.

0.2 Budget

The regular JCPRG budget ended at March 2001. We have been applying to the Japanese government for a competitive budget for our further activity. Last year 4 million JPY was allocated for astrophysical application of nuclear data by Japan Society for the Promotion of Science (JSPS) and an intensive compilation from doctoral theses has been done.

1. Data Compilation (NRDF and EXFOR)

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

1.1 Scope

We are scanning 16 journals for Japanese charged-particle and photo-nuclear nuclear reaction data compilation:

PR/C, PRL, NP/A, PL/B, EPJ/A, NST, JP/G, NIM/A, NIM/B, PTP, JPJ, NSE, ARI, RCA, JRN and JNRS.

1.2 NRDF

From April 2006 to March 2007, CPND and PhND in 45 references (453 records, 1.83 MB) have been newly compiled for NRDF. Usually new data are released at the JCPRG web site several months prior to EXFOR.

1.3 EXFOR

Since the 2006 NRDC meeting, we have made 104 new entries and have revised or deleted 142 old entries. These were transmitted as 18 trans files (E039-E048, J005-J006, K001-K002 and R019-R022) to the NDS open area. JCPRG is grateful for valuable comments from Svetlana Dunaeva and Otto Schwerer (NDS), Stanislav Maev (CJD) and Vladimir Varlamov (CDFE) on our transmissions as always.

According to the agreement (Conclusion 2006-4) at the 2006 NRDC meeting, the scope of area K is defined for photonuclear reaction data from Japan. So far 10 entries were made for data measured at Institute for Nuclear Study, Univ. Tokyo (INS) and National Institute of Advanced Industrial Science and Technology (AIST), and two files (TRANS.K001 and K002) were transmitted to the NDS open area.

Author proof of EXFOR compilation has been made by researchers from ATOMKI, Lawrence Berkeley National Laboratory, Tohoku Univ., JAEA, Konan Univ., RIKEN and KEK.

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

1.4 Numerical data input from dissertations

Intensive numerical data compilations have been done. These data were shown in tabular form in dissertations which are (partially) published in Journals. About 30 new entries were compiled from these data. In addition, digitized data of about 10 entries are replaced by these authors' data. They were partially transmitted in K002. Submission of all other entries will be included in TRANS.E049 and E050.

1.5 NRDF/EXFOR editor

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

2. Bibliography Compilation (CINDA)

We have prepared CINDA batches for CPND published in Japan every half year. Each batch covers 6 issues of each of 4 Japanese journals JPJ, PTP, NST and JNRS.

Since the 2006 NRDC meeting, two regular batches (49 new lines and 0 modified lines) and a special batch for JENDL-HE2004 (JENDL High Energy File 2004) and JENDL-PD 2004 (JENDL Photonuclear Data File 2004) were prepared and sent to NEA-DB (Reader code J). Bibliographies for neutron induced reaction data in JPJ, PTP, NST and some reports have been compiled by JAEA Nuclear Data Center (Reader code N) as before.

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

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

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

A new web-based NRDF search and plot system on MySQL was released in July, 2007. New compilation, which has been finalized for NRDF, but not for EXFOR, can be obtained from this site. DARPE (another NRDF search and plot system written in Perl) is also available at http://www.jcprg.org/darpe/.

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

EXFOR/ENDF search and plot system is available. This system is written in Perl+MySQL and covers JENDL-3.2 and 3.3, ENDF-B/VI.8 and VII.0, JEFF-3.0 and 3.1, BROND-2.2, CENDL-2 as well as EXFOR.

We have also developed following utilities: PENDL (http://www.jcprg.org/endf/) can output evaluated data libraries in a tabulated form at any temperature and accuracy of interpolation. This is an interface of the ENDF-B Pre-processing codes (PREPRO). Another system RENORM (http://www.jcprg.org/renorm/) is a converter from cross section ratios (e.g. cross section relative to ^{235}U(n,f) cross section) to absolute cross sections and vice versa using evaluated data libraries as reference cross section sets.

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

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

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

A Java-based digitizing system "GSYS" has been updated and released as GSYS Ver.2.2. Main feature implemented on this release was "Automatic Axis Detection" system, which automatically detects and sets the position of axis by easy operation. It reduced operators' workload and variation coming from human factors.

5. XML format for nuclear reaction data

We are interested in describing nuclear reaction data in XML (Extensible Markup Language), which might be a common (meta-) format of nuclear reaction data for various libraries (NRDF, EXFOR, ENDF etc.) and enable us to have common bases of softwares.

6. Customer services

We provide Japanese researchers in the fields of nuclear physics and nuclear engineering with nuclear reaction data. For more information, we published "Annual Report of Nuclear Reaction Data File Vol.20" in March 2007 (Japanese + English abstract, http://www.jcprg.org/annual/annual-e.html). We have also issued a list of newly added data into EXFOR every month (http://www.jcprg.org/exfor/info/recentdata.html) in a CINDA like format.

We have received many comments on EXFOR compilation from Japanese users (mainly JENDL evaluators).

These comments have been listed to a table (http://www.jcprg.org/exfor/info/feedbacks.html), and forwarded to other centres.

ANNEX: Organization and members of JCPRG

NRDF Advisory Committee

Yasuhisa ABE (*Research Center for Nuclear Physics, Osaka Univ., Suita, Osaka*)
Yoshinori AKAISHI (*RIKEN, Wako, Saitama*)
Yasuo AOKI (*Univ. of Tsukuba, Tsukuba*)
Mamoru BABA (C*yclotron and Radioisotope Center, Tohoku Univ., Sendai*)
Junsei CHIBA (*Tokyo Univ. of Science, Noda, Chiba*)
Akira HASEGAWA (*NEA Data Bank, Paris*)
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Masayasu ISHIHARA (*RIKEN Nishina Center, Wako, Saitama*)
Kiyoshi KATŌ (*Hokkaido Univ., Sapporo*)
Jun-ichi KATAKURA (*Japan Atomic Energy Agency, Tokai*)
Mitsuji KAWAI (*Kyushu Univ., Fukuoka*)
Shigeru KUBONO (*Center for Nuclear Study, Univ. of Tokyo, Tokyo*)
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Tohru MOTOBAYASHI (*RIKEN Nishina Center, Wako, Saitama*)
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Tetsuo NORO (*Kyushu Univ., Fukuoka*)
Hajime OHNUMA (*Tokyo Institute of Technology, Meguro, Tokyo*)
Koichi OKAMOTO (*Japan Atomic Industrial Forum Inc., Tokyo*)
Hikonojo ORIHARA (*Tohoku Institute of Technology, Sendai*)
Teijiro SAITOH (*Nuclear Science Laboratory, Tohoku Univ., Sendai*)
Hajime TANAKA (*Hokkaido Univ., Sapporo*)
Hiroaki UTSUNOMIYA (*Konan Univ., Kobe*)

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*)
Akira OHNISHI (*Chairman*, *Hokkaido Univ., Sapporo*)
Shigeto OKABE (*Hokkaido Univ., Sapporo*)
Hiroyoshi SAKURAI (*RIKEN Nishina Center, Wako, Saitama*)

NRDF Annual Report Editorial Committee

Yoshiharu HIRABAYASHI (*Chairman*, *Hokkaido Univ., Sapporo*)
Hiroshi NOTO (*Hokusei-Gakuen Univ., Sapporo*)
Ryusuke SUZUKI (*Hokkaido Univ., Sapporo*)

Staff

1) Data Compilation (NRDF and EXFOR):

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Shin-ya ITO (*Hokkaido Univ., Sapporo*)
Chikako ISHIZUKA (*Hokkaido Univ., Sapporo*)
Chie KUROKAWA (*Hokkaido Univ., Sapporo*)
Hiroshi MATSUMIYA (*Hokkaido Univ., Sapporo*)
Takaomi MURAKAMI (*Hokkaido Univ., Sapporo*)
Naohiko OTSUKA (*Japan Atomic Energy Agency, Tokai*)
Tomoaki TOGASHI (*Hokkaido Univ., Sapporo*)
Kohsuke TSUBAKIHARA (*Hokkaido Univ., Sapporo*)
Tooru YOSHIDA (*Hokkaido Univ., Sapporo*)

2) Bibliography Compilation (CINDA):

Chie KUROKAWA (*Hokkaido Univ., Sapporo*)
Naohiko OTSUKA (*Japan Atomic Energy Agency, Tokai*)

3) System Maintenance and Development (NRDF, EXFOR/ENDF, CINDA, GSYS):

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Ayumi MINOGUCHI (*Hokkaido Univ., Sapporo*)
Hirokazu OHMI (*Hokkaido Univ., Sapporo*)
Naohiko OTSUKA (*Japan Atomic Energy Agency, Tokai*)
Ryusuke SUZUKI (*Hokkaido Univ., Sapporo*)

4) Data Services:

Naohiko OTSUKA (*Japan Atomic Energy Agency, Tokai*)
Hitomi YOSHIDA (*Hokkaido Univ., Sapporo*)

Secretariat

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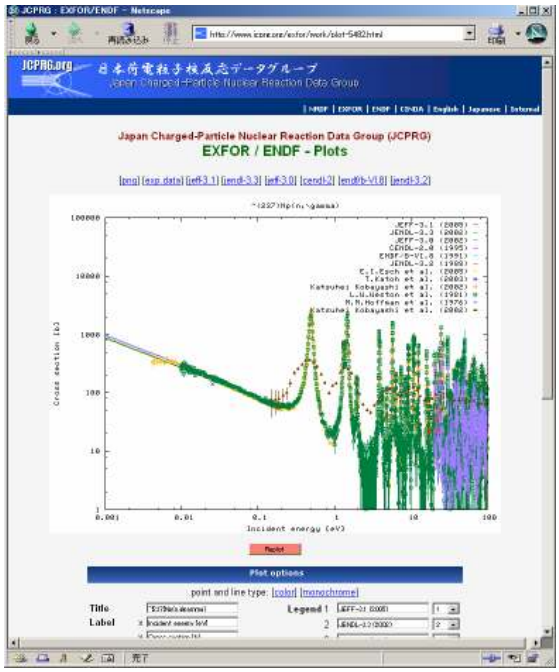
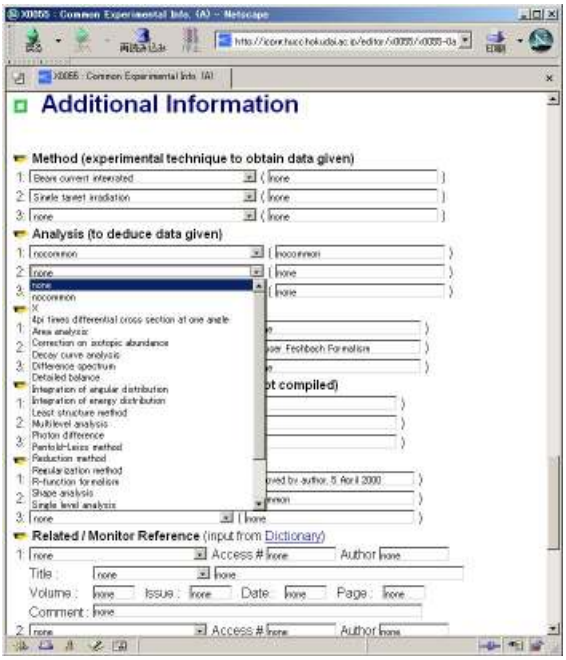
Our Products

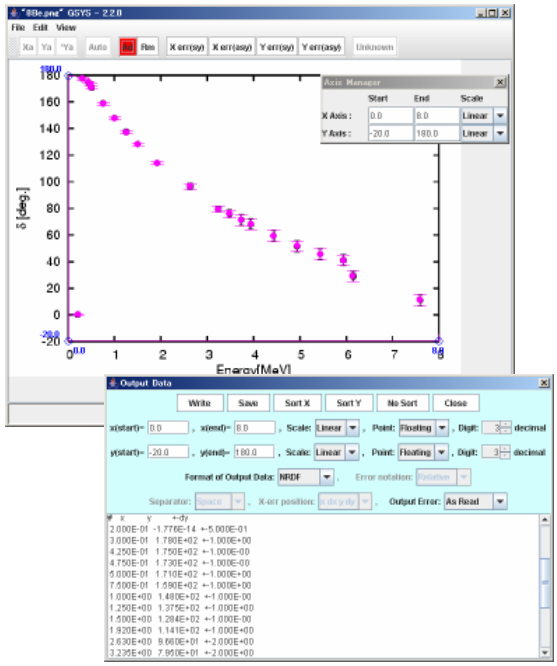
NRDF search/plot (DARPE)
http://ww.jcprg.org/darpe/



EXFOR/ENDF search/plot
http://www.jcprg.org/exfor/



NRDF/EXFOR editor (HENDEL)
http://www.jcprg.org/hendel/



Digitizer (GSYS Ver.2.2)
http://www.jcprg.org/gsys/

ACTIVITY of CAJAD
for the
IAEA Technical Meeting:
Vienna, Austria, 08-10 October 2007

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

Our **Exfor activity** had two main direction

1. Compilation A -Library

After last meeting 2006 we prepared **A062 Trans files**. This Trans files contains astrophysical data, fission data, monitor reaction data. The files include new entries and some corrected old entries according new rules .

2. Team-work with NEA DATA-BANK

During 2006-2007 years near 100 Entries were prepared and included in O-library. These Entries contain mainly differential data for elastic and inelastic scattering and production cross section radioactive and stable isotopes, data for material analysis by charged beams.

3. Checking Codes

We use to check our TRANS and ENTRIES two checking codes-

- our checking code
- CHEX

It is very useful, because the codes are not similar and different errors are finding.

PROGRESS REPORT
to NRDC Technical Meeting
(8 - 10 October 2007, Vienna)

M.V.Mikhaylyukova, V.N.Manokhin, A.I.Blokhin

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-2006 Recommendations and Actions. A large part of activity was related to the nuclear data evaluation. The details are given below.

1. Staff

At present moment the number of CJD staff is 8 : 3 leader scientist, 2 senior scientists and 3 engeneers.

2. EXFOR activity.

All journals available at the Institute library are checked for the presence of the experimental data.

After the NRDC2006 meeting :
Exfor Trans 4138 was transmitted to NDS as final.
Exfor Transes 4139 and 4140 were transmitted and declared as final.
Exfor Trans 4141 is transmitted as preliminary.

Compilation statistics

TRANS	TRANS-Flag	Entries Total	Entries New	Entries Revised	Subents Total	Subents New	Subents Revised
4138	Final	48	5	43	534	99	435
4139	Final	44	12	32	355	67	288
4140	Final	33	11	22	192	47	145
4141	Prelim.	23	5	18	116	24	92
Total	(final)	125	28	97	1081	213	868
Total		**148**	**33**	**115**	**1197**	**237**	**960**

The efforts were made to get numerical data from authors. Good cooperation was established with authors O. Shcherbakov (4RUSLIN), V. Roshchenko(4RUSFEI).

The scannning of experimental data from graphics (in the case if authors reply is absent) let us to increase the number of compiled articles for EXFOR library.

3. Computer and software matters. WEB-site service

At present the CJD Web-site http://www.ippe.ru/podr/cjd/ is under reconstruction.
New versions of CHEX testing code and EXFOR dictionaries are copied from NDS open area and used in compilation.

The digitizing program of Sarov is used to digitize graphical data for EXFOR.

4. Nuclear data evaluation activity.

The main efforts of CJD in the data evaluation activity are directed to 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.

5. Publications.

One issue of journal "Yadernye Konstanty" were published during 2006 year. The electronic copy of this issue was sent to NDS for translation in English and publishing as NDS report. During 2007 year issue 1-2 is prepairing for publishing.

6. Acknowlegments.

We greatly appreciate the help of Otto Schwerer, Naohiko Otsuka and Svetlana Dunaeva for assistance in the successful compilation.

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

Progress Report of 2006/2007 to the

IAEA Technical Meeting on the Network of Nuclear Reaction Data Centres

8-10 October, 2007

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/ NDEL) has 7 Staffs and 1 Secretary (Evaluation 3, Processing and Benchmark 4). KAERI/NDEL is funded by government as a long term nuclear energy development program. The nuclear data needs from the program are as follows:

- Advanced Reactor Development (Liquid Metal Fast Reactor and High Temperature Gas Cooled reactor) requires quantification of cross section uncertainties in their reactor designs.
- Advanced Fuel Cycle needs up-to-date neutron cross sections of fission products.
- Proton Accelerator Development requires high energy neutron and proton nuclear data relevant to the radiological safety and beam application of the accelerator.
- Beside the R&D program, 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)

1. Facilities and Measurements

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

Specifications:

- electron energy = 65 MeV
- repetition rate = 10 ~ 15Hz
- pulse width = 1 ~ 2 μs
- peak beam current = 30 ~ 50 mA
- TOF flight length = 12m
- Target + water moderator to produce neutron pulse
- Ta plates + cooling system
- Detector : scintillator + PM tube
- BC702 [6Li-ZnS(Ag)]Thickness 1.6cm , diameter 12.5cm
- Sample changer consisting of remotely controlled 4 sample holders

Measurements:

- The total cross sections of natural Pd, Nb, Mo were measured using TOF method.
- The resonance parameters of Pd, Nb, Mo were determined using SAMMY code
- Nuclear spectroscopic data and photo-neutron ((γ,3n)) cross-sections in ^{209}Bi with 65 MeV bremsstrahlung were measured at first time

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

Specifications:

- 1 MeV ~ 2 MeV monoenergetic pulsed beam with TOF system
- based on Van der Graaf with bunching and pulsing
- 3H(p,n) reaction with 10^7~10^8 neutrons/sec and FWHM < 15 %
- Pulsed beam with period 125 ns, width 1-2ns, Time Pick up detecting system
- Prompt gamma-ray with anti-Compton system amdtwo parameter (E,T) data taking system
- BC-501 monitor detector (2"x2", 3"x 1 cm)

Measurements:

- Neutron captured gamma spectrum on 197Au is measured and being analyzed for neutron energies 1 ~ 2 MeV

1.3 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
- Measurements of proton induced reaction cross-sections on ^{nat}Mo, ^{nat}Zn, and ^{nat}W:
  - ^{nat}Mo(p,xn)^{99m,96m,g,95m,g}Tc
  - ^{nat}Zn(p,xn)^{66}Ga, ^{nat}Zn(p,xn)^{67}Ga, ^{nat}Zn(p,pxn)^{62}Zn, ^{nat}Zn(p,axn)^{61}Cu, ^{nat}Zn(p,axn)^{65}Zn, Zn(p,axn)^{69m}Zn
  - ^{nat}Mo(p,xn)^{99m,96m,g,95m,g}Tc

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

- A number of different emission channel production cross sections induced by charged particles such as reactions such as ^{nat}Cu(α,x)^{66,67}Ga,^{65}Zn, ^{nat}Fe(d,X)^{56}Co are being evaluated using the statistical model code TALYS, which allow us to solve the discrepancies existing among the literature data.

- For design of an accelerator-based facility, proton induced nuclear data was evaluated for Al-27 in the energy region up to 100 MeV using nuclear reaction model code TALYS and validated with experimental data available. Our evaluation includes the production cross sections and double-differential cross sections for all residual nuclides as well as light particles such as neutron, proton, and alpha.

- In response to discrepancies between calculations and measurements of several fusion shielding benchmarks, neutron cross sections for ^{182,183,184,186}W were evaluated in the neutron-incident energy range from 0.1 MeV to 20 MeV using the nuclear reaction model code EMPIRE-2.19 with a consistent set of input parameters for all tungsten isotopes.

- A new module has been developed for the evaluation of cross sections in the resolved

and unresolved resonance regions. It automates most of the evaluation procedures and can be executed within EMPIRE or as a stand-alone program. When it is used as connected to the EMPIRE code, the single ENDF-6 formatted file can be obtained in the full energy region. -

- As a first step for the fusion neutronics shielding benchmarks, the ENDF/B-VII beta 1, JEFF-3.1, and JENDL-3.3 have been tested for 5 pulsed sphere experiments performed at the OKTAVIAN, FNS/JAEA, and FNG/ENEA facilities. The leakage neutron and/or gamma spectra calculated by the MCNPX code have been compared with the measurements.

NNDC Staff Changes

- Marco Pigni
  - Joined the NNDC in January 2007 (PhD from TU Vienna)
  - Covariance postdoc
- Manojeet Bhattacharya
  - Joined the NNDC in April 2007 (PhD, came from NASA)
  - Replacement for Dave Winchell
  - NSR compilations + structure evaluations
- Dimitri Rochman
  - Left the NNDC in August 2007 (moved to NRG Petten)
  - EXFOR compilations + ENDF evaluations
  - The position is currently vacant, replacement in ~1/2 year
  - Stanislav Hlavac (Bratislava) is taking care of EXFOR

EXFOR Compilations

New compilations in FY07 (Oct 1, 2006 – Sep 30, 2007)

Neutrons:	36 entries,	174 subentries
Charged particles:	100	392
Gammas:	0	0
Total	**136**	**566**

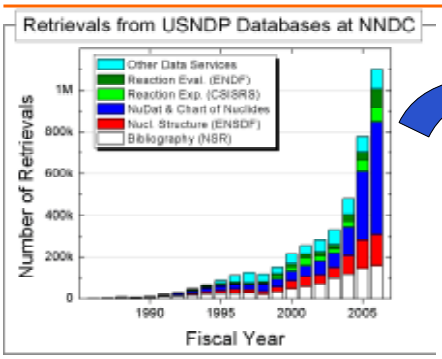
Compilations in FY06

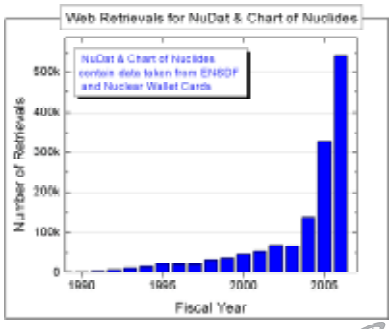
Total 179 entries, 708 subentries

Scope of compilation

- All new papers are compiled regularly
- Old papers as time permits (~150 neutron, ~350 charged particle still un-compiled, remaining part of the collection by V. McLane)

Data Services: 1 Million Retrievals in FY2006





- ~1.1M retrievals, 40% up compared to FY2005
- ~50% from NuDat & Chart of Nuclides

Data Services in FY2007

Data retrievals increased by 26% compared to 2006

Data retrievals in 11months of FY07

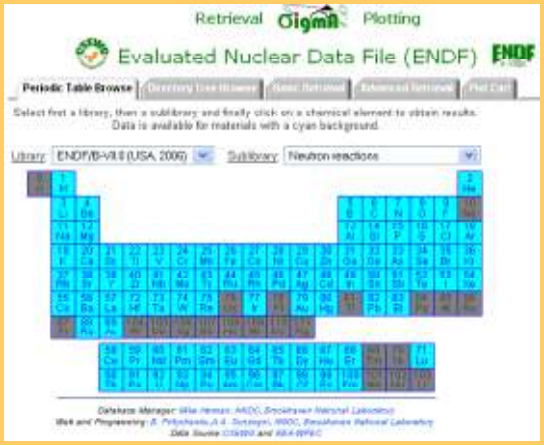
Total 1,256,000 projected increase 26%

Reactions 195,000

- CINDA 6,500
- EXFOR 98,500
- ENDF 90,000

Sigma interface for ENDF

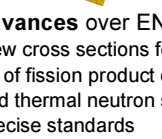
- NuDat-like interface
- Launched in April 2007

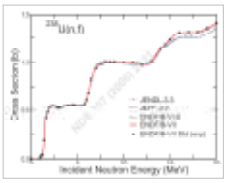


Release of the ENDF/B-VII.0 library

The first major release since 1990

- The ENDF/B-VII.0 has been developed by CSEWG with a significant contribution from several labs (LANL, BNL, NIST, LLNL) – critical support for AFCI, GNEP, Gen-IV!





Principal advances over ENDF/B-VI library

- Many new cross sections for major actinides
- New set of fission product evaluations (BNL)
- Improved thermal neutron scattering
- More precise standards
- New radioactive data (BNL)
- Photonuclear reactions
- β-delayed photon decay spectra
- New methods for uncertainties and covariances (BNL,…)

Validation carried out in US and Europe (hundreds of integral experiments) proved absolute superiority of the ENDF/B-VII.0 over precedent libraries

ENDF/B-VII.0 Library Contents

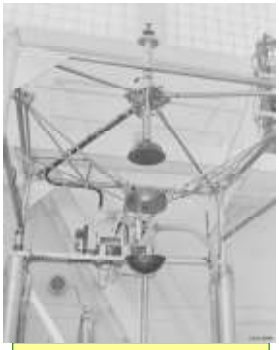
14 sublibraries, many additions and improvements

New sublibraries: Neutron standards cross sections, photonuclear
Large improvements: Neutron reaction sublibrary, charged particles, decay data, thermal neutron scattering sublibrary
No changes: Fission yields, atomic data (taken over from ENDF/B-VI.8)

No.	NSUB	Sublibrary name*	Short name	VII.0	VI.8	
1	0	Photonuclear	g	163	-	LANL, IAEA
2	3	Photo-atomic	photo	100	100	
3	4	Radioactive decay	decay	3838	979	BNL
4	5	Spont. fis. yields	s/fpy	9	9	
5	6	Atomic relaxation	ard	100	100	
6	10	Neutron	n	393	328	LANL, ORNL, BNL
7	11	Neutron fis.yields	n/fpy	31	31	
8	12	Thermal scattering	tsl	20	15	LANL
9	19	Standards	std	8	8	IAEA-NEA-NIST-LANL
10	113	Electro-atomic	e	100	100	
11	10010	Proton	p	48	35	LANL
12	10020	Deuteron	d	5	2	LANL
13	10030	Triton	t	3	1	LANL
14	20030	^{3}He	he3	2	1	LANL

ENDF/B-VII Validation, Case Study:

Lady Godiva - well characterized critical assembly



- Highly enriched **uranium** sphere, first built at Los Alamos in ~1950s
- Bare assembly
- Pure
- Object of beauty!

Lady Godiva rode naked through Coventry, England, in the 11th Century, following a wager with her husband whereby he agreed to reduce taxes on the poor!

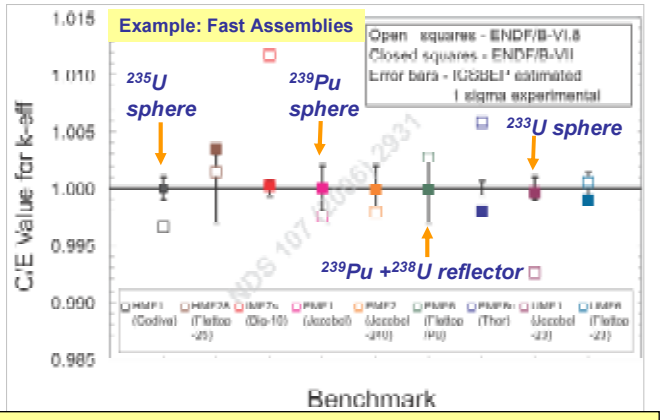
Lady Godiva by John Collier, ca 1897

Integral Critical Assembly Data Validation

Excellent ENDF/B-VII Performance

Critical assemblies:
C/E values of k-eff

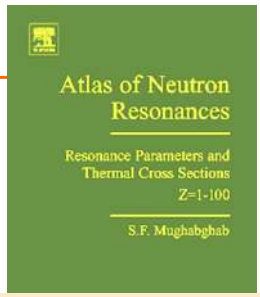
Data testing against > 800 assemblies:
-Fast assemblies
(Godiva, Flattop, Big10, Jezebel)
- Reflected assemblies
- HEU
- LEU
- Pu solutions
- Np, ^{233}U,…
etc.



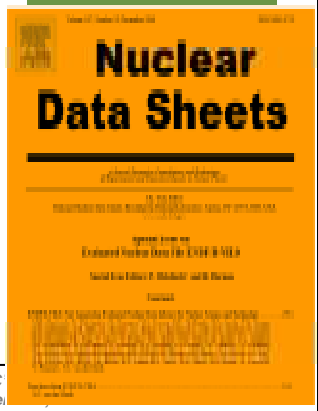
ENDF/B-VII not an "adjusted library". Some evaluation-choices were made to optimize agreement with critical assembly data - but physics motivated & within uncertainties

Major Publications

Atlas of Neutron Resonances
S.F. Mughabghab
Elsevier, April 2006



"Big Paper" on ENDF/B-VII.0
M. Chadwick, **P. Oblozinsky, M. Herman** *et al*
Nuclear Data Sheets, Dec 2006
Reference paper



EMPIRE: Nuclear Reaction Model Code System for Data Evaluation
M. Herman, R. Capote, B. Carlson *et al*
Nuclear Data Sheets, Dec 2007

Working Papers for the 2007 NRDC Meeting in Vienna, October 2007

WP2007-1		Conclusions and Actions of the 2007 NRDC Meeting
WP2007-2	Otsuka Naohiko, Hans Henriksson	Plotting flags in Archive Dictionary 24 (Data headings)
WP2007-3	S.Dunaeva, V.Zerkin	Procedure for correcting mistakes in the central EXFOR master file
WP2007-4	S.Dunaeva	EXFOR compilation and transmission statistics (New and revised entries since the last meeting)
WP2007-5	S.Dunaeva	Status of new publication compilation
WP2007-6	V.Varlamov, N.Otsuka	ENTRY L0091 correction
WP2007-7	S.Dunaeva	Proposal to update old entries instead of creating new
WP2007-8	V.Zerkin, S.Dunaeva	Proposal to move alteration flag into column 11 of ENTRY and SUBENT records
WP2007-9	S.Dunaeva, O.Schwerer	Suspicious EXFOR entries
WP2007-10	V.Zerkin	EXFOR+Interpreted (extended) EXFOR format
WP2007-11	N.Otsuka, O.Schwerer	Definition of spectrum averaged cross section
WP2007-12	N.Otsuka	Bibliographical information (TITLE, AUTHOR) from several references
WP2007-13	O.Schwerer	Journal code PR and general format of page number
WP2007-14	N.Otsuka	Reference frame of analyzing power
WP2007-15	V.Zerkin	EXFOR errors report
WP2007-16	V.Zerkin	Error in ENTRY 11333
WP2007-17	S.Dunaeva	Procedure for creation CINDA reference
WP2007-18	N.Otsuka	Review of corrections since the 2006 NRDC meeting
WP2007-19	N.Otsuka	Multiplicity of prompt gamma in capture reaction (22960.005-006)
WP2007-20	F.Tarkanyi	List of missing EXFOR data of experimental works compiled in the CRP for “Recommended data for production of therapeutic radioisotopes”
WP2007-21	S.Dunaeva	Statistics of new publication compilation of photonuclear data
WP2007-22	V.Zerkin	Error in TRANS.2185 and Re: Memo CP-D/491
WP2007-23	V.Zerkin	Output of IAEA EXFOR Web retrieval system

Note: The working papers are available online from http://www-nds.iaea.org/nrdc-int/2007nrdc/wps.html

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