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INDC International Nuclear Data Committee

Report on the

IAEA Technical Meeting on
Network of Nuclear Reaction Data Centres

IAEA Headquarters, Vienna, Austria
25 – 28 September 2006

Prepared by

O. Schwerer
IAEA Nuclear Data Section, Vienna, Austria

December 2006

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Abstract

An IAEA Technical Meeting on the Network of Nuclear Reaction Data Centres (biennial Data Centre Heads Meeting) was held at IAEA Headquarters, Vienna, Austria, from 25 to 28 September 2006. The meeting was attended by 19 participants from 10 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.

December 2006

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THE 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, 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
BNL	Brookhaven National Laboratory, Upton, New York, USA
BROND-2	Russian evaluated neutron reaction data library, version 2
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
CENPL	Chinese evaluated nuclear parameter library
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
EFF	European evaluated nuclear data file for fusion applications
ENDF-6	International format for evaluated data exchange, version 6
ENDF/B-6	US Evaluated Nuclear Data File, version 6
ENSDF	Evaluated Nuclear Structure Data File
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
IAEA	International Atomic Energy Agency
IFRC	International Fusion Research Council
INDC	International Nuclear Data Committee
INIS	International Nuclear Information System, a bibliographic system
IRDF	International Reactor Dosimetry File, maintained by the IAEA-NDS
ITER	International Thermonuclear Experimental Reactor
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 (previously Study Group for Information Processing)
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
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
OECD	Organization for Economic Cooperation and Development, Paris, France
PhND	Photonuclear data
RIKEN	Nuclear Data Group, RIKEN Institute of Physics and Chemistry Research, Wako-Shi, Saitama, Japan
TRANS	Name of transmission tapes for data exchange in the EXFOR system
UKRNDC	Ukraine Nuclear Data Center at KINR, Kyiv, Ukraine
USDOE	US Department of Energy
VNIIEF	Russian Federal Nuclear Center, Sarov, Russia
X4TOC4	A conversion program from EXFOR to a computational format
4C...	Numbering code of memos exchanged among the four Neutron Data Centres

AGENDA

International Atomic Energy Agency
Technical Meeting on
"Network of Nuclear Reaction Data Centres"

IAEA Headquarters, Vienna, Austria
25 - 28 September 2006

1.	**General**		
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1.2	Brief status reports of Centres		
1.3	Review of general actions from the last meeting		
1.4	Date and places of next two NRDC meetings		
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2.2	General discussion on future direction of EXFOR compilation		
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	2.2.2	Journal distribution	***WP 2006-6***
	2.2.3	"Current compilation" webpage	*Dunaeva, Zerkin*
	2.2.4	Review of compilation scope	***WP 2006-13***
		Update of J series definition	***WP 2006-16***
		Compilation of Japanese photonuclear data	*JCPRG*
2.3	Report on situation in India and China		*Schwerer*
2.4	Status of results from n_TOF		*Mengoni*
2.5	Automatic creation of BibTex citations within EXFOR database		***WP 2006-7***
2.6	Compilation and transmission statistics		***WP 2006-2***
2.7	Mistakes and quality control		***WP 2006-3,4,5***
2.8	Common master file and exchange mechanisms		*Schwerer, Zerkin*
2.9	Manuals		*Schwerer*
2.10	Proposal for a change of EXFOR format		***WP 2006-18***
3.	**Common EXFOR/CINDA dictionaries**		*Schwerer*
3.1	Review of actions		***WP 2006-1***
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4.2	EXFOR editor	*Taova, Pikulina*
4.3	CHEX	*Zerkin*
4.4	X4toC4	***WP 2006-9, 19***
4.5	Other programs	

5. EXFOR, technical

5.1	Review of actions	***WP 2006-1***
5.2	Issues and problems with digitizing data	*Dunaeva et al.*
5.3	Usage of greek letters and accentuations in Exfor compilations	***WP 2006-10***
5.4	Pending proposals and issues from CP and 4C memos since the last meeting	***WP 2006-11***

- 5.4.1 New STATUS code RCALC (CP-D/457)
- 5.4.2 Clarification on format of LEVEL-PROP
- 5.4.3 Reference type X for electronic preprints (CP-D/446)
- 5.4.4 Quantities KE and AKE (CP-E/092 Rev.)
- 5.4.5 Coding of ISINN conferences (CP-D/467)
- 5.4.6 Production cross sections for decay gammas

5.5	Clarification of spin observables	***WP 2006-14***
5.6	Pending corrections, retransmission issues	***WP 2006-15***

6. CINDA *Zerkin, Dunaeva*

6.1	Review of actions	***WP 2006-1***
6.2	CINDA book issues	***WP 2006-12***
6.3	New CINDA issues	
6.4	CINDA exchange	
6.5	CINDA manual	
6.6	Projects in CINDA	***WP 2006-17***

7. Services

8. Closing items

8.1 Review of actions and conclusions

International Atomic Energy Agency
Technical Meeting on
"Network of Nuclear Reaction Data Centres"
IAEA Headquarters, Vienna, Austria
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MEETING SUMMARY

Introduction

The IAEA Technical Meeting on the Co-ordination of the Network of Nuclear Reaction Data Centres was held at the IAEA Headquarters, Vienna, Austria, from 25 to 28 September 2006. Nineteen participants of ten 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 (as this one), involving Centre heads and technical staff, every two years (the last full meeting was held in October 2004 at NNDC in Brookhaven, USA). Main topics of the present meeting were a review of the responsibilities, scope and coordination of the EXFOR compilations, proposals for updating the EXFOR format, new compilation software, compilation quality control and corrections, technical questions on EXFOR quantities, codes, and dictionaries, and issues of the extended CINDA bibliography and an upcoming archival book production. Nineteen working papers were presented at the meeting. The results of the discussions are summarized in the List of Conclusions and Actions (p 18 ff).

Brief Minutes

Dr. N. Ramamoorthy, the Director of the IAEA Division of Physical and Chemical Sciences, welcomed the participants on behalf of the IAEA. The meeting was opened by A. L. Nichols, Head of the IAEA Nuclear Data Section. The agenda was adopted. Nichols chaired the general sessions, while Schwerer chaired the technical sessions.

The ten attending Centres presented brief status reports (see reports P1 – P10). Reports of three centres who are members of the network but could not attend the meeting were also distributed (reports P11 – P13).

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

Schwerer gave an overview of the status of the EXFOR compilations in the network. The contents of the database has increased by 15% (number of entries) in the past two years (number of subentries: 10%); by data type, the number of entries increased by 32% for charged-particle data, by 6% for neutron data, and by 15% for photonuclear data. Nevertheless, neutron data still amount to 58% of the whole database, with the share of charged-particle data obviously increasing as a function of time, because of more new measurements and the filling of gaps in the old literature. He mentioned recent progress such as the high number of new compilations, the common master file, some compilations undertaken before the data are published in the journal, and extended or new compilation activities in India, China and Japan.

Schwerer discussed actual or perceived gaps and delays in compilation and showed that most cases concern data which cannot be readily compiled (e.g. published in graphical form not suitable for digitizing) or data types of marginal interest to EXFOR (e.g. high energy or heavy ion data) where compilation is not obligatory. He stressed the difference between EXFOR and the bibliographic databases, and gave many examples of entries with more than one journal reference, showing that a distribution of compilation responsibilities strictly by journal would not eliminate the need for close coordination between the Centres. He also

addressed questions about the quality of the compilations. Problems included both the misrepresentation of data and missing some of the data in a publication. The input can be made easier for compilers by means of the new EXFOR editor presented at this meeting. However, compilers still have to read all relevant parts of the article, collect all necessary publications, and refer to the proper manuals and dictionaries when doing compilation work. Where there are problems, they cannot be solved by simplifying the rules but only by undertaking accurate work. In conclusion, Schwerer noted problems arising from recent or upcoming staff changes in Centres, and expressed his opinion that data compilation is often not sufficiently appreciated by managers as highly qualified work essential for maintaining good quality work in the nuclear data field.

Rochman presented a proposal of NNDC to change the compilation responsibility from geographic to full journal coverage, arguing that the need to scan many different journals was unnecessarily time consuming. A thorough discussion followed where all facets of the problem were considered, including the actual cases of delays and compilation gaps. While the meeting agreed that the scanning of journals needed to be streamlined, there was also agreement that it was important for compilers to develop and maintain personal links with authors (who usually publish in several different journals). The relationship is particularly important in order to receive numerical data when only graphs are published in the journal. The meeting also took into account that some countries (India, China, Russia, partly Japan) definitely prefer to compile their data as a national activity, in whatever journal the data are published, and that a special mechanism is needed for covering conferences reliably. It was agreed that all these needs and wishes can best be realized using the new proposed web page for compilation control, maintained by NDS under http://www-nds.iaea.org/exfor-master/x4compil/
This is a tool for technical compilation control of newly published literature from the most important journals; it is not meant to give a complete picture for managers on the whole compilation effort of the network. *Note added after the meeting:* This webpage is already in use and has speeded up compilations.

The changes in compilation procedures can be summarized as follows:

- Compilation control through a central web page as described above
- Revised responsibilities for journal coverage
- New procedure for covering conferences
- Better coverage of data from India through the start of an Indian compilation activity
- Better coverage of data from China through increased activities at CNDC
- Agreement on improved completeness for photonuclear data and start of a photonuclear EXFOR series at JCPRG (area “K”)
- Extension of scope of area J (voluntary compilations of JCPRG)

Schwerer reported on a one-week EXFOR compilation workshop he conducted in September at BARC, Mumbai, India, attended by about 30 senior and junior nuclear scientists from various Indian institutes. The workshop was very successful, producing several new entries of important Indian neutron and charged-particle data, and it is expected that a group of compilers will emerge who will on a regular basis cover new Indian experiments and fill the EXFOR gaps in old literature. This activity is part of an initiative, started by former NDS staff member S. Ganesan and Indian INDC member R. Srivenkatesan, to organize an Indian nuclear data centre. The Indian counterparts expressed strong interest to be invited to the next NRDC meeting.

Schwerer also reported on a short visit to CNDC to discuss EXFOR compilations at the Chinese Centre. CNDC agreed to work on the backlog of Chinese publications and to cover the 10 most important Chinese journals, 5 of which publish in Chinese.

Mengoni gave a report on the publication status of the data obtained from the n_TOF facility.

Statistics were presented that quantified the EXFOR compilations over the past year, and the database contents. In three working papers, mistakes in the database collected by critical users and the data centres were presented and corrections on an urgent basis were agreed.

The formats and exchange mechanisms of the EXFOR/CINDA dictionaries were discussed. A detailed proposal on the simplification of dictionary 236 (EXFOR quantities) by introducing wildcards for the "particle considered" field (REACTION subfield 7) was approved.

A newly developed "EXFOR editor" software for compilers was presented by Pikulina and Taova and distributed to the Centres. A short workshop for interested compilers was held during one of the afternoon sessions. The software makes the formatting of EXFOR entries much more convenient and also integrates the ORDER and CHEX programs.

The meeting also discussed other EXFOR-related software, including improvements to the X4TOC4 program needed for processing and plotting and further developments of the CHEX program. Problems with digitizing data from graphics and the usage of the related software were also discussed. The need for more co-operation in software development was recognized, and NDS will investigate possibilities to convene a meeting of EXFOR software specialists.

Proposals were presented on the automatic creation of BibTex citations and DOI reference numbers within EXFOR, and also for the introduction of Greek letters and other special characters. More far-reaching changes of the EXFOR format were discussed for potential implementation in the medium-term future.

The session on technical EXFOR matters continued with consideration of pending proposals and issues from memos exchanged in the past year concerning changes and clarifications of various coding rules, quantities and dictionary codes.

A special session was devoted to CINDA. The NEA Data Bank will produce a new archival book in early 2007 and presented a draft of the introductory pages for review. The status of the new CINDA database (with charged-particle and photonuclear data) was discussed. The new CINDA master is ready and in use in two Centres. Zerkin presented a new proposal for a "project" concept in CINDA, and the formation of a working group on this topic was initiated.

In the closing session, the meeting reviewed the conclusions and actions. The next technical NRDC meeting was tentatively scheduled for October 2007 in Vienna.

Conclusions and Actions of the 2006 NRDC Meeting

Conclusions

General

C1 The next NRDC meeting will be a meeting of technical staff and is planned for October 2007 in Vienna.

EXFOR, General

C2 The extension of the compilation scope of EXFOR area J to include antiproton data from the world (not only Japan) is approved.

C3 A first version of the "current compilation" webpage was presented and will be placed on an internal webpage (open to NRDC members, not publicised).

C4 The introduction of a new EXFOR area K for photonuclear data from Japan (compiled by JCPRG) is agreed.

C5 The meeting decided that better completeness in photonuclear data compilation should be achieved. In particular, photoneutron and photofission data, as well as (g,p) and (g,a) cross sections, should be covered completely.

C6 (Info) Schwerer reported on the EXFOR compilation workshop held in Mumbai and on his visit to CNDC. Hopefully the Indian nuclear data group will be represented as observers at the next NRDC meeting, and coverage of Chinese works in EXFOR will considerably improve in the near future.

C7 The proposal of WP2006-7 (generation of BibTex citations) was well received. Zerkin will look into implementation.
Inclusion of DOI numbers in REFERENCE may be considered for the future.

C8 The NRDC appreciates Koning's paper WP2006-3 (Recommendations to improve the quality of EXFOR) and the necessary corrections are initiated (Action A10). On items 3 and 4 (quality flagging and review team) it is recommended that the initiative comes from outside the NRDC. Once this activity is initiated (e.g. within WPEC), the NRDC should be informed and become involved.

C9 (Info) Common EXFOR master file: NEA-DB and NNDC started from a new common master file, but they usually update the TRANS files individually. This may account for small time synchronization differences, but in essence the files should be the same.

C10 The new procedure for coverage of conferences (Rev. to WP2006-13, see p 23) is approved.

C11 The table of responsibilities for journal coverage is updated (see Rev. to WP2006-13, see p 23)

Common EXFOR/CINDA dictionaries

C12 The dictionary updates will from now on be distributed together with the latest version of CHEX and the corresponding ZVV dictionaries.

EXFOR software

C13 (Info) The new EXFOR editor was presented by Sarov, and the first version

distributed to the Centres.

C14 (Info) CHEX was updated and the latest version is available from the NDS web page http://www-nds.iaea.org/exfor-master/programs/

C15 (Info) On request, NDS can offer local databases and/or web retrieval systems to other network Centres.

C16 (Info) JCPRG is working on new version of GSYS, to be ready by the end of the year. See also Action A25.

C17 The meeting emphasizes the need for more cooperation in software development in all areas concerning EXFOR. The digitizing program by JCPRG and the EXFOR editor are first examples. The next project should be computational formats (See also Action A24).

EXFOR, technical

C18 The list of permitted characters (Manual p.1.3) is extended by the following characters: { } | (for later use to code special characters as in NSR).

C19 Compilers should take into account a sufficient number of significant digits when digitizing.

C20 The new status code RCALC is approved (CP-D/457, WP2006-11).

C21 Another option to refer to monitor data from evaluated libraries is planned for the future. Under MONIT-REF in the field now used for referring to an EXFOR accession number, a reference to an evaluated file can be given. The detailed formalism needs to be developed.

C22 LEVEL-PROP: separating comma for a missing level identification field is NOT needed (example in manual to be corrected; CHEX to be updated).

C23 Usage of Ref-type X for electronic preprints is approved (CP-D/446, WP2006-11).

C24 Separate codes for AKE (Average kinetic energy) and KE (Kinetic energy) are retained. AKE is averaged over all products. See also Actions A28 and A29.

C25 The new report code ISINN- (for the conference series *Int. Seminar on Interactions of Neutrons with Nuclei*) is approved (CP-D/467, WP2006-11).

C26 Production cross sections for decay gammas will be coded PAR,SIG,DG (modification of proposal in CP-D/470, WP2006-11).

C27 The proposed dictionary modifications of WP2006-14 (spin observables in polarization entries) are approved. See also Action A30.

CINDA

C28 The CINDA book draft (WP2006-12) was discussed in detail. Draft CINDA pages containing the final modifications will be circulated for feedback.

C29 CINDA master file is ready, and is being used in two Centres. All Centres are welcome to download the master file from the NDS CINDA area. Manual input and corrections of the existing file are now possible, although further changes of the master file may arise. Regular input generated from EXFOR can begin.

C30 NDS will produce quarterly an automatic extension of CINDA based on the current EXFOR database.

Actions

General

A1	All	(Continuing) 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	(Continuing) Review the Citation Guidelines (2004 version from NRDC internal webpage) and send updates to NDS by 1 April 2007; if needed, a reminder will be sent before the end of the year.
A3	All	Update CP memo distribution list with NDS version; including Nichols and Hasegawa.

EXFOR, general

A4	All	(Continuing) All Centres should give high priority to compiling new compilations.
A5	NDS	Continue to try developing sensible means of data communication between laboratories and the network via the major journals.
A6	All	(Continuing) Follow the procedures described in WP 2005-30 for journal coverage. Instead of the reaction code, it is sufficient to give data type (neutron, charged particle, photonuclear) and priority (A = obligatory, B = voluntary).
A7	All	(Continuing) Follow the procedures described in WP 2005-31 for compilation of new publications (but without including the e-mail address, para. 4)
A8	Schwerer	(Continuing) Review the EXFOR Basics Manual and submit revision when time permits. Also include the “C4” computational format.
A9	All	(Continuing) On the proposal of WP 2005-14: store locally pdf versions of EXFOR relevant articles and discuss within the Centres what part can be shared with a central archive kept at NDS.
A10	All	Go through the error lists of WPs 2006-3, 4 and 5 and retransmit the necessary corrections as soon as possible. Centres must check the original references before doing the corrections; also check for additional errors.
A11	Henriksson	Keep the NRDC informed of any developments in establishing a working group on improvements of EXFOR (re WP2006-3).
A12	Zerkin	Develop revised EXFOR format (items 1-3 of WP2006-18) and report on trial implementation at the next meeting.
A13	All	Check at their Centres what consequences the revised format would have on their software.
A14	All	Give feedback to NDS on the “current compilation” webpage

A15	NDS	Develop automatic e-mail reminders on delayed compilations based on current compilation webpage
		Common EXFOR/CINDA dictionaries
A16	Henriksson, Zerkin, Otsuka	Compare the internal dictionaries used in their Centres, in particular for URL addresses to generate hyperlinks to references, and explore possibilities for including them in the shared dictionary system.
		EXFOR software
A17	NDS	Distribute test version of CHEX, compatible with wildcards for SF7 in dictionary 236, together with revised dictionary 236 for testing.
A18	All	Give feedback on EXFOR editor to Sarov.
A19	All	Give feedback to NDS on the existing CHEX version (bugs, refinements)
A20	Zerkin	Contact Trkov about correction of X4TOC4 (bug no. 2 of WP2006-9)
A21	Zerkin	Communicate with other interested Centres about exchange of information on usage of C4 (X4TOC4) and similar formats, with the goal of developing a common computational format.
A22	Sarov, NDS	Continue development and testing the EXFOR editor in cooperation with NDS and other data centres.
A23	Zerkin	Adapt XTRACT (VMS-based indexing program for EXFOR files) for use under Windows.
A24	NDS	Investigate possibilities to hold a meeting of software specialists on EXFOR software before the next NRDC meeting (Conclusion C17).
A25	All	Give feedback on the digitizing software GSYS to JCPRG.
		EXFOR, technical
A26	Otsuka	(Continuing) Submit summary on tensor polarization data as a memo to remove inconsistencies in dictionary expansions.
A27	Rochman	On WP2006-10: investigate with NSR and ENSDF experts how Greek and other special symbols are implemented and report to NRDC.
A28	NDS	Clarify quantities KE (Kinetic energy) and AKE (Average kinetic energy) in LEXFOR.
A29	All	Check KE and AKE EXFOR entries compiled in their area and correct if necessary.
A30	NNDC, JCPRG	Retransmit corrections requested in WP2006-14.
A31	All	Check WP2006-15 for remaining corrections to be transmitted.
A32	Dunaeva	Distribute list of duplications for action.

A33	All	(Continuing) 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.
		CINDA
A34	CINDA centers	(Continuing) Search for illegal experimental entries for MANY and replace them with individual entries.
A35	All	Give feedback on the draft CINDA annexes (see http://www.nea.fr/html/dbdata/data/cindabook/) and introduction.
A36	All	Inform NEA-DB about needs for copies of CINDA book.
A37	All	After implementation of the modifications discussed at this meeting, check CINDA file for a particular target and give feedback to NEA-DB.
A38	Zerkin	On WP 2006-17: distribute a more detailed technical proposal on “projects” in CINDA for internal discussions in Centres.
A39	Zerkin, Henriksson, Otsuka, other volunteers	Form working group on Projects in CINDA.
A40	Zerkin	Plan meeting of this working group (A39).
A41	NEA-DB	Distribute final version of CINDA manual including latest corrections.

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 ***(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. For neutron data, the 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. For CPND, the 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 copy to NDS.

PROGRESS REPORTS

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Memo CP-C/379

Date: September 21, 2006
To: Distribution
From: P. Oblozinsky, D. Rochman
Subject: NNDC Progress Report (October 2004 – September 2006)

NNDC Staff

Since the last full NRDC meeting in October 2004, the following personnel changes took place at the NNDC:

- Vicki McLane retired in December 2004, she was replaced by Dimitri Rochman (formerly at LANL), who joined the NNDC in November 2004.
- Charlie Dunford retired in June 2005. His position was not filled-in due to budgetary constraints.

The NNDC has 12.6 FTE staff (full-time equivalent). This includes 9 PhD physicists, 1 computer professional, 2 support staff, and 1 secretary (0.6 FTE).

EXFOR Compilations

Our nuclear reaction compilation was done regularly and we kept adding experimental data to the EXFOR (CSISRS) library continuously. The last TRANS file for neutron-induced reaction was #1340 and the last TRANS file for charge-particle induced reaction was C077. Gamma-induced reactions were also compiled with two TRANS files (L009).

Over the period of October 2004 – September 2006, we added a total of 543 new entries to EXFOR, including

- 180 neutron-induced reactions,
- 337 reactions induced by light charged-particles, and
- 26 photonuclear reactions.

Development of the ENDF/B-VII.0 Library

The NNDC continued to be heavily involved in the development of the new ENDF/B-VII.0 library. This includes active contribution to neutron cross-section evaluations primarily in the fission product mass range (70 new evaluations), entirely new evaluations for the decay data library (3,830 nuclides), database management and web service.

The schedule for testing and release of ENDF/B-VII.0 is as follows:

- April 2006 Beta2 testing version released
- June 2006 CSEWG validation meeting at BNL
- September 2006 Beta 3 testing version released
- November 2006 CSEWG annual meeting at BNL
- December 2006 ENDF/B-VII.0 library officially released

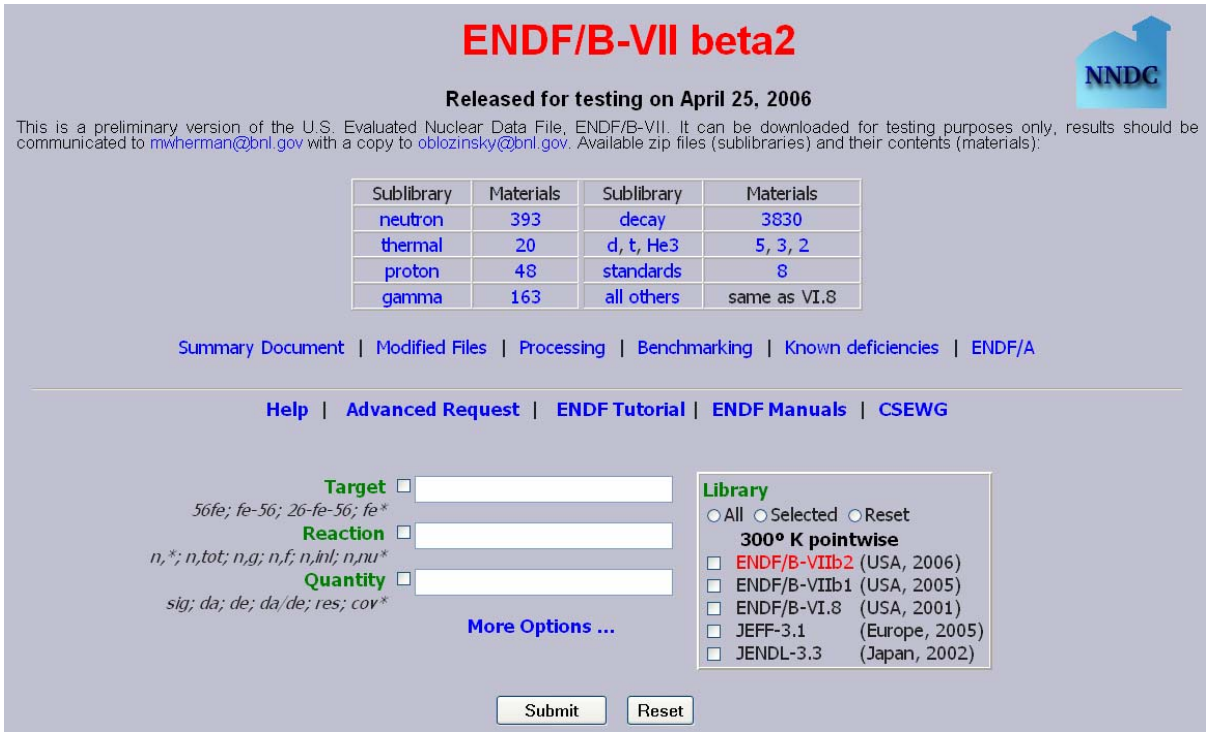

Fig.1. The NNDC webpage, with direct access to 14 sublibraries of ENDF/B-VII.0

Web Service and Communication with Users

The number of data retrievals from the NNDC web service continued to grow rapidly. Since April 2004, when we launched the new relational database management system coupled to new hardware and new web service, our retrieval statistics almost tripled. We are expecting to reach 1 million retrievals per year in 2006.

Although the demand for nuclear reaction services is relatively small compared to nuclear structure services, combined EXFOR and ENDF retrievals grew in the last year by about 40% compared to the previous year. Demand for CINDA continues to be marginal and represents less than 0.5% of all data retrievals.

We are devoting our time both to neutron and charge-particle reaction compilation activities, with priorities driven by the users' needs. Our contact with users is maintained primarily by the open EXFOR contact area on the NNDC website, www.nndc.bnl.gov/exfor.

In early 2005, we created the "Recent Comments on CSISRS/EXFOR" webpage, www.nndc.bnl.gov/exfor3/compilations/web_emails.html. Since then, users from many countries, mostly from Europe and northern America, have sent their comments and suggestions to the NNDC. A total of 66 e-mail exchanges were presented on this web page, but some more exchanges were realized and not made publicly available. In general, we respond to users within 1 day after receiving a question or comment.

A special effort was devoted to the analysis of the EXFOR retrieval system. Based on this analysis, our website was redesigned in February 2006, with positive impact on retrieval statistics.

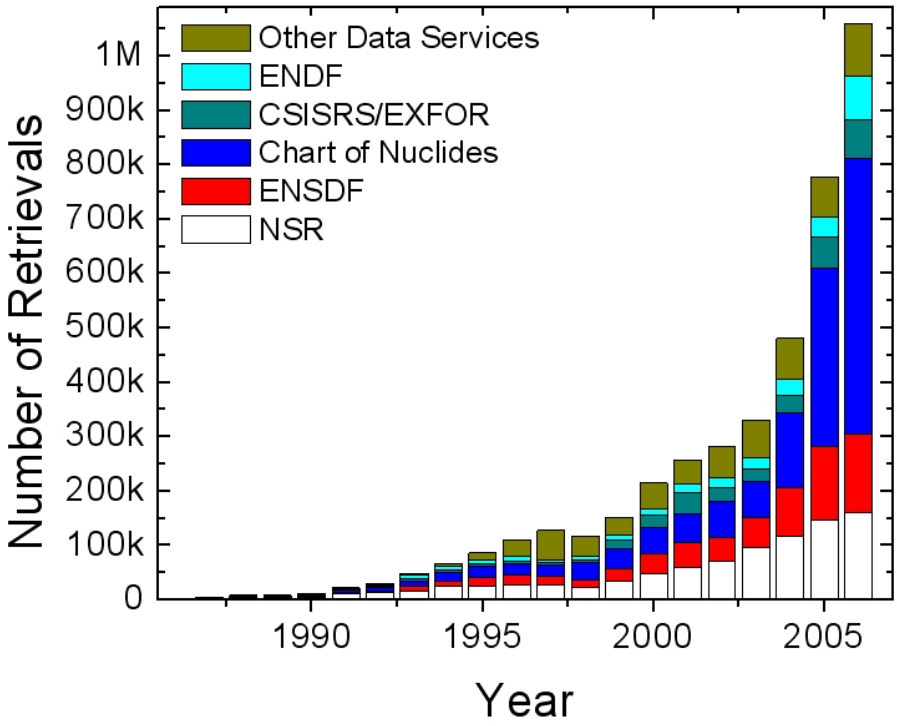

Fig. 2. Data retrievals statistics for the NNDC web service. The year 2006 represents projection based on the actual 9 months value.

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PROGRESS REPORT FROM THE OECD/NEA DATA BANK

At the NRDC meeting at IAEA, Vienna, Austria
25 – 28 September 2006

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

General

The Data Bank's primary role is to provide scientists in member countries with reliable 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 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 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 NEA Data Bank maintains a close cooperation with the NEA Nuclear Science Section, which provides useful feedback on the performance of computer programs and nuclear data through a number of benchmark studies, especially in the areas of reactor and fuel cycle physics, criticality safety, and radiation shielding.

The annual meeting of the Data Bank management committee (the NEA Nuclear Science Committee Executive Group) was held in May 2006. The two main decisions at this meeting were to actively encourage the release of new computer codes to the Data Bank's collection and to extend the mandate of the Joint Evaluated Fission and Fusion (JEFF) project for the period 2006–2009.

Organisation

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 parts of the NEA.

Thierry Dujardin is Director for Science and Development with Claes Nordborg and Akira Hasegawa below him as heads of the Nuclear Science Section and the NEA Data Bank, respectively. Within the Data Bank, Enrico Sartori is responsible for the Computer Program Services (CPS) together with Juan Galan and Ivo Kodeli (employed by the IAEA). Hans Henriksson and Yolanda Rugama are responsible for the Nuclear Data Services (NDS). The in-house computer system is taken care of by Pierre Nagel. Yolanda Rugama, Yong-Joon Choi and Enrico Sartori are also working part-time for the Nuclear Science Section, whereas Federico Mompean work full time for the Thermochemical Database (TDB) project in support of the NEA Radioactive Waste Management division. See Fig. 1 for an overview of the NEA Data Bank professional staff (including the Nuclear Science Section).

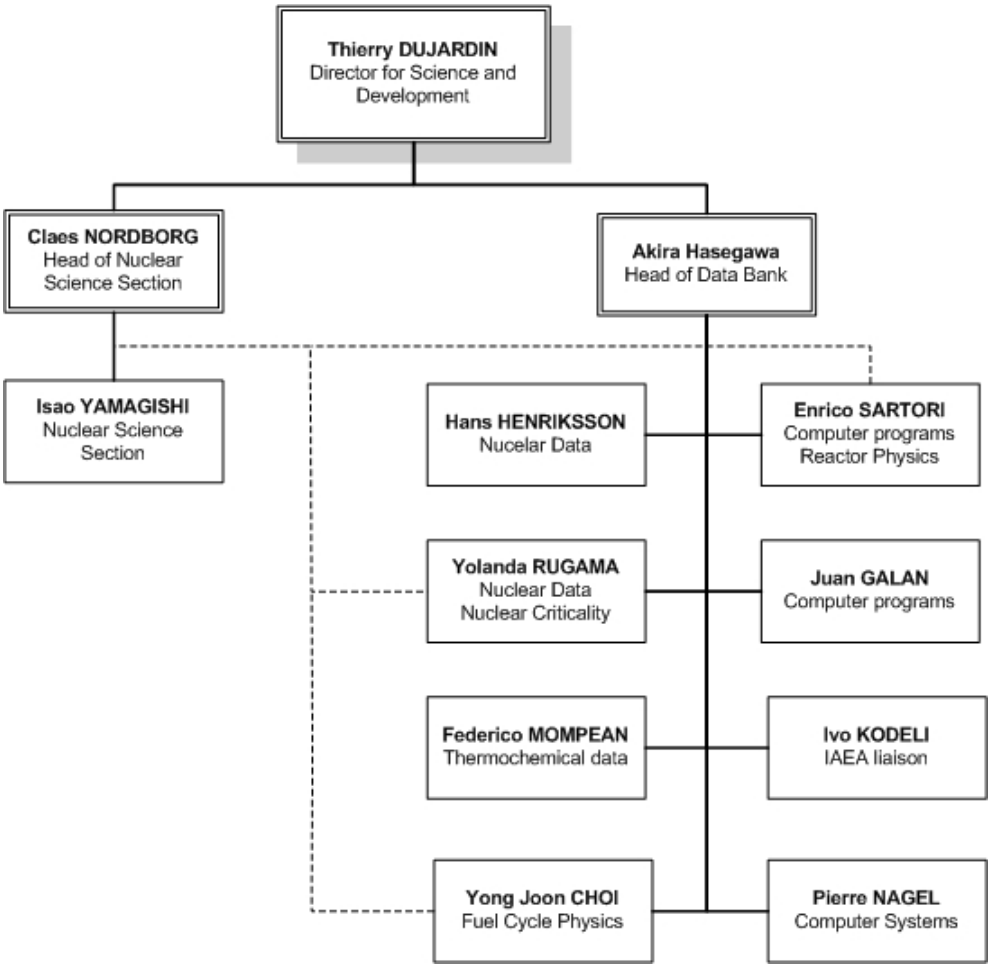

Figure 1. NEA Data Bank and the Nuclear Science Section

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. The number of retrievals from the NEA Web pages is between 900-1400 requests/month for EXFOR and CINDA, and about the same for evaluated data libraries in the EVA database. See Table 1 for the numbers of retrievals of some services from the web pages during 2004-2005.

Table 1. Web retrievals 2004-2005 from the NEA Data Bank

Service		2005	2004
CINDA		897	873
EVA searches		13 843	8 481
EXFOR searches		13 368	13 105
Janis		216 520	218 811
Web pages	NDS	86 894	83 437
	CPS	186 443	166 649
	TDB	38 649	30 189
	other Data Bank pages	34 166	33 107

Lately, the displaying program for experimental and evaluated data, directly obtained from Web retrieval, has been upgraded. This online plotting facility is performed by Janis-2.2.1 (released in October 2005), the software that has been developed at the NEA (see below).

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.

EXFOR and CINDA compilation

More than 100 new neutron reaction experiments and almost 200 charged particle experiments have been entered by the Data Bank into the EXFOR database since the beginning of 2005 (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 2005 and Jan-July 2006

AREA 2	Trans	No of works
2005	2168	7
	2169	20
	2170	8
	2171	5
	2172	8
	2173	7
2006	2174	17
	2175	18
	2176	11
	2177	10
	Total	**111**

AREA O	Trans	No of works
2005	o022	34
	o023	38
2006	o024	9
	o025	17
	o026	69
	Total	**167**

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 archive version is planned to be printed 2006. A draft has already been produced.

Data display tools: 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. The latest version of Janis (Janis-2.2.1) was released in October 2005.

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.

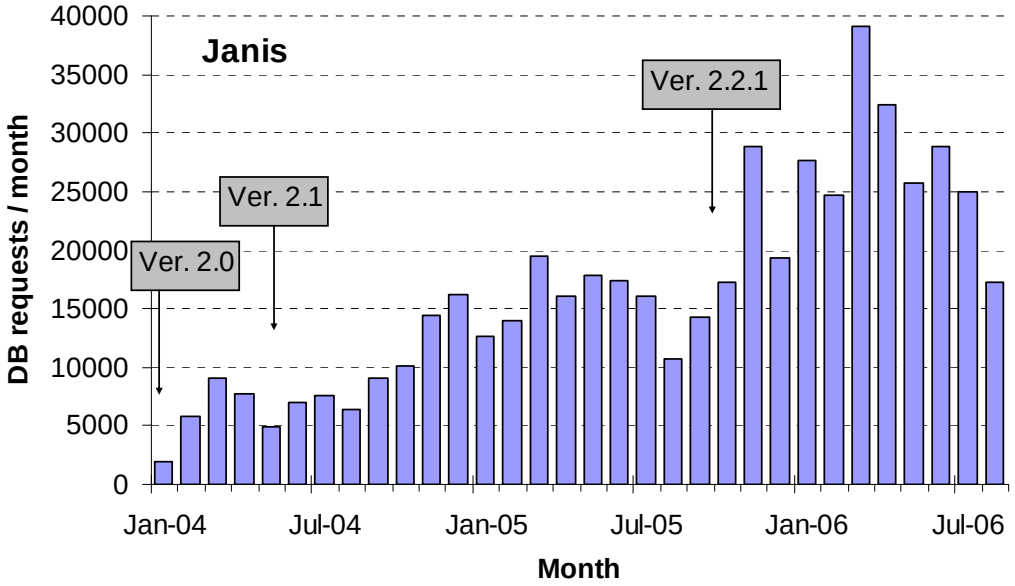

Figure 2. Janis statistics, January 2004 - August 2006, with the different versions indicated as well. Janis 2.2.1 included the Web retrieval plotting facility.

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 is to be published later this year.

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. Three high priority requests have been accepted after peer review by the HPRL reviewing procedure, and one general request was 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

The computer program services distribute 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 that the computer program package is complete and adequately documented (see www.nea.fr/html/dbprog). The computer program collection covers a wide range of nuclear energy and radiation physics applications.

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).

Computer program training courses & tutorials 2006

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. A list of recent and planned events is given below.

23 January-10 February 2006, Seminar and Training on Scaling, Uncertainty and 3D Coupled Code Calculations in Nuclear Technology, (3D.S.UNCOP-2005), School of Nuclear Engineering, Barcelona, Spain.

7-8 April 2006, Training Course on Neutron Spectra Unfolding, Cape Town, South Africa: UMG software package provided by PTB (UMG: Unfolding with GRAVEL and MAXED)

4-7 July 2006, Electron-Photon Transport Modelling with PENELOPE-2006 - Physics, Code Structure and Operation, University of Barcelona, Barcelona, Spain.

17-21 July 2006, Intermediate Workshop on MCNPX: Monte Carlo N-Particle Transport Code System for Multiparticle and High Energy Applications, ENEA, Bologna, Italy.

10-14 September 2006, PHYSOR-2006-Topical Meeting Advances in Nuclear Analysis and Advances in Nuclear Analysis and Simulation, Hyatt Regency Vancouver.

15-17 September 2006, Workshop on Use of Monte Carlo Techniques for Design and Analysis of Radiation Detectors, University of Coimbra, Coimbra, Portugal.

25-29 September 2006, 9th Information Exchange Meeting on Actinide and Fission Product Partitioning and Transmutation (co-organised NSC/NDC), Nîmes, France.

9-13 October 2006, Training Course on MCNP5 Coupled Neutron, Electron Gamma 3-D Time-Dependent Monte Carlo Transport Calculations, ITN Sacavém, Lisbon, Portugal.

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 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 next version of DICE will be released in September 2006. The 2006 version will contain some minor improvements, but may also introduce new data.

Radioactive Waste Management

The Thermochemical Database 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.

An update to earlier reviews of thermochemical data for Uranium, Neptunium, Plutonium, Americium, and Technetium was published in 2003. Reviews of data for Zirconium, Selenium, Nickel and selected organic compounds have been published in 2005. A new phase of the project has been started, covering evaluation of inorganic complexes and compounds of Thorium, Iron and Tin. The Thorium review is scheduled for publication early in 2007, followed by the review on Tin. The project has also funded the preparation of guidelines for the evaluation of thermodynamic data for solid solutions in the context of radioactive waste management. The peer review on Iron is scheduled during the first semester of 2007.

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.

Data Bank Computer System

An outline of the Data Bank computer system is given in figure 3 below.

The new software system for monitoring the various pieces of equipment and some basic user services (Nagios) has been deployed and is used to detect performance issues as well as for being warned in case of breakdown of some critical piece of hardware.

An upgrade of the Oracle database system to version 10 is underway. This task will resolve some problems encountered with displaying multinational character sets in the framework of the ISOE project. The new version will also allow better handling of the failover between different Oracle databases.

The central file storage system has been upgraded in the spring 2006. The increase in storage space will allow all user and all application files to be consolidated into a single system. The initial capacity will be 1 TeraByte.

Some improvements in security will be expected from the reorganisation of the subnets into specialised firewall managed .DMZs. The main Internet DMZ will be split into a Windows OS and a Linux OS subnet. In this way, potential weaknesses in the windows OS (in case of attacks) will not affect the Linux servers and vice versa.

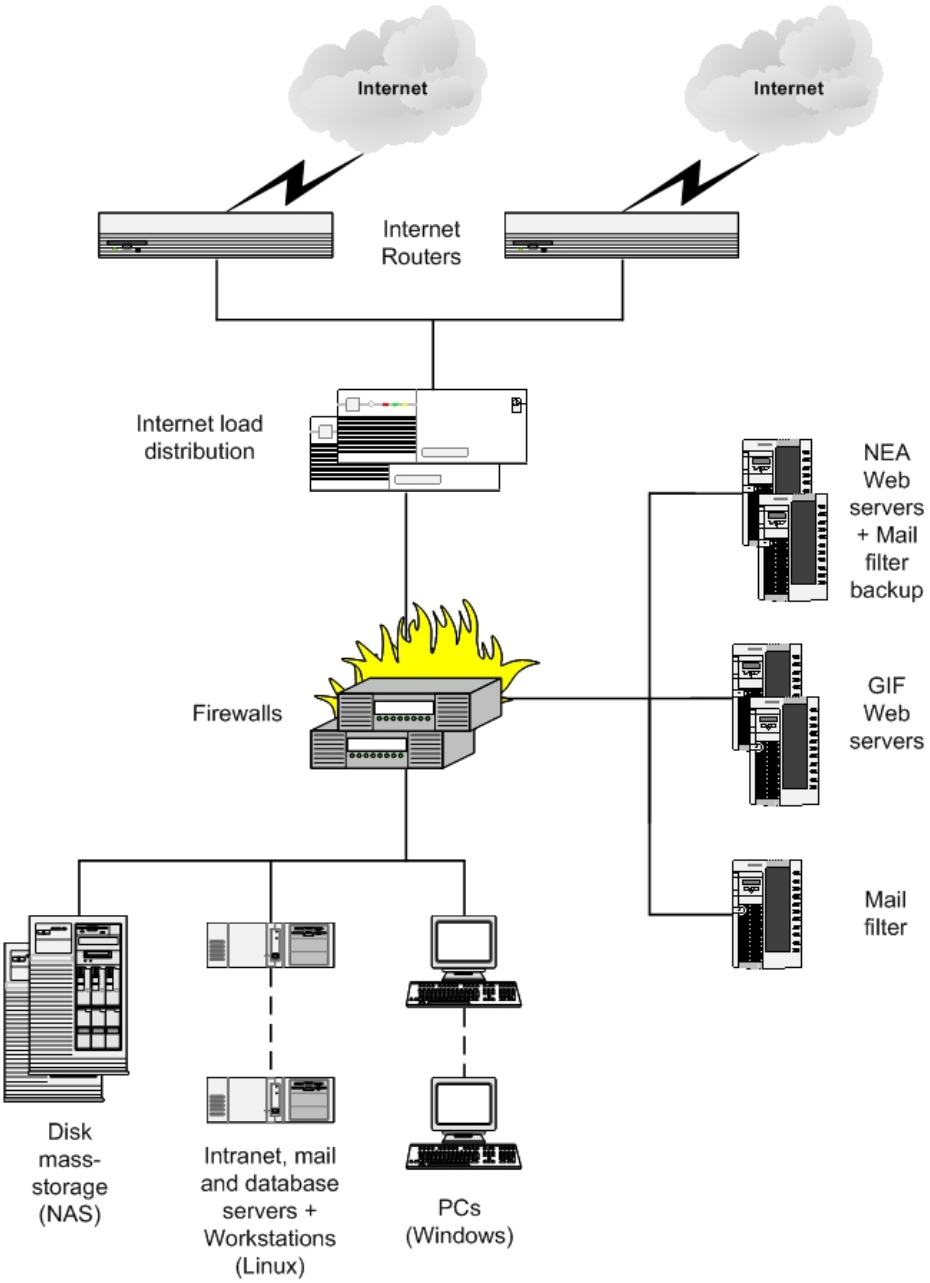

Figure 3. Outline of the NEA Data Bank computer configuration.

IAEA Nuclear Data Section: Progress Report 2005/06
Summary of Nuclear Data Studies
by Staff of the IAEA Nuclear Data Section,
1 October 2005 – 30 September 2006,
Editor: O. Schwerer

IAEA Technical Meeting, 25 - 28 September 2006
International Atomic Energy Agency,
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 remains at a total of 18 professionals and support staff (although a vacancy exists as a consequence of one member of the support staff having transferred to another section). A recruitment exercise is also underway to fill a P5 vacancy in the Nuclear Data Development Unit (hopefully, to be filled in mid-autumn 2006).

2. Data Compilations

2.1 EXFOR and Dictionaries

Over the previous year, NDS staff have distributed 6 CPND TRANS files (D044 - D049), containing 109 new entries (92 compiled at NDS, 14 at ATOMKI, 3 at UkrNDC) and 172 revised entries, and 3 neutron TRANS files (3118 - 3120) containing 41 new entries (38 compiled at NDS, 2 at UkrNDC and 1 in India) and 23 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 being carefully monitored and controlled for completeness of compilation:

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

As of 20 September, 52 TRANS files were received, checked (with feedback to the originating Centres) and processed, of which 43 were final versions that were added to the master file. These final transmissions contained 408 neutron entries (177 new, 231 revised), 677 CPND entries (542 new, 135 revised) and 72 photonuclear entries (49 new, 23 revised).

NDS staff have produced and distributed three regular transmissions of the EXFOR/CINDA dictionaries (TRANS 9090-9092) in EXFOR, DANIEL (backup) and archive format. The dictionary revisions introduced in 2004/05 are now routinely in operation, and the introduction of "wild cards" for REACTION SF7 in the quantities dictionary 236 is in preparation. The feedback of Otsuka (JCPRG) on the dictionary transmissions is again much appreciated.

From 4 - 8 September 2006, Schwerer conducted a workshop on EXFOR compilation for Indian scientists at BARC in Mumbai, India.

2.2 CINDA

CINDA Master file
A new CINDA library (2006/06/20) has been produced since in 2006, containing old CINDA data and data imported automatically from the EXFOR database (2006/01/11) using version 9090 of the Dictionaries. The preliminary data were offered to the NRDC community for revision and corrections. After that exercise, the new CINDA Master File was made available via the NDS compilers' Web site.

Coverage control
Under the CINDA coverage control system, NDS staff scan over 80 journal titles (mainly through the Internet) for the purpose of compilation coverage control. The current status of the compilation activity will be available for EXFOR compilers on the NDS Web site.

Over 1100 journal issues from 1995 to 2006 were added to the database for CINDA coverage control in late 2005/2006. 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 hardcopies of the papers, if necessary.

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

- NuDat-2.1 for interactive searching and plotting of nuclear structure and decay data
- PREPRO 2004. ENDF/B Pre-Processing Codes, November 2004, updated June 2005
- Stopping Power for light ions, compilation by H. Paul (University of Linz)
- EXFOR - CINDA Database and Retrieval System, Version 1.91, data updated February 2006 (CD-ROM)
- ENDVER/GUI and EXFOR-CINDA package; Integrated Tools for ENDF-Evaluators, Version 1.4, January 2006

3. Services

Web Services
Further improvements have been implemented in the EXFOR-CINDA-ENDF retrieval systems: plotting of differential cross-sections, simplified data output of plotted data, data uploading The system is also functioning successfully at NNDC, in BARC (India) and IPEN (Brazil). Statistics for the usage of the Web retrieval system are presented in Fig. 1.

CD-ROMs
- "EXFOR/CINDA for Windows" CD was issued once.
- "EXFOR/CINDA for Applications" for Linux and Windows was issued once; also distributed as part of EndVer/GUI-CD and Empire-package.

4. Software

CINDA software
Extensions and changes to the CINDA format agreed upon at the last NRDC meeting were implemented in the CINDA loading tools, Web and CD-ROM retrieval systems, and CINDA

editor. An improved algorithm of comparison and import of EXFOR data to CINDA was implemented, discussed and checked together with H. Henriksson (NEA-DB) and N. Otsuka (JCPRG). The concept of CINDA-Projects was further developed.

EXFOR software-tools

The checking program (ZCHEX) was regularly updated. Executables for Windows and Linux with a complete set of dictionaries are maintained on the NDS-compilers' Web-site.

EXFOR-ENDF advanced plotting software-tools

Programs for automatic extension of EXFOR-ENDF conversion dictionaries were developed. Program X4TOC4 was extended. Web wrapping software for the EndVer package and effective support in the database structures were designed and implemented.

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):

- "Update of X-Ray and Gamma-Ray Decay Data Standards for Detector Calibration and Other Applications": completed, all materials with IAEA Publishing Section
- "Fission Product Yield Data Required for the Transmutation of Minor Actinide Nuclear Waste": completed, all materials with IAEA Publishing Section
- "Improvement of the Standard Cross Sections": completed, document to be submitted to IAEA Publishing Section
- "Nuclear Data for the Production of Therapeutic Radioisotopes": on-going
- "Data for the Th-U-fuel cycle": completed, database and document preparation in progress
- "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

Data development projects:

- Thermal scattering law library – H in H_2O, D in D_2O, H in ZrH(x) and other metal hydrides (Ti, Y, Ce), and graphite
- Resonance parameters for ^{58}Fe and all Cd isotopes – re-analysis and evaluation (in collaboration with IRMM)
- Applications library for ADS – JEFF-3.1 data library selected as source for pilot library – ACE format for Monte-Carlo particle transport calculations, and MATXS format for deterministic transport calculations
- Updates to WIMS-D library package (following release of JEFF-3.1 library)
- Nuclear model parameter sets for RIPL-II
- Update of the handbook and database "Nuclear Data for Safeguards" (on-going)
- Beta decay and decay heat – CM in collaboration with WPEC (Sub-group 25) on Total Absorption Gamma-ray Spectroscopy (TAGS) and improvements to decay data files for decay heat calculations

6. Publications

IAEA nuclear data for applications: cross section standards and the reference input parameter library (RIPL)
R. Capote Noy, A.L. Nichols and V.G. Pronyaev, presented at Enlargement Workshop on Neutron Measurements, Evaluations and Applications, NEMEA-2, Bucharest, Romania, 20-23 October 2004, EUR 22136 EN (2005), pp. 7-16, Ed.: A.J.M. Plompen, Luxembourg, ISBN 92-894-8618-X.

Neutron activation cross section measurements from threshold to 20 MeV for the validation of nuclear models and their parameters
A.J.M. Plompen, D.L. Smith, R. Capote et al., A report by the Working Party on International Evaluation Co-operation of the NEA Nuclear Science Committee (WPEC-19), NEA/WPEC-19, OECD, Paris, 2005, ISBN 92-64-01070.

IAEA Co-ordinated Research Project on fission product yield data for minor actinides up to 150 MeV
M. Lammer and A.L. Nichols, presented at 3rd International Workshop on Nuclear Fission and Fission-product Spectroscopy, Fission 2005, 11-14 May 2005, Cadarache, France; also published in AIP Conf. Proc. – 3rd Int. Workshop on Nuclear Fission and Fission-product Spectroscopy, Eds.: H. Goutte, H. Faust, G. Fioni and D. Goutte, Vol. 798 (2005) pp. 285-293, AIP, Melville, New York, ISBN 0-7354-0288-4, ISSN 0094-243X.

Simulation of an end-of cycle trip transient with the LOADF code package
M. Božič and A. Trkov, Int. Conf. Nuclear Energy for New Europe 2005, Bled, Slovenia, 5-8 September 2005.

Neutron capture reaction rates for stellar nucleosynthesis
A. Mengoni, published in Proc. 20th Int. Conf. on Capture Gamma-ray Spectroscopy and Related Topics, University of Notre Dame, Indiana, USA, 4-9 September 2005.

Is a global coupled-channel dispersive optical model potential for actinides feasible?
R. Capote, E.Sh. Soukhovitski, J.M. Quesada and S. Chiba, *Phys. Rev.* **C72** (2005) 064610.

Isospin dependent dispersive coupled channel optical model potential for actinides
R. Capote, E.Sh. Soukhovitski, J.M. Quesada and S. Chiba, presented at Workshop on the Future of Theory and Experimental Based Nuclear Data Evaluation, 26-28 September 2005, CEA-DIF Bruyeres-le-Châtel, France, to be published by NEA.

Neutron capture cross section measurements for nuclear astrophysics at CERN n-TOF
U. Annondanno, R. Capote, A. Mengoni et al., (the n-TOF Collaboration), Nucl. Phys. A758 (2005) 501-504.

Measurement of the ^{151}Sm(n,γ) cross section at n_TOF
S. Marrone, R. Capote, A. Mengoni, et al., (the n-TOF Collaboration), Nucl. Phys. **A758** (2005) 533-536.

Measurement of the Zr-90,91,92,94,96(n,γ) cross sections at n_TOF
G. Tagliente, R. Capote, A. Mengoni et al., (the n-TOF Collaboration), Nucl. Phys. **A758** (2005) 573-576**.**

Stellar neutron capture rates of C-14
R. Reifarth, A. Mengoni et al., Nucl. Phys. **A758** (2005) 787-790.

Nuclear data requirements for decay heat calculations
A.L. Nichols, pp. 65-69 in Lecture Notes, Vol. 20, Workshop on Nuclear Reaction Data and Nuclear Reactors: Physics, Design and Safety, 25 February – 28 March 2002, The Abdus Salam International Centre for Theoretical Physics, Eds.: M. Herman, N. Paver, ICTP Publ., Trieste, Italy, 2005.

Higher Landau levels contribution to the energy of interacting electrons in a quantum dot
A. Gonzalez, J.D. Serna, R. Capote and G. Avendaño, *Physica* **E30** (2005) 134-137.

Laser-generated nanosecond pulsed neutron sources: scaling from VULCAN to table-top
T. Žagar, J. Galy, J. Magill and M. Kellett, *New J. Phys.* **7** (2005) 2-13.

Nuclear reaction and structure web services of the National Nuclear Data Center
B. Pritychenko, A.A. Sonzogni, D.F. Winchell, V.V. Zerkin, R. Arcilla, T.W Burrows, C.L. Dunford, M.W. Herman, V. McLane, P. Obložinský, Y. Sunborn and J.K. Tuli, *Nucl. Instrum. Meth. Phys. Res. A*. **33** (2006) 390-399.

Monte Carlo correction factors for a Farmer 0.6 cm^3 ion chamber dose measurement in the build up of the 6 MV clinical beam
J. Pena, F. Sanchez-Doblado, R. Capote, J.A. Terrón and F. Gómez, to be published on-line by IOP, March 2006.

New measurements of neutron capture resonances of ^{209}Bi
C. Domingo-Pardo, R. Capote, A. Mengoni, et. al., for publication in *Phys. Rev. C.*

Uncertainty estimation in IMRT absolute dosimetry verification
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: ^{232}Th(n,f) and ^{231}Pa(n,f) reactions
M. Sin, R. Capote, A. Ventura, M. Herman and P. Obložinský (submitted to Phys. Rev. C).

Atomic and nuclear data services of the International Atomic Energy Agency
S. Dunaeva, A.L. Nichols, O. Schwerer, presented to 56th International Conference "Nucleus-2006", 4-8 September 2006, Sarov, Russia *(to be published in proceedings)*

International Atomic Energy Agency: Dedicated nuclear databases
A.L. Nichols, invited paper presented at a plenary session on 'Advances in Nuclear Data Libraries', PHYSOR-2006, ANS Topical Meeting on Advances in Nuclear Analysis and Simulation, 10-14 September 2006, Vancouver, British Columbia, Canada.

7. Workshops 2006 (since 2005 NRDC Meeting)

- Workshop on Nuclear Structure and Decay Data: Theory and Evaluation, 20 February -3 March 2006, ICTP Trieste, Italy.
- Workshop on Atomic and Molecular Data for Fusion Energy Research, 28 August – 8 September 2006, ICTP Trieste, Italy.

8. Visits and Inter-Centre Cooperation

- V. Zerkin (IAEA/NDS) to BNL/NNDC, 14 November – 2 December 2005: Develop ENDF, EXFOR and CINDA Web-Retrieval and Management Systems.
- M.A. Kellett (IAEA/NDS) to BNL/NNDC: 5 – 9 December 2005, NSR Keyword Abstract Compilation Discussions
- S. Duneva (IAEA/NDS) to CJD and CAJAD, 28 – 30 December 2005: EXFOR compilation.
- G. Pikulina and S. Taova (Sarov) to NDS, 22 – 26 May 2006: Development of EXFOR-Editor.
- D. Winchell (BNL/NNDC) to NDS, 12 – 16 June 2006: NSR Keyword Abstract Collaboration Discussions
- O. Schwerer (IAEA/NDS) to CNDC, 11 – 12 September 2006: EXFOR compilation at CNDC
- G. Pikulina and S. Taova (Sarov) to NDS, 20 – 29 September 2006: Development and deployment of EXFOR-Editor.

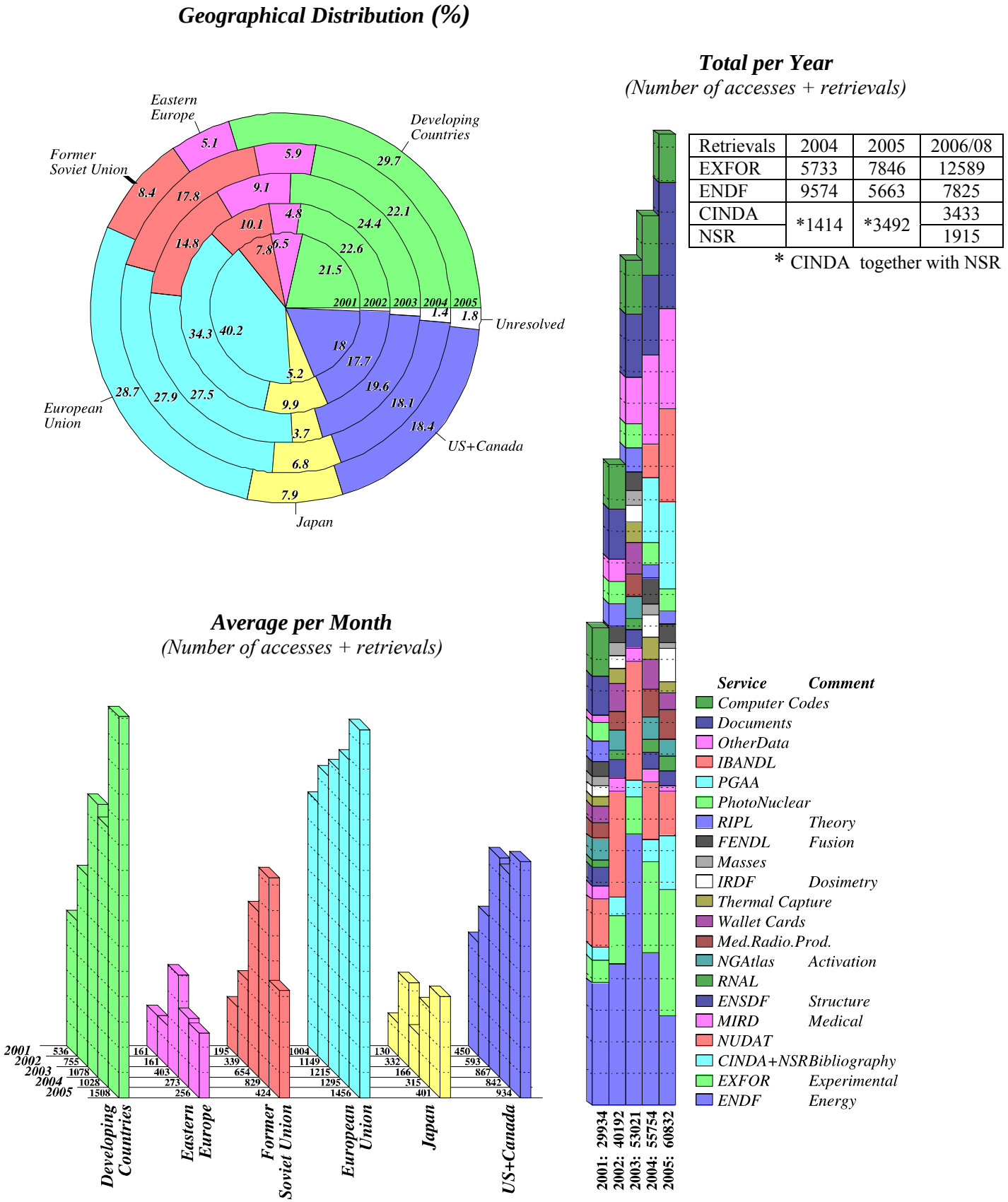

Fig.1. Statistics of Web accesses and retrievals from IAEA-NDS, IPEN (Brazil) and BARC (India)

CJD: PROGRESS REPORT 2005/06

IAEA Technical Meeting
"Co-ordination of the Network of Nuclear Reaction Data Centers"
(Vienna, IAEA, Nuclear Data Section, 25 – 29 September 2006)

A.I. Blokhin, V.N. Manokhin, V.G. Pronyaev, K.I. Zolotarev,
M.V. Mikhailukova, A. Demin

1. Staff

Total number of staff in the CJD is 9.
This is divided into 6 professional staff and three support staff.
In August 2006 Dr. A.Pashchenko left the IPPE.

2. Data Compilation

2.1. EXFOR activity.

New and revised entries / subentries since the 2005 NRDC meeting

CJD

TRANS	TRANS-Status	Entries Total	Entries New	Entries Revised	Subents Total	Subents New	Subents Revised
Area 4							
4135	Final	50	9	41	76	19	57
4136		21	3	18	83	38	45
4137		17	8	9	94	51	43
4138	Prelim.	48	5	43	534	99	435
Sum		136	25	111	787	207	580

2.2. CINDA activity.

Nominally the CINDA activity is continued. All types of publications (Russian scientific journals, preprints and so on) are investigated to include in CINDA compilation. We are going to adopt the new technology process created by the NDS and NEA DB for a CINDA compilation and to start in a participation of exchange of CINDA compilation.

3. Publications

In during 2005-2006 the three issues of the journal "Yadernye Konstanty" were prepared and printed.

4. Nuclear Data Services

The nuclear data services are provided through direct contact with the users from many Russian organizations. Mainly the compilation of the evaluated data of the different types are needed. That is why the requests obtained by the CJD in last time are needed in a specialist labour. Within the CJD A.Blokhin, V.Pronyaev and K.Zolotarev are responsible for the Nuclear Data Services.

5. Nuclear Data Evaluation Activity

1. BROND-2.2(mod) – processing and integral testing

2. New data library ACDAM for the activation/damage calculations is compiled in the Russian Nuclear Data Center and consists from three parts:
   - *Activation/transmutation neutron cross-section base (*From the element H (A=1) to Po (A=210), in the neutron energy range 10^{-5} to 20- MeV and it includes 704 target isotopes with data presentation: in ENDF-6 format).
   - *Decay Data Library (DeDaL)*
   - *Damage Data Library (DDL) (*60 elements/isotopes in the neutron energy range 10^{-5} to 20- MeV. The data for main structural elements and basic impurities involved in alloys and steels are included in the DDL in ENDF-6 format.

3. New version of the Russian Reactor Dosimetry File is prepared and now it is under the compilation and benchmark testing. Evaluated data files were made for the 26 reactions with the covariance matrices. Some of them were included into the IRDF-2002 compiled by the NDS. New evaluated data sets were prepared in during 2006.

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

ACTIVITY of CAJAD
for the
IAEA Technical Meeting:
Vienna, Austria, 25-28 September 2006

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

Our **Exfor activity** had two main directions.

1. Compilation A -Library.

After the last meeting 2005 we prepared **A061 Trans files**. These Trans files contain astrophysical data, fission data, monitor reaction data. The files include new entries and some corrected old entries according to the new rules .

2. Team-work with NEA DATA-BANK.

During the time of 2005/2006, 100 entries were prepared and included in O-library. These entries mainly contain differential data for elastic and inelastic scattering and production cross section radioactive and stable isotopes, data for material analysis by charged beams. This work is orientated mainly for nuclear waste transformation , medical applications and material analysis.

3. Checking Codes.

We use to check our TRANSES and ENTRIES with two checking codes:
- our checking code
- CHEX

This is very useful, because the codes are not similar and detect different errors .

4. According to the conclusion last meeting EPJ/A and YF journals review was performed by CAJAD and will distribution right now.

The European Physical Journal A – Hadrons and Nuclei, Publisher: Springer, Berlin / Heidelberg, ISSN: 1434-6001
Issue: Volume 26, Number 2 (2005) 271-75 - for CAJAD
"Mass distribution studies in the $^{19}F + ^{197}Au$ reaction"
R. Tripathi and A. Goswami

Lab	*inc.proj.*	*energy*	*center*	*data form*	*status*	*an*
3INDTRM	F-19	96,100 MeV	CAJAD	table		A0741

Issue: Volume 26, Number 2 (2005) 301-305 - for CAJAD+NEADB
"First direct measurement of the total cross-section of $^{12}C(\alpha,\gamma)^{16}O$"
D. Schürmann, A. Di Leva, L. Gialanella, D. Rogalla, F. Strieder, A. D'Onofrio, G. Imbriani, R. Kunz, C. Lubritto, A. Ordine, V. Roca, C. Rolfs, M. Romano, F. Schümann, F. Terrasi and H. -P. Trautvetter

Lab	*inc.proj.*	*energy*	*center*	*data form*	*status*	*an*
2GERBOC	A	1.9-3.2 MeV	CAJAD +NEADB	table		O1308

Issue: Volume 27, Number 3 (2006) 301-312 - for NEADB+CAJAD

"Gamma-ray spectroscopy of the nucleus ^{139}Ce"

D. Bucurescu, G. Căta-Danil, I. Căta-Danil, M. Ivaşcu, N. Mărginean, R. Mărginean, L. C. Mihăilescu, C. Rus

Lab	*inc.proj.*	*energy*	*center*	*data form*	*status*	*an*
3RUMRUM	P	5-6 MeV	CAJAD +NEADB	table		O1401
	C-12	50.5 MeV				

Issue: Volume 27, Supplement 1 (March 2006) 141-44 - for ATOMKI

"$^{106, 108}$Cd (p,γ)$^{107, 109}$In cross-sections for the astrophysical p-process"

Gy. Gyürky, G. G. Kiss, Z. Elekes, Zs. Fülöp and E. Somorjai

Lab	*inc.proj.*	*energy*	*center*	*data form*	*status*	*an*
3HUNDEB	P	2.4-4.8 MeV	ATOMKI	graph		

Issue: Volume 27, Supplement 1 (March 2006) 145-48 - for NNDC

Lab	*inc.proj.*	*energy*	*center*	*data form*	*status*	*an*
1USANOT	A	8-12 MeV	NNDC	graph		

Issue: Volume 27, Supplement 1 (March 2006) 153-58 - for CDFE

"Photonuclear reaction data and γ-ray sources for astrophysics"

H. Utsunomiya, Goko, H. Toyokawa, H. Ohgaki, K. Soutome, H. Yonehara, S. Goriely, P. Mohr and Zs. Fülöp

Lab	*inc.proj.*	*energy*	*center*	*data form*	*status*	*an*
2JPNKTO	G	10 MeV	CDFE	graph		

Issue: Volume 27, Supplement 1 (March 2006) 197-200 - for ATOMKI

"Study of the ^{106}Cd (α,α)^{106}Cd scattering at energies relevant to the p-process"

G. G. Kiss, Zs. Fülöp, Gy. Gyürky, Z. Máté, E. Somorjai, D. Galaviz, A. Kretschmer, K. Sonnabend and A. Zilges

Lab	*inc.proj.*	*energy*	*center*	*data form*	*status*	*an*
3HUNDEB	A	15.5-19 MeV	ATOMKI	graph		

Issue: Volume 27, Supplement 1 (March 2006) 233-236 - for JCPRG

"Study of the ^{26}Si(p,γ)^{27}P reaction through Coulomb dissociation of ^{27}P"

Y. Togano, T. Gomi, T. Motobayashi, Y. Ando, N. Aoi, H. Baba, K. Demichi, Z. Elekes, N. Fukuda, Zs. Fülöp, U. Futakami[1], H. Hasegawa, Y. Higurashi, K. Ieki, N. Imai, M. Ishihara, K. Ishikawa, N. Iwasa, H. Iwasaki, S. Kanno, Y. Kondo, T. Kubo, S. Kubono, M. Kunibu, K. Kurita[1], Y. U. Matsuyama, S. Michimasa, T. Minemura, M. Miura, H. Murakami, T. Nakamura, M. Notani, S. Ota, A. Saito, H. Sakurai, M. Serata, S. Shimoura, T. Sugimoto, E. Takeshita, S. Takeuchi, K. Ue, K. Yamada, Y. Yanagisawa, K. Yoneda and A. Yoshida

Lab	*inc.proj.*	*energy*	*center*	*data form*	*status*	*an*
2JPNIPC	P	1439 MeV	JCPRG	graph		

Issue: Volume 28, Number 2 (2006) 193-203 - for NEADB+CAJAD

"Excitation functions of evaporation residues in the interaction of ^{16}O with ^{103}Rh at incident energies up to 400 MeV"

E. Z. Buthelezi, F. Cerutti, E. Gadioli, G. F. Steyn, A. Pepe, S. H. Connell and A. A. Cowley

Lab	*inc.proj.*	*energy*	*center*	*data form*	*status*	*an*
3SAFITH	O-16	40-400 MeV	NDB+CAJAD	graph		

Issue: Volume 28, Number 3 (2006) 295-299 - for NEADB+CAJAD
"Scattering of ^{11}Be halo nucleus from ^{209}Bi at the Coulomb barrier"
M. Mazzocco, C. Signorini, M. Romoli, A. De Francesco, M. Di Pietro, E. Vardaci, K. Yoshida, A. Yoshida, R. Bonetti, A. De Rosa, T. Glodariu, A. Guglielmetti

Lab	***inc.proj.***	***energy***	***center***	***data form***	***status***	***an_***
2ITYPAD	BE-11	40 MeV	NDB+CAJAD	table		

Physics of Atomic Nuclei, December 2005
Volume 68, Issue 12, pp. 1957-1967 - for CAJAD
"Investigation of the Mechanism of the Reaction ^{10}B(d, $p\gamma$)^{11}B at E^d= = 15.3 MeV by the Method of Angular $p\gamma$ Correlations"
L. I. Galanina, N. S. Zelenskaya, A. V. Ignatenko, V. M. Lebedev, N. V. Orlova, O. I. Serikov, and A. V. Spassky

Lab	***inc.proj.***	***energy***	***center***	***data form***	***status***	***an_***
4RUSMOS	D	15.3 MeV	CAJAD	graph	in process	

Physics of Atomic Nuclei, September 2005
Volume 68, Issue 9, pp. 1417-1420 - for CDFE
"Independent Yields of Kr and Xe Fragments in the Photofission of ^{237}Np and ^{243}Am Odd Nuclei"
Yu. P. Gangrsky, V. I. Zhemenik, G. V. Mishinsky, and Yu. E. Penionzhkevich

Lab	***inc.proj.***	***energy***	***center***	***data form***	***status***	***an_***
4ZZZDUB	G	25	CDFE	table		

Physics of Atomic Nuclei, January 2006
Volume 69, Issue 2, pp. 189-96 - for CAJAD
"Differential Analyzing Power in pp_ Scattering on a ^{28}Si Nucleus in the Case of the Excitation of High-Spin Particle–Hole States"
V. Plavko and M. S. Onegin

Lab	***inc.proj.***	***energy***	***center***	***data form***	***status***	***an_***
4RUSLIN	P		CAJAD	graph	in process	

Physics of Atomic Nuclei, January 2006
Volume 69, Issue 3, pp. 452-459 - for CAJAD
"Polarization in Quasielastic (p, 2p) Scattering on a 4He Nucleus at 1 GeV"
O. V.Miklukho, G.M. Amalsky, V. A. Andreev, S. L. Belostotskyand et al

Lab	***inc.proj***	***energy***	***center***	***data form***	***status***	***an_***
4RUSLIN	P	1-GeV	CAJAD	table+graph	in process	

Physics of Atomic Nuclei, August 2006
Volume 69, Issue 8, p. 1399 - for JCPRG
"Evidence of complete fusion in the sub-barrier ^{16}O+ ^{238}U reaction*"
K. Nishio, H. Ikezoe, M.Asai, K.Tsukada, S.Mitsuoka, K. Tsuruta, K. Satou, C. J.Lin

Lab	***inc.proj.***	***energy***	***center***	***data form***	***status***	***an_***
2JPNJPN	O-16		JCPRG			

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

Technical paper for the NRDC Meeting, September 25-28, 2006
IAEA, Austria, Vienna
S.M. Taova
Russian Federal Nuclear Center-VNIIEF
Russia, 607190, Sarov, Nizhni Novgorod region, Mira Ave., 37

Compilation activity

Within the period under report three transmission files TRANS (F023, F024, F025) were prepared and included into the EXFOR data library.
Scanning of the Russian Journal "Izvestiya Rossiiskoi Akademii Nauk" for the period from 2000 to 2005 was performed. List of articles to be entered to the EXFOR library was sent to the NDS.

EXFOR – Editor software

Work on software development (Exfor-Editor) for processing and compilation of experimental data to the EXFOR library was continued. S. Taova and G. Pikulina, experts from CNPD visited Nuclear Data Section in May 2006.
During the visit a trial version of the program has been installed on the NDS PC's, functionality of the Exfor-Editor was reviewed, plans of future EXFOR– Editor development were agreed.

The following functions of Exfor-Editor are available now:

- creation of a new file in the EXFOR format with the aid of a template and wizard;
- editing of EXFOR file using a specialized editor;
- sorting of entered numerical data;
- presenting of numerical data in graphical form;
- checking the edited file for its correspondence to the EXFOR format.

Data base development

The development of SaBa library is continuing. In the previous SaBa version the experimental differential data were presented in the form of Legendre polynomial expansion only. In the present version the experimental data are presented in the form of cross sections depending on angle and energy. The modes of data reviewing and evaluation were modified taking into account a new form of data presentation. A procedure for inputting differential data from text and Exfor files has been realized.
It is also planned to include model calculations into SaBa library.

Center Web page

Web-page design of the Center of Nuclear Physical Data has been completed. It is planned to place it at the VNIIEF site in autumn this year.

Progress Report
For the period of October 2004 – August 2006
To the NRDC Meeting (25 – 28 September 2006, IAEA, Vienna, Austria)

ATOMKI NUCLEAR REACTION DATA GROUP

Institute of Nuclear Research of the Hungarian Academy of Sciences (ATOMKI)
Debrecen, Hungary

F. Tárkányi, S. Takács, F. Ditrói, B. Király, F. Szelecsényi, Z. Kovács, J. Csikai

Introduction

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

Experimental works

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

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

These experiments were done at the MGC 20E cyclotron and in Debrecen and at cyclotrons of foreign laboratories in the frame of well established long term collaboration, in :

- Institute of Nuclear Chemistry (FZ Jülich, Germany)
- Cyclotron Laboratory of the Vrije Universiteit Brussel (VUB, Brussels, Belgium)
- Cyclotron Radioisotope Centre of the Tohoku University (CYRIC, Sendai, Japan)
- Division of Advanced Technology for Medical Imaging of the National Institute of Radiological Sciences (Chiba, Japan)
- Radionuclide Production Laboratory of the iThemba Laboratory for Accelerator Based Sciences (Somerset West, South Africa).

Theoretical calculation of the measured data was done in collaboration with scientist from:

- Institute of Theoretical Physics, IPPE, Obninsk, Russia.

The results published in the period covered are in the part “References”.

Compilations and evaluations

EXFOR compilations

During the June 2004 – August 2006 period 34 charged particle entries were compiled at ATOMKI with experimental data inputs mostly from Hungary (ATOMKI) Belgium (VUB) and Germany (FZ Jülich).
The compilation activity shows constant tendency. Practically all new works from Debrecen, Brussels and Jülich were compiled.

Upgrading the charged particle cross-section database for medical radioisotope production: diagnostic radioisotopes

The Debrecen group is participating in the upgrading process of the IAEA recommended cross-section data base for charged particle induced reactions relevant to production of radioisotopes used for medical diagnostics and the related reactions to monitor beam parameters. During 2002 - 2004 the upgrade of the database for production of SPECT radioisotopes (single photon emitters) was completed. At present the upgrade of the reaction cross section data of charged particle monitor reactions is in progress.

Development of database for production of therapeutic radionuclides

The IAEA – Coordinated Research Project (CRP) for development of a standard database for production of therapeutic radionuclide is approaching completion. The main contributions of the Debrecen group to the development of the database are new measurements and compilation of the cross section data of selected charged particle reactions (compilation, critical selection, comparison with integral data).

Database for activation cross sections of proton and deuteron induced reactions for accelerator technology

In the production process of medical radioisotopes the so-called "targetry" plays very important role. The overwhelming part of the medical radioisotope production is done with proton and deuteron induced reactions. Activation data for target holders, target backing, target chambers and collimator units are very important for safe handling of irradiated parts. Systemic study of low energy activation data on metals are in progress.

Modern accelerators can produce high intensity deuteron beams and the deuteron induced reactions play important role in setting up fast neutron sources (IFMIF) and in thin layer activation technology. The Technical Meeting on Nuclear Data for the International Fusion Irradiation Facility (IFMIF, Karlsruhe 2005) gave high priority to establishing a reliable database for deuteron activation data, in first instance on selected metals. To meet these requirements we started to create an experimental activation database by performing new experiments and systematic survey of deuteron induced activation cross sections up to 50 MeV.

Proton induced nuclear reactions are presently the most widely used in different applications. An important field is the accelerator technology and technology for accelerator based nuclear waste transmutation and energy amplification. The cross section data are in most cases well documented, but reliable experimental data for medium energy reactions on many important material are contradictory or completely missing. During recent years we investigated systematically these missing data up to 80 MeV proton energies.

Database for emerging positron emitters (secondary PET isotopes)

The great success of positron emission tomography (PET) in medicine requires new tracers and new radioisotopes that provide new possibilities for labelling new molecules and broadens the field of application. At present all routine PET scanner (more than one thousand) use radiotracers labelled exclusively with ^{18}F, ^{11}C and ^{15}O. The short lived and longer-lived β^+-emitters are of interest for investigating metabolic processes via PET. Furthermore, they can be used for quantitation of radiation dosimetry and bio kinetics of γ-emitting radiopharmaceuticals.

No effort was made to compile and evaluate the nuclear reaction data of the most important

production routes of these emerging PET radioisotopes. During recent years we investigated systematically (new data measurement and compilation) these missing production data for these radionuclides.

Charged particle cross-section database for thin layer activation technique

To deduce depth - activity curves either new measurement has to be done on the investigated material or knowledge of the nuclear reaction data and the elemental composition of the irradiated part is required. Unfortunately no evaluated cross section database is available for thin layer activation studies. Therefore an independent database for TLA applications is under development in ATOMKI, using evaluated cross section data. It contains p, d, ^{3}He and alpha-particle induced reactions up to 40 MeV on the following elements: Al, Ti, V, Cr, Mn, Fe, Co, Ni, Cu, Zn, Y, Zr, Nb, Mo, Rh, Pd, Ag, Cd, In, Sn, Sb, Er, Tm, Yb, Ta, W, Ir Pt, Au, Pb.

Nuclear data service

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

Staff

The staff connected to the experimental data measurement consist of six physicists and two chemists. Out of them three physicists are working in part time on data compilation and evaluation. All are engaged in practical application of the ATOMKI cyclotron.

Future plans

Continuation of the present activity.

References

(October 2004 - August 2006)

Tárkányi F., Ditrói F., Takács S., Csikai Gy., Hermanne A., Uddin M. S., Hagiwara M., Baba M., Shubin Yu. N., Dityuk A. I., *Activation cross-sections of light ion induced nuclear reactions on platinum: proton induced reactions,* Nuclear Instruments and Methods in Physics Research Section B: Beam Interactions with Materials and Atoms **226** (2004) 473.

Tárkányi F., Takács S., Ditrói F., Hermanne A., Shubin Yu. N., Dityuk A. I., *Activation cross-sections of deuteron induced reactions on platinum,* Nuclear Instruments and Methods in Physics Research Section B: Beam Interactions with Materials and Atoms **226** (2004) 490.

Ditrói F., Tárkányi F., Csikai Gy., Uddin M. S., Hagiwara M., Baba M., *Investigation of activation cross sections of the proton induced nuclear reactions on natural iron at medium energies,* Proc. Int. Conf. on Nuclear Data for Science and Technology. Santa Fe, NM, USA, 26 Sept. – 1 Oct. 2004, Haight, R.C., Talou, P., Kawano, T. et al (Eds), American Institute of Physics, AIP Conference Proceedings 769/1 (2005) 1011.

Ditrói F., Takács S., Tárkányi F., *Evaluation of reaction cross section data used for thin layer activation technique,* Proc. Int. Conf. on Nuclear Data for Science and Technology, Santa Fe, NM, USA, 26 Sept. – 1 Oct. 2004, Haight, R.C., Talou, P., Kawano, T. et al. (Eds), American Institute of Physics, AIP Conference Proceedings 769/1 (2005) 1654.

Hermanne A., Tárkányi F., Takács S., Szûcs Z., Shubin Yu. N., Dityuk A. I., *Experimental study of the cross-sections of alpha-particle induced reactions on ^{209}Bi,* Applied Radiation

and Isotopes **63** (2005)1.

Hermanne A., Tárkányi F., Takács S., Szûcs Z., *Experimental study of the cross sections of alpha-particle induced reactions on ^{209}Bi,* Proc. Int. Conf. on Nuclear Data for Science and Technology, Santa Fe, NM, USA, 26 Sept. – 1 Oct. 2004, Haight, R.C., Talou, P., Kawano, T. et al. (Eds), AIP, AIP Conference Proceedings 769/1 (2005) 957.

Hermanne A., Tárkányi F., Takács S., Shubin Yu. N., *Experimental determination of cross section of alpha-induced reactions on ^{nat}Pd.,* Proc. Int. Conf. on Nuclear Data for Science and Technology, Santa Fe, NM, USA, 26 Sept. – 1 Oct. 2004, Haight, R.C., Talou, P., Kawano, T. et al. (Eds), AIP, AIP Conference Proceedings 769/**1** (2005) 961.

Hermanne A., Tárkányi F., Takács S., Shubin Yu. N., *Experimental determination of cross section of alpha-induced reactions on ^{nat}Pd,* Nuclear Instruments and Methods in Physics Research Section B: Beam Interactions with Materials and Atoms **229** (2005) 321.

Spahn I., Takács S., Shubin Yu. N., Tárkányi F., Coenen H. H., Qaim S. M., *Cross-section measurement of the $^{169}Tm(p,n)$ reaction for the production of the therapeuticradionuclide ^{169}Yb and comparison with its reactor-based generation,* Applied Radiation and Isotopes **63** (2005) 235.

Takács S., Tárkányi F., Hermanne A., *Validation and upgrading of the recommended cross-section data of charged particle reactions: Gamma emitter radioisotopes,* Nuclear Instruments and Methods in Physics Research Section B: Beam Interactions with Materials and Atoms **240** (2005) 790.

Tárkányi F., Ditrói F., Csikai Gy., Takács S., Uddin M. S., Hagiwara M., Baba M., Shubin Yu. N., Dityuk A. I., *Activation cross-sections of long-lived products of proton-induced nuclear reactions on zinc,* Applied Radiation and Isotopes **62** (2005) 73.

Tárkányi F., Takács S., Ditrói F., Csikai Gy., Hermanne A., Uddin M. S., Hagiwara M., Baba M., Shubin Yu. N., Dityuk A. I., *Measurement of activation cross sections of the proton, deuteron, and alpha particle-induced nuclear reactions on platinum,* Proc. Int. Conf. on Nuclear Data for Science and Technology, Santa Fe, NM, USA, 26 Sept. – 1 Oct. 2004, Haight, R.C., Talou, P., Kawano, T. et al. (Eds), AIP, AIP Conference Proceedings 769/1 (2005) 1015.

Tárkányi F., Ditrói F., Takács S. , Király B., Hermanne A., Uddin M. S., Hagiwara M., Baba M., Shubin Yu. N., Dityuk A. I., *Cross sections of proton induced nuclear reactions on iridium,* Proc. Int. Conf. on Nuclear Data for Science and Technology. Santa Fe, NM, USA, 26 Sept. – 1 Oct. 2004, Haight, R.C., Talou, P., Kawano, T. et al. (Eds), AIP, AIP Conference Proceedings 769/1 (2005) 1023.

Tárkányi F., Ditrói F., Takács S., Csikai Gy., Mahunka I., Uddin M. S., Hagiwara M., Baba M., Ido T., Hermanne A., Sonck M., Shubin Yu. N., Dityuk A. I., *Excitation funcitions for production of ^{88}Zr and ^{88}Y by proton and deuteron irradiation of Mo, Nb, Zr and Y.,* Proc. Int. Conf. on Nuclear Data for Science and Technology. Santa Fe, NM, USA, 26 Sept. – 1 Oct. 2004, Haight, R.C., Talou, P., Kawano, T. et al., (Eds), AIP, AIP Conference Proceedings 769/2 (2005) 1658.

Tárkányi F., Ditrói F., Takács S., Mahunka I., Csikai Gy., Uddin M. S., Hagiwara M., Baba

M., Ido T., Hermanne A., Shubin Yu. N., Dityuk A. I., *Excitation functions of proton-induced reactions on ^{nat}Sn and ^{nat}Cd: Relevance to the production of ^{111}In and ^{114m}In for medical applications,* Proc. Int. Conf. on Nuclear Data for Science and Technology, Santa Fe, NM, USA, 26 Sept. – 1 Oct. 2004, Haight, R.C., Talou, P., Kawano, T. et al. (Eds), AIP, AIP Conference Proceedings 769/2 (2005)1662.

Tárkányi F., Király B., Ditrói F., Takács S., Csikai Gy., Hermanne A., Uddin M. S., Hagiwara M., Baba M., Ido T., Shubin Yu. N., Dityuk A. I., *Activation cross sections of proton induced nuclear reactions on iridium,* Nuclear Instruments and Methods in Physics Research Section B: Beam Interactions with Materials and Atoms **239** (2005) 293.

Tárkányi F., Takács S., Hermanne A., Van den Winkel P., van der Zwart R., Skakun Y., Shubin Yu. N., Kovalev S. F., *Investigation of the production of the therapeutic radioisotope ^{114m}In through proton and deuteron induced nuclear reactions on cadmium,* Radiochimica Acta **93** (2005) 561.

Uddin M. S., Hagiwara M., Baba M., Tárkányi F., Ditrói F.:
Experimental studies on excitation functions of the proton-induced activation reactions on silver.
Applied Radiation and Isotopes **62** (2005)533

Uddin M. S., Hagiwara M., Baba M., Tárkányi F., Ditrói F., *Experimental studies on excitation functions of the proton-induced activation reactions on yttrium,* Applied Radiation and Isotopes **63** (2005) 367.

Uddin M. S., Hagiwara M., Tárkányi F., Ditrói F., Baba M., *Investigation of the proton-induced activation reactions on natural molybdenum,* Proc. of the 2003 Symposium on Nuclear Data, Tokai, Japan, 27-28 Nov. 2003, T. Ohsawa, T. Fukahori (Eds), IAEA, Vienna, Austria (JAERI-Conf 2004-005, INDC(JPN)-191/U) 0 (2005) 1.

Uddin M. S., Baba M., Hagiwara M., Tárkányi F., Ditrói F., *Measurements of cross-sections of the proton-induced activation reactions,* Proc. of the 2004 Symposium on Nuclear Data, Tokai, Japan, 11-12 Nov. 2004, Y. Tahara, T. Fukahori (Eds), IAEA, Vienna, Austria (JAERI-Conf 2005-005, INDC(JAP)-195/U) 0 (2005)1

F. Szelecsényi, G.F. Steyn, Z. Kovács, C. Vermeulen, N.P. van der Meulen, S.G. Dolley, T.N. van der Walt, K. Suzuki and K. Mukai, *Investigation of the ^{66}Zn(p,2pn)^{64}Cu and ^{68}Zn(p,x)^{64}Cu nuclear processes up to 100 MeV: Production of ^{64}Cu,* Nuclear Instruments and Methods in Physics Research Section B: Beam Interactions with Materials and Atoms **240** (2005) 625.

F. Szelecsényi, G.F. Steyn, Z. Kovács, T.N. van der Walt, K. Suzuki, K. Okada and K. Mukai, *New cross-section data for the ^{66}Zn(p,n)^{66}Ga, ^{68}Zn(p,3n)^{66}Ga, ^{nat}Zn(p,x)^{66}Ga, ^{68}Zn(p,2n)^{67}Ga and ^{nat}Zn(p,x)^{67}Ga nuclear reactions up to 100 MeV*, Nuclear Instruments and Methods in Physics Research Section B: Beam Interactions with Materials and Atoms **234** (2005) 375.

Ditrói F., Tárkányi F., Csikai Gy., Uddin M. S., Hagiwara M., Baba M., Shubin Yu. N., Kovalev S. F.,
Excitation functions of long lived products in deuteron induced nuclear reactions on platinum up to 40 MeV, Nuclear Instruments and Methods in Physics Research Section B: Beam

Interactions with Materials and Atoms **243** (2006) 20.

Hermanne A., Tárkányi F., Ditrói F., Takács S., Rebeles R. A., Uddin M. S., Hagiwara M., Baba M., Shubin Yu. N., Kovalev S. F., *Experimental study of the excitation functions of proton induced reactions on ^{nat}Sn up to 65 MeV,* Nuclear Instruments and Methods in Physics Research Section B: Beam Interactions with Materials and Atoms **247** (2006) 180.

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: Proton induced nuclear reactions up to 80 MeV,* Nuclear Instruments and Methods in Physics Research Section B: Beam Interactions with Materials and Atoms **245** (2006) 379.

Tárkányi F. , Király B., Ditrói F. , Takács S. , Csikai Gy. , Hermanne A., Uddin M. S., Hagiwara M., Baba M., Shubin Yu. N., Kovalev S. F., *Cross sections of deuteron induced nuclear reactions on iridium,* Nuclear Instruments and Methods in Physics Research Section B: Beam Interactions with Materials and Atoms **247** (2006) 210.

Uddin M. S., Baba M., Hagiwara M., Tárkányi F., Ditrói F., Takács S., Hermanne A., *Experimental studies of the deuteron-induced activation cross-sections on ^{nat}Ag,* Applied Radiation and Isotopes 64 (2006) 1013.

Uddin M. S., Baba M., Hagiwara M., Tárkányi F. , Ditrói F., *Experimental study of the deuteron-induced activation reactions on yttrium,* Application of Radiotracers in Chemical, Environmental and Biological Sciences, ARCEBS 06, Kolkata, India, 23-27 Jan. 2006. Proceedings, S. Lahiri, D. Nayak, A. Mukhopadhyay (Eds), Kolkata, Saha Institute of Nuclear Physics 2 (2006) 69.

Hermanne A., Takacs S., Goldberg M. B., Lavie E., Shubin Yu. N. Kovalev S.F., *Deuteron-induced reactions on Yb: Measured cross sections and rationale for production pathways of carrier-free, medically relevant radionuclides*, Nuclear Instruments and Methods in Physics Research Section B: Beam Interactions with Materials and Atoms **247** (2006) 223.

Toshimitsu Fukumura, Kazuhiro Okada, Hisashi Suzuki, Ryuji Nakao, Kensaku Mukai, Ferenc Szelecsényi, Zoltán Kovács and Kazutoshi Suzuki, *An improved ^{62}Zn/^{62}Cu generator based on a cation exchanger and its fully remote-controlled preparation for clinical use*, Nuclear Medicine and Biology **33** (2006) 821.

Szelecsényi F., Steyn G. F., Kovács Z., van der Walt T. N., Suzuki K., *Comments on the feasibility of ^{61}Cu production by proton irradiation of ^{nat}Zn on a medical cyclotron*, Applied Radiation and Isotopes **64** (2006) 789.

Steyn G. F., Szelecsényi F., Kovács Z., van der Walt T. N., Dolley S. G., Vermeulen C., *Large discrepancies in the excitation function data of the ^{68}Zn(p,x)^{64}Cu reaction: A possible explanation,* Journal of Physics: Conference Series **41** (2006) 561.

Hermanne A.,Tárkányi F., Takács S., Shubin Yu. N., Kovalev S., *Experimental determination of activation cross section of alpha-induced nuclear reactions on ^{nat}Pt.*, Nuclear Instruments and Methods in Physics Research Section B: Beam Interactions with Materials and Atoms, In Press, Corrected Proof, available online 1 September 2006.

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 Pharmaceuticals (submitted) 2006.

Tárkányi F., Király B., Ditrói F., Takács S., Csikai J., Hermanne A., Uddin M. S., Hagiwara M., Baba M., Shubin Yu. N., Kovalev S. F, *Cross sections of deuteron induced nuclear reactions on iridium,* Nuclear Instruments and Methods in Physics Research Section B: Beam Interactions with Materials and Atoms (submitted) 2006.

Tárkányi F., Takács S, Szelecsényi F., Ditrói F., Hermanne A., Sonck M., *Excitation functions of proton induced nuclear reactions on natural tungsten up to 34 MeV,* Nuclear Instruments and Methods in Physics Research Section B: Beam Interactions with Materials and Atoms (accepted) 2006.

Tárkányi F., Király B. ,Ditrói F., Takács S., Csikai J., Hermanne A., Uddin M. S., M. Hagiwara M., Baba M., Ido T., Shubin Yu. N, S. F. Kovalev S. F., *Activation cross sections on cadmium: deuteron induced nuclear reactions up to 40 MeV,* Nuclear Instruments and Methods in Physics Research Section B: Beam Interactions with Materials and Atoms (accepted) 2006.

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

Uddin M. S., Baba M., Hagiwara M., Tárkányi F., Ditrói F., *Experimental study of the deuteron-induced activation reactions on yttrium,* Journal of Radioanalytical and Nuclear Chemistry (submitted) 2006.

Ditrói F., Tárkányi F., Takács S., Uddin M.S., Hagiwara M., Baba M., Ignatyuk A., Kovalev S. F., Hermanne A., *Investigation of excitation functions of deuteron induced nuclear reactions on lead,* Journal of Radioanalytical and Nuclear Chemistry (submitted) 2006.

Ditrói F., Tárkányi F., Takács S., Mahunka I., Csikai Gy.,Hermanne A., 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 (submitted) 2006.

Ditrói F., Tárkányi F., Takács S., Baba M., Hagiwara M., Hermanne A., *Systematic study on excitation functions for thin layer activation analysis,* Proc. 15th Pacific Basin Nuclear Conference, 15 – 20 October 2006, Sidney, Australia (submitted).

Szelecsényi F., Steyn G.F., Dolley S.G., Kovács Z., Vermeulen C., van der Walt T.N., *New cross-section data on the 68Zn(p,2p)^{67}Cu nuclear reaction: production possibility of 67Cu used for internal radiotherapy,* Proc. 15th Pacific Basin Nuclear Conference, 15 – 20 October 2006, Sidney, Australia (submitted).

Japan Charged-Particle Nuclear Reaction Data Group
(JCPRG)
Nuclear Reaction Data File Steering Committee

Progress Report to the
IAEA Technical Meeting on the Network of Nuclear Reaction Data Centres
25-28 September 2006

0. General

Since the last NRDC meeting (October 2005, Vienna), we have carried out the following activities:

1. Data compilation (NRDF and EXFOR)
2. Bibliography compilation (CINDA)
3. Database maintenance and development (NRDF, EXFOR/ENDF and CINDA)
4. Development of digitization system (GSYS)
5. Customer services

0.1 Staff

Our activities have been carried out by 13 group members (6 postdoctoral researchers, 6 graduate students and 1 technical staff). They have been supervised by the NRDF Steering Committee, which consists of 8 senior researchers (7 nuclear physicists and 1information 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. This year 4 million JPY is allocated for astrophysical application of nuclear data by the Japan Society for the Promotion of Science (JSPS).

1. Data Compilation (NRDF and EXFOR)

We are continuing data compilation for charged-particle nuclear reaction data obtained with Japanese accelerators.

1.1 Scope

We are scanning 16 journals for Japanese charged-particle 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. Alerts of new publications from Svetlana Dunaeva (NDS) are always helpful.

1.2 NRDF

From April 2005 to March 2006, CPND in 40 references (631 records, 1.8 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 2005 NRDC meeting, we have made 73 new entries and have revised or deleted 41 old entries. These were transmitted as 9 trans files (E034-E038, J004 and R016-R018) to the NDS open area. JCPRG is grateful for valuable comments from Otto Schwerer (NDS) on our transmissions as always. Comments on isotope production data from Sandor Takacs (ATOMKI) are also instructive. Some numerical data were converted from the McGowan data book to NRDF and EXFOR with help of Victoria McLane (NNDC).

According to the agreement (Conclusion 2004-14) at the 2004 NRDC meeting, the scope of area J is defined as "Charged-particle nuclear data for projectile with non-positive baryon number" (See also Action 2004-24, CP-E/053). Since the last NRDC meeting we moved 4 old entries from area E to area J, but no new entry has been made for area J.

Author proof of EXFOR compilation has been made by researchers from Cyclotron Radioisotope Center (CYRIC) of Tohoku University (Sendai), Institute of Nuclear Research of the Hungarian Academy of Sciences (Debrecen) and Lawrence Berkeley National Laboratory (Berkeley). We appreciate their cooperation.

Compilation of Japanese neutron reaction data is in principle outside our compilation scope. But many corrections were proposed by JCPRG and JAEA, and revised by Stanislav Maev (CJD).

1.4 NRDF/EXFOR editor

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

2. Bibliography Compilation (CINDA)

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

Since 2005 NRDC meeting, one batch (9 new lines and 55 modified lines) has been submitted to NEA-DB (Reader code J). Bibliographies for neutron induced reaction data in JPJ, PTP, NST and reports have been compiled by JAEA Nuclear Data Center (Reader code N) as before.

Some old (before 1944) Japanese neutron records included in the draft of the CINDA master file have been checked and corrected by JCPRG in collaboration with Hans Henriksson (NEA-DB).

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

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

3.1 NRDF

NRDF is available at http://www.jcprg.org/nrdf/. New data, which have not yet been finalized for EXFOR but for NRDF, can be obtained from this site. This retrieval system is written in a Perl script without any database management system. Now we are planning a new search and plot system which is based on Perl and MySQL.

Table 1: Annual statistics of NRDF search at http://www.jcprg.org/nrdf/

	2003	2004	2005	2006 (Estimation)
# of search (Total)	1870	2000	1340	1540
# of search (Hokkaido U. & JAEA)	1090	750	410	430

3.2 EXFOR/ENDF

JCPRG has developed a new search and plot system for EXFOR/ENDF based on Perl and MySQL. This is available at http://www.jcprg.org/exfor/. This system covers JENDL-3.2, JENDL-3.3, ENDF/B-VI, JEFF-30, JEFF-31, BROND-2.2, CENDL-2 as well as EXFOR.

Some web-based utilities were also developed. PENDL (http://www.jcprg.org/endf/) can output evaluated data libraries in tabulated form at any temperature and accuracy of interpolation Another system RENORM (http://jcprg.hucc.hokudai.ac.jp/renorm/) is a converter from the cross section ratio (e.g. cross section relative to 235U(n,f) cross section) to the absolute cross section and vice versa using evaluated data libraries as reference cross section sets.

3.3 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. Development of Digitization System (GSYS)

A Java-based digitizing system "GSYS" has been improved after the release of the first version and released as GSYS Ver.2 at http://jcprg.hucc.hokudai.ac.jp/gsys/gsys-e.html. The user interface and design are entirely revised so that the system is more user-friendly. In addition to writing out of data from the system after digitization, the new version can read numerical data sets before digitization. This function is useful when we have a digitized data set made by an old system and want to improve their quality.

5. Customer services

We provide Japanese researchers in the fields of nuclear physics and nuclear engineering with nuclear data as well as nuclear reaction data (NRDF and EXFOR). For more information, we published the "Annual Report of Nuclear Reaction Data File Vol.18" in March 2006 (in Japanese with English abstract). We have also issued a list of newly added data into EXFOR every month (http://jcprg.hucc.hokudai.ac.jp/exfor/recentdata.html).

We have received many comments on EXFOR compilation from Japanese users (e.g. JENDL evaluators). These comments have been listed to a table (http://jcprg.hucc.hokudai.ac.jp/exfor/feedbacks.html), and forwarded to responsible Centres.

We have received requests of laboratory reports (coded in REFERENCE record of EXFOR) from Japanese users. We appreciate the help of Dimitri Rochman (NNDC) and Marina Mikhaylyukova (CJD) to obtain reports issued by institutes in area 1 and 4.

ANNEX: Organization and members of JCPRG

NRDF Advisory Committee

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Yoshinori AKAISHI (*RIKEN, Wako, Saitama*)
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Hajime TANAKA (*Hokkaido Univ., Sapporo*)
Yoshihiko TENDOW (*RIKEN, Wako, Saitama*)
Hiroaki UTSUNOMIYA (*Konan Univ., Kobe*)

NRDF Steering Committee

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Shigeyoshi AOYAMA (*Niigata Univ., Niigata*)
Masaki CHIBA (S*apporo-Gakuin Univ. Ebetsu*)
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Hiroshi NOTO (*Hokusei-Gakuen Univ., Sapporo*)
Akira OHNISHI (*Hokkaido Univ., Sapporo*)
Shigeto OKABE (*Hokkaido Univ., Sapporo*)

NRDF Annual Report Editorial Committee

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

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Masatsugu ISSE (*Hokkaido Univ., Sapporo*)
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Hideki MAEKAWA (*Hokkaido Univ., Sapporo*)
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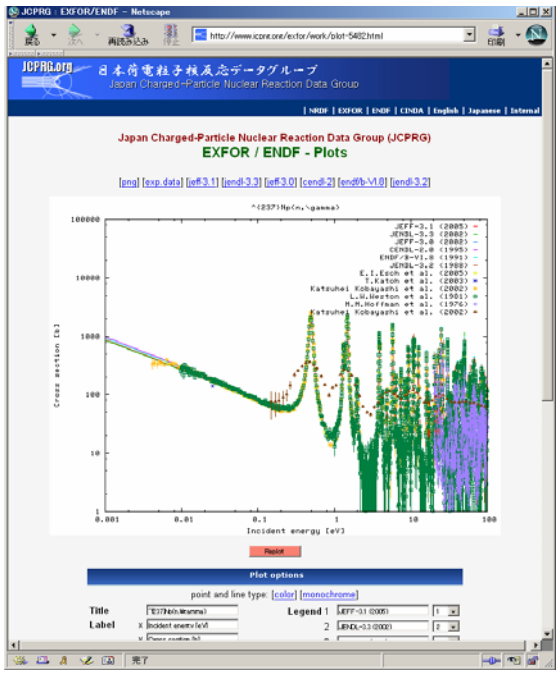
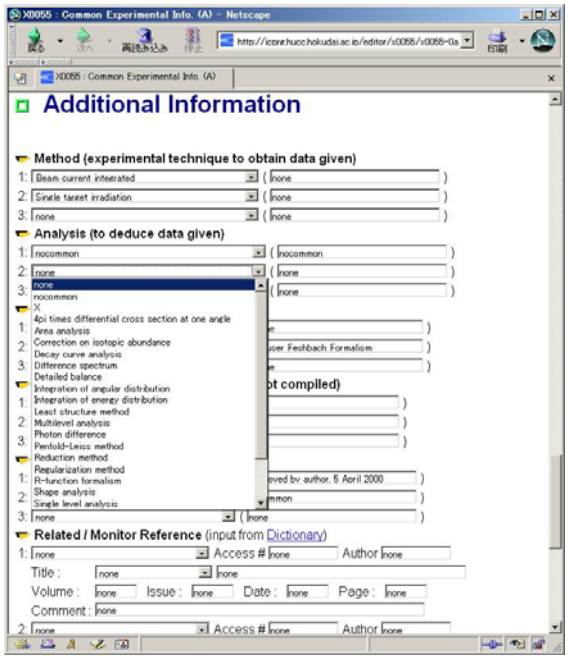
Our Products

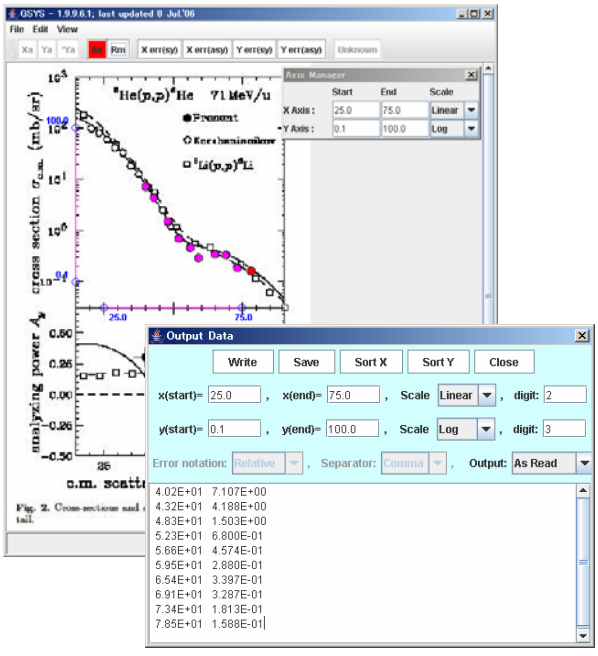
NRDF search/plot (DARPE)
http://ww.jcprg.org/nrdf/



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



NRDF/EXFOR editor (HENDEL)
http://jcprg.hucc.hokudai.ac.jp/editor/



Digitizer (GSYS Ver.2)
http://jcprg.hucc.hokudai.ac.jp/gsys/gsys-e.html

Ukrainian Nuclear Data Centre (UKRNDC)

Progress Report to the
IAEA Technical Meeting on the Network of Nuclear Reaction Data Centres,
25 - 28 September 2006, IAEA, Vienna, Austria

Summary of nuclear data activity by staff of the UKRNDC
October 2004 – September 2006

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Introduction

The Ukrainian Nuclear Data Centre (UKRNDC) is a 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 years under review four members of the staff were widely involved in the experimental investigations of neutron cross sections at the Kyiv Research Reactor.

Compilation

We continue collection and compilation of experimental neutron data published by Ukrainian researchers. We also started to compile the experimental charged particle data and photonuclear data executed by Ukrainian scientists. EXFOR's entries sent to NDS IAEA by UKRNDC are presented in Table 1.

Collaboration

- We continue our collaboration with the Physical Department of the National Taras Shevchenko 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 2004-2006 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" (54 hours per year) are lectured in 2004-2006 for fourth-year students of NPD KNU.
- We had a collaboration with the Lawrence Livermore National Laboratory (STCU Project #P176, "Experiments at Kyiv Research Reactor") to determine the neutron standard cross sections with high accuracy. In the frame of this activity the measurements of total, elastic scattering and angle scattering neutron cross sections were carried out at the reactor neutron filtered beams.

Table 1. EXFOR's entries sent to NDS IAEA by UKRNDC.

#	EXFOR's entry	N_SUB	Reference	Author
Neutron data				
1	32212	3	J,NST,1,389,200208	O.O. Gritzay, V.V.Kolotyi, O.I.Kalchenko, P.M.Vorona, M.L.Gnidak
2	32213	3	J,YF,61,(9),1562,199809	I.N.Vishnevsky, V.Yu.Denisov, V.A.Zheltonozhsky, S.V.Reshitko, L.V.Sadovnikov, N.V.Strilchuk
3	32214	2	C,2004SANTA,,969,2004	O.O.Gritzay, V.V.Kolotyi, N.A.Klimova, O.I.Kalchenko; M.L.Gnidak, O.I.Korol', P.M.Vorona
4	41012	1	C,87KIEV,2,283,198709	P.N.Vorona, V.P.Vertebnyy, A.I. Kal'chenko, V.G.Krivenko, L.E.Chervonnaya, V.Yu.Chervyakov
Charged particle data				
1	D5003	13	J,JP/G,7,1699,1981	M.P.Bilaniuk,V.V.Tokarevskii,V.S.Bulkin,L.V. Dubar, O.F.Nemets, L.I.Slyusarenko
2	D5004	7	J,IZV,50,(10),2016,1986	I.D.Fedorets, I.I.Zalubovskiy, B.A.Nemashkalo, V.E.Storizhko
3	D5005	10	J,IZV,69,(1),102,2005 J,VKHU,22,(2),86,2003	B.A.Nemashkalo,K.B.Shebeko, S.N.Utenkov B.A.Nemashkalo,I.D.Fedorets, R.P.Slabospicskij,K.B.Shebeko,S.N.Utenkov
4	D5006	3	J,IZV,69,(1),81,2005	I.M.Vishnevskyy, O.I.Davidovskaya, V.A.Zheltonozhskyy, M.V.Strilchuk, P.N.Trifonov
Photonuclear data				
1	G4001	3	J,UFZ,38,(6),846,1993	I.Z.Beseda, V.S.Bokhinyuk, A.I.Guty, A.P.Osipenko, N.V.Pashchenko, N.T.Sabolchy, I.V.Khimich, I.A.Shabalina
2	G4002	2	J,UFZ,35,(8),1153,1990	Ya.E.Kostyu, M.P.Medve, A.P.Osipenko, N.T.Sabolchy, I.V.Khimich, I.A.Shabalina
3	G4003	2	J,UZHV,12,83,2002	O.O.Parlag, V.T.Maslyuk, O.I.Lendel, V.A.Pilipchenko
4	G4004	2	J,UZHV,3,24,1998	O.I.Lendel, V.T.Maslyuk, O.O.Parlag, D.I.Sikora

Customer Services

- During 2004-2006 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. Kharkiv Institute of Physics and Technology.
8. 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. Address of the UKRNDC site: *http://ukrndc.kinr.kiev.ua.*

Calculation

- The code FILTER_L for simulation of neutron filters was modernized and calculations for the filter component optimization were carried out.
- Several modules (subroutines) were developed and added to the C_SG-W code for treatment of instrumental spectra in the scattering neutron cross section measurements.
- The ACE-format libraries for the isotopes which are the main constituents of the RBMK-1000 fission fragments and reactor fuel , namely, $^{83, 85}$Kr, $^{89, 90}$Sr , $^{90, 91}$Y , ^{95}Zr , ^{95}Nb , ^{95}Mo , ^{99}Tc, $^{101, 103, 106}$Ru, $^{103, 104}$Rh, ^{105}Pd , ^{109}, ^{110}Ag, ^{113}Cd, ^{115}In, ^{127}I, $^{125, 126}$Sb, $^{131, 133}$Xe, $^{133, 134, 135, 137}$Cs, $^{141, 144}$Ce, $^{143, 145}$Nd, $^{148, 149}$Pm, $^{147, 149, 150, 151, 152}$Sm, $^{152, 153, 154, 155}$Eu, ^{157}Gd, $^{234, 235, 236, 237, 238}$U, $^{238, 239, 240, 241, 242}$Pu, $^{241, 242m, 243}$Am, $^{242, 244}$Cm, were produced. The input data were taken from five nuclear data libraries: BROND-2, ENDF-VI (rel. 8), JEFF-3.0, JENDL-3.3, CENDL-2. Calculations were made for three temperatures, T=0K, 293K and 593K, by NJOY99.81 code on the computer with RISC/6000 processor under AIX operating system.
- The Monte Carlo calculations by means of the MCNP4C code were carried out to estimate functions of detector efficiency, thickness of the carbon samples, thickness of the standard sample, geometry, filter energy, etc., required for determination of the scattering neutron cross sections for carbon.

Experimental Neutron Data Measurements

- The technique for investigation of the elastic scattering neutron cross section was developed and an experimental installation was designed and mounted on the ninth horizontal channel at the Kyiv Research Reactor (KRR).
- The technique for investigation of the angle scattering neutron cross section was developed and two experimental installations were designed and mounted on the eighth horizontal channel at the KRR.
- The total neutron cross sections for natural carbon were measured using neutron filtered beams at the eight average energies 2, 3.5, 12, 24, 55, 59, 133 and 148 keV with an accuracy better than 1%.
- The neutron scattering cross sections for natural carbon were measured using neutron filtered beams at the five average energies 2, 3.5, 24, 54 and 133 keV with an accuracy better than 2%.
- The angle scattering neutron cross sections for natural carbon were measured using neutron filtered beams with the three average energies 2, 59 and 133 keV at the angles 30^0, 55^0, 90^0, 125^0 and 150^0 with an accuracy better than 7%.
- The capture cross section for ^{181}Ta (n,γ)^{182}Ta reaction was measured with an accuracy of about 5% at quasi-monochromatic neutron beam with main energy 2 keV at the KRR using activation method.

Visits and Conferences

- In July 16-20, 2006 O. Gritzay took part in the INMM 47th Annual Meeting, Nashville, Tennessee,USA.

- In May 29-June 3, 2006 the UKRNDC's staff took part in the International Conference Current Problems in Nuclear Physics and Atomic Energy (NPAE-2006), Kyiv, Ukraine.
- In May 18-20, 2005 N. Klimova took part in the Conference IEP-2005, Uzhhorod, Ukraine.
- In November 2005 O. Gritzay took part in the Fifth International Conference on Nuclear and Particle Physics, , Cairo, Egypt.
- In October 12-14, 2005 N. Klimova took part in the IAEA Technical Meeting, IAEA, Austria, Vienna.

References

1. O. Gritzay, M. Gnidak, V. Kolotyi, O. Korol, V. Razbudey, V. Venedyktov, J. Richardson, K. Sale, Neutron Scattering Cross Sections For Natural Carbon In The Energy Range 2-133 keV, the INMM 47th Annual Meeting, July 16-20, 2006, Nashville, Tennessee,USA, Book of Abstracts.
2. O.O. Gritzay, V.A. Libman, A.V. Chyzh, Cross Section Measurement of the ^{181}Ta (n,γ)^{182}Ta Reaction at the Neutron Energy 2 keV, International Conference Current Problems in Nuclear Physics and Atomic Energy, May 29 - June 3, 2006 Kyiv, Ukraine, Book of Abstracts.
3. O.O. Gritzay, V.V. Kolotyi, V.A. Pshenychnyi, N.A. Klimova, V.A.Libman, V.M. Venedyktov, A.I. Kyslitskyi, V.M. Archipov, Experimental Installations for Investigation of the Angle Distribution of Scattering Neutrons, International Conference Current Problems in Nuclear Physics and Atomic Energy, May 29 - June 3, 2006 Kyiv, Ukraine, Book of Abstracts.
4. O.O. Gritzay, O.I. Kalchenko, N.A. Klimova, V.V. Kolotyi, V.A.Libman, P.M. Vorona, Filter of Quasi-Monochromatic Neutrons with Average Energy 7.5 keV on the Basis of Natural Copper, International Conference Current Problems in Nuclear Physics and Atomic Energy, May 29 - June 3, 2006 Kyiv, Ukraine, Book of Abstracts.
5. O.O. Gritzay, M.L. Gnidak, O.I. Korol, V.F. Razbudey, V.M. Venedyktov, Investigation of the Scattering Cross Sections of Neutrons on Carbon Nuclei at the Reactor Filtered Beams, International Conference Current Problems in Nuclear Physics and Atomic Energy, May 29 - June 3, 2006 Kyiv, Ukraine, Book of Abstracts.
6. O.O. Gritzay, O.I. Kalchenko, N.A. Klimova, V.V. Kolotyi, Studies of Interaction of Nuclei with 2-keV Quasimonoenergetics Neutrons at Kyiv Research Reactor, Conference IEP-2005, Uzhhorod, Ukraine, 18-20 May 2005, Book of Abstracts.
7. I. Kadenko, R. Yermolenko, O. Gritzay, V. Libman, Determination of Cross Sections for the Reaction ^{181}Ta(N, γ)$^{182\ m2}$Ta at Neutron Filtered Beams, The Fifth International Conference on Nuclear and Particle Physics, November 2005, Cairo, Egypt, Book of Abstracts.
8. O. Gritzay, V. Koloty, O. Kalchenko, N. Klimova, V. Libman, Well Known and New Neutron Filters and Employment of them for Fundamental and Applied Investigations, The Fifth International Conference on Nuclear and Particle Physics, November 2005, Cairo, Egypt, Book of Abstracts.
9. Gritzay O.O., Kalchenko O.I.,Klimova N.A., Sanzhur, A.I., Razbudey V.F., Calculations of Neutron Source at the Kyiv Research Reactor for the Boron Neutron Capture Therapy Aims, The Fifth International Conference on Nuclear and Particle Physics, November 2005, Cairo, Egypt, Book of Abstracts.

Status Report of the KAERI Nuclear Data Evaluation Lab 2005 – 2006

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The Nuclear Data Evaluation Laboratory (NDEL) of the Korea Atomic Energy Research Institute (KAERI/ NDEL) has 9 Staffs and 1 Secretary (Evaluation 5, Processing and Benchmark 4). KAERI/NDEL's main project is "Establishment of Nuclear Data for Future Nuclear R&D" funded by the 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 Development (Extended Burnup, Thorium cycle) needs up-to-date neutron cross sections of fission products.
- Proton Accelerator Development (100 MeV, 20 mA) requires high energy neutron and proton nuclear data relevant to the radiological safety of the accelerator.
- Medical Cyclotron Application needs nuclear data of charged particles.
- Beside the R&D program, usual activities for the nuclear power plant operation, the space satellite development project, 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 in contact with the Pohang Accelerator Laboratory and the Van de Graaff laboratory of the Korea Institute of Geology and Mineral.

1. Facility

1.1. Pohang Accelerator Laboratory

Major upgrade plan of The Pohang TOF has initiated which includes extension of Fight length to 20m and improvement of electric gun and pulsing system. Measurements were performed for neutron total cross sections for energies from thermal to hundreds eV for 12 samples such as Ta, W, Ti, Dy, Sm, Ag, Hf, Zr, In, Cu, Mo, and Bi.

1.2. Korea Institute of Geology and Mineral

The 1.4 MV Van de Graaff of Geoscience and Mineral Resources (KIGAM) is equipped with a pulsing and bunching system to measure neutron capture cross section at 1 – 2 MeV range. Their characteristics such as the response function of gamma-ray detecting system, its weight function and optimum conditions for generating MeV neutrons, were studied. The neutron energy spectrum, which was obtained by these optimum conditions, was characterized for the neutron energy of 2.2 MeV. Also the neutron TOF spectra were measured as a function of the scattering angle and the incident proton beam energy.

2. Measurement

Neutron total cross sections of natural Mo, Cd and Bi were measured in the energy range 0.01 - 100 eV at Pohang TOF. Photo-neutron production cross sections and isomeric cross section ratio were measured by gamma activation analysis at Pohang facility.

Cross sections for residual radio-nuclide production by proton-induced reactions on natural molybdenum were measured from their respective thresholds up to 35 MeV using MC-50 cyclotrons at KIRAMS. The activation method and the stacked foil technique using high-resolution HPGe gamma-ray spectrometry were applied to determine the excitation functions. The detector energy resolution and full energy photo-peak efficiency were measured using standard calibrated γ-ray point sources. The measurements were performed in a low background radiation environment. The data were analyzed by using *EG&G-ORTEC* gamma vision software. The proton beam energy along the stacks were measured experimentally employing ^{nat}Cu(p, xn)^{62}Zn / ^{nat}Cu(p, xn)^{65}Zn method as well as theoretically, by using computer program *SRIM-2003*, and found a good agreement

The neutron capture cross-sections and the capture γ-ray spectra of ^{155}Gd and ^{157}Gd were measured at the energy 550 keV by using the 3-MeV Pelletron accelerator of the Research Laboratory for Nuclear Reactors at the Tokyo Institute of Technology. Pulsed keV-neutrons were produced from the ^{7}Li(p,n)^{7}Be reaction by bombarding the lithium target with the 1.5-ns bunched proton beam from the Pelletron accelerator. The incident neutron spectrum on a capture sample was measured by means of a time-of-flight (TOF) method with a ^{6}Li-glass detector. Capture γ-rays were detected with a large anti-Compton NaI(Tl) spectrometer by employing a TOF method. A pulse-height weighting technique was applied to the observed capture γ-ray pulse-height spectra to derive the capture yields. The neutron capture cross-sections were determined relative to the standard capture cross-section of ^{197}Au.

3. Evaluation

Neutron induced reactions on 32 major fission products isotopes such as ^{95}Mo, ^{101}Ru, ^{103}Rh, ^{105}Pd, ^{109}Ag, ^{131}Xe, ^{133}Cs, ^{141}Pr, ^{142,143,144,145,146,147,148,150}Nd, ^{144,147,148,149,150,151,152,153,154}Sm, and ^{156,158,160,161,162,163,164}Dy for energies up to 20 MeV have been evaluated by the KAERI-BNL collaboration. Resonance regions were carefully analyzed using all available experimental information and systematics. In the fast neutron energy region, a modular system of nuclear reaction codes EMPIRE-2.19 was used to produce physical observables such as cross sections, spectra, angular distributions and double-differential cross sections. The evaluations in the fast neutron region are based on nuclear model calculations that allow for a reliable interpolation to the energy regions and/or reactions channels for which no experimental data are available. In the case of neodymium, samarium and dysprosium, we evaluated the entire families of isotopes. This approach ensures consistency among isotopes of the same element and allows for utilization of experimental data for all isotopes to constrain model parameters. The remaining nuclides have been evaluated individually, adjusting model calculations to the available experimental data

Neutron capture and gamma spectra were evaluated in view points of gamma strength functions, even though the level densities play great role to determine the these reactions. The data of iodine-127, cesium-133, gold-197, and gadolinium-155,156,157,158,160 were produced. The gold-197 with apparent anomalous bumps has the experimental data on double differential cross sections from 0.4 MeV to 18.57 MeV and energy spectra at 0.5 MeV. The calculated gamma spectra describe the experimental data well in full energy ranges. The remaining nuclides were carefully evaluated employing the gamma strength functions describing anomalous bumps.

Carbon and copper in the proton accelerator, through actication, become radionuclides such as ^{7}Be and ^{64}Cu. Copper is a major element of the accelerator components and the carbon is planned to be used as a target material of the beam dump. A recent survey showed that the

currently available cross sections create a large difference from the experimental data in the production of some residual nuclides by the proton-induced reactions for carbon and copper. To more accurately estimate the production of radioactive nuclides in the accelerator, proton cross sections for carbon and copper are evaluated. The TALYS code was used for the evaluation of the cross sections for the proton-induced reactions. To obtain the cross sections which the best fit the experimental data, optical model parameters for the neutron, proton and other complex particles such as the deuteron and alpha were successively adjusted.

Resonance parameters for ^{232}Th, Pd-107 and Er-166 in resolved and unresolved energy regions were newly evaluated using the weighted average method, the Porter-Thomas distribution and the Bayesian approach. Recent measurements data and evaluation data were taken into account in this evaluation. In the resolved resonance energy region, quantum numbers and neutron reaction widths for each resonance were assigned and the upper energy of the resolved resonance region was adjusted so as to make the capture cross section be connected smoothly to that in the unresolved resonance region. In the unresolved resonance region, the neutron strength functions, average level spacings and average capture widths were determined, and then the evaluated resonance parameters were compiled into the ENDF format.

4. Processing and Benchmarks

Various libraries such as for MCNP4C code, WIMSD-5 code, fast reactor, shielding, fission product burnup, and reactor benchmark were generated, and a new resonance integral method was developed and applied for the heterogeneous reactor.
The covariance data processing and the nuclear data sensitivity and uncertainty (S/U) analysis of the keff have been carried out using SUS3D-ERRORJ-NJOY-ANSN code system . The uncertainties of the keff due to the U-235 and U-238 cross sections of JENDL-3.3 have been estimated for the 1-D fast benchmark GODIVA.. The elastic and inelastic scattering cross sections are highly and negatively sensitive in the fast energy region, while the fission and total nu-bar cross sections are positively sensitive. The U-235 cross sections were more sensitive to the keff calculation for GODIVA than U-238. Especially, the elastic scattering cross section of U-235 can provide the largest uncertainties to the keff calculation. As a result, the uncertainty of the keff due to the U-235 and U-238 cross sections of JENDL-3.3 was evaluated to be ~1.4% for GODIVA (calculated keff = 1.02516).

5. Services

As for the online nuclear data service at http://atom.kaeri.re.kr/, the nuclear structure database, neutron data, charged particle data, and high energy service were upgraded in response to the relevant users' opinions from domestic laboratories, universities and industries. In the nuclear data service for the R&D, the WIMSD-5B library is constantly being updated and upgraded by responding users' demands, such as adding new nuclides and burnup chains. Libraries for the liquid metal reactor are also being upgraded, and the structure of the group is being revised constantly according to the users' needs.

The Progress Report of CNDC to NRDC Meeting

(25 - 28 September 2006, Vienna, Austria)

Yu Hongwei
China Nuclear Data Center
China Institute of Atomic Energy

1. General

CENDL is carried out by the China Nuclear Data Center and the China Nuclear Data Network, the China Nuclear Data Committee assumes responsibility for the management of the CENDL project. The China Nuclear Data Center serves as the secretariat of the Chinese Nuclear Data Committee. A young staff has joined CNDC this year, the CNDC staff are 19 now. The following shows the organization of the committee and the network:

Committee Chair:	Dr. Zhao Zhixiang, CIAE
Technical working party:	Evaluation Working Party
	Measurements Working Party.
	Benchmark Working Party.
China Nuclear Data Network:	China Institute of Atomic Energy.
	Peking University,
	Sichuan University.
	Lanzhou University.
	Tsinghua University
	Nankai University,
	Jilin University
	Zhenzhou University ,
	Northwest University and et al

The progress and achievements in the China nuclear data field are carried in the issue of Communication of Nuclear Data Progress (CNDP)

2. EXFOR Compilation

18 neutron reaction experiments and 3 charged particle experiments have been compiled since the 2005 NRDC meeting. A list of the 10 most important Chinese journals relevant to nuclear data has been provided to NDS.

3. Nuclear Data Evaluation

CENDL-3.1

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

Nuclear data for ADS

In order to satisfy the need of ADS project of China, a code MEND for calculating the nuclear data in medium energy region has been developed, The following nuclear data have been calculated and evaluated:

Nuclear data for incident neutron from 20 to 250MeV: ^{50,52,53,54}Cr, ^{54,56,57,58}Fe, ^{90,91,92,94,96}Zr, ^{180,182,183,184,186}W, ^{204,206,207,208}Pb, ^{238}U.

Nuclear data for incident proton from theshold energy to 250MeV: ^{54,56,57,58}Fe, ^{180,182,183,184,186}W, ^{204,206,207,208}Pb, ^{209}Bi, ^{238}U.

Structure and decay data

CNDC have taken permanent responsibility for evaluating and updating NSDD for A=51, 52 and 195-198.The mass chain A=51 and 67 have been revised using available experimental decay and reaction data, A=67 was published in NDS in 2005 and A=51 have been sent to NNDC in review. Now A=196 was being updated.

The decay data evaluation covers the following nuclides: ^{7}Be, ^{101}Mo,^{175}Hf, ^{225}Ra, ^{231,232}Th, ^{231,233}Pa and ^{232,233,234,236}U. All evaluations including decay scheme were completed.

Fission yield

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

4. International Co-operation:

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

- Evaluated Nuclear Data for Thorium-Uranium Fuel Cycle;
- Parameters for Calculation of Nuclear Reactions of Relevance to Non-energy Applications (RIPL-3);
- Updated Decay Data Library for Actinides.

MSU SINP CDFE 2005 – 2006 Progress Report

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

Progress Report to
the IAEA Technical Co-ordination Meeting
of the Network of Nuclear Reaction Data Centres
(25 – 28 September 2006, IAEA NDS, 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 Meeting on Coordination of the Network of Nuclear Reaction Data Centres (12 – 14 October 2005, IAEA NDS, Vienna, Austria) till the fall of 2006 and main results obtained.

EXFOR Compilations

Two new CDFE EXFOR TRANSes M039 and M040 have been produced and transmitted to the IAEA NDS. Many old data have been corrected in accordance with comments of O. Schwerer, D. Rochman, and N. Otsuka. On the whole, the CDFE TRANSes mentioned contain (Annex 1) 16 retransmitted and 11 new ENTRYs with 34 new data SUBENTs.

Upgrading of Databases

The CDFE relational nuclear data databases (http://cdfe.sinp.msu.ru) have been upgraded significantly:

- the “2005” part (the “2006” is in processing) has been added to the CDFE “Photonuclear Data Index”; as whole the “Photonuclear Data Index 1955 -2005” database has been added by a significant amount of entries from /1/; for articles included into international EXFOR nuclear reaction data fund all data sets are available in forms of table and graphs;
- the database "Giant Dipole Resonance Parameters" has been upgraded significantly: many new data sets have been added.

The New Database – Chart of Nuclear Quadrupole Deformations

A new Chart (relational database, really) of Nuclear Quadrupole Deformations (http://cdfe.sinp.msu.ru/services/nsr/defchart/defmain.html) has been developed using various sources of related information (quadrupole moments and parameters of quadrupole deformation β_2) /2, 3/ - more than 1300 of electric quadrupole moment values for more than 440 nuclides and 1765 B(E2)↑ values for about 200 nuclides. Database is realized as information system analogue to well-known Chart of nuclides (nuclide properties sorted in N and Z coordinates). The colour and intensity solution of the Chart’s individual nuclide elements gives one the possibility for comfortable overview and search of nuclei of different (spherical, prolate and oblate) shapes in various N and Z regions.

Photonuclear Data Evaluations

As an continuation of CDFE program of consistent analysis and evaluation of total and partial photonuclear reactions cross sections joint combined evaluation of total (γ,xn) and (γ,sn) and partial (γ,n), (γ,2n) and (γ,3n) photoneutron reactions cross sections was carried out /4/ for ^{127}I because many applied research needs. Those were based on the results of investigation of various photonuclear reactions in experiments used the bremsstrahlung and

quasimonoenergetic annihilation photon beams. The reasons of data disagreements were analyzed, the values of renormalization factors for putting all data in consistency to each other were obtained. The evaluated cross sections energy dependencies were obtained, integrated cross section values have been calculated.
Evaluated data are in preparation for the new CDFE EXFOR TRANS M041.

Nuclear Structure Data

Using the new CDFE Chart of nuclear quadrupole deformation parameters the systematical comparative analysis of that from various sources was carried out for many even-even nuclei. 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) were revealed. It was found out that all nuclides (with only few exceptions) can be clearly separated into 2 groups: 1) for isotopes of Ti, Cr, Zr, Nd, Sm, Gd, Dy, Er, W, Os, Ra good agreement is observed for data of both types; 2) for isotopes of C, Si, Ar, Ca, Fe, Ni, Zn, Ge, Se, Kr, Sr, Mo, Ru, Pd, Cd, Sn, Te, Ba, Yb, Hf, Pt, Pb B-type deformation parameters are systematically (and in many cases – significantly) larger than G-type ones (in cases of only few exceptions mentioned above (Mg, Xe, U) both types of disagreement are combined). It was shown that two types data difference could be explained in the frame of assumption about the not-negligible role of dynamical vibrations of nucleus surface.

New double magic nucleus ^{96}Zr has been found out on the base of systematical joint analysis of nucleon single-particle subshells energy positions and occupation probabilities and "magicy parameters" - energy $E(2^+_1)$ of the first 2^+ state, ratio $E(4^+_1)/E(2^+_1)$ and nucleus quadrupole deformation parameter β_2. It was pointed out that in ^{96}Zr there are two closed subshells with the large identical moment j = 5/2 (i.e. $\pi 1f_{5/2}$ and $\nu 2d_{5/2}$) near to Fermi and in addition above one of them, $\pi 1f_{5/2}$, the closed subshell with j = 1/2, $\pi 2p_{1/2}$, occurs. Several other new magic were revealed by application of ^{96}Zr subshell structure features scheme (an empirical rule) to other nuclei subshells: 1) with j = 3/2 (i.e. $\pi 1d_{3/2}$ and $\nu 2p_{3/2}$) together with j = 1/2, $\nu 2p_{1/2}$ closed subshell above leads to magic nucleus ^{54}Ca, discussed in; 2) with j = 5/2 (i.e. $\pi 1d_{5/2}$ and $\nu 1d_{5/2}$)) together with j = 1/2, $\pi/\nu 2s_{1/2}$ closed subshells above leads to magic numbers N = 16 for Z = 14 (^{30}Si) and vise versa – N = 14 for Z = 16 (^{30}S); 3) with j = 3/2 (i.e. $\pi 1p_{3/2}$ and $\nu 1p_{3/2}$) together with j = 1/2, $\pi/\nu 1p_{1/2}$ closed subshells above leads to magic numbers N = 8 for Z = 6 (^{14}C) and vise versa – N = 6 for Z = 8 (^{14}O). The empirical rule under discussion can be attributed to additional specific attractive proton-neutron interaction.

New evaluated nuclear structure data on new non-traditional magic nuclei and nuclear static and dynamic deformations are submitted for reports to the International Conference on Nuclear Data for Science and Technology at Nice, France (ND-2007).

CDFE Short-term Programmes

The main items of CDFE future short-term programmes, priorities and new tasks in fields both photonuclear and nuclear structure data are listed in the Annex 2.

References

1. E.G. Fuller, H. Gerstenberg. Photonuclear Data - Abstracts Sheets 1955 - 1982. NBSIR 83-2742. U.S.A. National Bureau of Standards, 1986.
2. N.J. Stone. Table of Nuclear Magnetic Dipole and Electric Quadrupole Moments. Preprint Oxford Physics, Clarendon Laboratory OXFORD OX1 3PU U.K., 2001.
3. P. Raghavan, Table of Nuclear Moments. Atomic and Nuclear Data Tables, 42 (1989) 189.

4. V.V. Varlamov, B.S. Ishkhanov, I.V. Makarenko, V.N. Orlin, N.N. Peskov. Evaluation of ^{127}I Photonuclesr Reaction Cross Sections. Preprint MSU SINP - 2006 - 9/808 (in Russian - http://dbserv.sinp.msu.ru:8080/sinp/files/pp-808.pdf).

Annex 1. The CDFE new EXFOR TRANSes M039, M040, and M041 (PRELIM) contents (*old corrected* and **new** ENTRYs)

TRANS M039		**TRANS M040**	
ENTRY N	Amount of SUBENTs	ENTRY N	Amount of SUBENTs
M0385	*3*	*M0680*	*7*
M0419	*1*	*M0681*	*10*
M0507	*3*	**M0686**	**6**
M0510	*5*	**M0687**	**2**
M0537	*7*	**M0688**	**4**
M0538	*4*	**M0689**	**1**
M0543	*3*	**M0690**	**1**
M0600	*2*	**M0691**	**1**
M0629	*5*	**M0692**	**1**
M0631	*2*		
M0633	*6*		
M0637	*1*		
M0669	*2*		
M0679	*11*		
M0680	**7**		
M0683	**4**		
M0684	**3**		
M0685	**4**		
Total new: 4	Total new: 18	Total new: 7	Total new: 16
Sum of new ENTRYs: 11 *) Sum of new SUBENTs: 34 *)			

) For crazy coincidence of financial, technical, manpower, health, scientific business etc. reasons the sums of new ENTRYs and SUBENTRYs are not enough large unfortunately.

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

1. Continuation of photonuclear data compilation using EXFOR format, new TRANSes (M041, M042, etc.) production.
2. Upgrading and addition of all CDFE 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. Investigation of possibility of development of Giant Dipole Resonance Chart using the experience of previous production of the Chart of Nuclear Quadrupole Deformations.
5. Investigations of new non-traditional magic nuclei properties and existence conditions using the search possibilities of the CDFE database "RelationalENSDF".

Status Report of JAEA Nuclear Data Center

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1. General

The Japan Atomic Energy Agency (JAEA) was established as an independent administrative agency on October 1, 2005 after the merger of the Japan Atomic Energy Research Institute (JAERI) and the Japan Nuclear Cycle Development Institute (JNC). The Nuclear Data Center in JAEA has taken over the activities of the Nuclear Data Center in JAERI. JAEA, however, is an administrative agency and a mid-term plan has to be submitted to and approved by the Minister of Education, Culture, Sports, Science and Technology. The mid-term plan is the work plan to be performed from October 1, 2005 through March 31, 2010. In the mid-term plan it is officially declared to compile the next Japanese Evaluated Nuclear Data Library JENDL-4. The main effort to compile the JENDL-4 library is to improve the quality of nuclear data of fission products (FP) and minor actinides (MA) because the importance of those nuclear data is increasing in the fields relating to ADS, FBR, MOX fuel utilization, R & D on innovative reactors etc. Covariance data are also considered to be important and emphasis is placed on their evaluation, too.

2. Status of Evaluation works

1) JENDL-4

(1) Evaluation of minor actinides

After the establishment of JAEA, resonance parameters have been updated for ^{229}Th, ^{231,233}Pa, ^{234,236}U, ^{236,242}Pu, ^{242,242m}Am, $^{242\text{-}248}$Cm and ^{250,251}Cf. Fission cross sections have also been updated for ^{230,232}Th, ^{237}Np, ^{237}U, ^{236,238}Pu, $^{241\text{-}243}$Am and ^{244}Cm. In these evaluation works, a least-squares fitting code GMA was used.

The project to measure the cross section data of ^{237}Np and ^{241,243}Am nuclides has been performed in Japan. The measured data is scheduled to be obtained this year. The data will be used for the new evaluation.

(2) Evaluation of fission products

Resolved resonance parameters of JENDL-3.3 FP nuclides were examined for JENDL-4 by taking into account recently measured data. As a result, the parameters of 89 FP nuclides were updated. In addition to those updated data the parameters of 13 nuclides were newly evaluated.

In the non-resonance energy region, nuclear model calculations are performed to evaluate cross sections. Optical model parameters used for the model calculations were searched for by using a coupled-channel optical code OPTMAN. The systematics of optical model parameters has been obtained by comparing with experimental data.

(3) Covariance data

The need for covariance data is increasing to estimate the accuracy of reactor calculations. The least-squares fitting code GMA is used to estimate covariance data. In the case of nuclear model calculations, covariance data of cross sections are calculated by taking into consideration the propagation of the covariances of model parameters. At present no covariance data are fixed for JENDL-4, but the preparation of covariance data for some nuclides are being performed.

2) JENDL High Energy File

JENDL High Energy File (JENDL/HE) contains the evaluated data for neutron and proton reactions up to 3 GeV. A part of the JENDL/HE file was released as JENDL/HE-2004 in March 2004. The file contains the data of 66 nuclides which are selected as having the first priority in the discussion of Japanese high energy nuclear data evaluation group. The full JENDL/HE file is planned to include the data of total 132 nuclides and to be released in early 2007.

3) JENDL Photo nuclear Data File

JENDL Photonuclear Data File (JENDL/PD) contains the gamma-ray induced reaction up to 140 MeV. The data is used for the fields of electron accelerator shieldings, radiation therapy and actinides detection. The data of 68 nuclides was released as JENDL/PD-2004 in 2004. The evaluated data of 107 nuclides by KAERI group are going to be included in the JENDL/PD file. The extended JENDL/PD file will be released in early 2007.

4) JENDL PKA/KERMA File

The JENDL PKA/KERMA File is being developed for the purpose of the estimation of radiation damage in solid material. The incident particle is assumed to be neutrons with energy up to 50 MeV. The file contains the spectra of primary knock-on atoms (PKA), damage energy spectra, DPA cross sections and KERMA factors.

3. Other Activities

1) CINDA Compilation

Papers on neutron induced reaction data published in Japanese journals and reports are surveyed. Total of 66 entries were sent to NEA Data Bank from April 2005 through March 2006.

2) Code development

We are developing theoretical calculation codes for the evaluation of cross section and particle emission spectrum which are not able to be estimated from only experimental data. The codes are based on the spherical and coupled-channel optical models, the Distorted-Wave Born Approximation (DWBA), the pre-equilibrium exciton model and the Hauser-Feshbach statistical model width fluctuation corrections.

The two kinds of codes are now developed: one is a FORTRAN program and the other one is a C++ program. Both of them are being checked by comparison with experimental data.

Working Papers for the 2006 NRDC Meeting in Vienna, September 2006

WP 2006-1		Conclusions and Actions of the 2005 NRDC Meeting
WP 2006-2	O. Schwerer	EXFOR compilation and transmission statistics (New and revised entries since the last meeting)
WP 2006-3	A.J. Koning	Recommendation to improve the quality of EXFOR
WP 2006-4	H. Henriksson	EXFOR Correction factors from EAF (CP-N/54)
WP 2006-5	D. Rochman	Deficiencies in CSISRS(EXFOR) (CP-C/378)
WP 2006-6	D. Rochman, P. Obložinský	Proposal to change the geographic compilation responsibility to full journal coverage (CP-C/380)
WP 2006-7	D. Rochman	Proposal for the generation of Bibtex citations from CSISRS (CP-C/375)
WP 2006-8	O. Schwerer, V. Zerkin	Wildcards for SF7 in Dictionary 236 (CP-D/469)
WP 2006-9	D. Rochman	Deficiencies in the X4TOC4 programs (CP-C/377)
WP 2006-10	D. Rochman	Proposal to allow the usage of greek letters etc. (CP-C/376)
WP 2006-11	O. Schwerer	Pending proposals and issues from recent memos
WP 2006-12	A. Hasegawa, H. Henriksson, P. Nagel	CINDA book draft (CP-N/53)
WP 2006-13	O. Schwerer	Review of compilation scope (2005). ***See revised version on page 23***
WP 2006-14	N. Otsuka	Clarification of spin observables (CP-E/100)
WP 2006-15	N. Otsuka	Review of corrections since 2005 NRDC meeting (CP-E/101)
WP 2006-16	N. Otsuka	Compilation of anti-proton induced nuclear reaction data at JCPRG (CP-E/096)
WP 2006-17	V. Zerkin	Projects in CINDA: Proposal #2
WP 2006-18	V. Zerkin	Proposal for a change of EXFOR format
WP 2006-19	V. Zerkin	X4TOC4: conversion of full EXFOR database to computational format

All working papers are available online from the NDS web site under
http://www-nds.iaea.org/nrdc-int/2006nrdc/wps.html

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