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I N D C INTERNATIONAL NUCLEAR DATA COMMITTEE

Report on the IAEA Technical Meeting on

Network of Nuclear Reaction Data Centres

OECD Nuclear Energy Agency
Issy-les-Moulineaux, France

27 – 30 May 2002

Prepared by
V.G. Pronyaev, O. Schwerer and A.L. Nichols
IAEA Nuclear Data Section
Vienna, Austria

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Abstract

An IAEA Technical Meeting on the Network of Nuclear Reaction Data Centres (and the biennial Data Centre Heads' Meeting) was held at the OECD Nuclear Energy Agency, Issy-les-Moulineaux (near Paris), France, from 27 to 30 May 2002. The meeting was attended by 21 participants from 12 co-operating data centres of six Member States and two international organizations. This report contains the meeting summary, conclusions and actions, status reports of the participating data centres, and working papers considered.

CONTENTS

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. A brief summary of the data centres network is given below.

The nuclear reaction data centres:

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
JAERI	-	Nuclear Data Center of the Japan Atomic Energy Research Institute, 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
(KACHAPAG)	-	Karlsruhe Charged Particle Group, Karlsruhe, Germany. (Discontinued in 1982, its responsibilities were taken over by CAJaD)
(RIKEN)	-	Nuclear Data Group, RIKEN Institute of Physical and Chemical Research, Wako-Shi, Japan. (Discontinued in 2000)

1. Neutron Nuclear Data

1.a Bibliography and Data Index CINDA:
Input prepared by NNDC, NEA-DB, NDS, CJD, JAERI
Handbooks published by IAEA
Online services by NNDC, NEA-DB and NDS, CJD

1.b Experimental data exchanged in EXFOR format:
Input prepared by NNDC, NEA-DB, NDS, CJD, CNDC, UKRNDC
Online services by NNDC, NEA-DB, NDS and CJD

1.c Data Handbooks based on EXFOR
published by NNDC (last issue in 1988)

1.d Evaluated data exchanged in ENDF format:
NNDC, NEA-DB, NDS, CJD, CNDC, JAERI and others. Main data libraries:

BROND-2 (Russia)	FENDL-2 (IAEA)
CENDL-2 (China)	IRDF-90, Rev. 92 (IAEA)
ENDF/B-6 (USA)	JEF-2 (NEA)
	JENDL-3 (Japan)

Online services by NNDC, NEA-DB and NDS

1.e Computer retrieval services upon request of customers:
NNDC, NEA-DB, NDS, CJD, CNDC

1.f International data evaluation cooperation coordinated by NEA-DB

2. Charged Particle Nuclear Data (including heavy-ion reaction data)

2.a Bibliography NSR published by NNDC
Online services by NNDC, NEA-DB and NDS

2.b Numerical data exchanged in EXFOR format:
Input prepared by CAJaD, RIKEN, CNDC, ATOMKI, NDS, NNDC, JCPRG, NEA-DB
Online services by NNDC, NEA-DB and NDS
Coordination of compilation: CAJaD

2.c Computer retrieval services upon request of customers:
NNDC, NEA-DB, NDS, CAJaD, CNDC

3. Photonuclear Data

3.a Numerical data exchanged in EXFOR format:
Input prepared by CDFE, occasional contributions from NNDC, NDS
Online services by NNDC, NEA-DB, NDS and CDFE

3.b Evaluated data:
Online service by NDS, CDFE

3.c Bibiliography published by CDFE and JAERI

3.d Computer retrieval services upon request of customers:
NNDC, NEA-DB, NDS, CDFE

PAST NRDC MEETINGS

Paris, 27-30 May 2002	Centre Heads + Tech. = 16th NRDC Meeting	INDC(NDS)-434
Vienna, 28-30 May 2001	Technical	INDC(NDS)-427
Obninsk, 15-19 May 2000	Centre Heads + Tech. = 15th NRDC Meeting	INDC(NDS)-418
Vienna, 18-20 May 1999	Technical	INDC(NDS)-407
Vienna, 11-15 May 1998	Centre Heads + Tech. = 14th NRDC Meeting	INDC(NDS)-383
Vienna, 26-28 May 1997	Technical	INDC(NDS)-374
Brookhaven, 3-7 June 1996	Center Heads + Tech. = 13th NRDC Meeting	INDC(NDS)-360
Vienna, 2-4 May 1995	Technical	INDC(NDS)-343
Paris, 25-27 April 1994	Center Heads + Tech. = 12th NRDC Meeting	INDC(NDS)-308
Vienna, 1-3 Sept 1992	Technical	INDC(NDS)-279
Obninsk, 7-11 Oct 1991	Center Heads + Tech. = 11th NRDC Meeting	INDC(NDS)-262
Vienna, 13-15 Nov 1990	Technical	Memo CP-D/210
Vienna, 2-4 Oct 1989	Centre Heads + Tech. = 10th NRDC Meeting	Memo CP-D/200
Vienna, 4-6 Oct 1988	Technical	Memo CP-D/190
Brookhaven, 27-29 Oct 1987	Center Heads + Tech. = 9th NRDC Meeting	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	NEA-NRDC-3 = 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, N.Y., 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
CINDA	A specialized bibliography and data index on neutron nuclear data operated jointly by NNDC, NEA-DB, NDS and CJD
CJD	Russian Nuclear Data Center at F.E.I., Obninsk, Russia
CNDC	Chinese Nuclear Data Center, Beijing, China
CNPD	Center of Nuclear Physics Data at RFNC-VNIIEF, Sarov, Russia
CP...	Numbering code for memos exchanged among the NRDC
CPND	Charged-particle nuclear reaction data
CRP	Coordinated Research Programme 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	The International Reactor Dosimetry File, maintained by the IAEA-NDS
ITER	International Thermonuclear Experimental Reactor
JAERI	Japan Atomic Energy Research Institute

JCPRG	Japan Charged-Particle Nuclear Reaction Data Group, Sapporo, Japan (previously Study Group for Information Processing)
JEF	The Joint Evaluated File of neutron data, a collaboration of European NEA member countries and Japan
JENDL-3	Japanese Evaluated Nuclear Data Library, version 3
KAERI	Korea Atomic Energy Research Institute
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	The journal Nuclear Data Sheets
NEA	Nuclear Energy Agency of the OECD, Paris, France
NEA-DB	NEA Data Bank, Paris, 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	The 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
PC	Personal Computer
PhND	Photonuclear data
RIKEN	Nuclear Data Group, RIKEN Inst. of Phys, and Chem. Res., Wako-Shi, Saitama, Japan
TRANS	Name of transmission tapes for data exchange in the EXFOR system
UKRNDC	Ukrain Nuclear Data Center at KINR, Kyiv, Ukraine
USDOE	U.S. Department of Energy
VNIIEF	Russian Federal Nuclear Center, Sarov, Russia
4C...	Numbering code of memos exchanged among the four Neutron Data Centers

MEETING SUMMARY

Introduction

16th IAEA Technical Meeting on the Network of Nuclear Reaction Data Centers (NRDC) was held at the OECD Nuclear Energy Agency, Issy-les-Moulineaux, France from 27 to 30 May 2002. Twenty-one participants from twelve co-operating data centers in China, Hungary, Japan, Russia, Ukraine and USA, and NEA OECD and IAEA attended the meeting (*see list of participants in Appendix 1*). The location of the meeting also gave an opportunity for the staff of the NEA Data Bank to demonstrate the software developed for network-shared databases and services.

Discussions included the biennial coordinating meeting of NRDC Heads, with the main tasks of considering data center cooperation in maintaining, updating and providing full-scale and user-friendly access to the common nuclear reaction databases, outlining the priorities of future work, and considering the technical issues associated with data compilation, exchange and dissemination. The main results of these meetings are summarized in the conclusions, recommendations and actions.

Brief Minutes

L.E. Echávarri, Director-General of the OECD Nuclear Energy Agency, welcomed all participants, and emphasised the major priority of the NRDC network to improve user services through better co-ordination between the centers. Many new requirements for nuclear data will be related to the proposed development of a new generation of nuclear power plants.

A. Nichols was elected as the NRDC meeting chairman. The provisional Agenda was discussed and adopted with a few changes (*see Appendix 2*), and the Status Reports of the centers were presented (*see reports in Appendix 3*).

All General Actions from previous meetings were checked, and some were defined as still on-going or continuous (*see Conclusions, Recommendations and Actions in Appendix 5*).

V. Pronyaev presented a new NDS approach to customer services, which is based on users initiating wish lists on topics of interest with the possibility to receive reports in hardcopy or electronically forms. After completion within the next two years of the multiplatform software for management and data retrievals from shared databases, users will have the opportunity to install directly their own local nuclear data center for desktop applications. Preliminary results were presented of the NNDC-BNL and NDS-IAEA Web retrieval statistics and NEA-DB approach to such data. While individual centers are unable to spend too much time analysing such statistics, intercomparisons between the different service centers may aid in formulating more objective criteria for the retrieval procedures.

Discussions on CINDA were led by M. Kellett. Old actions A6 - A9 were considered, and WP2002-22 and WP2002-24 (CINDA compilations) and WP2002-25 (journal coverage) were discussed (*see WP in Appendix 4*). Coverage in EXFOR of experimental work indexed in CINDA is 55% complete through all years and even higher (70%) for 1980 to 1999, which

was judged to be a satisfactory situation. Plans were agreed for conversion of CINDA to a new format, which is related to the creation of a joint CINDA-EXFOR-ENDF relational Nuclear Reaction Data Base (NRDB). CINDA will continue to be used as an entry point to the NRDB of all experimental and evaluated work, while theoretical studies will be compiled only in the Nuclear Science Reference (NSR) database which will be linked to NRDB. Support should be given by all reaction data centres to compile and incorporate into NSR theoretical work published in world-wide non-English literature. The conversion of the existing file will be completed, and compilation in the new format will begin in early 2003.

Discussions on EXFOR matters were led by O. Schwerer, including consideration of Actions from previous meetings and analysis of statistics for EXFOR compilations (*see WP2002-20 and WP2002-21 in Appendix 4*), EXFOR manpower at the different centers, compilation responsibilities, and the need to reduce the current backlog. Checking of possible duplications was proposed when the same first reference appears in different entries (*see WP2002-17 in Appendix 4*). Platform-independent stand-alone versions of the EXFOR checking code CHEX were made available to the centers. The need for EXFOR compilers' workshop to train new compilers was endorsed.

A. Nichols reported on the recommendations of the International Nuclear Data Committee Meeting (14 - 17 May 2002) to the NDS, which could impact on network activities. Thus, reorganization of the hierarchical structure of the NRDC network had been proposed in an attempt to simplify and accelerate the process of introducing new data in the database and increase EXFOR compilations. The transition to the multiplatform relational/network database technology with a single master file will also require some reorganization. Paper entitled "Proposal for new Nuclear Reaction Data Center Protocol" describes this reorganization, and was approved with some modifications by the Data Center Heads (*see below and Appendix 5*).

Presentations were made describing progress in the migration of the reaction databases EXFOR, CINDA and ENDF to a common multiplatform relational database (joint project of NDS and NNDC, *see WP2002-26 in Appendix 4)*. The migration of EXFOR by NDS is essentially completed, while work to include CINDA in a common database is underway. These changes will alter NRDC cooperation on CINDA (see proposed schedule in *WP2002-28 in Appendix 9*). These alterations will allow the merging of all existing EXFOR files into a master file and will avoid the confusion of users retrieving data from different master files. The meeting endorsed this development. A working paper on the intercomparison of NDS, NNDC and CDFE master files was discussed (*see WP2002-18 in Appendix 4*), and other centers were invited to take part in this intercomparison and further data merging.

The meeting of Data Centers Heads was devoted to general policy matters, while CINDA and EXFOR technical discussions were organized to take place at the same time as a parallel session. Conclusions and recommendations of the centers heads' session are given in *Appendix 6*. The parallel technical session considered the problems of restructuring Particle Dictionaries to give a single dictionary (*see WP2002-2 in Appendix 4*), progress achieved on the conversion of CINDA to a new format, corrections to specific TRANS files (diverse opinions on how the data should be entered), pending transmissions and general procedures to avoid delays in entering data. There was agreement that the NDS "open area" should be made more secure as proposed in *WP2002-19* (*see Appendix 4*). Recommendations, conclusions

and actions taken at these parallel sessions were reported and approved at the subsequent plenary session.

Centers presented their future data development programmes, including the preparation and release of new evaluated data libraries and files for different applications, and computer packages for data evaluations, pre-processing, checking and quality assurance.

A provisional list of Actions and Recommendations was prepared during the meeting and approved. This list of actions increased during the technical discussions and post-meeting communications between participants *(see Appendix 6)*.

The next NRDC Technical Meeting should be held late May – begin of June 2003 in Vienna. Two days of this meeting could be reserved for a small workshop on either software development for shared databases or the training of EXFOR/CINDA/NSR compilers. The next NRDC Data Centers Heads Meeting will be held at NNDC-BNL, in Spring of 2004.

Software developments by NEA DB staff were described that covered nuclear database management and dissemination. CINDA, EXFOR and ENDF had been developed under Oracle RDBMS and cgi-scripts had been created for Web retrievals from these nuclear databases. The ASCII exchange format will continue to be used for updates to these databases as batches and TRANS files.

The demonstration session included:

(i) on-line work with a new Web multiplatform EXFOR relational database developed by NDS (V. Zerkin) in cooperation with NNDC (V. McLane). A test version with powerful search and other convenient features has been installed under Linux/Apache/JavaServlet/MySQL on the NDS server (http://zlinux.iaea.org/exfor/).

(ii) V. Varlamov described further developments of NESSY RDB which allow specific retrievals from the ENSDF database, searches on an EXFOR relational database with a large number of parameters, on-fly graphical presentation of data and a few other products available from CDFE Web site (http://depni.npi.msu.su/cdfe/).

(iii) A. Nouri demonstrated Nuclear Information Software JANIS, which visualises experimental and evaluated data for nuclear reaction cross sections and nuclear structure and decay data. Based on Java technology, JANIS has the capability to present different types of interactive graphical data (cross sections, differential and double differential cross sections, etc.).

(iv) New comprehensive method for data retrieval from the NEA-DB EXFOR relational database was shown by M. Kellett. Free user access is envisaged to this page (http://www.nea.fr/html/dbdata/x4/x4ret.html).

(v) Y. Ohbayashi presented SyGRD, a new System of Graphical Reading and numerical Displaying with image analysis software, developed by JCPRG. This free software is available to the cooperating network data centers. Tests against CAJaD graphic digitalizing programme has given results with good consistency.

(vi) N. Otuka presented the work of HENDEL associated with a Web-browser editor for the compilation of nuclear reaction data in EXFOR and NRDF formats. A test version is available at http://nucl.sci.hokudai.ac.jp/~nrdf/editor/ (only for registered users), and will be made available to the network after updating with a comprehensive list of treated keywords (for EXFOR system).

(vii) A. Kaltchenko introduced the UkrNDC Web-site (http://ukrndc.kinr.kiev.ua/).

The following EXFOR coding rules for data compilation were considered: units for particle and product yields, use of alphanumeric symbols for page numbers in REFERENCE field, some new proposed quantities for high-energy reactions, correlation quantities, 4-momentum transfer and momentum distribution, and clarifications on product yield, thick target yields and polarization. The controversy of zeros appearing in the error field and on the Legendre polynomial modifier for symmetric angular distributions were resolved. Discussions were based on *WP2002-3 – WP2002-16 and WP2002-23 (see Appendix 4)*, and the resulting recommendations are summarized as new Actions (*see Appendix 5*).

The meeting ended with a half-day workshop devoted to the resolution of some complex difficulties in EXFOR coding, which could not be satisfactory addressed through e-mail communications. As a result of this brainstorming activity, agreement was found for the coding of reactions in more than ten entries.

Conclusions

The co-ordinating role of the NDS for the central tasks of the NRDC network was significantly strengthened and agreed (i.e. compilation and exchange of nuclear data in the EXFOR and CINDA databases). This agreement will result in a greater workload for NDS, and increased responsibilities for the NDS staff member in charge of co-ordination.

With the implementation of the relational nuclear databases, a new era of nuclear data services will begin, which will provide more effective database maintenance to the data centres, and greater user-friendly data access to users. We must ensure that the quality and completeness of the compiled data is kept at a correspondingly high level. These aims can be achieved if the highest priority is given to those projects that will create a common EXFOR master file and improve the completeness and timeliness of the data compilations.

Appendix 1: LIST OF PARTICIPANTS

INTERNATIONAL ATOMIC ENERGY AGENCY

334-F4-TM-25394 **27 May 2002**

IAEA Technical Meeting
on the
"Network of Nuclear Reaction Data Centres"

OECD Nuclear Energy Agency
Issy-les-Moulineaux, France

27 to 30 May 2002

Scientific Secretary: Vladimir G. PRONYAEV

CHINA

Mr. ZHUANG Youxiang
China Nuclear Data Center
China Institute of Atomic Energy
P.O. Box 275 (41)
102413 Beijing

Phone: +86 10 6935 7830
Fax: +86 10 6935 7008
E-mail: yxzhuang@iris.ciae.ac.cn

HUNGARY

Mr. Ferenc T. TÁRKÁNYI
Cyclotron Department
Institute of Nuclear Research of
the Hungarian Academy of Sciences
Bem tér 18/c, H-4026 Debrecen
P.O. Box 51, H-4001 Debrecen

Phone: +36 52 417 266
Fax: +36 52 416 181
E-mail: tarkanyi@atomki.hu

JAPAN

Mr. Akira HASEGAWA
Nuclear Data Center
Department of Nuclear Energy System
Japan Atomic Energy Research
Institute (JAERI)
Shirakata Shirane 2-4
Tokai-mura, Naka-gun
Ibaraki-ken, 319-1195

Phone: +81 29 282 5480
Fax: +81 29 282 5766
E-mail: hasegawa@ndc.tokai.jaeri.go.jp

JAPAN (continued)

Mr. Kiyoshi KATO
Division of Physics
Graduate School of Science
Hokkaido University
Kita 10, Nishi 8, Kita-ku
Sapporo, Hokkaido, 060-0810

Phone: +81 11 706 2684
Fax: +81 11 706 4850
Fax: +81 11 706 4926
E-mail: kato@nucl.sci.hokudai.ac.jp

RUSSIA

Mr. Feliks E. CHUKREEV
Russia Nuclear Structure and
Reaction Data Centre (CAJAD)
"Kurchatov's Institute"
1, Kurchatov's Square
123 182 Moscow

Phone: +7 095 196 1612
Phone: +7 095 196 9968
Fax: +7 095 882 5804
E-mail: feliks@polyn.kiae.su

Ms. Svetlana A. DUNAEVA
All Russian Scientific Research
Institute of Experimental Physics
Center of Nuclear-Physics Data
(CNPD)
RFNC-VNIIEF
607 190 Sarov
Nizhni Novgorod

Phone: +7 831 30 45770
Fax: +7 831 30 45569
E-mail: dunaeva@expd.vniief.ru

Mr. Vasilij N. MANOKHIN
Institute of Physics and
Power Engineering
Bondarenko Sq. 1
249 033 Obninsk, Kaluga Region

Phone: +7 084 399 8982
Fax: +7 095 883 3112
E-mail: manokhin@ippe.obninsk.ru

Mr. Vladimir V. VARLAMOV
Centre for
Photonuclear Experiments Data
Skobeltsyn Institute of Nuclear Physics
Lomonosov Moscow State University
Leninskie Gory
119922 Moscow

Phone: +7 095 939 3483
Fax: +7 095 939 0896
E-mail: varlamov@depni.sinp.msu.ru
E-mail: varlamov@depni.npi.msu.su

UKRAINE

Ms. Olena O. GRITZAY
Neutron Physics Department
Ukrainian Nuclear Data Center
SC Institute for Nuclear Research
Prospekt Nauky, 47
Kyiv-28, 03680

Phone: +380 44 265 3987
Phone: +380 44 265 4957
Fax: +380 44 265 4463
E-mail: ogritzay@kinr.kiev.ua

UNITED STATES OF AMERICA

Ms. Victoria McLANE
Bldg. 197D
National Nuclear Data Center
Brookhaven National Laboratory
P.O. Box 5000
Upton, NY 11973-5000

Phone: +1 631 344 5205
Fax: +1 631 344 2806
E-mail: vml@bnl.gov
E-mail: nndcvm@bnl.gov

Mr. Pavel OBLOŽINSKÝ
Bldg. 197D
National Nuclear Data Center
Brookhaven National Laboratory
P.O. Box 5000
Upton, NY 11973-5000

Phone: +1 631 344 2814
Fax: +1 631 344 2806
E-mail: oblozinsky@bnl.gov

INTERNATIONAL ORGANIZATIONS

OECD/NEA Data Bank, FRANCE

Local Organizer and Participant:

Mr. Claes NORDBORG
Nuclear Science Division
OECD Nuclear Energy Agency
Le Seine-Saint Germain
12, boulevard des Îles
F-92130 Issy-les-Moulineaux

Phone: +33 1 4524 1090
Fax: +33 1 4524 1110
E-mail: nordborg@nea.fr

Mr. Mark A. KELLETT
Nuclear Data Services
OECD Nuclear Energy Agency
Le Seine-Saint Germain
12, boulevard des Îles
F-92130 Issy-les-Moulineaux

Phone: +33 1 4524 1085
Fax: +33 1 4524 1110
E-mail: kellett@nea.fr

OBSERVERS

JAPAN

Mr. Yoshihide OHBAYASHI
Life-Oriented Software Laboratory
Muroran Institute of Technology
27-1 Mizumoto-cho
Muroran, Hokkaido, 050-8585

Phone: +81 143 46 5955
Fax: +81 143 46 5959
E-mail: oba@nrdf.meme.hokudai.ac.jp
E-mail: y-oba@cd5.so-net.ne.jp

Mr. Naohiko OTUKA
Division of Physics
Graduate School of Science
Hokkaido University
Kita 10, Nishi 8, Kita-ku
Sapporo, Hokkaido, 060-0810

Phone: +81 11 706 3518
Phone: +81 11 756 4170
Fax: +81 11 706 4850
Fax: +81 11 706 4926
E-mail: ohtsuka@nucl.sci.hokudai.ac.jp

UKRAINE

Mr. Aleksandre KALTCHENKO
Neutron Physics Department
Ukrainian Nuclear Data Center
SC Institute for Nuclear Research
Prospekt Nauky, 47
Kyiv-28, 03680

Phone: +380 44 265 3987
Phone: +380 44 265 4957
Fax: +380 44 265 4463
E-mail: kaltchenko@kinr.kiev.ua

OBSERVERS OF INTERNATIONAL ORGANIZATIONS

OECD/NEA Data Bank, FRANCE

Mr. Ali NOURI
OECD Nuclear Energy Agency
Le Seine-Saint Germain
12, boulevard des Îles
F-92130 Issy-les-Moulineaux

Phone: +33 1 4524 1084
Fax: +33 1 4524 1110
E-mail: nouri@nea.fr

Mr. Christian PENON
NEA Data Bank
OECD Nuclear Energy Agency
Le Seine-Saint Germain
12, boulevard des Îles
F-92130 Issy-les-Moulineaux

Phone: +33 1 4524 8200
Fax: +33 1 4524 1110
E-mail: penon@nea.fr

IAEA, Vienna, AUSTRIA

Mr. Vladimir G. PRONYAEV
Scientific Secretary of the Meeting
IAEA Nuclear Data Section — **Phone:** +43 1 2600 21717
Wagramer Strasse 5 — **Fax:** +43 1 26007
A-1400 Vienna — **E-mail:** v.pronyaev@iaea.org

Mr. Alan L. NICHOLS
Section Head
IAEA Nuclear Data Section — **Phone:** +43 1 2600 21709
Wagramer Strasse 5 — **Fax:** +43 1 26007
A-1400 Vienna — **E-mail:** a.nichols@iaea.org

Mr. Otto SCHWERER
IAEA Nuclear Data Section — **Phone:** +43 1 2600 21715
Wagramer Strasse 5 — **Fax:** +43 1 26007
A-1400 Vienna — **E-mail:** schwerer@iaeand.iaea.or.at

Appendix 2: AGENDA

IAEA Technical Meeting:
Network of Nuclear Reaction Data Centres

27 - 30 May 2002

Room A
OECD Nuclear Energy Agency
Issy-les-Moulineaux, France

Monday, 27 May 2002

Plenary: 09:30

1. Welcome address from NEA Data Bank	10 min
2. Election of Chair; and adoption of Agenda	10 min
3. Brief status reports - all Centres (work programmes, priorities, new tasks)	2 h

Plenary: 14:00

4. General Actions A1→ A14 from last full and technical NRDC meetings	15-30 min
5. Customer services (discussion leader: V. Pronyaev)	1 h
6. CINDA (discussion leader: M.A. Kellett (also CINDA Actions A6 → A9))	1 h
7. EXFOR (discussion leader: O. Schwerer (also EXFOR Actions A14 → A33))	1 h

Tuesday, 28 May 2002

Plenary: 09:00

8. Recommendations from INDC meeting to NDS (14 – 17 May 2002)	30 min
9. Database development/unification/migration (discussion leader: V. McLane)	2 h

Parallel Session – Management: 14:00

Meeting of NRDC Heads	3 h

Parallel Session – Technical: 14:00

CINDA and EXFOR (discussion leaders: M. A. Kellett and O. Schwerer)	3 h

Wednesday, 29 May 2002

Plenary: 09:00

10. Parallel technical session: issues of importance to NRDC Heads	30 min
11. Report on meeting of NRDC Heads	30 min
12. Data development programs (new evaluated data libraries, files, computer packages, etc)	1 h
13. Approval of Actions and Recommendations	1 h
14. Next technical NRDC and full NRDC Meetings (proposed locations/dates)	15 min
15. Any other business	15 min

Demonstration Session: 14:00 2 h

Thursday, 30 May 2002

Plenary: 09:00
Continuation of technical discussions

Appendix 3: STATUS REPORTS OF THE DATA CENTRES

NATIONAL NUCLEAR DATA CENTER

Status Report to the IAEA Technical Meeting on the Network of Nuclear Reaction Data Centers 27-30 May 2002

General

In February 2002, Charlie Dunford stepped down after 10 plus outstanding years of service as the NNDC Head. Pavel Oblozinsky took over as the NNDC Head, while Charlie continues to serve as the NNDC Deputy Head.

Since the last meeting of the Nuclear Reaction Data Centers in May 2001, one staff member and one support staff member have retired; one staff member and one support staff member will be leaving within the next year. There are currently 10 FTE scientific/professional and three support staff. See Table 1 for list of visitors for this period. Also, attached is a list of NNDC visits to other centers (Table 2).

Computer Facilities

The main work of the NNDC continues to be performed on our Compaq Alpha Server 4100. The TCP/IP network software has been upgraded.

Two new Linux workstations were purchased; one is used to run the Empire nuclear model code, the other will be used as a Web database server. Work has begun on implementing a secure and workable computer environment that includes a web server located outside the firewall communicating with the database server inside the firewall through a secure channel.

The NNDC staff PC's have been upgraded to Windows 2000.

Bibliographies

The NSR compilation activity has continued. About 4,600 references have been entered in the past year.

The CINDA compilation activity continues with respect to those references associated with the experimental data compiled at the Center. In the period from June 2001 to May 2002, 4 CINDA transmissions were sent (Table 4) containing a total of 2091 records.

Experimental Nuclear Reaction Data

The NNDC continues to compile neutron and charged-particle reaction data produced in the U. S. and Canada. In the period from June 2001 through May 2002, 10 final neutron data

transmission tapes and 7 charged-particle transmission tapes were sent containing new and corrected entries; one preliminary transmission has been sent (see Table 3).

The LEXFOR Manual has been updated.

Evaluated Nuclear Reaction Data

NNDC continues to coordinate the work of the Cross Section Evaluation Working Group. ENDF/B-VI, Release 8, was distributed in September-October 2001. Version 6.13 of the ENDF Utility codes will be distributed within the next three months. The ENDF-201 Summary Documentation Appendix A, History of materials issued in ENDF/B-VI, has been updated and is available on the NNDC Web site.

The collaboration with LANL and IAEA Vienna on the development of a modular code for nuclear reaction data evaluations continues. The modular code Empire-II was extended by adding a module based on the exciton model code Degas, motivated by the need to handle direct-semidirect capture in the fast neutron energy region. A further major extension of the code Empire-II was the addition of a new module, the coupled-channels optical model code Ecis-95, with NNDC responsible for validation. These updates are included into recently released Empire-2.17 (April 2002).

The cooperation with the Korean Atomic Energy Research Institute (KAERI) on 19 fission product cross-section evaluations continued in the fast neutron energy range. Preliminary versions of all evaluations were completed, including 6 highly deformed nuclei where coupled-channels optical model is of importance.

Review of cross section evaluations of the 211 available fission products ($31 < Z < 68$) from the five evaluated data files (ENDF/B, JEF, JENDL, BROND and CENDL) has started as an international project under NEA WPEC (new Subgroup 21). The best evaluations will be recommended for inclusion into the future ENDF/B-VII library. So far, 20 nuclides were reviewed.

Nuclear Structure Data

NNDC continues to publish the ***Nuclear Data Sheets***. As of April 2002, issues through Volume 95, #3 have been sent to Academic Press.

The experimental nuclear structure and decay data database (XUNDL) now contains more than 857 data sets, compared to 635 one year ago).

Nuclear Data Base Migration

During the last year, the NNDC has purchased and installed the Sybase Adaptive Server Enterprise (ASE) software on a Linux server. Relational versions of NSR, ENSDF, and several reaction databases are being developed and loaded on this platform. For web-based retrieval of the data, we will be using Java Server Pages (JSP) hosted by www2.bnl.gov, a laboratory maintained computer outside of the security firewall.

A second Linux server has been purchased and will be used for web application development, and to host a copy of the databases in "warm stand-by" mode for use in case of hardware failure on the main server.

During the coming year, administrative functions for CSISRS(EXFOR) and NSR will be transferred to the new system. This involves installation of new software and modification of legacy codes, where appropriate, to work with the relational database. Once this is accomplished, the VMS-based version of the database will function as a mirrored copy of the data, updated on a weekly basis. Similar steps will be taken for the other databases over the next two years.

Customer Services

The number of online retrievals continues to increase, primarily due to the availability of most databases on the Web. There are now about 950 customer accounts for the Online Service with more than 1,100 users. There are about 23,000 retrievals per month from the combined Online Service, Web site, and anonymous ftp (87% of retrievals are from Web). A chart of statistics for the combined online retrievals is attached.

CINDA, CSISRS, and NSR links to the APS Link Manager were extended back to include all of Physical Review from Series II on and all of Physical Review Letters and Reviews of Modern Physics. NSR now contains links to somewhat over 40,000 journal abstracts from 15 journals.

The printed version (January 2000) of Nuclear Wallet Cards was adopted by the DOE Security Office, Nuclear Materials Management and Safeguards System, as its official decay data standard.

A general update of all information pages that are under NNDC control (NNDC, CSEWG, and USNDP) was done. An International Nuclear Structure and Decay Data Network page was added. The NRDC Web page was updated and distributed to other centers for comment. The following have been added to the NNDC Web site:

1. Table of Magnetic Dipole Rotational Band (Balraj Singh);
2. History of the Origin of the Chemical Elements and Their Discoverers (Norm Holden);
3. WPEC SG21 Assessment of Neutron Cross-Section Evaluations for the Bulk of Fission Products, including graphical inter-comparison for all 211 nuclides;
4. Nuclear Reaction Model Codes containing ABAREX (R.D. Lawson and A.B. Smith. ANL), EMPIRE-II (M. Herman, IAEA, R. Capote, Univ. Sevilla, P. Oblozinsky, BNL, and A. Trkov, IAEA), and PRECO-2000 (C.K. Walker, TUNL);
5. Improved tabular representation of data from ENSDF, MIRD, and XUNDL;
6. Utility code QCALC, which calculates decay and reaction Q-values and reaction threshold energies;
7. CSISRS page upgrade to use the program ZVView (Viktor Zerkin, IAEA Nuclear Data Section) as a helper application.

Table 1.
Visitors to NNDC from June 2001 to May 2002

Visitor	Host	Duration	Topic
Viktor Zerkin, NDS	D. Winchell V. McLane	2 weeks	Nuclear reaction relational databases
Yong-Deok Lee, KAERI	P. Oblozinsky	1 month	Fission product nuclei evaluation
He Dong Choi, Seoul National Univ., Korea	S. Mughabghab	1 year	1-year sabbatical: capture gamma ray evaluation.
Viktor Zerkin, NDS	V. McLane	2 weeks	Nuclear Reaction Database, ZVView

Table 2.
Visits by NNDC Personnel to Other Centers

Staff Member	Host	Duration	Topic
Jagdish Tuli	IAEA/NDS	1 week	Evaluators' training workshop planning
Victoria McLane	IAEA/NDS	1 week	Nuclear reaction database design

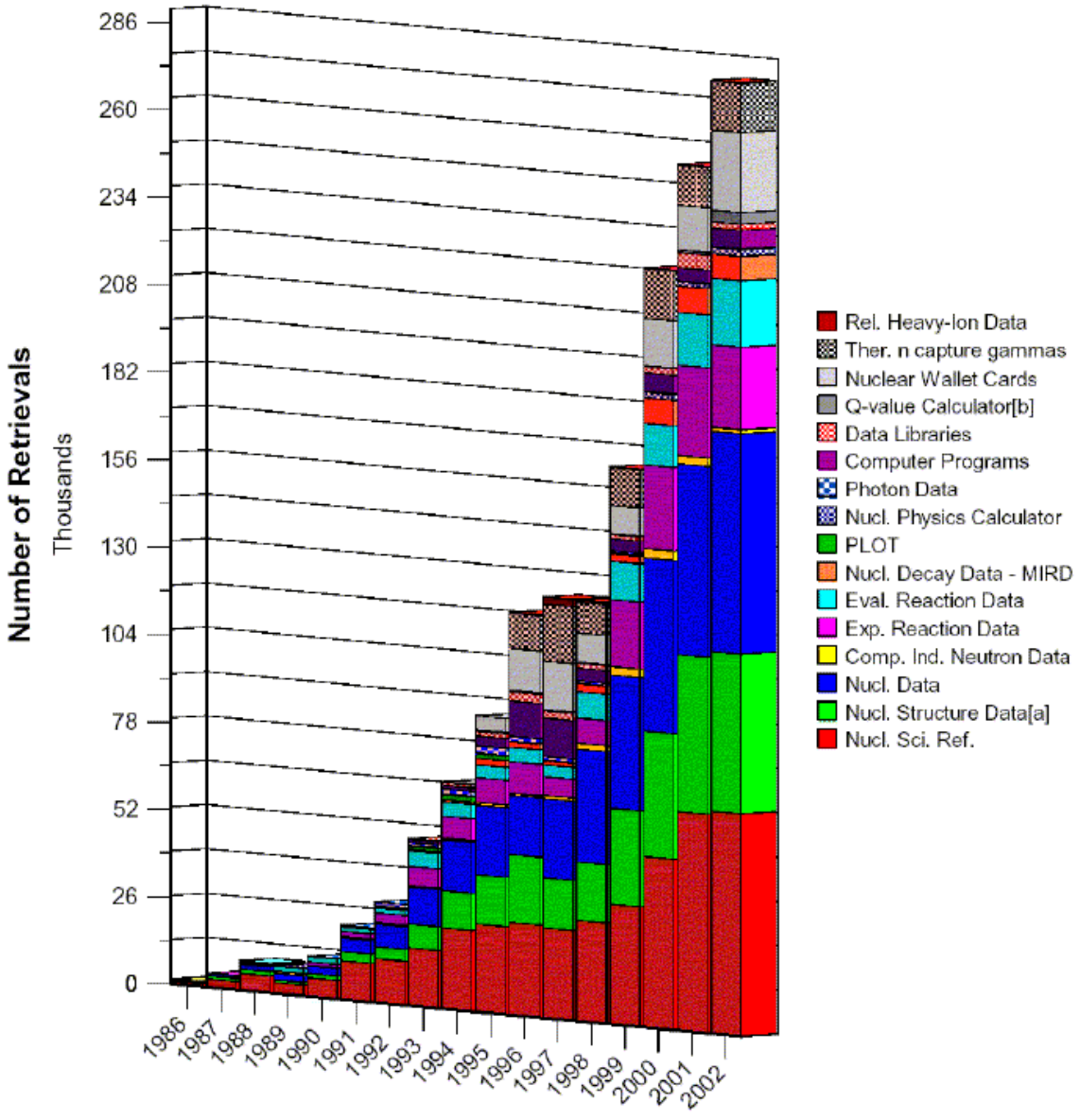
Table 3. NNDC Transmissions (June 2001 - May 2002)

Tape	Prelim sent	Final sent	# Data points	# Entries	# Subents	# New Subents
Area 1 (neutron)						
1295	20010711	20010815	50622	16	49	21
1296	20010726	20011023	78827	8	41	18
1297	20010913	20011023	76206	13	76	46
1298	20010913	20011024	119691	5	21	12
1299	20011024	20011127	112996	6	28	20
1300	20011130	20011227	37264	12	40	25
1301	20011204	20011227	52075	22	132	4
1302	20011204	20011227	66173	9	98	0
1303	20020102	20020213	52364	23	167	0
1304	20020213	20020402	47153	18	24	47
1305	20020409	20020515	2991	13	59	27
Area 1 Total			**696362**	**145**	**735**	**220**
Area C (charged particle)						
C050	20010518	20010628	10434	18	66	42
C051	20010628	20010815	50622	22	76	46
C052	20010726	20011024	40910	19	95	66
C053	20011025	20011127	13548	20	159	131
C054	20011218	20020214	5791	23	77	48
C055	20020214	20020402	7474	45	189	11
Area C Total			**128779**	**147**	**662**	**344**
Area T (charged particle - original compiled at other centers)						
T009	20010829	20020102	7681	21	118	95
T010	20020215	20020402	10512	16	78	59
Area T Total			**18193**	**37**	**196**	**154**
NNDC Total			**843334**	**329**	**1593**	**718**

Table 4. NNDC CINDA transmissions (June 2001 - May 2002)

Transmission			Lines in database	Blocks in database
	Date	# lines		
NNDC				
167	20010726	541		
168	20011211	184		
169	20020205	1322		
170	20020401	44		
171	20020506	111		
NNDC Total		2202	131592	265189

*NNDC On-Line Data Service, Web, & FTP Retrievals 1986-2002**



* Extrapolated as of April 30, 2002.
[a] Includes proton emitters (added to Web February 21, 2002).
[b] Added to Web September 11, 2001.

REPORT FROM THE NEA DATA BANK

to the NRDC meeting in Paris, France

27 – 30 May 2002

Organisation

Total number of full time staff in the NEA Data Bank is 19. This is divided into 9 professional staff and 10 support staff. However, only 7 professional and 7 support staff members work within the Data Bank computer program and nuclear data services. The rest of the staff is allocated to work with other parts of the NEA.

An organisation chart of the Data Bank can be found in the annex. This chart shows the general allocation of professional staff in the four different activity areas. The post as head of the Data Bank is presently vacant. Two names (Byung-Chan Na and Federico Mompean) are indicated in *italic*, as they work mainly on nuclear science and radioactive waste management issues, respectively.

Total annual budget of the Data Bank is about 3,4 million Euros. The two persons, working for other parts of the NEA, mentioned above are paid by the NEA main budget, leaving an annual budget for the Data Bank scientific services of about 2,6 million Euros.

Nuclear Data Services

EXFOR compilations

The compilation of measured neutron and charged particle induced reaction data continues with the help of outside consultants. The statistics below show the number of neutron and charged particle induced data sets loaded into the EXFOR database. However these figures do not necessarily reflect the compilation effort. This is due to the rather long and complicated checking procedures that have been adopted by the Nuclear Reaction Data Centres (NRDC) network, which tend to delay the loading of entries, particularly for charged particle data where the precise coding of data becomes more difficult. It is hoped that the procedures will be simplified to minimise the time needed between the compilation and the loading of the data into the database.

Neutron induced data

The compilation of neutron induced data continues reasonably smoothly, with data being taken mainly from recently published work. Some revision of earlier compilation has also taken place, where the original data have now become available, or better scanning techniques for data extraction from figures. In total forty (40) new works and thirty (30) revised works were loaded and distributed during 2001. Currently there are forty-six (46) new and twenty-seven (27) revised works being processed.

Charged particle induced data

Noting the problems of loading charged particle data mentioned above a significant number of entries were nonetheless loaded during 2001, namely fifty-seven (57) new entries. Recently a further sixty-five (65) revised entries have been processed and distributed, but just over two hundred (205) new entries are awaiting agreement within the NRDC network prior to their

loading and distribution. It is foreseen that at least half of these will be loaded in the next two months following the May 2002 meeting of the NRDC, where final agreement on the coding of some of these will be achieved.

Bibliographic (CINDA) data

The CINDA compilation work has been enhanced during 2001 by the use of a consultant, as well as the continued support of the Japanese Nuclear Data Centre. This has allowed the preparation of over one thousand two hundred (1200) entries, of which two hundred and forty-four (244) were loaded in 2001 and the remainder are being currently being loaded prior to the closure of the database for the preparation of the CINDA book by the IAEA and the CD-ROM by the NEA.

Services to Nuclear Data Users

The nuclear data services are mainly provided through direct on-line access to the CINDA, EXFOR, EVA databases containing bibliographic, experimental and evaluated nuclear data respectively. The access to the CINDA database is open, whereas only accredited users, having obtained personal passwords, can access the EXFOR and EVA databases. In addition to these on-line services, the Data Bank also answers specific requests from customers. This concerns normally requests for very large datasets, which are too large for direct Internet download. The very large datasets are normally distributed on CD-ROM. Providing advice to nuclear data users is another important part of the nuclear data services.

The last two year's statistics concerning the on-line access to the databases show that the number of EXOR retrievals is roughly constant (8 075 in 2001 compared to 8 572 in 2000).

The number of EVA retrievals has gone down from about 3 200 in 2000 to about 1 600 in 2001. This can partly be explained by the release of the JANIS software, which contains a number of evaluated data libraries, and also by the fact that there were no new releases of evaluated data libraries in 2001.

The CINDA statistics was harder to analyse, as this database is open to the public. A number of filters had to be applied in order to eliminate occasional users, such as Internet search engines and "tourists", and to obtain a reliable value of the real use of the database. The total number of accesses to the CINDA Internet pages in 2001 was over 15 000. However, the number of real retrievals from the CINDA database was only about 2 600. The trend for CINDA on-line retrievals is increasing (there were only about 1 300 retrievals in 2000). This is somewhat surprising as the CINDA database is now distributed on CD-ROM once a year, together with the printed version.

Other Nuclear Data Activities

The Joint Evaluated Fission and Fusion Project (JEFF)

The JEFF project established a new working group on nuclear data measurement activities in May 2001. The objective of this group is to help analysing the expressed needs for nuclear data measurements and to co-ordinate the experiments for addressing these needs.

The JEFF-3.0 General Purpose Library, intended for use in Fission and Fusion neutronic applications, was released in April 2002. This library contains recommended nuclear data for

use in neutron transport calculations. Evaluated nuclear data are given for 340 isotopes or elements and for five molecular/lattice structures in the case of thermal scattering data.

JEFF-3.0 contains many new evaluations produced in the framework of JEFF and EFF compared to previous versions of the data library. Evaluations from other projects were also included when their quality was proven to be superior to those contained in JEF-2.2. Integral measurements provided the main guidance in the choice of data among the existing evaluated files. Compared to JEF-2.2 and EFF-2.4, JEFF-3.0 contains new evaluations for many materials including:

- Major actinides (e.g. U-233, U-235, U-238, Pu-239, Pu-240, Pu-241 and Pu-242)
- Minor actinides (e.g. Np-237, U-236, Pu-238 and Cm isotopes)
- Structural materials (e.g. Cr-52, Mn-55, Fe-56, Ni-58, Ni-60, Pb)
- Major fission products (e.g. Rh-103, Eu-152 to Eu-155, Nd-143 and Sm-149)
- Absorbers (e.g. Hf, Cd, V)

Besides the basic evaluated files, the JEFF Project has decided to produce JEFF-3.0-based processed libraries (in point-wise and group-wise formats). A documentation of the JEFF-3.0 general-purpose file will be published in June 2002.

The JEFF-3.0 activation file will be released in Autumn 2002. The Decay Data and Fission Yields libraries will be released in Autumn 2003. A revised version of the General Purpose file including an extension to intermediate energies (up to 200 MeV) will also be produced in Autumn 2003.

JANIS Software

The first version of the JANIS (Java Nuclear Information System) software was released in October 2001. A presentation of the software was made at the International Nuclear Data conference at Tsukuba, Japan. This first version has proven to be very useful to a variety of users. More than 530 copies have been distributed since October 2001.

Extensions of the software to include other capabilities are underway. A new version is foreseen in 2003 and will provide access to other categories of data such as activation files and Monte-Carlo application libraries (ACE format). (see http://www.nea.fr/janis/).

Data from Integral Experiments

The Data Bank and the NEA Nuclear Science section work closely together on the preservation of data from integral experiments to increase their uses and benefits and to favour innovation, especially in the context of the development of future nuclear energy systems. The Nuclear Science committee is responsible for overall guidance of the project, whereas the Data Bank provides the infrastructure for the safeguarding of information in databases and for services to member countries.

The following databases were all updated with new material in 2001:

- Radiation Shielding (SINBAD)
- Reactor Fuel Performance (IFPE)
- Criticality Safety Benchmark Experiments (ICSBEP)
- Code Validation Matrix of Thermal-Hydraulic Codes for LWR LOCA and Transients (CCVM)
- Reactor Physics Experiments (IRPhE) - pilot project

The demand for the integral nuclear data services was in line with the average distribution during the last 3 years. More than 1 800 data sets were distributed, of which about 290 went to non-OECD countries according to the cooperative agreement with the IAEA

Computer Program Services

The Data Bank maintains a database containing more than 2 000 documented program packages and group cross-section data sets, covering all civil application areas in nuclear energy. The program packages (the program itself, the user manual and suitable test cases) are distributed on CD-ROM or sent via Internet on request. New acquired computer codes are stored in a full computer readable form and other programs are being restructured to include full computer readable documentation.

The demand for the Data Bank computer program services remained very high in 2001. More than 2 200 programs were dispatched following requests. About 150 of these programs were sent to non-OECD countries according to a special cooperative agreement with the IAEA.

The most requested programs in 2001 were in the field of radiation transport and shielding, in particular the two Monte Carlo codes MCNP and PENELOPE. About 50 percent of the requests for computer programs originated from national laboratories, whereas about 25 percent came from universities and the remaining 25 percent from industry and consulting firms.

The Thermochemical Data Base (TDB)

The Thermochemical Data Base (TDB) project is a co-operative effort between the NEA Data Bank and the NEA Radioactive Waste Management Committee to produce internationally recommended chemical thermodynamic data needed for the safety assessment of radioactive waste disposal systems.

The review of Neptunium and Plutonium data was published in June 2001 by Elsevier North Holland.

The present activities of the TDB project (phase II) is organised as a separate funding semi-autonomous project, supervised by a Management Board with representatives from all the participating organisations. This phase of the project comprises the following five data review teams:

- Update of Uranium, Americium, Technetium, Neptunium and Plutonium data
- Review of Nickel data
- Review of Selenium data
- Complexation of simple organic ligands with radionuclides and competing cat-ions
- Review of Zirconium data

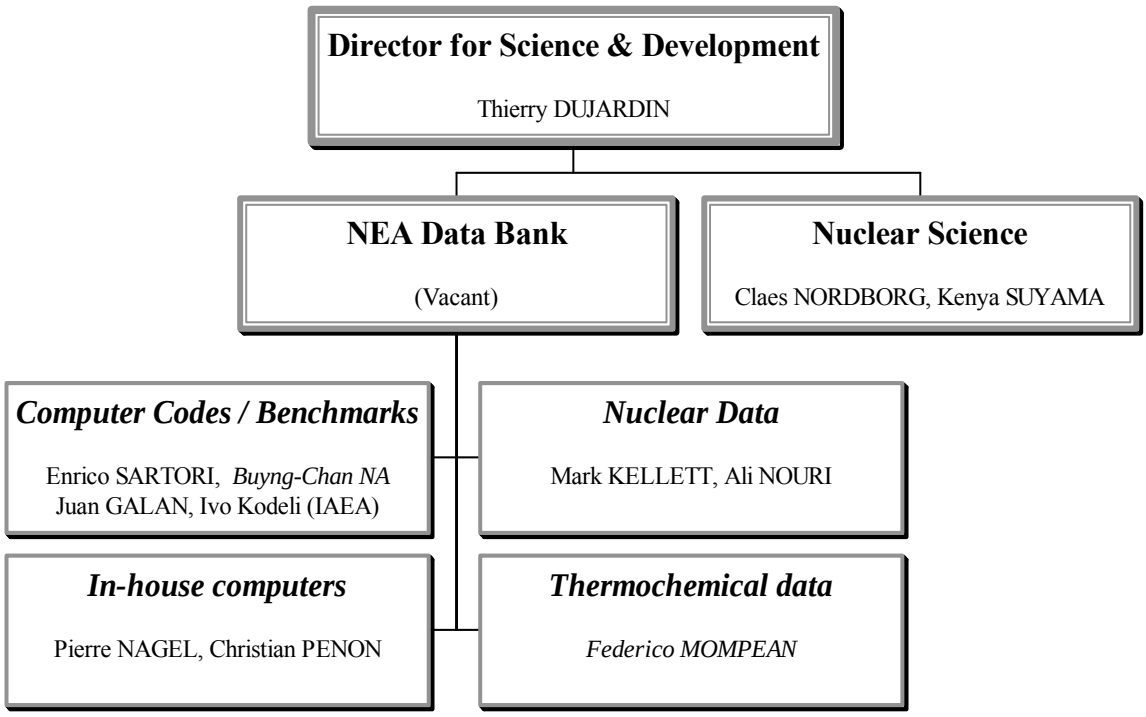
Among these five review efforts, it is expected that the updating of U, Am, Tc, Np and Pu data will be completed and sent to publication late in 2002 or in early 2003. The reviews of the inorganic compounds of Zr and the simple organic compounds will be sent for peer-review in 2002 and published in early 2003. The two remaining reviews will be published later in 2003.

In-house computer configuration

See separate document entitled "NEA Computer Network".

Annex

NEA Data Bank organisation chart
May 2002



Progress Report of the IAEA Nuclear Data Section, 2000-2001

to the IAEA Technical Meeting
on the Network of Nuclear Reaction Data Centres
27 – 30 May 2002
OECD Nuclear Energy Agency
Issy-les-Moulineaux, France
(Extract taken from report to INDC, May 2002)

1. NUCLEAR DATA SECTION: OVERVIEW

The budget and staffing level of the Nuclear Data Section has been relatively stable during the current reporting period. The authorized staff level for 2001-2002 is 18, consisting of 10 professionals (P-staff) and 8 support staff (G-staff). Of these 18 staff members, 3 (2 P-staff and 1 G-staff) are assigned to the Atomic and Molecular Data Unit.

The previous Section Head (Douglas Muir) retired from his position, effective from 30 June 2001. His successor (Alan Nichols) was unable to take up his duties in the Section until 8 October 2001. The various Unit Heads are:

Robert Clark, Atomic and Molecular Data Unit,

Liam Costello, Systems Development Unit,

Vladimir Pronyaev, Nuclear Data Unit,

Andrej Trkov, Nuclear Data Development Unit (joined NDS on 10 May 2000),

all of whom have contributed to the contents of this report. Pavel Obložinský resigned from his position as Deputy Section Head (effective from 31 March 2000), and has been subsequently replaced by Andrej Trkov. An atomic physicist is being sought as replacement for Jeffrey Stephens, who resigned with effect from 31 December 2001 to accept employment at the University of Colorado in Bolder, USA. The previous Section Secretary (Elisabeth Baumgartner) was promoted to Divisional Secretary (June 2000), and has been replaced by Andrea Scherbaum.

IAEA staff costs after 2000 are shown to rise markedly as a consequence of agreed parity alignments with equivalent workers elsewhere (Table 1). The programme budgets from 2000 to 2003 exhibit some fluctuations, but are almost unchanged bearing in mind the variability of the exchange rates year on year. There has been some shift of emphasis in the programme of the Section, with more resources devoted to workshops and other user training initiatives, and efforts are being made to increase staff involvement in Technical Cooperation projects. Increased communication through the more user-friendly IAEA-NDS Website is a noteworthy feature and continues to aid in reducing other expenditures (e.g., hard-copy printing and manual retrieval). Figures for 2003 are provisional, and subject to significant modifications prior to approval in the autumn of 2002.

Table 1. Budget and staff summary: 2000-2003

	2000	2001	2002	2003
Authorized Staff Level	18	18	18	18
Actual Staff Level	18	18	17	18
Staff Costs Budget US$	1564000	1701465	1760800[+]	1760800[+]
Programme Budget US$	640000	517798	566200	569200
Total Budget US$	**2204000**	**2219263**	**2327000**	**2330000**

[+] Assuming 18 members of staff throughout year.

2. DATA CENTRE ACTIVITIES

The primary objectives of the NDS Nuclear Data Centre in 2000–2001 have been as follows:

- collection, assessment and dissemination of nuclear data for a wide range of applications,
- international exchange of nuclear data,
- co-ordination of the worldwide networks of national and regional nuclear reaction and nuclear structure and decay data centres,
- maintenance of manuals and software for internationally-agreed database formats and exchange procedures,
- improvements to the methods by which the data centre provides Member State users with information.

A new objective has been introduced during this timeframe to accommodate the need to perform database services on different hardware and software platforms:

- co-operate with other centres in the development of platform-independent nuclear databases and services.

2.1 Nuclear Data Compilations

Bibliographic information continues to be compiled on nuclear reaction data for assembly in the computerized formats of CINDA and EXFOR. NDS assumes a supervisory role in this area of NRDC activity.

The general purpose libraries of evaluated nuclear reaction data are prepared under national and regional programmes. After international release, they are placed in the ENDF database by NNDC, Brookhaven. Special purpose nuclear databases, libraries and files are prepared within the framework of IAEA Coordinated Research Projects or national and regional programs, and are documented by the IAEA NDS. Various checks and tests are performed before disseminating the data on request via online access or CD-ROMs.

2.1.1 CINDA

The CINDA exchange format will be revised as an inevitable consequence of the forthcoming unification of CINDA, EXFOR and ENDF to produce a joint nuclear reaction database. These revisions are controlled by NNDC, BNL in cooperation with other data centres. CINDA and Web-retrieval formats will also be substantially extended. The first transition to A4 format for the CINDA book (CINDA 2000) was initiated by the IAEA, while a new layout was approved at the 2001 NRDC meeting and will be implemented in CINDA 2002.

NDS staff scanned over 40 journal titles and about 20 titles from indexing journals. NDS prepared and transmitted 3290 CINDA entries in 2000-2001 either as direct input to the CINDA file (documentation of laboratory work is the responsibility of NDS) or for further processing by other responsible data centres. CINDA 2000 represents the cumulative index for 1988–2000, while CINDA 2002 will be the cumulative index for 1988-2002. NDS has established a duplicate database on the NDS Alpha server for use by CJD (Obninsk), who could not prepare any CINDA input during 2000-2001.

2.1.2 EXFOR

Twenty-five EXFOR entries were compiled during 2000-2001, representing new contributions from Argentina (6), Bulgaria (1), China (13), Hungary (1), Libya (1), Poland (1), Slovakia (1) and Ukraine (1). Seven entries prepared at the China Nuclear Data Centre were checked and processed at NDS, while data received from Ukraine (1) and Argentina (2) in a "raw EXFOR" format were finalized at NDS. Twenty-one charged-particle EXFOR entries compiled at ATOMKI (Hungary) were also checked and finalized at NDS and transmitted separately.

81 TRANS files were checked and included in the EXFOR database, containing 671 neutron entries (184 new, 487 revised), 1295 CPND entries (643 new, 652 revised), and 43 photonuclear entries (33 new, 10 revised). The EXFOR dictionaries were regularly updated and distributed. NDS will become fully responsible for the maintenance of common dictionaries with the development of the joint CINDA/EXFOR/ENDF database.

2.1.3 Evaluated Data Libraries, Files and Programs

Various evaluated data libraries, files and programs have been updated or added to the IAEA NDS database (listed in chronological order):

- IAEA Photonuclear Data Library – available on Web and CD-ROM;
- Charged-Particle Cross Section Database for Medical Radioisotope Production – **available on Web and CD-ROM;**
- FENDL/A in Picture Presentations – available on Web and CD-ROM;
- ENDF/B-VI Library, Release 7 – available on Web and CD-ROM;
- ENDF/B-VI Charged-Particle Sublibraries, Version: April 2000 – available on Web and CD-ROM;
- Nuclear Wallet Cards, Sixth Edition – available on Web and as hardcopy;

- PREPRO2000: 2000 ENDF/B Pre-processing Codes – available on Web and CD-ROM;
- SaBa: Library of Evaluated and Experimental Data on Charged Particles for Fusion Applications, Version for MS Word 97 – available on CD-ROM;
- EXFOR/ACCESS relational database with enhanced search and retrieval capabilities and interactive graphic tools – available on CD-ROM;
- Reference Neutron Activation Library (RNAL) for 255 most important reactions – available on Web and CD-ROM;
- POINT2000: Temperature Dependent ENDF/B-VI, Release 7 Cross Section Library (point-wise data for 8 temperatures between 0 and 2100 K) – available on Web and CD-ROM;
- DROSG-2000: Neutron Source Reactions, Version 2002 – available on Web and CD-ROM;
- Updates to PREPRO2000, updates to graphical pre-processing codes – available on Web or CD-ROM;
- ENDVER – Evaluated Data File Verification Support Package – available on Web and CD-ROM;
- EPDL97 Evaluated Photon and Electron Evaluated Data Libraries in ENDF-6 format – available on Web and CD-ROM;
- EMPIRE-II, System of Codes for Nuclear Reaction Calculations – available on Web and CD-ROM;
- ENDF/B-VI Library, Release 8 – available on Web and CD-ROM.

All these files, libraries and codes are documented either in the IAEA-NDS Report series or in INDC Reports, and are freely distributed.

2.1.4 Future Tasks

Two of the most important tasks to be performed by the NDS data centre within the next two years (2002-2003) are as follows:

- co-operate with other centres to develop the Nuclear Reaction Database (NRD), combining CINDA, EXFOR and ENDF as relational database for multi-platform/multimedia environment, and develop procedures to update and retrieve data;

- assist in the unification of different versions of EXFOR master files in a form acceptable to all network centres.

2.2 Nuclear Data Services

2.2.1 Improvements and Developments

The main activities associated with user services in 2000-2001 have been as follows:

- Layout and design of the NDS Web page has been significantly improved to ease user access;

- Contents of ADLIST (database of user addresses) was substantially updated, along with ease of registration for receipt of NDS publications and data;

- INDC reports are prepared in electronic format, and all of the more recent IAEA-NDS reports and Nuclear Data Newsletters are available on the NDS Web site;

- More than 30 different databases, libraries and computer packages can now be distributed to customers on CD-ROMs, which represents the best media for storing "frozen" versions of the libraries and files; CD-ROMs containing the major databases and interfaces are periodically updated for distribution to customers;

- NDS statistical analysis of Web page usage has been improved to give an accurate and more detailed quantification of user activity;

- EXFOR/ACCESS relational database on CD-ROM with retrieval system and interactive plotting was distributed to users who have no access to the Internet or prefer a localised database;

- Co-operative studies underway with other data centres to develop a platform-independent version of joint Nuclear Reaction Database combining EXFOR, CINDA and ENDF (see Section 2.3).

2.2.2 Statistics

A wide variety of user requests persist, and a range of different media are required to maintain services. These communications include: standard mail for hardcopies of documents, PC diskettes and CD-ROMs, e-mails with attached retrieved data or electronic documents, and on-line transfer of data retrieved by the users through the Web interface. Overall statistical analyses of user services are listed in Table 2 which covers the previous five years.

Table 2. Data Services of IAEA-NDS – Numbers of Serviced Requests and Retrievals per Annum

	1997	1998	1999	2000	2001
Web retrievals from the main NDS nuclear databases	23	4276	9581	9642	12894
Web retrievals of documents and other NDS files	4200	7809	7757	11472	16513
Telnet-based nuclear data retrievals	7350	2700	2180	1387	550
Requests for CD-ROMs	-	205	420	648	883
Off-line retrievals	1900	1995	2290	2557	2231

On-line retrievals from NDS databases are made directly by users through Telnet or Web access to the libraries, files and reports. Each registered retrieval contains at least one homogenous piece of information: one report, or a set of different data retrieved from one library or database, or a computer code or package of codes. On-line retrieval corresponds to a user creating output either on hard disk or in screen mode. CD-ROM distribution is simply the number of CD-ROMs sent to users. Off-line retrievals include dispatch by ordinary mail of hardcopy reports or computer outputs prepared by the NDS staff.

Figure 1 shows various representations of user access to the IAEA-NDS Web server and the mirror system in Brazil, including definition by geographical distribution and topics. The total number of data retrievals has increased by 40% due mainly to customer requirements for data from the general purpose and special applications libraries. Another observation is that the number of queries from developing countries has continued to grow in 2001. More detailed Web statistics are available, including user access from individual countries, monthly access and retrievals from different libraries.

The following trends are noted for the previous two years:

- CD-ROMs with "frozen" or regularly updated libraries and files are a popular medium for data distribution;

- About 32 Gbytes of information were downloaded by Web users in 2001 (doubling of 2000 figure);

- Number of Telnet retrievals is decreasing because of the alternative of user-friendly access to the Web site.

2.3 Development of New Generation of Nuclear Databases

NDS has invested in alternative Relational Database Management Systems, and is looking at various operating systems and hardware platforms. This project will have a major impact on the cost and nature of all nuclear data services, including the formulation of nuclear reaction databases on multisystem/multimedia environments to provide a common solution to the handling of different software and hardware platforms. This approach will create more user-friendly access, and improve the quality of the computerized data services. The new system is being developed in close co-operation with NNDC, based on shared responsibilities. Major nuclear databases will be included (CINDA, EXFOR, ENDF, ENSDF and NSR), and the resulting system will be proposed for the Nuclear Data Centers Network.

Current status:

- co-operative studies are underway with NNDC-USA to develop platform-independent relational nuclear databases and services;

- development of Nuclear Reaction Database (NRDB) is on-going, combining CINDA, EXFOR and ENDF as platform-independent relational database (final results will include procedures for maintenance and retrieval on Web and CD-ROM);

- test version of EXFOR has been developed as a platform-independent database with Web interface;

- EXFOR-relational database was installed on experimental Web sites of NDS and NNDC, and Java-retrieval program for CD-ROM distribution is under development;

- CINDA and ENDF-relational databases are under development.

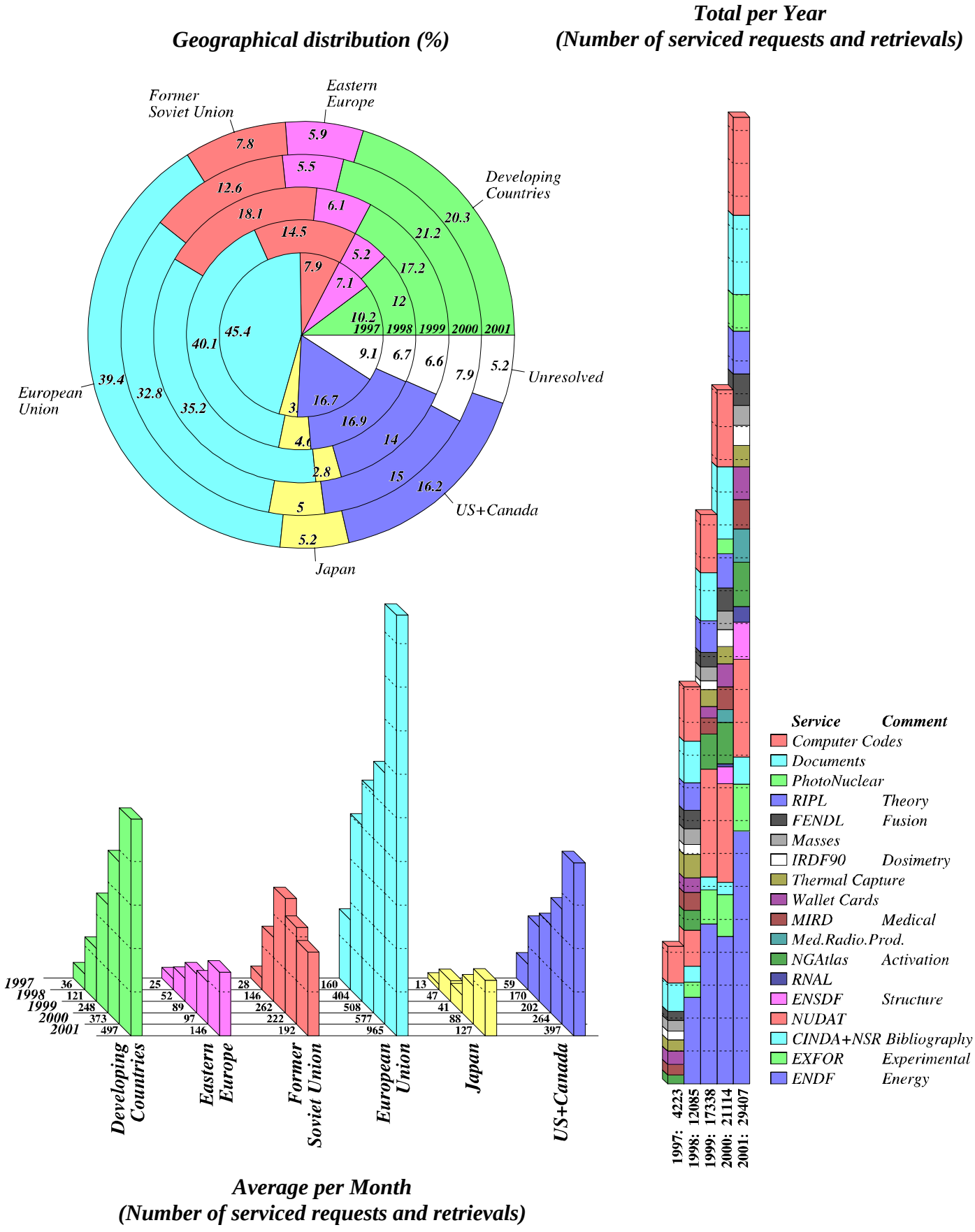


Fig. 1 IAEA Nuclear Data Services: Web Statistics

2.4 Future Tasks

The following tasks will improve user services further, and are proposed for 2003-2005:

- Continue the development of a new generation of nuclear databases (see Section 2.3, above).

- Migration of ADLIST (database for data and reports distribution) to the relational database platform, with addition of distribution options that can be selected by users.

- Creation of data services for special applications (Web pages linked to relevant data on CD-ROMs).

3. NETWORK CO-ORDINATION

3.1 Network of Nuclear Reaction Data Centres

The NDS assists the network of Nuclear Reaction Data Centres by organising the annual coordination meetings. This network includes four core data centres and nine national and specialised data centres. Biennial meetings of the data centre heads are designed to generate general recommendations on nuclear reaction data exchange and the development of shared databases and services. Technical matters associated with data exchange are also considered, although biennial technical meetings every other year are primarily devoted to this topic. Bilateral visits and consultancies are also used to solve difficulties in data exchange and database development.

3.1.1 NRDC Network Meetings

IAEA Advisory Group Meeting on Network of Nuclear Reaction Data Centres, Obninsk, Russia, 15-19 May 2000 (INDC(NDS)-418): conclusions and actions focused on the further development of the nuclear databases and services in a multiplatform/multimedia environment.

IAEA Consultants' Meeting on the Co-ordination of Nuclear Reaction Data Centres, Vienna, 28-30 May 2001 (INDC(NDS)-427): agreed actions focused on the coding rules, dictionaries and software development for nuclear relational databases.

3.1.2 Bilateral visits

- V. Zerkin (NDS) to NNDC, Brookhaven, 11–29 September 2000: participation in Workshop on “Relational Databases for Nuclear Data” and common software development of nuclear databases and services.
- O. Schwerer (NDS) to the Japan Charged-Particle Nuclear Reaction Data Group at Hokkaido University, 29 September – 30 October 2000 (no cost to the IAEA): assist in conversion of compiled nuclear reaction cross sections from NRDF to EXFOR format.
- Y. Ohbayasi, (JCPNRDG, Hokkaido University) to NDS, 13–22 February 2001 (no cost to the IAEA): unification of NRDF and EXFOR databases.

- V. Zerkin (NDS) to NNDC, Brookhaven, 5–16 March 2001: design, development and testing of CINDA/EXFOR/ENDF components of NRDB.
- V. McLane (NNDC, Brookhaven) to NDS, 21–27 May 2001: development of shared nuclear databases and services.
- V. Zerkin (NDS) to NNDC, Brookhaven, 7–21 November 2001: training and cooperation related to the introduction of new RDBM system and programming languages, and common nuclear database development.
- S. Takacs (Nuclear Data Group, Debrecen) to NDS, 3–14 December 2001: conversion of the medical isotope production experimental data files from internal to initial EXFOR format.
- L. Chervonna (UkrNDC, Kiev) to NDS, 18–21 December 2001: training and compilation of latest experimental data produced by Ukraine in EXFOR format; electronic publication of nuclear reactor dosimetry guide.

Detailed information about the NRDC network and latest activities can be found in INDC(NDS)-401 (Rev. 3), "The Nuclear Data Centres Network", ed. by V.G. Pronyaev (Rev. July 2000).

3.1.3 Future Tasks

Completion of the following tasks would improve the co-ordination of the NRDC network:

- Compilation of experimental data by the network data centres, e.g. by organizing workshops for compilers, and using consultants to help bridge gaps in the database.

- Organize workshops, consultancies and bilateral visits that assist in the development of shared databases and related software - requires some changes in NDS tasks as well as wider consideration of such topics at the network coordination meetings.

3.2. Network of Nuclear Structure and Decay Data Evaluators

The international network of nuclear structure and decay data (NSDD) evaluators is sponsored by the IAEA, and consists of evaluation groups and data service centres in several countries. A primary aim of this network is to provide up-to-date nuclear structure and decay data for all known nuclides by evaluating existing experimental data. The network includes more than 20 centres and groups.

Resulting recommended data are included in the Evaluated Nuclear Structure Data File (ENSDF) and published in Nuclear Physics A and Nuclear Data Sheets. Recommended values are made available to users through various media such as online computer services, PC diskettes and compact disks, wall charts of nuclides, handbooks and nuclear wallet cards. The ENSDF master database is maintained by the US National Nuclear Data Centre at the Brookhaven National Laboratory. Data from the latest version of ENSDF are also available from other distribution centres including the IAEA-NDS server.

Biennial meetings of the network assist in the co-ordination of the work by all centres and groups participating in the compilation, evaluation and dissemination of NSDD, and maintaining and improving the standards and rules governing NSDD evaluation. Consideration is also given to the development and use of the computerized systems and databases maintained specifically for this activity. The work of ENSDF evaluators and programmers is coordinated by the NNDC, Brookhaven, including centres that undertake "horizontal" evaluations (specific quantities for a well-defined set of nuclei) and dissemination. Some of the NDS Coordinated Research Projects contribute to the provisions of "horizontal" evaluations.

4. CONCLUDING REMARKS

Other work programmes are undertaken by the NDS (eg. Coordinated Research Projects, Data Development Projects, Workshops Training and Technology Transfer, and Hardware Development). Their features are not mentioned in the report, which focuses exclusively on direct Data Centre activities and associated networks.

PROGRESS REPORT OF CJD

to NRDC Meeting
(May 2002)

EXFOR AND CINDA

During 2001-2002 TRANS 4122-4126 were sent to other centers. The total number of entries is 222 (20 entries are new, 202 entries are corrected).

During 1999 –2000 because of some technical problems CJD did not send information into CINDA base. As a result of fruitful cooperation with NDS the solution was found and CJD eliminated backlog in CINDA entry transmission. All the works up to now were compiled and transmitted. Now we are checking CINDA completeness concerning preprints, proceedings of International Seminar on Interaction of Neutrons with Nuclei in Dubna Meetings and et al.

Since November 2001 the following activity was made in CINDA compilation: 6 files (CJD-038-042) with 5587 entries in Exchange format and 5 files with 249 entries in READER format were prepared and transmitted.

It is necessary to emphasize that all this activity was possible due to fruitful cooperation with the NDS and great help and attention given by V.Pronyaev, M.Lammer, L.Costello.

EVALUATION ACTIVITY

The work is in progress on steady level in analysis and evaluation of threshold reaction excitation functions on the basis of empirical systematics. As a base for analysis and data improvement we use mainly ADL-3 library and comparison with EAF-99 library in those cases where EAF-99 data are different from ADL-3 data. Now we are engaged in analysis and evaluation of excitation function for radioactive isotopes. In many cases we reveal very surprising curves and try to correct them considerably or evaluate new ones as a result of comparison with our systematics.

Recently all the (n,d) reaction excitation functions for all isotopes from C up to Mo were evaluated using some systematical trends based on the Crimes and Height experiments and theoretical consideration concerning (n,d) reaction mechanism.

The work was continued on evaluation of full files of fissile isotopes. Last year we again analyzed, corrected and supplemented the following files: Np-237, Am-241, Am-242m, Am-243, Cm-243, Cm-244.

The work on formation of the fission product yield library is close to the end.

The evaluation of photonuclear cross sections for U-235 and U-238 was made up to 200 MeV.

The new evaluation was made of the following dosimetry reactions: $^{139}La(n,\gamma)^{140}La$, $^{186}W(n,\gamma)^{187}W$, $^{204}Pb(n,n')^{204m}Pb$, $^{46}Ti(n,p)^{46m+g}Sc$, $^{48}Ti(n,p)^{48}Sc$, $^{19}F(n,2n)^{18}F$, $^{58}Ni(n,p)^{58m+g}Co$. The covariance matrices for all these reactions are prepared as well.

The revision and correction was made for the following dosimetry reactions: $^{46}Ti(n,2n)^{45}Ti$, $^{47}Ti(n,x)^{46m+g}Sc$, $^{48}Ti(n,x)^{47}Sc$, $^{49}Ti(n,x)^{48}Sc$, $^{54}Fe(n,2n)^{53m+g}Fe$, $^{54}Fe(n,\alpha)^{51}Cr$, $^{51}V(n,\alpha)^{48}Sc$, $^{59}Co(n,\alpha)^{56}Mn$, $^{63}Cu(n,\alpha)^{60m+g}Co$, $^{75}As(n,2n)^{74}As$, $^{141}Pr(n,2n)^{140}Pr$.

The analysis and evaluation of the spectra and production cross sections of gamma rays for main structural and technological materials, made recently, will be published in VANT, Yadernye Konstanty.

This year we are engaged in re-evaluation of full files for Cm-242, Cm-245. We think on the basis of new theoretical calculations to evaluate some fission product files from BROND-2. First of all the files for Ru, Pd, Nd, Sm isotopes will be evaluated.

ACTIVITY OF CAJAD

for the
IAEA Technical Meeting:
Network of Nuclear Reaction Data Centres
27-30 May 2002

F.E. Chukreev
Nuclear Structure and Reaction Data Centre
Kurchatov's Institute, Moscow

Our **Exfor** activity had three main directions:

1. Compilation for A-Library

After the last meeting in 2000, we prepared A050, A051 and A052 TRANS files. These TRANS files contains monitor reaction data, astrophysical data, fission data. The files include new entries and some corrected old entries. Some Entries, which have analogues in C- and T-libraries are deleted.

2. Status of B-library

I would like to hope that the work for transformation B-entries to today EXFOR rules is finished.

It is needed to remark, that we used original compilations of Munzel's group, which were received from Karlsruhe. Practically all original publications were read again and many informal corrections were included. Duplicated entries were excluded too. I would like to remark the existing of another versions of B-library. More detailed information about different versions of EXFOR entries is presented in V. Varlamov's report. My opinion: all Nuclear Reaction Data Centres must have identical entries. If similar differences will be kept, using of our libraries will be complicated**,** because citation of EXFOR entries will not be exact**.** Therefore CAJAD recommend to refuse from old versions B-library.

3. Team-work with NEA DATA-BANK

During the year 2001, 100 entries were prepared for O-library.

These entries contain data for elastic and inelastic scattering, production cross section of radioactive and stable isotopes, data for material analysis by charged beams. This work is orientated for nuclear wastes transmutation, medical applications and material analysis.

4. Data dissemination

We met some difficulties to organize the Internet site for our Centre. Therefore we decide to use the site of V. Varlamov's Centre. Our collaboration is very useful for both Centres, as I think. The collaboration permits to decrease expenditures and accelerate preparing data for dissemination. Our Centre, in EXFOR area, has the responsibility to transform new TANS files in needed format and transmit them to Moscow State University.

Usually CDFE receives new data in one-two days after appearance of new TRANS files at open area of NDS.

More detailed information about the site will be presented by V.V. Varlamov. At the same time I would like to remark that the data dissemination through Internet has a reverse side: we have no information about requests of our users. Probably, some time later we will have the possibility to fix up the requests.

Therefore we know requests only from the groups, which invite our Centre to participate in their investigations. In EXFOR area we participate in medium energy investigations of ITEP, which measured production cross sections of radioactive isotopes by charge particle beams with energy 100.-1000 MeV/nucleon. For example, we received a request to find data (or calculate cross sections) for suitable monitor reaction for C-12, Al-27 and copper beams in 100 -1000 MeV/nucleon energy region.

5. Additional remarks

During many years of our activity in the compilation area, we accumulated a large experience in communication with authors. All understand that data tables are more preferable than figures in publications. We met different attitude to our requests for data tables in different groups. For example, we have full, without any exclusion, data tables from the group of Fragment Separator of GSI. Some authors send their data even without our requests. But these examples are exclusive. Most authors, from developing countries especially, do not reply at our requests. I believe it is because the data tables are lost. I see two reasons why they are lost.

First, it is very often that after the work is finished the group is breaded up. Somebody, who had responsibility for data processing and presentation, leaves the group for another laboratory and his connection with the group disappears**.** At these conditions it is impossible to find data tables. Second, some authors are afraid, that their data will be criticized at the centre or the data will be used by the centre and the authors will loose their priority. Could NDS help us to receive charge particle data from developing countries?

Data tables have been lost in developed country too. I would like to mention only two European papers:

1. The results of very important experiment on pion production cross section in sub-threshold area (published in PR/C). Each negative pion will create a “star” with number neutrons. Therefore the data are important for nuclear wastes transmutation. The data were measured in Sweden by an international group. We could only find data for positive pions at interaction of protons with nitrogen. All other data are presented as little size figures, which are not suitable to scan.
2. The results of production cross sections for interaction of protons with several important elements obtained in United Kingdom.

Unfortunately I have no proposal how to save the numerical data.

MSU SINP CDFE Nuclear Data Activities in the Nuclear Reaction Data Centres Network.

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

Progress Report
to the IAEA Technical Meeting on the "Network of Nuclear Reaction Data Centres"
(27 - 30 May 2002, OECD NEA, Paris, France)

This report contains the **short review** of the works carried out by the CDFE concern the IAEA Nuclear Reaction Data Centres Network activities for the period of time from the IAEA Technical NRDC Meeting (28 - 30 May 2001, Vienna) till the end of May 2002 and the description of the main results obtained.

1. The **new** CDFE EXFOR **TRANS M031** has been produced and transmitted to the IAEA NDS. The TRANS contains (**Annex 1**) 11 retransmitted and 11 new (M0624 - M0634) ENTRYs with 54 data SUBENTs. A big amount of EXFOR charge particle data ENTRYs has been added (in cooperation with CAJaD (Dr. F.E.Chukreev)) to the CDFE relational **"Nuclear Reaction Database (EXFOR)"**.

2. The CDFE photonuclear databases have been put upon the Web-site (**http://depni.npi.msu.su/cdfe**) before were upgraded significantly by adding a new data and software improvement:

- the "2000" part was added to the "Photonuclear Data Index" (the "2001" and "2002" parts are in processing) as whole the **"Photonuclear Data Index 1955 - 2000"** database was added by a significant amount of entries from /1/; data sets are available in forms of table for articles included into EXFOR;
- the CDFE database **"Giant Dipole Resonance Parameters"** was upgraded significantly: many data sets were added, many integrated cross section and integrated cross section first moment data were calculated and included.

3. The new relational data base " Low ($\hbar\omega \leq 3$ keV) Energy Isomer Transition Internal Conversion Probabilities" was produced in cooperation with CAJaD (Dr. F.E.Chukreev) using the data /2/; conversion of some low-energy transitions of ΛL = E1 - E4, M1 - M3 multipolarities ($E_1I_1 \rightarrow E_2I_2$ ($\hbar\omega = E_1 - E_2 \leq 3$ keV; I_1,I_2 - nucleus initial and final states spins, correspondingly) on the external electronic shells ($4p_{3/2}$ - $7d_{5/2}$) in the nuclei ^{90}Nb, ^{99}Tc, ^{103}Rh, ^{110}Ag, ^{140,142}Pr, ^{153,159}Gd, ^{160}Tb, ^{165}Tm, ^{171}Lu, ^{183}W, ^{188}Re, ^{193}Pt, ^{201}Hg, ^{205}Pb, ^{236}Pa, ^{250}Bk were investigated for the case of an isolated atom; the probabilities of the conversion transitions were calculated in framework of the Hartri-Fock-Slater method with the electron wave functions, obtained by integrating numerically the Dirac equations in the atomic field; the calculations were carried out for the normal configuration of the valence bans of the above listed atoms; the search is possible (**Annex 2**) for Z, A, ΛL and shell (N, L, J); result example is presented in **Annex 3**.

4. The new powerful scientific tool **"Calculator for Nuclear Reaction Threshold and Energy Values"** (**Annex 4**) was produced using the nucleus mass data from other CDFE relational data base **"Nuclear Ground State Parameters"** (all needed mass data from /3/) in addition to previously developed database **"Main Photonuclear Reaction Thresholds"**; using the Calculator one can easily obtain both threshold and energy values (**Annex 5**) for any

reaction with definite incident particle (γ-quantum, neutron, charged particle, …) and any combinations of outgoing particles for all nuclei contained in atomic nuclei mass table /3/.

5. The content of EXFOR ENTRYs upon 3 Nuclear Reaction Data Centres (NRDC) Network Web-sites (http://depni.npi.msu.su/cdfe, http://www-nds.iaea.or.at, and http://www.nndc.bnl.gov) has been checked using the possibilities of the CDFE relational EXFOR database.

Many errors of two types:

- format errors (shifts, missing or extra commas etc.) and
- reaction description errors (CODEs absent in Dictionary 36)

have been founded (**Annex 6**) and listed in CDFE Memo CP-M/16.

The main result is that we have many ENTRYs in Internet (not only with errors, but without errors also) which exist in two-three versions. Some of them differ quite strongly (for example, CDFE ENTRY A0014 obtained from F.Chukreev contains 7 SUBENTRIES, but the same number ENTRY on NNDC site contains one SUBENTRY only).

Therefore for situation improvement the following questions could be discussed:

- Is it good that we have several versions of the ENTRYs with the same number in Internet? If "not", how could we improve the situation?
- Must we check all old ENTRYs by today checking codes?
- Must we correct the most obvious (format) errors as soon as possible?
- Must we do this job in coordination? By what procedure?
- Must we additionally discuss the way to correct not obvious reaction description errors?
- What about modification of Dictionary 36?

6. Many errors found out in the CDFE ENTRYs concern the item 5 of this report have been corrected (**Annex 6**) and include into the CDFE TRANS M031 (**Annex 1**).

The main items of CDFE future short-term programmes, priorities and new tasks are listed in **Annex 7**.

References

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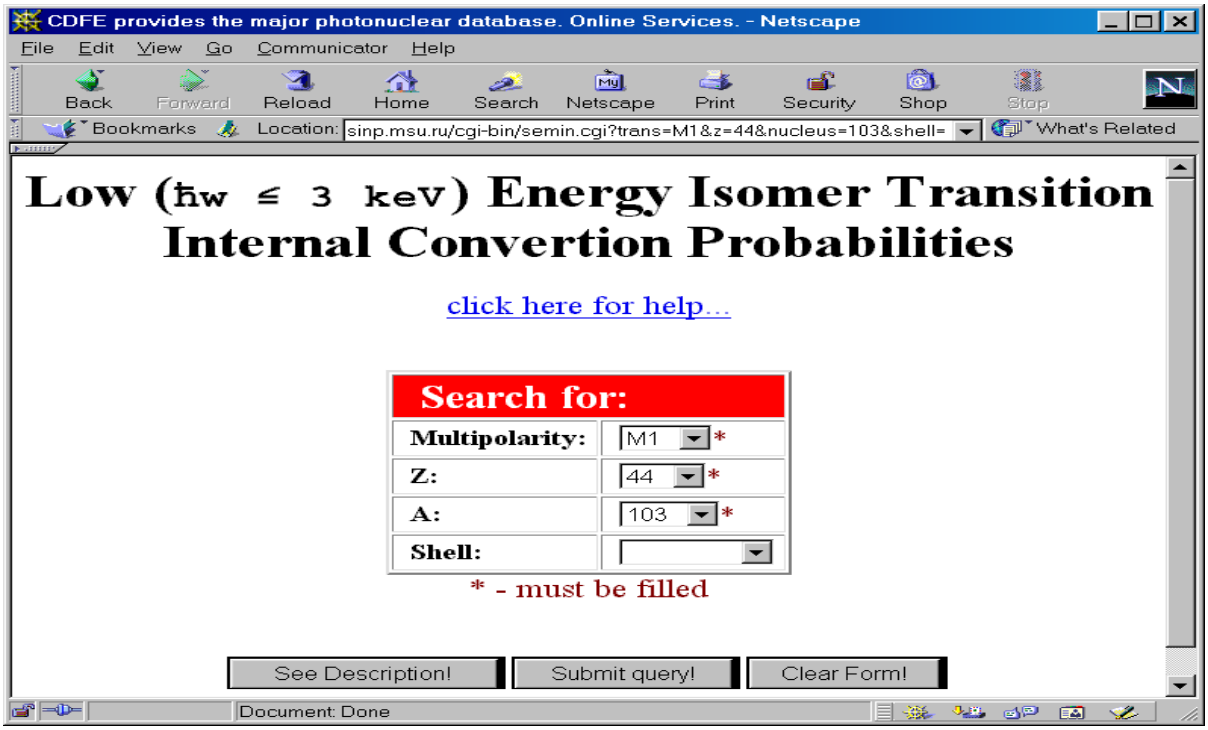
2. D.P.Grechukhin, A.A.Soldatov. Conversion of low energy nuclear transitions ($\hbar\omega \leq$ 3 keV) on external electronic shells of an isolated atom. Voprosy atomnoj nauki i tekhniki. Seriya: Yadernye Konstanty, 1 (1987) 55.
3. G.Audi, A.H.Wapstra. The 1995 Update to the Atomic Mass Evaluation. Nucl.Phys., A595 (1995) 409.

Annex 1.

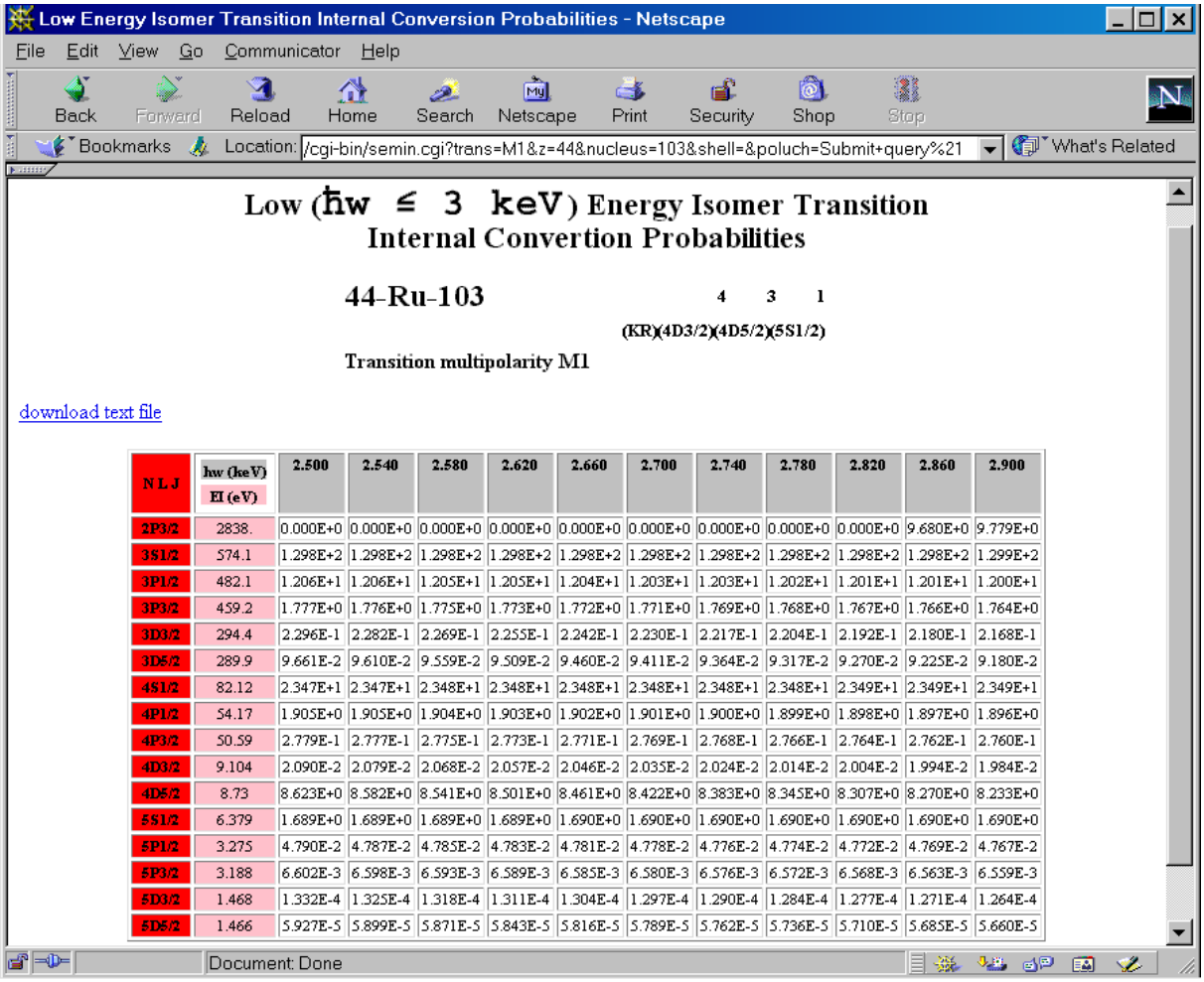
The CDFE EXFOR TRANS M031 contents (*old corrected* and new ENTRYs)

ENTRY's Number	*Amount of data SUBENTs*
L0005	*4*
L0006	*12*
L0036	*19*
M0064	*18*
M0067	*6*
M0071	*38*
M0169	*6*
M0242	*16*
M0274	*6*
M0382	*3*
M0525	*29*
M0624	2
M0625	4
M0626	5
M0627	3
M0628	2
M0629	5
M0630	2
M0631	2
M0632	21
M0633	6
M0634	2
Total: 22	**Total: 202**

Annex 2.

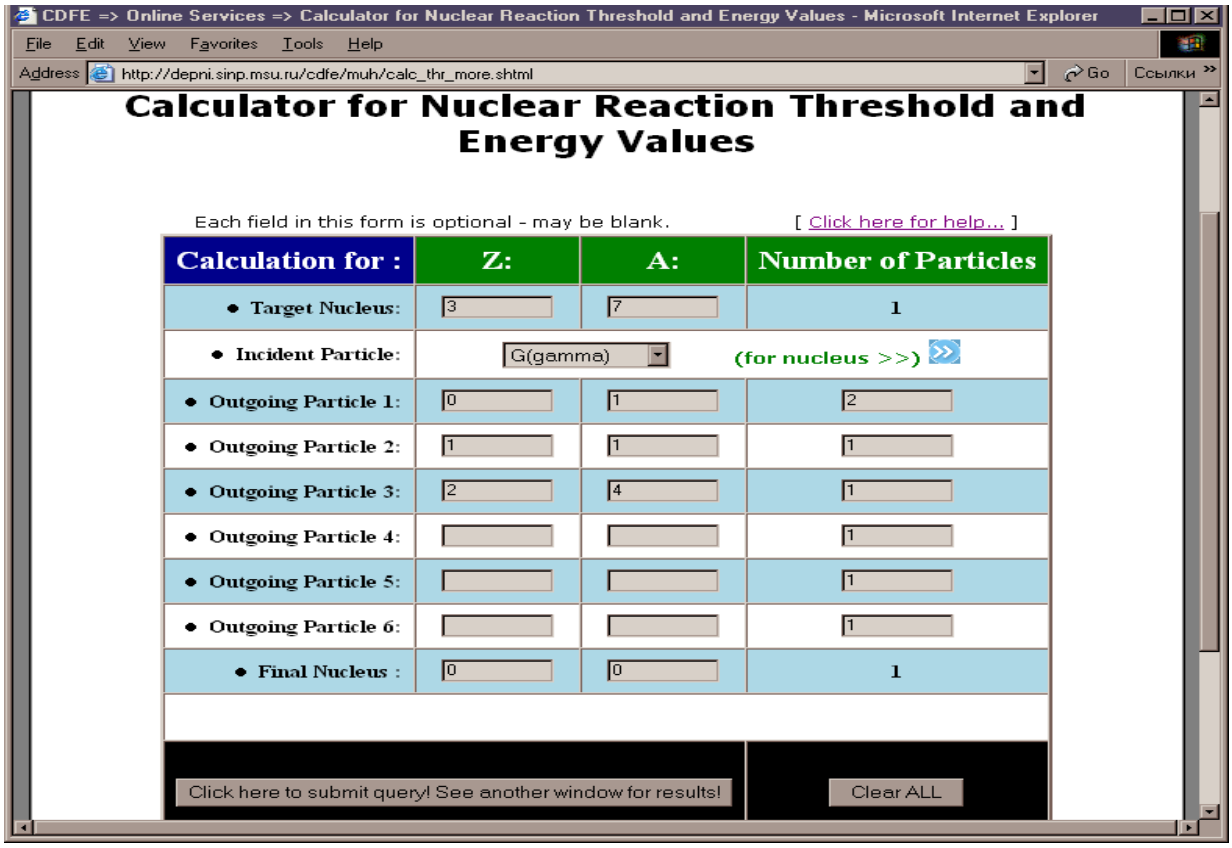


Annex 3.

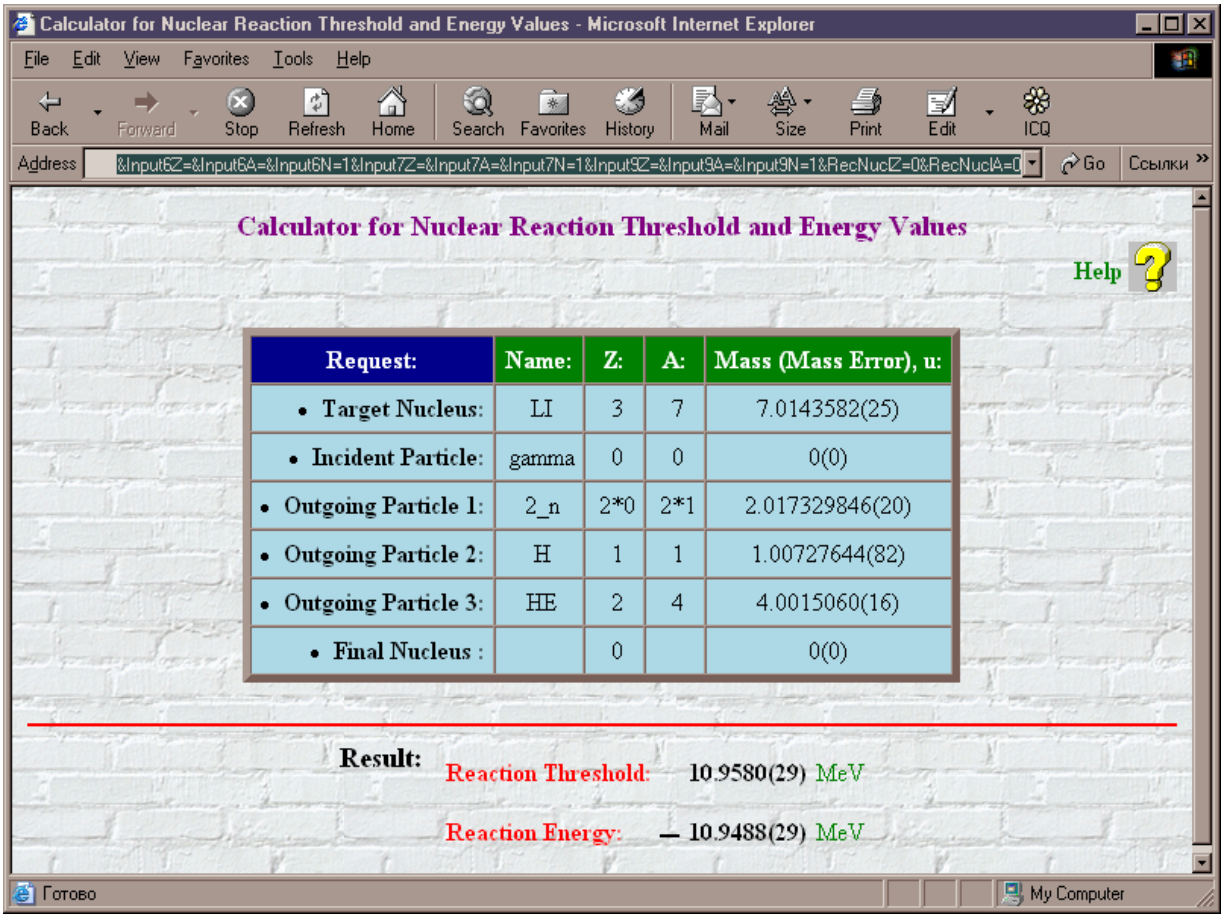


N L J	hw (keV) EI (eV)	2.500	2.540	2.580	2.620	2.660	2.700	2.740	2.780	2.820	2.860	2.900
2P3/2	2838.	0.000E+0	0.000E+0	0.000E+0	0.000E+0	0.000E+0	0.000E+0	0.000E+0	0.000E+0	0.000E+0	9.680E+0	9.779E+0
3S1/2	574.1	1.298E+2	1.298E+2	1.298E+2	1.298E+2	1.298E+2	1.298E+2	1.298E+2	1.298E+2	1.298E+2	1.298E+2	1.299E+2
3P1/2	482.1	1.206E+1	1.206E+1	1.205E+1	1.205E+1	1.204E+1	1.203E+1	1.203E+1	1.202E+1	1.201E+1	1.201E+1	1.200E+1
3P3/2	459.2	1.777E+0	1.776E+0	1.775E+0	1.773E+0	1.772E+0	1.771E+0	1.769E+0	1.768E+0	1.767E+0	1.766E+0	1.764E+0
3D3/2	294.4	2.296E-1	2.282E-1	2.269E-1	2.255E-1	2.242E-1	2.230E-1	2.217E-1	2.204E-1	2.192E-1	2.180E-1	2.168E-1
3D5/2	289.9	9.661E-2	9.610E-2	9.559E-2	9.509E-2	9.460E-2	9.411E-2	9.364E-2	9.317E-2	9.270E-2	9.225E-2	9.180E-2
4S1/2	82.12	2.347E+1	2.347E+1	2.348E+1	2.348E+1	2.348E+1	2.348E+1	2.348E+1	2.348E+1	2.349E+1	2.349E+1	2.349E+1
4P1/2	54.17	1.905E+0	1.905E+0	1.904E+0	1.903E+0	1.902E+0	1.901E+0	1.900E+0	1.899E+0	1.898E+0	1.897E+0	1.896E+0
4P3/2	50.59	2.779E-1	2.777E-1	2.775E-1	2.773E-1	2.771E-1	2.769E-1	2.768E-1	2.766E-1	2.764E-1	2.762E-1	2.760E-1
4D3/2	9.104	2.090E-2	2.079E-2	2.068E-2	2.057E-2	2.046E-2	2.035E-2	2.024E-2	2.014E-2	2.004E-2	1.994E-2	1.984E-2
4D5/2	8.73	8.623E+0	8.582E+0	8.541E+0	8.501E+0	8.461E+0	8.422E+0	8.383E+0	8.345E+0	8.307E+0	8.270E+0	8.233E+0
5S1/2	6.379	1.689E+0	1.689E+0	1.689E+0	1.689E+0	1.690E+0	1.690E+0	1.690E+0	1.690E+0	1.690E+0	1.690E+0	1.690E+0
5P1/2	3.275	4.790E-2	4.787E-2	4.785E-2	4.783E-2	4.781E-2	4.778E-2	4.776E-2	4.774E-2	4.772E-2	4.769E-2	4.767E-2
5P3/2	3.188	6.602E-3	6.598E-3	6.593E-3	6.589E-3	6.585E-3	6.580E-3	6.576E-3	6.572E-3	6.568E-3	6.563E-3	6.559E-3
5D3/2	1.468	1.332E-4	1.325E-4	1.318E-4	1.311E-4	1.304E-4	1.297E-4	1.290E-4	1.284E-4	1.277E-4	1.271E-4	1.264E-4
5D5/2	1.466	5.927E-5	5.899E-5	5.871E-5	5.843E-5	5.816E-5	5.789E-5	5.762E-5	5.736E-5	5.710E-5	5.685E-5	5.660E-5

Annex 4.



Annex 5.



Annex 6.

FORMAT ERRORS (left column)

Shifts in DATA/COMMON
& pointers in DATA-UNITS lines
err:40324006::data
err:O0219013::common
err:22205003::data
err:F0167012::common
err:A0557041::data
err:D4076003-017::data

"(" from free text in column 12
err:F0175001::SAMPLE

"-" from free text in column 11
err:A0126001::COMMENT:-

"." from free text in column 11
err:20822001::CORRECTION:.

"Not correct pointers": shift of "(" into column 11
err:O0166011::LEVEL-PROP:(
err:F0378002::STATUS:(
err:F0378004::STATUS:(
err:F0378008::STATUS:(
err:10729005::HISTORY:(
err:11659006::STATUS:(
err:40156005::MONITOR:(

err:40161016::STATUS:(

err:40161018::STATUS:(
err:40161019::STATUS:(
err:40161020::STATUS:(
err:40161021::STATUS:(
err:40161022::STATUS:(
err:40161023::STATUS:(
err:40858007::MONITOR:(

Not correct code in DATA-HEAD
err:40046002::ENERGY
err:40046003::ENERGY
err:40046004::ENERGY

Shift in DATA-HEAD line
err:M0169006::ASS-MIN *(Corr. M031)*
err:M0169007::ASS-MIN *(Corr. M031)*

CODE ERRORS (right column)

Number:Pointers:Codes

err:A0014002::PR,DA,,LEG
err:A0014003:1:PR,DA
err:A0014004:1:PR,DA
err:A0014005:1:PR,DA
err:A0014006:1:PR,DA
err:A0014007:1:PR,DA
err:A0014008:1:PR,DA
err:A0060002::PAR,DE,G
err:A0237011::PAR/UND,DA
err:A0237014::PAR/UND,DA
err:A0388002::PAR,TTY/DA,G
err:A0388003::PAR,TTY/DA,G
err:A0388004::PAR,TTY/DA,G
err:A0388005::PAR,TTY/DA,G
err:A0388006::PAR,TTY/DA,G
err:A0388007::PAR,TTY/DA,G
err:A1389002::PAR,DA,,COS/RS
err:A1389003::PAR,DA,,COS/RS
err:B0098003:2:(CUM)/UND,TTY
err:B0098003:3:(CUM)/UND,TTY
err:B0098008:2:(CUM)/UND,TTY
err:C0025003::,DA,,ASY
err:F0263003::PAR,DA,,COS/RS
err:13698002::TER,FY/CRL,HF/LF -
- added by Memo CP-C/300
err:13698007::PRE/TER,FY/CRL,A/LF -
- added by Memo CP-C/300
err:20582002:2:TEM,SIG
err:20616002::PAR,AKE,N
err:20616004::PAR,AKE,N
err:20616006::PAR,AKE,N
err:20836004::SEQ,DA,A
err:20836016::SEQ,DA,A
err:20837009::SEQ,DA,A
err:20837010::SEQ,DA,A
err:21016003::TEM,SIG
err:21095005::PR,NU,HF
err:21146013::TEM,SIG
err:21146016::TEM,SIG
err:21146017::TEM,SIG
err:21146018::TEM,SIG
err:21146019::TEM,SIG
err:21146020::TEM,SIG

Missing comma
err:R0019001::AUTHOR
err:A0055001::AUTHOR
err:20910001::AUTHOR
err:40033001::AUTHOR
err:M0502001::AUTHOR

"(" instead of ")"
err:11127001::HISTORY

Extra "C" in column 23
err:P0025002::COMMON

Missing ")"
err:M0274007::INC_SOURCE *(Corr. M031)*

Replaced DATA HEADINGS:
ELEM instead of MASS and vise versa
err:A0031003::DATA

err:21274002::TEM,SIG
err:21274003::TEM,SIG
err:21274004::TEM,SIG
err:21274005::TEM,SIG
err:21274006::TEM,SIG
err:21274008::TEM,SIG
err:21297004:3:STF
err:21628003::,PAR,DA
err:21643002::PAR/DL,NU
err:21689002::IND/PAR,FY
err:21689003::PAR,ZP
err:21689004::IND/PAR,FY
err:21689005::PAR,ZP
err:21689006::IND/PAR,FY
err:21689007::PAR,ZP
err:21689008::IND/PAR,FY
err:21689009::PAR,ZP
err:21689010::IND/PAR,FY

err:21689011::PAR,ZP
err:21689014::IND/PAR,FY
err:21689015::IND/PAR,FY
err:21689016::IND/PAR,FY
err:21689017::IND/PAR,FY
err:21689018::IND/PAR,FY
err:21699002::TER,AKE
err:21699003::TER,AKE
err:21701002::PAR/IND,FY
err:21701002::PAR/CUM,FY
err:21701005::PAR/IND,FY
err:21701005::PAR/CUM,FY
err:21723003::CUM,FY/SUM
err:21929004::,DA/DE,,LEG
err:22250002::,AH
err:22250003::,AH
err:22250004::,AH
err:22250005::,AH
err:22250006::,AH
err:22250007::,AH
err:22308003::TER/BIN,FY
err:30323005::,SIG,,RAT
err:30326002::TER/BIN,DA/RAT,FF
err:30326002::TER/BIN,DA/RAT,FF
err:30326003::TER/BIN,DA/RAT,FF
err:30326003::TER/BIN,DA/RAT,FF
err:30521002:L:TER,CRL,FF/FF
err:30521002:L:TER,CRL,A/FF
err:30521002:H:TER,CRL,FF/FF
err:30521002:H:TER,CRL,A/FF
err:30916002::,CRL,A/FF

err:40386002::,SPC,G
err:40387002::,SPC,G
err:40593002::PRE,DA,,RSD
err:40593003::PRE,KE/DA
err:M0030005::,DE,N/P
err:M0030006::,DE,P/D
err:M0030007::,DE,N/D
err:M0030008::PAR,DA,N/P
err:M0033002::,DE,N/P
err:M0035002::,DE,N/P
err:M0035005::,DE,P/D
err:M0035008::,DE,N/D
err:M0035020::,DE,N/P
err:M0051011::,DE,N/P
err:M0051014::,DE,P/D
err:M0051017::,DE,N/D
err:M0054002::PAR,MCO,N/P
err:M0064014::,DA,RSD *(Corr. M031)*
err:M0065003::,DE,N/P
err:M0065004::,DE,P/A
err:M0065005::,DE,P/RSD
err:M0065006::,DE,A/RSD
err:M0071018::,DA,RSD *(Corr. M031)*
err:M0071021::,DA,RSD *(Corr. M031)*
err:M0071024::,DA,RSD *(Corr. M031)*
err:M0071027::,DA,RSD *(Corr. M031)*
err:M0071030::,DA,RSD *(Corr. M031)*
err:M0071033::,DA,RSD *(Corr. M031)*
err:M0071036::,DA,RSD *(Corr. M031)*
err:M0071039::,DA,RSD *(Corr. M031)*
err:M0133007::,DA,,CS2/RS
err:M0179002::,DA,,SN2/RS
err:M0184002::,DA,,SN2/RS
err:M0184003::,DA,,SN2/RS
err:M0184004::,DA,,SN2/RS
err:M0184005::,DA,,SN2/RS
err:M0186012::,DA,,SN2/RS
err:M0186013::,DA,,SN2/RS
err:M0186014::,DA,,SN2/RS
err:M0186015::,DA,,SN2/RS
err:M0186016::,DA,,SN2/RS
err:M0191002::,DA,,SN2/RS
err:M0225029::,DA,A,LEG/RS
err:M0225030::,DA,A,LEG/RS

err:M0242004::,DA,LEG *(Corr. M031)*
err:M0242005::,DA,LEG *(Corr. M031)*
err:M0242006::,DA,LEG *(Corr. M031)*
err:M0242007::,DA,LEG *(Corr. M031)*
err:M0242009::,DA,LEG *(Corr. M031)*
err:M0242010::,DA,LEG *(Corr. M031)*
err:M0242013::,DA,LEG *(Corr. M031)*
err:M0242014::,DA,LEG *(Corr. M031)*
err:M0242016::PAR/EP,SIG *(Corr. M031)*
err:M0242017::PAR/EP,SIG *(Corr. M031)*
err:M0256002::,DA,N/P
err:M0256003::,DA,N/P
err:M0256004::,DA,N/P
err:M0350016::PAR,DA,,COS/RS
err:M0350017::PAR,DA,,COS/RS
err:M0382002::PAR,INT,G,4PI *(M031)*
err:M0382003::PAR,INT,G,4PI *(M031)*
err:M0382004::PAR,INT,G,4PI *(M031)*
err:M0393002::,DE,BRA/REL
err:M0435003::PAR,INT
err:M0435004::PAR,INT
err:M0435007::PAR,INT
err:M0435008::PAR,INT
err:M0435008::PAR,INT
err:M0435009::PAR,INT
err:M0436003::PAR,INT
err:M0437003::PAR,INT
err:M0446003::PAR,INT,G
err:M0448004::PAR,INT
err:M0448005::PAR,INT
err:M0499004::PAR,INT
err:M0499005::PAR,INT
err:M0500003::PAR,INT
err:M0525020::,DA,RSD *(Corr. M031)*
err:M0525021::,DA,RSD *(Corr. M031)*
err:M0525022::,DA,RSD *(Corr. M031)*
err:M0525023::,DA,RSD *(Corr. M031)*
err:M0525024::,DA,RSD *(Corr. M031)*
err:M0525025::,DA,RSD *(Corr. M031)*
err:M0525026::,DA,RSD *(Corr. M031)*
err:M0525027::,DA,RSD *(Corr. M031)*
err:M0525028::,DA,RSD *(Corr. M031)*
err:M0536004::,POL/DA,,AZI
err:O0132122::IND/UND,SIG,,G

Annex 7.

The main items
of the CDFE future short-term programmes, priorities and new tasks

1. Upgrading and addition of the CDFE bibliographical data collection. Including the 2001 - 2002 photonuclear data into the relational database "Photonuclear Data Index" (PNI). Participation the joint (CDFE - NDS - NNDC - CNPD - CAJaD - CJD) program of development of the joint (EXFOR - CSISRS - CINDA - NSR - PNI - …) Relational Nuclear Reaction Database.

2. Continuation of photonuclear data compilation using EXFOR format. Investigation (together with Institute of Nuclear Research of Russia Academy of Science) of including the data on meson photoproduction data, first of all for cross sections and angular distributions. Addition and correction of the existed CDFE EXFOR relevant databases:
- "Relational Nuclear Reaction Database (EXFOR)";
- "Giant Dipole Resonance Parameters. Photonuclear Reaction Cross Sections".

3. Improvement (in cooperation with CAJaD, Dr. F.E.Chukreev) of the CDFE Relational Nuclear Reaction Database (EXFOR) Search Engine. Development of special software for so-called "inverse geometry" charge particle reaction data search (any "incident particle - target nucleus" combinations without fixing for REACTION SF1 - SF2 and correspondent recalculation of energy values).

4. Improvement of the CDFE relational nuclear spectroscopy database NESSY (New ENSDF Search SYstem). Addition to the NESSY Search Engine several new available queries (standard or typical requests), for example, "Show Transitions with Equivalent Energies", Chains of queries", etc. Investigation of the possibilities of joint (CDFE - NNDC - NDS) program of development of advanced "Relational ENSDF" database.

China Nuclear Data Center (CNDC) Status Report

Zhuang Youxiang

1. General Situation

1.1 Nuclear Data Evaluation

CENDL-3.0 was developed during 1996 - 2001, it includes 214 nuclides for general purpose. Among them, the data of 169 nuclides were newly evaluated or reevaluated. Comparing to CENDL-2.1 and other evaluated libraries, the data were updated and improved. For structure materials, the data were given for both natural element and their isotopes, and are consistent between them. For fission product nuclides, the data were completely newly evaluated. For light nuclides, the data of double differential cross section can be made much improved. The data are being tested for some thermal, fast reactor assembles and some leak spectrum experiments. Some problems have been found and are being improved; for example, (1) double differential cross sections of light nuclides ^{6,7}Li, and ^{9}Be; (2) fission neutron spectra of ^{233,235,238}U and ^{239,240}Pu; (3) a complete set of data for unstable and/or short-lived nuclides; (4) excitation function of fission-product yield.

The present status of CENDL-3.0 is shown in Table 1.

Table 1. The present status of CENDL-3.0

Nuclides	Planned	Evaluated	Being Tested
Fissile nuclide	15	15	^{233,235,238}U, ^{239,240}Pu
Structure material	24	42	^{nat}Fe
Fission products	91	109	(n,γ)
Light nuclide	3	3	^{9}Be
Total evaluated	133	169	
Total CENDL-3	178	214	

1.2 Validation of CENDL-3.0

The Benchmarks testing of CENDL-3.0 has been done for some homogeneous fast reactors with the continuous Monte Carlo code MCNP and AMPX code system, and for thermal reactors with reactor lattice code WIMSD etc.. The comparisons of calculated results with different evaluated nuclear data libraries were also made.

In most thermal and fast uranium criticality benchmarks, the calculated K_{eff} values with CENDL-3.0 are in good agreements with experimental results. In small fast cores with ^{233}U fuel, good results of K_{eff} values are given with CENDL-3.0, due to reevaluation of ^{233}U fission cross sections.

For most uranium assemblies, CENDL-3.0 shows better agreements with references experimental cases. In the benchmarks testing for both uranium metal fuel lattice assemblies and uranium oxide fuel lattice assemblies, the K_{eff} values calculated with ENDF/B-6.7 are underestimated. We can see that the excellent K_{eff} values with CENDL-3.0 are given. The reason is that the inelastic cross section data of ^{238}U from CENDL-3.0 show better agreements with the most experimental results compared to the corresponding data in the ENDF/B-6.7 library. ^{238}U inelastic scattering effect of ENDF/B-6 makes assemblies spectrum harder and

underestimates the fission contributions of ^{235}U, so that the K_{eff} values calculated with ENDF/B-6 are underestimated.

It is well known that ^{238}U data affects strongly on the calculated results of reactor physics parameters and their trend, due to high concentration in the uranium fuel reactors. It is obvious that ^{238}U data of CENDL-3.0 are better than those of ENDF/B-6.7 for most reactors calculations, especially for thermal reactors calculations.

In the plutonium fast cores, the K_{eff} values were improved significantly with CENDL-3.0. This is duo to reevaluation of the fission spectrum and elastic angular distributions of ^{239}Pu and ^{240}Pu from CENDL-2.1 to CENDL –3.0.

In the spherical or cylindrical assemblies of plutonium or uranium with beryllium reflector, the K_{eff} values were improved considerably with CENDL-3.0, due to modification of elastic angular distribution and the (n,2n) cross sections of ^{9}Be, but CENDL-3.0 still underestimated the K_{eff} values compared with other evaluated data libraries for most assemblies. It's necessary to do further improvement for the data of beryllium from CENDL-3.0.

Benchmark testing for some structure materials has been done at CNDC. It can be seen that further improvement for data of iron is needed, and further benchmarks testing will be done with these materials.

The data testing for fission product nuclides has been done at CNDC. The reactor spectrum averaged (n,γ) cross sections were calculated and compared with the measured ones. Good results are given for most fission product nuclides compared with other nuclear data libraries. This is because of using the newest experimental data and adding the direct inelastic scattering for the evaluated data.

1.3 Future Work

A new five year plan (from 2001 to 2005) was made for the nuclear data development. It is certainly that CENDL-3.0, both general purpose data file and special purpose data file, will be developed further to CENDL-3.1. The general purpose data file will include more nuclides and more files (for example covariance data files). More fission product nuclides will also be included. The data for important nuclides will be improved further. The resonance parameters will be investigated and evaluated. The fission yield data and decay data will be continuously evaluated.

The nuclear data measurement, evaluation and validation will still be combined in CENDL-3.0 improvement and development.

2. CINDA and EXFOR Compilation

2.1 CINDA

Total 102 entries were compiled from the papers of "Communication of Nuclear Data Progress", No. 23 - 26 in 2000 - 2001.

2.2 EXFOR

Two young staff members under the guidance of Zhuang Youxiang compiled 15 entries for measurements made in China.

3. Publications

"Communication of Nuclear Data Progress" (CNDP) has been published for 4 issues (No.2 - 26) during 2000 - 2001, and it (350 books/each issue) has also been distributed by IAEA Nuclear Data Section as an INDC document.

4. Short-term Programs, New Tasks and Staffs

4.1 Short-term Program

The benchmark testing of CENDL-3.0 will be continued during two years, in order to improve and release it.

4.2 New Task (Nuclear Data for ADS)

Accelerator Driven Sub-critical System (ADS), called Accelerator Driven Radioactive Clean Nuclear Power System, is investigated in preparation as national project now in China. To meet the requirement, the data of some nuclides are being evaluated, the multi-group cross sections are being generated with the microscopic data taken from CENDL, and a code system to calculate the data in high-energy region is being developed.

4.3 Staff

There are four groups in CNDC:
(1) Evaluation Group: 6
(2) Theory Group: 4
(3) Macroscopic Data Group: 3
(4) Data Library and Computer Group: 3

They are engaged in neutron, charged-particle and photo-nuclear data evaluations; nuclear structure and decay data, fission product yield evaluations; parameters library, EXFOR, CINDA, data service, library management; group constant generating, validation and so on, respectively.

5. Activities and Cooperation during 2001

5.1 Meetings Held in China

(1) The meeting on the 10^{th} years plan of nuclear data evaluation, June 12 - 17, Zhangjiajie city, Hunan province;
(2) The Working Group Meeting of Nuclear Data Evaluation and Theoretical Calculation, July 25, Beijing;
(3) The Standing Committee Meeting of the Second China Nuclear Data Committee,

September 13, Beijing;

(4) The first plenary session of the third committee of China Nuclear Data Committee, September 14, Beijing. Prof. Zhao Zhixiang, the president of CIAE, was appointed to be the new chairman of this Committee.

5.2 The International Meetings in Nuclear Data Field Attended by Staffs of CNDC

(1) Research Co-ordination Meeting on Development of a Database for Prompt Gamma-ray Neutron Activation Analysis, May 14 - 17, Zhou Chunmei, Vienna, Austria;
(2) Consultants' Meeting on the Co-ordination of Nuclear Reaction Data Centers (Technical Aspects), May 28 - 31, Zhuang Youxiang, Vienna, Austria;
(3) International Conference on Nuclear Data for Science and Technology, Oct. 7 - 12, Xia Haihong, Zhuang Youxiang, Zhou Zuying, Yu weixiang, Shen Qingbiao and Yu Hongwei, Tsukuba, Japan;
(4) Research Co-ordination Meeting on Fission Product Yield Data Required for Transmutation of Minor Actinide Nuclear Waste, Oct. 8 - 12, Liu Tingjin, Vienna, Austria;
(5) Research Co-ordination Meeting on Final Stage of WIMS-D Library Update Project, Nov. 5 - 8, Liu Ping, Vienna, Austria;
(6) Research Co-ordination Meeting on Nuclear Model Parameter Testing for Nuclear Data Evaluation (Reference Input Parameter Library: Phase II), Dec. 3 - 7, Ge Zhigang, Vienna, Austria.

5.3 The Foreign Scientists in Nuclear Data Field Visited CNDC/CIAE

(1) Drs. T.V.Golashvili, V.P.Chechev and A.Demidov, Ministry of Atomic Energy of Russia Federation, Sep. 10 - 20;
(2) Dr. Jun-ichi Katakura, NDC/JAERI, Sep. 16 - 21;
(3) Dr. Guinyun Kim, Pohang Technology University, Korea, Sep. 20 - 21;
(4) Dr. Andrej Trkov, NDS/IAEA, Oct. 13 - 17;
(5) Dr. E.T.Cheng, San Diego, USA, Nov. 16.

5.4 Staffs of CNDC Worked in or Visited Foreign Country

(1) Rong Jian, JAERI, from Aug. 1, 2000 to July 31, 2001;
(2) Shu Nangchuan, ORNL, from Mar. 26, 1999 to Oct. 1, 2001.

Present Status of JENDL Project and Activities of JNDC

Akira Hasegawa
Nuclear Data Center
Japan Atomic Energy Research Institute
Hasegawa@ndc.tokai.jaeri.go.jp

1. JENDL-3 revision 3 (JENDL-3.3: General Purpose File)

The data improvement of JENDL-3.2 started in April 1997. Then after 5 years endurable work, JENDL-3.3 has been completed by March 2002 and released in May 2002 officially as a consolidated new version of JENDL. This is a cooperative work done by JAERI NDC (Nuclear Data Center) and JNDC (Japanese Nuclear Data Committee).

The main features of JENDL-3.3 are summarized as follows:

1) Enrichment of covariance data

Covariance data are supplied for major reactor constituents, such as major actinides, structural materials and main coolants, to be used for the applications of FBR, LWR and Fusion reactors. This was done so as to be able to make estimation of quantitative contribution of nuclear data uncertainty to design accuracy or safety margin. Only one nuclide (Mn-55) covariance data was supplied in the JENDL-3.2.

2) New material evaluation important for high burn-up application

Evaluations of new material not available in JENDL-3.2 are made. For example, Er isotopes are important as burnable poisons in LWR in high burn-up applications.

3) Adoption of isotope evaluation policy

From this version isotope evaluation policy is introduced against the natural element evaluation policy taken in the JENDL-3.2. Up to the JENDL-3.2, natural element data was prepared usually for a natural element material (i.e., isotopes data are aggregated in one material) data. At the same time, there exist isotope data. In some cases, inconsistency between natural and isotope data were alive. So as to solve the inconsistency we have claimed that for transport calculations in nuclear reactors, natural elements data are recommended to use and for dosimetry or activation applications, data given by isotopic evaluations are recommended. But there happened miss use so much. Therefore we changed the policy.

4) Enrichment of secondary gamma-ray production data

Secondary gamma-ray production data are newly incorporated for many nuclides needed in Fusion applications. The number of nuclides with gamma-ray production data was increased from 66 to 114.

5) Individual Evaluation

a. Heavy Nuclides (Modified Cross-sections)

A simultaneous evaluation of fission cross-sections for U-233, U-235, U-238, Pu-239, Pu-240 and Pu-241 was made. A least squares method was applied to selected absolute and relative measurements on the fission cross sections. Covariance matrices of the experimental data were constructed from the uncertainty information reported in the original references of each measurements.

U-233: URR(Un-resolved Resonance), 2n (n,2n), 3n (n,3n) and nu (neutrons per fission).

U-235: RR(Resolved Resonance) (Leal's evaluation), URR, 2n, 3n, 4n, nu and fission spectrum evaluated by multi-mode fission model.

U-238: 2n,3n,4n, capture in MeV range, partial level inela.

Pu-240:RR, URR, 2n,3n,4n and partial level inela.

Pu-242:RR(fission width), 2n,3n and partial level inela.
Problem of neutron emission spectrum is solved by GNASH+GAMFIL calculation.
Capture cross section in MeV range is calculated by newly developed code DSD; calculation code of Direct/Semi-Direct Capture cross-sections.

b. Medium Mass Nuclides

Na: Inela. cross section (Geel + TNG code calculation)
Ti-46,47,48,49,50: threshold reaction, gamma production, elastic scattering angular distributions.
V: RR, total cross section above 100keV by Geel data and gamma production data.
Cr-50,52,53,54: RR and gamma production data.
Fe-54,56,57,58: RR, total, capture in MeV range calculated by TNG including pre-equilibrium capture.
Co-59: RR, total, gamma-production.
Ni-58,60,61,62,64: Inela., threshold reaction, neutron emission spectra using SINCROS code.
Nb-93: capture gamma reflecting pre-equilibrium.
W-182,183,184,186: RR, threshold reaction, gamma production data.
Er-162,164,166,167,168,170: Complete new evaluation reflecting newly obtained capture data measured by TIT(Tokyo Institute of Technology).

2. JENDL Special Purpose Files

The following special purpose files other than JENDL-3.3 general purpose file are being developed in Japan. Their status is given below.

JENDL Fusion File

The latest version of JENDL Fusion File (JFF) was released in 1999 to provide precise double-differential neutron and charged particle emission data by using MF6 representation of the ENDF-6 format. The evaluation was made for the data of H, D, ^{6,7}Li, ^{9}Be, ^{12}C, ^{14}N, ^{16}O, ^{19}F, ^{27}Al, Si, Ca, Ti, ^{51}V, Cr, ^{55}Mn, Fe, ^{59}Co, Ni, Cu, Ga, ^{75}As, Zr, ^{93}Nb, Mo, Sn, Sb, W, Pb and ^{209}Bi. For H, D, Li, N and O, the data of JENDL-3.2 are directly adopted. The revision works for the nuclides excepting the light mass ones have been performed by the SINCROS-II code system which consists of GNASH, DWUCK, CASTHY and several auxiliary programs. Those results were examined by comparing with DDX measured at Tohoku and Osaka Universities. For the data of light mass nuclei, individual evaluation has been done. A lot of nuclides were adopted as FENDL-2 from this file. Formal evaluation paper was published as “Chiba S., Fukahori T., Shibata K. et.al: JENDL Fusion File 99,J. Nucl. Sci.Technol., 39,187 (2002)”.

JENDL Actinide File

This file will provide the data of main and minor actinides about 90 nuclei(Tl to ES) more than 1 day half life from 10-5 eV to 20 MeV in energy. The revision work of major and minor actinides has been made and their results were adopted in JENDL-3.3. The revision work for minor actinides not available in JENDL-3.3 will be continued in the coming several years. The results of the reevaluation will be stored in JENDL Actinide File.

Since 1994, International Science and Technology Center (ISTC) project for Measurements and Evaluation of miner actinide nuclei has been started at Institute of Physics and Power Engineering (IPPE, Obninsk Russia, #304.), V.I. Khlopin Radium Institute (KRI, StPetersburg Russia, #183.) and Radiation Physics and Chemistry Problem Institute (RPCPI, Minsk Belarus, #B-03). After that the forth project started to measure fission cross-sections of

minor actinides in medium energy range, i.e.,1 to 200 MeV by Petersburg Nuclear Physics Institute (PNPI St.Petersburg Russia, #609.) A project of actinide nuclear data evaluation for Th cycle started April 2000 (RPCPI, Minsk Belarus, #B-404). The last one is currently underway.

JENDL Dosimetry File

The working group on Dosimetry cross sections in JNDC has been published a new file JENDL Dosimetry File 99 and dissolved the WG. The cross section data of old version, JENDL Dosimetry File 91, were revised for 33 materials and their covariance matrices were replaced with new ones. Integral tests were also made. The file was released in FY99.and the data are also released with a CD-ROM, which is freely available through NDC/JAERI. Contents are 67 reactions with point-wise and 671 group structures data. An official evaluation report was published as "Kobayashi K., Iguchi T., Iwasaki S., at. al.:JENDL Dosimetry File 99 (JENDL/D-99), JAERI-1344 (2001)".

JENDL Activation Cross Section File

Evaluation and compilation work for JENDL Activation Cross Section File was completed and released in March 1996 as JENDL-A96. This first version stores the data for 233 nuclei and 1246 reactions. The final report is under preparation. Revision of the files is foreseen in the near future considering the feedback information from the ad hoc group for threshold reaction evaluation working group in JNDC.

JENDL Alpha-n Data File

Evaluation and compilation work for JENDL Alpha-n Data File has been progressed by Charged Particle Nuclear Data Working Group. This file is requested from Shielding Group and/or Nuclear Criticality Safety Group especially for the applications of spent fuel transportations and stockades or reprocessing plant design. Neutron behaviors are very important for the treatment of spent fuels due to the neutrons are born from alpha emitters of minor/major actinides converted from major actinides of fuels. Total of 32 nuclides for Li-6, 7, Be-9, B-10, 11, C-12, 13, N-14, 15, O-17, 18, F-19, Na-23, Al-27, Si-28, 29, 30, Cr-50, 52, 53, 54, Fe-54, 56, 57, 58, Ni-58, 60, 61,62,64, Cu-63, 65.will be stored. UP to now except Si the evaluation is finished. File release is expected in FY2002.

JENDL FP Decay Data File

Evaluation and compilation work for JENDL FP Decay Data File has been completed by sub-group in Decay Heat Evaluation Working Group of JNDC. This file is a succession of the former JNDC Decay Data Library compiled in private JNDC format. The newly released file is compiled in ENDF-6 Format. The file contains decay data for 1229 FP nuclides consisting of 142 stable and 1087 unstable nuclides. For each nuclides following data are given; decay modes, their Q values and branching ratios, average decay energy values of beta-rays, gamma-rays and alpha-particles and their spectral data. This file is inevitable for the decay heat calculations for the power reactors. This file was released in FY2000 and named as JENDL FP Decay Data File 2000. The official evaluation report was published as "Katakura J., et al. :JENDL FP Decay Data File 2000, JAERI-1343 (2001)".

JENDL High Energy Files

The evaluation of data for high-energy neutrons and protons has been initiated in JNDC. They will make data files for neutrons up to 50 MeV and for neutrons and protons up to 3 GeV.

The former files will be used for the IFMIF project that JAERI participates. The evaluation of neutron data up to 50 MeV has been made for almost all necessary nuclides. The evaluation results for neutron are being reviewed. After review, the data will be combined with JENDL Fusion File or JENDL-3.3 below 20 MeV. The file release will be envisaged in FY2002.

The latter files will be used for design of accelerators, transmutation systems of high-level waste, medical applications and so on. Stored nuclides are listed in Table-1. Among the list, evaluations for first and second categories were already finished for neutron and proton induced reactions up to 3 GeV. A test data file is compiled and benchmark test is in progress. The file release will be envisaged after the benchmark test, we expect distribution starts within FY2002.

JENDL PKA/KERMA File

This file stores the spectra of primary knock-on atoms (PKA) and KERMA factors. The data to be stored are created from the data files(JENDL High Energy File) up to 50 MeV made for the IFMIF project. A couple of processing codes to create the file from evaluated nuclear data file, by using the effective single particle emission approximation, have been developed and tested. The test compilation has been performed from JENDL Fusion File for the 69 isotope data except light mass nuclei below 20 MeV. The file release will be made in FY2002.

JENDL Photonuclear Data File

The evaluation has been finished for 46 isotopes; ^{2}D, ^{12}C, ^{14}N, ^{16}O, ^{23}Na, ^{24,25,26}Mg, ^{27}Al, ^{28,29,30}Si, ^{40,48}Ca, ^{46}Ti, ^{51}V, ^{52}Cr, ^{55}Mn, ^{54,56}Fe, ^{59}Co, ^{58,60}Ni, ^{63,65}Cu, ^{90}Zr, ^{93}Nb, ^{92,94,96,98,100}Mo, ^{133}Cs, ^{160}Gd, ^{182,183,184,186}W, ^{197}Au, ^{206,207,208}Pb, ^{209}Bi and ^{235,238}U in the gamma-ray energy range up to 140 MeV. Their compilation in the ENDF-6 format and the critical review are in progress. The file will be released in FY2002 also.

3. Other Activity Relating to Nuclear Data

1) ND2001: International Conference on Nuclear Data for Science and Technology

The International Conference on Nuclear Data for Science and Technology (ND2001) was held 7-12th October 2001 at the EPOCHAL Tsukuba International Congress Center in Tsukuba, Ibaraki, Japan. The Japan Atomic Energy Research Institute (JAERI) sponsored and organized in collaboration with OECD Nuclear Energy Agency – Nuclear Science Committee (NEA/NSC) and Atomic Energy Society of Japan (AESJ) as the co-sponsors. Total of 375 scientists from 41countries and 4 international organizations participated in the conference, of which 207 persons come from abroad. Total of 375 papers were presented including 4 keynotes and 3 summary talks in the 40 sessions; i.e., 50 invited talks, 116 oral and 202 poster contributed papers. One third of the presented papers are in the topics of Nuclear Reaction Data and Evaluated data Libraries. The other one third is devoted to the applications in energy production including ADS applications and Industry or Medical applications. The rest one third is devoted for forefront of Nuclear Reaction Theory, Astrophysics, Facilities for new century and steady progress in International Collaborations. An emphasis was laid down on the application of the Nuclear Data to ADS due to the increased interests in the world-wide environmental concern on nuclear high level waste. And data applications in the Astrophysics are also enthusiastically debated in connection with nuclear synthesis of the universe.

The proceedings will be published by July 2002 as a supplement to Journal of Nuclear Science and Technology of Japan Atomic Energy Society, including all the reviewed invited and contributed papers.

2) The 2001 Symposium on Nuclear Data and a specialists' meeting

As the side effect of the ND2001, both of the Symposium on Nuclear Data, which is held every year in November, and a specialists' meeting on some special topics, which is a topical meeting held every year on the selected hottest topics in that period, were cancelled in 2001.

Table 1. Stored Nuclides in JENDL High Energy File

Priority	Nuclides
1st Priority (42 nuclides)	**H-1**, *C-12*, *N-14*, *O-16*, Na-23, *Al-27*, **Cr-50, 52, 53, 54**, **Fe-***54*, **56**, *57, 58*, *Ni-58, 60, 61, 62, 64*, **Cu-63, 65**, *Ta-181*, *W-180, 182, 183, 184, 186, Au-197*, *Hg-196, 198, 199, 200, 201, 202, 204*, *Pb-204, 206, 207, 208*, *Bi-209*, *U-235, 238*
2nd Priority (41 nuclides)	*Be-9, Mg-24, 25, 26*, *Si-28, 29, 30*, *K-39, 41*, **Ca-40, 42, 43, 44, 46, 48**, **Ti-46, 47, 48, 49, 50**, *V-51*, **Mn-55**, *Co-59*, *Zr-90, 91, 92, 94, 96*, *Nb-93*, *Mo-92, 94, 95, 96, 97, 98, 100*, *Pu-238, 239, 240, 241,242*
3rd Priority (39 nuclides)	H-2, Li-6, 7, B-10, 11, C-13, F-19, Cl-35, 37, Ar-35, 38, 40, Zn-64, 66, 67, 68, 70, Ga-69, 71, Ge-70, 72, 73, 74, 76, As-75, Y-89, Th-232, U-233, 234, 236, *Np-237*, Am-241, 242, 242m, 243, Cm-243, 244, 245, 246

NB. **RED bold font**: Evaluation and File Compilation Finished.
. *BLUE italic font*: Evaluation Finished.
BLACK: Evaluation not yet Finished.

Appendix Activities of Japanese Nuclear Data Committee (Fiscal year 2001)

The Japanese Nuclear Data Committee (JNDC) consists of three subcommittees, six standing groups and a steering committee. Each subcommittee consists of several working groups (WG). The Committee Meeting of JNDC was held in July 2001 to discuss the nuclear data activity in the previous fiscal year and plans for the fiscal year 2001. Discussions were made on several topics including the final preparation status of ND2001: International Conference on Nuclear Data for Science and Technology to be held in TSUKUBA as well as domestic and international collaboration on nuclear data.

The ND2001 was held in 7-12th October 2001 at the EPOCHAL Tsukuba International Congress Center in Tsukuba, Ibaraki, Japan. As the side effect, both of the 2001 Symposium on Nuclear Data, which is held every year in November, and a specialists' meeting on some special topics, which is a topical meeting held every year on the selected hottest topics in that period, were cancelled.

The activities of subcommittees and standing groups are briefly summarized below.

Subcommittee on Nuclear Data

1) High Energy Nuclear Data Evaluation WG :

The evaluation is progressing parallel in two phases. In the phase-I, the data up to 50 MeV for IFMIF(International Fusion Material Irradiation Facility) project are targeted for neutron and proton induced reactions. In the phase-II, evaluations for high-energy neutron/proton induced reactions up to 3GeV are ongoing. Data requests are very keen by the joint projects for High Intensity Proton Accelerator of Center for Neutron Research in JAERI and KEK (High Energy Accelerator Research Organizations). Following is the status of each SWG.

- IFMIF Neutron File Compilation SWG: Neutron file compilation is the main task of this SWG. Up to now, evaluation of 43 nuclides has been finished. The files are in the final reviewing stage after the FORMAT check.
- MeV and GeV File compilation SWG: Compilation and evaluation of phase-II data is a main mission. Evaluations for the priority 2 nuclides (about 40 nuclides) has been performed together with the code preparation inevitable for the fundamental evaluation tools in this energy range(Quick-Gnash, QMD, JAM). Evaluation started for the priority 3 nuclides.
- Other Sub-Groups like Photonuclear Data, PKA/KERMA, High Energy Activation Cross-sections, and Guideline discussion group for differential data checking also have been progressed.

2)Evaluation and Calculation System WG :

Recommended parameters required in the nuclear model calculations such as OMP, level density, gamma strength functions, as well as advanced methodologies like multi-modal fission, essence from the latest frontiers of theoretical calculations are discussed. The results will be reflected to RIPL-2(Reference Input Parameter Library Version 2).

3) Charged Particle Nuclear Data WG : This WG is responsible for the JENDL (alpha,n) Reaction File. Evaluation has been finished and a file will be produced within a year. This group was dissolved at the end of March 2002 due to the completion of the missions..

4) Delayed Neutron Data Evaluation WG: This group was set up due to the follow up work of OECD/NEA/WPEC(Working Party on Evaluation Cooperation) subgroup 13 to investigate the delayed neutron data related problems. Evaluations of delayed neutron yields and spectra for main actinides of JENDL 3.3(U-235,-238, Pu-239) are also the mission of this group. Data evaluation in 6 group time dependent scheme has been made.

5) Evaluation WG on Intermediate Mass Nuclides: This WG was set up due to the revision fork for JENDL-3.3. Re-evaluation work and relevant checking has been finished for Na-23, V-51, Co-59, Cr, Ti, Ni, W, Nb and Er (total of 32 nuclides). Some follow up from the results of benchmark tests were made. This group has been dissolved by the end of March 2002 due to the completion of JENDL-3.3.

6) Evaluation WG on Heavy Mass Nuclides: This WG was set up due to the revision work for JENDL-3.3. Re-evaluation work has been made for U-233, -235,-236,-238, and Pu-236,-239,-240,-241,-242. Working group has been watching the feedback information from benchmark tests made by subcommittee of reactor constants. This group has been dissolved by the end of March 2002 due to the completion of the mission.

Subcommittee of Reactor Constants

1) Reactor Integral Test WG : Benchmark test of JENDL-3.3 tentative version for fast and thermal reactors has been made. Although over all agreements (C/E values) in Keff for thermal system as well as fast system revealed superior than JENDL 3.2 data. Problems for over estimation on Keff for SUS reflected cores are dissolved by the reevaluation of Cr data. No major problems are found.

2) Shielding Integral Test WG :

For the tentative version of JENDL-3.3, benchmark test were made for main shielding materials such as Al, Si, Na, Ti, V, Cr, Fe, Co, Ni, Cu, Nb, W. All the results were fed back to the evaluation WG on intermediate mass nuclides. Much effort has been given to Na, Fe, Cr and Ni data reevaluation.

3) Standard Group Constants WG : Revision work for JSSTDL library has been progressed. Report of the JSSTDL-300 are being prepared. Direction of group constants preparation for JENDL-3.3 has been discussed.

Subcommittee on Nuclear Fuel Cycle

The subcommittee on nuclear fuel cycle consists of three WGs, i.e., Decay Heat Evaluation WG, WG on Evaluation of Nuclide Generation and Depletion, and FP Mass Yield Evaluation WG.

For the first WG, FP Decay Data File has been completed and released as JENDL FP Decay Data File 2000. A plan for new measurement of strength function of beta decay at Valencia University(TAGS) was presented and discussions were made how to contribute the project by JNDC. For the second WG, new entry for PWR and BWR-MOX has been added to ORIGEN-2 Library and published a report. Methodology for the evaluation of sensitivity in one group cross section is discussed. To pole for questionnaire of ORIGEN Calculation Needs has been decided and preparation work has been made. For the last WG, this group was organized so as to work with IAEA CRP. To give precise mass yields data for minor actinides as well as major actinides covering the wide range of incident neutron/proton energies is the main mission. Collection of mass yields data evaluated/measured in Japan was made. The systematic made by Moriyama and Ohnishi was applied and analyzed and found that for Cm-248(p,f) case typical two peak cannot produced. A possibility for updating of recent Benllinure's semi-empirical model was investigated. Measurements of mass yields for Np-237, Am-241 and 243, Cm-248 by proton bombardment at 25 and 30Mev were made.

Standing Groups

1) CINDA Group : Papers on neutron induced reaction data published in Japanese journals and reports are surveyed. Total of 289 entries (without ND2001 presentations) were sent to the NEA Data Bank in the last one year to update the CINDA master database.

2) ENSDF Group : The evaluation of nuclear structure data is the duty of this group for nuclei with mass numbers from 118 to 129. Re-evaluation work has been made for A= 118 and 124.
3) Group on Atomic, Molecular and Nuclear Data for Medical Use : Survey work has been made for the radiopharmaceutical data needed in the field of nuclear medicine. Home page of this group was opened to promote and encourage WG missions.
4) JENDL Compilation Group : File compilation and editing were made for the JENDL-3.3.
5) Editorial Group of "Nuclear Data News" : Three issues of "Nuclear Data News" (No.69-71) which is a periodic informal journal circulated in nuclear data communities of Japan (written in Japanese) were published. Some 450 copies were distributed in the nuclear data communities without fee.
6) High Priority Request List Group: A revision was made(new entry:3, remove/merge:35, others:71) for the latest version of HPRL, this is mainly from ADS (Accelerator Driven System) application's requests. This group is a coordination group to set up a Japanese Requests Lists from domestic data users and a world-wide request list HPRL that is maintained at OECD/NEA/WPEC (Working Party on Evaluation Cooperation).

Japan Charged-Particle Nuclear Reaction Data Group

(JCPRG)
Executive Committee
Progress Report to the NRDC Meeting
May 27-30, 2002

General

In 2001, we have carried out the following activities:

Compiling the CPND(Charged Particle Nuclear Reaction Data) (25 entries) produced in Japan with the NRDF(Nuclear Reaction Data File) format.
Translating the NRDF data into the EXFOR data (25 entries, including 15 new).
Working on a new web-based system, so-called HENDEL(Hyper Editor for Nuclear Data Exchange Language), an online editor-compiler for both NRDF and EXFOR.
Distributing the CPND and promoting its utilization in Japan.
Creating a new system, named SyGRD (Graph Reading and Displaying numerical data), with an image analysis software.

The regular JCPRG budget has ended this year (2001). Starting from 2002, the budget will be drawn on a competitive basis, so that we have to apply for it each year separately. The budget of 2002 was accepted to be almost the same as 2001.

NRDF Data Compiling Activity

In 2001 we newly compiled 25 entries (360 tables, 2.2 MB) based on the data obtained with the accelerators in Japan. The data for 16% of entries and 123 tables (34%) among 360 tables were obtained from the authors directly.

EXFOR Translation from NRDF

Recent files made by translation from NRDF to EXFOR are
E016 31 entries
E017 9 entries
E018 7 entries
E019 12 entries
E020 10 (5/10) entries from 15 entries in NRDF compiled in 2000
E021 15 (7/15) entries from 25 entries in NRDF compiled in 2001
We can now convert NRDF files into EXFOR format by HENDEL. However, we found that the NRDF dictionary must be completed by comparing it with the EXFOR codes in order to perform the conversion smoothly. Furthermore, several codes (e.g. the Institute Codes) should be proposed as the EXFOR Codes.

Customer Services

Retrieval services of NRDF data by using computers in the Hokkaido University Computing Center were completely stopped in 2001. Now the retrieval services of NRDF and EXFOR are available via a WWW homepage: (http://jcprg.sci.hokudai.ac.jp/).
In order to extend the NRDF data service, we are developing a retrieval system based on the IntelligentPad.

ANNEX: Organization and members of JCPRG

Advisory committee:

Yasuhisa ABE (Yukawa Institute for Theoretical Physics, Kyoto Univ.)
Yoshinori AKAISHI (Institute for Particle and Nuclear Studies, KEK)
Yasuo AOKI (Tsukuba Univ.)
Junsei CHIBA (KEK)
Masayasu ISHIHARA (Tokyo Univ.)
Ichiro KATAYAMA (CNS, Tokyo Univ.)
Mituji KAWAI (Kyushu Univ.)
Akira HASEGAWA (Japan Atomic Energy Research Institute)
Tetsuo NORO (Kyushu Univ.)
Shunpei MORINOBU (Kyushu Univ.)
Hajime OHNUMA (Tokyo Institute of Technology)
Hikonojo ORIHARA (Cyclotron and Radioisotope Center, Tohoku Univ.)
Teijiro SAITOH (Tohoku Univ.)
Hajime TANAKA (Hokkaido Univ.)
Yoshihiko TENDO (Institute of Physical and Chemical Research)
Koichi OKAMOTO (Nihon Univ.)
Kiyoshi KATO (Hokkaido Univ.)

Executive committee:

Kiyoshi KATO (Chairman, Hokkaido Univ.)
Akira OHNISHI(Hokkaido Univ.)
Shigeto OKABE (Hokkaido Univ.)
Toshiyuki KATAYAMA(Hokusei-Gakuen Univ.)
Yoshiharu HIRABAYASHI (Hokkaido Univ.)
Hiroshi NOTO (Hokusei-Gakuen Univ.)
Masaki CHIBA (Sapporo-Gakuin Univ.)
Sigeyoshi AOYAMA(Kitami Institute of Technology)

Secretariat:

Hitomi YOSHIDA (Hokkaido Univ.)

Office address:

Division of Physics, Graduate School of Science, Hokkaido University
Kita-10 Nishi-8, Kita-ku, Sapporo, 060-0810
Tel: +81-11-706-2684, Fax: +81-11-706-4926
E-mail: nrdf@nucl.sci.hokudai.ac.jp

Staff:

(1) Data compiling:
Masayuki AIKAWA (Hokkaido Univ.)
Takayuki MYO (Hokkaido Univ.)
Naohiko OTUKA (Hokkaido Univ.)

Kenichi NAITO (Hokkaido Univ.)
Makoto ITO (Hokkaido Univ.)
Ryusuke SUZUKI (Hokkaido Univ.)
Chikako ISHIZUKA (Hokkaido Univ.)
Chie KUROKAWA (Hokkaido Univ.)

(2) Data input:
Takako ASHIZAWA (Hokkaido Univ.)
Hitomi YOSHIDA (Hokkaido Univ.)

NRDF system maintenance:

Naohiko OTUKA (Hokkaido Univ.)
Yoshihide OHBAYASHI (Muroran Institute of Technology)

Conversion from NRDF to EXFOR:

Yoshihide OHBAYASHI (Muroran Institute of Technology)
Naohiko OTUKA (Hokkaido Univ.)
Hiroshi NOTO (Hokusei-Gakuen Univ.)
Masayuki AIKAWA (Hokkaido Univ.)
Kenichi NAITO (Hokkaido Unov.)
Sergei KORENNOV (Hokkaido Univ.)

IntelligentPad-based database development:

Yoshihide OHBAYASHI (Muroran Institute of Technology)

Editor-compiler development:

Hirokazu OHMI(Hiokkaido Univ.)
Naohiko OTUKA (Hokkaido Univ.)

STATUS REPORT ON NUCLEAR DATA ACTIVITY COMPILATION (1999-2002)

Cyclotron Department

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

(Compiled by F. Tárkányi)

1. List of the co-authors

Tárkányi F., Takács S., Szelecsényi F., Ditrói F., Fenyvesi A., Kovács Z., Szűcs Z., Mahunka I., Andó L., Dóczi R.
Institute of Nuclear Research of the Hungarian Academy of Sciences, Debrecen, Hungary

Qaim S. M., Scholten,E., Hess. B., Coenen H.
Institute fur Nuklearchemie, Forschungszentrum Jülich, Germany

Hermanne A., Sonck M., Van hoyweghen J, Thielemans A., Van den Winkel P.
Cyclotron Laboratory, Vrije Universiteit Brussel, Brussels, Belgium

Azzam A., Ali M. A., Al-Abyad M.
Atomic Energy Authority, Cairo, Egypt

Suzuki K., Takei M., Okada K.
Division of Advanced Technology for Medical Imaging, National Institute of Radiological Sciences, Chiba, Japan

Nortier F. M., Van der Walt T.N., Steyn G. F.
Radionuclide Production, National Accelerator Centre, Faure, South Africa

Oblozinsky P.
Nuclear Data Section, International Atomic Energy Agency, Vienna, Austria

Shubin Yu. N.
Institute of Physics and Power Engineering, Obninsk, Russian Federation

Youxiang Z.
China Nuclear Data Centre, China Institute of Atomic Energy, Beiijing, People′s Republic of China

Mustafa M. G.
Lawrence Livermore National Laboratory, Livermore, USA

Gul. K
Pakistan Institute of Nuclear Science and Technology, Islamabad, Pakistan

Heselius S. -J.
Cyclotron Laboratory, Abo Akademi, Turku, Finland

Daraban L., Bolbos R.
Babes-Bolyai University, Cluj-Napoca, Romania

2. Experimental works

Cross sections for production of different residual radionuclei induced by low and medium energy light ion beams are important for a variety of applications and of research studies. The experimental data is the basis for applications demanding accurate data and for model calculations to test the capability of the models and to adjust the optimal parameters. During the last years we have continued the systematic measurement of excitation functions of charged particle reactions for many different applications.
These experiments were done at the MGC 20E cyclotron and VdG-5 accelerator in Debrecen and at cyclotrons of foreign laboratories in the frame of well established long term collaboration, in :

- the Institute of Nuclear Chemistry (FZ Jülich, Germany)
- the Cyclotron Laboratory of the Free University of Brussels (VUB, Brussels, Belgium)
- the Cyclotron Radioisotope Center of the Tohoku University (CYRIC, Sendai, Japan)
- the Cyclotron Laboratory of the Abo Akademi (Turku, Finland)
- the Division of Advanced Technology for Medical Imaging of the National Institute of Radiological Sciences (Chiba, Japan)
- the Radionuclide Production Laboratory of the National Accelerator Centre (Faure, South Africa)

The theoretical calculation of the measured data was done in collaboration with scientists from

- Institute of Theoretical Physics, IPPE, Obninsk, Russia
- Lawrence Livermore National Laboratory, Livermore, USA
- China Institute of Atomic Energy, Beijing, China

Bellow we have collected the results published in the period covered. Several other excitation functions of light charged particle induced nuclear reactions on Fe, Cu, Kr, Nb, Mo, Zr, Pd, Te, Ta, Pt and Bi have been also measured and are in evaluation stage.

2.1. Excitation functions relevant to the production of diagnostic radioisotopes

In the field of the production of diagnostic radioisotopes the nuclear reaction data are mostly used to optimise the production circumstances (high yield, minimal impurity level, low cost). The data for the production of major positron and gamma emitters requires validation and additional measurements in selected energy regions. The cross-section database for the newly introduced positron and gamma emitters is very poor. In many cases basic data are missing.

For production of diagnostic radioisotopes used in nuclear medicine during the covered period the following investigations were done.

2.1.1. Positron emitters

- Measurement of the excitation function of $^{18}O(p,n)^{18}F$ reaction in the energy range 3-35 MeV

- Investigation of the production possibility of ^{60,61,62}Cu radioisotopes by alpha induced reactions on cobalt for PET
- Cross section measurements on gas targets relevant to the production of the positron emitting radionuclides ^{14}0 and ^{76}Br
- Remeasurement of the excitation function of ^{nat}Rb(p,xn)^{82,83}Sr up to 70 MeV

2.1.2. Gamma-emitters

- Excitation functions of the ^{68}Zn(p,2n)^{67}Ga and ^{nat}Zn(p,xn)^{67}Ga reactions for production ^{67}Ga
- Cross sections of deuteron induced nuclear reactions on ^{nat}Mo and ^{100}Mo(90%) up to 50 MeV for production of ^{99m}Tc and ^{99}Mo
- Excitation function of the ^{122}Te(d,n)^{123}I nuclear reaction for production of ^{123}I
- Cross section data for production of ^{81}Rb via the ^{80}Kr(d,n) reaction
- Proton induced reactions on ^{nat}Mo: new cross sections for production of ^{99m}Tc and ^{99}Mo isotopes

2.2. Excitation functions relevant to the production of therapeutic radioisotopes

Therapeutic radioisotopes are playing an emerging role in nuclear medicine. There is a long list on radioisotopes either routinely used or undergoing research investigations. Due to the long half-life the production requires high flux reactors and high intensity accelerators. The knowledge of production data is essential to optimise the production circumstances under complicated circumstances. The database in the field of the neutron-induced reactions is more or less acceptable. In the field of charged particle reactions the situation is more complex. Here in most of the cases either no experimental data are available or only contradicting data sets were published, except a few well-measured reactions. During last years we have intensified our investigations on the measurements of nuclear data related to this field.

- Activation cross section of the ^{186}W(d,2n)^{186}Re reaction for production of ^{186}Re
- Production cross section of ^{103}Pd and characterisation of contaminants in the deuteron irradiation of ^{103}Rh
- Excitation functions of proton induced nuclear reactions on^{103}Rh. Production of ^{103}Pd up to 28 MeV

2.3. Excitation functions of monitor reactions

The importance of the monitor reactions is well known in the field of neutron and charged particle induced reactions. They are broadly used both in irradiations for practical applications and for basic research. We extended the list of the charged particle monitor reactions. We have tried to validate the existing database for series of reactions with integral measurements. We made dedicated irradiations under identical circumstances to produce consistent data sets and to make intercomparison of the different monitor reactions. The main published results:

- Monitoring of alpha-beam properties by the $^{nat}Ti(\alpha,x)^{51}Cr$ reaction.
- Investigation of ^{3}He-induced reactions on natural Ti for nuclear analytical studies and beam monitoring.
- Experimental study of excitation functions for some reactions induced by deuterons (10-50 MeV) on natural Fe and Ti.
- New data on the $^{nat}Cu(\alpha, X)^{66}Ga$, $^{nat}Cu(\alpha, X)^{67}Ga$ and $^{nat}Cu(\alpha, X)^{65}Zn$ monitor reactions.
- Deuteron monitor reactions on Al, Ti, Fe, Ni and Cu.
- Alpha beam monitoring via ^{nat}Cu+alpha processes in the energy range from 40 to 60 MeV.
- New cross-sections and intercomparison of proton monitor reactions on Ti, Ni and Cu.
- Proton beam monitoring on Cu via $^{nat}Cu(p,x)^{58}Co$ reaction in medium energy range.

2.4. Excitation functions for TLA technique

The thin layer activation technique is an important field of application of the charged particle reactions. It is used to follow quantitatively the wear, the corrosion or the erosion process by detection of the loss of the radioactive material during the investigated industrial or biological process. The nuclear data are inevitable important to optimise the activation and to follow wear process. The investigated tools are constructed mostly from metals. Some reactions, therefore, are common with the monitor reactions, considering that the targets for monitor are also metal due to the required physical properties.

- Alpha particles up to 42 MeV on ^{nat}Ti forTLA.
- Investigation of deuteron induced nuclear reactions on niobium.
- Investigation of ^{3}He-induced reactions on natural Ti for TLA.
- Excitation functions for reactions induced by deuterons (10-50 MeV) on natural Fe and Ti.
- TLA with alpha particles on Cu.
- Nuclear data for the $^{nat}Ti(p,x)^{48}V$ nuclear process.
- New data and evaluation of ^{3}He induced nuclear reaction on Cu.

2.4. Isomeric ratios

The investigation of the formation of isomeric pairs has special interest in basic studies of the mechanism of the nuclear reactions and of the nuclear structure. In the ongoing experiments significant information have been collected on the population of isomeric states, but the data evaluation and the model calculation are still in progress. The isomeric ratios have been measured for the following reactions:

Nb(α,xn)Tc
Mo(p,xn)Tc
Mo(d,xn)Tc
Kr(p,xn)Rb
Kr(d,xn)Rb
Pd(p,xn)Ag

Pt(p,x)Au
Pt(d,x)Au
W(p,x)Re
W(d,x)Re
Ta(α,xn)Re

3. Data compilation and evaluation

3.1. EXFOR compilations

In the frame of collaboration of the Nuclear Reaction Data Centers the following compilation were made with assistance of the IAEA NDS:

- 97 “short” entrees for CRP on medical radioisotopes
- 35 entrees mostly from ATOMKI and FZ Jülich

3.2. Charged particle cross-section database for medical radioisotope production: diagnostic radioisotopes

Medical application of nuclear technology is very important for every country. A project was started at 1996 with co-ordination of the IAEA to produce recommended cross-section data base for charged particle induced reactions relevant to production of radioisotopes used for medical diagnostic and for related reactions to monitor beam parameters. The database contains 86 reactions. In the reported period, two members ATOMKI group have been participated in the following work:

- Finalisation of the database.
- Preparation of the TECDOC.
- Preparation of the Web page.
- Updating and corrections.

3.3 Cross-section database for production of ^{103}Pd from Rh, ^{123,124}I from Te, ^{201}Tl from Tl

In the production process of medical radioisotopes the so called "targetry" plays very important role. For standardisation of high intensity solid targets a co-ordinated project was initiated by the IAEA: "Standardised High Current Targets for Production of Diagnostic and Therapeutic Radionuclides". The project deals with all aspects of the production of ^{103}Pd, ^{123,124}I and ^{201}Tl radioisotopes by using Rh, Te and Tl targets including yields, radionuclidic purities, and radiation dose from the targets and from the backings. The production requires reliable cross section database for the main and the unwanted parallel reactions taking place on realistic target composition. Compilation and evaluation have been started for the participating stable isotopes of targets and for the backing materials:

- About 40 proton and deuteron induced reactions on isotopes of Te.
- 2 reactions on Rh.
- 3 reactions on Tl.
- Reactions on Pt, Ir, Cu, Rh.

3.4. 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 of the elemental composition are required. The detailed measurements are very time consuming; therefore in most cases it is more fruitful to obtain the activity distribution with calculation and to perform checking and validation only at few points with more simple experiments. Unfortunately presently no evaluated cross section database exists for thin layer activation studies. In an earlier co-ordinated project a preliminary cross-section database was reported for TLA applications. In the database the reported calibration functions and integral yields are based on direct measurements and mostly on excitation functions obtained in the literature. We have found large disagreement in several cases between our recently measured integral yields and the data sets reported in the mentioned database. Therefore for practical use in the ATOMKI an independent database for TLA is under development by using evaluated cross section data. Presently it contains p, d, ^{3}He and alpha-particle induced reactions up to 30-40 MeV on the following elements:

Al, Ti, Fe, Ni, Cu, Zn, Zr, Nb, Mo, Rh, Pd, Cd, W, Ta, Pt

4. Methodology for measurements and application of nuclear data for practical purposes

At the Cyclotron Department in the ATOMKI the nuclear data measurement and the data evaluation is performed only in part time. The members of the department have an every day task in the field of routine radioisotope production for medical and other purposes, in irradiations for wear measurement and for charged particle activation analysis. In connection with the nuclear data measurements and with the application it was necessary to perform several methodical investigations:

4.1. Methodical investigations for nuclear data measurement

- Gas density reduction by using gas targets.
- Measurement of energy averaged cross section and integral yields by using thin targets.
- Determination of charged particle beam energy/intensity uncertainties at a multi-target irradiation.

4.2. Investigations in application of nuclear data

- Applications of small energy cyclotrons for thin layer activation technique.
- The use of cross section data for monitoring charged particle beam parameters.
- Accelerators used for routine production of PET radioisotopes.
- Determination of activation curves on the basis of excitation functions.

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Ukrainian Nuclear Data Centre

Status report to the NRDC Meeting on
the Network of Nuclear Reaction Data Centres
Paris, 27-30 May, 2002

O.O.Gritzay
Institute for Nuclear Research
Prospekt Nauky, 47, Kyiv, Ukraine, 03680

Introduction

UKRNDC is operating as the division of the Neutron Physics Department in the Institute for Nuclear Research of the National Academy of Sciences Ukraine. The staff is partly involved in the experimental investigations of neutron cross sections at Kyiv Research Reactor.

Compilation

We continue collection and compilation of new experimental data published in Ukrainian printed sources. As soon as they are ready, they are sent to NDS IAEA to be included to EXFOR library.

This year we started also the compilation of charge particle data works fulfilled in Ukraine. After last meeting in 2001 we prepared three entries 32207, 32208 and 32210.

Collaboration

- We continue our collaboration with Laboratory of Engineering Research and Technology, Slavutych (LERT) in scientific support of Slavutych Nuclear Data Bank and its users. In frame of this activity the teaching course "*The use of codes and special libraries FSX96, VITAMIN-B6, SNLRML, SINBAD-96 for nuclear-physical calculations"* (46 hours) was lectured at this laboratory in September 2001.

- The work under the joint project supported by Science and Technology Center of Ukraine (STCU Project #1648) *Development and support of Nuclear Data Base in Slavutych for decommissioning of Chornobyl NPP reactor units* has started since 1 April 2002. This work is foreseen for three years and this activity is very important for support our UKRNDC work. We are very much obliged to our collaborators, two of them are here: NNDC, USA and NDS, IAEA. Due to their strong support we can plan our activity for next years.

- The teaching course "*Nuclear Data for Science and Technology* "(72 hours) was lectured in 2001-2002 for graduate course students of Kyiv University, Physical Department. This course included the following items: ENDF/B libraries, EXROR system, ENSDF library, the use of PREPRO codes in the work with ENDF libraries, the introduction to NJOY94 (NJOY97) code system, the Network of Nuclear Data Centers and the use of on-line services.

Customer Services

- During 2001-2002 the data for users requests were prepared and adapted (from ENDF, ENSDF and EXFOR libraries, from the special library DAMSIG-84) for our institute researchers and for ones from other institutes (Kharkiv Institute of Physics and Technology, Kyiv National University, Institute of Physics, Kyiv).

- Reconstruction of UKRNDC site is now in progress and the first turn is now in operation. This is the help for our customers, especially for those who wish to prepare the pointwise and multigroup cross sections self-dependently, but do not have a good experience in it. Address: http:\\ ukrndc.kinr.kiev.ua\
  - Set of codes, which is proposed on our site, includes only a part of codes, developed by C.L. Dunford - Utility Codes (CHECKR, FIZCON, GETMAT, PSYCHE) and by D.E. Cullen - PREPRO2000 (LINEAR, RECENT, SIGMA1, GROUPIE) to work with evaluated nuclear data libraries. This choice was based on our experience of work with users - just these codes were in use the most frequently in our practice for users requests on codes and data from libraries. To facilitate the work with these codes we offer to users the short explanatory information in English and in Ukrainian. Of course, we cite address of sites with full sets of these codes.
  - To facilitate the task input file preparation for Cullen's codes LINEAR, RECENT, SIGMA1, GROUPIE we propose on our site the four small codes LIN0, REC0, SIG0, GROUP0.
  - For presentation of the ENDF formatted cross sections (MF=3), obtained after processing with any of codes LINEAR, RECENT, SIGMA1 or GROUPIE, in a table format we offer the PL_ORI code. This code can be used as a very simple and useful tools to prepare input file for the graphical package Microcal™Origin™ (see http://www/microcal.com), which is very wide used now in Ukraine.

Calculation

- The work on *Neutron Exitation Function Guide for Reactor Dosimetry (NEFGRD)* was fulfilled. This work was carried out in collaboration with the IAEA NDS staff member V.Zerkin. Now NEFGRD is in edition as INDC(UKR) report and is placed on IAEA NDS site. It is available for everybody as PDF-file at the address: http://www-nds.iaea.org/indc_sel.html.
- The calculations of absolute difference in cross sections weighted on Cf-252 and U-235 spectrum for different dosimetry and ENDF/B libraries have been done. Plots of these calculation results are prepared. This work is useful to facilitate the selection process for IRDF-2002 library.
- Special library, including total neutron cross sections of 65 nuclides, for modeling of neutron filters was prepared using ENDF/B-6 and JENDL-3.2. Some of this library files were used with the code FILTER_L for neutron spectra calculation of filters, existing in INR. The results are presented in: *"Neutron Filters at Kyiv Research Reactor", Gritzay O.O., Kolotyi V.V., Kaltchenko O.I., Reprint KINR-01-6, 2001, Kyiv* (see http://ukrndc.kinr.kiev.ua/public/)
- Analysis of self-shielding factors for Cr, Cr-52 and Ni, using all ENDF libraries was fulfilled at several energy ranges. These calculations were carried out with the code

complex DT_GRO, GROUPIE, SELF. The results were used to present the measured cross sections on Cr and Cr-52 samples and will be used in further investigations.
- We started the calculations of damage cross section based on ENDF libraries for reactor structure materials. These data are needed for NPPs operating in Ukraine.

For all calculations of the pointwise and group cross sections we used PREPRO and/or NJOY94/97 package codes.

Experimental Neutron Data Measurements

- The total neutron cross section of Cr and Cr-52 was measured at Kyiv Research Reactor using Neutron Filter Technique. The accuracy of measured cross sections was better than 1%, as it was requested 3% in *The NEA High Priority Nuclear Data List (1998).* These data for neutron energies 24 and 58 keV were compared with the data from ENDF libraries and presented to ND2001 Conference (Tsukuba, Japan).
- In 2002 this research was prolonged with a set of Cr and Cr-52 samples to investigate the self-shielding effects. These measurements were fulfilled for energies 24 and 58 keV, the results were presented to the Annual Institute Conference and now they are in progress for publication.

Future Plans

Experimental investigations

- To continue the study of the Cr and Cr-52 total neutron cross sections and self-shielding effects for different energies with high accuracy using Neutron Filter Technique (2, 12, 144 keV and other energies).
- The same investigations we plan to start for Ni-nat samples.
- To investigate the total neutron cross section in deep minimum of Mn-55 at 275 keV neutron energy. This minimum is unknown for all Mn-55 data, but it is well seen using Neutron Filter Technique.

Data analysis and calculation

- Analysis of ENDF libraries files for the main RBMK structural elements and comparing with the recent EXFOR and other experimental data with the purpose to develop the specialized library for MCNP code calculations of RBMK decommissioning. This work is planned in the framework of the STCU Project #1648.
- The other analysis of ENDF files is planned for MCNP library additional files for calculation of epithermal neutron source needed in BNCT. This work is supported with CRDF Project # UP2-2437-KV-02, to be started soon.
- We plan to intencify our work in EXFOR compilation also with charge particles and CINDA references by recruiting the young graduates from Kyiv University.

Visits and Conferences

- In October 7-12, 2001 O.Kaltchenko took part in the International Conference on Nuclear Data for Science and Technology (ND2001), with report on new experimental nuclear data on Cr and Cr-52.
- In December 18-21, 2001 L.Chervonna visited NDS IAEA as EXFOR compiler to take part in the consultancy visit "Compilation of the Latest Experimental Data Produced in the Ukraine in EXFOR Format"
- In March 2002 there was a short meeting in Kyiv with Jess Gehin, ORNL, Division of Computational Physics and Engineering, concerning our possible joint activity together with Slavutych Laboratory of Engineering and Technology on the problems of ChNPP decommissioning.

Center of Nuclear-Physics Data (CNPD) RFNC-VNIIEF. Status report to the IAEA Advisory Group Meeting, May 27-30, 2002.

S.A.Dunaeva

Russian Federal Nuclear Center - VNIIEF.
Russia, 607190,Sarov, Nizhnij Novgorod region, pr. Mira 37

Compilation.

CNPD continues to compile charged-particle reaction data. In the period from June 2001 to May 2002, 3 transmission tapes (TRANS F011, T009-T010) were sent containing new and corrected entries.

Experimental data compilation and checking have been made using the VMS operating system with the help of NNDC software and Windows operating system with the help of the own and CAJaD software.

Collaboration.

We worked in collaboration with the NNDC. CNPD digitizes data produced in the US and Canada for entries with mark "C" and "T".

As we reported at the last meeting we prepared a project to CRDF in collaboration with NNDC. The goal of the project is to review and evaluate alpha-induced cross sections for nuclei with $8 \le Z \le 32$ and $E_{c.m.} \le 20$ MeV. The results of our efforts are not clear up today. We hope on the best. NNDC and CPND presented the report about it at the International Conference “Nuclear data in the Science and Technology” that was held in Japan.

Now we prepared another project that we try to pass through ISTC. The objective of this project is to create an integrated relational base (IRBD) of data on nuclear reactions, to fill it with data from libraries EXFOR/CSISRS, NSR, specialized PNI library, science and engineering journals and other similar information sources. We plan to fulfill this work in collaboration with other Russian centers. We hope that NRDC meeting supports our effort and pleads with representatives of France and Japan for sending the official letters to their financial ISTC committees.

Software.

Now we develop new SaBa’s interface, extend the range of the nuclei (up to Fluorine) and include thermonuclear reaction rates calculations. The results of this work we presented in October 2001 at the International Conference in Japan (“Nuclear data in the Science and Technology”). CNPD plans to send it to the IAEA at the end of this year.

New software for digitizing curves is in progress. Unfortunately, there are a few mistakes in the old version.

The EXFOR data were input to the NDX system. Now NDX includes all international nuclear data libraries excluding NSR and CINDA.

Evaluation and experiments.

The evaluation and experiment activity was stimulated by participation of the CNPD staff in some international projects.

In 2001 the new ISTC project K-497 was started. It is financed by USA. The main goal of this project is to measure and calculate charged particles induced cross sections for the light nuclei including Fluorine. In the frame of this project:

- New $^{11}B(p,\gamma)$ reaction measurements were carried out at RFNC-VNIIEF. The results were reported on the International Conference in Japan ("Nuclear data in the Science and Technology").
- New $^{9}Be(p,\alpha_2)^{6}Li$ reaction measurements were made at the end of the last year. The results will be reported at the conference in Moscow in June 2002.
- CNPD plan to reevaluate the $^{9}Be(p, \gamma)^{10}B$ and $^{7}Be(p, \gamma)^{8}B$ reactions. The results will be published in the report.
- CNPD continues scanning the old journals. The goal of this scanning is to find all missed papers with the experimental results that are important for the goal of project.

Report to NRDC: Status of Nuclear Data Activity in Korea

Jonghwa Chang, KAERI/NDEL, May 2002

1. Staff of Nuclear Data Evaluation Laboratory (KAERI/NDEL)

KAERI/NDEL has 7 regular staffs and 1 consultant now, 4 staffs for nuclear data evaluation, 3 staffs and 1 full time consultant for data processing and benchmark. Two evaluators will be hired soon.

KAERI/NDEL is performing data evaluation, data processing, and data dissemination inside Korea. However, KAERI/NDEL is also supporting measurement activity in Korea through contract and collaboration.

2. Experimental Facility

Three nuclear data measurement facilities were built for capability of measurements.

2.1. Pohang Neutron Facility

Pohang Neutron Facility (PNF) was constructed in order to measure neutron cross sections. The characteristics of PNF is as follows;

Electron Linac
Energy: 60 – 75 MeV
Peak Current: 100 – 200 mA
Pulse Width: 1 – 2 us
Frequency: 10 Hz
Target: Ta
TOF: 11 m

Measurements on well known samples are undergoing to confirm performance for the facility.

2.2. 1.7 MV Tandem at Geoscince Institute

A tritium target was used to generate neutrons of energy 1 – 2.3 MeV with 2% energy spread. Standard gold capture measurement confirms the maximum neutron flux as 10^8 n/sec. This electrostatic accelerator is being improved to have a pulsing and double bunching system.

2.3. KAERI Hospital Cyclotron

A vacuum scattering chamber was installed at a cyclotron at Korea Cancer Hospital, MC-50. This scattering chamber was used to measure proton scattering cross section.

3. Measurements

Most data measurements were done at KURRI and TIT, Japan

3.1. Dy and Gd isotopes

Neutron cross sections of Dy isotopes was measured at KURRI linac and TIT peletron. For natural sample, total and capture cross section below 100 keV were measured at KURRI. For metalic samples of Dy-161, -162, -163, and -164, the capture below 100 keV were measured at KURRI and TIT. Capture measurement at 550 keV is planed on 2002 at TIT. Measurement for Gd isotopes, Gd-155, -156, -157, -158, and –160, were performed or undergoing.

3.2. Other nuclides at low energy

Total cross section of natural Hf was measured at KURRI. Capture cross section of Th was measured at JINR, Russia.

3.3. 1 ~ 2 MeV cross section

The total and capture cross sections of natural Cu and W were measured KIGAM neutron source. Final result is not published yet.

3.4. Proton cross section of C

The differential cross sections $C^{12}(p,p')$, $C^{12}(p,d)$, $C^{12}(p,\alpha)$, $C^{12}(p,He^3)$ were measured at 35 MeV. The experiment was carried at the KCCH vacuum scattering chamber. Energy spectrum at 45, 60, 75, 90 degrees were reported. Final result is not published yet.

4. Data Evaluation

4.1. Neutron Resonance Parameters

The resonance parameters for the fission nuclides are evaluated under collaboration with BNL/NNDC. The resolved resonance parameters, unresolved parameters, and the bound level parameters were evaluated. The Mughabghab compilation of 1981, many recent measurements, and new level density theory are adopted. The evaluated nuclides are Mo-95, Tc-99, Ru-101,Rh-103, Pd-105, Ag-109, I-129, Xe-131, Cs-133, Cs-135, Pr-141, Nd-143, Sm-147, Sm-149, Sm-150, Sm-151, Sm-152, Eu-153, Gd-155, Gd-157, Dy-160, Dy-161, Dy-162, Dy-153, and Dy-164. Almost all evaluations were contributed to ENDF/B-VI.

4.2. Neutron Cross Sections

Along with resonance parameter evaluation, higher energy part below 20 MeV were evaluated using EMPIRE-II under collabotation with BNL/NNDC.

4.3. Intermediate Energy Nuclear Data

Major efforts for the intermediate nuclear data above 20 MeV were to setup computation system and optical parameter search for various nuclides.

Another important work are on the soft rotator model study for the inelastic scattering cross section calculation of structure materials.

4.4. Charged Particle Data

Charged Particle Data including scattering cross sections were evaluated up to energy range of 60 MeV for the proton incident reactions of Al, Ti, Ni, Cu, Zn, Kr, Cd, Te, I, Xe, N, O, the deuteron incident reactions of Al, Ti, Fe, Ni, N, O, the He-3 incident reactions of Al, Ti, and the He-4 incident reactions of Al, Ti, Cu. The resulting library was published as KAERI report.

5. Data Service

NDEL/KAERI is providing an internet service targeting the people outside of nuclear data community. (http://atom.kaeri.re.kr/) A pointwise ENDF / MCNP library plotting web service was developed last year.

Appendix 4: Selected Working Papers

The working papers whose numbers are listed below in **bold** *are included in this report on the following pages. The other papers, or the memos of which they consist, are available from the IAEA Nuclear Data Section.*

WP 2002-1	Actions of previous meetings (2000, 2001) *see INDC(NDS)-427, pp.20-26, and INDC(NDS)-418, pp.26-31*
WP 2002-2	Dictionary Restructuring
WP 2002-3	Units for particle and product yields: *see memos CP-C/294, 286*
WP 2002-4	Page numbers for REFERENCE (CP-C/285)
WP 2002-5	Correlation quantities
WP 2002-6	4-momentum transfer and mom.distr.data: *see memos CP-C/295 and CP-D/330*
WP 2002-7	Several "straightforward" new quantities: *see memos CP-/C/291, 298, and CP-A/118*
WP 2002-8	Proposed data heading EN-CM-TOT (memo CP-A/121)
WP 2002-9	Proposed high energy quantities (memo CP-A/123)
WP 2002-10	Quantities proposed by JCPRG *(see memos CP-D/337, CP-E/004, 003)*
WP 2002-11	Use of nuclide codes in SF 7 (memo CP-C/302)
WP 2002-12	Redundant coding, new data heading PART-OUT
WP 2002-13	Clarifications on Product Yields and Thick Target Yields *(see memo CP-D/332)*
WP 2002-14	Clarifications on Polarization quantities *(see memo CP-D/320)*
WP 2002-15	New Legendre polynomial modifier proposed *(see CP-C/305)*
WP 2002-16	Zeros in error field (CP-C/306)
WP 2002-17	Multiple appearance of the first Reference in EXFOR
WP 2002-18 + Add.	EXFOR master file comparisons
WP 2002-19	Measures of Security at the NDS Open Area for EXFOR
WP 2002-20	New and revised entries received at NDS

WP 2002-21	EXFOR transmissions (NNDC)
WP 2002-22	CINDA Statistics (NNDC)
WP 2002-23	*see memo 4C-4/126 (reply to WPs 2002-15,16)*
WP 2002-24	CINDA batch exchange information (NDS)
WP 2002-25	Journal coverage for CINDA
WP 2002-26	EXFOR-relational as multi-platform database (V. Zerkin)
WP 2002-27	Completeness of EXFOR compil. as indexed in CINDA
WP 2002-28	**Future NRDC Cooperation on CINDA: see Appendix 9**
WP 2002-29	Comments and Recommendations of Working Groups 1-3 of the INDC Meeting, Vienna, 14-17 May 2002 *(see report on that meeting)*
WP 2002-30	SyGRD (System of Graph Reading) by JCPRG (H. Ohmi)
WP 2002-31	Development of Web Editor for Charged-Particle Nuclear Reaction Data (N. Otuka, H. Noto, A. Ohnishi, K. Kato)
WP 2002-32	The JEFF-3.0 General Purpose Library (A. Nouri)
WP 2002-33	NEA Data Bases
WP 2002-32	WebTrends (NEA web statistics)
WP 2002-35	NEA Computer Network (P. Nagel)

WP2002-2

Dictionary Restructuring

1. Single particle dictionary proposal, CP-C/287
2. Reform of Nuclides Dictionary 27, CP-C/303, CP-D/338, CP-C/301, CP-A/124

(Minor modifications by NDS are in ***bold italics***.)

NATIONAL NUCLEAR DATA CENTER
Bldg. 197D
Brookhaven National Laboratory
P. O. Box 5000
Upton, NY 11973-5000 U.S.A.

(*Internet*) "NNDC@BNL.GOV
Telephone: (516)344-2902
FAX: (516)344-2806

Memo CP-C/287

DATE: June 28, 2001
TO: Distribution
FROM: V. McLane
SUBJECT: Single particle dictionary proposal

As discussed at the NRDC Technical meeting, I am submitting the following proposal for the combining of the EXFOR particle dictionaries into one dictionary. (This proposal may look suspiciously like the current Archive Dictionaries).

Merge EXFOR dictionaries ***13 (for BIB keywords other than REACTION)***, 28 ***(incident particles)***, 29 ***(Product particles),*** and 33 ***(particle considered)*** into a complete particle dictionary: Dictionary 33. All codes that exist in any of the dictionaries will be included in the combined dictionary. Add allowed subfield flags (similar to Dictionary 27). The format of the dictionary would be as follows.

Dictionary 33: PARTICLES

Column		
	12-***15***	Allowed use flags
12		D: BIB keyword other than REACTION ***(PART-DET, RAD-DET, DECAY-DATA, DECAY-MON, EN-SEC)***
13	***2***:	REACTION SF2
14	***3***:	REACTION SF3
15	7:	REACTION SF7

NATIONAL NUCLEAR DATA CENTER

Bldg. 197D
Brookhaven National Laboratory
P. O. Box 5000
Upton, NY 11973-5000, U.S.A.

(Internet) nndc@bnl.gov

Telephone: (631)344-2902
FAX: (631)344-2806

Memo CP-C/303

DATE: May 3, 2002

TO: Distribution

FROM: V. McLane

SUBJECT: Modification of Dictionary 8 and 27
(Re: Memo CP-A/124, CP-C/301, and CP-D/388))

Regarding my statement in Memo CP-C/301, since we are at the point of reinventing our databases, it is good time to rethink the way we are doing many things. Maintaining Dictionary 27 in its present state is a duplication of the work done for the Nuclear Wallet Cards.

I propose to link the Nuclear Wallet Cards Database with the EXFOR system. This database is available to all and contains all the information needed to check on whether:

- a nuclide is known,
- it is stable,
- it has metastable states.

Other useful information contained in the Wallet Cards, such as half-life, could be used in the future for checking purposes. The Wallet Cards also contains the isotopic abundance for naturally occurring isotopes and the ground state spin and parity, which are needed for computation format programs.

If need be, we can reformat the Wallet Card Database to be more useful for the Network needs.

Distribution:
M. Chiba, Sapporo
F. E. Chukreev, CAJaD
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O. Gritzay, KINR
K. Kato, JCPDG
M. Kellett, NEADB
V. N. Manokhin, CJD
S. Maev, CJD
O. Schwerer, NDS
S. Takács, ATOMKI
F. T. Tárkányi, ATOMKI
V. Varlamov, CDFE
Zhuang Youxiang, CNDC
NNDC File

Memo CP-D/338

26 April 2002

From: O. Schwerer

To: Distribution

Subject: Modification of Dictionary 8 and 27
(Reply to Memos CP-C/301 and CP-A/124)

General remark: The dates on CP-C memos often appear incorrect. In this case, memo CP-C/301 is dated November 29, 2001 and is replying to memo CP-A/124 dated 14 April 2002.

Remarks on the proposed reform / elimination of the nuclide dictionary 27.

1) The basic idea of simplification is welcomed since it will not only reduce the number of error messages but also the work of the dictionary updates to be done at NDS.

2) In the reference to the description of the current dictionary 27 (obviously taken from the latest version of the NNDC EXFOR manual), I notice 2 inconsistencies:

   a) Col.15 (flag '3') - valid also for REACTION SF7: This is in contradiction with what the same manual says about REACTION SF7, "Particle Considered" (page 7.5), which says "Codes are taken form Dictionary 33". No nuclide codes from dictionary 27 are allowed in SF7. There are no such cases in the NDS or NNDC master file, and I do not remember a change of this rule.

   b) Col.17 - flag 'F' for fission product: not implemented, this flag does not exist in the file, and I do not remember a conclusion to this effect. It may be useful but it would be lost again with the new proposal.

3) I hesitate to get rid of the "Stable" flag. For DECAY-DATA it is good to check that no decay information is given for stable nuclei (except X-ray data). It is not clear to me what is meant in memo CP-C/301 by the sentence *"The nuclear structure databases would be used to check on whether a nuclide is stable or radioactive and whether s known isomer exists."* Who would do this check? A new EXFOR check program on the fly?
   I do not expect much change in the number of known stable isotopes, so I don't see the advantage of getting rid of this flag.

4) Presently in many cases, the range of nuclides in dict. 27 has one or more gaps. E.g., for Pa, we have isotopes 213-218 and then from 221 up, or Rn: 201-217 and 223. In some cases also the Chart of Nuclides has gaps in between isotopes of an element. If we want to keep some meaning to checking nuclides, we may have to allow more than 1 range of isotopes.

5) In CP-C/301, last line of item 2, "Columns 35-43": "SF3 or SF4" should read "SF2 or SF3". (In SF4, the nuclide codes must be used, not the particle codes.)

NATIONAL NUCLEAR DATA CENTER

Bldg. 197D
Brookhaven National Laboratory
P. O. Box 5000
Upton, NY 11973-5000, U.S.A.

(Internet) nndc@bnl.gov Telephone: (631)344-2902
FAX: (631)344-2806

Memo CP-C/301

DATE: April 18, 2002

TO: Distribution

FROM: V. McLane

SUBJECT: Modification of Dictionary 8 and 27
(Reply to Memo CP-A/124)

NNDC and NDS are currently in the process of evaluating links between the nuclear reaction and nuclear structure databases. Given the limitation on manpower, it seems illogical to duplicate the information stored in these databases. Therefore, I am making the following modification to the proposal of Memo CP-A/124.

1. Eliminate Dictionary 27, as proposed.

2. Modify the Dictionary 8, as follows:
   - Key: Z-symbol (A6)
   - Columns 1-3: integer Z (I3)
   - Columns 4-5: symbol (A2)
   - Columns 6-25: Element name (A20)
   - Columns 26-32: Range of known nuclei (I3,'-',I3)
   - Column 34: Natural mixture allowed flag (A1).
   - Column 35-43: Isotopes not used in SF3 or SF4 (3I3).

We would add 0-G and 0-NN to dictionary 8 (1-D and 1-T need not be added as they will not exist in the new CINDA system).

The Compound dictionary would be modified to eliminate the CMP and OXI codes which may be added to any nuclide. I am also suggesting adding stainless steel.

Distribution:
M. Chiba, Sapporo
F. E. Chukreev, CAJaD
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O. Gritzay, KINR
K. Kato, JCPDG
M. Kellett, NEADB
V. N. Manokhin, CJD
S. Maev, CJD
O. Schwerer, NDS
S. Takács, ATOMKI
F. T. Tárkányi, ATOMKI
V. Varlamov, CDFE
Zhuang Youxiang, CNDC
NNDC File

The nuclear structure databases would be used to check on whether a nuclide is stable or radioactive and whether s known isomer exists.

Examples of records in the reformatted dictionaries follow.

Dictionary 8 (Elements)

```
   0-G                  0G Gamma ray          0-  0    0
   0-NN                 0NNNeutron            1-  1    1
   1-H                  1H Hydrogen           1-  6 N  1  2  3
   2-HE                 2HEHelium             3- 10 N  3  4  6
   3-LI                 3LILithium            4- 12 N
   4-BE                 4BEBerylium           5 -14
   5-B                  5B Boron              7- 19 N
   6-C                  6C Carbon             8- 22 N
   7-N                  7N Nitrogen          10- 24 N
   8-O                  8O Oxygen            12- 26 N
   9-F                  9F Fluorine          14- 29
  10-NE                10NENeon              16- 32 N
  11-NA                11NASodium            18- 35
  12-MG                12MGMagnesium         20- 37 N
  13-AL                13ALAluminium         21- 40
  14-SI                14SISilicon           22- 42 N
  15-P                 15P Phosphorus        24- 46
  16-S                 16S Sulfur            26- 49 N
  17-CL                17CLChlorine          28- 51 N
  18-AR                18ARArgon             30- 53 N
  19-K                 19K Potassium         32- 54 N
  20-CA                20CACalcium           34- 56 N
```

Dictionary 9 (Compounds)

```
1-H-BNZ                Benzene             C6H6
1-H-CXX                Organic Compound
1-H-MTH                Methane             CH4
1-H-PFN                Paraffin)
1-H-PHL                Phenyl
1-H-PLE                Polyethylene
1-H-TXX                Tritium Compound
1-H-WTR                Water, Ice, Steam   H2O
7-N-AIR                Air
7-N-AMM                Ammonium Compound
26-FE-SS               Stainless Steel              (added)
40-ZR-ALY              Zircalloy
40-ZR-HYD              Zirconium Hydride
```

MEMO CP-A/124

14-Apr-2002

To: **Distribution**
From: **F.E. Chukreev**
Subject: **Modification of Dictionary 8 and Dictionary 27**
(Action A10 of last Technical Meeting)

The development experimental technique permits accelerate practically any nucleus. Now our science has possibility to accelerate radioactive projectiles and I believe, that irradiation radioactive targets by radioactive beams will be possible after some time. Consequently we will must add numerous corrections in 27-th Dictionary constantly. To exclude the corrections I propose to refuse from 27-th Dictionary and to modify 8-th Dictionary.

Let us see Columns 12-26 of the 27-th dictionary. My remarks for Manual page are shown by red color.

Columns 12-26 have the following structure:

Column 12 (*Parenthesis*

13-23 Each column contains either a flag or blank:

13 used for REACTION SF1 (SF2 0)

Any nuclide can be used as target in suitable accelerator. Therefore the label is not needed.

1 indicates validity,

X indicates a warning for unusual use.

14 used for REACTION SF2.

Any nuclide can be used as beam in suitable accelerator. Therefore the label is not needed too.

2 indicates validity.

15 used for REACTION SF3, REACTION SF4, REACTION SF7, plus other keywords which allow nuclide codes[8].

Z code is needed only. Subfields SF3 and SF4 can contain any nuclide

3 indicates validity,

V virtual (not yet found)

Z indicates validity except for those cases where the particle codes are used instead of the corresponding nuclide codes[1].

16 used for REACTION SF1 (SF2=0).

As I understand SF2=0 means radioactive decay. Consequently, any unstable nuclide must have the label.

[1] DECAY-DATA, DECAY-MON, EN-SEC, EMS-SEC, HALF-LIFE, MOM-SEC, PART-DET, RAD-DET

But 27-th dictionary has the label for little number of radioactive nuclides and some stable ones (N-15 and O-17, for example). If a label in 23-th column is absent, then radioactive decay is possible. Therefore the label is not needed too.

4 indicates validity.

17 used to indicate a fission product

If SF3=F, then SF4 is fission product. Therefore the label is not needed too.

F indicates validity.

(18-21 are presently unused)

22 used for CINDA

Is it needed for EXFOR?

C indicates validity,

T indicates validity for theoretical work only.

23 used to indicate a stable isotope. It is needed

S indicates stability.

24-25 isomer field:

The conception of "isomer" was extended in last years. I met isomers with half-life some nanoseconds in literature. Similar isomers can exist in any nuclide practically. Therefore the label is not needed too.

either blank, indicating that the nuclide has no isomeric states

or a number, right justified, indicating the maximum number of metastable states (*i.e.*, number of isomeric states not including the ground state).

or A, indicating one or more short-lived isomers (<1 sec.), but no long-lived isomers.

26) *parenthesis*

Conclusion: Only Z and S labels are needed now.

Therefore I would like to propose to use 8-th dictionary with a little modification only. Let us see one example. Today we have in 8-th Dictionary:

```
55-CS       (Cesium)
```

We can modify the record:

55-CS (Cesium) [S134, 112-151]

S134 means that 55-CS-134 is stable.

Cesium isotopes with mass 112-151 are known.

Second example:

```
1-H         (Hydrogen)
```

The record must be modified as

1-H (Hydrogen) [SZ1,SZ2,Z3,1-3].

SZ1 means that 1-H-1 is stable and P must be used in SF2 and SF3. Z3 means that tritium is radioactive nuclide and T must be used in SF2,SF3

Proposed modification of 8-th Dictionary will permit exclude 27-th Dictionary and numerous corrections of it.

Distribution:

OBLOZINSKY@BNL.GOV
VML@BNL.GOV
NORDBORG@NEA.FR
KELLETT@NEA.FR
MANOKHIN@IPPE.RSSI.RU

WP 2002-4

NATIONAL NUCLEAR DATA CENTER
Bldg. 197D
Brookhaven National Laboratory
P. O. Box 5000
Upton, NY 11973-5000 U.S.A.

(*Internet*) "NNDC@BNL.GOV

Telephone: (516)344-2902
FAX: (516)344-2806

Memo CP-C/285

DATE: June 14, 2001
TO: Distribution
FROM: V. McLane
SUBJECT: **Page numbers for reference**

I propose that we update the REFERENCE coding rules to allow page numbers with letters (e.g., 123c or L121). I am suspect the original restriction was placed on the page number because of CINDA. There seems to be no reason to continue with that restriction.

The Manual section would be updated as follows:

Page (paper #) subfield: If present, contains:

- the page number which may be numeric or may contain a number proceeded or followed by a letter, and/or
- the paper #, enclosed in parentheses, which may have any content, except commas or parentheses. If omitted, the following comma is also omitted.

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S. Takács, ATOMKI
F. T. Tárkányi, ATOMKI
V. Varlamov, CDFE
Zhuang Youxiang, CNDC
NNDC

WP 2002-5

Correlation Quantities

1. There was a consensus that all angular correlations are to be coded with SF6 = DA/CRL.

NDS requested (last year's Action A35) further clarification in LEXFOR about:
- general definition of angular correlation and difference to angular distribution of correlated particle pairs
- include examples with data units (NO-DIM vs. MB/SR ?)
- add definitions and examples of other correlations (MCO - lin. Momentum correlations, ECO - energy correlations)

2. New correlation quantities were proposed in 4C-4/122 but withdrawn after some discussion by e-mail:

PR,DE/COR,N/FF
PR,KE/COR,N/FF
PR,NU/COR,FF

CJD may want to submit a modified proposal.

WP 2002-8

MEMO CP-A/121

28 Feb 2002

To: **Distribution**
From: **F.E. Chukreev**
Subject: **Addition to Dictionary 24**

Add to dictionary 24

Some publications contains energy in C.-M. System as independent variable. The energy is sum of kinetic energy of incident projectile and target nucleus in C.-M. System.

The connection of the energies:

E(cm)=(M/(M+m))E(lab),

Where **M** – mass of target nucleus,
m – mass of projectile,
E(lab) – projectile energy in Lab-system.

A little index the publication, where E(cm) were used:

J,PL/B,462,237,99
J,NP/A,614,238,97
J,NP/A,645,13,99
J,NP/A,596,299,96
J,NP/A,635,305,98

The independent variable is suitable for astrophysical data. We have in Dictionary 24 now only:

EN-CM Incident Projectile Energy in C.M. System.

Therefore we would like to include special code for E(cm).

EN-CM-TOT Sum kinetic energies of projectile and target Nucleus in C.-M. System.

We can discuss the independent variable during to nearest meeting.

Distribution:

OBLOZINSKY@BNL.GOV
VML@BNL.GOV
NORDBORG@NEA.FR
KELLETT@NEA.FR
MANOKHIN@IPPE.RSSI.RU
MAEV@IPPE.RSSI.RU
FELIKS@POLYN.KIAE.SU
CHUKREEV@POLYN.KIAE.SU
DUNAEVA@EXPD.VNIIEF.RU
VARLAMOV@depni.NPI.MSU.SU
CHIBA@EARTH.SGU.AC.JP
KATO@NUCL.SCI.HOKUDAI.AC.JP
TENDOW@POSTMAN.RIKEN.GO.JP
YXZHUANG@IRIS.CIAE.AC.CN
TARKANYI@ATOMKI.HU
TAKACS-S@ATOMKI.HU
HASEGAWA@CRACKER.TOKAI.JAERI.GO.JP
VLASOV@KINR.KIEV.UA
KALTCHENKO@KINR.KIEV.UA
OGRITZAY@KINR.KIEV.UA

WP 2002-9

Proposed high energy quantities (ETA meson; process code TCC)

MEMO CP-A/123

03 Apr 2002

To: **Distribution**
From: **F.E. Chukreev, S. Babykina**
Subject: **Addition to Dictionaries**

Add to dictionary 13
ETA (Eta meson**)**

Add to dictionary 18
SRING (Storage ring)

The addition is needed to compile J, PRL, 77, 1230, 1996.

We have now ESTRG (Electron storage ring) only, but storage rings are using for different kinds of particles.

Add to dictionary 27
86-RN-199 (3)

Add to dictionary 29
ETA (Eta meson)
The addition is needed to compile ZP/A, 344, 345, 1993

Add to dictionary 30
TCC (Total charge changing)
The addition is needed to compile ZP/A, 352, 69, 1995 and another papers from GSI.

Add to dictionary 36
,DA/DE,ETA DAE (Double diff.cross section d2/dA/dE of ETA mesons)

Distribution:

OBLOZINSKY@BNL.GOV
VML@BNL.GOV
NORDBORG@NEA.FR
KELLETT@NEA.FR
MANOKHIN@IPPE.RSSI.RU
MAEV@IPPE.RSSI.RU
FELIKS@POLYN.KIAE.SU
CHUKREEV@POLYN.KIAE.SU
DUNAEVA@EXPD.VNIIEF.RU
VARLAMOV@depni.NPI.MSU.SU
CHIBA@EARTH.SGU.AC.JP
KATO@NUCL.SCI.HOKUDAI.AC.JP
TENDOW@POSTMAN.RIKEN.GO.JP
YXZHUANG@IRIS.CIAE.AC.CN
TARKANYI@ATOMKI.HU
TAKACS-S@ATOMKI.HU
HASEGAWA@CRACKER.TOKAI.JAERI.GO.JP
VLASOV@KINR.KIEV.UA
KALTCHENKO@KINR.KIEV.UA
OGRITZAY@KINR.KIEV.UA

Use of nuclide codes in SF 7

- Memo CP-C/302, and short note by NDS

- The memos CP-D/337 (included in WP 2002-10) and CP-D/338 (included in WP 2002-2) only mention that so far, nuclide codes were not allowed in SF 7.

NATIONAL NUCLEAR DATA CENTER

Bldg. 197D
Brookhaven National Laboratory
P. O. Box 5000
Upton, NY 11973-5000, U.S.A.

(Internet) nndc@bnl.gov

Telephone: (631)344-2902
FAX: (631)344-2806

Memo CP-C/302

DATE: May 2, 2002

TO: Distribution

FROM: V. McLane

SUBJECT: Particle Considered field

1. Use of Nuclide code in SF7 (Re: Memo CP-D/337, CP-D/338).

I believe it was agreed many years ago to allow codes from Dictionary 27 in SF7. This is necessary as we go to higher energies, most particularly for charged-particle data.

I have not had the time to go back and search all memos and NRDC Meeting minutes, but in memo CP-C/211 (the proposal for adding wild card flags to SF7 of Dictionary 36, September 1995), the following statement is given:

> - All codes from Dictionary 33 and those from Dictionary 27 which have a "3" or a "Z" in column 15.

I believe the agreement on the use of nuclides in SF7 came before this date. In any case, In any case, we should discuss this at the NRDC Meeting.

2. Particle considered code RCL

I propose to drop the code RCL from Dictionary 33, as suggested at the last technical meeting. I was unable to find any entries for this on the EXFOR library.

Notes by NDS (O. Schwerer):

- The proposal of CP-C/211 (of September 1995) was part of the proposal allowing wildcards for SF 7 in Dictionary 36, which was not yet put into force. So far there is not a single entry using it. If the nuclide is the same as SF 4, RSD (not RCL) can be used.
- I am not against introducing nuclide codes in SF 7 (update of LEXFOR page on REACTION SF 7 will be required). However, we soon may need continuation records for long REACTION strings.

WP 2002-12

Redundant coding, new data heading PART-OUT
CP-C/304, CP-A/122

NATIONAL NUCLEAR DATA CENTER
Bldg. 197D
Brookhaven National Laboratory
P. O. Box 5000
Upton, NY 11973-5000 U.S.A.

(*Internet*) "NNDC@BNL.GOV

Telephone: (631)344-2902
FAX: (631)344-2806

Memo CP-C/304

DATE: May 3, 2002
TO: Distribution
FROM: V. McLane
SUBJECT: Redundancies in EXFOR (Memo CP-C/259)

We have discussed redundancies in EXFOR at many of the recent NRDC meetings. In Memo CP-C/***259***, I made some proposals for clarification. *(Note by NDS: CP-C/259, dated 17 November 1999, was not received at NDS until 6 May 2002).* There is no mention of whether anything was decided at the NRDC in 2000, I will reiterate the following proposals.

1. Independent versus cumulative: In EXFOR, a defined cross section is assumed to be independent if no other indication is given.

   Proposal: The use of the code IND, in REACTION sub-field 5, is restricted to use with the codes F and X in SF3.

I have a code that will convert the affected entries.

2. Undefined reaction channels: Similarly, a reaction for which the reaction channel is undefined is coded using the process code X in sub-field 3. The use of UND was introduced for charged particles and was coupled to the number of protons and neutrons being given in sub-field 3. This led to the introduction of the variable number of emitted nucleons formalism in order to be able to use the variable nucleus formalism for multiple reaction products.

Distribution

M. Chiba, Sapporo
F. E. Chukreev, CaJaD
S. Dunaeva, Sarov
K. Kato, JCPDG
M. Kellett, NEADB
V. N. Manokhin, CJD
S. Maev, CJD
O. Schwerer, NDS

Proposals:

a.) Eliminate the use of the codes UND and DEF in REACTION sub-field 5. The code (DEF) will remain.

b.) Eliminate the use of a variable number of emitted nucleons, that is, the process codes XN and YP. XN have been used in about 60 subentries, where neutron emission data is given, i.e., they should be coded as (…,X)0-NN-1…..).

c.) Eliminate the data headings N-OUT and P-OUT. These have been used in only one entry, which could be easily recoded. (*There are new proposals for variable output particles*).

I volunteer to retrieve and convert the entries affected.

3. Experimental data code: Data with no code in REACTION SF9 is considered to be experimental. For charged-particle data, the code EXP was introduced for REACTION sub-field 9 as a positive indication that the data is experimental. This is not so serious, however, it may be confusing to users, who may think there is a difference between data coded in 2 different ways..

Proposal: Eliminate the use of the code EXP in REACTION sub-field 9.

MEMO CP-A/122

02 Apr 2002

To: **Distribution**
From: **F.E. Chukreev, S. Babykina**
Subject: **Action A38 of Technical Meeting 2001**

Addition to Dictionary 24

Add to dictionary 24

We suggest to input in Dic.24 new code-

PART-OUT (the number of emitted particles)

The development of experimental technique permits detects some particles simultaneously.

For example: In work of F.Goldenbaum et.al. “Heating of nuclei with energetic antiprotons”, published in Phys. Rev. Letters, v.77, p.1230, 1996, the authors measured the reaction cross sections in dependent from the number of outgoing particles (all hydrogen and helium isotopes). If we can use N-OUT and P-OUT for neutrons and protons, another particles request more common decision.

Therefore, we propose PART-OUT as new independent variable (the quantity emitting particles. SIG/DN could be used as measurement unit (see C24 of Technical Meeting 2001). Of course, under PART-DET we must indicate measured particles, obligatory.

Another similar publication:

1. PR/C,63,034616,2001
2. EPJ/A,8,197,2000
3. PL/B,472,15,2000.

In future we will have many publication produced on “Berlin ball”, where similar measurements are possible.

One example of EXFOR entry with PART-OUT is given in separate attachment.

```
ENTRY            O0939     020325                                   O093900000001
SUBENT        O0939001     020325                                   O093900100001
BIB                 11         41                                   O093900100002
TITLE       Heating of Nuclei with Energetic Antiprotons.           O093900100003
AUTHOR      (F.GOLDENBAUM, W.BOHNE, J.EADES, T.V.EGITY, P.FIGUERA, O093900100004
            H.FUCHS, J.GALIN, YE.S.GOLUBEVA, K.GULDA, D.HILSCHER,   O093900100005
            A.S.IIJINOV, U.JAHNKE, J.JASTRZEBSKI, W.KURCEWICZ,      O093900100006
            B.LOTT, M.MORJEAN, G.PAUSCH, A.PEGHAIRE, L.PIENKOWSKI, O093900100007
            D.POLSTER, S.PROSCHITZKI, B.QUEDNAU, H.ROSSNER,         O093900100008
            S.SCHMID, W.SCHMID, P.ZIEM)                             O093900100009
INSTITUTE   (2GERBER)                                               O093900100010
            (2ZZZCER)                                               O093900100011
            (2GERMUN)                                               O093900100012
            (2FR PAR)                                               O093900100013
            (4RUSJIA)                                               O093900100014
            (3POLWWA)                                               O093900100015
            (2GERDRE)                                               O093900100016
REFERENCE   (J,PRL,77,1230,96)                                      O093900100017
HISTORY     (020207C)                                               O093900100018
            (020325U) Last checking has been done.                  O093900100019
SAMPLE      Cu-Natural, Ho-165, Au-197 and U-238 Targets with       O093900100020
            Thicknesses of 1-2 Mg/Cm**2, were Used.                 O093900100021
ADD-RES     (COMP).Intranuclear Cascade Calculations.               O093900100022
DETECTOR    (SCIN) Antiprotons Triggered a Scintillator System      O093900100023
            Consisting of a Thin 2-Mm Start Detector Vetoed by      O093900100024
            An Annular Detector.                                    O093900100025
            (D4PI) The Reaction Products were Detected by Means of O093900100026
            Two 4Pi-Detectors Surrounding the Target-The So-Called O093900100027
            Berlin Neutron Ball (BNB), Containing at Its Center theO093900100028
            Berlin Silicon Ball (BSIB). The Bnb is a Spherical TankO093900100029
            With an Outer Diameter of 140-Cm and a Scintillator     O093900100030
            Volume of 1500 Liters, Housing a Reaction Chamber of 40O093900100031
            Cm Diameter at the Center of Which the Targets were     O093900100032
            Located. This Detector was Mainly Used For Counting     O093900100033
            Evaporationlike Neutrons in Each Reaction. Light-       O093900100034
            Particle (H+HE ISOTOPES), Intermediate Mass Fragments   O093900100035
            And Fission Fragments were Detected by the              O093900100036
            Bsib-Detector Composed of 158 Independent Silicon       O093900100037
            Detectors, 500 Mum Thick, Forming a 20-Cm Diameter      O093900100038
            Sphere. These Detectors Covered an Active Zone of AboutO093900100039
            90% of 4Pi-Detectors.                                   O093900100040
FACILITY    (ACCEL,2ZZZCER) Low-Energy Antiproton Ring (LERA)       O093900100041
METHOD      (TOF)                                                   O093900100042
STATUS      (CURVE).By CAJAD.                                       O093900100043
ENDBIB              41                                              O093900100044
COMMON               1          3                                   O093900100045
EN                                                                  O093900100046
GEV                                                                 O093900100047
       1.2                                                          O093900100048
ENDCOMMON            3                                              O093900100049
ENDSUBENT           48                                              O093900199999
SUBENT        O0939002     020325                                   O093900200001
BIB                  3          5                                   O093900200002
REACTION    (79-AU-197(AP,ABS),,SIG/DN,,,EXP)   Figure 2a          O093900200003
PART-DET    (P) And Another Hydrogen Isotopes                       O093900200004
            (HE3)                                                   O093900200005
            (A)                                                     O093900200006
ERR-ANALYS  (DATA-ERR).Data-Point Reader Uncertainty.               O093900200007
ENDBIB               5                                              O093900200008
COMMON               1          3                                   O093900200009
DATA-ERR                                                            O093900200010
MB                                                                  O093900200011
       1.1                                                          O093900200012
```

```
ENDCOMMON            3                                          O093900200013
DATA                 2         50                               O093900200014
PART-OUT   DATA                                                 O093900200015
NO-DIM     MB                                                   O093900200016
         1.        19.                                          O093900200017
         2.       23.8                                          O093900200018
         3.       24.6                                          O093900200019
         4.       24.7                                          O093900200020
         5.       24.8                                          O093900200021
         6.       24.8                                          O093900200022
         7.       24.9                                          O093900200023
         8.       28.1                                          O093900200024
         9.       28.9                                          O093900200025
        10.       29.8                                          O093900200026
        11.       32.2                                          O093900200027
        12.       35.4                                          O093900200028
        13.       37.9                                          O093900200029
        14.       41.1                                          O093900200030
        15.       44.3                                          O093900200031
        16.       45.9                                          O093900200032
        17.       49.9                                          O093900200033
        18.       53.9                                          O093900200034
        19.       56.3                                          O093900200035
        20.       60.3                                          O093900200036
        21.       63.6                                          O093900200037
        22.       67.6                                          O093900200038
        23.        66.                                          O093900200039
        24.       69.3                                          O093900200040
        25.       71.7                                          O093900200041
        26.       73.3                                          O093900200042
        27.       72.6                                          O093900200043
        28.       71.1                                          O093900200044
        29.       69.6                                          O093900200045
        30.       66.5                                          O093900200046
        31.       62.6                                          O093900200047
        32.        58.                                          O093900200048
        33.       51.7                                          O093900200049
        34.       45.8                                          O093900200050
        35.       39.3                                          O093900200051
        36.       33.8                                          O093900200052
        37.       28.4                                          O093900200053
        38.       21.5                                          O093900200054
        40.       15.9                                          O093900200055
        41.        12.                                          O093900200056
        42.        9.8                                          O093900200057
        43.        7.5                                          O093900200058
        44.        5.2                                          O093900200059
        45.        3.6                                          O093900200060
        46.        2.1                                          O093900200061
        47.        2.2                                          O093900200062
        48.        2.3                                          O093900200063
        49.        0.8                                          O093900200064
        50.        0.9                                          O093900200065
        51.        0.1                                          O093900200066
ENDDATA              52                                         O093900200067
ENDSUBENT            66                                         O093900299999
```

WP 2002-16

NATIONAL NUCLEAR DATA CENTER
Bldg. 197D
Brookhaven National Laboratory
P. O. Box 5000
Upton, NY 11973-5000 U.S.A.

(*Internet*) "NNDC@BNL.GOV

Telephone: (631)344-2902
FAX: (631)344-2806

Memo CP-C/306

DATE: May 9, 2002
TO: Distribution
FROM: V. McLane
SUBJECT: Zeros in error field.

At last year's NRDC Technical meeting in Vienna, there was a discussion on zero errors and some understanding that these should not be allowed in the EXFOR data entries (e.g., Chukreev's checking code marks them as errors). I cannot find any actions mentioning this, but would like to specifically allow the use of zeros in an error field.

We get many large electronic files directly from experimentalists; many of these have zero data errors. These files must then be edited to delete all such errors. It is obvious to all who use such data that the error is simply smaller than the number of digits given in the error field. In any case, any computer program processing these files will read the error as zero.

Distribution

M. Chiba, Sapporo
F. E. Chukreev, CaJaD
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M. Kellett, NEADB
V. N. Manokhin, CJD
S. Maev, CJD
O. Schwerer, NDS
S. Tak<cs, ATOMKI
F. T. Tárkányi, ATOMKI
Y. Tendow, RIKEN
V. Varlamov, CDFE
Zhuang Youxiang, CNDC

NNDC File

WP 2002-17

Multiple appearance of the first Reference in EXFOR

(NDS Master File, 02-May-2002, re old Action A30)

V.Zerkin to A30

It is understood that not all cases are duplications. E.g., report codes without page numbers appear as same reference while actually different papers are compiled; or, several entries were compiled from different lab reports, and then a final combined publication appeared which then became the first reference of all entries. All cases to be checked by the responsible centers. (O.S.)

Total: 267 Entries

ENTRY	ENTRY2	nA	nA2	Author	Author2	Debut	Debut2	Reference
10003	10004	3	3	R.B.Schwartz	R.B.Schwartz	10/17/69	10/20/69	R,NBS-MONO-138,197401
10003	10006	3	3	R.B.Schwartz	R.B.Schwartz	10/17/69	10/21/69	R,NBS-MONO-138,197401
10003	10069	3	3	R.B.Schwartz	R.B.Schwartz	10/17/69	8/11/71	R,NBS-MONO-138,197401
10287	10413	2	2	W.E.Kinney	W.E.Kinney	7/12/72	9/18/74	R,ORNL-4806,7401
10314	10545	4	4	M.C.Davis	M.C.Davis	10/15/74	10/14/75	J,ANE,5,569,78
10371	10533	5	5	G.A.Keyworth	G.A.Keyworth	5/28/74	8/11/75	J,PRL,31,1077,7310
10514	10860	4	4	J.Callerame	J.Callerame	11/11/75	2/22/79	J,PR/C,12,1428,7511
10572	10573	2	2	W.E.Kinney	W.E.Kinney	1/28/76	6/16/76	C,76LOWELL,2,1319,7607
10582	10584	3	2	J.K.Dickens	G.L.Morgan	10/23/78	11/4/76	J,NSE,62,515,7703
10597	10648	3	3	J.W.Behrens	J.W.Behrens	4/15/76	3/7/77	J,NSE,66,433,7806
10734	10749	1	1	J.W.Meadows	J.W.Meadows	4/4/78	6/7/78	J,NSE,68,360,7812
10770	12782	5	5	F.D.Mc Daniel	F.D.Mc Daniel	9/15/81	10/15/90	P,A-KTY-74/77,3,77
10770	12850	5	5	F.D.Mc Daniel	J.D.Brandenberger	9/15/81	10/17/90	P,A-KTY-74/77,3,77
11577	12238	2	1	L.G.Cook	A.P.Baerg	6/14/77	7/18/77	J,PR,90,1121,5306
11762	12636	4	4	R.G.Allen	R.G.Allen	7/31/76	7/11/78	J,PR,96,1297,5412
11769	13016	4	5	C.R.Baldock	J.Halperin	5/18/77	8/26/85	P,ORNL-3994,1,6609
11821	13052	2	2	J.Arnold	J.R.Arnold	7/31/76	11/9/87	J,JCP,15,703,47
11827	13662	1	1	H.E.Jackson	H.E.Jackson	7/6/77	11/10/97	J,PR,127,1687,6209
11921	12613	2	2	S.Katcoff	S.Katcoff	5/9/77	5/1/78	J,JIN,7,194,58
12074	21392	3	1	R.C.Block	R.C.Block	8/3/76	2/22/80	R,WASH-1048,71,6406
12086	13384	4	4	E.Melaika	E.A.Melaika	8/3/76	12/11/89	J,CJC,33,830,55
12106	13352	3	3	M.G.Inghram	M.G.Inghram	8/3/76	11/29/89	J,PR,79,271,5007
12267	12427	4	4	J.C.Connor	J.C.Connor	8/3/76	5/23/77	J,NSE,29,408,67
12696	13010	4	2	W.E.Tucker	T.C.Martin	5/31/85	6/27/85	P,ORO-2791-30,6908
12696	13006	4	4	W.E.Tucker	D.O.Nellis	5/31/85	6/11/85	P,ORO-2791-30,6908
12696	13002	4	3	W.E.Tucker	T.C.Martin	5/31/85	6/10/85	P,ORO-2791-30,6908
12696	13000	4	4	W.E.Tucker	P.S.Buchanan	5/31/85	6/5/85	P,ORO-2791-30,6908
12696	13009	4	1	W.E.Tucker	W.E.Tucker	5/31/85	6/27/85	P,ORO-2791-30,6908
12696	12698	4	1	W.E.Tucker	W.E.Tucker	5/31/85	6/3/85	P,ORO-2791-30,6908
12696	12699	4	4	W.E.Tucker	W.E.Tucker	5/31/85	6/4/85	P,ORO-2791-30,6908
12696	12697	4	4	W.E.Tucker	D.O.Nellis	5/31/85	5/30/85	P,ORO-2791-30,6908
12762	12796	3	3	A.B.Smith	A.B.Smith	9/15/82	12/22/82	J,NP/A,415,1,8403
12762	12805	3	3	A.B.Smith	A.B.Smith	9/15/82	2/17/83	J,NP/A,415,1,8403
12762	12801	3	2	A.B.Smith	A.B.Smith	9/15/82	2/17/83	J,NP/A,415,1,8403
12762	12795	3	3	A.B.Smith	C.Budtz-Jorgensen	9/15/82	12/22/82	J,NP/A,415,1,8403
12762	12802	3	3	A.B.Smith	A.B.Smith	9/15/82	2/17/83	J,NP/A,415,1,8403
12762	12803	3	2	A.B.Smith	A.B.Smith	9/15/82	2/17/83	J,NP/A,415,1,8403
12762	12804	3	3	A.B.Smith	A.B.Smith	9/15/82	2/17/83	J,NP/A,415,1,8403
12833	12906	3	3	R.Gwin	R.Gwin	8/29/83	10/9/84	J,NSE,87,381,8408
12898	12904	3	3	D.L.Smith	I.Kanno	8/30/84	10/18/84	J,ANE,11,623,8412
12931	13183	4	4	L.Robinson	L.Robinson	7/23/85	2/1/90	J,PR/C,31,1334,8504
13255	13445	2	2	G.P.Ford	G.P.Ford	6/28/89	1/11/90	R,LA-6129,7602
13255	13446	2	2	G.P.Ford	G.P.Ford	6/28/89	1/11/90	R,LA-6129,7602
13255	13448	2	2	G.P.Ford	G.P.Ford	6/28/89	1/17/90	R,LA-6129,7602

13255	13447	2	2	G.P.Ford	G.P.Ford	6/28/89	1/11/90	R,LA-6129,7602
13255	13443	2	2	G.P.Ford	G.P.Ford	6/28/89	1/11/90	R,LA-6129,7602
13255	13444	2	2	G.P.Ford	G.P.Ford	6/28/89	1/11/90	R,LA-6129,7602
13335	13478	10	10	D.M.Gilliam	D.M.Gilliam	10/24/89	10/23/89	S,NUREG/CP-0004,(3),1289,7710
13335	13479	10	10	D.M.Gilliam	D.M.Gilliam	10/24/89	10/23/89	S,NUREG/CP-0004,(3),1289,7710
13490	22142	9	8	I.Bergqvist	I.Bergqvist	5/23/91	9/5/90	J,NP/A,456,426,86
13639	22260	7	7	R.F.Casten	R.F.Casten	12/5/96	1/16/94	J,PL/B,297,19,92
20051	20192	1	2	E.Steinnes	A.Prosdocimi	11/5/70	10/5/72	J,JNE,21,373,6704
20118	20121	1	1	H.Tellier	H.Tellier	8/10/72	10/2/71	R,CEA-N-1459,7108
20148	20149	1	7	P.Ribon	P.Ribon	10/20/72	10/24/72	R,CEA-N-1149,6912
20432	20697	6	6	N.Yamamuro	N.Yamamuro	7/10/75	11/2/76	J,NST,15,637,7809
20547	20895	1	1	H.-U.Fabian	H.-U.Fabian	11/19/71	5/2/79	J,ZN/A,26,317,7102
20567	20570	5	3	I.Szabo	I.Szabo	5/30/72	3/3/76	C,76ANL,208,7606
20567	20569	5	5	I.Szabo	I.Szabo	5/30/72	6/8/71	C,76ANL,208,7606
20582	21017	1	2	A.Steyerl	A.Steyerl	6/24/76	8/10/79	J,ZP,250,166,7202
20726	30426	8	6	F.Poortmans	A.Lajtai	9/21/77	1/18/78	C,77KIEV,,7704
20801	20839	6	6	G.Haouat	G.Haouat	10/18/78	2/13/79	J,NSE,81,(4),491,8208
20801	21782	6	6	G.Haouat	G.Haouat	10/18/78	1/15/82	J,NSE,81,(4),491,8208
21012	21013	3	2	L.Koester	L.Koester	8/8/79	8/9/79	P,NEANDC(E)-182U,5,78,7704
21036	21278	1	1	P.A.Egelstaff	P.A.Egelstaff	7/13/79	1/18/80	R,AERE-N/R-1147,5304
21038	21366	1	2	P.A.Egelstaff	D.B.Gayther	7/13/79	2/19/80	J,PPS/A,70,51,5701
21069	60542	6	6	L.Colli	L.Colli	8/23/79	3/31/82	J,NC,7,400,5802
21073	61194	1	1	G.H.Stafford	G.H.Stafford	8/24/79	9/15/78	J,PPS/A,64,388,51
21177	61193	6	6	F.Merchez	F.Merchez	12/17/79	3/31/82	C,66PARIS,1,393,6610
21212	V0025	2	1	F.H.Froehner	F.Froehner	12/6/79	5/15/81	C,77GEEL,,138,7712
21284	61120	1	3	J.L.Leory	J.L.Leroy	1/24/80	3/31/82	J,JPR,24,826,6311
21343	21344	6	6	M.Bormann	M.Bormann	2/6/80	2/8/80	J,ZP,174,1,6302
21367	21815	4	4	T.C.Griffith	T.C.Griffith	2/19/80	8/3/82	J,PPS,71,305,58
21381	60832	4	4	M.A.Grace	M.A.Grace	2/14/80	3/31/82	J,PR,82,969,5106
21445	60817	3	3	J.F.Barry	J.F.Barry	2/28/80	3/31/82	J,PPS,78,801,61
21452	21455	10	10	P.Billaud	P.Billaud	3/3/80	3/6/80	C,58GENEVA,16,106,5809
21470	60795	5	3	D.Jowitt	H.Rose	3/25/80	3/31/82	J,PNE,3,242,59
21712	21723	4	4	H.N.Erten	H.N.Erten	1/16/81	1/19/81	J,NSE,79,(2),167,8110
21970	21998	4	9	R.Fischer	A.Brusegan	9/10/85	1/27/86	C,85SANTA,,85
22025	22077	6	6	N.Yabuta	M.Baba	11/26/86	8/2/88	C,88MITO,291,8805
22168	22249	16	1	R.Richter	R.Richter	2/1/91	7/9/93	J,NP/A,499,221,89
22186	22251	6	1	A.Takahashi	A.Takahashi	7/16/91	10/26/93	R,JAERI-M-90-220,9012
22219	30969	6	6	H.Maerten	H.Maerten	1/10/93	12/5/91	J,NSE,106,353,90
22304	41181	9	9	K.Merla	K.Merla	2/14/96	12/26/95	C,91JUELIC,,510,9105
22409	22410	3	3	D.Schmidt	D.Schmidt	9/21/98	10/2/98	C,97TRIEST,1,407,199705
22409	22411	3	2	D.Schmidt	D.Schmidt	9/21/98	10/8/98	C,97TRIEST,1,407,199705
22409	22412	3	3	D.Schmidt	D.Schmidt	9/21/98	10/14/98	C,97TRIEST,1,407,199705
30033	30119	2	2	J.Csikai	J.Csikai	9/3/70	2/25/71	J,AHP,23,87,6705
30067	30074	5	5	J.Csikai	J.Csikai	11/27/70	10/29/71	J,NP/A,95,229,6703
30083	30184	6	4	F.Cvelbar	F.Cvelbar	12/15/68	10/30/73	J,NIM,44,292,6610
30083	30185	6	4	F.Cvelbar	F.Cvelbar	12/15/68	10/30/72	J,NIM,44,292,6610
30086	30087	2	2	A.K.Chaubey	A.K.Chaubey	11/24/69	12/8/70	J,NP/A,117,545,6809
30103	30196	4	4	V.Valkovic	V.Valkovic	11/16/76	11/9/72	J,NP/A,98,305,6705
30104	30151	8	9	P.Decowski	P.Decowski	1/17/72	1/19/72	J,NP/A,204,121,7304
30114	78013	3	3	L.M.Spitz	L.M.Spitz	6/4/97	4/1/85	J,NP/A,121,655,6812
30116	30186	2	2	A.Pazsit	A.Pazsit	2/12/71	9/27/72	J,YF,15,412,7203
30222	30380	2	2	L.Gonzalez	L.Gonzalez	12/7/72	2/16/77	J,NP,72,218,6510
30385	30414	4	4	A.R.Del	A.R.Del	4/19/77	6/22/77	C,78HARWELL,426,7809
30389	30491	5	4	N.Lakshmana Das	N.Lakshmana Das	3/2/77	6/11/79	C,74BOMBAY,2,105,7410
30392	30484	3	3	L.Adamski	L.Adamski	6/2/77	5/11/79	J,ANE,7,(7),397,80
30392	30515	3	3	L.Adamski	L.Adamski	6/2/77	9/24/79	J,ANE,7,(7),397,80
30393	30429	6	6	M.J.Kenny	M.J.Kenny	5/6/77	2/23/78	R,AAEC/E-400,7701
30483	30523	5	5	Li Chi-Chou	Lu Han-Lin	5/11/79	11/16/79	R,INDC(CPR)-16,8908

30483	30595	5	4	Li Chi-Chou	Li Ji-Zhou	5/11/79	9/14/81	R,INDC(CPR)-16,8908
30483	30637	5	5	Li Chi-Chou	Lu Han-Lin	5/11/79	10/20/82	R,INDC(CPR)-16,8908
30483	30671	5	4	Li Chi-Chou	Lu Han-Lin	5/11/79	12/8/83	R,INDC(CPR)-16,8908
30483	30759	5	6	Li Chi-Chou	Ma Hongchang	5/11/79	11/9/87	R,INDC(CPR)-16,8908
30483	30724	5	3	Li Chi-Chou	Lu Hanlin	5/11/79	11/13/86	R,INDC(CPR)-16,8908
30483	30615	5	4	Li Chi-Chou	Lu Han-Lin	5/11/79	12/30/81	R,INDC(CPR)-16,8908
30483	30686	5	3	Li Chi-Chou	Zhao Wen-Rong	5/11/79	12/11/84	R,INDC(CPR)-16,8908
30483	30608	5	4	Li Chi-Chou	Huang Jian-Zhou	5/11/79	10/28/81	R,INDC(CPR)-16,8908
30483	30614	5	4	Li Chi-Chou	Huang Jian-Zhou	5/11/79	12/31/81	R,INDC(CPR)-16,8908
30537	V0021	1	1	Chou You-Pu	Zhou You-Pu	4/11/80	4/10/80	R,HSJ-77091,7810
30558	30706	11	13	R.Arlt	C.M.Herbach	10/23/80	12/10/85	J,IP,21,344,85
30558	30559	11	13	R.Arlt	R.Arlt	10/23/80	10/29/80	J,IP,21,344,85
30674	30675	5	5	A.Antov	A.Antov	4/9/84	4/10/84	J,BJP,10,(6),601,83
30687	V0041	4	4	Lu Han-Lin	Lu Han-Lin	12/11/84	12/12/84	J,CNP,6,(1),76,8402
30763	G0004	4	4	Hoang Dac Luc	Hoang Dac Luc	11/23/87	11/24/87	J,BJP,14,(2),152,8705
30774	78002	1	1	J.Janczyszyn	J.Janczyszyn	5/16/88	7/28/86	C,82ANTWER,,869,8209
30814	40702	10	7	S.Daroczy	N.V.Kornilov	11/4/85	5/12/85	J,AE,58,(2),128,8502
31007	65002	0	1		A.Fert	11/15/77	7/19/79	J,ACR,19,679,65
31465	31501	6	6	S.Hlavac	S.Hlavac	4/24/97	4/30/01	R,INDC(NDS)-412,12,199912
31465	31466	6	6	S.Hlavac	S.Hlavac	4/24/97	4/25/97	R,INDC(NDS)-412,12,199912
31467	70111	2	2	K.Alexander	K.Alexander	5/21/97	4/6/82	J,NP,32,482,62
31469	70350	1	1	A.Peil	A.Peil	5/21/97	4/6/82	J,NP,66,419,6505
31470	70400	4	4	K.F.Alexander	K.F.Alexander	5/21/97	6/21/78	J,NP/A,112,474,68
31471	70402	2	2	S.Latek	S.Latek	5/22/97	5/5/78	J,NKA,13,881,68
31472	70403	1	1	E.T.Jozefowitz	E.T.Jozefowitz	5/21/97	5/8/78	J,NKA,8,437,63
31473	78004	4	4	N.T.Kashukreev	N.T.Kashukreev	5/22/97	7/28/86	R,INDC(BUL)-4,7705
31474	78005	4	4	N.T.Kashukreev	N.T.Kashukreev	5/22/97	7/28/86	J,AE,42,373,7705
31475	78015	2	2	D.M.H.Chan	D.M.H.Chan	5/23/97	3/13/78	J,AUJ,24,671,7110
31477	78017	3	3	M.Ricabarra	M.Ricabarra	5/23/97	4/13/78	P,INDC(ARG)-8,73
32506	32528	5	5	Mu Yunshan	Mu Yunshan	10/12/90	6/12/91	J,CNP,10,(3),233,8808
40005	40327	5	5	V.A.Tolstikov	V.A.Tolstikov	7/8/70	1/17/76	J,AE,24,(6),576,6806
40036	40365	5	5	D.L.Broder	D.L.Broder	8/31/70	12/23/77	R,FEI-155,6904
40045	40249	5	5	M.V.Pasechnik	M.V.Pasechnic	8/22/70	10/16/74	J,UFZ,14,(11),1874,196911
40051	40072	4	4	T.S.Belanova	T.S.Belanova	3/26/81	7/22/71	J,AE,19,(1),3,6507
40102	40163	7	3	B.I.Fursov	B.M.Aleksandrov	12/4/73	5/21/73	J,AE,32,(2),178,7202
40337	40339	2	1	K.D.Zhuravlev	K.D.Zhuravlev	3/24/76	3/22/76	R,YK-19,3,7504
40468	40469	10	7	V.A.Anufriev	S.M.Kalebin	4/4/77	2/2/77	C,76LOWELL,,7607
40554	41086	10	10	A.N.Gudkov	A.N.Gudkov	7/20/79	12/6/91	C,77KIEV,3,192,7704
40721	40722	5	6	A.N.Davletshin	A.N.Davletshin	4/28/84	5/3/84	J,AE,58,(3),183,8503
40721	40723	5	5	A.N.Davletshin	A.N.Davletshin	4/28/84	5/3/84	J,AE,58,(3),183,8503
40721	40724	5	7	A.N.Davletshin	A.N.Davletshin	4/28/84	5/4/84	J,AE,58,(3),183,8503
41053	41067	6	6	N.V.Kornilov	N.V.Kornilov	6/26/91	4/13/92	J,YK,,(1),11,9004
41115	41180	4	4	E.F.Fomushkin	E.F.Fomushkin	4/8/93	2/5/96	C,91JUELIC,,439,199105
41202	41224	2	2	Yu.M.Kazarinov	Yu.M.Kazarinov	8/8/96	4/7/97	J,ZET,31,(2),169,5608
41240	41298	17	5	A.A.Filatenkov	A.A.Filatenkov	5/28/97	9/29/98	R,RI-252,199905
41303	41343	12	4	B.I.Fursov	B.I.Fursov	9/23/99	9/13/99	C,97TRIEST,1,488,199705
41351	41366	7	10	Yu.P.Popov	S.B.Borzakov	2/1/00	4/25/00	J,YF,63,(4),589,200004
61177	68013	3	3	R.Bass	R.Bass	3/31/82	8/29/86	P,EANDC(E)-57,1,6502
67010	68009	2	2	E.K.Sokolowski	E.K.Sokolowski	6/22/78	7/28/86	R,AE-351,6902
68014	68015	2	2	L.Koester	B.Leugers	7/31/86	8/1/86	P,EANDC(E)-157,46,72
A0133	T0131	8	7	C.J.Orth	C.J.Orth	6/28/82	11/21/00	J,JIN,38,13,1976
A0133	B0096	8	7	C.J.Orth	C.J.Orth	6/28/82	1/15/79	J,JIN,38,13,1976
A0138	D0044	4	4	C.Wasilevsky	C.Wasilevsky	8/10/82	3/15/83	J,RRL,50,(5),307,82
A0139	D0045	3	3	C.Wasilevsky	C.Wasilevsky	8/8/82	3/18/83	J,RRL,50,(4),211,82
A0161	R0002	4	4	A.M.J.Paans	A.M.J.Paans	1/4/82	1/31/84	J,ARI,27,465,76
A0174	C0391	3	3	F.E.Cecil	F.E.Cecil	2/3/83	12/7/00	J,NP/A,376,379,1982
A0175	R0023	3	3	H.Backhausen	H.Backhausen	1/7/83	9/18/85	J,RCA,29,1,81
A0186	T0157	4	4	T.J.Ruth	T.J.Ruth	6/28/83	6/7/01	J,ARI,31,51,1980

A0265	R0024	6	6	S.R.Wilkins	S.R.Wilkins	8/28/85	9/18/85	J,ARI,26,279,75
A0334	T0003	5	5	K.Murphy	K.Murphy	3/13/87	3/25/99	J,NP/A,355,1,1981
A0351	D4074	3	3	V.N.Aleksandrov	V.N.Aleksandrov	10/21/87	5/21/97	J,AE,62,411,87
A0394	D4041	3	3	F.Tarkanyi	F.Tarkanyi	10/29/88	10/25/95	J,RCA,43,185,88
A0569	D4070	10	10	N.G.Zaitseva	N.G.Zaitseva	2/6/97	5/14/97	J,ARI,41,177,90
A1241	T0051	5	5	T.K.Alexander	T.K.Alexander	8/17/87	10/7/00	J,NP/A,427,(3),526,198410
A1449	T0053	2	2	J.C.P.Heggie	J.C.P.Heggie	10/2/80	10/16/00	J,PL/B,43,289,197302
B0004	T0137	8	8	R.J.Silva	R.J.Silva	1/1/75	11/28/00	J,NP/A,216,97,1973
B0039	T0120	3	3	N.W.Golchert	N.W.Golchert	11/5/76	11/21/00	J,NP/A,152,419,1970
B0045	T0121	4	4	L.F.Hansen	L.F.Hansen	11/19/76	11/21/00	J,NP,30,389,1962
B0046	T0122	3	3	C.H.Johnson	C.H.Johnson	10/17/76	11/21/00	J,PR,109,1243,1958
B0062	T0123	4	4	G.H.Mccormick	G.H.Mccormick	8/9/77	11/21/00	J,JIN,2,269,1956
B0065	T0124	2	2	J.Wing	J.Wing	3/1/77	11/21/00	J,PR,128,280,1962
B0067	T0125	3	3	B.W.Shore	B.W.Shore	4/13/77	11/21/00	J,PR,123,276,1961
B0068	T0135	3	3	C.H.Johnson	C.H.Johnson	4/21/77	11/21/00	P,ORNL-2910,25,1960
B0080	T0127	2	2	J.Gonzalez-Vidal	J.Gonzalez-Vidal	11/4/77	11/21/00	J,PR,120,1354,1960
B0082	T0128	4	4	R.Holub	R.Holub	10/18/78	11/21/00	J,NP/A,288,291,1977
B0089	T0129	4	4	A.Fleury	A.Fleury	11/9/78	11/21/00	J,PR/C,7,1231,1973
B0122	T0196	4	4	C.M.Castaneda	C.M.Castaneda	2/27/80	1/4/02	J,PR/C,16,1437,1977
B0125	T0133	2	2	H.Vera Ruiz	H.Vera Ruiz	4/22/80	11/21/00	J,RCA,24,65,1977
B0136	C0671	5	5	J.L.Zyskind	J.L.Zyskind	5/1/80	6/12/00	J,NP/A,301,179,1978
B0168	T0148	4	4	M.C.Lagunas-	M.C.Lagunas-Solar	8/19/80	2/7/01	J,ARI,29,159,1978
C0049	C0193	2	2	J.A.Davies	J.A.Davies	2/28/96	11/2/98	J,NIM,168,611,1980
C0061	C0382	4	4	L.Valentin	L.Valentin	2/14/80	3/4/96	J,PL,7,163,63
C0072	P0018	2	2	E.M.Franz	E.M.Franz	9/15/99	6/20/83	J,NP,76,123,1966
C0073	C0744	15	16	B.Aas	B.Aas	4/22/99	11/29/00	J,NP/A,460,675,1986
C0081	O0269	17	17	D.A.Hutcheon	D.A.Hutcheon	2/3/99	10/23/96	J,NP/A,483,429,1988
C0130	P0007	2	2	J.L.Need	J.L.Need	9/15/99	6/20/83	J,PR,129,1298,1963
C0158	C0450	6	6	S.J.Yennello	S.J.Yannello	8/5/97	4/25/97	J,PR/C,41,79,199001
C0165	C0527	8	8	B.G.Glagola	B.G.Glagola	9/1/98	6/29/99	J,PR/C,25,34,198201
C0166	C0433	13	13	K.E.Rehm	K.E.Rehm	9/2/98	10/22/96	J,PR/C,53,1950,199604
C0169	O0099	7	7	W.B.Amian	W.B.Amian	9/11/98	4/12/95	J,NSE,115,1,1993
C0170	O0101	7	7	W.B.Amian	W.B.Amian	9/11/98	4/19/95	J,NSE,112,78,1992
C0203	C0559	9	9	M.A.Pickar	M.A.Pickar	2/9/87	8/20/99	J,PR/C,35,37,198701
C0306	T0115	6	6	J.Jastrzebski	J.Jastrzebski	1/15/88	4/19/00	J,PR/C,34,60,198607
C0319	C0526	3	3	N.Jarmie	N.Jarmie	2/1/88	6/28/99	J,PR/C,29,2031,198406
C0463	C0812	10	10	J.D`auria	J.D`auria	2/16/99	5/17/01	J,PR/C,30,1999,198412
C0468	P0140	1	1	R.D.Macfarlane	R.D.Macfarlane	3/8/99	6/20/83	J,PR/B,136,941,196411
C0482	P0054	2	2	Hsin-Min Kuan	Hsin-Min Kuan	4/13/99	6/20/83	J,NP,51,518,1964
C0502	T0039	4	4	B.W.Filippone	B.W.Filippone	9/25/97	4/9/99	J,PR/C,28,2222,198312
C0502	F0219	4	4	B.W.Filippone	B.W.Filippone	9/25/97	1/25/85	J,PR/C,28,2222,198312
C0502	C0629	4	4	B.W.Filippone	B.W.Filippone	9/25/97	4/6/00	J,PR/C,28,2222,198312
C0506	D4092	5	5	F.Szelecsenyi	F.Szelecsenyi	9/26/98	4/23/01	J,ARI,49,1005,1998
C0555	T0105	6	6	A.J.T.Jull	A.J.T.Jull	8/12/99	7/8/99	J,GCA,62,3025,1998
C0571	P0004	1	1	T.Sikkeland	T.Sikkeland	9/16/99	6/20/83	J,PR/B,135,669,1964
C0631	F0158	3	3	G.Weber	G.Weber	4/6/00	8/29/84	J,PR,104,1307,195612
C0632	F0313	3	3	J.A.Neuendorffer	J.A.Neuendorffer	4/6/00	6/19/86	J,PR,82,75,195104
C0639	C0662	9	9	M.L.Barlett	M.L.Barlett	4/19/00	6/30/00	J,PR/C,30,279,198407
C0695	P0023	2	2	R.G.Thomas	R.G.Thomas	8/9/00	8/8/00	J,PR,159,1022,1967
C0696	P0024	2	2	R.G.Thomas	R.G.Thomas	8/9/00	8/8/00	J,NP/A,106,323,1968
C0697	P0040	2	2	D.L.Morrison	D.L.Morrison	8/9/00	3/20/82	J,PR,127,1731,1962
C0706	P0079	2	2	M.Blann	M.Blann	8/14/00	6/20/83	J,NP,52,673,1964
C0707	P0087	4	4	H.G.Hicks	H.G.Hicks	8/14/00	6/20/83	J,PR,128,700,1962
C0708	P0088	2	2	V.E.Viola	V.E.Viola	8/14/00	6/20/83	J,PR,128,767,1962
C0716	P0104	3	3	A.Ewart	A.Ewart	8/15/00	6/20/83	J,NP,69,625,1965
C0719	P0113	3	3	R.M.Lessler	R.M.Lessler	8/15/00	6/20/83	J,NP,81,401,1966
C0720	P0118	2	2	R.V.Carlson	R.V.Carlson	8/15/00	6/20/83	J,NP,102,161,1967
C0721	P0126	2	3	Y.W.Yu	Yu.-Wen	8/16/00	6/20/83	J,PR,170,1131,1968

C0722	P0083	1	1	R.L.Andelin	R.L.Andelin	8/14/00	6/20/83	J,JIN,26,1117,1964
C0724	P0135	3	3	M.Blann	M.Blann	8/17/00	6/20/83	J,PR,133,700,1964
C0726	P0143	2	2	M.Kaplan	M.Kaplan	8/18/00	6/20/83	J,PR,148,1123,1966
C0774	P0025	3	3	C.H.Johnson	C.H.Johnson	1/22/01	6/20/83	J,NP/A,107,21,1968
C0841	O0141	10	10	A.M.Kalend	A.M.Kalend	8/6/01	6/21/95	J,PR/C,28,105,1983
C0846	F0160	1	1	F.S.Mozer	F.S.Mozer	12/6/01	6/27/84	J,PR,104,1386,195612
D0047	D0048	2	2	D.West	D.West	11/29/83	12/1/83	R,AERE-R-10502,8206
D4039	R0010	4	4	V.R.Casella	V.R.Casella	10/10/95	1/31/84	J,RCA,25,17,78
D4083	D4091	8	8	F.Szelecsenyi	F.Ditroi	4/10/01	3/18/01	J,NIM/B,174,47,2001
E0691	E1456	7	7	H.Ohnuma	H.Ohnuma	10/19/88	4/28/95	J,PL/B,112,206,82
E0769	E1458	7	7	H.Orihara	H.Orihara	10/19/88	4/28/95	J,PL/B,106,171,81
E0776	E1454	7	7	H.Orihara	H.Orihara	10/20/88	4/28/95	J,PRL,49,1318,82
E0780	E1441	8	8	M.Fujiwara	M.Fujiwara	10/20/88	4/25/95	J,NP/A,410,137,83
E0835	E0868	12	10	K.A.Snover	K.A.Snover	10/25/88	9/13/90	J,PR/C,27,493,83
E0928	O0051	10	10	K.Hosono	K.Hosono	10/25/88	11/2/94	J,PR/C,30,746,84
E1144	E1379	11	11	H.Ohnuma	H.Ohnuma	9/13/90	10/25/94	J,NP/A,448,205,85
E1145	E1412	19	18	H.Ohnuma	H.Ohnuma	9/13/90	10/18/94	J,NP/A,456,61,86
E1187	E1424	6	6	H.Orihara	H.Orihara	8/1/89	10/18/94	J,NP/A,403,317,83
E1258	E1359	12	12	S.Kubono	S.Kubono	8/14/91	10/4/94	J,ZP/A,331,359,88
E1317	O0061	19	19	H.Ohnuma	H.Ohnuma	10/11/94	11/10/94	J,NP/A,514,273,90
E1365	O0230	4	4	M.Kurokawa	M.Kurokawa	10/4/94	8/30/96	J,NP/A,470,377,87
E1436	O0031	7	7	K.Maeda	K.Maeda	10/18/94	10/20/94	J,NP/A,403,1,83
E1442	O0201	8	8	Y.Fujita	Y.Fujita	4/28/95	4/23/96	J,PR/C,40,1595,89
E1568	O0087	10	10	M.Matoba	M.Matoba	5/1/98	3/1/95	J,NP/A,581,21,1995
F0035	T0032	5	5	A.J.Elwyn	A.J.Elwyn	9/28/83	4/7/99	J,PR/C,25,2168,198205
F0036	T0033	5	5	B.W.Filippone	B.W.Filippone	10/11/83	4/7/99	J,PR/C,25,2174,198205
F0213	T0038	5	5	M.T.Collins	M.T.Collins	12/3/84	4/9/99	J,PR/C,26,332,198208
F0239	T0040	5	5	F.D.Becchetti	F.D.Becchetti	2/28/85	5/7/99	J,PR/C,24,2401,198112
F0245	T0041	5	5	K.Ramavataram	K.Ramavataram	7/16/85	4/9/99	J,NC/A,58,342,198008
F0259	T0043	5	5	J.Pouliot	J.Pouliot	4/8/85	4/9/99	J,CJP,61,1609,198312
G0007	G0013	2	2	R.P.Rassool	R.P.Rassool	1/24/90	2/5/92	J,PR/C,39,(4),1631,8904
L0043	M0364	7	7	P.Carlos	P.Carlos	12/6/89	2/23/94	J,NP/A,258,365,76
L0044	M0362	4	4	U.Kneissl	U.Kneissl	12/7/89	4/21/93	J,NP/A,264,30,76
M0026	M0239	2	2	L.Z.Dzhilavyan	L.Z.Dzhilavyan	12/1/80	3/21/90	J,YF,30,294,79
M0368	M0415	6	6	P.Carlos	P.Carlos	4/21/93	2/18/91	J,NP/A,378,317,82
M0395	M0499	4	4	H.Ferdinande	H.Ferdinande	4/8/89	2/18/91	J,CJP,55,428,77
O0057	T0100	5	5	R.H.Mccamis	R.H.Mccamis	11/4/94	7/8/99	J,CJP,64,685,1986
O0301	T0101	8	8	A.Nadasen	A.Nadasen	10/4/94	7/8/99	J,PR/C,23,1023,198103
O0385	T0103	6	6	G.M.Crawley	G.M.Crawley	6/25/97	7/8/99	J,PR/C,23,1818,1981
O0390	T0102	12	12	E.T.Baker	F.T.Baker	6/25/97	7/8/99	J,NP/A,393,283,1983
P0001	T0010	2	2	J.H.Gibbons	J.H.Gibbons	3/5/98	10/11/99	J,PR,114,571,1959
P0001	P0055	2	2	J.H.Gibbons	J.H.Gibbons	3/5/98	6/20/83	J,PR,114,571,1959
P0015	T0030	4	4	K.K.Harris	K.K.Harris	6/20/83	9/15/99	J,NIM,33,257,1965
P0044	T0012	3	3	G.B.Chadwick	G.B.Chadwick	6/20/83	4/14/99	J,CJP,34,381,1956
P0081	P0122	2	2	D.R.F.Cochran	D.R.F.Cochran	3/6/98	6/20/83	J,PR,128,1281,1962
S0003	S0005	8	10	Mao Zhenlin	Jiang Chenglie	3/27/85	4/26/85	C,72LANZH,,3,72
T0132	T0139	5	5	C.H.Johnson	C.H.Johnson	11/21/00	1/22/01	J,PR/C,15,196,197701
V0002	V0003	3	3	A.A.Lapenas	A.A.Lapenas	11/27/75	11/28/75	B,LAPENAS,75

WP 2002-18

EXFOR master file comparisons

NNDC and NDS will compare their master files with a view to unify them. The exercise was started by comparison runs by V. Zerkin at NDS (see below).
These two related papers (originally attached to this WP) are available from NDS:

- An analysis by O.Schwerer (December 2001) of what differences can be expected
- Memo CP-M/16 by V.V. Varlamov on errors found when comparing the CDFE with NNDC and NDS master files.

Welcome to pilot project "Merge NDS and NNDC EXFOR Libraries"

V. Zerkin

Introduction
For some reasons NDS and NNDC have slightly different EXFOR data libraries. The project aiming to merge the data was initiated by P.Oblozinsky (NNDC) in 2001 and supported by V.McLane (NNDC), V.Pronyaev and O.Schwerer (NDS). First stage of the project is comparison of EXFOR Master files between NDS and NNDC. Software for this comparison as well as this page was created by V.Zerkin with consultancy of O.Schwerer. MySQL/Linux version of EXFOR-Relational was used for data manipulations. Next stage of the project will be done mainly by V.McLane and O.Schwerer.

Comparison NDS and NNDC EXFOR Master files
1) Missing Entries, Subentries, 09-May-2002
2) Different REACTION codes, 09-May-2002
3) Different N1*N2 in DATA section, 09-May-2002
4) Difference in coded information (to be done?)

Summary of comparison [1)]

Parameter	*NDS*	*NNDC*	*Entries*	*Comment*
Total ENTRY	12,717	12,690		
Total SUBENT	82,147	81,869		SUBENT.001 not included
Exclusive ENTRY [2)]	40	13	53	
Exclusive SUBENT	111	86	70	excluding Subentries from [2)]
Different REACTION codes	2,416		288	excluding ", EXP"
Different N1*N2 in DATA section	482		211	

1) *Note.* *NDS and NNDC Master files were taken at 02-May-2002; Deleted & Superseded data are not included*

See also: EXFOR/NDS: Entries with the same 1-st reference, related to EXFOR errors problem, May-2001

EXFOR Master File Comparison and Unification - Addendum to WP 2002-18

V. McLane and O. Schwerer

All centers are invited to submit their area's master file to NDS (V. Zerkin) for the comparison. This could be important with a view to find data sets which might be missing in both the NDS and NNDC master files.

NDS (V. Zerkin) will run his comparison software comparing these files against the NDS master file.

All centers may submit lists of (other centers') known uncorrected errors to NDS.

NDS will attempt to correct all files with help from other volunteer centers.

As far as practical, additional items may be included in the comparison software (e.g. Data Units, numerical values in tables)

WP 2002-19

Measures of Security at the NDS Open Area for EXFOR

L. Costello, 23 April 2002

v2 – 23-April-2002

The following is intended to replace NDSOPEN - TRANS.

New account created on NDSALPHA.IAEA.ORG for the EXFOR TRANS area.
Username: NDSX4. (password optional)

User NDSX4 has access by remote FTP only.

Account is located on node NDSALPHA, disk/directory UD1:[NDSX4]

The NDSOPEN EXFOR TRANS directory tree structure will be migrated to UD1:[NDSX4]. Permissions and access rules will be applied as follows:

The owner of this directory, all subdirectories and files is user NDSX4.

User NDSX4 can ‘put’ and ‘get’ files by FTP only, cannot modify, delete or overwrite in any way. If the sender wishes to update a particular file then they will have to ‘put’ it again. The new file will take the next highest version number, the old file will remain untouched.

The NDSX4 directory and files are managed by the holder of the XMAN token. Current holder is user SCHWERER. XMAN has full access to all files in the directory tree.

New and revised entries / subentries received at NDS since the last NRDC meeting (Update of CP-D/335)

Date: 17 May 2002

TRANS	TRANS-Flag	Entr-Tot	Entr-New	Entr-Rev	DSub-Tot	DSub-New	DSub-Rev
NNDC							
Area 1							
	1295	16	6	10	32	16	16
	1296	9	5	4	30	18	12
	1297	13	9	4	63	46	17
	1298	5	3	2	16	12	4
	1299	6	5	1	22	20	2
	1300	12	11	1	26	25	1
	1301	22	0	22	109	3	106
	1302	9	0	9	69	0	69
	1303	23	0	23	109	0	109
	1304	18	11	7	63	43	20
	1305	13	10	3	46	26	20
Sum		146	60	86	585	209	376
Area C							
	C050 Final	18	15	3	48	42	6
	C051	21	12	9	54	46	8
	C052	19	14	5	69	65	4
	C053	20	16	4	139	131	8
	C054	23	18	5	54	48	6
	C055	45	1	44	144	6	138
Sum		146	76	70	508	338	170
NEA-DB							
Area 2							
Last submission: March 2001							
Area O							
	O009 Final	57	57	0	192	192	0
	O010 Final	65	0	65	636	1	635
Sum		122	57	65	828	193	635

TRANS	TRANS-Flag	Entr-Tot	Entr-New	Entr-Rev	DSub-Tot	DSub-New	DSub-Rev
NDS							
Area 3							
3108	Final	12	6	6	28	16	12
3109		15	9	6	64	23	41
3110	Prelim.	11	8	3	78	33	45
Sum		38	23	15	170	72	98
NDS + ATOMKI							
Area D							
D023		19	14	5	63	49	14
D024		6	6	0	64	64	0
Sum		25	20	5	127	113	14
CJD							
Area 4							
4123	Final	85	1	84	561	14	547
4124		75	1	74	652	8	644
4125		15	4	11	253	22	231
4126	Prelim.	30	11	19	129	69	60
Sum		205	17	188	1595	113	1482
CAJAD							
Area A							
A049	Final	17	14	3	2107	2107	0
A050		28	13	15	133	100	33
A051		27	4	23	78	76	2
A052	Prelim.	43	14	29	985	667	318
Sum		115	45	70	3303	2950	353
Area B (old Muenzel file)							
B018	Final	180	0	180	1278	37	1241
B019	Prelim.	19	0	19	38	2	36
Sum		199	0	199	1316	39	1277

TRANS	TRANS-Flag	Entr-Tot	Entr-New	Entr-Rev	DSub-Tot	DSub-New	DSub-Rev
JCPRG							
Area E							
	E019 Final	12	12	0	212	212	0
CNPD-VNIIEF							
Area F							
Last submission: November 2000							
CNPD-VNIIEF + NNDC							
Area T							
	T009	21	20	1	97	95	2
	T010	16	13	3	62	59	3
Sum		37	33	4	159	154	5
CDFE							
Area M							
	M030 Final	21	13	8	149	95	54
	M031	22	11	11	178	54	124
Sum		43	24	19	327	149	178

CNDC

Neutron data: in area 3, last entries in TRANS 3109

Area S
Last submission: January 2000

Notes:

Final = Preliminary version received before, final version after last NRDC meeting
Prelim. = So far only preliminary version received

Dsub = Data subentries (excluding subentry 1 and NOSUBENT)

EXFOR Transmissions (May 2001 - April 2002)

Only final transmissions are counted in statistics

Tape	Prelim sent	Final sent	# Recs.	# Refs.	# Sets	# New Sets	#Recs./Set	Sets added	Points added
Area 1 (neutron)									NNDC
1295	20010711	20010815	50622	16	49	21			
1296	20010726	20011023	78827	8	41	18			
1297	20010913	20011023	76206	13	76	46			
1298	20010913	20011024	119691	5	21	12			
1299	20011024	20011127	112996	6	28	20			
1300	20011130	20011227	37264	12	40	25			
1301	20011204	20011227	52075	22	132	4			
1302	20011204	20011227	66173	9	98	0			
1303	20020102	20020213	52364	23	167	0			
1304	20020213	20020402	47153	18	24	47			
1305	20020409								
Area 1 Total			**693371**	**132**	**676**	**193**	**1025.7**		
Area C (charged particle)									NNDC
C050	20010518	20010628	10434	18	66	42			
C051	20010628	20010815	50622	22	76	46			
C052	20010726	20011024	40910	19	95	66			
C053	20011025	20011127	13548	20	159	131			
C054	20011218	20020214	5791	23	77	48			
C055	20020214	20020402	7474	45	189	11			
Area C Total			**128779**	**147**	**662**	**344**	**194.5**		
Area T (charged particles - originally compiled by another center)									NNDC
T008	20010402	20010514	9970	26	263	237			
T009	20010829	20020102	7681	21	118	95			

T010	20020215	20020402	10512	16	78	59			
Area T Total			**28163**	**63**	**459**	**391**	**61.4**		
NNDC Total			**850313**	**342**	**1797**	**928**	**547.8**		
Tape	**Prelim sent**	**Final sent**	**# Recs.**	**# Refs.**	**# Sets**	**# New Sets**	**#Recs./set**	**Sets added**	**Points added**
Area 2 (neutron)									NEADB
Area 2 Total			**0**	**0**	**0**	**0**	**0**		
Area 3 (neutron)									NDS
3108	20010430	20010727	1195	12	42	16			
3109	20011126	20011221	4065	15	79	23			
3110	20020325	20020418	2619	11	89	33		33	110
Area 3 Total			**7879**	**38**	**210**	**72**	**37.5**		
Area 4 (neutron)									CJD
4122	20010220	20010502	3190	17	91	6			
4123	20010601	20010727	19878	85	655	14			
4124	20010813	20011023	22908	75	733	8			
4125	20011016	20011211	7141	15	276	22			
4126	20020425								
Area 4 Total			**53117**	**192**	**1755**	**50**	**30.3**		
Area A (charged particle)									CAJaD
A048	20000727	20010518	7224	27	215	174			
A049	20010330	20010615	27835	17	2132	2107			
A050	20010615	20010905	5099	28	166	133			
A051	20010903	20011005	2371	27	250	78			
A052	20020322	20020418	20792	45	1034	989		674	2334
Area A Totals			**63321**	**144**	**3797**	**3481**	**16.7**		

Area B (charged particle)									CAJaD
B018	20000714	20020102	50520	180	1691	37			
B019	20020117								
Area B Totals			**50520**	**180**	**1691**	**37**	**29.9**		
Area D (charged particle)									NDS
D023	20011023	20011126	4950	19	82	49			
D024	20011221	20020402	1135	6	70	42			
Area D Totals			**6085**	**25**	**152**	**91**	**27.2**		
Tape	**Prelim sent**	**Final sent**	**# Recs.**	**# Refs.**	**# Sets**	**# New Sets**	**#Recs./set**	**Sets added**	**Points added**
Area E (charged particle)									JCPDG
E019	20010313	20011126	8022	12	224	212			
Area E Totals			**8022**	**12**	**224**	**212**	**35.8**		
Area M (photon)									CDFE
M030	20010521	20010828	10332	21	171	102			
M031	20020425								
Area M Totals			**10332**	**21**	**171**	**102**	**60.4**		
Area O (charged particle - compiled by CAJaD)									NEADB
O009	20000926	20010727	13193	57	249	192			
O010	20000926	20020219	53379	65	1440	1		-16	-40,351
Area O Totals			**66572**	**122**	**1689**	**193**	**39.4**		
Other Totals			**265848**	**734**	**9465**	**4238**	**28.8**		
Grand Total			**1116161**	**1076**	**11262**	**5166**	**99.1**		

CINDA Statistics by publication year for block

Data for past 10 years

	Experimental data blocks					All blocks
Year	**Area1**	**Area2**	**Area3**	**Area4**	**Total**	**Grand Total**
1992	72	156	105	231	564	1796
1993	95	185	114	123	517	1198
1994	110	162	66	168	506	1222
1995	31	85	78	176	370	893
1996	119	95	7	172	393	1824
1992-1996	427	683	370	870	2350	6933
1997	53	217	76	93	439	880
1998	60	160	84	31	335	1483
1999	51	138	50	281	520	962
2000	61	116	101	84	362	643
2001	54	0	28	0	82	129
2002	10	0	0	0	10	10
1997-2002	289	631	339	489	1748	4107
Total	716	1314	709	1359	4098	11,040

Total for all references and all years

Blocks	39817	40787	25539	25549	131592
Records	90428	77355	42006	55400	265189

CINDA Transmissions (May 2001 - April 2002)					
	Transmission		Total lines	Total blocks	Comment
	Date	# lines	in database	in database	
NNDC					
167	20010726	541			
168	20011211	184			
169	20020205	1322			
170	20020401	44			
NNDC total		2091	90428	39817	
CJD					
35	20020204	133			
36	20020116	71			del. for CJD035 seq. errors
37	20020116	107			readditions for seq. errors
38	20020201	708			
39	20020402	1675			
40	20020412	239			
41	20020416	1870			
CJD total		4803	55400	25449	
NDS					
34	20010913	265			
35	20011206	79			
36	20020318	290			
NDS total		634	42006	25539	
NEADB					
174	20011211	244			
NEADB total		244	77355	40784	
Total for all centers		5681	265189	131589	

CINDA batch exchange information

M. Lammer, NDS

The information in the table covers the time between the 2000 and 2002 NRDC meetings (time span: 2000-05-20 to 2002-05-26, as there was no statistics and no CINDA book in 2001).

area	batch	date	Exchange Records	-------- total	reader area 1	format area 2	records area 3	-------- area 4
1	BNL163	2000-10-04	93		-		22	
	BNL164	2000-12-05	143		-		0	
	BNL167	2001-07-26	541		-		3	
	BNL168	2001-12-11	181		-		0	
	BNL169	2002-02-05	1322		-		5	
	BNL170	2002-04-01	44		-		0	
	BNL171	2002-05-06	111		-		0	
	total		2435		-		30	
2	NEA057	2000-07-07	200	34	0	-	21	13
	NEA058	2000-07-13	480	0	0	-	0	0
see	NEA059	2001-12-10	244	202	68	-	99	35
Note 2	NEA060	2002-05-16	659	75	0	-	34	41
	NEA061	2002-05-17	439	135	98	-	37	0
	total		2022	446	166	-	191	89
3	NDS029	2000-06-16	26	7	1	2	-	4
	NDS030	2000-07-13	293	3	0	3	-	0
	NDS031	2000-07-18	211	0	0	0	-	0
	NDS032	2000-08-29	93	396	155	207	-	34
	NDS033	2001-03-14	321	389	0	6	-	383
	NDS034	2001-09-13	265	497	151	93	-	253
	NDS035	2001-12-05	79	683	29	146	-	508
	NDS036	2002-03-18	290	63	0	4	-	59
	NDS037	2002-05-16	366	77	31	30	-	16
	total		1944	2115	367	491	-	1257
4	CJD032	2000-06-01	10					-
	CJD033	2000-06-16	619					-
	CJD034	2000-06-19	1					-
	CJD035	2001-11-19	133				81	-
	CJD038	2002-01-24	708				0	-
	CJD039	2002-02-20	1675				0	-
	CJD041	2002-04-16	1870	117	10	75	32	-
	CJD042	2002-05-06	1201	0	0	0	0	-
	CJD043	2002-05-17	87	0	0	0	0	-
	total		6304				113	-

Notes: 1) Batches BNL165, BNL166, CJD036, CJD037 and CJD040 are not included as they contain only deletions and resubmissions of erroneous entries.

2) For the exchange between NEA and BNL, the NEA batch numbering is different: NEA057 = BNLEX172 up to NEA061 = BNLEX176

3) The thin line across the field of each center indicates the time of the 2001 NRDC meeting.

WP 2002-25

Journal coverage for CINDA

assembled by M.Lammer

1) Most important journals and journals scanned regularly

Explanation to Table:

scan: scanning of journal
- circ = received regularly in circulation
- c.a.s. = current awareness service (current contents, IAEA library SDI service, etc.)
- rarely = rarely scanned because not relevant or not available regularly
- regular = scanned regularly (availability not specified)

entry: CINDA entries prepared for
- all = entries made for all labs
- area x = entries made only for area x labs
- area 3 (+1) = NDS prepares entries for non-experimental work from area 1 labs
- exp area 1 = entries for experimental work, area 1 only

area	NNDC		NEA-DB		NDS		CJD	
code	scan	entry	scan	entry	scan	entry	scan	entry
area 1								
AJ	regular	exp area 1	regular	area 2				
AND	regular	exp area 1	regular	area 2	circ	area 3 (+1)		
AP					c.a.s.	area 3 (+1)		
ARN	regular	exp area 1			circ	area 3 (+1)		
CJP	regular	exp area 1			circ	area 3 (+1)		
IRE					circ	area 3 (+1)		
NSE	regular	exp area 1	regular	area 2	circ	area 3 (+1)		
NT					circ	area 3 (+1)		
PR/C	regular	exp area 1	regular	area 2	circ	area 3 (+1)		
PRL	regular	exp area 1	regular	area 2	circ	area 3 (+1)		
area 2								
ANE			regular	all	circ	area 3		
ANP					c.a.s.	area 3		
APH					c.a.s.	area 3		
ARI			regular	all	circ	area 3		
EPJ/A			regular	all				
EUL					c.a.s.	area 3		
FBS			regular	all				
FDP					c.a.s.	area 3		
JP/G			regular	all	circ	area 3		
JPJ			regular	all	c.a.s.	area 3		
KT					circ	area 3		
NC/A					c.a.s.	area 3		
NIM/A			regular	all	c.a.s.	area 3		
NIM/B			regular	all	c.a.s.	area 3		
NP/A			regular	all	circ	area 3		
NST			regular	all	circ	area 3		
PL/B			regular	all	circ	area 3		

area	NNDC		NEA-DB		NDS		CJD	
code	scan	entry	scan	entry	scan	entry	scan	entry
area 2 (cont'd)								
PL/C					circ	area 3		
PNE					circ	area 3		
PNP					circ	area 3		
PTP			regular	all				
RCA			regular	all	circ	area 3		
ZN/A					c.a.s.	area 3		
area 3								
AAB					circ	all		
APP/B					c.a.s.	all		
AUJ					circ	all		
BJE					circ	all		
BJP					circ	all		
CNDP					circ	CPR		
CRB					circ	all		
CST					circ	all		
CZC					c.a.s.	all		
CZJ					circ	all		
CZJ/A					circ	all		
FIZ/B					circ	all		
HFH					circ	all		
IJP/A					circ	all		
IPA					circ	all		
JRN					circ	all		
NSF					circ	all		
PRM					c.a.s.	all		
RJP					circ	all		
RMF					circ	all		
SCS					c.a.s.	all		
TNS					circ	all		
translation series								
AE/T					circ	all		
BAS					circ	all		
HEN					c.a.s.	all		
JEL					c.a.s.	all		
PAN					circ	all		
SRA					circ	all		
area 4								
AE							rarely	all
IZV							regular	all
RAK							rarely	all
UFZ							rarely	all
YF							regular	all
YK							regular	all
ZEP							rarely	all
ZET							rarely	all

2) NDS: miscellaneous coverage information

Journals without code covered regularly:

Chinese Physics Letters (via Current Contents)
Chinese Science Bulletin (via Current Contents)
Industrial laboratory (English of "Zavodskaya Laboratoriya"/ via Current Contents)
International J. Modern Physics (via Current Contents)
J. Scientific Industrial Research (India/ via Current Contents)
J University of Kuwait - Science (via Current Contents)
Modern Physics Letters (received in circulation)
PTB Mitteilungen (via Current Contents)
Research and Industry (India/ via Current Contents)
Sadhana (India/ via Current Contents)

Journals currently not received from publisher (library claimed), coverage not up-to-date:

AUJ, BJP, FIZ/B, HFH, JP/G, JRN, KT NSE, NST, PHE, PNP, RRIP, ZN/A

Journals not available (not at library or not covered by Current Contents):

AHP, AJN, AJSE, ASI, ASL CP, HIP, KNS, KPS.

Coverage stopped because not relevant:

AEJ, 21 chemical journals and some minor journals from area 3.

3) CJD: miscellaneous coverage information

(Regular) coverage stopped because not relevant and/or not regularly available:

AE, DOK, UFN, UFZ, ZEP ZET

EXFOR-Relational as multi-platform database with several retrieval interfaces: details of technology, current progress and nearest plans

V.Zerkin, NDS-IAEA

EXFOR-Relational project is essentially a further development of the EXFOR/Access project, started in 1999. In 2001 it became part on the Nuclear Reaction Database (NRDB) project, which plans to integrate CINDA, EXFOR, ENDF and their Dictionaries in one relational database system. Work on NRDB project, started in 2000, is being performed by NDS and NNDC in collaboration. Each relational database is being developed independently, but their integration and common use is foreseen in their structure. The structure of the databases and current development are regularly discussed among the collaborators. The NDS has the primary responsibility for implementing the system.

Mainly used technologies

Along with the development of EXFOR-Relational, several modern technologies were studied and tested in several systems environment. (Note the positive role of "Workshop on relational database and java technologies for nuclear data", BNL, 2000). Finally, the main components of the technology and their interconnection were defined. This technology is based on usage of platform independent components with the goal of reaching universality, effectiveness and long life of the new database system. The final product should provide a full set of EXFOR database utilities (including loading, updating, data backup) and retrieval systems, to be used on different types of PC, in local network and through the Web. All software should work on most popular operating systems and several DBMS and be easily portable to other platforms.

Basic components of the technology used in the development of EXFOR-Relational are following:

- programming languages: Java, C
- language to access database: SQL
- drivers to database access: JDBC, ODBC
- database management system: any Relational, supporting SQL
- also used (not key components): Perl, JavaScript, html, XML
- tested to be used in future: Fortran-C-ODBC-Database

A typical connection of components used to access database in different type of applications is shown in Fig.1. Basic components of the technology were tested in most* of possible client-server combinations of platforms. Java/JDBC with SQL is mainly used for access to database (see Fig.1a). This is the most universal approach existing on most platforms. An essential thing in the development is that all software is always tested on several DBMS in order to be sure that very generic (no specific) features are used.

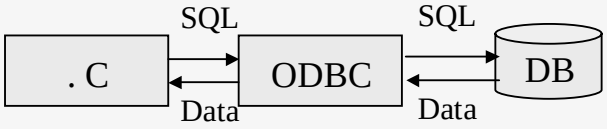
**Note. EXFOR/Access Retrieval system using Microsoft Access technology with VBA (Basic), DAO and MS-Jet is still distributed on CD-ROMs; it will be replaced by EXFOR/Java on CD (see below).*

a) **Database utilities, Retrieval systems, other programs**

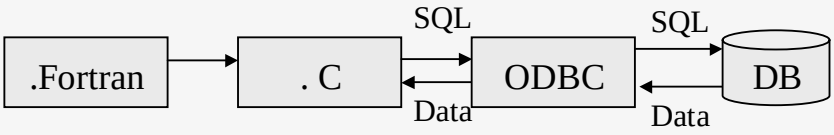
Used platforms: all

b) **Legacy codes, other programs**

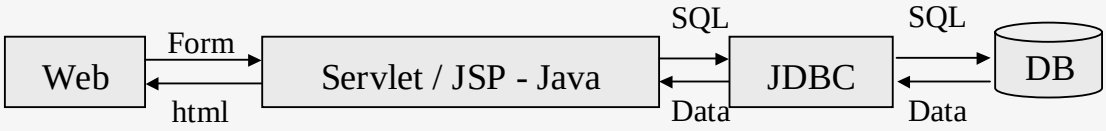
Used platforms: all DB on Windows, MySQL on Linux



Tested platform: MySQL on Linux

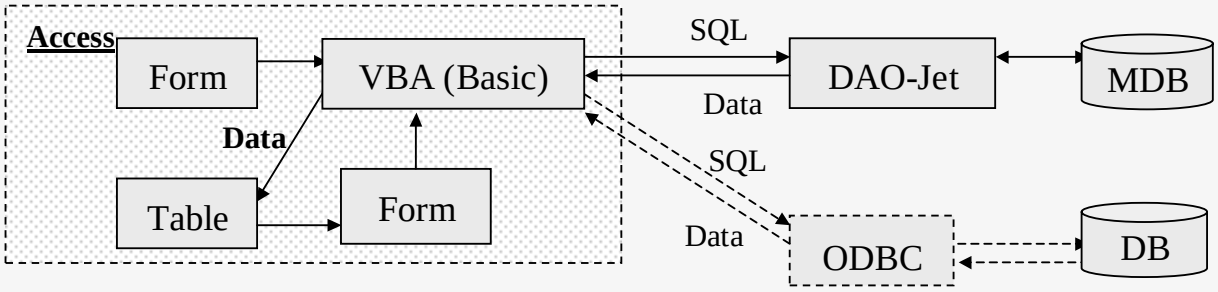


c) **Web Retrieval Systems**



Platform (05/2002): Linux-Apache-Tomcat(Jserv)-MySQL(SyBase)

d) **MS-Access Retrieval system (CD-ROM, LAN)**



Platform: Windows only

Fig.1 Chains of access of different software to databases

The programs are used on any platform without any change in the source code. All differences are concentrated and described in Configuration file (see Fig.2). Usually, the program reads this file at the beginning. All configuration parameters can be redefined on the fly: e.g. user can change working database (data source, database location and even type of DBMS) within the same retrieval session.

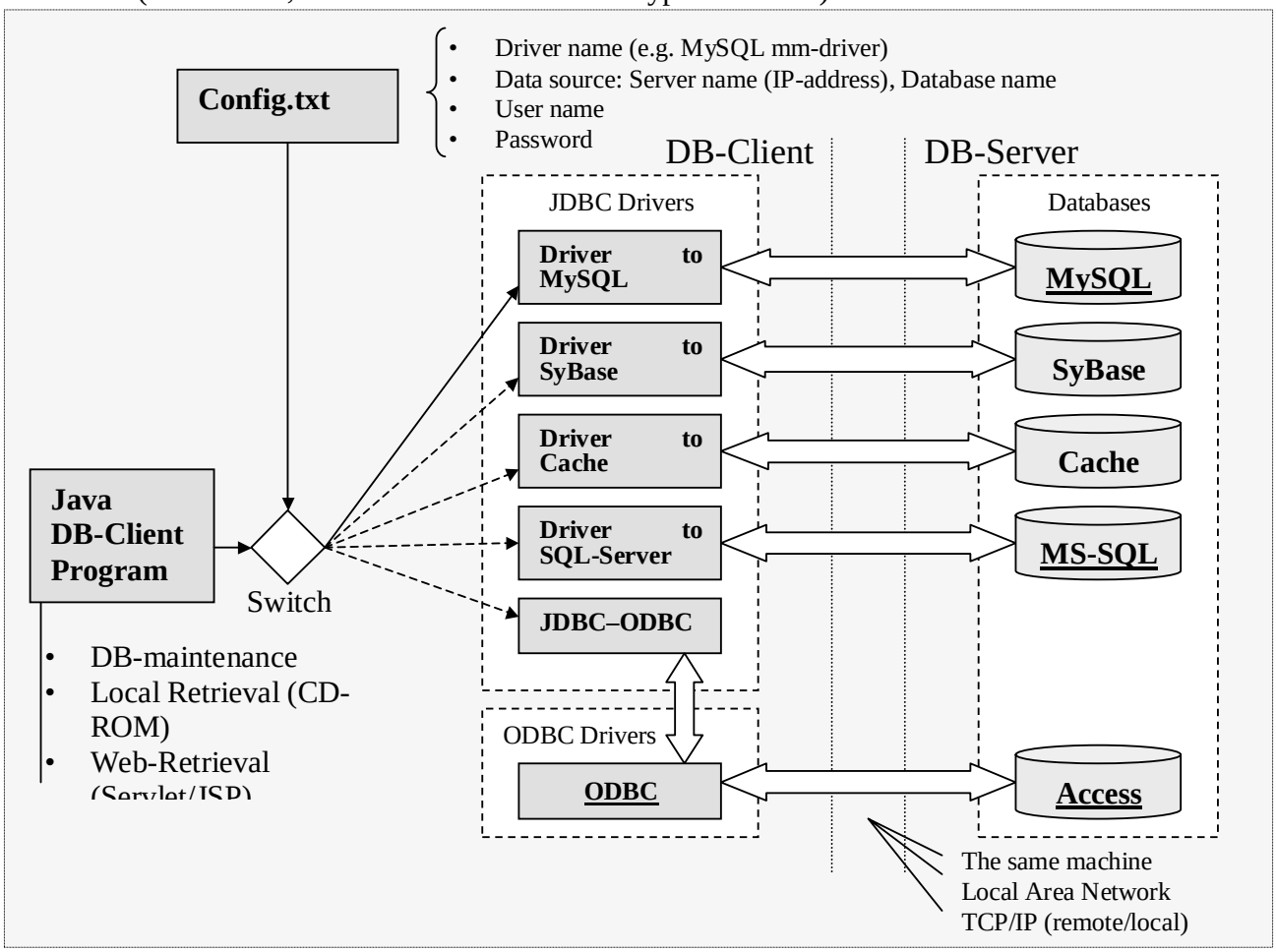


Fig.2 Access Java programs to databases; tested database management systems

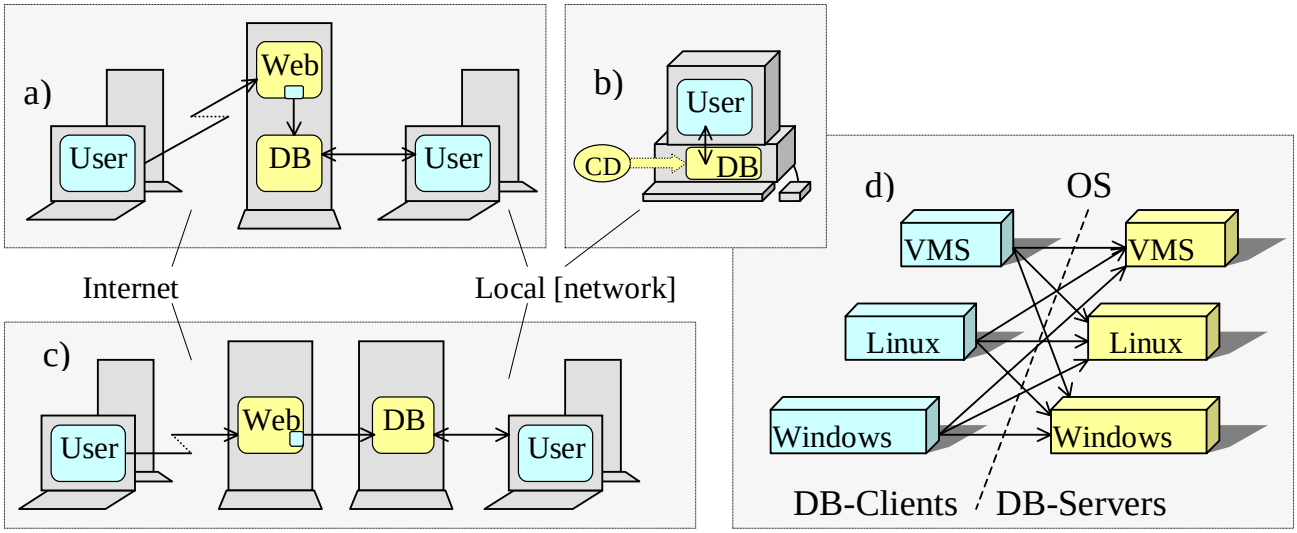


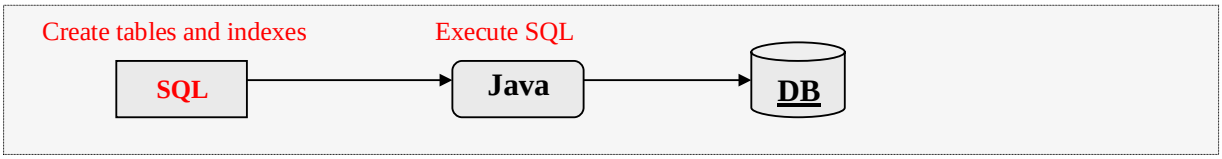
Fig.3 Client-server: a-c) typical location on computers, d) tested location on operating systems

Present status and nearest plans

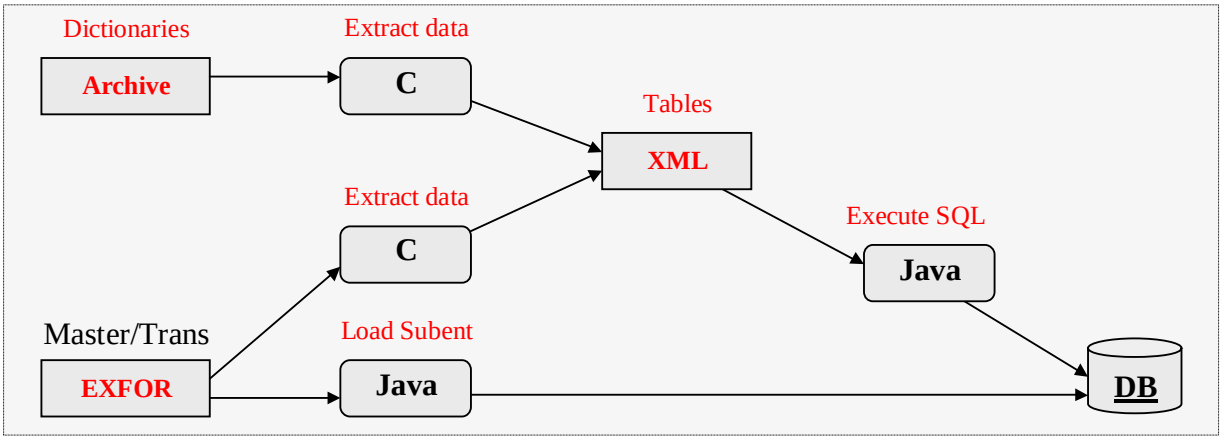
Software of EXFOR Relational contains several parts:

1. Create database and update its schema
2. Load/update data and help/dictionaries in the database
3. Web retrieval system
4. CD-ROM retrieval system

Create/update database schema

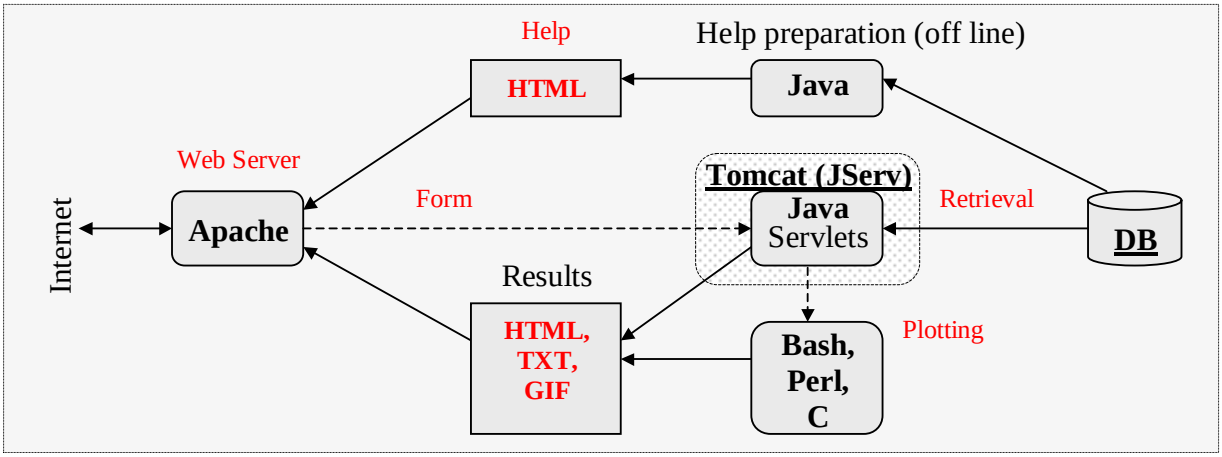


Load/update utilities



Web retrieval system

Until now, Web retrieval system works on a Linux platform, but all components also exist for Windows. The test version was developed in June-2001 (http://zlinux.iaea.org/exfor/) using Apache/JServ/MySQL and also installed at BNL in March-2002 using Apache/Tomcat/SyBase.



WP 2002-27

Completeness of EXFOR compilation as indexed in CINDA

by M.Lammer
Nuclear Data Section, IAEA

I have been asked to make a rough completeness check of the EXFOR compilation. The only survey that may give a reasonable answer is to compare blocks in CINDA with EXFOR index lines to the total number of experimental blocks.

Since I had to do that comparison manually, and it was a last minute effort, the check is not comprehensive. I selected one or a few labs from each area – OHO, part of ORL, WAL-WAU for area1, JUL for area 2, several labs for area 3 and KUR for area 4 - and restricted the selection of blocks to references from 1990 onwards. The results are as follows:

area 1: about 70 % coverage
area 2: about 53 % coverage
area 3: about 90 % coverage
area 4: about 55 % coverage

For area 1, the main contributors to 'misses' are 0EXFOR entries where data have been requested, and some papers with many reactions that have been missed.

The situation is similar for area 2, only that for several 0EXFOR entries no attempt to compile it is indicated (comments are: graphs or values given). On the other hand, there seem to be several cases that are not real misses of compilation, but appropriate reblocking is missing: references that are now labeled "without EXFOR" (either in separate block or with a different quantity like DNG-NEG) should be combined with a block with an EXFOR line.

For area 3, the main contributors to 'misses' are single lines with progress reports and inelasic resp. nonelastic gamma spectra, which are not compiled by NDS.

In the case of area 4, the main contributors to 'misses' are some JINR- reports and also entries for inelasic resp. nonelastic gamma spectra.

Common to all areas is

(1) incomplete indexing of EXFOR in CINDA: e.g. indexed as
   (a) NEG only for gamma production cross sections, but not for DNG or N2N which are often also specified in the publication and the EXFOR entries;
   (b) RES but not for STF which is also given.
(2) incorrect indexing of progress reports (PR), where insufficient information is given. Examples:

(a) A PR indicates “neutron capture studies” and is compiled in CINDA as NG, but the final publication contains capture gammas (SNG), and the original PR entry is overlooked.
(b) A PR indicates measurements for several quantities and a range of targets, which are all indexed in CINDA, but actually not all quantities have been measured for all targets. Again, no corrections are done for the wrong combinations.
(c) Similarly, if the energy range is not or only approximately specified, the connection between the PR and the final publication is not recognized.

My conclusion and recommendation is: Entries for progress reports should not be made unless the target-reaction combinations and the energy range are specified with sufficient accuracy and detail. An acceptable exception would be if the compiler initiates an EXFOR entry with that progress report information and keeps track of all the associated publications.

WP 2002-27 Addendum
V. McLane

Percentage of total experimental CINDA blocks compiled

	1980-1999					Total				
Area	# blocks	# action	No action	# EXFOR	% treated	# blocks	# action	No action	# EXFOR	% treated
1	6472	-245	6227	4769	77	24609	-257	24352	14713	60
2	9051	-32	9019	5806	64	18832	-32	18800	10126	54
3	3000	-28	2972	2206	74	7722	-35	7687	4309	56
4	6460		6460	4438	69	12808		12808	6153	48
Average	24983	-305	24678	17219	70	63971	-324	63647	35301	55

Data are for references with work type E or M.

This is only a valid measure of compilation completeness assuming all experimental references have been compiled.

Some experimental references will never be compiled because, *e.g.*, the data have been withdrawn, or the authors will not release it.

Data from program X4CHEXK (24 May 2002) V. McLane

Development of Web Editor for Charged-Particle Nuclear Reaction Data
(Working report of JCPRG, May 2002)

N.Otuka[a,b,*], H.Noto[c], A.Ohnishi[b], K.Kato[b]

a) Meme Media Laboratory, Hokkaido Univ. 060-8628 Sapporo, Japan
b) Division of Physics, Hokkaido Univ. 060-0810 Sapporo, Japan
c) Dept. of Management and Information, Hokusei Gakuen Univ.,
004-8631 Sapporo, Japan

Abstract

We have developed a web editor, HENDEL, which is an editing system of charged-particle nuclear reaction data by using web browsers. With this system, compilers can input data without detailed knowledge of data files such as grammar and data structure. The inputted information is processed to EXFOR and NRDF format simultaneously.

Keyword: Nuclear Data, CPND, WWW, EXFOR, NRDF

1. Introduction

Japan Charged-Particle Nuclear Reaction Data Group (JCPRG) compiles and accumulates the charged-particle nuclear reaction data produced in accelerator facilities in Japan. We edit the data in our own data format (NRDF: Nuclear Reaction Data File) which are distributed through the internet. A part of compiled file is translated to EXFOR format. The purposes of developing the web editor are

- To provide editing environment to compilers who do not have much knowledge of the grammar and structure of nuclear data.

- To output data files in various formats (e.g. EXFOR, NRDF...) simultaneously.

- To provide author proof environment.

2. Advantages of web editor

The internet has given the drastic change in the distribution system of nuclear data. Under this situation, our group has developed retrieval system using web browsers. The advantages of editing nuclear data with a web editor are as follows:

- Compiler can choose the appropriate code from a pull down menu or by writing a value/word in a Q and A style form for each item. Therefore compiler can input nuclear data without detailed knowledge of nuclear data files.

- Illegal codes and errors would be reduced in compiled results by using selective queries instead of descriptive ones.

- We can easily output data files in both of the EXFOR and NRDF formats simultaneously, since most of the necessary information is common in two formats.

- Experimentalists can make proof-editing of the compiled results for their data from remote terminals without much knowledge of data files by using the browsing functions of the editor.

- The web browser is a very familiar tool which works on various OS (e.g. Windows, Macintosh, UNIX....). Compilers can work on their favorite terminals in which a browser is installed.

3. Present Status

In July 2001, beta version has been completed and 25 references are compiled using this editor system. Out of these compiled files, 12 were translated to EXFOR and 6 passed the check at CHEX. Using this editor and CHEX, we can improve the quality not only of EXFOR files but also of NRDF files. This system can plot the graph of numerical data merged in the data file. Then we check the quality of digitized data by comparing with original paper.

4. Conclusion

We have developed a web editor, HENDEL, on trial. JCPRG has started compiling with the web editor to make data files in EXFOR and NRDF formats at the same time. This editor is basically developed according to NRDF coding sheets. The editor consequently gives some limitations for the compilation of EXFOR files at present. It would be possible to improve this editor as an EXFOR editor by extending the input formats through compilation of various types of data.

Appendix 5: Conclusions and Actions

Conclusions

General

C1: The next Technical NRDC Meeting will be held at IAEA Vienna in late May or early June 2003. The next full meeting will be held in Brookhaven in spring 2004 (date to be decided).

C2: For new data (1980-1998) the comparison between CINDA and EXFOR (WP-2002-27) showed that about 75% of all possible EXFOR data are compiled. This is assumed to be approximately the maximum amount possible due to the availability of data. As expected the coverage for pre-1980 data is lower.

General CINDA matters

C3: CINDA coverage was reviewed and it was felt that all major journals are adequately covered. Future coverage of progress reports may not necessarily be important nor need be continued.

C4: The future NRDC cooperation on CINDA was adopted as proposed in WP 2002-28. All centers, except ATOMKI, volunteered to contribute CINDA input to the new system (neutron and/or charged particle data).

C5: CINDA 2002 will be published as Supplement. At the same time the CD will be produced again by NEA-DB. NDS will consider publishing a final CINDA archival book, spread over 2 years in 2004/5, based on the new CINDA2001, i.e. including also CPND and photonuclear data.

Dictionaries

C6: The proposal of Memo CP-C/287 (WP 2002-2, p.1) is accepted, i.e. there will be only one particle dictionary.

C7: Dictionaries must still be transmitted in the TRANS format.

C8: A new Nuclides dictionary (as a replacement to dictionary 27) will be produced, which will be extracted from the Nuclear Data Wallet cards database. *(See also Action A11).*

General EXFOR matters

C9: The proposed security measures as outlined in WP-2002-19 regarding the NDS Open area were agreed. Hence a username NDSX4 must be entered (no password is required as yet) and this user can only put and get files. This user, along with all

others, cannot modify, delete or overwrite existing files. File management will be carried out by the holder of the XMAN token, currently allocated to user SCHWERER.

EXFOR dictionary codes and coding rules

C10: Following from WP-2002-3 (Units for particle and product yields, Dict.25) it was agreed that:
PRT be used for the outgoing particle, i.e. SF3, or SF7
PRD be used for reaction product, i.e. SF4
INC used for incident projectile, i.e. SF2
REAC used for reaction (with FIS used for fission), in general SF2-3
PC for percent or per 100 incident particles

Consequently, the unit PRD/FIS should be allowed.

C11: Page number format as presented in WP-2002-4 has been adopted, i.e. to allow alphanumeric characters in the page number field in REFERENCE.

C12: The proposed new heading EN-CM-TOT is NOT needed, but the definition of EN-CM needs to be clarified (WP-2002-8). *(See also Action A34)*.

C13: The units MUB/SRGEVC and the new particle code AP (anti-proton) are adopted (WP-2002-10)

C14: The proposed code NSF is not needed nor the other new quantities of CP-E/004 (WP-2002-10).

C15: (WP-2002-12) Agreed that UND and DEF (in REACTION SF5) should not be used, but that (DEF) can be used if the compiler is uncertain.

C16: A working group will be formed in order to investigate the way in which high energy physics data can be coded in EXFOR, including the coding of fundamental particles. The following participants agreed to sit on the committee: Chukreev, McLane, Kato, Otuka, Tarkanyi. *See also Action A36.*

C17: The proposed code 2XL as a modifier (REACTION SF8) as proposed in CP-C/305 (WP-2002-15) is not necessary and therefore has been rejected.

C18: The use of a zero value in the DATA-ERR field is allowed (CP-C/306 = WP-2002-16) except when the data are digitized. Required for large datasets sent by the author when the accuracy representation of the field is not sufficient to have a finite value. The DATA-ERR column cannot contain only zeros, in this case the column should not be included at all and a comment included under ERR-ANALYS.

C19: The proposed use of 4-momentum transfer and momentum distribution data is agreed as in CP-C/295 = WP-2002-6

C20: (WP 2002-11) Nuclide codes are from now on allowed in REACTION SF7 (Particle considered). If the resulting REACTION string can no longer fit in cols. 12-66, continuation onto the next record will follow the same rules as for DECAY-DATA (i.e., line breaks are allowed only after one of the commas which separate subfields)

C21: (WP 2002-12) The new headings PART-OUT and ELEM-MAX will be introduced in dictionary 24.

Actions

General

A1: All **(Continuing)** Support the joint project of Russia, Ukraine (UkrNDC) and Belarus (Minsk-Sosny) on development of Internet site structure and web pages for nuclear databases and related software. This support will include establishment of contacts of project initiators with European, US and other centers and organisations interested in collaboration, cooperation or partnership.

A2: Dunaeva **(Continuing)** Keep other centers informed on the status of the proposed project.

A3: All 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.

A4: NDS Assist the Slavutych Laboratory, Ukraine, in upgrading their NDIS (Telnet-based nuclear data system), which has not been upgraded since 1999.

A5: NDS Consider organizing an EXFOR compilers' workshop, either separately or adjacent to next years' Technical NRDC Meeting.

A6: All Check the "Citation Guidelines" document (available from NNDC and NDS websites) and send updates to NDS who will be responsible for maintenance from now on.

CINDA

A7: NEA-DB Submit the area 2 CINDA neutron master file in the new format to NDS and NNDC.

A8: NEA-DB Send to NNDC the area 2 CINDA master file in exchange format for conversion to the new format.

A9: NNDC Compare the two versions of area 2 master file as outlined above.

A10: CNDC (Continuing) Compile all Chinese experimental works (journals and conference proceedings) for CINDA and send to NDS in Reader format. Consider the possibility of including in the "Communication of Nuclear Data Progress" journal abstracts/brief publications of all nuclear data works undertaken in China.

Dictionary system

A11: McLane: To produce a format for the new Nuclides dictionary (see *Conclusion C10*) and provide a program for the production and updating of this dictionary from the Nuclear Data Wallet cards database.

A12: All (Continuing) To ensure that the "wild cards" can be used for REACTION SF7 (Particle considered) in Dictionary 36 .

A13: NDS (Continuing) To remove the restrictions “for photonuclear data (only)” from all dictionaries at their earliest convenience.

General EXFOR matters

A14: All Test V. Zerkin's experimental new "EXFOR relational" web interface *http://zlinux.iaea.or.at/~zerkin/x4s/indx.htm* and send feedback to NDS

A15: NDS Distribute new copies of the "Relational EXFOR" CD-ROM to the participants of this meeting.

A16: All (Continuing) To check/retransmit all entries included in the list of pending retransmissions by McLane distributed at the 2001 NRDC meeting.

A17: Dunaeva (Continuing) To make a benchmark test of Chukreev's code TEST-EXF vs. CHEX

A18: CPND centers (Continuing) To check the list of references identified as missing in EXFOR during the CRP on Medical Radioisotope Production, and distributed by Tarkanyi; communicate with Tarkanyi and NDS concerning which items they will compile from their area of responsibility. References not covered in this way will then be available for compilation by others.

A19: NEA-DB,NDS (Continuing) To convert remaining 60000 and 70000 series entries to proper EXFOR entries of area 2 and 3.

A20: All (Continuing) In view of the poor statistics for EXFOR compilations of recent works, all centers should give higher priority to new works.

A21: McLane **(Continuing)** Send to all participating centers a memorandum of understanding that defines compilation responsibilities resulting from the agreement with Phys.Rev.C (on EXFOR archiving of experimental data published in Phys.Rev.C).

A22: Dunaeva, Chukreev (Continuing) Once the agreement between NNDC and the publishers of Phys.Rev.C has been put into operation, try to establish a similar agreement with the publisher of Yadernaya Fizika.

A23: NEA To transmit the corrected EXFOR entries containing correlation data sent earlier by McLane.

A24: All: Send their area's EXFOR master file to NDS for comparison.

A25: All: Send list of known errors in other centers' entries to NDS.

A26: NDS: Compare all master files received with the NDS file, and as far as possible correct them (with help of other centers).

A27: NDS Make available to all centers the "final" EXFOR master file, together with a matching set of dictionaries.

A28: All concerned Transmit with highest priority all preliminary EXFOR TRANS files which have been held back because of pending corrections. Problematic entries should be excluded temporarily from transmission (until agreement on the correction is reached) to speed up the procedure.

A29: JCPRG After upgrading, send HENDEL (Web-based EXFOR editor) to the other centres for testing and comments.

EXFOR dictionary codes and coding rules

A30: All **(Continuing)** To consider and propose methods for coding fundamental particles in SF4, in particular those negatively charged (e.g. negative pions).

A31: Tarkanyi: To produce a list of quantities related to Product Yields and Thick Target Yields with a detailed explanation and including reference to an appropriate paper as an example.

A32: McLane/Schwerer: To improve the LEXFOR entry on 'Correlations' with respect to the clarifications requested in WP-2002-5.

A33: McLane/Schwerer: To produce new LEXFOR entries relating to the various quantities discussed in WP-2002-13.

A34: Schwerer: Modify the definition of EN-CM in dictionary 24 to be energy of the projectile relative to the target.

A35: Chukreev The REAC in WP-2002-12 (Memo CP/A-122) should be recoded from
`79-AU-197(AP,ABS),,SIG/DN,,,EXP` as
`79-AU-197(AP,X)ELEM/MASS,,SIG/DN,,,EXP`
The range of ELEM and MASS will be defined in the COMMON section by ELEM-MIN, MASS-MIN, ELEM-MAX and MASS-MAX. These codes will need to be added to the dictionary.
Thus the data under the heading PART-OUT can remain the same as entered previously.

A36: Working Group *(On coding of high energy data in EXFOR, see Conclusion C17)* To investigate the coding of high energy physics data and fundamental particles, and produce a report for discussion at the next meeting.

A37: McLane To correct the LEXFOR entry for the proposed coding of 4-momentum transfer (WP-2002-6).

A38: McLane To check whether there is a LEXFOR entry on the new process code FUS (total fusion, Dictionary 30); if not, provide such an entry.

A39: Schwerer (WP 2002-14) Check whether the quantities
`LS/SEQ,POL/DA,,D`
`PAR,POL/DA,,TAP`
`SL/SEQ,POL/DA,,D`
exist in the file, and delete them in Dictionary 36 if this is not the case.

A40: Schwerer (WP 2002-14) For the codes `20/PAR,POL/DA,,TAP` and `PAR/20,POL/DA,,TAP`: pick one of these options, maintaining consistency with other similar quantity codes, and update dictionary 36 (and any affected entries) accordingly.

A41: Schwerer (WP 2002-14) Correct the expansion of `NN,POL/DA,,ANA` to "Spin correlation parameter".

A42: McLane Try to resolve the problems in order to define the various polarization quantities for LEXFOR and dictionary 36 consistently.

A43: Schwerer Delete RCL from dictionary 33.

Miscellaneous

A44: Lammer **(Continuing)** Include the PC program package for calculation of Fission Yield distributions by A. C. Wahl in the NDS data collection.

Appendix 6: Comments and Recommendations of Centre Heads' Meeting:

Meeting of Nuclear Reaction Data Centres Network (NRDC), held at NEA Data Bank, Paris, 27-30 May 2002

The NRDC network was originally established to ensure simple, efficient and timely compilation of measurements of neutron reaction cross sections. Efforts are also being made to include charged-particle and photonuclear reaction cross sections, although greater priority will continue to be given to neutron cross-section compilations. The network must respond rapidly to user needs (particularly requests from cross-section evaluators).

Managerial and technical sessions were held in parallel, and the following actions/comments arose from the Centre Heads' meeting:

(a) Changes were agreed involving "co-ordination" procedures for NRDC (see memo entitled "Proposals for New Nuclear Reaction Data Centre Protocols" by Schwerer and McLane (28 May 2002)), which will result in an increased workload for NDS. One member of NDS staff will be co-ordinator of the EXFOR work throughout the network to ensure more rapid compilations of reaction cross-section data. The co-ordinator will assign areas of responsibility for such data compilations – re-assignments will be made by this co-ordinator if progress is not being made in particular areas.

(b) Proposals for co-operation in CINDA compilations were approved (see WP2002-28), but the eventual hope is to integrate this work with NSR and EXFOR activities.

(c) NRDC members endorsed and supported current work to establish a more cost-effective relational database system (particularly developments at NDS and NNDC, Brookhaven).

(d) International collaboration in both compilation and software development is of crucial importance to all members of the NRDC network, and greater efforts are required to capture real funding for some data centres (eg., in Russian Federation and Ukraine through possible ISTC funding).

(e) Emerging manpower problems throughout the NRDC were noted and discussed - loss of expertise and replacement of these staff will be a major priority in 2003/2004.

Appendix 7: Proposal for new Nuclear Reaction Data Center Protocol

O. Schwerer and V. McLane

modified - 28 May 2002

The Nuclear Data Section (NDS) will assume a more active role co-ordinating all Nuclear Reaction Data Centers (NRDC). In this extended role, NDS will be responsible for ensuring that data compilations are done in an efficient, productive and timely manner. The role of NDS will be to:

(a) assign clear responsibilities for the creation and correction of data compilations, and drive these activities forward,
(b) ensure implementation of compilation rules,
(c) decide on all issues relating to dictionary codes,
(d) be responsible for CINDA and EXFOR distribution to the other data centers.

1. Compilation Responsibilities

NDS will assign areas of responsibility for data compilation. If a center assigned to a particular area of compilation (e.g., neutron data from a country or countries)[1] is not carrying out their responsibilities, i.e., compiling all new data for that area in a timely manner, the NDS co-ordinator will reassign all or part of those responsibilities to another volunteer center.

A center responsible for an area of compilation may agree with another network center to share the compilation work for that area on a regular basis. However, the responsibility for coverage and quality of the compilation remains with the responsible center.

2. Decisions concerning compilation rules and new quantities

Final decisions on proposals concerning compilation rules and new quantities can be made with Core Center[2] agreement after discussions among all centers. NDS will be the final arbiter in case the "Core Centers" are unable to reach a decision.

3. Decisions concerning dictionary codes

NDS will be the final arbiter for all decisions concerning dictionary codes (see also 2).

4. EXFOR/CINDA Transmissions

All preliminary and final EXFOR and all CINDA transmission will be sent to NDS. NDS will be responsible for distributing all final transmissions.

5. Corrections to EXFOR/CINDA entries

NDS may correct or assign volunteers to correct preliminary transmissions, which are not corrected and resubmitted as final transmissions in a timely manner.

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1 An area may be for a given projectile or set of projectiles, for a given country or group of countries, for a given data type or data types, or for any combination of these.
2 Core centers will be defined by NDS based on contributions to network and user service capabilities.

6. Urgent compilation needs

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

7. Corrections to entries compiled at another center

Notification of errors found in entries originating at another center should be communicated to all centers. The NDS should make sure these corrections are done in a timely manner. If they are not, the co-ordinator will ask one of the other centers to submit the corrected entries.

8. Maintenance of the Masterfile.

NDS will maintain and distribute the EXFOR (and CINDA) Masterfile.

Notes

As a consequence of the above, the obligatory link between the geographical area of the Institute and the accession number, which is in force for neutron data, will now be lifted for all data. Similarly, for corrections to entries of another center according to item 7 above, it will be allowed to transmit entries of different accession number areas on the same TRANS file.

This protocol will be reviewed at the next NRDC meeting.

Appendix 8: EXFOR Compilation Responsibilities

Center	Basic responsibility	Additional compilation
NNDC	Neutron data and CPND from USA and Canada	
NEA-DB	Neutron data from "area 2"	CPND (O-series) (co-ordinated 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" (co-ordinated by NDS)
CDFE	Photonuclear data	
CNDC	Neutron data and CPND from China (entries submitted through NDS)	
JCPRG	CPND from Japan (entries submitted through NDS)	
ATOMKI	CPND from Juelich and ATOMKI (entries submitted through NDS)	
UkrNDC	Neutron data and CPND from Ukraine (entries submitted through NDS)	
CNPD-VNIIEF	CPND on light nuclei, co-ordinated with other centres	

Appendix 9: WP 2002-28

Future NRDC Cooperation on CINDA

Prepared for the Nuclear Reaction Data Center Meeting
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V. McLane, M. Lammer, O. Schwerer

General

This document contains several proposals, which are meant as a starting point for further discussions. The three main points addressed are: 1) the transmitting of CINDA entries needs to be reorganised, 2) transmission of CINDA entries in the new formats should be initiated before the end of the year, and 3) the new CINDA database should be considered as an index to the experimental and evaluated data files. Detailed proposals follow.

CINDA Transmission

A subset of the original "core" centers will be responsible for all CINDA transmissions. That is, the NNDC will be responsible for the US and Canada, the NEA Data Bank will be responsible for the NEA member countries, and the NDS will be responsible for the rest of the world. All other centers compiling new references will transmit the data through one of these three centers.

Creation of a CINDA database in the new format

In order to allow time for the centers to work on the creation of their new CINDA databases, there will be a moratorium on new transmissions for some period of time before the changeover. (A time schedule should be completed before the end of the 2002 NRDC Meeting). The database creation project consists of four parts: 1) the conversion of the existing library, 2) the production of a starter library for charged particle and photonuclear data, 3) the addition of new entries, and 4) the addition of entries from other existing bibliographies, and the merging of these entries with the existing database.

1. **Conversion of the existing CINDA library**:

Each neutron center, or its designated center, will:

- Either convert its CINDA master file to the new format,
- Or will retrieve the data for their area in the exchange format and send it to NNDC to be converted.

These files will be distributed by NDS to those centers that want them.

Completion: October 2002 (moratorium initiated).

2. **Production of a starter library for charged particle and photonuclear data**

A starter library of charged-particle and photonuclear data references will be produced by NDS/NNDC from the existing EXFOR database after the EXFOR master file comparison is completed and the libraries are updated.

This library will then be distributed to those centers who want it.

Completion: December 2002

3. **Addition of new entries**

For new CINDA entries, an agreement will be reached with the center responsible for co-ordination of coverage as to who will compile which references. After the entries are compiled, they will be sent through the co-ordinating center to NDS. NDS will check and distribute the entries.

Implementation: January 2003 (moratorium lifted).

4. **Addition of entries from other existing bibliographies**

There exist several other bibliographies that contain nuclear reaction references in a form useful for conversion and entry into the CINDA database. Among these are the CPBIB at NNDC and Photonuclear Data at CDFE. The conversion of these files to the CINDA format will greatly add to the coverage of the literature in the database. However, each reference must be checked against the contents of the CINDA database a) to see if it already exists in the database, and b) if it does not exist, to see if it should be loaded into an already existing block. This checking and blocking may take a considerable amount of time to complete.

Completion: to be decided for each database to be converted.

Contents of CINDA

From 2002 forward, CINDA will be considered to be an index to the experimental and evaluated data, that is, entries for theory (except those given in EXFOR entries), compilations, and reviews will not be entered in CINDA. Such references are now entered in Nuclear Science References (NSR), and present coverage seems to be complete; 98% of all new theory references given in CINDA are already in NSR; a comparison of CINDA theory entries for 2000-2002 to NSR found only 4 missing references in NSR: 3 from laboratory reports and one from a conference. The savings in duplicated effort will allow more time to be devoted to data compilation. Existing CINDA entries will remain in the database until such time as they are documented to exist in the NSR database.

For older references, the coverage in NSR is not as good. The NNDC will provide a program to be used in checking which CINDA theory entries exist in NSR and will ask for help in entering those which are not in NSR.

Those documents which exist or are entered in NSR will then be deleted from the CINDA database.

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

e-mail: services@iaeand.iaea.or.at
fax: (43-1) 26007
cable: INATOM VIENNA
telex: 1-12645
telephone: (43-1) 2600-21710

Online: TELNET or FTP: iaeand.iaea.or.at
username: IAEANDS for interactive Nuclear Data Information System
usernames: NONYMOUS for FTP file transfer;
FENDL2 for FTP file transfer of FENDL-2.0;
RIPL for FTP file transfer of RIPL;
NDSONL for FTP access to files sent to NDIS "open" area.
Web: http://www-nds.iaea.or.at