INTERNATIONAL ATOMIC ENERGY AGENCY

INDC(NDS)-446
Distr.: G, NC

I N D C INTERNATIONAL NUCLEAR DATA COMMITTEE

Report on the IAEA Technical Meeting on Co-ordination of the Network of Nuclear Reaction Data Centres

IAEA Headquarters, Vienna, Austria

17 – 19 June 2003

Prepared by O. Schwerer
IAEA Nuclear Data Section
Vienna, Austria

August 2003

IAEA NUCLEAR DATA SECTION, WAGRAMER STRASSE 5, A-1400 VIENNA

Produced by the IAEA in Austria
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Abstract

Results of the IAEA Technical Meeting on the Co-ordination of the Network of Nuclear Reaction Data Centres held at the IAEA Headquarters, Vienna, Austria, 17 to 19 June 2003, are summarised in this report. The meeting was attended by 14 participants from 9 co-operating data centres of five Member States and two International Organizations. A meeting summary, the conclusions and actions, progress and status reports of the participating data centres, and working papers considered at the meeting, are given in the relevant sections.

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. At present, the following data centres participate in the network:

NNDC	-	US National Nuclear Data Center, Brookhaven, USA
NEA-DB	-	OECD/NEA Nuclear Data Bank, Issy-les-Moulineaux, France
NDS	-	IAEA Nuclear Data Section
CJD	-	Centr Jadernykh Dannykh (= Nuclear Data Centre), Obninsk, Russia
CAJaD	-	Russian Nuclear Structure and Reaction Data Centre, Moscow, Russia
CDFE	-	Centr Dannykh Fotojadernykh Eksperimentov (= Centre for Photonuclear Experiments Data), Moscow, Russia
CNDC	-	China Nuclear Data Center, Beijing, China
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

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

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

Technical Meeting on Coordination of the Network of Nuclear Reaction Data Centres
17 – 19 June 2003, IAEA Headquarters, Vienna, Austria

AGENDA

1. General

1.1 Opening, Adoption of the agenda, announcements
1.2 Brief status reports of centres
1.3 Review of General Actions from the 2002 Meeting (A1-A6) ***WP2003-1***
1.4 Revision of Network document
1.5 Review of new working procedures agreed in Paris ***WP2003-2***
1.6 Workshop on relational databases and EXFOR compilation (Vienna, 1-5 December 2003) ***WP2003-3***

2. EXFOR/CINDA Dictionary System

2.1 Review of Actions (A11-A13) ***WP2003-1***
2.2 Proposed new/reformed dictionaries, including
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  2.22 Proposed split of dictionary 7 ***WP2003-5***;
  2.23 Unified particle dictionary (Conclusion C6 of 2002);
  2.24 Addition of CINDA-specific dictionaries ***WP2003-6***
2.3 Dictionary formats and transmissions

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3.1 Review of Actions (A7-A10) ***WP2003-1***
3.2 CINDA-CINDA2002 compilation and exchange ***WP2003-25***
3.3 Proposed format changes:
  3.31 Quantity, institute (no WP)
  3.32 Ref.type * and date of update ***WP2003-5***
3.4 Coding of journals, conferences ***WP2003-7***, reports ***WP2003-8***
3.5 Conversion from old CINDA:
  3.51 Codes MANY and FPROD ***WP2003-5***
  3.52 Fission quantities; references (general) ***WP2003-7***, reports ***WP2003-8***
3.6 Schedule for new CINDA (discussion based on old WP 2002-28)
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4. General EXFOR items

4.1 Review of Actions (A14-A29) ***WP2003-1***
4.2 General compilation situation and problems
4.3 TRANS files exchanged (statistics, dealing with corrections) ***WP2003-9, WP2003-22***
4.4 Check programs ***WP2003-23***
4.5 Errors in old entries, status of master file
4.6 Manuals, LEXFOR

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5.2 Fundamental particles in dict. 27 ***WP2003-10***
5.3 Process "Total charge changing" for Dict.30 ***WP2003-11***
5.4 Thick target yields and product yields / quantities, definitions, units ***WP2003-12***
5.5 Total spin transfer ***WP2003-13***
5.6 New coding for REACTION SF7 ***WP2003-14***
5.7 Longitudinal momentum ***WP2003-15***
5.8 Partial cs for production of specified number of product particles ***WP2003-16***
5.9 Differential number of (prompt) neutrons ***WP2003-17***
5.10 New quantities for secondary particle spectra ***WP2003-18***
5.11 New format for DECAY-MON ***WP2003-19***
5.12 Branch codes 'DIS' and 'CON' (for γ production) ***WP2003-20***
5.13 Transmission (new code TRN for REACTION SF8) ***WP2003-21***

6. Status of Migration Project

6.1 Presentation on EXFOR/CINDA-relational ***WP2003-24***
- Utilities, Web, CD-ROM
- Test installation in NDS (Linux, VMS) and NNDC (SyBase)

6.2 Plans of "migration" in Centres: intentions, platforms, deadlines

7. Demonstrations

7.1 Integrated EXFOR/ CINDA CD-ROM (V. Zerkin)
7.2 JANIS (M. Kellett)

8. Any other business

9. Closing items

9.1 Review of Actions and Conclusions of present meeting
9.2 Next meeting

LIST OF PARTICIPANTS

CHINA

Mr. Y. Zhuang
China Nuclear Data Centre
China Institute of Atomic Energy
P.O. Box 275 (41)
Beijing 102413
Tel: +86 10 6935 7830
Fax: +86 10 6935 7008
E-mail: yxzhuang@iris.ciae.ac.cn

HUNGARY

Mr. S. Takács
Department of Cyclotron
Institute of Nuclear Research of the
Hungarian Academy of Sciences
Bem tér 18/c
H-4026 Debrecen
Tel: +36 52 417 266
Fax: +36 52 416 181
E-mail: s.takacs@atomki.hu

JAPAN

Mr. K. Kato
Division of Physics
Graduate School of Science
Hokkaido University
Kita-10, Nish-8, Kita-ku
Sapporo, Hokkaido 060-0810
Tel: +81 11 706 2684
Fax: +81 11 706 4850
E-mail: kato@nucl.sci.hokudai.ac.jp

RUSSIA

Ms. S.A. Dunaeva
All Russian Scientific Research
Institute of Experimental Physics
Centre of Nuclear Physics Data (CNPD)
RFNC-VNIIEF
607190, Sarov
Nizhni Novgorod
Tel: +7 831 30 45770
Fax: +7 831 30 45569
E-mail: dunaeva@expd.vniief.ru
dunaeva@rol.ru

RUSSIA

Ms. S.Y. Babykina
Russia Nuclear Structure and
Reaction Data Centre (CAJAD)
"Kurchatov's Institute"
46 Ulitsa Kurchatova
123 182 Moscow
Tel: +7 095 196 1612
E-mail: chukreev@polyn.kiae.su
feliks@polyn.kiae.su

RUSSIA

Mr. A.I. Blokhin
Centr Jadernykh Dannykh
Fiziko-Energeticheskij Institut
Ploshchad Bondarenko
249 033 Obninsk, Kaluga Region
Tel: +7 084 399 8986
Fax: +7 095 230 2326
E-mail: blokhin@ippe.obninsk.ru

USA

Ms. V. McLane
Building 197D
National Nuclear Data Centre
Brookhaven National Laboratory
PO Box 5000
Upton, NY 11973-5000
Tel: +1 631 344 5205
Fax: +1 631 344 2806
E-mail: vml@bnl.gov

INTERNATIONAL ORGANIZATION

OECD Nuclear Energy Agency

Mr. M.A. Kellett
Nuclear Data Services
OECD Nuclear Energy Agency
Le Seine St-Germain
12, boulevard des Îles
F-92130 Issy-les-Moulineaux
Tel: +33 1 4524 1085
Fax: +33 1 4524 1110
E-mail: kellett@nea.fr

OBSERVER

JAPAN

Mr. N. Otuka
Nuclear Data Center
Department of Nuclear Energy System
Japan Atomic Energy Research Institute
Naka-gun Tokai-mura Shirakata-Shirane 2-4
319-1195 Ibaraki
Tel: +81 29 282 5484
Fax: +81 29 282 5766
E-mail: ohtsuka@nucl.sci.hokudai.ac.jp

IAEA PARTICIPANTS

Mr. O. Schwerer
Scientific Secretary
Nuclear Data Section
Division of Physical and Chemical Sciences
Room A2323
Tel: +43 1 2600 xt. 21715
Fax: +43 1 26007
E-mail: Schwerer@iaeand.iaea.or.at

Mr. M. Lammer
Nuclear Data Section
Division of Physical and Chemical Sciences
Room A2322
Tel: +43 1 2600 xt. 21727
Fax: +43 1 26007
E-mail: Lammer@iaeand.iaea.or.at

Mr. A.L. Nichols
Head, Nuclear Data Section
Division of Physical and Chemical Sciences
Room A2312
Tel: +43 1 2600 xt. 21709
Fax: +43 1 26007
E-mail: A.L.Nichols@iaea.org

Mr. V. Zerkin
Nuclear Data Section
Division of Physical and Chemical Sciences
Room A2318
Tel: +43 1 2600 21714
Fax: +43 1 26007
E-mail: V.Zerkin@iaea.org

Mr. W. Costello
Nuclear Data Section
Room A2333
Tel: +43 1 2600 xt. 21724
Fax: +43 1 26007
E-mail: L.Costello@iaea.org

MEETING SUMMARY

Introduction

The IAEA Technical Meeting on Co-ordination of the Network of Nuclear Reaction Data Centres was held at the IAEA Headquarters, Vienna, Austria, from 17 to 19 June 2003. Fourteen participants of nine co-operating data centres from China, Hungary, Japan, Russia, USA, NEA and IAEA attended the meeting.

Meetings of this network are held annually, with full meetings involving centre heads and technical staff every two years (the last full meeting was held in May 2002 at NEA in Paris, France). The present meeting focused mainly on technical questions concerning the EXFOR and CINDA databases, including the introduction of new data types, improved quality control, new formats for the CINDA bibliographic database which in future will include not only neutron data but all nuclear reaction data, and the migration of the nuclear reaction databases to a modern relational database management system. Technical discussions were based on 28 working papers (WPs) submitted to the meeting, and the most important results of the technical sessions are summarized in the list of Conclusions and Actions (pp. 17-24).

Brief Minutes

The meeting was opened by Alan L. Nichols, the head of the IAEA Nuclear Data Section.

The agenda was adopted with minor modifications.

A. Nichols chaired the general sessions, while O. Schwerer, the Scientific Secretary of the meeting, chaired the technical sessions on EXFOR and the EXFOR/CINDA dictionary system; M. Lammer chaired the session on CINDA.

Each of the centres presented a brief status report. Reports of three centres who are members of the network but could not attend the meeting were distributed.

The general actions from the last meeting (2002) were reviewed. The meeting took note of the revised draft of the "network document" defining the role of the nuclear reaction data centres network and the participating centres (Report INDC(NDS)-401, Rev. 4) which had been distributed earlier and will be published in late summer. The NRDC protocol introduced at the 2002 Paris meeting was reviewed and amended. O. Schwerer, the NDS staff member in charge of EXFOR compilation co-ordination for the network, reported on the compilation situation and stressed that, if gaps in the completeness of experimental data in EXFOR are observed, it is essential to report these gaps to a competent place (i.e. NDS or another network centre) and in a concrete, specific manner. NDS staff reported on the planned workshop on “Relational Databases for Nuclear Data Development, Dissemination and Processing: EXFOR Implementation, Maintenance and

Compilation" which will be held in December 2003 in Vienna, with participation of NNDC, and invited the other centres to propose possible candidates for participation.

In the technical sessions, the fulfillment of the actions of the last meeting was reviewed. Several new EXFOR/CINDA dictionaries, needed for the new CINDA format and to harmonize CINDA and EXFOR coding, were agreed upon, and some changes of existing dictionaries were approved. Minor modifications of the proposed new CINDA format were agreed and several clarifications for the conversion from old to new CINDA format were approved. A new protocol on CINDA exchange procedures and an agreement on the future NRDC co-operation on CINDA were agreed.

The exchange of EXFOR TRANS files was reviewed and a comparison of the two existing EXFOR check programs was presented, noting that both of them are useful and should be kept. A number of actions related to further improving quality and completeness of EXFOR were agreed. Several new quantities and modified EXFOR compilation coding rules were approved, including e.g. new coding for fundamental particles, a new reaction type "total charge changing", new quantities for secondary particle spectra. Among others, an action was approved on resolving some inconsistencies in coding various types of thick target and product yield data.

V. Zerkin (NDS) demonstrated a "Stand-alone retrieval system on CD-ROM: EXFOR+CINDA/Java2" and reported on a CINDA compilation program being developed. He also presented progress in the Nuclear Reaction Database Migration project at NDS. M Kellett demonstrated JANIS, the NEA-DB nuclear data plotting package.

In the final session, the 34 conclusions and 46 actions of the meeting were reviewed, and the next NRDC meeting was tentatively scheduled for 4-7 October 2004 (week following the Santa Fe international conference on nuclear data for science and technology).

CONCLUSIONS

General

C1 The NRDC Protocol (approved at the 2002 NRDC Meeting) is amended by adding item 9 on "Problematic entries":
NDS will create a new subdirectory of the open area NDSX4.TRANS for those problematic entries which were removed from a PRELIM transmission. These entries will be reviewed by the other centers and can be finalized at the next NRDC meeting.

C2 The next (full) NRDC meeting (4 days) is planned for the week following the Santa Fe Conference (i.e. starting 4 October 2004) in Brookhaven.

EXFOR/CINDA Dictionaries

C3 Dictionary 7 will be split into two: new dictionary 7 (conferences only) and dictionary 207 for books. The format will be unchanged.

C4 The particle dictionaries (EXFOR dictionaries 13, 28, 29, 33) will be unified also in EXFOR dictionaries (combined particle dictionary 33, as used already in archive dictionary).

C5 A new dictionary 236 will be created by V. McLane which will provide more space for code expansions and no longer contain the numerical equivalents for the REACTION subfields.

C6 A new dictionary 235 will be added containing work types for EXFOR and CINDA. (Note: present dictionary 35 contains similar information for REACTION SF9).

C7 The proposed dictionary 46 (not mentioned in WP2003-6), containing the correspondence between EXFOR quantities and (new) CINDA quantities, will be replaced by an additional column in the new dictionary 236.

C8 Numbering of dictionaries: The correspondence dictionary for old and new CINDA quantities will be dictionary 47, while the dictionary for CINDA Reader codes will be dictionary 52. The numbers of the other new dictionaries will be as indicated in WP2003-6.

C9 The dictionaries, including all new CINDA dictionaries, will be provided in all formats (Archive, TRANS, Daniel-backup). The backup dictionaries should be provided also in zipped form.

C10 The new nuclides dictionary 227 is approved in the format provided by McLane (Addition to WP2003-4) and a new Compounds dictionary 209 will be introduced.

CINDA and common CINDA/EXFOR items

C11 All Japanese CINDA entries (including CPND) will go to NEA-DB (by e-mail).

C12 The CINDA Protocol (**Revision** of WP 2003-25) is approved.

C13 The NEA-DB will print the CINDA2003 book (cumulative issue). NDS will send them the CINDA file for book production. The deadline for transmissions to be included is end of August 2003. NDS will inform the NEA-DB of the number of copies normally sold by IAEA.

C14 The following changes of the CINDA2001 format were approved:
- The quantity field will be in columns 24-26 (1 character less than before)
- The institute code will start with the area code in column 27
- The date of last update will be included on each record in columns 125-132.
- Comments will be shortened (from 40 in original proposal) to 38 characters

C15 The following new Reference types are introduced for both CINDA and EXFOR:

A Abstract of Conference
K Abstract of Journal
X Preprint

A and K will replace * for Abstract (was used in CINDA only).
The "Content" code proposed in WP 2003-5 is not introduced. Reference types P (Progress report) and S (Conference report) are kept.

C16 Reminder: All reference codes in CINDA will be as in EXFOR, even in cases where there were differences in the past (some long journal, report and conference codes had shorter versions in CINDA).

C17 The proposal of WP 2003-5 for the conversion of MANY and FPROD, using Z=999 for both, is adopted.

C18 When converting from old CINDA, centers should be aware that spontaneous fission data must be in separate blocks from neutron fission data. The energy field must be checked for SPON so that the reaction will correctly be specified as (0,F).

C19 The revised schedule for the cooperation on CINDA as summarized in WP 2003-26 is agreed.

C20 The meeting notes that, since NSR will take over the compilation of theoretical works from CINDA, the inclusion of NSR into the network should be considered.

General EXFOR matters

C21 Both check programs CHEX and TEST-EXF are useful to the network. CAJAD is recommended to consider releasing the source code (and the code to update the

dictionaries) to the network, to make sure that TEST-EXF will continue to be available and be maintained in the future.

Technical EXFOR matters

C22 When new codes in REACTION SF5 or SF 8 are introduced, the sequence of codes within a subfield should maintain consistency with other similar codes in dictionary 36.

C23 The dictionary 27 codes for fundamental particles are approved as given in the 3rd and 4th column of WP 2003-10 with the following modifications:

- 0-K0-0 will be used for neutral kaons, and
- –1 will be replaced by 1 in the Z field.

C24 The decision about a new lepton dictionary (memo CP-A/135, WP 2003-10) is postponed until it is needed for compilation.

C25 The process code TCC (Total charge changing, WP 2003-11) is approved.

C26 The proposal on Total Spin Transfer (WP 2003-13) is approved.

C27 The new formalism for correlated particles for REACTION SF7 (WP 2003-14) is approved using + as separator. This may be used also in EN-SEC.

C28 The proposal on Longitudinal Momentum (WP 2003-15, CP-C/313) is approved.

C29 The proposal of WP 2003-16 (Partial cross section for production of specified number of product particles) is approved. In addition, the definition of DN is changed to “differential with number of outgoing particles”.

C30 As a consequence of the above, the coding of the quantity "Probability of emission of 'n' prompt fission neutrons" is changed to

(…,F)NPART,PR/NUM,NU

This replaces the coding proposed in WP 2003-17.

C31 The new quantities for secondary particle spectra are agreed as proposed in WP 2003-18.

C32 New formalism for DECAY-MON is agreed as proposed in WP 2003-19.

C33 The clarification on DIS and CON (WP 2003-20, CP-C/324) is agreed.

C34 The new coding for Transmission (WP2003-21) is agreed.

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**	(Continuing) All recognized policy papers for consideration by the NRDC members need to be prepared and distributed four weeks before the Annual NRDC meeting. This will ensure adequate thought and discussion prior to the meeting.
A4	**Zerkin**	Discuss with Slavutytch Nuclear Data Bank joining the migration project rather than pursuing VMS upgrades
A5	**NDS**	Put new draft of "Citation Guidelines" on NDS open area.
A6	**All**	(Standing Action) Send any changes or updates of the "Citation Guidelines" to NDS
A7	**CAJAD, CNDC, JAERI, JCPRG, ATOMKI, CNPD, KAERI**	Send to NDS the information about manpower dedicated to activities for the network (for Annex 2 of the network document INDC(NDS)-401) by 31 July
A8	**All**	As soon as possible propose potential participants of compilation workshop (Vienna, December 2003) to NDS.
A9	**NDS**	Take lead in preparing a common paper of the core centres for the Nuclear Data Conference in Santa Fe, 26 Sept. – 1 Oct. 2004
A10	**All**	Provide names of participants of next year's NRDC meeting by the end of December to both NNDC and NDS.

EXFOR/CINDA Dictionaries

A11	**McLane, Schwerer**	Decide on a procedure for updating the new Nuclides Dictionary 227
A12	**McLane**	Provide file of new Nuclides Dictionary 227 to NDS.
A13	**NDS**	(Continuing) Remove the restrictions "for photonuclear data (only)" from all dictionaries at their earliest convenience.
A14	**Zerkin,McLane**	Agree on format for the new quantities dictionary 236 and submit to Schwerer
A15	**NDS**	Finalize and transmit the new CINDA dictionaries (including Dictionary 52 / Reader codes).

CINDA and common CINDA/EXFOR items

A16	**NEA-DB**	Send final list of area 2 CINDA reader codes to NDS
A17	**NEA-DB**	(Continuing) Submit the area 2 CINDA neutron master file in the new format to NDS and NNDC.
A18	**NEA-DB**	(Continuing) Send to NNDC the area 2 CINDA master file in exchange format for conversion to the new format.
A19	**NNDC**	(Continuing) Compare the two versions of area 2 master file as outlined above.
A20	**CNDC**	Compile all Chinese experimental works (journals and conference proceedings) for CINDA and send to NDS in Reader format. The first entries will be sent in July 2003.
A21	**McLane**	Produce revised CINDA 2001 Manual
A22	**CINDA centers**	(WP 2003-8, Section 2): When coming across report codes in dictionary 6 which differ significantly from what is shown on the cover, submit additional explanation to NDS for inclusion in dictionary 6
A23	**McLane, NEA-DB, CJD**	Check and confirm/clarify report codes given in WP 2003-8, Sections 4 and 5
A24	**CINDA centers**	Correct errors in report coding, as listed in Sections 6 and 7 of WP 2003-8

A25	**All CINDA centers**	Search for illegal experimental entries for MANY and replace them with individual entries, and for the many illegal entries for FPROD which may be used only for lumped fission products.

General EXFOR matters

A26	**All**	(Continuing) Check/retransmit those entries from the list of pending retransmissions (distributed by McLane at the 2001 NRDC meeting) which still need correction
A27	**CPND centers**	(Continuing) 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.
A28	**McLane**	Check whether conversion of EXFOR 60000 series was finished and communicate result to NEA-DB
A29	**NEA-DB, NDS**	(Continuing) Convert any remaining 60000 and 70000 series entries to proper EXFOR entries of area 2 and 3.
A30	**All**	All centers should give high priority to compiling new publications.
A31	**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).
A32	**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.
A33	**NDS**	(Continuing) Compare EXFOR master files received from other centres with the NDS file, and as far as possible correct them (with help of other centers).
A34	**NDS**	(Continuing) Make available to all centres the “final” EXFOR master file, together with a matching set of dictionaries.
A35	**JCPRG**	(Continuing) After upgrading, send HENDEL (Web-based EXFOR editor) to the other centres for testing and comments.

A36	**All**	Give priority to data sets that NNDC requests regarding the compilation of alpha-induced reactions on “alpha-nuclei” (O-16 through Ti-44).
A37	**All**	Compile with priority data related to the new Co-ordinated Research Project on "Nuclear Data for Production of Therapeutic Radionuclides" (see WP 2003-28).
A38	**McLane**	Make available a platform independent version of the ORDER program.
A39	**All**	The following centers volunteer to participate in a test of EXFOR coverage completeness for a few main journals for one “test” year, 1998. Included will be neutron data and CPND up to 1 GeV, excluding projectiles heavier than alpha. Results will be sent to NNDC and NDS before the next meeting. NNDC: PR/C ATOMKI: NIM/B CAJAD: ARI, RCA VNIIEF: YF (=PAN) NEA-DB: EPJ/A NDS: NP/A JCPRG: PR/B, PRL

Technical EXFOR matters

A40	**McLane/ Schwerer**	(Continuing) Improve the LEXFOR entry on 'Correlations' with respect to the clarifications requested in WP 2002-5.
A41	**McLane**	(Continuing) Correct the LEXFOR entry for the proposed coding of 4-momentum transfer (WP 2002-6).
A42	**McLane**	(Continuing) Check whether there is a LEXFOR entry on the process code FUS (total fusion, Dictionary 30); if not, provide such an entry.
A43	**McLane**	(Continuing) Try to resolve the problems in order to define the various polarization quantities for LEXFOR and dictionary 36 consistently.
A44	**Schwerer**	(Continuing) Delete RCL from dictionary 33.
A45	**McLane**	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, and produce revised LEXFOR entries on them.

Miscellaneous

A46 Lammer/NDS (Continuing) Include the PC program package for calculation of Fission Yield distributions by A. C. Wahl in the NDS data collection.

Nuclear Reaction Data Center Protocol

Reviewed and amended at the 2003 NRDC Meeting, 17 June 2003

(Original drafted by O. Schwerer and V. McLane and approved at the 2002 NRDC Meeting)

The Nuclear Data Section (NDS) will assume a more pro-active role co-ordinating all Nuclear Reaction Data Centres (NRDC). NDS staff will be responsible in this extended role for ensuring that data compilations are undertaken and completed in an efficient, productive and timely manner. Thus, the role of NDS will be as follows:

(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 centres.

1. Compilation Responsibilities

NDS will assign areas of responsibility for data compilation. If a centre assigned a particular area of compilation (e.g., neutron data from a country or countries)[1] does not carrying out their responsibilities (i.e., compile all new data for that area in a timely manner), the NDS co-ordinator will re-assign all or part of those responsibilities to another volunteer centre.

A centre responsible for an area of compilation may agree with another network centre 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 centre.

2. Decisions Concerning Compilation Rules and New Quantities

Final decisions on proposals concerning compilation rules and new quantities can be made with Core Centre[2] agreement after discussions among all centres. NDS will be the final arbiter in case the Core Centres 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 Section 2, above).

4. EXFOR/CINDA Transmissions

All preliminary and final EXFOR and CINDA transmissions will be sent to NDS, who will be responsible for distributing all final transmissions.

5. Corrections to EXFOR/CINDA Entries

NDS may correct or assign volunteers to correct preliminary transmissions, that have not been corrected and resubmitted as final transmissions in a timely manner.

[1] An area may be defined in terms of 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 centres will be defined by NDS, based on contributions to the network and user service capabilities.

6. Urgent Compilation Needs

If a centre requires a particular data set to be compiled immediately, the centre should send a request to the responsible centre with a copy to NDS. If the responsible centre cannot compile the data to the timetable requested, the requesting centre may compile the data as an area Z entry. This entry will be sent to both the original responsible centre and NDS. If the responsible centre does not intend entering the data in a timely fashion, the NDS may transmit the new Z entry to all centres. The responsible centre can subsequently delete the Z entry, if they are able to replace the earlier compilation with their own entry for their area.

7. Corrections to Entries Compiled at Another Centre

Notification of errors found in entries originating from another centre should be communicated to all centres. The NDS should make sure corrections are undertaken in a timely manner. If they are not, the co-ordinator will request one of the other centres to submit the corrected entries.

8. Maintenance of the Masterfile

NDS will maintain and distribute the EXFOR (and CINDA) Masterfile.

9. Problematic entries

NDS will create a new subdirectory of the open area NDSX4.TRANS for those problematic entries which were removed from a PRELIM transmission. These entries will be reviewed by the other centers and can be finalized at the next NRDC meeting.

10. NDS staff

Otto Schwerer (NDS) has been appointed co-ordinator of the NRDC Network.

Notes

a). As a consequence of the above, the link between the geographical area of the Institute and the accession number, which has been in place for all neutron data, is no longer obligatory and may be lifted in certain cases. Similarly, for corrections to entries of another centre according to Section 7 above, entries of different accession number areas can be transmitted on the same TRANS file.

b). This protocol will be reviewed at each NRDC meeting.

CINDA Protocol

(WP 2003-25 Rev.2)

V. McLane, M. Lammer, V. Zerkin

1. The CINDA2001 format shall be the method of exchange between the Nuclear Reaction Data Centers. The CINDA Format Manual shall contain the coding rules for CINDA exchanges.

2. 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.

3. Updates sent by a center that contain corrections to their own entries shall be transmitted in a separate file from updates to entries that are the responsibility of another center. The latter shall be sent in update files, separated by coordinating center.

4. The EXFOR Accession Number will, in general, be used as the CINDA block number.

5. The sequence number within a block shall be unique, *i.e.*, if a line is deleted, the sequence number should not be reassigned.

6. New blocks that are the responsibility of another center (to be transmitted on UPDATE files) shall have block numbers beginning with zero (0) and sequence numbers equal to zero.

7. CINDA Transmissions shall be deposited on the NDS open area, NDSX4, subdirectory CINDA.

8. In the case where there is problem with updates to files of a given center, the Nuclear Data Section shall have the authority to produce transmission files for that center and release them to all data centers.

Future NRDC Cooperation on CINDA

(WP 2003-26)

Nuclear Reaction Data Center Meeting
June 2003

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.

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. 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:

- Convert its CINDA master file to the new format,
- Retrieve the data for their area in the old exchange format, and
- Send both files to NDS.

These files will be distributed by NDS to those centers that want them.

Completion: October 2003 (moratorium on new transmissions initiated 1 Sept. 2003).

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 2003

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 2004 (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 2004 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.

NNDC Status Report to the IAEA Technical Meeting on the Network of Nuclear Reaction Data Centers 17-19 June 2003

General

Since the last meeting of the Nuclear Reaction Data Centers in May 2002, we have had the following personnel changes: I. Sirakov, completed his term in September 2002. J. Tallarine (support staff,) retired and has been replaced by J. Totans. M. Herman was hired in March 2003, with primary responsibility for nuclear reaction data evaluation and ENDF management. There are currently 10 FTE scientific/professional and three support staff. One additional retirement is expected within the coming year.

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. We are currently in the process of migrating to a multi-server environment:

1. a dual-processor Intel Xeon Red Hat Advanced Server (2.8 GHz) as our working server;
2. two database servers (Intel Itanium-2 HP-UX (1 GHz) currently planned);
3. a Web server (Intel Xeon single processor (2.0GHz MP) currently planned. This server will be owned by us, but operated by the BNL Information Technology Division.

NNDC replaced six PC's running on 466-MHz Intel Celeron with PC's having INTEL Pentium 4 preocessors. An additional Intel Pentium 4-based workstation was purchased to handle compute-intensive activities. The remaining NNDC staff PC's are being upgraded to Windows XP.

Bibliographies

The NSR compilation activity has continued. Over 4,200 references were entered in FY2002.

The CINDA compilation activity continues with respect to those references associated with the experimental data compiled at the Center. In the period from June 2002 to May 2003, 7 CINDA transmissions were sent (see Table 3) containing a total of 1380 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 4).

Evaluated Nuclear Reaction Data

NNDC continues to coordinate the work of the Cross Section Evaluation Working Group. Version 6.13 of the ENDF Utility codes has been distributed and is available on the Web.

Collaboration with LANL (Chadwick) and IAEA Vienna (Trkov and Zerkin) on the development of a modular nuclear reaction model code EMPIRE (principle author M. Herman) for nuclear reaction data evaluations continued. Validation of the Monte Carlo Hybrid Monte Carlo code DDHMS (authors M. Chadwick and M. Blann, LANL) is underway. Several improvements of the code EMPIRE were done, including new graphic user interface shown in Fig. 1, merging of resonance and fast energy region into single ENDF-6 file, and plotting of particle spectra and angular distributions.

Collaboration with the Korean Atomic Energy Research Institute (KAERI) on 19 fission product cross-section evaluations reached its final stage. Evaluations for 15 materials were submitted to ENDF/B-VII. The remaining evaluations for 4 deformed nuclei are under revision.

Review of all available fission product cross sections from 5 international data files (ENDF/B, JEF, JENDL, BROND and CENDL) continued as an international project (NEA WPEC Subgroup 21, chaired by P. Oblozinsky). The project intends to review all 211 evaluations in the fission products region (Z = 31 - 68), to focus on the bulk of evaluations and to recommend the best evaluations for inclusion into ENDF/B-VII. After completion of trial reviews for 18 materials in 2001, SG21 reviewed another 65 materials including 15 by the NNDC.

Photonuclear data on ^{14}N were evaluated for 9.17 MeV resonance photons, to be used in MCNP simulations of the Gamma Resonance Technique to detect explosives. Preliminary evaluation of ^{74}Ge+n was performed with a focus on complete discrete and continuous photon production data that are needed for MCNP simulations of detector systems using Germanium. To validate EMPIRE procedures for gamma production, the well-measured ^{56}Fe+n was compared with calculations.

The NNDC, in cooperation with Russian Nuclear Data Center VNIIEF, Russia, and Michael Smith (ORNL), has been awarded a grant from the Civilian Research and Development Foundation (CRDF) for the “Compilation and Evaluation of Alpha-Induced Nuclear Reaction Cross Sections for Astrophysics”. Work has begun on collecting references and compiling the data. So far, a “complete” list of references for 16O, 20Ne and 24Mg has been obtained.

Nuclear Structure Data

NNDC continues to publish the ***Nuclear Data Sheets***. As of April 2002, issues through Volume 99, #1 have been sent to Academic Press.

The experimental nuclear structure and decay data database (XUNDL) now contains more than 1000 data sets, compared to 857 one year ago).

Nuclear Data Base Migration

During the coming year, it is expected that administrative functions for CSISRS(EXFOR), CINDA, ENDSDF, and NSR will be transferred to the new Linux/Sybase 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 in the following year, and the database migration is expected to be completed by December 2004.

Customer Services

The number of online retrievals continues to increase, primarily due to the availability of most databases on the Web. There are about 30,000 retrievals per month from the combined Online Service, Web site, and anonymous ftp (97% of retrievals are from Web). A chart of statistics for the combined online retrievals is attached.

The NNDC continues to host the USNDP Web site, CSEWG Web site, and International Nuclear Structure and Decay Data Network Web site. The IAEA Nuclear Data Section has taken over maintenance of the Web site for the Nuclear Reaction Data Centers (NRDC) Network.

Table 1.
Visitors to NNDC from June 2002 to May 2003

Visitor	Host	Duration	Topic
Viktor Zerkin, NDS	D. Winchell V. McLane	2 weeks	Nuclear reaction database migration
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 migration

Table 2.
Visits by NNDC Personnel to Other Centers

Staff Member	Host	Duration	Topic
Jagdish Tuli	IAEA/NDS	1 week	NSDD Evaluators' Training Workshop
Thomas Burrows	IAEA/NDS	1 week	
Victoria McLane	IAEA/NDS	3 days	Database migration; EXFOR training session.

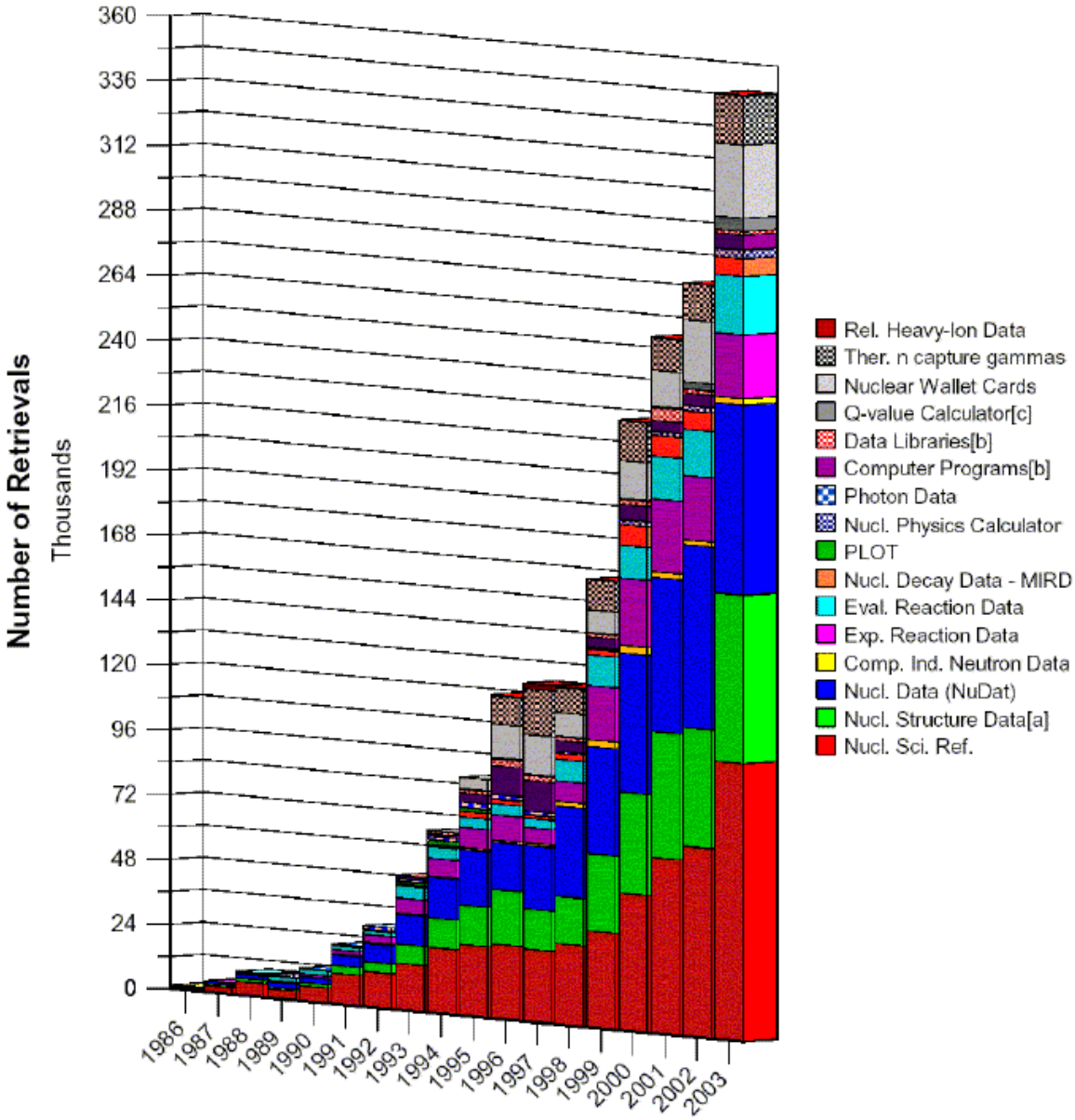
Table 3. NNDC CINDA Transmissions (June 2002 – May 2003)

Transmission			Lines In database	Blocks in database
	Date	# lines		
172	20020611	164		
173	20020614	45		
174	20020626	26		
175	20021108	51		
176	20021218	332		
177	20030220	198		
178	20030516	564		
NNDC Totals		1380	90,708	39,865

Table 4. NNDC Transmissions (June 2002 – May 2003)

Tape	Preliminary posted	Final			Change in	
		Posted	# data points	# entries	# data points	# subentries
Area 1 (neutron)						
*1305	20020408	20020515	2,991	13		
1306	20020607	20020711	13,845	20		
1307	20020823	20020924	24,070	32		
1308	20021018	20021119	79,772	21		
1309	20021202	20030106	30,276	26		
1310	20021211	20030203	88,390	28		
1311	20030103	20030203	19,336	24		
1312	20030207	20030305	19,385	25		
1313	20030304	20030411	58,363	36		
1314	20030411	20030530	51,230	28		
1315	20030530					
Area 1 Total			333,437	212	152,227	318
Area C (charged particle_						
C056	20020617	20020722	15,425	94		
C057	20020827	20021018	7,919	19		
C058	20030225	20030328	4,924	10		
Area C Total			28,268	123	19,444	175
Area T (charged particle - originally compiled at another center)						
T011	20020726	20020827	24,091	16		
T012	20030127	20030225	3,539	13		
Area T Total			27,630	29	22,709	214
NNDC Total					194,380	707

*NNDC On-Line Data Service, Web, & FTP Retrievals 1986-2003**



* Extrapolated as of May 31, 2003.
[a] Includes proton emitters (added to Web February 21, 2002).
[b] Removed from Online Data Services June 25, 2002.
[c] Added to Web September 11, 2001.

Report to the NRDC from the OECD Nuclear Energy Agency – Data Bank,

17 June 2003

INTRODUCTION

The NEA Data Bank service statistics for 2002 continues to confirm the fact that these services are more and more solicited in Member countries. The computer program services, including the distribution of integral data sets, recorded close to 4700 requests, which is the highest figure ever. The increase in the request for computer programs was especially noticeable with a 35% increase from 2001.

The statistics from the nuclear data services also show an increased number of accesses in 2002, especially after the removal of the password restrictions in July 2002 for accessing the EXFOR and the Evaluated data. A very large increase in the volume of data retrieved in 2002 is the result of the release of JEFF-3.0 and of new versions of other evaluated data libraries.

The Management Board of the Thermo-chemical database (TDB) project decided in November 2002 to launch a new phase of the project. This new phase will be a 4-year project starting from January 2003 and will be devoted to the review of chemical thermodynamic data of Thorium (Th), Iron (Fe), Tin (Sn), and Molybdenum (Mo).

The Data Bank manpower situation was stable in 2002 and is expected to remain at the present level throughout 2003 and 2004. The A5 post as head of the Data Bank was announced in early autumn 2002, but the recruitment had to be delayed due to an imposed freeze of vacant posts, a result of the difficult budget discussions in OECD. The freeze was lifted in the beginning of April 2003. Two A2/3 posts, both allocated to the nuclear data services, are expected to become vacant, one in 2003 and one in 2004.

NUCLEAR DATA SERVICES

EXFOR/CINDA:

The compilation of entries for the CINDA and EXFOR databases continues. For 2002 941 CINDA entries were distributed from area 2 (that of the Data Bank Member countries.) For this current year, 2003, many more entries are expected (~2000) as JAERI have kindly provided the CINDA entries relevant to numerous of the JENDL libraries (including JENDL-3.2, -3.3, -D/99) some of which were never compiled at the time. Further to this the JEFF-3.0 library, which was officially released in April 2002 will also be included in CINDA this year. Compilation of newly published work is also up-to-date for 2002.

The Data Bank has prepared the tables for the CINDA-2001 database entries and we are awaiting final decisions on the exact format for exchange before we finalise our loading/distribution programs etc.

Following discussions with the IAEA Nuclear Data Section, it has been agreed that the NEA Data Bank will assume the responsibility of producing and printing the CINDA book, including the database version on CD-ROM (CD-CINDA/JANIS). This agreement is due to the fact that most of the CINDA book customers are within the NEA Data Bank area and that it would be more economical for the NEA to produce the books in-house. However for this year's book the IAEA will provide the relevant Postscript/PDF files relevant for sending to the printers as the NEA have as yet not developed the relevant programs as we are waiting for the new format before starting this non-trivial task.

The Joint Evaluated Fission and Fusion File Project (JEFF):

Since the release of the JEFF-3.0 General Purpose Library in April 2002, the work has focused on the testing and the benchmarking of the file. An on-line form has been created on the Project's web site (http://www.nea.fr/html/dbdata/jeff3feedback) in order to facilitate the sharing of information among JEFF-3.0 users and developers. The form allows the users to describe their feedback (e.g. processing problems, data representation anomalies...). This information is then summarised and discussed at regular JEFF meetings. The agreed-upon corrections are made available for users who wish to use them before the next official release of the data library.

Contributions to the validation of the JEFF-3.0 library were presented by CEA/Cadarache and NRG/Petten at the JEFF meeting held on 28 April 2003. A series of fast reactor criticals (MASURCA, SNEAK) were calculated and the results show improvements with JEFF-3.0 compared to JEF-2.2. A series of ICSBEP benchmarks, including various combinations of fuel compositions and spectra, were analysed using various libraries, including JEFF-3.0, ENDF/B-VI.8 and JENDL-3.3. This study confirmed the results of a previous work presented at the US Cross Section Evaluation Working Group, namely that the most recent versions of the evaluated files lead to more consistent benchmark results. Validation efforts within the JEFF Project are aiming in particular at solving the problem of reactivity under-prediction for LWR lattices, an international study carried out in the framework of the NSC Working Party on International Nuclear Data Co-operation (WPEC).

An extension of the JEFF Project mandate for another 3 years was recently agreed. It was noted that:

1) The progress on the decay data and fission yields libraries is still slowed down by the lack of manpower.
2) There is an important decrease in the level of nuclear data activities in member countries. In particular, it is difficult for JEFF/SCG members to make commitments on a level of participation of their country in the JEFF Project for the coming years. Thus, the planning of activities and deliverables is uncertain.

The JANIS software:

The first official version of the nuclear data-plotting package JANIS was released in October 2001. Since then, about 700 copies of the CD-ROM have been distributed and important feedback has been accumulated, mainly originating from E. Dupont (CEA, Cadarache), A. Koning (NRG, Petten) and Christopher Dean (Serco Assurance, Winfrith).

A new version, which will address this feedback, is expected to be released in late summer 2003. It is planned that this new version would enable the user to access activation data described using files 8, 9 and 10 of the ENDF-6 format as well as NUBASE-formatted files. The "Computation" and "Weighting" features will be generalised to allow the user to combine several types of data (e.g. a combination of cross-sections and angular distributions for the production of differential cross-sections).

The structure of the data in JANIS-1.0 (serialised Java objects) is considered to be an important weakness since databases created with a given version of JANIS become obsolete when the data input routines are updated. To overcome this difficulty, a relational database technology will be used to store and retrieve the data. A Java-based database will be used in the next version to index ENDF-6 formatted files. The code will then directly access these files for the display and manipulation of the data.

It is also planned to incorporate the CINDA database into the next version of JANIS. A first version including CINDA is currently being tested. The longer term goal is to incorporate all the major databases containing nuclear data related information (CINDA, EXFOR and Evaluated data) in JANIS and to develop routines for updating these databases through on-line connection to the master databases stored at the NEA Data Bank.

Services to Nuclear Data Users:

The nuclear data services are to a very large extent provided through direct on-line access to the CINDA, EXFOR, EVA databases containing bibliographic, experimental and evaluated nuclear data respectively. Following the decision by the NSC Executive Group last year to eliminate the password protection for the database containing experimental and evaluated data, the Data Bank has noticed a significant increase in the number of real accesses. The term “real accesses” refers to the number of accesses after subtraction of Internet search engines, which constitute a substantial proportion of the total number of accesses. For more details about this and the number of accesses to the different databases, see the section below on “Computer Infrastructure and Development”.

COMPUTING INFRASTRUCTURE AND DEVELOPMENT

Achievements in 2002

Hardware

Dual Internet Service Providers and Linkproof
One of our Internet Service Providers (ISP), KPNQWEST, went bankrupt in June 2002 and was replaced by the TELIA operator. By December 2002 the Internet links with Telia and Renater were both running at 2 Mbps. In the previous configuration, the traffic was being preferentially routed through only one ISP because of the artificial weightings being given in the Border Gateway Protocol (BGP). This problem no longer exists, as we have abandoned the BGP approach to one that relies on dynamically determining the optimum route for both incoming and outgoing traffic. The route balancing work is done by a device called “Linkproof”.

Linux cluster architecture
A set of 4 Linux operating systems in rack mounted Dell equipment has replaced the Ex-Digital True-64 Intranet server. All common system files, Intranet files and user files are stored on a shared Network Attached Storage (NAS) device through a Network File System (NFS) protocol.

Cisco switches
The internal network equipment shared by the Data Bank and the Office Automation (OA) unit of the Agency was completely renewed. Fast switches have been installed in two different parts of the premises. The vital elements of the network have the ability to failover to their corresponding redundant partners.

Backup
An integrated file backup operation, servicing all of NEA, was implemented in spring 2002. All platforms (Unix, Linux, NAS and NT servers) have their file systems backed up to cassettes by the same unique tool. In addition the NAS uses daily and weekly snapshots to keep track of all file changes. This affords the capability to restore online any file lost within a month.

Online Services

Statistics of the usage of the Data Bank services rely on the logging of all accesses through the web site. It is necessary to eliminate from the logs various un-representative accesses such as ‘Page not found’ errors, images and icons that get downloaded with a page view and so on. It has become apparent in recent years that search engines account for a large fraction of accesses to the web site. For instance, the number of accesses to the Computer Program Abstracts was 690,000 in 2001 and 733,000 in 2002. The search engines alone accounted for 364,000 (53%) and 507,000 (69%) in 2001 and 2002 respectively. This year we have attempted to remove the search robots from the statistics. Although there still remain many cases where real end users have downloaded large parts of the site using freely available tools to accomplish this task easily.

When access to parts of the site is password protected, there is no interference from 'commercial' search engines. Such was the case in 2001 for the Computer Program requests and downloads and the EXFOR, Evaluated data files and JEFF documents. In July 2002, following a decision by the Executive Group, the password protection was removed from the nuclear data areas. As a result there was a rapid increase in the number of accesses to those pages.

Table 2. Number of accesses

	2002	**2001**	**2001**
	Robots excluded		**robots included**
Abstracts	225299	322689	689953
Program retrievals	489*	286*	287*
Cinda	2733	1916	2929
EVA searches	4400	2333^	2335^
EVA downloads	2915	1527^	1530^
JEF documents	12783*	11104*	20309*
EXFOR searches	9063	6979^	7005^
EXFOR downloads	8872	7431^	7545^
JANIS	25068	10250	14397
Web pages - CPS	107491	102865	159881
Web pages – DB	27738	17007	22179
Web pages - Data	57138	54866	56839
Web pages - TDB	16997	16129	30268
Total accesses	**487714**	**525722**	**971009**

* password protected
^ Password protected until July 2002

Table 3. Number of Gigabytes

	2002	**2001**	**2001**
	Robots excluded		**robots included**
Abstracts	3.9	4.0	8.4
Program retrievals	9.1	3.9	3.9
EVA downloads	13.3	8.2	8.2
EXFOR	0.24	0.2	0.2
JEF documents	10.3	8.4	14.1
Web pages - CPS	5.7	2.2	4.1
Web pages - Data	2.3	2.3	3.3
Total traffic	**44.8**	**29.2**	**42.2**

The number of total 'page accesses' to the various services has not changed very much since last year and is at about half a million. On the other hand much larger files are

now being transferred through the Internet; in particular for the Computer program dispatches and the Evaluated files (as a result of the release of JEFF-3.0 and JENDL-3.3 in particular).

Current and recent work in 2003

Cinda and Janis
The Data Bank started to produce a CDROM version of CINDA in 2000. Since that time the CD-Rom database used was a version of Oracle which could only run on Microsoft Windows. We have now completed a version of CINDA based on the same Java database system used in Janis: Mackoi. At the same time, the opportunity was taken to integrate CINDA into the Janis environment. Janis now integrates all three nuclear data repositories managed by the Data Bank (Evaluations, EXFOR and CINDA) into a single multiplatform CD-based search and plot facility. The final Janis 2.0 release is expected in the summer.

E-mail spam and security
An enormous amount of spam E-mails arrive at the Data Bank and the increasing trend is alarming. It is also becoming more difficult to recognize which emails are spam, as, for instance, the emails could consist of just an image and a text analysis tool will be powerless. A highly recommended software system (called Mailsweeper) has been installed in February with the ability to intercept spam emails based on phrase lists which are updated automatically on a daily basis. The software also protects from viruses using a similar text analysis mechanism.

Plans for 2003-2004

Internet server
The current Internet server is a dual ex-Digital True-64 Unix system. It is expected to remain in service for the next two years. It is reliable and powerful enough to fulfil its main role as Web server. There are, however, signs that its configuration is becoming obsolete. A major operating system upgrade is overdue and there are already difficulties in finding or installing current versions of open source software (Apache-2, Java, Verity search, …). It is therefore planned to install a standard Linux web server in such a way that Web accesses will be spread equally over the two servers (in a round robin set up). The Linux server will be able to fully replace the True-64 Unix server when taken offline for upgrades.

Parallel computing
It is planned to implement a code such as MCNP on the set of Linux machines currently used for the Intranet and other dedicated tasks. The 8 Linux computers at our disposal can be configured to run the parallel processing tasks during the night when normal activity is at a minimum. With this technique, it is expected that some benchmark calculations and computer program tests, running in tens of days, will be over in much less time.

ORACLE
A major upgrade of the internal ORACLE database management system software (version 8 to version 9i) is planned for this period. It will improve the operation of the

"hot standby" facility we implemented between the master ORACLE server and the backup server. Currently, the operation of failing over to the standby machine requires a good deal of manual intervention.

COMPUTER PROGRAM SERVICES

Acquisitions:

During 2002 in all 85 new or revised versions of computer codes were acquired and 103 were verified, tested and master-filed. Twenty-two new or revised compilations of integral experiments (SINBAD, IFPE and IRPhE) were acquired during 2002. The number of acquired and tested programs and integral sets of data exceeds the expected values. The increase of testing could be realised with the help of external consultants.

The trend in acquisition of packages from member countries and others participating in the computer program service is shown in the following figure:

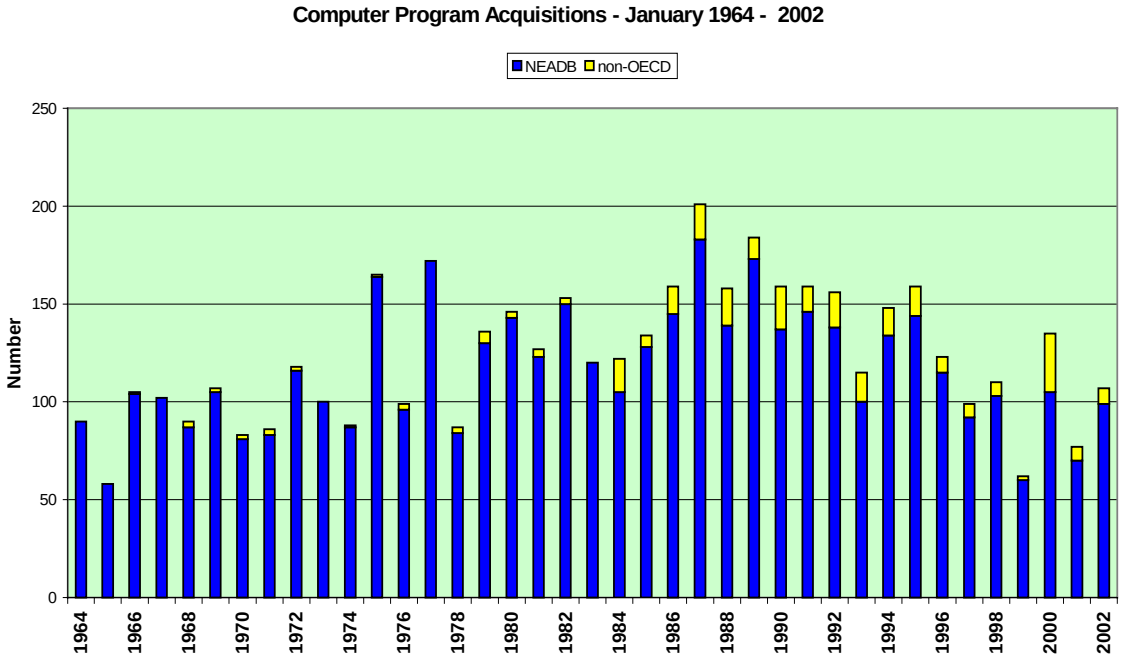


Figure 1. Total Annual Acquisitions of Codes and Integral Data

Dispatches:

During 2002, 2984 computer program packages were distributed, which is larger than expected. Regarding integral data experiments, 1680 sets were distributed during 2002, which is slightly lower than the figure of recent years. An additional 249 programs were distributed directly in Japan.

913 packages or 24% of the total distribution in 2002 were sent to non-OECD establishments or International Organisations.

A full historic for the past eight years is shown in Table 1 and Figure 2 shows the total dispatches (codes and integral data) since 1964 for OECD and non-OECD countries.

Table 1. Number of Computer Program Dispatches

Year	Programs	Integral Experiments	Total	% Integral Experiments
1995	1525	55	1580	3
1996	1641	208	1849	11
1997	1311	898	2409	37
1998	1787	1110	2897	38
1999	1898	2787	4685	59
2000	2249	1265	3514	36
2001	2205	1833	4038	45
2002	2984	1680	4664	36
Average	*1950*	*1230*	*3205*	*38*

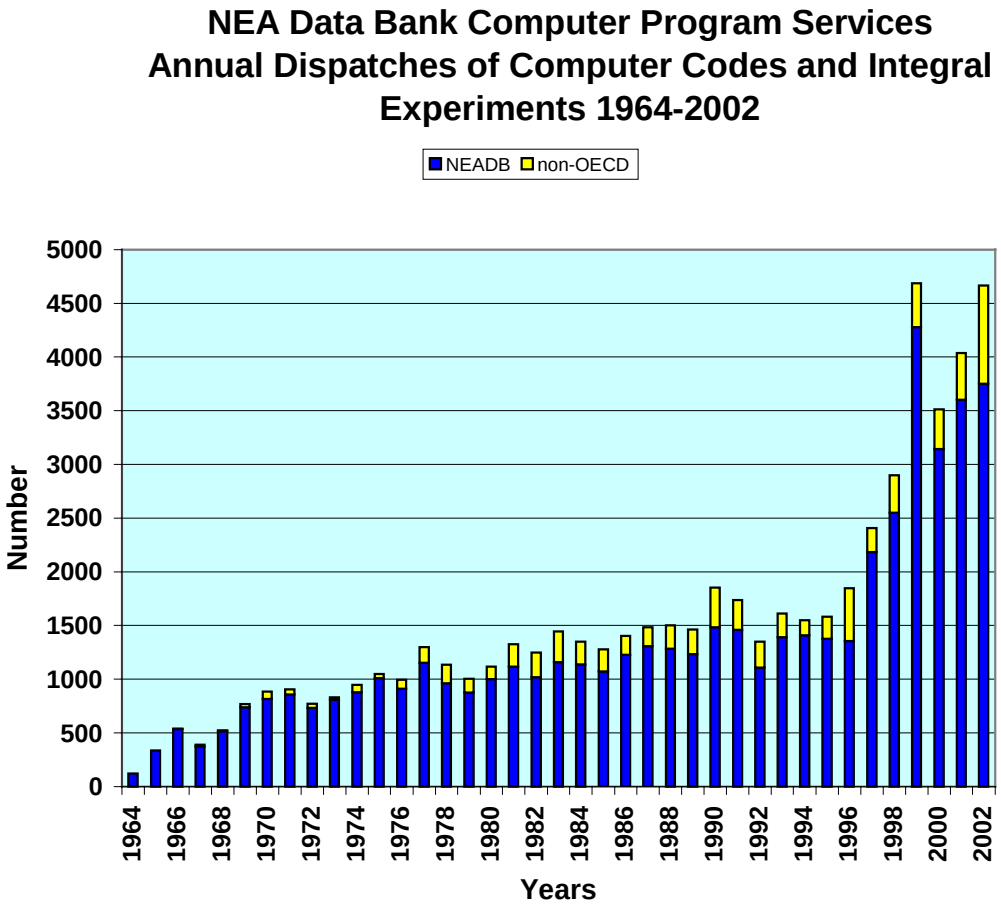


Figure 2. Total Annual Dispatches of Codes and Integral Data

P3

IAEA Nuclear Data Section: Progress Report, 2002/03

to the Technical Meeting
on the Co-ordination of the Network of Nuclear Reaction Data Centres,
IAEA, Vienna, 17 - 19 June 2003

Work done in the field of nuclear data by staff in the IAEA Nuclear Data Section is summarised for the period 1 June 2002 – 31 May 2003.

Web: http://www-nds.iaea.org/
e-mail: services@iaeand.iaea.org

O. Schwerer (editor)

1. Staff

The authorized staff level of the Nuclear Data Section remained at a total of 18 professional and support staff. The vacant position in the Atomic and Molecular Data Unit was filled by Denis Humbert in October 2002. Three staff members left NDS in 2003, and it is hoped that these positions will be filled later in the year: Mike Herman left at the end of February 2003 for a similar post at NNDC, BNL; Meinhart Lammer retired at the end of March 2003, while P. Kevin McLaughlin retired at the end of May 2003.

2. Data compilations

2.1 CINDA

As a contribution to the new format and file 'CINDA-2001', the necessary platform-independent software was developed as described under item 4 below, and was extensively tested. Furthermore, the old CINDA file was converted to CINDA-2001 format and the resulting data base checked. In particular, the conversion and coding of references and the new reaction-quantity codes were checked, and new proposals for coding have been made for discussion at the meeting.

Currently, NDS staff are scanning about 40 journal titles received regularly and about 25 titles from indexing journals. These include 9 journals originating from area 1 countries, 16 from area 2 and 6 translation series; the rest originate from area 3 countries.

Since the last NRDC meeting, NDS staff have prepared and transmitted 4 CINDA batches (NDS038-041) containing altogether 3569 CINDA entries (1733 area 3 entries in exchange format and 1836 in reader format for processing by other centers).

CINDA 2002 was published as a cumulative issue, including literature published and data files compiled/updated between 1988 and 2002. A new book page format has been developed to make full use of the space provided with the new A4 book format. The text pages in the Introduction

and Annex of the book have been completely revised. A copy of the CD-CINDA 2002, produced and supplied cost-free by the NEA-DB, was inserted in a special pocket of the CINDA 2002 book and was distributed with the book.

2.2 EXFOR and Dictionaries

Since last year's meeting, four neutron TRANS files (3111-3114) were distributed containing 17 new and 37 revised entries. 19 new charged-particle transmissions were received from ATOMKI, checked and finalized at NDS and, together with some NDS revisions of earlier entries, transmitted on two area D TRANS files (D025, D026).

Altogether 42 TRANS files from the network were received, checked and processed at NDS, containing 711 neutron entries (357 new, 354 revised), 396 charged-particle entries (355 new, 41 revised) and 26 photonuclear entries (10 new, 17 revised).

Since the previous meeting, NDS produced and distributed three transmissions of the EXFOR/CINDA dictionaries (9080-9082) in EXFOR, DANIEL and archive format.

2.3 Evaluated data libraries, files and data processing codes

New evaluated data libraries, files and data processing codes were checked and advertised for distribution to the NDS customers through the Web or on CD-ROM. Some of these products were obtained from the network of co-operating centres, while others comprise the results of IAEA/NDS CRPs and data development projects. They include:

- JEFF-3.0 General Purpose Library;
- JENDL-3.3, Japanese Evaluated Nuclear Data Library;
- Minsk Library of Actinides, with documentation;
- Data for Prompt Gamma 2002 (on CD-ROM only);
- DROSG 2000 Neutron Source Reactions, Version 2.2;
- EXFOR+CINDA/Java on Web (test version at development machine);
- EXFOR+CINDA/Java2 on CD-ROM;
- RIPL-2 Reference Input Parameter Library;
- EMPIRE-II, Modular System of Codes for Nuclear Reaction Calculations, Version 2.18;
- ENDF Utility Codes, Release 6.13;
- PREPRO2002 ENDF/B Pre-Processing Codes;
- ENDVER Verification Codes, updates of November 2002.

3. Services

On-line data services continue to be provided by NDS staff through the Alpha system. However, new and more cost-effective platforms are being developed to serve the various nuclear databases (see Section 4). The Web interface to the EXFOR and CINDA databases has been adopted to Alpha/VMS. NDS can now use the new software on the VMS-platform, and this system can be installed on the Linux-platform in other nuclear data centres.

The number of Web-retrievals by Member State users from the main Agency nuclear databases continues to increase mainly due to the opening of access to new libraries, files, programs and documents. Individual users also requested 1108 CD-ROMs containing the desired nuclear data and related documentation, and the number of requests for off-line retrievals remains at an approximately constant level of around 2500. Statistics are shown in Fig. 1 for accesses and retrievals from NDS and IPEN-mirror Web sites, including the geographical distribution of users.

A new scheme is in operation for NDS document and product distribution, which is based on a "wish list" as selected by the customers from a list of the NDS activities and modes of distribution. The addresses from the ADLIST database will be merged with the common IAEA addresses database, and options supported by the IAEA central documents distribution facility. However, NDS will still keep control of the addresses of their customers.

Biannual Nuclear Data Newsletters advertising new NDS products and services were published and distributed as hardcopies and electronically. Twenty-two INDC-NDS and countries' reports were prepared and published as hardcopy and electronically, including two complete Nuclear Constants journals translated from Russian to English.

4. Development of New Generation of Nuclear Databases and Services

A key task to create a fully platform-independent nuclear database has been successfully completed: a trial version of the nuclear reaction database has been developed and tested that combines bibliographic (CINDA) and experimental (EXFOR) data, and can be run on any platform supporting SQL and Java.

During the past year the following items were developed:

- CINDA loading software was created.
- CINDA Web retrieval system using Java-Servlet technology was created on Linux and tested with MySQL (NDS) and SyBase (NNDC).
- EXFOR+CINDA CD-ROM with a retrieval system based on Java2 for Windows and Linux was developed. The system has replaced EXFOR/Access CD-ROM for Windows. Integrates CINDA, does not need any installation, can work on several platforms with local and remote database, and has extended functionality.
- New EXFOR regular database maintenance has begun at NDS and NNDC.
- Web interface to EXFOR and CINDA was adopted to VMS with Apache Web-server using Tomcat and Java in full scale, including plotting (ZVView). Now available through NDS main page with addresses:
  http://ndsalpha.iaea.org:8008/exfor2/index.html (EXFOR)
  http://ndsalpha.iaea.org:8008/exfor2/cinda.htm (CINDA).

Tasks for the next year:

- begin ENDF-Relational project development: loading utilities, Web interface,
- create CINDA compiler's tool to input data to database,
- continue development of EXFOR and CINDA-Relational: utilities, documentation, etc.

5. Nuclear data development

Although nuclear data development is outside the immediate nuclear data centre's operations, we give a brief summary of recent developments below.

Nuclear data standards and evaluation methods:
First RCM of CRP on *"Improvement of the Standard Cross Sections for Light Elements"* included a detailed analysis of all problems to be faced in this reaction standards evaluation, agreed benchmarking of the codes to be employed, and the formulation of an appropriate work plan. The primary aim is to prepare these extremely important standards over the next 2 to 3 years according to the specifications and requirements of Member States.
Final RCM on *"Update of X- and Gamma-Ray Decay Data Standards for Detector Calibration and Other Applications"* was held in Vienna on 21-24 October 2002. The database resulting from this CRP is being assembled and documentation will be completed by the end of 2003.
Agreed modifications to the CRP library *on "Nuclear Model Parameter Testing for Nuclear Data Evaluation (Reference Input Parameter Library: Phase II)"* were implemented and tested during 2002, and the data work programme is close to completion. Detailed documentation is now being prepared, and will be ready for publication by the end of 2003.
An extension was approved for CRP on *"Fission Product Yield Data Required for Transmutation of Minor Actinide Nuclear Waste"*, and fourth RCM was held in Vienna, 25-29 November 2002.The database and documentation will be prepared in late 2003.

Nuclear data for radiotherapy using radioisotopes or external radiation sources:
A Consultants' Meeting on "Nuclear Data for Production of Therapeutic Radioisotopes" was held in Vienna, 27 February - 1 March 2002, at which the creation of a co-ordinated research project on this topic was strongly advocated. Thus, proposals for participation have been solicited, and the first RCM will be held on 25-27 June 2003.

Data for the Th-U-fuel cycle:
CRP on "Data for the Th-U Fuel Cycle" has formally begun: two research contracts and three research agreements have been awarded, and the first RCM is scheduled for 25-29 August 2003.
Work to establish an international database on the properties of irradiated graphite has continued as an extra-budgetary project. Fourth meeting of the Steering Committee was held 16, 17 October 2002 at IAEA Vienna, with the introduction of a new member (the Netherlands). Work continues to expand the database and improve the interface communications.

Nuclear data for reactor dosimetry:
The Agency organised a technical meeting on "International Reactor Dosimetry File (IRDF-2002)" in Vienna on 27-29 August 2002. Problems with existing data were identified, and corrective actions were discussed and assigned to participants or other experts in the field, subject to their approval to address these issues. The bulk of the work should be completed by the end of 2003.

6. Publications

- Herman, M., Parameters for Nuclear Reaction Calculations, Workshop on Astrophysics, Symmetries and Applied Physics at Spallation Neutron Source, 11-13 March 2002, Oak Ridge, Tennessee, USA.

- Herman, M., EMPIRE-II: Application to Radiative Neutron Capture, 11th Int. Symp. Capture Gamma-ray Spectroscopy and Related Topics, 2-6 Sept 2002, Pruhonice near Prague, Czech Republic.

- Jacimovic, R., Maucec, M., Trkov, A., Verification of Monte Carlo Calculations of the Neutron Flux in the Carousel Channels of the TRIGA Mark II Reactor - Ljubljana, Int. Conf.

Nuclear Energy for New Europe, 9-12 Sept 2002, Kranjska Gora, Slovenia; to be published in symposium proceedings.

- Paviotti-Corcuera, R., Zerkin, V., Zsolnay, E.M., Zolotarev, K.I., Mannhart, W., Greenwood, L.R., Griffin, P.J., International Reactor Dosimetry File: IRDF-2002, 11th Int. Symp. Reactor Dosimetry, 18-23 Aug 2002, Brussels, Belgium; to be published in symposium proceedings.

- Schwerer, O., IAEA Nuclear Databases for Applications, XXV Reuniao de Trabalho sobre Fisica Nuclear no Brasil, 31 Aug - 4 Sept 2002, Sao Pedro, Brazil; to be published in special issue Brazilian Journal of Physics.

- Trkov, A., Kurincic, B., Validation of the IAEA-WIMSD Library for the LOADF Code on Operation Transients at the Krsko Power Plant, Int. Conf. Nuclear Energy for New Europe, 9-12 Sept 2002, Kranjska Gora, Slovenia; to be published in symposium proceedings.

- Zagar, T., Ravnik, M., Trkov, A., Isothermal Temperature Reactivity Coefficient Measurement in TRIGA Reactor, Int. Conf. Nuclear Energy for New Europe, 9-12 Sept 2002, Kranjska Gora, Slovenia; to be published in symposium proceedings.

7. Workshops 2002/2003

- Nuclear Reaction Data and Nuclear Reactors: Physics, Design and Safety, 28 Feb - 29 March 2002, ICTP Trieste, Italy.

- Nuclear Structure and Decay Data Evaluation, 18-22 Nov 2002, IAEA Vienna, Austria.

- Nuclear Data for Science and Technology: Materials Analysis, 19-30 May 2003, ICTP Trieste, Italy.

- Atomic and Molecular Data for Fusion Energy Research, 8-12 Sept 2003, ICTP Trieste, Italy.

- Nuclear Structure and Decay Data: Theory and Data Evaluation, 17-28 Nov 2003, ICTP Trieste, Italy.

- Relational Databases for Nuclear Data Development, Dissemination and Processing, 1-5 December 2003, IAEA Vienna, Austria.

8. Visits and inter-centres co-operation

The following visits have taken place and contributed towards data centre co-operation:

- D. Winchell (NNDC) to NDS, 3 - 7 June 2002: Relational NSR,
- V. Zerkin (IAEA/NDS) to BNL/NNDC, 14-25 October 2002: Develop Software for the Management and Dissemination of Shared Nuclear Reaction Database (CINDA and

EXFOR-Relational),

- V. Zerkin (IAEA/NDS) to BNL/NNDC, 10-21 March 2003: Develop Software for the Management and Dissemination of Shared Databases (EXFOR, CINDA and ENDF),
- N. Ohtsuka (JCPRG, Sapporo, Japan) to NDS, 18 March 2003: EXFOR compilation questions,
- V. McLane (NNDC) to NDS, 12 -16 June 2003: Relational EXFOR and dictionaries.

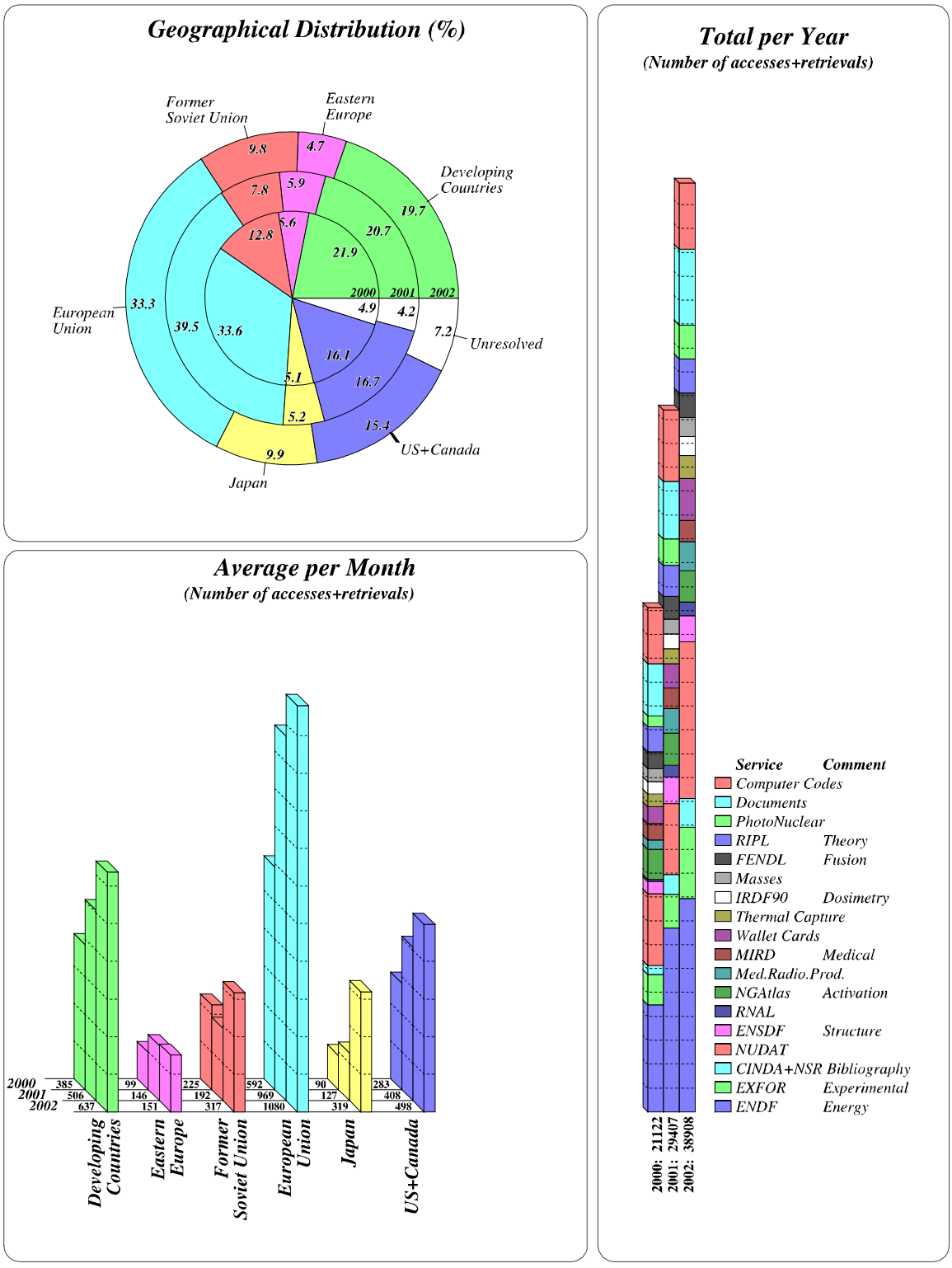


Fig. 1. Statistics of accesses and retrievals from NDS and IPEN (NDS-mirror in Latin America) Web sites.

Progress Report
to NRDC Meeting (17-19 June 2003, Vienna)

A.I.Blokhin, S.A.Maev, V.N.Manokhin
Russia's Nuclear Data Centre (CJD, IPPE, Obninsk)

EXFOR and CINDA activity.

1. TRANS 4127-4129 were prepared with 112 entries (17 new, 95 corrected). Three CINDA batches (CJD044-CJD046) with 2031 entries were transmitted.
2. During 2002-2003 we were engaged in checking Cinda Entry`s coded as "many". Some of them were compiled again in order to split by elements. We found that it was very useful. In process of this work some essential errors were corrected. We are going to do further the checking and re-compilation, if necessary, in order greatly diminish the number of works with code "many". In some cases the corresponding corrections were made in EXFOR entries.
3. In addition to Dr. S.Maev another coworker of CJD (Marina Mikhailyukova) was engaged in EXFOR compilation. Many years she worked together with Dr. A.Blokhin in nuclear data processing for the BROND Library. At present time we are going to train Marina as EXFOR compiler.

NUCLEAR DATA EVALUATIONS

Work performed with the participation of CJD

1. **V-nat, V-51, V-50:** Neutron energy E_n<20 MeV; work done in collaboration with the Kurchatov institute (Moscow) and the Institute of experimental physics (Sarov), in the frame of the ISTC project#910.
2. **Zr-90, Zr-91, Zr-92, Zr-94, Zr-96:** Neutron energy E_n<20 MeV; work done in collaboration with the Institute of experimental physics (Sarov), in the frame of the ISTC project#731.
3. **Pb-204, Pb-206, Pb-207, Pb-208, Bi-209:** Neutron energy E_n<20 MeV; work done in collaboration with the Institute of experimental physics (Sarov), in the frame of the ISTC project#731.
4. Enrichment of secondary gamma-ray production data produced by neutrons with energy E_n<20 MeV. Secondary gamma-ray production data are newly re-evaluated and incorporated for some nuclides

needed for in the fusion application, namely for: **Al-27, Fe-nat, Cu-63, Cu-65, Zr-nat, Zr-90, Zr-91, Zr-92, Zr-94, Zr-96, Pb-nat, Pb-204, Pb-206, Pb-207, Pb-208, Bi-209.** work done in collaboration with the Institute of experimental physics (Sarov), in the frame of the ISTC project#731.

5. CJD is engaged in re-evaluation of evaluated neutron data for the Nd and Sm separate isotopes for BROND-Library. The correction, processing and testing of new files for Ru and Pd isotopes is under way.
6. Considerable efforts are made to provide by reliable nuclear data the problem of activation and radiation damage of materials used in nuclear reactors and fusion designs. Selection of reaction excitation functions is made on the base of empirical systematics developed in CJD. The final aim is to check all available data and prepare the library similar to the FENDL-2/A, ADL-3 or EAF-99 but more reliable from our point of view.

We greatly appreciated the help of V.Pronyaev, O.Schwerer, L.Castello and M.Lammer to overcome our technical problems for successful compilation into CINDA and EXFOR.

ACTIVITY of CAJAD

to technical nuclear data centers meeting Vienna, 17-19 June 2003

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

Our **Exfor activity** had two main direction-

1. **Compilation A -Library**.

After last meeting 2002 we prepared **A053 , A054 And A055 Trans files**. These Trans files contains monitor reaction data, astrophysical data, fission data. The files include new entries and some corrected old entries. We have some remarks for A055 TRANS. We will corrected this TRANS after the discussion at our Meeting disputable moments.

2. **Team-work** with NEA DATA-BANK.

During 2002 year 100 Entries were prepared and included in O-library. This Entry contain differential data for elastic and inelastic scattering and production cross section radioactive and stable isotopes, data for material analysis by charged beams. This work is orientated for nuclear wastes transformation , medical applications and material analysis. The part of compiler entry was devoted new method of measurements- total charge-changing cross section measurements, knowledge of it is essential for many research areas including astrophysics, cosmic ray propagation, radiation protection of man in space and clinical treatment of cancer.

3. Checking Codes.

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

- our checking code
- CHEX

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

4. We met some difficulties to organize the Internet site for our Centre. Therefore we decide to use the site of Varlamov's Centre. Our colaboration is very usefyl for both Centres.

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

Status report to the IAEA Technical Meeting, June 17-19, 2003.

S.A.Dunaeva

Russian Federal Nuclear Center - VNIIEF.

Russia, 607190,Sarov, Nizhnij Novgorod region, pr. Mira 37

Compilation.

This year 2 transmission tapes (TRANS F013, F014) were sent including new and corrected entries.

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

Collaboration.

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

Our CRDF project started at March,8. In collaboration with NNDC we shall review and evaluate alpha-induced cross sections for nuclei with $8 \le Z \le 32$ and $E_{c.m.} \le 20$ MeV.

At the first quarter we started a search of reports including experimental measurements of α-induced reactions in the available literature. NNDC-partner performed the search of experimental reports on α-induced reactions on oxygen included into NSR (International Nuclear Science Reference) They found 80 references. Having analyzed the references we found that only 14 of them are in the EXFOR (International data base for experimental data). According to the agreement between the data centers we asked other centers about their compilation plans concerning reports.
Finally, we reached an agreement that we'll compile 59 reports.
In the most of these references the data are present only on figures. We are unable to acquire the actual data because the experiments were done several years ago and authors didn't keep these data. We started the process of scanning curves from figures. There is a lot of figures in reports. Now we finished compilation of 15 entries. 12 references we didn't find on our shells and we'll receive them next month from NNDC. The data on a diskette was transmitted by NPDC to the NNDC for entry into the EXFOR data library.

Our ISTC project is at the stage of approval. The Governing Board agreed to convene an Executive Session meeting in Moscow on 30 June 2003. During July, the ISTC Funding Parties will hold an electronic Project Funding Session. We hope on the best. We asked Akira Hasegawa and Charlie Dunford to facilitate the process of the project advance.

As you remember, the objective of this project is to create an integrated relational base (IRBD) of data on nuclear reactions, to fill it with data from the 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.

Software.

Before, our software was divided into two parts. One was installed at PC with

WINDOWS-98 operating system, another at the Alpha-station with Open VMS operating system. Unfortunately, our Alpha-station stopped and now we use only WINDOWS2000 (and upper) operating system. We were forced to upgrate and to install the whole software on PC with WINDOWS2000 operating system.

New software for digitizing curves was installed. 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.

Progress Report of the Charged Particle Nuclear Data Group
of the Institute of Nuclear Research, (Atomki) Debrecen, Hungary
to the IAEA Technical Meeting
on the Network of Nuclear Reaction Data Centres
17 - 19 June 2003

S. Takács

General

The Nuclear Data Group at the Institute of Nuclear Research of the Hungarian Academy of Sciences (ATOMKI) is working within the Cyclotron Department.
The main activity of the nuclear data group in Debrecen is concentrated on the integral cross sections of light ion induced reactions. The investigated reactions are connected to the following application fields:

- nuclear reactions for production of diagnostic radioisotopes,
- **nuclear reactions for therapeutic radioisotopes**
- nuclear reactions for thin layer applications
- nuclear reactions to monitor beam parameters
- nuclear reactions connected to transmutation of radioactive waste

The investigations include experimental measurements, data compilations, data evaluations, data validations and data applications. The investigations are connected to several applications simultaneously. The experimental measurements and the data evaluations are done in international collaborations. The main partners for measurements of nuclear data for production of therapeutic radioisotopes: VUB Brussels, FZ Jüelich, CYRIC Tohoku University.

Recent Progress

We have continued the determination of experimental cross sections on various target materials bombarded with charged particle beams, as well as the compilation and the critical comparison of several selected processes used for production of medically important radioisotopes, for monitoring charged particle beams and for thin layer activation measurements.

In 2002 first priority was given to check, update and upgrade of the evaluated Reference Database for medical isotope production and monitoring light charged particle beams. The database including recommended cross-section data and the corresponding deduced yields was published in IAEA-TECDOC-1211 and also was placed on the world-wide-web. The results of the Co-ordinated Research Project for "Development of reference charged particle cross section database for medical radioisotope production" were reviewed and 11 nuclear reactions for positron emitters were updated with

experimental results not included in the primary data base.

A validation test and upgrading of the recommended cross-section database for production of PET radioisotopes in charged particle induced reactions was performed. Experimental microscopic cross section data published earlier or measured recently and not yet included in the earlier evaluation work were collected and added to the primary database in order to improve the quality of the recommended data. The newly compiled experimental data in some cases influenced the decision made earlier and resulted in new selected cross-section data sets. A spline fitting method was applied to the selected data sets an updated recommended data were produced in those cases. The integral thick target yields deduced from the new recommended cross sections were critically compared with experimental yield data available in the literature and were compared with the data of the frequently used compilation work of P.P. Dmitriev, (*Radionuclide Yield in Reactions with Protons, Deuterons, Alpha Particles and Helium-3, Moscow, Ehnergioatomizdat (1986), and INDC(CCP)-263/G+CN+SZ (1986)*).

The results of the upgrading work were summarized in an article and were sent for publishing to Nuclear Instruments and Methods in Physics Research B. New evaluation and fit was performed for 8 reactions to produced improved recommended cross section. Data validation was performed for all the 11 investigated reactions by collecting and comparing experimental thick target integral yields with the calculated ones deduced from the new recommended cross sections. Generally the available experimental yields support our new recommended yields with minor deviations. Computational error and/or sub-optimal fitting procedures were detected in the TECDOC published data which were also corrected. The recommended cross section values for the 11 investigated reactions were compiled in EXFOR entry D4111.

Good agreement was found between our data and the ones published by Dmitriev for the $^{14}N(p,\alpha)^{11}C$ and $^{69}Ga(p,2n)^{68}Ge$ reactions. In two cases, $^{16}O(p,\alpha)^{13}N$ and $^{18}O(p,n)^{18}F$, the agreement is good up to 16 and 8 MeV respectively but above these energy points Dmitriev's data are higher than our ones. For the $^{nat}Ne(d,x)^{18}F$ and $^{124}Te(p,n)^{124}I$ reactions the data agree within a few percent. In the case of $^{85}Rb(p,4n)^{82}Sr$ and $^{nat}Rb(p,x)^{82}Sr$ the values in compilation work of Dmitriev are too low and are in disagreement with the new recommended yield data. No data were published by Dmitriev for the $^{15}N(p,n)^{15}O$, $^{14}N(d,n)^{15}O$ and $^{nat}Ga(p,x)^{68}Ge$ reactions. The results of this part of the upgrading work are summarized in Table 1.

EXFOR compilation

As agreed earlier the Debrecen CP Nuclear Data Group collects and compiles charged particle experimental cross section data measured in Debrecen and Jüelich.
In the last year this activity was temporary slowed down, due to the overload by other program. By this time two TRANS were transmitted to NDS including 19 entries and 85 new subentries containing experimental data.

Nuclear data services

The group continue to supply compiled experimental charged particle data at low a medium energies for special request, needed mainly on non-energy related applications (medical isotope production, TLA, etc).

Staff

The staff consists of three physicists, working in different application areas at the Debrecen cyclotron. They work in-part time in different percentage on data measurement and compilations and other related work. The main problem is the lack of technical support for data input

Technical developments

New high speed computers were installed to increase the effectivity of data evaluation and data processing of experimental primary data. A high resolution scanner and simple but effective software were also put into operation to scan and digitize data given only in graphical form.

Planned new measurements to complete the available charged particle data

In collaboration with other laboratories we participate in a systematic study and measurements of CP cross sections data in low and medium energy range. The reactions are selected on the basis of the every day practice and requirements of the collaborating laboratories, and on the problems arising during compilation and evaluation of the available data. We continue to investigate the following processes and areas:

- Production of radioisotopes for medical diagnostic.
- Production of radioisotopes for therapy.
- Commonly used reactions for thin layer activation technique.
- Intercomparison of commonly used monitor reactions.
- We continue to work on the problems related to the Reference Database for medical isotope production and monitoring light charged particle beams.
- We continue to compile new entries in EXFOR from the papers published by the INC, Forschungszentrum Jüelich, Jüelich, Germany, and Institute of Nuclear Research, Debrecen, Hungary.

Address

Institute of Nuclear Research
of the Hungarian Academy of Sciences,
(ATOMKI)
Bem tér 18/c, Debrecen, H-4026, Hungary
Tel.: +36 52 417-266
Fax.: +36 52 416 181

email: Ferenc Tárkányi: tarkanyi@atomki.hu
Sándor Takács: stakacs@atomki.hu

Experimental work done on charged particle cross sections in 2002-2003

The following light charged particle induced nuclear reactions were investigated and cross sections were measured. Results were summarized in articles and were published or were sent to publisher.

$^{nat}Ti(p,x)^{48}V$
$^{nat}Ni(p,x)^{57}Ni$
$^{nat}Cu(p,x)^{62}Zn$
$^{nat}Cu(p,x)^{63}Zn$
$^{nat}Cu(p,x)^{65}Zn$
$^{85}Rb(p,4n)^{82}Sr$
$^{nat}Mo(p,x)^{96mg}Tc$
$^{nat}Mo(p,x)^{99m}Tc$
$^{nat}Mo(p,x)^{99}Mo$
$^{100}Mo(p,2n)^{99m}Tc$
$^{14}N(p,n)^{14}O$
$^{18}O(p,n)^{18}F$

$^{nat}Pd(d,xn)^{111}Ag$
$^{nat}Pd(d,xn)^{110m}Ag$
$^{nat}Pd(d,xn)^{104mg}Ag$
$^{nat}Pd(p,xn)^{104mg}Ag$
$^{103}Rh(d,x)^{103}Pd$
$^{nat}Zn(d,x)^{66}Ga$
$^{nat}Zn(d,x)^{67}Ga$
$^{nat}Zn(d,x)^{62}Zn$
$^{nat}Zn(d,x)^{65}Zn$
$^{nat}Zn(d,x)^{69m}Zn$
$^{nat}Zn(d,x)^{61}Cu$
$^{nat}Zn(d,x)^{64}Cu$
$^{nat}Zn(d,x)^{67}Cu$
$^{nat}Zn(d,x)^{58}Co$
$^{nat}Zr(d,x)^{88}Zr$
$^{nat}Zr(d,x)^{89}Zr$
$^{nat}Zr(d,x)^{95}Zr$
$^{nat}Zr(d,x)^{97}Zr$
$^{nat}Zr(d,x)^{86}Y$
$^{nat}Zr(d,x)^{87}Y$
$^{nat}Zr(d,x)^{88}Y$
$^{nat}Zr(d,x)^{90}Nb$
$^{nat}Zr(d,x)^{91m}Nb$
$^{nat}Zr(d,x)^{92m}Nb$
$^{nat}Zr(d,x)^{95}Nb$
$^{nat}Zr(d,x)^{96}Nb$
$^{nat}W(d,x)^{181}Re$
$^{nat}W(d,x)^{182mg}Re$
$^{nat}W(d,x)^{183}Re$
$^{nat}W(d,x)^{184g}Re$
$^{nat}W(d,x)^{186}Re$
$^{nat}W(d,x)^{187}W$
$^{78}Kr(d,\alpha)^{76}Br$

$^{nat}Fe(^{3}He,x)^{54}Mn$
$^{nat}Fe(^{3}He,x)^{55}Co$
$^{nat}Fe(^{3}He,x)^{56}Co$
$^{nat}Fe(^{3}He,x)^{57}Co$
$^{nat}Fe(^{3}He,x)^{58}Co$
$^{nat}Fe(^{3}He,x)^{56}Ni$
$^{nat}Fe(^{3}He,x)^{57}Ni$
$^{nat}Cu(^{3}He,x)^{66}Ga$
$^{nat}Cu(^{3}He,x)^{67}Ga$
$^{nat}Cu(^{3}He,x)^{63}Zn$
$^{nat}Cu(^{3}He,x)^{65}Zn$

$^{nat}Fe(\alpha,x)^{56}Mn$
$^{nat}Fe(\alpha,x)^{55}Co$
$^{nat}Fe(\alpha,x)^{56}Co$
$^{nat}Fe(\alpha,x)^{57}Co$
$^{nat}Fe(\alpha,x)^{58}Co$
$^{nat}Fe(\alpha,x)^{61}Co$
$^{nat}Fe(\alpha,x)^{56}Ni$
$^{nat}Fe(\alpha,x)^{57}Ni$
$^{nat}Ta(\alpha,xn)^{184mg}Re$
$^{nat}Ta(\alpha,xn)^{183}Re$
$^{nat}Ta(\alpha,xn)^{182mg}Re$
$^{nat}Ta(\alpha,xn)^{181}Re$
$^{nat}Nb(\alpha,x)^{96mg}Tc$
$^{nat}Nb(\alpha,x)^{95mg}Tc$
$^{nat}Nb(\alpha,x)^{94g}Tc$
$^{nat}Nb(\alpha,x)^{95mg}Nb$
$^{nat}Nb(\alpha,x)^{92m}Nb$

Table 1.: Experimental data summary for upgraded diagnostic positron emitters.

Nuclear reaction	Number of data sets (σ) in the CRP	Selected data sets (σ) in the CRP	Additional works (σ) in this work	Integral data (TTY, PY) in this work	New evaluation in this work	Reason	Agreement with Dmitriev's data
$^{14}N(p,\alpha)^{11}C$	13	9	2	10	no		good
$^{16}O(p,\alpha)^{13}N$	11	10	0	8	no		good below 16 MeV
$^{15}N(p,n)^{15}O$	5	5	2	3	yes	better fit	no data
$^{14}N(d,n)^{15}O$	9	5	0	3	yes	better fit	no data
$^{18}O(p,n)^{18}F$	6	4	2	14	yes	new data	good up to 8 MeV
$^{nat}Ne(d,x)^{18}F$	6	3	0	3	no		acceptable
$^{69}Ga(p,2n)^{68}Ge$	3	2	0	3	yes	better fit	good
$^{nat}Ga(p,x)^{68}Ge$	3	2	0	3	yes	better fit	no data
$^{85}Rb(p,4n)^{82}Sr$	1	1	2	8	yes	new data	bad
$^{nat}Rb(p,x)^{82}Sr$	3	2	3	11	yes	new data	bad
$^{124}Te(p,n)^{124}I$	8	2	0	5	yes	better fit	acceptable

Publications in 2002-2003

The new experimental cross section and yield data measured by our group were published in different papers and presented at different conferences. Here we give the list of publications appeared in the last two years or were submitted for publication in a scientific journal.

Hermanne A., Sonck M., Takács S., Tárkányi F., Shubin Yu. N.:
Study on alternative production of ^{103}Pd and characterisation of contaminants in the deuteron irradiation of ^{103}Rh up to 21 MeV.
Nuclear Instruments and Methods in Physics Research Section B: Beam Interactions with Materials and Atoms ***187*** *(2002)3.*

Takács S., Tárkányi F., Sonck M., Hermanne A.:
New cross-sections and intercomparison of proton monitor reactions on Ti, Ni and Cu.
Nuclear Instruments and Methods in Physics Research Section B: Beam Interactions with Materials and Atoms ***188*** *(2002)106.*

Takács S., Tárkányi F., Sonck M., Hermanne A.:
Investigation of the ^{nat}Mo(p,x)^{96mg}Tc nuclear reaction to monitor proton beams: New measurements and consequences on the earlier reported data.
Nuclear Instruments and Methods in Physics Research Section B: Beam Interactions with Materials and Atoms ***198*** *(2002)183.*

Tárkányi F., Ditrói F., Takács S., Al-Abyad M., Mustafa M. G., Shubin Yu. N., Zhuang Y.: New data and evaluation of ^{3}He-induced nuclear reactions on Cu.
Nuclear Instruments and Methods in Physics Research Section B: Beam Interactions with Materials and Atoms ***196*** *(2002)215.*

Hermanne A., Takács S., Tárkányi F., Bolbos R.:
Cross section for the charged particle production of the therapeutic radionuclide Ag-111 and its PET imaging analogue Ag-104g.
Annales Universitatis Turkuensis, Seria D ***499*** *(2002)14.*

Hermanne A., Sonck M., Takács S., Tárkányi F., Shubin Yu. N.:
Deuteron bombardment of ^{103}Rh: A new promising pathway for the production of ^{103}Pd.
Journal of Nuclear Science and Technology, Supplement ***2*** *(2002)1286.*

Qaim S. M., Tárkányi F., Oblozinsky P., Gul K., Hermanne A., Mustafa M. G., Nortier M., Scholten B., Shubin Yu. N., Takács S., Zhuang Y.: Charged-particle cross section database for medical radioisotope production.
Journal of Nuclear Science and Technology, Supplement ***2*** *(2002)1282.*

Scholten B., Hess E., Takács S., Kovács Z., Tárkányi F., Coenen H. H., Qaim S. M.:
Cross section measurements on gas targets relevant to the production of the positron emitting radionuclides ^{14}O, ^{18}F and ^{76}Br.

*Journal of Nuclear Science and Technology, Supplement **2** (2002)1278.*

Tárkányi F., Takács S., Andó L., Vera-Ruiz H., Shubin Yu. N., Hermanne A.:
Status of the database for production of medical radioisotopes of ^{103}Pd ^{123,124}I, ^{201}Tl by using Rh, Te and Tl targets.
*Journal of Nuclear Science and Technology, Supplement **2** (2002)1318.*

Ido T., Hermanne A., Ditrói F., Szûcs Z., Mahunka I., Tárkányi F.:
Re-measurement of the excitation function of the ^{85}Rb(p,4n)^{82}Sr nuclear reaction near the threshold: relevance to the production of a ^{82}Sr(^{82}Rb) generator system with a medium energy cyclotron.
*Journal of Nuclear Science and Technology, Supplement **2** (2002)1310.*

Tárkányi F., Ditrói F., Szelecsényi F., Sonck M., Hermanne A.:
Measurement and evaluation of the excitation functions for alpha particle induced nuclear reactions on niobium.
*Nuclear Instruments and Methods in Physics Research Section B: Beam Interactions with Materials and Atoms **198** (2002)11.*

Ido T. , Hermanne A., Ditrói F., Szûcs Z., Mahunka I., Tárkányi F.:
Excitation functions of proton induced nuclear reactions on ^{nat}Rb from 30 to 70 MeV. Implication for the production of ^{82}Sr and other medically important Rb and Sr radioisotopes.
*Nuclear Instruments and Methods in Physics Research Section B: Beam Interactions with Materials and Atoms **194** (2002)369.*

Kovács Z., Scholten B., Tárkányi F., Coenen H. H., Qaim S. M.:
Cross section measurements using gas and solid targets for production of the positron-emitting radionuclide O-14.
*Radiochimica Acta **91** (2003)185.*

F. Tárkányi, S. Takács, A. Hermanne, F. Ditrói, L. Andó, S. -J. Heselius and J. Bergman
New experimental data on excitation functions for practical applications of alpha induced nuclear reactions on Ta up to 30 MeV, *Nuclear Instruments and Methods in Physics Research Section B: Beam Interactions with Materials and Atoms, In Press, Corrected Proof, Available online 28 May 2003,*

F. Tárkányi, F. Ditrói, S. Takács, F. Szelecsényi, A. Hermanne and M. Sonck
Activation cross-sections of alpha induced nuclear reactions on iron up to 40 MeV, *Nuclear Instruments and Methods in Physics Research Section B: Beam Interactions with Materials and Atoms, In Press, Corrected Proof, Available online 17 May 2003,*

F. Tárkányi, S. Takács, F. Szelecsényi, F. Ditrói, A. Hermanne and M. Sonck
Excitation functions of deuteron induced nuclear reactions on natural tungsten up to 50 MeV, *Nuclear Instruments and Methods in Physics Research Section B: Beam Interactions with Materials and Atoms, In Press, Uncorrected Proof, Available online 17 May 2003,*

F. Tárkányi, F. Ditrói and S. Takács
Excitation functions of ^{3}He-particle induced nuclear reaction on iron, *Nuclear Instruments and Methods in Physics Research Section B: Beam Interactions with Materials and Atoms, In Press, Uncorrected Proof, Available online 15 May 2003,*

S. Takács, F. Tárkányi, A. Hermanne and R. Paviotti de Corcuera
Validation and upgrading of the recommended cross section data of charged particle reactions used for production of PET radioisotopes, *Nuclear Instruments and Methods in Physics Research Section B: Beam Interactions with Materials and Atoms, In Press, Uncorrected Proof, Available online 24 April 2003,*

F. Tárkányi, A. Hermanne, S. Takács, F. Ditrói
Excitation functions for production of radioisotopes of niobium, zirconium and yttrium by irradiation of zirconium with deuterons
Submitted to: *Nuclear Instruments and Methods in Physics Research Section B: Beam Interactions with Materials and Atoms,*

F. Tárkányi, S. Takács, F. Ditrói, A. Hermanne and M. Sonck
Excitation functions of deuteron induced nuclear reactions on natural zinc up to 50 MeV
Submitted to: *Nuclear Instruments and Methods in Physics Research Section B: Beam Interactions with Materials and Atoms,*

S. Takács, Z. Szűcs, F. Tárkányi, A.Hermanne, M. Sonck
Evaluation of Proton induced reactions on ^{100}Mo: New cross sections for production of ^{99m}Tc and ^{99}Mo,
In press at: Radioanalytical and Nuclear Chemistry

A. Hermanne, M. Sonck, **S. Takács.** and F. Tárkányi:
Monitoring of proton beams: a practical application of an Evaluated Charged Particle Database. Submitted to: *Nuclear Instruments and Methods in Physics Research Section B: Beam Interactions with Materials and Atoms*

A. Hermanne, S. Takács, F. Tárkányi, R. Bolbos
Cross sections for charged particle production of the therapeutic radionuclide ^{111}Ag and its PET imaging analogue ^{104mg}Ag
Submitted to: *Nuclear Instruments and Methods in Physics Research Section B: Beam Interactions with Materials and Atoms*

P8

China Nuclear Data Center (CNDC) Progress Report

Zhuang Youxiang

1. General Situation

The second half of 2002, the head of CNDC has been changed to the younger generation, the new director is Dr. GE Zhigang; There are four groups in CNDC, as shown in Table 1.

Table 1 Organization chart of the CNDC as in May 2003 is giving below

Nuclear Data Evaluation Group	Nuclear Theory Group	Macroscopic Data Group	Data Library Group
Huang Xiaolong (Head) **Fan sheng** Wu Zhendong **Chen Guochang** **Zhuang Youxiang**	Ge Zhigang (Head) **Han Yinlu** **Zhang Jingshang** **Wang Shunuan**	**Liu Ping (Head)** **Rong Jian** **Wu Haicheng**	**Yu Hongwei (Head)** **Shu Nengchuan** Jing Yongli

2. Nuclear Data Evaluation

CENDL-3.0 was accomplished during 1996~2000, it includes 214 nuclides for general purpose. A new five year plan (from 2001 to 2005) has been started for the development of nuclear data evaluation and library construction. 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 (>300) and more files (for example covariance data files). More fission product nuclides will also be increased. 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-3.1 improvement and development.

The planned status of CENDL-3.1 is shown in Table 2.

Table 2. The planned status of CENDL-3.1

Nuclides	Planned in CENDL-3.1	Evaluated in CENDL-3.0	CENDL-3.1 Total
Fissile nuclide	**29**	**15**	**44**
Structure material	**55**	**42**	**97**
Fission products	**91**	**109**	**200**
Light nuclide	**7**	**3**	**10**
Total evaluated	**182**	**169**	**351**

3. CINDA and EXFOR Compilation

3.1 CINDA Total 25 entries were compiled from the papers of "Communication of Nuclear Data Progress" No. 27~28 in 2002. The entry compilations of the journals published in China are in progress.

3.2 EXFOR 5 entries (32609, 32646, 32647, 32648, 32649) measured in China. were compiled in cooperation with Dr. O.Schwerer.

4. Publication

"Communication of Nuclear Data Progress" (CNDP) has been published for 2 issues (No.26~28) during 2002, and it (350 books/each issue) has also been distributed by IAEA Nuclear Data Section as an INDC document. Now the editor-in-chief are Zhao Zhixiang and GeZhigang from on No.29 of the CNDP..

5. A New Task - Basic Data Library for Nuclear Physics

CNDC has got a new task of "The Basic Data Library for Nuclear Physics" during 2002~2005 in cooperation with China Committee of CODATA. It includes 7 sub-libraries: (1) Original experimental data, (2) Nuclear structure data, (3) Nuclear reaction data, (4) Nuclear decay data, (5) Nuclear model parameters, (6) Special purpose data, for example, astrophysics data, and (7) Related programs.

6. Activities and Cooperation during 2002

6.1 Meetings Held in China

(1) The network meeting on the 10^{th} years plan of nuclear data measurement, April 27~30, Hangzhou city, Zhejiang province;

(2) The meeting on annual plan of nuclear data evaluation, July 15~19, Mudanjiang city, Heilongjiang province;

(3) The Standing Committee Meeting of the Third China Nuclear Data Committee, September, 5, Beijing city;

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

(1) NEA Working Party Research on International Nuclear Data Evaluation Co-operation, May 8~11, Yu Hongwei, Brussels, Belgium;

(2) The 24^{th} Meeting of International Nuclear Data Committee Meeting, May 14~17, Zhao Zhixiang, Vienna, Austria;

(3) IAEA Advisory Group Meeting on Network of Nuclear Reaction Data Centers, May 27~30, Zhuang Youxiang, Paris, France;

(4) Research Co-ordination Meeting on Fission Product Yield Data Required for Transmutation of Minor Actinide Nuclear Waste, Nov. 25~29, Liu Tingjin, Vienna, Austria;

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

Drs. T.V.Golashvili, V.P.Chechev and A.Demidov, Ministry of Atomic Energy of Russia Federation, Dec. 15~24;

6.4 Staffs of CNDC Worked in or Visited Foreign Country

Wu Zhendong, JAERI, from Sep. 9, 2002 to Sep. 8, 2003.

Japan Charged-Particle Nuclear Reaction Data Group (JCPRG)

Executive Committee

Progress Report to the
IAEA Technical Meeting on the Network of Nuclear Reaction Data Centres
17-19 June, 2003

1. General

In 2002, we have carried out the following activities:

1. Compiling CPND (Charged-Particle Nuclear Reaction Data) (26 entries) in Japan with the NRDF (Nuclear Reaction Data File) format.
2. Transmitting CPND into the EXFOR data (79 entries, including 75 new)
3. Improving a web-based system, so-called HENDEL, an online editor-compiler for both NRDF and EXFOR.
4. Disseminating CPND and promoting its utilization in Japan.
5. Developing a new retrieval system, named DARPE (DAta Retrieval and Plotting Engine) for NRDF.
6. Designing a new retrieval system for EXFOR and JENDL (in collaboration with JAERI and SAE).
7. Investigating titles of journals which will be scanned by JCPRG for compilation of the CPND bibliographic information to CINDA.

The regular JCPRG budget has ended at March 2001. Starting from 2002, the budget was drawn on a competitive basis. The budget of 2002 was accepted to be almost the same as 2001. However the budget of 2003 was not accepted.

2. NRDF Data Compiling Activity

In 2002 we newly compiled 26 entries (717 tables, 3.23 MB) based on CPND obtained with the accelerators in Japan and published in NP/A, PR/C, PRL, PL/B, NIM/A, NST, EPJ/A, PTP and JP/G. One of important progresses in this year is found in quality of numerical data according to the following reason: With the cooperation of experimentalists, we received many numerical data from authors of references. The data of 520 tables (72.5%) among 717 tables were obtained from authors directly, while data of 38 tables (5% of total table number) were taken by scanning figures.

3. Transmission to EXFOR

Since the last NRDC meeting (May 2002, Paris), 4 files E021, E022, E023 and R013 have been transmitted to IAEA-NDS. E021, E022 and R013 were accepted and added into the EXFOR master. Preliminary trans files of these were corrected based on comments from NDS, CAJaD and NNDC. Many new codes proposed through 17 CP-Memo promote the transmission of Japanese CPND.

Recent CPND sent to the NDS open area are summarized in the following table (June 2002 to May 2003):

TRANS	TRANS-Flag	Entr-Tot	Entr-New	Entr-Rev	Dsub-Tot	Dsub-New	DSub-Rev
Area E							
E020		30	30	0	197	197	0
E022		28	25	3	308	295	13
E022	Prelim.	21	20	1	760	709	51
Sum		79	75	7	1265	1201	64

The number of newly transmitted entries is remarkably increased in comparison with results of the last year (Last year, we transmitted one entry E019 which includes 12 new entries). E1706, E1717 and E1751 are now pending because these data contain inclusive reaction data (production cross sections of elementary particles). These will be therefore transmitted after getting an agreement about the elementary particles code scheme in EXFOR.

In order to solve the duplication problem shown in WP2002-17, we deleted 18 E-library entries (which are duplications of E1790 to E1799), and also deleted 3 R-library entries, R0002, 0023 and R0024 (which are duplications of A0161, A0175 and A0265). There are still 6 duplication pairs between E-library and O-library.

All E-entries after E1700 have been compiled by HENDEL (web-based editor for NRDF and EXFOR). Using this editor, we can compile CPND in both formats of NRDF and EXFOR quite efficiently. Now we are working on the compilation of data published in the first quarter of 2003 (and some old references which should be in but lacked in the E-library).

3. Web-Based Editor "HENDEL"

Since July 2001, JCPRG has compiled all NRDF and EXFOR entries using the web-based editor HENDEL (Hyper Editor for Nuclear Data Exchange Language) as reported in WP2002-31. This editor is a very useful tool for us to compile CPND in both formats of NRDF and EXFOR simultaneously. HENDEL has been improved to cover completely CPND which JCPRG compiled, but it does not yet include whole part of EXFOR System Manual. We will further improve the HENDEL system and open website of HENDEL to the other centers for testing and comments in near future (see Action 29 of the NRDC meeting 2002).

4. Customer Services

Now the retrieval services of NRDF are available via web-server of JCPRG (http://www.jcprg.org/) and customers can access to NRDF data for 1213 references. In order to improve the retrieval environment, we are developing a new NRDF retrieval system DARPE (DAta Retrieval and Plotting Engine), by which we can compare many data from various entries on the same panel. This system is now on the step of the final test and will be released on the third quarter of 2003. We are also developing a retrieval system based on the IntelligentPad in order to extend the NRDF data service.

Other development started at the last winter in collaboration with JAERI and SAE. In this project, the new system for retrieval, plot and utilization of EXFOR and JENDL (Japanese Evaluated Nuclear Data Library) is being developed.

5. Recent Trend of Nuclear Reaction Data

We studied recent trends of neutron and charged-particle induced nuclear reaction

data published in 2002 by taking statistics for 8 major journals (PR/C, PRL, PL/B, NP/A, EPJ/A, JP/G, JPJ and PAN). In total, 614 papers were screened. These papers are categorized by journal, area, incident energy, induced particle, target and detected particle. We compared the results with a similar research which was done in 1991 (751papers). The main trends found in this research are as follows

Journal: The majority of the papers, both in 1992 and in 2002, were published by PR/C, although their number has slightly decreased. The number of papers in NP/A has also decreased, whereas EPJ/A published more paper in 2002. Numbers of papers published in PRL and PL/B are almost the same as a decade ago.

Area: According to the location of accelerators, we categorized papers by 5 areas (EU, US-Canada, CIS, Japan, Others). Accelerators in E countries published the most papers, with US and Canada following them (as in 1992). The combined number of papers with the data produced in the CIS countries was reduced by about half. The number of papers reporting on the data obtained at Japanese accelerators is almost the same as in 1992.

Incident energy: The number of papers reporting on thermal and low energy (<15MeV/*A*) reactions is the largest. The number of higher energy experiments is less than that of thermal and low energy experiments, but increased in comparison with that of 1992 (130% for 15-150MeV/*A*, 100% for 150 MeV-1 GeV/*A* and 150% for 1- GeV/*A*).

Induced particle: The number of neutron induced experimental data is reduced to 25% of the previous result, while the total number of π- and *K*- meson induced experiments is now larger than that of neutron induced experiments

Target: Experiments with heavy nuclei (*A*>40) contributed to the major art of the papers both in 2002 and in 1992. Light target (*A*<4) experiments are not frequently reported, although the number of papers on them increased about fourfold.

Detected particle: In the most experiments, the detected particle is γ. Next, hadrons, light nuclei (*A*<4) and heavy nuclei (*A*>4) are detected in a similar number of papers.

6. CINDA CPND entries for Japanese Journal

We have discussed the Japanese journals which should be scanned by JCPRG for compilation of the CPND bibliographic information to CINDA. We are planning to scan JPJ, PTP, NST and NSTS regularly (This is a subject to be discussed in NRDC).

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 (Univ. of Tsukuba)
Junsei CHIBA (Institute for Particle and Nuclear Studies, KEK)
Akira HASEGAWA (Japan Atomic Energy Research Institute)
Masayasu ISHIHARA (Institute of Physical and Chemical Research)
Ichiro KATAYAMA (Center for Nuclear Study, Univ. of Tokyo)
Kiyoshi KATŌ (Hokkaido Univ.)
Mitsuji KAWAI (Kyushu Univ.)
Shunpei MORINOBU (Kyushu Univ.)
Tetsuo NORO (Kyushu Univ.)
Hajime OHNUMA (Chiba Institute of Technology)
Koichi OKAMOTO (Nihon Univ.)
Hikonojo ORIHARA (Cyclotron and Radioisotope Center, Tohoku Univ.)
Teijiro SAITOH (Laboratory of Nuclear Science, Tohoku Univ.)
Hajime TANAKA (Hokkaido Univ.)
Yoshihiko TENDOW (Museum of Future Science and Technology)

Executive committee:

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

Secretariat:

Hitomi YOSHIDA (Hokkaido Univ.)

Office address:

Division of Physics, Graduate School of Science,
Hokkaido University
Kita-10 Nishi-8, Kita-ku, 060-0810 Sapporo
Tel: +81-11-706-2684, Fax: +81-11-706-4850, 4926
E-mail: nrdf@nucl.sci.hokudai.ac.jp Web: http://www.jcprg.org/

Staff:

1) Data compiling:

Masayuki AIKAWA (Hokkaido Univ.)
Chikako ISHIZUKA (Hokkaido Univ.)
Masatsugu ISSE (Hokkaido Univ.)
Sergei KORENNOV (Hokkaido Univ.)
Chie KUROKAWA (Hokkaido Univ.)
Kenichi NAITO (Hokkaido Univ.)
Naohiko OTUKA (Hokkaido Univ.)
Ryusuke SUZUKI (Hokkaido Univ.)

2) Data input:

Takako ASHIZAWA (Hokkaido Univ.)
NRDF system maintenance:
Masayuki AIKAWA (Hokkaido Univ.)
Naohiko OTUKA (Hokkaido Univ.)
Transmission of EXFOR files:
Masayuki AIKAWA (Hokkaido Univ.)
Hiroshi NOTO (Hokusei-Gakuen Univ.)
Naohiko OTUKA (Hokkaido Univ.)

3) New retrieval-plot system (DARPE) development:

Sergei KORENNOV (Hokkaido Univ.)
Kenichi NAITO (Hokkaido Univ.)
Naohiko OTUKA (Hokkaido Univ.)

4) IntelligentPad-based database development:

Yoshihide OHBAYASHI (Muroran Institute of Technology)

5) Editor-compiler development:

Naohiko OTUKA (Hokkaido Univ.)

Present Status of JENDL Project (May 2003)

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) and beyond

After 8 years of endurable revision works for JENDL-3.2 which had been released in 1994, the latest version of JENDL-3 (JENDL-3.3) was released publicly in May 2002. It contains the data for 337 nuclides in the energy range from 10^{-5} eV to 20 MeV. The ENDF-6 format is adopted. The pointwise files are also constructed at 0 K and 300 K by using RESENDD, RECENT, LINEAR and SIGMA1. All data are released on the WEB of our home page

http://wwwndc.tokai.jaeri.go.jp/jendl/j33/j33.html

or in a CD-ROM published from JAERI Nuclear Data Center (Aug. 2002)

The data improvement of JENDL-3.2 started at April 1997. Then after 5 years revision 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).

Some remarks of JENDL-3.3 are presented at
http://www.jaeri.go.jp/english/press/2002/020510

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

1) Supply of qualified 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. Strong requests for this data comes from FBR reactor projects in Japan conducted by JNC(Japan Nuclear Fuel Cycle Corporation) as well as LWR reactor design group of Reactor Designs Makers in Japan.

2) Newly evaluated materials important for high burn-up application

Er isotopes are newly supplied in JENDL-3.3, because of the importance as burnable poisons in LWR in high burn-up applications.

3) Adoption of isotope evaluation policy

From this JENDL3.3, isotope evaluation policy is adopted completely, abandoning long used element evaluation policy adopted up to JENDL-3.2. Up to the previous version, natural element data was usually prepared for a natural element material(i.e., isotopes data are aggregated in one material), in parallel with this natural data we devised also isotope data in some case. In particular cases, inconsistency between natural and isotope data were alive. So as to solve this inconsistency among data we have claimed that for transport calculations in nuclear reactors, natural elements data are solely 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. This change resulted in quality up in data expressions compared with natural evaluations.

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 Mass 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 measurement.

b. Medium Mass Nuclides (Modified Cross-sections)

Na, Ti, Cr, Fe, Co, Ni, Nb, W isotopes are revised based on the latest high resolution measurements. As to Er-162,164,166,167,168,170isotopes, complete new evaluation are made reflecting newly obtained capture data measured by TIT(Tokyo Institute of Technology).

6) Benchmark Test

Group constants or MCNP/MVP Monte Carlo libraries of JENDL-3.3 were generated and used in the benchmark test. A vast benchmark tests were made for shielding performances as well as reactor physics performances in LWR, FBR and Intermediate energy reactors. Criticality calculations showed very good performances and got superior results than JENDL 3.2.

The JENDL-3.3 was released on 10th May 2002 after a long review of vast range of benchmark tests suitable for the reevaluated nuclides.

JENDL-4

Five year project of JENDL-4 is going to start in 2003. Prior to the start of JENDL-4 project, an adhoc group for making the road map of JENDL-4 development was set up at March 2002 in JNDC. After one year discussions among nuclear data evaluators, users from various fields especially in advanced/innovative reactors, astrophysics group, BNCT(Boron neutron capture therapy) medical application etc, a group report will be opened in the next month. We present an outline here but this is not a final one, rather tentative one, i.e., not confirmed in the group.

We set the JENDL-4 main target as a file solving current concern on nuclear energy development such as high burn up, MOX fuels utilization, evaluations of burn-up credit and their safety assessments as well as innovative/advanced reactors seeking ultimate reliability in safety with reducing cost of fabrication. In the scope we also included medical or fundamental scientific applications such as BNCT, medical use of accelerators, and elemental synthesis in astrophysics. In JENDL-4, we set our goal as a supply of whole product not only JENDL-4 itself but also application libraries such as point Monte Carlo library (MVP/MCNP) library and/or group constants library produced from JENDL-4.

Contents will be enriched in the quality for actinide and FP nuclides, in the numbers for covariance data, fission product yields including prompt fission reactions, secondary gamma production data, charged particle spectra, the last one is especially required for the calculation of material damage.

Maximum energy of the file will be the same as the current one, i.e., 20 MeV. In ADS applications some materials require higher energy, only such materials will be extended up to some value of several tens MeV. Charged particle induced reactions will also be included even in limited numbers due to the requests from nuclear fusion or medical accelerator applications.

Adopted Format will be ENDF/B-7.

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 reflected in JENDL-3.3. The revision work for minor actinides not reflected in JENDL-3.3 will be continued in the coming several years. The results of the reevaluation will be stored in JENDL Actinide File.

□□□Fission and capture cross section of minor actinides given in JENDL-3.3 are compared thoroughly with other evaluated data and experimental data for the preparation of the JENDL Actinide File. The comparison was made for 32 nuclides of Th-227, 228, 229, 230, 233, 234, Pa-231, 232, 233, U-232, 234, 236, 237, Np-236, 237, 238, Pu-236, 237, 238, 242, 244, Am-241 ,242, 242m, 243, Cm-242 ,243, 244, 245, 246, 247, 248. Figures of compared cross sections and tables of cross sections at 0.0253 eV and resonance integrals are available in the publication of JAERI-Data/Code 2002-025: T. Nakagawa and O.Iwamoto,”Comparison of Fission and Capture Cross Sections of Minor Actinides”.

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, St.Petersburg Russia, #183.) and Radiation Physics and Chemistry Problem Institute (RPCPI, Minsk Belarus, #b-03). After those 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, #609.) for the coverage of JENDL High Energy File Project. Another project of actinide nuclear data evaluation for Th cycle started April 2000 (RPCPI, Minsk Belarus, #B-404). Summary record about ISTC is given in Appendix. A.

JENDL Dosimetry File

The working group on Dosimetry cross sections in JNDC has been published a new file JENDL Dosimetry File 99 and the WG was dissolved. Cross section data of previous version , JENDL Dosimetry File 91, were revised for 33 materials and their covariance matrices were

replaced completely with new ones. Integral tests were also made. The file was released in FY99 and the data were also released with a CD-ROM, which is freely available through NDC/JAERI. Contents are 67 various reactions with point-wise and 671 group structures averaged 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. Final report is under preparation. Revision of the files is foreseen 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, isotopes evaluation is finished. A partial file was released in Feb. 2003 containing 13 nuclides from Li-6 to Na-23 out of above described 32 nuclides. All these data are available from ftp://wwwwndc.tokai.jaeri.go.jp/www/JENDL/JENDL-AN-2003 .

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 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. 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-3.3

below 20 MeV. The file release will be envisaged in FY2003.

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 FY2003 for first priority nuclides.

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 FY2003.

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 FY2003 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 participants 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 (accelerator driven sub-critical system) 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 was published on August 2002 as a supplement to Journal of Nuclear Science and Technology, a publication of Atomic Energy Society of Japan(AESJ), including all invited and contributed papers passed through peer reviews of program committee members.

2) The 2002 Symposium on Nuclear Data

The 2002 Symposium on Nuclear Data was held at Tokai Research Establishment, Japan Atomic Energy Research Institute (JAERI), on 21st and 22nd of November 2002. Japanese Nuclear Data Committee and Nuclear Data Center, JAERI organized this symposium. In the oral sessions, presented were 17 papers on the release of JENDL3.3: Outline of JENDL3.3 and it's Benchmark test for LWR/FBR reactors and Shielding applications, Requests and discussions about JENDL utilizations among Developers and Japanese Nuclear Industrial User Groups, International session and other topics like Neutrino Physics. In the poster session, presented were 33 papers concerning experiments, evaluations, benchmark tests and software on nuclear data. Those presented papers are compiled in the proceedings and will be published as a JAERI-conf report having INDC (JPN)-190/U (2003) report number. Total of 133 attendees including 8 foreigners (of which 2 Asian researchers invited by the organizing committee) and 85 outside JAERI were gathered. This year, due to VISA problems, three invited foreigners could not attend.

3) Development of Integrated Nuclear Data Utilization System for Innovative Reactors

This is a 5 year project starting 2002 to furnish up-to-date nuclear data for the users of innovative reactor (advance reactors such as ADS, low moderation LWR, super high burn up reactors, etc) design very timely in the frame of Innovative Reactor Development Projects, in which so wide users are anticipated in Japan. This is mainly for application users representing innovative reactors, but it also act as a very strong tool for fundamental or academic users of nuclear data as well as students of universities.

So as to make available accurate and reliable latest nuclear data to users, we are developing an integrated software system called CONDUCT (Consolidated Nuclear Data Utilization, Calculation and Transfer System) functioning on the Internet. This system consists of three parts, system control part, retrieval and plotting system part, and processing and utilization system part. System control part manages nuclear database and application programs under this system. Nuclear data database contains latest evaluated nuclear data such as JENDL-3.3, JEFF-3, ENDF/B-VI and measured data from EXFOR data base. The data retrieval and plotting system provides the numerical data files, data tables and figures that are produced from the stored experimental and/or evaluated nuclear data in the user friendly way according to the user's requests. The processing and utilization system consists of two parts: data processing and data utilization. The processing part provides the tools that create data libraries needed for reactor application codes such as MVP,MCNP,ANISN, DOT,DORT,ORIGEN2 and so on from the evaluated nuclear data. The utilization part provides the tools that make criticality and shielding benchmark calculations together with the tools tabulating and plotting numerical data.

This work is a part of "Fundamental R&D on Neutron Cross Sections for Innovative Reactors Using Advanced Radiation Measurement Technology", which is one of research tasks selected with competitions for "Innovative Nuclear Energy System Technology(INEST) Development Projects" funded by the Ministry of Education, Culture, Sports, Science and Technology(MEXT). Assigned fund for the utilization system development is about 135 million yen (1.1M$US) out of 760million yen (6.3M$US) in 5 years.

Table-1 Stored Nuclides in JENDL High Energy File

Priority	Nuclides (Total:122)
1st Priority (40 uclides)	**H-1, C-12, N-14, O-16, Al-27,** **Cr-50, 52, 53, 54,** **Fe-54, 56, 57, 58,** **Ni-58, 60, 61, 62, 64,** **Cu-63, 65,** **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 (45 nuclides)	**H-2, Be-9, B-10, 11,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, Ta-181,** **Pu-238, 239, 240, 241,242**
3rd Priority (37 nuclides)	**Li-6, 7, C-13, F-19, Na-23, 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: Evaluation and File Compilation Finished. (65nuclides)
. BLUE: Evaluation Finished. (33nuclides)
BLACK: Evaluation not yet Finished. (24nuclides)

Appendix-A

Summary of ISTC project that JAERI participated with some funds, relating to the JENDL Actinide File

Objective:

.Improvement of minor actinide data for transmutation projects using actinide burner reactors or accelerator driven spallation neutron sources.

.The data needed are for $^{237, 238}$Np, $^{238, 242}$Pu, $^{241, 242g, 242m, 243}$Am and $^{242, 243, 244, 245, 246}$Cm.

.The corresponding data for most important cross sections should be obtained on the basis of ISTC.

ISTC projects:

- "Measurements of the fission neutron spectra for minor actinides"
  V.I.Khlopin Radium Institute (KRI St.Petersburg Russia, # 183-p)
  1995-1997

.high precision measurements of the fission neutron spectra for spontaneous fission of Cm-244, -246, Pu-240 -242, and that for thermal induced fission of Cm-243, -245

- "Measurements and analysis of basic nuclear data for minor actinides"
  Institute of Physics and Power Engineering (IPPE Obninsk Russia, #304-p)
  1995-1996

precise measurements of the fission cross sections of
Cm-243, -244, -245, -246, -247, -248m, Am-242m, Pu-238.
measurements of fission product yields for Np-237

.measurements of inelastic scattering and prompt fission neutron spectra for Np-237

.measurements of delayed neutron yields and it's 6-group constants for Np-237 fast neutron fission

.critical comparison between evaluated data for BROND-2, JENDL-3 and ENDF/B-VI and deduction of recommended values

- "Evaluation of actinide nuclear data"
  Radiation Physics and Chemistry Problems Institute
  (RPCPIMinsk Belarus Russia, # b-03)
  1995-1998

.complete new evaluations of neutron cross sections for Cm-243, -245 -246, Am-241, 242, 242m, 243, Np-238, Pu-238, -242.

- "Neutron induced fission cross-sections of some actinides heavy nuclei in energy region 1-200 MeV
  Petersburg Nuclear Physics Institute (PNPI St.Petersburg Russia, #609)

1996-1999

.measurements of neutron fission cross-section of U-233, U-238, Np-237, Th-232, Pu-239, Pb and Bi in the energy range up to 200 MeV.
Relative measurements to U-235 fission with accuracy 3-10%.
evaluation of above listed cross section for neutron and proton induced fissions in the energy range 20-200 MeV.

- " Fission Cross section at Intermediate Energies"
Petersburg Nuclear Physics Institute (PNPI St.Petersburg Russia, #1971)
2001-2002 (Extension of #609)

.measurements of neutron fission cross-section of Pu-240, Am-243 and W in the energy range up to 200 MeV.
Relative measurements to U-235 fission with accuracy 3-10%.
evaluation of above listed cross section for neutron and proton induced fissions in the energy range 20-200 MeV.

Other ISTC Project relating to Nuclear Data

- "Benchmark Data on Gamma-ray Production For Fusion Application",
Institute of Physics and Power Engineering (IPPE Obninsk Russia, #731)
1997-2000

measurements and evaluations of the benchmark data on gamma-ray production cross section in the fast neutron induced reactions for materials that are most important for fusion power applications.
Measurements anticipated are 32 structure materials at 14MeV.
(For 1st year: Li-6,-7, B-10,-11, C, N, O, Al, Si, Fe, Cu, Mo,W, Pb were measured.)
The data will be available in EXFOR Format.
Evaluations in ENDF/B-6 Format will be made for most important 20 nuclides.

- "Experimental and Theoretical Study of the Yields of Residual Product Nuclei Produced In thin Targets Irradiated by 100-2600 MeV protons",
Federal Scientific Center of Russia Institute for Theoretical and Experimental Physics (ITEP Moscow Russia, #839)
1997-2000

Residual product nuclei measurements from spalation by high energy proton beam for thin targets of ^{182}W, ^{183}W, ^{184}W, ^{186}W, ^{232}Th, $^{nat.}$U, ^{99}Tc, ^{59}Co, ^{63}Cu and ^{65}Cu .
Measured proto energies are 100, 150, 200, 800, 1000, 1200, 1400, 1600 and 2600 MeV.
To get the reference data to check the simulation code such as LAHET, ALICE, QMD, etc.

- "Nuclear Physics Investigation Aimed at the Solution of Weapon Plutonium Conversion

and Long-lived Radioactive Wastes Transmutation Problems ”,
Russia Federal Nuclear Center All-Russia Scientific Research of Experimental Physics
(VNIIFF Sarov Russia, #1145)
1998-2000

- measurements of the cross sections necessary for the transmutation technologies and electro-nuclear energy production system on the basis of high-current proton accelerator.
- Cross sections of a wide range of isotopes for minor actinides of Np, Pu, Am and Cm in the fast and intermediate neutron spectra; Thermal cross section for neutron induced fission and radiative capture of Np-238(T1/2 = 2.12 d); Spectra of fast fission neutrons from Th, U, Np and Pu by 40-200 MeV protons.

- “Evaluation of actinide nuclear data”

Radiation Physics and Chemistry Problems Institute

(RPCPIMinsk Belarus Russia, # B-404)
2000-2002

.complete new evaluations of neutron cross sections for Th-232, Pa-231,Pa-233, U-232, U-233, U-234. up to 20MeV.

- new evaluations of neutron cross sections for U-238 and Pu-239 up to 150 MeV.

Progress Report of the KAERI/NDEL - 2002

Jonghwa Chang
(KAERI/NDEL, Daejeon, Korea)

1. General

KAERI/NDEL is funded from a 4 years (2001~2004) national nuclear R&D project, "Evaluation of Nuclear Data for Nuclear R&D Projects."

2. Data Services

KAERI/NDEL is providing nuclear data on-line service targeting non-nuclear data experts. The address is http://atom.kaeri.re.kr/ . The statistics are as follows:

Item	1999	2000	2001	2002
Data retrieved/month	7,644	20,138	19,973	18,480
IP/month	984	3,689	3,257	3,864

3. Experimental Facility

Experimental activities at two domestic facilities have been supported by KAERI/NDEL for improving nuclear data measurement capability.

- Pohang E-Linac based TOF; 10.8 m, 60 MeV, 80 mA, 1.5 us, 12 Hz
- KIGAM Tandem VDG based TOF; 1.7 MV, 300 uA, 2 ns, 8 MHz

4. Measurements

- Natural elements (Ta, W, Dy, Ti, Sm, Ag) transmission data at 0 – 100 eV at Pohang TOF.
- Dy isotopes capture data in the resonance region at KURRI linac, Japan.
- Gd isotopes capture data in the unresolved resonance region at TIT pelletron, Japan.

5. Evaluation Works

Main directions of nuclear data development are the Fission Products cross section data for Transmutation, the data for Thorium cycle, the Photon-production data for in-core detector, and the Intermediate energy data for ADS.

The cross sections of 19 fission products below 20 MeV are submitted for ENDF/B-VII.

6. Staff and Computers

KAERI/NDEL has 9 regular staffs, and 1 full time consultant scientist;

- Evaluation: 5,
- Multi-group library generation and benchmark: 4,
- Data services: 1.

Computers;

- A cluster of Linux PCs for evaluation,
- 3 HP desk side Workstations for the multi-group library generation and benchmarks,
- 1 Linux PC for internet web server, 1 Linux PC for backup.

CDFE in the Nuclear Reaction Data Centres Network at 2002 – 2003. P12

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 "Coordination of the Network of Nuclear Reaction Data Centres" (17 - 19 June 2003, IAEA NDS, Vienna, Austria)

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 Meeting on the "Network of Nuclear Reaction Data Centres" (27 - 30 May 2002, OECD NEA, Paris, France) till the middle of June 2003 and the description of the main results obtained.

1. Two **new** CDFE EXFOR **TRANSes M032 and M033** have been produced and transmitted to the IAEA NDS. The TRANSes contain (**Annex 1**) 16 retransmitted and 10 new (M0635 - M0644) ENTRYs with 151 new data SUBENTs.

2. The CDFE relational nuclear data databases have been put upon the Web-site (**http://depni.sinp.msu.ru/cdfe**) before were upgraded significantly by adding a new data and software improvement:
   - the "2001" and "2002" parts have been added to the "Photonuclear Data Index" (the "2003" and part is in processing) as whole the **"Photonuclear Data Index 1955 - 2002"** 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 database **"Giant Dipole Resonance Parameters"** has been upgraded significantly: many new data sets were added;
   - the relational **"Nuclear Reaction Database (EXFOR)"** included now not only photonuclear data, but also data for neutron, charge particle and heavy ion reaction data has been improved (in cooperation with CAJaD, Dr.F.E.Chukreev) significantly by producing of advanced Search Engine giving to one the possibility (**Annex 2**) to find charge particle reaction data in so called "inverse geometry" (any "incident particle (a) – target nucleus (b)" combinations: "a + b" and "b + a" without fixing for REACTION SF1 - SF2 and correspondent recalculation of energy values).

3. New completely relational database "**ENSDF Relational**" has been developed (**Annex 3**) as the improved version of "**Relational Nuclear Spectroscopy Database NESSY"** /2, 3/ put upon the CDFE Web-site before; it includes practically all data from the ENSDF, is added by new flexible and powerful Search Engine, and give to one possibility to receive any part of initial file; new possibilities under construction are now

the graphical presentation of the schemes of levels, transitions, and decays and direct connection to references from the NSR (Nuclear Structure References) file.

4. New relational bibliography database has been developed on the base of international data file NSR (**Annex 4**).

5. The consitent evaluation (**Annex 5**) of partial photonuclear reactions (γ,n) and (γ,2n) cross sevtions has been carried out using the data obtained in the experiments with quasimonoenergetic annihilation photon beams at USA Livermore and France Saclay for 19 nuclei ^{51}V, ^{75}As, ^{89}Y, ^{90}Zr, ^{115}In, ^{116,117,118,120,124}Sn, ^{127}I, ^{133}Cs, ^{159}Tb, ^{165}Ho, ^{181}Ta, ^{197}Au, ^{208}Pb, ^{232}Th, ^{238}U. Data are published as MSU SINP Preprint /4/, included into EXFOR ENTRY M0635 (TRANS M032) and presented for publication to the journal Yadernye Konstanty /5/.

The main items of CDFE future short-term programmes, priorities and new tasks are listed in the **Annex 6**.

References

1. E.G.Fuller, H.Gerstenberg. Photonuclear Data - Abstracts Sheets 1955 - 1982. NBSIR 83-2742. U.S.A. National Bureau of Standards, 1986.
2. I.N.Boboshin, V.V.Varlamov. The New ENSDF Search System NESSY: IBM/PC Nuclear Spectroscopy Data Base. Nucl.Instr. and Meth., A369 (1996) 113.
3. I.N.Boboshin, V.V.Chesnokov, E.M.Ivanov, M.E.Stepanov, A.V.Varlamov, V.V.Varlamov. Photon and Charge Particle Reactions and Nuclear Structure Data Bases Upon the MSU INP CDFE Web-site. International Conference on Nuclear Data for Science and Technology. Embracing the Future at the Beginning of the 21st Century (October 7 - 12, 2001). Tsukuba, Japan, Abstracts, Japan Atomic Energy Research Institute, 2001, p. 13-P-1.
4. V.V.Varlamov, N.N.Peskov, D.S.Rudenko, M.E.Stepanov. Photoneutron Reaction Cross Sections in Experiments with Beams of Quasimonoenergetic Annihilation Photons. Preprint SINP MSU 2003-2/715.
5. V.V.Varlamov, N.N.Peskov, D.S.Rudenko, M.E.Stepanov. Consistent Evaluation of Photoneutron Reaction Cross Sections Using Data Obtained in the Experiments with Quasimonoenergetic Annihilation Photon Beams at USA Livermore and France Saclay. Voprosy Atomnoj Nauki i Tekhniki. Seriya: Yadernte Konstanty (to be published).

Annex 1.

The CDFE EXFOR TRANSes M032 and M033 contents (*old corrected* and new ENTRYs)

TRANS M032		**TRANS M033**	
ENTRY's Number	**SUBENT Amount**	**ENTRY's Number**	**SUBENT Amount**
L0001	*7*	*L0021*	*12*
L0002	*4*	*L0031*	*15*
L0003	*4*	*M0041*	*13*
L0005	*5*	*M0372*	*7*
L0015	*26*	*M0488*	*1*
L0024	*18*	*M0598*	*4*
L0031	*15*	*M0636*	*9*
M0056	*7*	M0639	1
M0188	*18*	M0640	1
M0420	*4*	M0641	1
M0635	114	M0642	3
M0636	9	M0643	4
M0637	1	M0644	5
M0638	12		
Total new: 4	**Total new: 136**	**Total new: 6**	**Total new: 15**
		Sum new: 10	**Sum new: 151**

Annex 2.

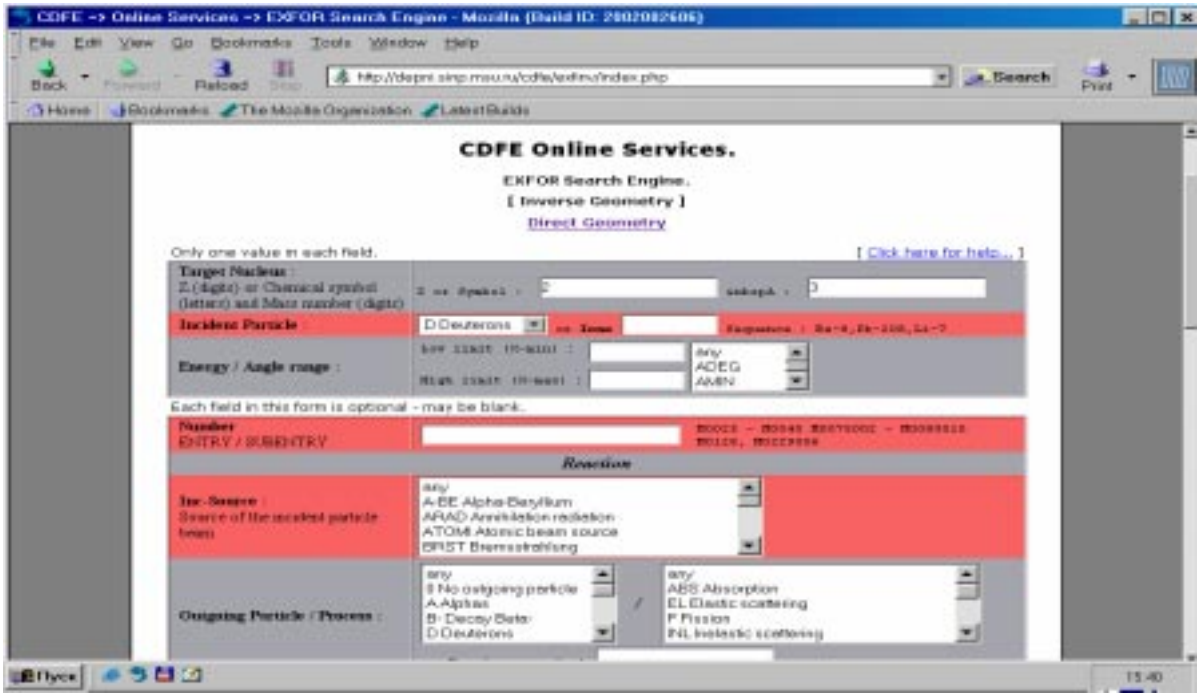
New version of Search Engine (**Inverse Geometry**) for the relational **"Nuclear Reaction Database (EXFOR)**" gives to one the possibility to obtain the data for different reactions with the same combination of incident particle and target nucleus, for example

$$d + {}^3He = p + {}^4He \text{ and } {}^3He + d = p + {}^4He$$

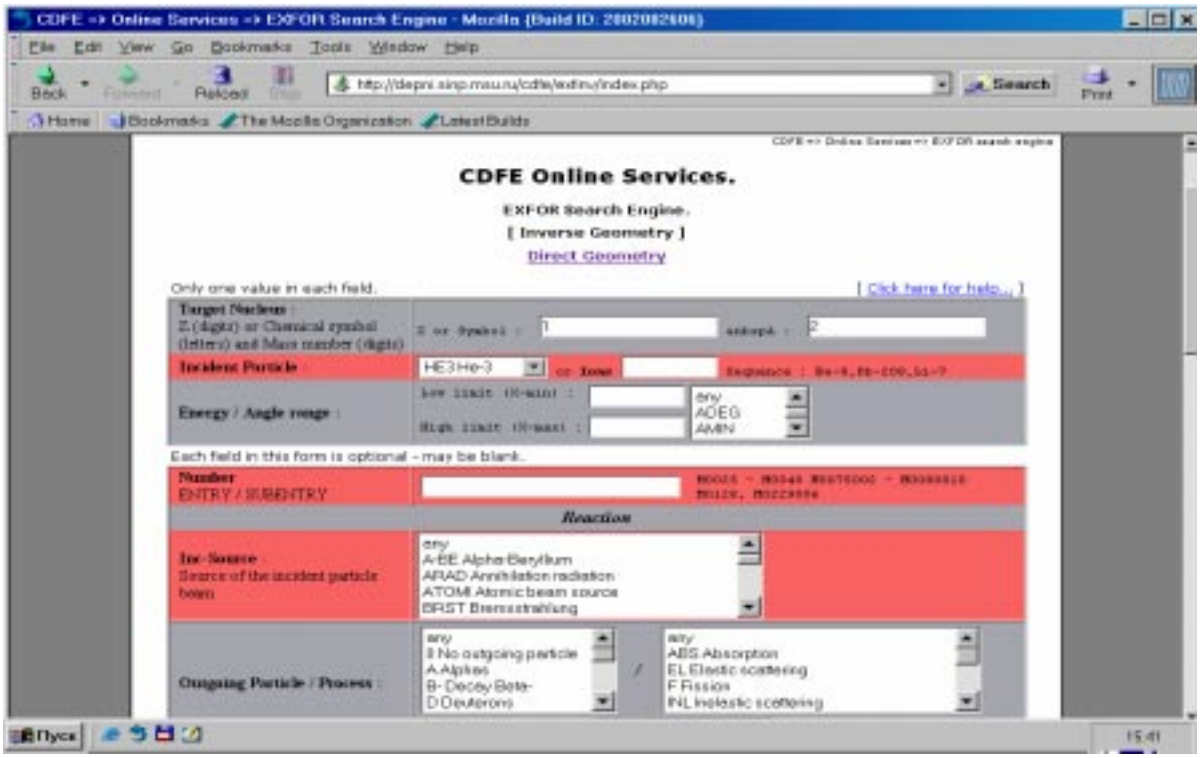
in one request and for energy recalculated from LAB-system to SCI-system

$$E_{SCI} = - (M_a + M_b) + ((M_a + M_b)^2 + 2 \bullet E_{LAB} \bullet M_b)^{1/2}.$$

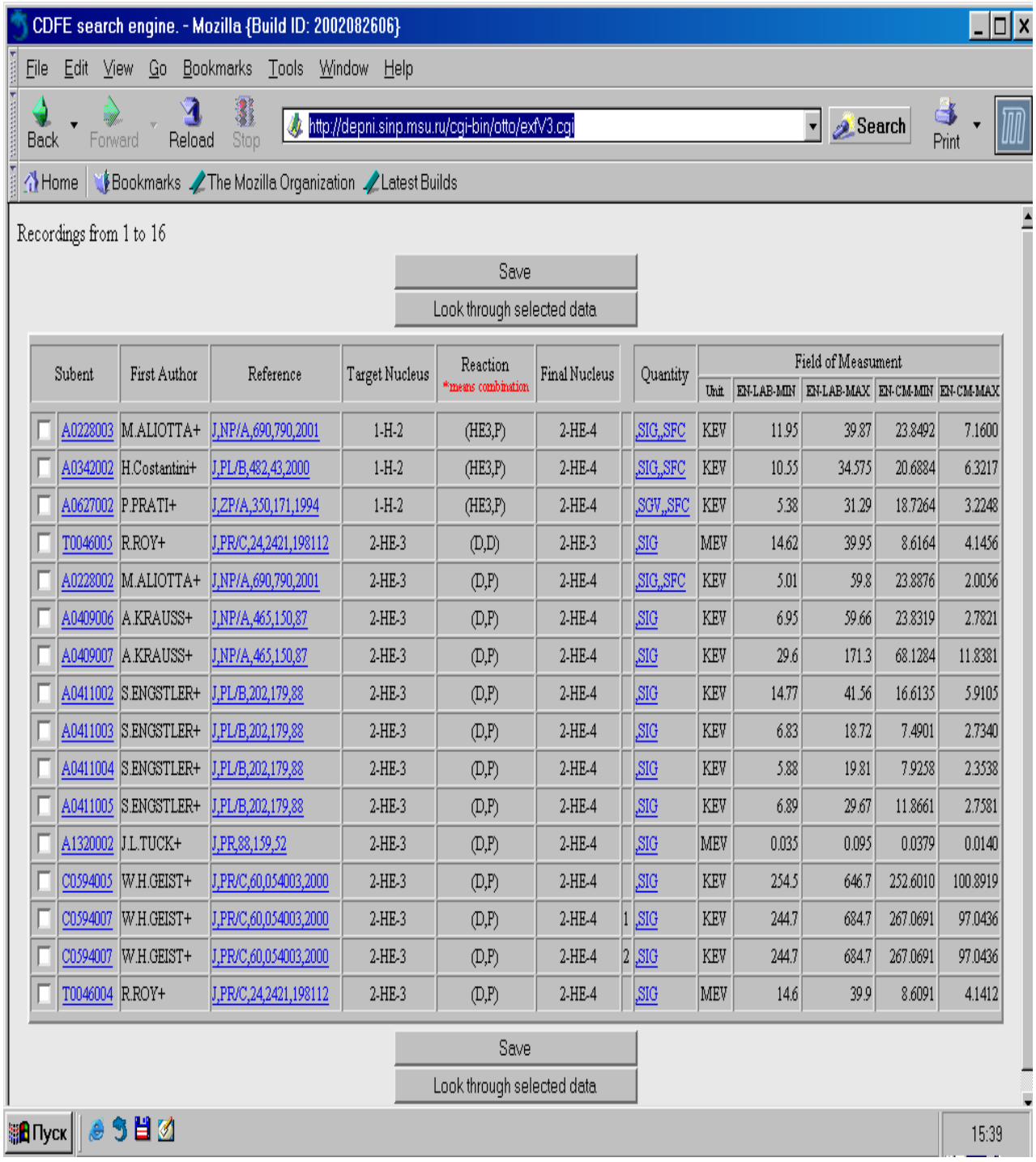
An example of result of data search for reaction $d + {}^3He = p + {}^4He$ – «Incident Particle: D (Deuterons), Target Nucleus: Z = 2, A = 3»



and for reaction $^3He + d = p + {}^4He$ – «Incident Particle: HE3 He-3, Target Nucleus: Z = 1, A = 2»



is presented as the one joint result table produced



Subent	First Author	Reference	Target Nucleus	Reaction *means combination	Final Nucleus		Quantity	Field of Measument				
								Unit	EN-LAB-MIN	EN-LAB-MAX	EN-CM-MIN	EN-CM-MAX
A0228003	M.ALIOTTA+	J,NP/A,690,790,2001	1-H-2	(HE3,P)	2-HE-4		,SIG,,SFC	KEV	11.95	39.87	23.8492	7.1600
A0342002	H.Costantini+	J,PL/B,482,43,2000	1-H-2	(HE3,P)	2-HE-4		,SIG,,SFC	KEV	10.55	34.575	20.6884	6.3217
A0627002	P.PRATI+	J,ZP/A,350,171,1994	1-H-2	(HE3,P)	2-HE-4		,SGV,,SFC	KEV	5.38	31.29	18.7264	3.2248
T0046005	R.ROY+	J,PR/C,24,2421,198112	2-HE-3	(D,D)	2-HE-3		,SIG	MEV	14.62	39.95	8.6164	4.1456
A0228002	M.ALIOTTA+	J,NP/A,690,790,2001	2-HE-3	(D,P)	2-HE-4		,SIG,,SFC	KEV	5.01	59.8	23.8876	2.0056
A0409006	A.KRAUSS+	J,NP/A,465,150,87	2-HE-3	(D,P)	2-HE-4		,SIG	KEV	6.95	59.66	23.8319	2.7821
A0409007	A.KRAUSS+	J,NP/A,465,150,87	2-HE-3	(D,P)	2-HE-4		,SIG	KEV	29.6	171.3	68.1284	11.8381
A0411002	S.ENGSTLER+	J,PL/B,202,179,88	2-HE-3	(D,P)	2-HE-4		,SIG	KEV	14.77	41.56	16.6135	5.9105
A0411003	S.ENGSTLER+	J,PL/B,202,179,88	2-HE-3	(D,P)	2-HE-4		,SIG	KEV	6.83	18.72	7.4901	2.7340
A0411004	S.ENGSTLER+	J,PL/B,202,179,88	2-HE-3	(D,P)	2-HE-4		,SIG	KEV	5.88	19.81	7.9258	2.3538
A0411005	S.ENGSTLER+	J,PL/B,202,179,88	2-HE-3	(D,P)	2-HE-4		,SIG	KEV	6.89	29.67	11.8661	2.7581
A1320002	J.L.TUCK+	J,PR,88,159,52	2-HE-3	(D,P)	2-HE-4		,SIG	MEV	0.035	0.095	0.0379	0.0140
C0594005	W.H.GEIST+	J,PR/C,60,054003,2000	2-HE-3	(D,P)	2-HE-4		,SIG	KEV	254.5	646.7	252.6010	100.8919
C0594007	W.H.GEIST+	J,PR/C,60,054003,2000	2-HE-3	(D,P)	2-HE-4	1	,SIG	KEV	244.7	684.7	267.0691	97.0436
C0594007	W.H.GEIST+	J,PR/C,60,054003,2000	2-HE-3	(D,P)	2-HE-4	2	,SIG	KEV	244.7	684.7	267.0691	97.0436
T0046004	R.ROY+	J,PR/C,24,2421,198112	2-HE-3	(D,P)	2-HE-4		,SIG	MEV	14.6	39.9	8.6091	4.1412

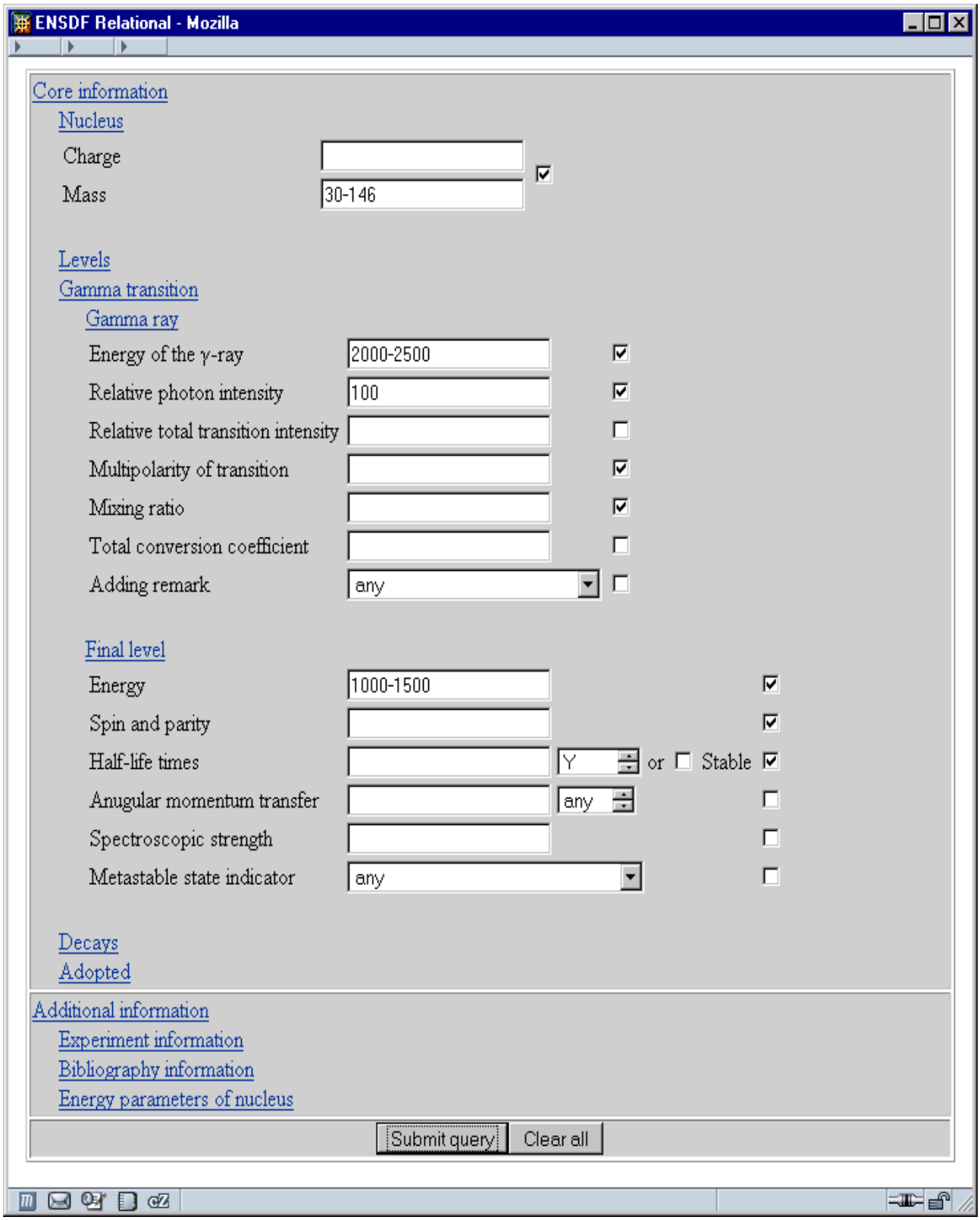
Save
Look through selected data

for all reactions of types mentioned 1-H-2 (HE3,…); 1-H-2(T,…); 2-HE3(D,…), etc.

The energy data for both pairs of nuclei and for both LAB-and SCI-systems are presented in the energy value columns of the table.

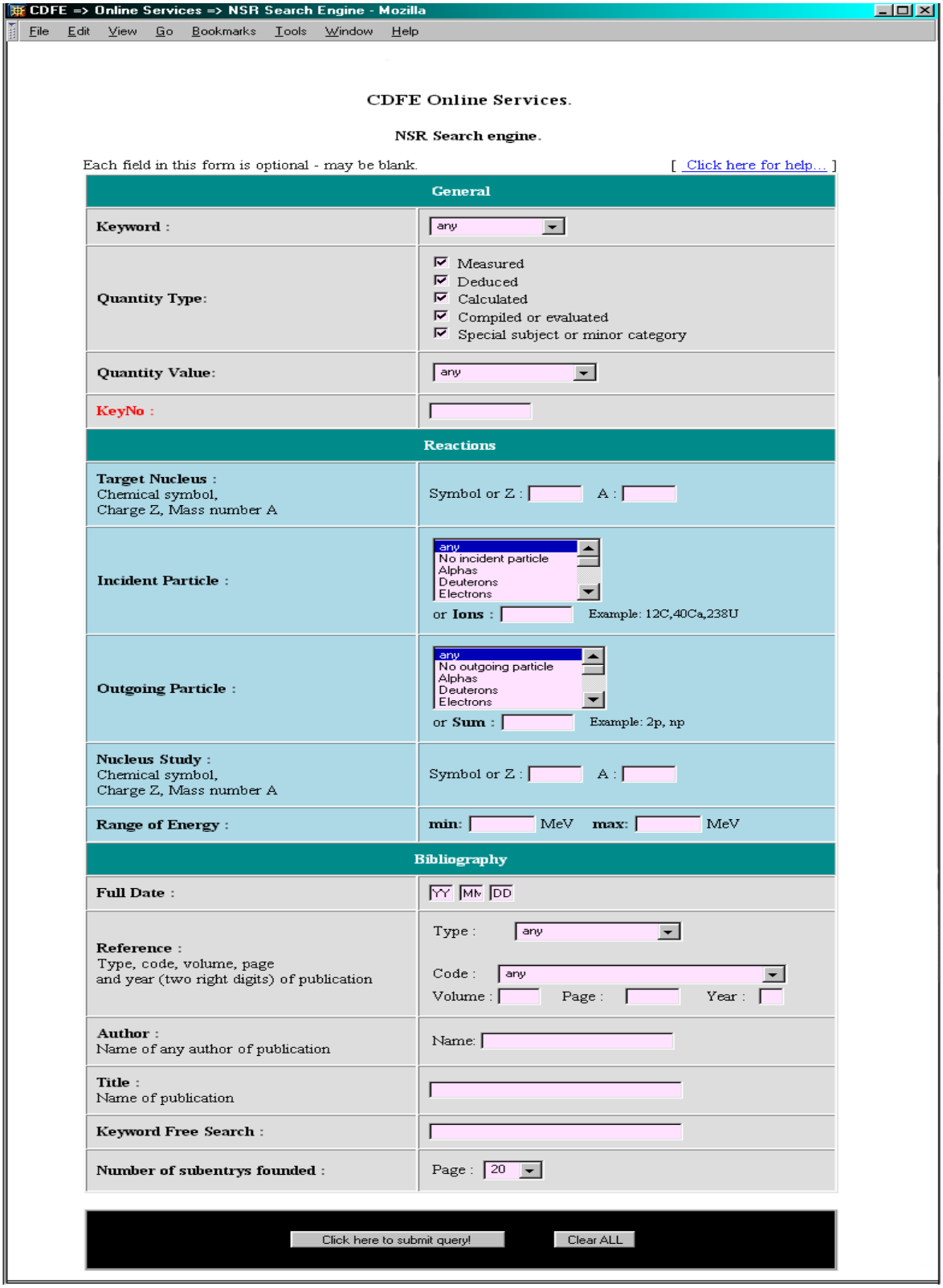
Annex 3.

New “ENSDF Relational” database interface.



Annex 4.

The new relational database NSR interface.



Annex 5.

V.V.Varlamov, N.N.Peskov, D.S.Rudenko, M.E.Stepanov. Consistent Evaluation of Photoneutron Reaction Cross Sections Using Data Obtained in the Experiments with Quasimonoenergetic Annihilation Photon Beams at USA Livermore and France Saclay.

The detailed system analysis of the (γ,xn), (γ,n) and (γ,2n) reaction cross section data obtained using quasimonoenergetic annihilation photon beems at Livermore (USA) and Saclay (France) was carried out for 19 (for 7 of them – at first) nuclei ^{51}V, ^{75}As, ^{89}Y, ^{90}Zr, ^{115}In, ^{116,117,118,120,124}Sn, ^{127}I, ^{133}Cs, ^{159}Tb, ^{165}Ho, ^{181}Ta, ^{197}Au, ^{208}Pb, ^{232}Th, ^{238}U. It was observed that the (γ,xn) reaction cross section data obtained at both laboratories without using neutron multiplicity sorting procedure disagree by 10 – 15 %. Additionally it was found out that the disagreement of partial reactions (γ,n) and (γ,2n) cross sections, obtained at both laboratories using neutron multiplicity sorting procedure are significantly more (till 30 – 40 %) and as a rule have opposite directions. These disagreements were interpreted as the result of difference of neutron multiplicity sorting procedures used in both laboratories: that is incorrect at Saclay with the result of incorrect transmission of the part of (γ,2n) reaction cross section into that of (γ,n) reaction. The special method was used to move the data into consistence. Its idea is that definite "false" part of (γ,n) reaction cross section was recalculated and transmitted back into that of reaction (γ,2n). For all 19 nuclei listed above the jointly corrected (γ,xn), (γ,n) and (γ,2n) reaction cross were evaluated and prepared for including into the EXFOR nuclear reaction database (TRANS M032, ENTRY M0635).

Annex 6.

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 2003 hotonuclear 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. Addition and correction of the existed CDFE EXFOR relevant databases:
   - "Relational Nuclear Reaction Database (EXFOR)";
   - "Giant Dipole Resonance Parameters. Photonuclear Reaction Cross Sections".

3. Development of new complete database "ENSDF Relational" combined with another relational database NSR as bibliographical support, new software for graphics.

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.*

WP2003-1 Actions and Conclusions of the 2002 NRDC Meeting
see INDC(NDS)-434, pp.147-153

WP2003-2 Nuclear Reaction Data Center Protocol (2002)
see INDC(NDS)-434, p.155

WP2003-3 Workshop on Rel.Databases and EXFOR compilation, Vienna, December 2003

WP2003-4 New Nuclides Dictionary (replacing Dictionary 27)

WP2003-5 CINDA exchange format updates and related dictionary changes (CP/C-309, 4C-1/212)

WP2003-6 New dictionaries for CINDA-2001

WP2003-7 Proposals for CINDA-2001 (CP-D/346)

WP2003-8 Report codes (CP-D/347)

WP2003-9 New and revised EXFOR entries received at NDS

WP2003-10 Fundamental particle codes proposed for dictionary 27

WP2003-11 Dict. 30 code TCC (Total charge changing) (CP-A/144, CP-D/364)

WP2003-12 Thick target yields, product yields: Quantities, definitions, units

WP2003-13 Total spin transfer (CP-E/020)

WP2003-14 New coding for REACTION SF7 (CP-C/315, CP-D/354,350,CP-E/017)

WP2003-15 Longitudinal momentum (CP-C/313, CP-E/021, CP-E/023)

WP2003-16 Partial cs for prod. of specified number of prod.part. (CP-C/318, D/359)

WP2003-17 Differential number of (prompt) neutrons (CP-D/358)

WP2003-18 New quantities for secondary particle spectra (CP-D/357, CP-D/355)

WP2003-19 Proposed modified format for DECAY-MON (CP-D/351)

WP2003-20 Branch codes 'DIS' and 'CON' (for γ production) (CP-C/324, 4C-4/136)

WP2003-21 Transmission (new code TRN for REACTION SF8) (CP-D/368)

WP2003-22 NRDC Transmission Statistics (NNDC)

WP2003-23 Differences between checking codes CHEX and TEST-EXF

WP2003-24 Stand-alone retrieval system on CD-ROM: EXFOR+CINDA/Java2

WP2003-25 CINDA Protocol: **see p. 27**

WP2003-26 Future NDRC Cooperation on CINDA: **see p. 28**

WP2003-27 Nuclear Reaction Database Migration in IAEA-NDS

WP2003-28 Framework of the Co-ordinated Research Project on Nuclear Data for the Production of Therapeutic Radionuclides

New Nuclides Dictionary (replacing Dict.27)

Ref.: Conclusion C8 and Action A11 of 2002 NRDC Meeting (WP 2003-1)

See below e-mails between NNDC and NDS from October and September 2002.

Subject: Re: Dict. 27
From: Victoria McLane <vml@bnl.gov>
Date: Mon, **28 Oct 2002** 13:07:54 -0500
To: Otto Schwerer <schwerer@iaeand.IAEA.ORG>

Otto,

The plan is to list only states given in the Wallet Cards. However, the
computer database for the Wallet Cards is updated several times a year.

Vicki
----- Original Message -----
From: "Otto Schwerer" <schwerer@iaeand.iaea.or.at>
To: "Victoria McLane" <vml@bnl.gov>
Sent: Monday, October 28, 2002 1:05 PM
Subject: Re: Dict. 27

> Vicki,
>
> I have your message of 10 September which gives a list of fields for the
> new dictionary 27, but I have not seen an example (the message had no
> attachment).
> In the message, you asked me about the units for half-lives. My opinion
> is that giving it in seconds only is not convenient. I would prefer
> having it with the unit (e.g. 1.5 MIN) anyway; conversion to seconds
> could be given in addition (would probably be useful).
>
> You list "spin and parity of ground or metastable state". I understand
> that metastable states will be listed separately. Which states will
> qualify for it (only those now listed in the wallet cards?)
>
> Otto
>
> ----------
>
> Victoria McLane wrote:
>

> > Otto,
> >
> > Before I send a CP Memo on Dict. 27, do you have any comments on the sample
> > dictionary I sent in September?
> >
> > Vicki
> >
> > Victoria McLane
> > National Nuclear Data Center

Subject: Dict. 27 produced from Nuclear Wallet Cards
From: Victoria McLane <vml@bnl.gov>
Date: Tue, **10 Sep 2002** 11:18:12 -0400
To: ZERKIN Viktor <zerkin@iaeand.IAEA.ORG>, SCHWERER Otto <schwerer@iaeand.IAEA.ORG>

Victor and Otto,

I have written a program to produce a Dictionary 27 from the Nuclear Wallet Cards. The atomic weight has been extracted from the Audi-Wapstra files.

Ramon is now working on a relational database for the Nuclear Wallet Cards. It may be a good idea to put all the info we need (e.g., atomic weights into the NWC database. That way we can interface directly to the NWC database for the relational databases and extract the Dict. 27 from the NWC database for other users.

The Dict. 27 fields I have produced are the EXFOR code as primary key, and includes an entry for each metastable state as in NWC.

The following fields are given:
. Code as given for NSR et al. (e.g., 3Li).
. Integer equivalent of Z,A,M (zzzaaam).
. Spin and parity of ground or metastable state, given as floating point number (e.g., +1.5).
. Natural abundance, for naturally occuring nuclides.
. Half-life, for radioactive nuclides; given in min, sec, etc., with units (e.g., 1.5 MIN). Alternately, can be given in secs, or in both representations (Otto: what are your feelings on this?).
. Atomc weight (extracted from Audi-Wapstra files).

I am giving our needs and my code to Ramon to look at. When Victor comes we can discuss it further.

I will also send a proposal for a new format for dictionary 27 soon.

Vicki

Victoria McLane
National Nuclear Data Center
Brookhaven National Laboratory
Upton, NY 11973-5000
Phone: 631-344-5205
Fax: 631-344-2806
Email: vml@bnl.gov

CINDA Exchange format updates and related dictionary changes

- CINDA codes **MANY** and **FPROD** (CP/C-309, item I; 4C-1/212)

- Reference type * and date of update; Proposed **split of dictionary 7** (Book and Conference Codes) into 2 separate dictionaries; reference flag should correspond to given dictionary on one-to-one basis (CP/C-309, item II)

*Question by NDS: How will this reflect on ref.type P and S entries in EXFOR and on **dictionary 4** ?*

Attached: CP/C-309 and 4C-1/212

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/309

DATE: December 2, 2002

TO: Distribution

FROM: V. McLane

SUBJECT: CINDA Exchange Format Updates
I. Codes MANY and FPROD
II. Reference type * and date of update

I. Codes MANY and FPROD

Since there may be some lines left in the CINDA database containing the codes FPROD and MANY, these must be translated to the CINDA2001 format.

I suggest for MANY we use a Z of 999 (or some other unlikely atomic number), and MNY in the A field.

For FPROD, we can either also a Z of 999 with LFP in the A field, or use the Z of the nuclide from which the lumped fission products were generated.

The codes 999-*-LFP (or 92-U-LFP) and 999-*-MNY would be added to the compounds and mixtures dictionary.

As a corollary to this: When I checked the area 1 entries for FPROD, most of the experimental and many of the other lines were for measurements on many fission products and not

measurements on lumped fission products. So I will have only a few lines to be translated to the new format.

II. Reference type * and date of update

I am proposing a slight modification to the CINDA2001 exchange format in order to accomplish adding 2 new fields on a 132-character record. The solution would involve reducing the reaction field from 15 to 12 characters (I looks as if that would be enough with the new simplified codes, and shifting the remaining fields of the present format to the left.

Proposal 1) Include the date of last update. This would be added in columns 125-132 as an 8-digit integer.

Proposal 2) As an alternate proposal for using the code * for CINDA and not for EXFOR, convert the * code in the reference type field to either C or J, as appropriate to the code given in the reference field, and add the abstract code * to column 124.

To further elaborate on this second proposal and to have the reference code correspond to the appropriate dictionary, I suggest the following.

- **Split Dictionary 7** (Book and Conference Codes) into 2 separate dictionaries. (I'm not sure why they were originally put together as one in any case.
- Have the reference flag always correspond to a given dictionary on a one to one basis.
- Introduce Col. 124 flags to differentiate the content. To accomplish this, I suggest the addition of the Content flags * (abstract), C (conference papers), P (progress report) or S (preprint) to be used as given in the following table.

Current Reference Code	Proposed Reference Code	Proposed Content Code
J	J	
*	J or C	*
C	C	
S	R	C
R	R	
P	R	P
B	B	
T	T	
W or	W W	 S

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 4C-1/212

DATE: November 13, 2002
TO: Distribution
FROM: V. McLane
SUBJECT: CINDA entries for FPROD and MANY

There currently exist in CINDA many entries for FPROD and MANY (in the nuclide field). The code MANY should not have been used for experimental work, but is meant for systematic trends, which implies theoretical calculations. The code FPROD is meant to be used for targets that contain lumped fission products. I propose that the four neutron centers agree to do the following before the next NRDC meeting in June.

For the entries under MANY, all experimental entries should be redone using the individual isotopes. For FPROD, there are almost no entries for experimental works. We should decide what to do about those few on a one by one basis.

For those MANY and FROD that are theoretical, reviews, etc., NSR should be checked to see if the entry is there. If the entry is in NSR, the CINDA entry should be deleted. If the entry is not in NSR, notify me and I will work with Dave Winchell to create an NSR entry.

I will send files containing the affected entries to all center CINDA representatives, so they may see the scope of the effort for their center.

Distribution:

M. Chiba, Sapporo
F. E. Chukreev, CAJaD
S. Dunaeva, Sarov
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

New dictionaries for CINDA-2001

Various new dictionaries were proposed for CINDA-2001, partly with conflicting dictionary numbers.

It seems to be the understanding that the new dictionaries will be needed only in Archive dictionary format.

Existing:

Dict. # (Archive)	Contents	Notes
12	CINDA Quantities (=old)	= EXFOR dict. # 42 !
43	NLIB for eval. libraries (for ENDF)	
44	Eval. library codes for CINDA	

Proposed:

Dict. # (Archive)	Contents	Notes
45	New CINDA quantities	
113	Web retrieval quantities	Based on Dict.# 13
144	Eval. library codes for CINDA, revised	Extended Dict.# 44
52 (47?)	Correspondence old - new CINDA quantities	
48	Energy values for spectrum averages (5 chars.)	
47?	Reader codes	

References (not reproduced here, see INDC(NDS)-427):

- CINDA2001 MANUAL (May 2001) with revisions as of 24 May 2001, see WP 2001-23 (mentions all above dictionaries)
- WP 2001-24 (Provisional lists of Dicts. 45 and 52, as of May 2001)

Memo CP-D/347

Date: 15 November 2002
To: Distribution
From: M. Lammer
Subject: **Report codes**

During his conversion of the old CINDA file into the new CINDA 2001 format, Viktor Zerkin has produced a list of all reference codes found in CINDA and compared them to the EXFOR dictionaries. I have looked into all those report codes, which had no corresponding EXFOR codes. The results are presented here.

1) Restriction of code length in CINDA 2001

An addition to Memo CP-D/246: the need to insert a blank before the report number if the code is shorter than 4 characters, can be dropped (obviously also blanks required for journal codes before the volume number). Also, longer codes can be accepted (cf. item (7) below: "…. simple corrections").

2) Proposal for presentation of code in EXFOR Dictionary 6

As a requirement of coding rules, some of the codes in EXFOR dictionary 6 are so different from the codes printed on the cover of reports, that I propose to add in all such cases (not just a few like CEC- or INR-) the actual code on the cover in the text of the expansion or somewhere thereafter. This should avoid a number of coding errors (see part on coding errors in (6) and (7) below) by compilers or related problems. Example:

EXFOR: PNR/SETR-R-25 code on cover: PNR/SETR on 2 lines
R.025

3) New codes (confirmed) for inclusion in EXFOR Dictionary 6

The "confirmed" codes, I have either found on actual reports or in INIS (in a retrieval or the book IAEA-INIS-6: the INIS authority list for "report number prefixes").

AES-	2SWDAE	Aktiebolaget Atomenergi, Studsvik, reports
BNWL-TR-	(same expansion as BNWL-)	
CEA-CONF-	2FR FR	Commissariat a L'Energie Atomique (NOTE: not confined to a lab, includes publications by BRC,CEL,CAD,GRE,SAC,…)
GSI-J-	2GERGSI	(same expansion as GSI-)
KAERI/GP-	3KORKAE	Korean Atomic Research Institute reports
JINR-D6- JINR-E4- JINR-P12- JINR-P14	(same as other JINR- reports)	
OKTAV-C-	2JPNOSA	(same expansion as OKTAV-A-) Note: why not use full name OKTAVIAN-? (see comment (1) above)

PNR/SETR-	2FR CAD	(same expansion as PNR/SETR-R-) code on report cover e.g.: PNR/SETR 65.010, to be coded as PNR/SETR-65-10;
RD/B/N-	2UK CEG	(same expansion as RD/B/M-)
TIB/FICS-	2ITYITY	ENEA Dipmt. **T**ecnologie **I**ntersettorali di **B**ase/Div. **FI**sica e **C**alcolo **S**cientifico reports; code on cover: TIB/FICS (83) 4 ("ENEA" expanded: Comitato Nazionale Ricerca e Sviluppo **E**nergia **N**ucleare e **E**nergia **A**lternativa)

4) New codes (unconfirmed) for possible inclusion in EXFOR Dictionary 6

These codes, found in CINDA, I could not confirm via the sources mentioned above. They will have to be checked and confirmed by the responsible center, as well as the proposed labcode and expansion, which are only my assumptions.

AD-A-	1USADOD	origin: 1 entry in CINDA coded as AD-A009563, with lab=4CCPLEB, comment indicates translation from book LEB; INIS-6: "Defense Documentation Center, Alexandria, VA, USA, (assigned to unclassified documents …)".
AE-RFT-	2SWDAE	(all entries have lab=2SWDAE, probably expansion as AE-)
AERE-NP/PR-	2 entries, both with lab 2UK ALD; code not found anywhere; could be miss-spelt, or confused with AERE- PR/NP- or AERE-NP/R-: to be checked.	
ANL-AJD-	1USAANL	probably same as ANL-
FOA4-D-	2SWDFOA	probably same as FOA4-A- and FOA4-C-
GA-B-	?1USAGA	suggests same as GA- (GA-A- and GA-C- found in INIS-6, but not GA-B-), but lab in CINDA entry is 1CANCRC???
MON-C-	1USAUSA	probably expansion as MON-N-;
UNC-PH/M-	1USAUNC	found (libraries, INIS-6) only code UNC-, probably same.

5) Proposed or possible corrections for EXFOR Dictionary 6

AFWL-TDR-	does not occur in CINDA nor in EXFOR, but several entries in both with code AFWL-TR-; neither code could be confirmed; to be checked by NNDC (see EXFOR# 10022 and 12069).
AWRE-CNR/PR	change to AWRE-CNR/PR- (add dash at end of code);
CEA-, CEA-N-, CEA-R-	according to INIS-6, published by different CEA labs (as item (3) above: CEA-CONF-) => propose to change lab to 2FR FR (or introduce code for CEA).
IPNO-TH	change to IPNO-TH- (add dash at end of code);
NIIAR-P1-	needs clarification (see also item (6) below): entry EXFOR40469 contains NIIAR-P1-335, the corresponding CINDA entry contains

NIIAR-P-335 (possibly because of limited space); INIS sources contain only NIIAR-P-; conclusion: NIIAR may have part -P1,-P2, etc. similar to JINR-, which may have been partially omitted; has to be checked and clarified by CJD.

6) Obvious coding errors in CINDA

Several more such errors I could correct easily without checking the original reference.

EANDC(U)76U175	CINDA entry for Mo-97 RES, lab=2FR SAC: check and correct;
INDC(EUR)14374	this number does not exist (several entries);
NEANDC(E)-GE/R	CINDA entry for U-238 TOT 2ZZZGEL: check and correct;
NIIAR-	several ways of coding that are inconsistent and partially do not conform with coding rules; some have to be corrected: NIIAR-P-335 NIIAR-P22(356) NIIAR-1(360) NIIAR-2(361) NIIAR-P-5, NIIAR-52

The different ways of coding NIIAR- reports support my proposal to include in the EXFOR dictionary, in some doubtful cases, the codes printed on the report cover.

7) Coding errors in CINDA requiring simple corrections

The following coding errors can easily be identified and corrected by a small computer program. In particular could corrections be implemented during conversion to CINDA 2001, also because for some of the errors, the correct coding would exceed the field length foreseen in the old system, and hence cannot be corrected there. In most cases listed below, "no" stands for report number and "yy" for year.

wrong coding	***correct coding***	***comment***
AAEC/AP-PR1986 AAECAP-PR-1986	AAEC/AP/PR-1986	correct coding exceeds field length; total of 7 entries
AERE-PR/NPno	AERE-PR/NP-no	675 wrong entries (only 1 correct)
AWRE-CNRPR/10	AWRE-CNR/PR-10	correct coding exceeds field length; 58 wrong entries
CEC(yy)-no	CEC-(yy)-no	266 wrong entries; code on report: CEC(yy)no
EANDC(E)no	EANDC(E)-no	over 1500 wrong entries
EANDC(J)22	EANDC(J)-22	5 wrong entries
EANDC(OR)no	EANDC(OR)-no	85 wrong entries
EANDC(UK)151 EANDC(UK) 151	EANDC(UK)-151	3 wrong entries 73 wrong entries
FOA4-Ano	FOA4-A-no	total of 22 wrong entries

FOA4-Cno	FOA4-C-no	code on report (example): FOA 4 Rapport
FOA4-Dno	FOA4-D-no	(printed on 2 lines) A 4410-411
HEDL-TMEyy-no	HEDL-TME-yy-no	5 entries; on report: HEDL-TME yy-no
INDC(EUR)no	INDC(EUR)-no	264 wrong entries
JAERI- no JAERI-C- no JAERI-D- no JAERI-M- no JAERI-R- no	JAERI-no JAERI-C-no JAERI-D-no JAERI-M-no JAERI-R-no	total of 357 wrong entries
JUELSPEZ-no	JUEL-SPEZ-no	5 wrong entries
NAA-SR-TDRno	NAA-SR-TDR-no	24 wrong entries
NEANDC(E)no	NEANDC(E)-no	18 wrong entries
NEANDC(J)no	NEANDC(J)-no	24 wrong entries
NEANDC-J-no NEANDC-Jno	NEANDC(J)-no	total of 69 wrong entries
NEANDC(UK) no	NEANDC(UK)-no	4 wrong entries
PNR/SETRyy-no	PNR/SETR-yy-no	24 wrong entries; code on report: see (3);
UKNDC(75)P71	UKNDC-(75)P71	or UKNDC-(75)-P71, or? code on report: UKNDC (75) P71

New and revised entries / subentries since the last NRDC meeting

Date: 10 June 2003

TRANS	TRANS-Flag	Entr-Tot	Entr-New	Entr-Rev	DSub-Tot	DSub-New	DSub-Rev
NNDC							
Area 1							
1306		20	17	3	64	59	5
1307		32	10	22	117	30	87
1308		21	1	20	215	22	193
1309		26	4	22	82	19	63
1310		28	5	23	83	6	77
1311		24	2	22	199	73	126
1312		25	9	16	127	52	75
1313		36	10	26	252	59	193
1314		28	10	18	153	38	115
1315	Prelim.	19	3	16	67	12	55
Sum		259	71	188	1359	370	989
Area C							
C056		19	16	3	69	66	3
C057		19	17	2	61	60	1
C058		10	6	4	63	58	5
C059	Prelim.	21	13	8	113	91	22
Sum		69	52	17	306	275	31
NEA-DB							
Area 2							
2155		21	20	1	277	273	4
2156		42	33	9	234	209	25
2157		32	11	21	126	78	48
2158		9	6	3	45	28	17
2159		41	38	3	360	321	39
2160	Prelim.	141	140	1	442	442	0
Sum		286	248	38	1484	1351	133
NEA-DB + CAJAD							
Area O							
O011	Final	86	84	2	1186	1150	36

TRANS	TRANS-Flag	Entr-Tot	Entr-New	Entr-Rev	DSub-Tot	DSub-New	DSub-Rev
NDS							
Area 3							
3111		12	5	7	99	14	85
3112		18	5	13	54	12	42
3113		13	6	7	74	42	32
3114	Prelim.	11	1	10	23	10	13
Sum		54	17	37	250	78	172
Area G							
G011		1	0	1	0	0	0
NDS + ATOMKI							
Area D							
D025	Prelim.	14	11	3	63	55	8
D026	Prelim.	8	8	0	30	30	0
Sum		22	19	3	93	85	8
CJD							
Area 4							
4127		60	9	51	413	39	374
4128		29	3	26	277	21	256
4129		23	9	14	84	49	35
Sum		112	21	91	774	109	665
CAJAD							
Area A							
A053		18	17	1	221	211	10
A054		22	21	1	72	68	4
A055		20	19	1	142	140	2
Sum		60	57	3	435	419	16
JCPRG							
Area E							
E020		30	30	0	197	197	0
E021		28	25	3	308	295	13
E022		20	19	1	732	682	50
Sum		78	74	4	1237	1174	63

TRANS	TRANS-Flag	Entr-Tot	Entr-New	Entr-Rev	DSub-Tot	DSub-New	DSub-Rev

CNPD-VNIIEF

Area F

F013		25	24	1	101	101	0
F014	Prelim.	47	30	17	154	125	29
Sum		72	54	18	255	226	29

CNPD-VNIIEF + NNDC

Area T

T011		16	16	0	141	141	0
T012		13	11	2	79	60	19
Sum		29	27	2	220	201	19

CDFE

Area M

M032		14	4	10	237	136	101
M033		12	6	6	59	15	44
Sum		26	10	16	296	151	145

CNDC

Neutron data: in area 3, last entries in TRANS 3113

Area S
Last submission: January 2000

Notes:

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

Dsub = Data subentries (excluding subentry 1 and NOSUBENT)

Summary by data type

Neutron data

Area 1	259	71	188	1359	370	989
Area 2	286	248	38	1484	1351	133
Area 3	54	17	37	250	78	172
Area 4	112	21	91	774	109	665
Sum	711	357	354	3867	1908	1959

TRANS	TRANS-Flag	Entr-Tot	Entr-New	Entr-Rev	DSub-Tot	DSub-New	DSub-Rev
CPND							
Area A		60	57	3	435	419	16
Area C		69	52	17	306	275	31
Area D		22	19	3	93	85	8
Area E		78	74	4	1237	1174	63
Area F		72	54	18	255	226	29
Area O		86	84	2	1186	1150	36
Area T		29	27	2	220	201	19
Sum		416	367	49	3732	3530	202
Photonuclear							
Area G		1	0	1	0	0	0
Area M		26	10	16	296	151	145
Sum		27	10	17	296	151	145

Fundamental particles codes proposed for dictionary 27

Particle	**CP-C/317,314**	**CP-A/133, 4C-4/139**	**CP-A/135,137**	**CP-E/017**
Kaons	0-KA-0	0-KA-0		
Neutral Anti-K.		0-AK-0		
K-	0-KN-0	**-1-KN-0**		
K+	0-KP-0	**1-KP-0**		1-KP-0
π unspecified	0-PI-0			
π 0	0-P0-0	0-P0-0		
π -	0-PN-0	**-1-PN-0**		
π +	0-PP-0	**1-PP-0**		
Anti-proton	1-AP-1	**-1-AP-1**		1-AP-1
η (eta)			0-ET-0	
W+boson			1-WP-0	
W-boson			-1-WN-0	
Z-boson			0-ZZ-0	
Lepton diction.			*see CP-A/135*	

MEMO CP-A/135

02-Apr-2003

To: **Working group for high-energy EXFOR.**
From: **F.E. Chukreev**
Subject: **Preliminary Draft of Draft**
Fundamental particles in EXFOR.

The reactions of fundamental particles, specially the reactions where fundamental particles transform from one type to another, request other dictionaries, than nuclear reactions at low energies.

Main difference is new conservation laws.

If check codes in usual EXFOR checks conservation laws for electric and barion charges, high energy physics uses conservation laws for lepton charge, stranges, beauty and another quantum numbers.

Only gauge bosons could be included in our 27-th dictionary.
Possible codes for the bosons :

Photon	0-G-01
W+ boson	1-WP-0
W- boson	-1-WN-0
Z -boson	0-ZZ-0

All another fundamental particles (leptons and adrons) have lepton charges (numbers) and quarks compositions.

As leptons can not transform to adrons and adrons can transform to leptons in weak interaction processes only, but the weak interaction is not subject of EXFOR, two separate dictionaries for leptons and adrons are needed. The dictionaries must include (except separate cases) the particles, which are stable for strong decay, because only the particles can be detected directly.

Possible structure of lepton dictionary is presented.

		Electric charge	L_e	L_μ	L_τ
NE	Negative electron	-1	+1	0	0
PE	Positive electron	+1	-1	0	0
NM	negative muon	-1	0	+1	0
PM	positive muon	+1	0	-1	0

1 The code presents in 27-Dictionariy now.

NT	negative tauon	-1	0	0	+1
PT	positive tauon	+1	0	0	-1
UE	electron neutrino	0	+1	0	0
UU	electron antineutrino	0	-1	0	0
UM	muon neutrino	0	0	+1	0
MM	muon antineutrino	0	0	-1	0
UT	tauon neutrino	0	0	0	+1
TT	tauon antineutrino	0	0	0	-1

First column – possible code, third column – electric charge, -electronic lepton charge, mounic lepton charge, tauon lepton charge.
As you can see, each lepton can be presented as four components vector. If two leptons with vectors $L_1$and L_2 will produce some leptons with L_k L_l …L_m conservation law request:
$L_1 + L_2 = L_k + L_l + \ldots\ldots + L_m$.
The lepton codes must be used in all subfields of the reaction. As I understand obviousness will be lost. Sorry, but high energy community likes Greek symbols with additional symbols sub- and underline.
One examples lepton reactions

Reaction μ+ +μ- →e+ + e- will be coded as

PM(NM,NE)PE

Similar conservation laws act for adron interaction too. But adron vector contains six components.

To distinguish adrons and leptons I would like to propose to use 3-symbols codes for mesons (quark + antiquark) and 4-symbols for barions (3 quark)

Proposed dictionary 30 code TCC (Total Charge Changing)

Comments on MEMO CP-A/144

V. McLane and O. Schwerer

Total Charge-Changing Cross Section: After looking at the papers given as examples in Memo CP-A/144, we think a clearer definition would be as follows.

Definition: The cross section for emission of a product whose charge differs from the incident projectile charge.

If Z_0 = incident projectile charge,
then σ_{TCC} = cross section for production of all particles such that $Z_1 \neq Z_0$

Sum Rule: $\sigma_{TCC} = \sigma_{tot} - \sigma_{Z0=Z1}$; where Z_0 is the projectile charge and Z_1 is the charge of the product measured.

Coding example:

REACTION (26-FE-56(N,TCC),,SIG)

The **Partial Charge-Changing Cross Section**, which is given for particles with a given ΔZ (e.g., ΔZ = -1) can be coded as:

REACTION (26-FE-56(N,X)ELEM,,SIG); with ELEM given in COMMON or DATA

Attached for reference: CP-A/144, CP-D/364

MEMO CP-A/144

02-June-2003

To: **Distribution**
From: **F.E. Chukreev, S.Babykina**
Subject**: TCC code plus LEXFOR page**
(Reply to Memo CP-D/364)

We propose to input in Dictionary 30 new code-

TCC (total charge-changing cross sections)

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

Total Charge-Changing Cross Section

Definition: the sum of all energetically possible nonelastic interactions minus the neutron removal cross section.

Reaction Coding: TCC in SF3

Examples (Target(28-Ni-52,TCC),,SIG)

(Target(6-C-12,TCC),,SIG)

Sum-rules: TCC= sigma (total)-sigma(el)-sigma(nr),

Where-sigma(total)=elastic plus nonelastic cross section

Sigma (nr)= only neutron removal cross section

Units: a code from Dictionary 25 - MB, etc.

References

1. B.Blank et.al. , Z.PHYS.A, 352, 69, 1995
2. A.N.Golovchenko et.al, Phys.Rev. C, 66, 014609, 2002

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

Memo CP-D/364

Date: 28 May 2003
To: Distribution
From: O. Schwerer

Subject: **Proposed dictionary 30 code TCC**

Reference: **Memos CP-A/139, CP-A/123**

The dictionary 30 (Process) code **TCC - Total charge changing**
was proposed in memo CP-A/123 in April 2002. Decision was postponed at the 2002 Paris NRDC meeting for the working group on high energy data in EXFOR to look into the matter.

While several memos relevant to high energy data were exchanged (all on elementary particle coding), no new information concerning total charge changing was distributed. However, the proposal was renewed in memo CP-A/139.

Adding a new code to the "Process" dictionary (REACTION SF3) is not trivial - these are codes like TOT (total), F (fission), EL (elastic) etc. which are all self-explanatory. Therefore we need more information.

- What is the definition of the Total charge changing cross section? (Lexfor entry)

- A coding example is needed. Is there a reaction product to be coded, either obligatory or optional? Any independent variables besides EN?

- In memo CP-A/123, the article ZP/A,352,69,1995 is mentioned as example. How would this be coded in EXFOR? (E.g., Tables 1 and 2)

- This article mentions a second article by the same authors measuring "partial charge changing cross sections". How will this be coded?

- Is the abbreviation TCC known well enough to be understood by the users? The present SF3 codes do not need any explanation or looking up the dictionary.

Japan Charged-Particle Nuclear Reaction Data Group

Division of Physics, Graduate School of Science
Hokkaido University
060-0810 Sapporo, JAPAN

Telephone +81(JPN)-11-706-2684
Facsimile +81(JPN)-11-706-4850
E-mail nrdf@nucl.sci.hokudai.ac.jp

Memo CP-E/020

Date: April 19, 2003
To: Distribution
From: OTUKA Naohiko and KATŌ Kiyoshi
Subject: Total spin transfer

Recently we received experimental data of "total spin transfer" (A.Tamii et al., Phys. Lett. **B459** (1999) 61, T.Kawabata et al., Phys.Rev. C**65** (2002) 064316). This quantity is defined as follows:

$$\Sigma = \{3-(D_{SS}+D_{NN}+D_{LL})\}/4=(S_{SS}+S_{NN}+S_{LL})/2,$$

where D_{ii} (ii=*SS*, *NN*, *LL*) are "spin-rotation-deporalization parameters", and $S_{ii} = (1-D_{ii})/2$ (ii=*SS*, *NN* and *LL*) is spin-flip probability for the i -direction, respectively.

Total spin transfer Σ is used as an index to distinguish spin-flip (ΔS=1) and non-spin-flip (ΔS=0) excitation. $\Sigma \approx 1$ (0) for ΔS=1(0) is regarded as a good approximation at forward angles of outgoing particle. At 0 degree, especially, this relation is exactly correct due to the spatial symmetry. In this sense, total spin transfer Σ is similar to "spin-flip probability" S_{NN}, for which also $S_{NN} \approx 0$ for ΔS=0. However, S_{NN} takes various values in ΔS=1 excitations depending on the J^{π}. Therefore Σ is considered as a better index than S_{NN}.

A rule of "$D_{SS}+D_{NN}+D_{LL}$ =3(-1) for ΔS=0(1)" had been known in the measurements of (p,n) scattering. H.Sakai pointed out that this rule is effective to distinguish ΔS=1 and 0 excitations and introduced Σ in 1999 (H.Sakai, Nucl. Phys. **A654** (1999) 731c). The validity of Σ as an index of ΔS=0(1) is theoretically confirmed (T.Suzuki, Prog. Theor. Phys. **103** (2000) 859). Due to the recent progress of experimental technique (high luminosity beam, reliable measurement of forward scattered particle), D_{SS} and D_{LL} are widely measured as well as D_{NN} , and consequently Σ is recognized as an experimental observable. We propose some codes for total spin transfer :

Dictionary 24 (Modifiers)

TST	Total spin transfer

Dictionary 36 (Quantities)

,POL/DA/DE,,TST NO	Total spin transfer with respect to angle and energy
PAR,DA,,TST DA	Partial diff. cross section d/dA *total spin transfer

Related two proposals:

1. "NN,POL/DA,,SF" and ",POL/DA,,SF"

Now we have *two* codes "NN,POL/DA,,SF" and ",POL/DA,,SF" for "spin-flip probability S_{NN}". We propose that we keep "NN,POL/DA,,SF" while obsolete

“,POL/DA,,SF” (we cannot find any entry which use the latter quantity code in EXFOR+CINDA Ver.1.10).

Dictionary 36 (Quantities)

~~,POL/DA,,SF~~	~~NO~~	~~Spin-flip probability S(nn)~~
		(*obsolete, use* “NN,POL/DA,,SF”)

2. “,SIG,,SF”

Now “,SIG,,SF“□is expanded as “spin-flip cross section” in our dictionary (we cannot find any entry which use this quantity code in EXFOR+CINDA Ver.1.10). But the definition of this quantity is ambiguous. If this quantity means “cross section multiplied by S_{NN} (spin-flip-probability)”, it is better to use “NN,SIG,,SF” with a corrected expansion.

Dictionary 36 (Quantities)

~~,SIG,,SF~~	~~B~~	~~Spin-flip cross section~~
		(*obsolete, use* “NN,SIG,,SF”)
NN,SIG,,SF	B	Cross section * Spin-flip probability S(nn)

We attach a coding sample for the proposed two new quantities “,POL/DA/E,,TST” and “PAR,DA,,TST”.

Distribution:

J.H. Chang, KAERI	M. Chiba, JCPRG	F.E. Chukreev, CAJaD	S. Dunaeva, Sarov
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M. Vlasov, KINR	M. Wirtz, NDS	V. Zerkin, NDS	Y.X. Zhuang, CNDC

Sample of coded entry (E1776.004, 027):

T. Kawabata et al., Phys. Rev. C **65** (2002) 064316 Fig.4 and Table II

```
SUBENT        E1776004   20030311                                  E177600400001
BIB                 4          8                                  E177600400002
REACTION   (8-O-16(P,INL)8-O-16,,POL/DA/DE,,TST)                   E177600400003
           DATA: total spin transfer                               E177600400004
…
ENDBIB              8          0                                  E177600400011
COMMON              1          3                                  E177600400012
ANG                                                               E177600400013
ADEG                                                              E177600400014
 0.0                                                              E177600400015
ENDCOMMON           3          0                                  E177600400016
DATA                3         96                                  E177600400017
E-EXC      DATA       DATA-ERR                                    E177600400018
MEV        NO-DIM     NO-DIM                                      E177600400019
 5.61       -2.768     2.975                                      E177600400020
 5.856      -1.308     1.971                                      E177600400021
…
 28.796     0.406      0.062                                      E177600400114
 29.043     0.507      0.064                                      E177600400115
ENDDATA            98          0                                  E177600400116
ENDSUBENT         115          0                                  E177600499999
SUBENT        E1776027   20030311                                  E177602700001
BIB                 5          8                                  E177602700002
REACTION   (8-O-16(P,INL)8-O-16,PAR,DA,TST)                       E177602700003
           DATA: spin flip cross section(=angular distribution *  E177602700004
                 total spin transfer)                             E177602700005
…
ENDBIB              8          0                                  E177602700011
COMMON              1          3                                  E177602700012
E-LVL                                                             E177602700013
MEV                                                               E177602700014
 8.87                                                             E177602700015
ENDCOMMON           3          0                                  E177602700016
DATA                3          1                                  E177602700017
ANG-CM     DATA       DATA-ERR                                    E177602700018
ADEG       MU-B/SR    MU-B/SR                                     E177602700019
 4.4        19.0       2.0                                        E177602700020
ENDDATA             3          0                                  E177602700021
ENDSUBENT          20          0                                  E177602799999
```

WP 2003-14

New coding for REACTION SF7 (particle considered)

Attached: CP-C/315, CP-D/354, CP-D/350, CP-E/017

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/315

DATE: January 31, 2003
TO: Distribution
FROM: V. McLane
SUBJECT: Reaction Field Particle considered (SF7)

For complex quantities for which, *e.g.*, the secondary energy given is for the relative motion between two particles, or the angle is given for the center-of-mass of two particles, a new way is needed to specify the particles considered. Consider for example data set E1748 (TRANS E021). The triple differential cross section is given for the angle of the outgoing tritons and alphas and the energy for the relative motion between the triton and the alpha. (Many other similar cases have been reported).

I propose that we introduce the separator dash (-) to indicate the correlated particles. For the above case, the quantity would be coded as: (……..DA/DA/DE,A/T/A-T)

This might require some retrofitting of previously transmitted entries, but I am willing to look into and report on those, if this proposal is accepted. It would also require updating any codes that parse the REACTION string.

Distribution

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

Memo CP-D/354

Date: 18 February 2003

To: Distribution

From: O. Schwerer

Subject: 1) Dictionary 18 code PRJFS
2) REACTION SF7

Reference: Memo CP-E/017, items 4 and 5

1) I support the proposal to introduce the dictionary 18 code PRJFS (rather than PRJFS2) since we still have the restriction of 5 characters for this dictionary.

2) (See also CP-C/315 and CP-D/350) While I agree with the idea of coding correlated particles in REACTION SF7, it occurred to me that at the 2002 Paris NNDC meeting (Conclusion C20) we allowed nuclide codes in SF7. This means, we might end up with SF7 containing

   ….,DA/DA/DE,N/A/4-BE-9-3-LI-7

   which is rather confusing. Therefore I propose to use another separator for the correlated particles, e.g. a plus sign:

   ….,DA/DA/DE,N/A/4-BE-9+3-LI-7

Distribution:

oblozinsky@bnl.gov
vml@bnl.gov
nordborg@nea.fr
kellett@nea.fr
manokhin@ippe.obninsk.ru
maev@ippe.obninsk.ru
may@obninsk.ru
feliks@polyn.kiae.su
chukreev@polyn.kiae.su
dunaeva@expd.vniief.ru
taova@expd.vniief.ru
varlamov@depni.sinp.msu.ru
chiba@earth.sgu.ac.jp
kato@nucl.sci.hokudai.ac.jp
oba@nrdf.meme.hokudai.ac.jp
yxzhuang@iris.ciae.ac.cn
gezg@iris.ciae.ac.cn
cndc@mipsa.ciae.ac.cn
tarkanyi@atomki.hu
s.takacs@atomki.hu
hasegawa@ndc.tokai.jaeri.go.jp
vlasov@kinr.kiev.ua
kaltchenko@kinr.kiev.ua
ogritzay@kinr.kiev.ua
jhchang@kaeri.re.kr
ohtsuka@nucl.sci.hokudai.ac.jp
m.wirtz@iaea.org
m.lammer@iaea.org
v.pronyaev@iaea.org
schwerer
zerkin

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

Memo CP-D/350

Date: 12 February 2003
To: Distribution
From: O. Schwerer

Subject: Proposed new coding for REACTION SF7 (Particle considered)

Reference: Memo CP-C/315 (31 January 2003)

I agree with the proposal in CP-C/315. However, some additional clarifications and additions (including LEXFOR) will be required, in particular:

When referring to secondary energies:

The correlated particles need to be given also under EN-SEC. In the example of CP-C/315, this would be
EN-SEC (E,A-T)

When referring to angles of secondary particles:

Will this new formalism also apply to the existing data on angular correlations and/or correlated particle pairs (as given in LEXFOR under "Correlations")? Even if the answer is negative, LEXFOR should explain where this new formalism is to be used, and where it isn't. This update should go together with the clarification requested earlier for the definitions and coding rules for angular correlations (pending Action A32 of the 2002 NRDC Meeting), i.e. definition of angular correlation vs. angular distribution of correlated particle pairs, units to be used, number of angles to be given).

Distribution:

oblozinsky@bnl.gov
vml@bnl.gov
nordborg@nea.fr
kellett@nea.fr
manokhin@ippe.obninsk.ru
maev@ippe.obninsk.ru
may@obninsk.ru
feliks@polyn.kiae.su
chukreev@polyn.kiae.su
dunaeva@expd.vniief.ru
taova@expd.vniief.ru
varlamov@depni.sinp.msu.ru
chiba@earth.sgu.ac.jp
kato@nucl.sci.hokudai.ac.jp
oba@nrdf.meme.hokudai.ac.jp

yxzhuang@iris.ciae.ac.cn
gezg@iris.ciae.ac.cn
cndc@mipsa.ciae.ac.cn
tarkanyi@atomki.hu
s.takacs@atomki.hu
hasegawa@ndc.tokai.jaeri.go.jp
vlasov@kinr.kiev.ua
kaltchenko@kinr.kiev.ua
ogritzay@kinr.kiev.ua
jhchang@kaeri.re.kr
ohtsuka@nucl.sci.hokudai.ac.jp
m.wirtz@iaea.org
m.lammer@iaea.org
v.pronyaev@iaea.org
schwerer
zerkin

Japan Charged-Particle Nuclear Reaction Data Group

Division of Physics, Graduate School of Science
Hokkaido University
060-0810 Sapporo, JAPAN

Telephone +81(JPN)-11-706-2684
Facsimile +81(JPN)-11-706-4850
E-mail nrdf@nucl.sci.hokudai.ac.jp

Memo CP-E/017

Date: February 3, 2003
To: Distribution
From: OTUKA Naohiko and KATŌ Kiyoshi
Subject: Reply to CP-C/313, 314, 315 and NNDC's comments on PRELIM.E021, CP-E/013, 016

thank you very much for Vicki's carefully checking and giving useful comments and suggestions to help our compilations of PRELIM.E021. The following is reply for them:

1. Longitudinal momentum LP (CP-C/313)

We are satisfied with Vicki's proposals CP-C/313 1)-3).

2. Elementary particle production cross sections (PRELIM.E021.E1706, E1711, CP-C/314)

The preliminary E021 includes elementary particle production cross sections for anti-proton (in E1706) and positive kaon (in E1717). CP-C/314 proposes the following compilation for them:

REACTION (6-C-0(D,X)1-AP-1,,DA/DP)	E170600600003
REACTION (6-C-0(KN,X)0-KP-0,,DA/DP)	E171700200003

The expression for anti-proton looks good, while we prefer to use 1-KP-0, where we suggest *Z* would be the absolute value of electric charge. We also propose that *A* denotes absolute value of baryon number (this with the example of CP-C/314). We hope to have more discussion for K^+. We withdraw E1717 from final TRANS.E021 and wait a conclusion of High Energy Working Group).

3. Angular range codes: ANG1-MIN, ANG1-MAX... (PRELIM.E021.E1711, CP-E/013)

Vicki proposed to treat these angular ranges as additional information on 16 December. In the present paper (W.Q.Shen et al., Phys.Rev.C**56**(1997)1996, compiled as E1711 in PRELIM.E021),

1) Two polar angular ranges for two protons, 10 deg<θ<160 deg, would rise from the limitation of measurement technique, which cannot cover most forward and backward direction;

2) The authors would not expect that this theta range affects current experimental azimuthal angular correlations.

So we conclude that these polar angular ranges can be treated as additional information. We also withdraw CP-E/013 which proposed new codes ANG1-MIN, ANG1-MAX, ANG2-MIN and ANG2-MAX.

4. Beam from projectile fragment separator: PRJFS (PRELIM.E021.E1721, CP-E/016)

In CP-E/016, we proposed new codes PRJFS (Secondary beam from projectile fragment

separator) which is used in E1721 of PRELIM.E021. Vicki's counterproposal is PRJFS2. The last 2 probably expresses "secondary". It seems to be good. But now the length of code in Dict.18 (Facility) is limited to be less than 5. So now I propose to use PRJFS again if there is no other proposal.

5. Reaction field particle considered (PRELIM.E021.E1748)

We support Vicki's proposal for the expression of correlated particles in SF7. The following is a coding example for PRELIM.E021.E1748.020 using the proposal:

(DA/DA/DE,A/T/A-T or DA/DA/DE,T/A/T-A ?)

```
SUBENT        E1748020   20021202                                  E174802000001
BIB                 7         23                                  E174802000002
REACTION   (30-ZN-64(3-LI-7,T+A)30-ZN-64,,DA/DA/DE,A/T/A-T)       E174802000003
           DATA: triple differential cross section with respect   E174802000004
                 to kinetic energy and angle for relative motion  E174802000005
                 between alpha and triton, and angle for motion   E174802000006
                 of the center of mass of the 7Li(=alpha+triton)  E174802000007
                 system                                           E174802000008
PART-DET   (A)                                                    E174802000009
           (T)                                                    E174802000010
…
EN-SEC     (E,T/A)kinetic energy for relative motion between      E174802000017
                  alpha and triton, positive (negative) energies  E174802000018
                  correspond to the branch where velocity of      E174802000019
                  alpha is larger (smaller) than that of triton   E174802000020
           ANG1 is polar angle between beam and alpha             E174802000021
           ANG2 is polar angle between beam and triton            E174802000022
```

Distribution:

J.H. Chang, KAERI	M. Chiba, JCPRG	F.E. Chukreev, CAJaD	S. Dunaeva, VNIEF
O. Gritzay, KINR	A. Hasegawa, JAERI	K. Katō, JCPRG	M. Kellett, NEADB
M. Lammer, NDS	S. Maev, CJD	V.N. Manokhin, CJD	V. McLane, NNDC
P. Oblozinsky, NNDC	Y. Ohbayasi, JCPRG	N. Otuka, JCPRG	V. Pronyaev, NDS
O. Schwerer, NDS	S. Takacs, ATOMKI	F.T. Tárkányi, ATOMKI	V. Varlamov, CDFE
M. Vlasov, KINR	M. Wirtz, NDS	V. Zerkin, NDS	Y.X. Zhuang, CNDC

Longitudinal Momentum

Attached: CP-C/313, CP-E/021, CP-E/023

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/313

DATE: January 28, 2003
TO: Distribution
FROM: V. McLane
SUBJECT: Longitudinal Momentum

I had proposed in Memo CP-C/290 to use the code "LON,DA/DP,,IPA", where LON stood for longitudinal secondary linear momentum. N. Otuka of the JCPRDG points out that the definition of LON in Dictionary 31 is longitudinal spins, and would not apply here for momentum. He also questions whether this is a correct use of the branch field, and whether the use MOM-SEC is correct.

I can see that a problem might arise if a polarization quantity were given as a function of longitudinal momentum; this is a possibility in the future.

I make the following proposals.

1) Add the quantity LP to Dict. 31 for longitudinal momentum. (In future, TP can be added for transverse momentum, if required).

2) The longitudinal momentum is a component of the total linear momentum and, therefore, it can be argued that the use of SF5 is correct.

3) MOM-SEC is defined as secondary linear momentum, and its' use for the longitudinal component is correct.

Changes for Dictionary 36 (Quantities): replace LON with LP.

LON,DA/DP,,IPA	LP,DA/DP,,IPA
LON,DA/DP,P,IPA	LP,DA/DP,P,IPA

I will take care of correcting the entry already transmitted (C0820).

Distribution

Japan Charged-Particle Nuclear Reaction Data Group

Division of Physics, Graduate School of Science
Hokkaido University
060-0810 Sapporo, JAPAN

Telephone +81(JPN)-11-706-2684
Facsimile +81(JPN)-11-706-4850
E-mail nrdf@nucl.sci.hokudai.ac.jp

Memo CP-E/021

Date: April 19, 2003
To: Distribution
From: OTUKA Naohiko and KATŌ Kiyoshi
Subject: Differential cross section with respect to longitudinal momentum

We are compiling two experiments in which fragment longitudinal momentum distributions are measured from the breakup of secondary beam provided by RIKEN Projectile Fragment Separator - RIPS - (R. Kanungo *et al*., Phys. Rev. Lett. **88** (2002) 142502 and T. Suzuki *et al*., Phys. Rev. Lett. **89** (2002) 012501). Fragments ^{15}B, ^{22}O and ^{21}O coming from Be(^{17}B,^{15}B)X, C(^{23}O,^{22}O)X, and C(^{23}O,^{21}O)X are detected. In EXFOR, these detected fragments are treated as residual nuclei. We propose the following code for longitudinal momentum distribution for residual nuclei:

Dictionary 36 (Quantities)

LP,DP,RSD	DP	Differential cross section with respect to longitudinal secondary momentum

Also we need to add some flags for unstable nuclei used as beam and detected as outgoing fragments:

Dictionary 27 (Nuclides)

5-B-17	Flag 2 at column 14
5-B-15	Flag 3 at column 15
8-O-23	Flag 2 at column 14
8-O-22	Flag 3 at column 15

We attach a coding sample of this quantity.

Distribution:

J.H. Chang, KAERI	M. Chiba, JCPRG	F.E. Chukreev, CAJaD	S. Dunaeva, Sarov
O. Gritzay, KINR	A. Hasegawa, JAERI	K. Kato, JCPRG	M. Kellett, NEADB
M. Lammer, NDS	S. Maev, CJD	V.N. Manokhin, CJD	V. McLane, NNDC
P. Oblozinsky, NNDC	Y. Ohbayasi, JCPRG	N. Otuka, JCPRG	V. Pronyaev, NDS
O. Schwerer, NDS	S. Takacs, ATOMKI	F.T. Tárkányi, ATOMKI1	V. Varlamov, CDFE
M. Vlasov, KINR	M. Wirtz, NDS	V. Zerkin, NDS	Y.X. Zhuang, CNDC

Sample of coded entry (E1780.002):

T. Suzuki et al., Phys. Rev. Lett. **89** (2002) 012501 Fig.2 (upper panel)

```
SUBENT        E1780002   20030312                                  E178000200001
BIB                6         22                                  E178000200002
REACTION   (4-BE-9(5-B-17,X)5-B-15,LP,DP,RSD)                     E178000200003
           DATA: distribution of 15B longitudinal momentum in the E178000200004
                 projectile rest frame is characterized by a     E178000200005
                 FWHM=86+-10MeV/c and 80+-10MeV/c for folding and E178000200006
                 unfolding the system resolution (14MeV/c in 1   E178000200007
                 sigma)                                          E178000200008
           DATA-ERR: uncertainty (22%) due to normalization      E178000200009
                     factor (2 neutron separation cross section) E178000200010
                     is not included                             E178000200011
MONITOR    experimental data points were normalized to the       E178000200012
           measured 2 neutrons separation cross section value    E178000200013
PART-DET   (5-B-15)                                              E178000200014
ADD-RES    (COMP)Glauber approximation.(longitudinal momentum    E178000200015
                 distribution was calculated by using            E178000200016
                 Eqs.(3.5)-(3.18) in [Y.Ogawa et al., Nucl.Phys. E178000200017
                 A571 (1994)784]. Pure 2s1/2, 1d2/5              E178000200018
                 conficuratoins and their configuration mixing   E178000200019
                 are considered.)                                E178000200020
MOM-SEC    (MOM-SEC,5-B-15)longitudinal momentum in the          E178000200021
                           projectile rest frame                 E178000200022
STATUS     (TABLE)Data (Fig.2-a,p012501-3 in reference) sent by  E178000200023
                  author                                         E178000200024
ENDBIB              22          0                                E178000200025
NOCOMMON             0          0                                E178000200026
DATA                 3         15                                E178000200027
MOM-SEC    DATA       DATA-ERR                                   E178000200028
MEV/C      MB/MEV/C   MB/MEV/C                                   E178000200029
 -140.0     0.19       0.07                                      E178000200030
 -120.0     0.17       0.08                                      E178000200031
 -100.0     0.36       0.09                                      E178000200032
 -80.0      0.46       0.13                                      E178000200033
 -60.0      0.64       0.22                                      E178000200034
 -40.0      1.32       0.31                                      E178000200035
 -20.0      2.11       0.32                                      E178000200036
 0.0        1.62       0.3                                       E178000200037
 20.0       1.52       0.27                                      E178000200038
 40.0       1.07       0.28                                      E178000200039
 60.0       0.64       0.24                                      E178000200040
 80.0       0.2        0.16                                      E178000200041
 100.0      0.37       0.1                                       E178000200042
 120.0      0.18       0.06                                      E178000200043
 140.0      0.18       0.06                                      E178000200044
ENDDATA             17          0                                E178000200045
ENDSUBENT           44          0                                E178000299999
```

Japan Charged-Particle Nuclear Reaction Data Group

Division of Physics, Graduate School of Science
Hokkaido University
060-0810 Sapporo, JAPAN

Telephone +81(JPN)-11-706-2684
Facsimile +81(JPN)-11-706-4850
E-mail nrdf@nucl.sci.hokudai.ac.jp

Memo CP-E/023

Date: June 9, 2003
To: Distribution
From: OTUKA Naohiko and KATŌ Kiyoshi
Subject: Dictionary 27 (Nuclides) and secondary linear momentum

1. Radon isotope which alpha decay is measured

We are compiling two experiments of fusion-evaporation residue measurements at JAERI (S.Mitsuoka *et al*., Phys. Rev. C**65** (2002) 054608 and K.Satou *et al*., Phys. Rev. C**65** (2002) 054602). In these experiments, alpha decay of ^{206}Rn was observed. We propose to add Flag 3 for ^{206}Rn.

Dictionary 27 (Nuclides)

`86-RN-206` Flag 3 at column 15

2. Secondary Linear Momentum and parameter DP

□□Now data heading belonging to Secondary Linear Momentum (family L, e.g. `MOM-SEC`) can be used when parameter (SF6) contains the linear momentum correlation `MCO` (EXFOR System Manual (April, 2001) 7.10). We propose that the parameter `DP` (differential with linear momentum of out going particles) also allows the use of family L.

(Now CHEX often gives error message like

```
** Illegal independent variable          SEC.ENERGY
```

when `DP` is connected with family L).

Distribution:

J.H. Chang, KAERI	M. Chiba, JCPRG	F.E. Chukreev, CAJaD	S. Dunaeva, VNIIEF
O. Gritzay, KINR	A. Hasegawa, JAERI	A. Kaltchenko, KINR	K. Kato, JCPRG
M. Kellett, NEADB	M. Lammer, NDS	S. Maev, CJD	V.N. Manokhin, CJD
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S. Taova, VNIIEF	T. Tárkányi, ATOMKI1	V. Varlamov, CDFE	M. Vlasov, KINR
M. Wirtz, NDS	V. Zerkin, NDS	Zhuang Y.X., CNDC	

Sample of coded entry (E1779.002):

R. Kanungo *et al*., Phys. Rev. Lett. **88** (2002) 142502 Fig.2-a

```
SUBENT        E1779002   20030606                                  E177900200001
BIB                 4          7                                  E177900200002
REACTION   (6-C-0(8-O-23,X)8-O-22,LP,DP,RSD,REL)                  E177900200003
           DATA: count number                                     E177900200004
PART-DET   (8-O-22)                                               E177900200005
MOM-SEC    (MOM-SEC,8-O-22)longitudinal momemtum in projectile    E177900200006
                          rest frame                              E177900200007
STATUS     (CURVE)Data scanned from Fig.2-a (filled               E177900200008
                 circle),p.142502-2 in reference                  E177900200009
ENDBIB              7          0                                  E177900200010
NOCOMMON            0          0                                  E177900200011
DATA                3         15                                  E177900200012
MOM-SEC    DATA       DATA-ERR                                    E177900200013
MEV/C      ARB-UNITS  ARB-UNITS                                   E177900200014
 -2.532E+02  1.126E+01  4.929E+00                                 E177900200015
 -2.214E+02  1.971E+01  4.225E+00                                 E177900200016
…
```

Partial cs for production of specified number of product particles

Attached: CP-C/318, CP-D/359

Subentry A0361.002 compiles partial cross sections for the production of a specifies number of heavy product particles from the reaction U-238 nicident on Au-197 at 3850 MeV.

After some discussion, NNDC and NDS agree on proposing the following coding:

```
(79-AU-197(92-U-238,X)NPART,NUM,SIG,FF)
```

(in units MB or equivalent), with `PART-OUT` as independent variable.

NPART replaces the reaction product in SF4 (cannot be blank if SF3 = X) and links the REACTION codes to the independent variable PART-OUT. NUM in SF5 indicates that this is a partial cross section (for each of the values of PART-OUT; their sum may be equal the total cross section). SF7 (in this case FF) may be used to define particles considered.

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/318

DATE: February 12, 2003
TO: Distribution
FROM: V. McLane
SUBJECT: Reply to Memos CP-D/358 and CP-D/359

Memo CP-D/358 (Differential by number of prompt neutrons.

Memo CP-C/359 (Partial cross section for production of a specified number of product particles)

I like the addition of NUM in SF5. However, I prefer the more generic code for SF4; the exact particle can be specified in SF7 as is now the practice, e.g., ……)NPART,NUM,SIG,HF. Otherwise we will eventually need more codes for SF4 (LFRAG, LCP, HCP).

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

Memo CP-D/359

Date: 10 March 2003
To: Distribution
From: O. Schwerer

Subject: **Partial cross section for production of specified number of product particles**

Reference: Subentry A0361.002 (TRANS A054) and related comments

In this work, partial cross sections for the production of a specified number of heavy product particles from the reaction U-238 incident on Au-197 at 3570 MeV are measured.

In subentry A0361.002 (on TRANS A054) this is coded as

```
(1)     (79-AU-197(92-U-238,F),,SIG/DN,FF)
```

with PART-OUT as independent variable and DATA in units MB/PRT.

In V. McLane's comment on TRANS A054 it is mentioned that
- SIG/DN is not appropriate because DN stands for "differential with respect to number of outgoing neutrons" while here all (heavy) product particles are included, and
- SF3 = F (fission) is not appropriate because according to the publication, not only fission is included,

and a new way of coding was proposed:

```
(2)     (79-AU-197(92-U-238,X)NPART,,SIG)
```

(to be given in units MB), introducing a new code NPART for SF4.
(Note that there is no dictionary for SF4. Like ELEM and MASS, such special codes need to be hard-wired into all relevant programs.)

While I agree that the original coding needs to be replaced by something new, I am not happy with using the simple quantity (REACTION SF5-8)
,SIG (dictionary 36 entry for a straightforward cross section)

because we have here a partial cross section with an additional independent variable (PART-OUT). Since the checking programs check the consistency of quantities, variables and units based on dictionary 36 (which does not include SF4), I prefer a solution with a new code not only in SF4 but also in SF5 and/or SF6, to enable proper checking. For example:

(3) (79-AU-197(92-U-238,X)HFRAG,NUM,SIG)

NUM and NUM,SIG, respectively, would be added to **dictionaries 31** and **36** as "partial cross section for production of specified number of product particles".

Also, I propose to replace NPART by HFRAG (for heavy fragment) to indicate that these are not e.g. neutrons or protons which would be coded with a proper nuclide code.

In any case, any new special code for SF4 (such as NPART or HFRAG) will have to be added to the EXFOR Systems Manual (Chapter 7 on REACTION, Section on Reaction Product).

There might be still other, perhaps better ways of coding such data. Please give your feedback.

Addition to WP 2003-16

MEMO CP-A/138

7-May-2003

To: **Distribution**
From: **F.E. Chukreev , S.Babykina**
Subject**: Modify the definition SIG/DN and DN in dictionaries 36 and 32**

We are suggest to change the definition of '**SIG/DN**' and '**DN**' in dic.36 and 32.

SIG/DN	**(cs differential by number of outgoing particles)**
DN	(**differential with number of outgoing particles**)

It will permit to compile a lot of paper without input new codes in dic.36 and 32, which has been proposed for A0361 (See action 35, meeting 2002) and O0939 (see CP-D/359) and lot of other.

On last Paris meeting after discussion of WP12 , Action 35 was accepted where SIG/DN code has been recommended to use for data from Entry o0939.

Therefore, we do not see needed to input new codes NPART etc (See Memo-CP-D/359) for SF4, if the definition code DN will be modified.

New quantities for secondary particle spectra

Attached: CP-D/357, CP-D/355

The following new quantities were agreed and introduced in **dictionary 32** (REACTION SF6):

KEP Most probable kinetic energy of outgoing particle
KEM Temperature of Maxwellian distribution of outgoing particles

For a secondary particle spectrum measured relative to a Maxwellian distribution of a given temperature, the **dictionary 34** (Modifiers) code

MXD

was introduced. A corresponding new **dictionary 36** quantity is

PR,DE,N,MXD

The reference Maxwellian temperature must be given under the new heading (**Dictionary 24**)

KT-NORM.

See the attached memos for more details.

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

Memo CP-D/357

Date: 4 March 2003
To: Distribution
From: O. Schwerer

Subject: **Maxwellian distribution of outgoing particles: New proposal (Additions to dictionaries 24, 32, 34, 36)**

Reference: **Memos CP-D/353** (18 February 2003)**,** **4C-4/138** (16 January 2003)**, 4C-4/134** (2 December 2002) **Entries 40472 and 40535 (PRELIM 4129)**

1) DE,N,MXW and PR,DE,N,MXW: "Maxwell distribution of outgoing neutrons"

Actually in subentry 40535002 this is only used in denominator of a ratio; measured was ratio of neutron spectrum to calculated Maxwellian distribution.
Such data cannot be coded with MXW is SF8 because this means that the data were measured for an INCIDENT Maxwellian spectrum.
Since the denominator of the measured ratio is a calculated quantity which is a function of single number (spectrum temperature), it should not be coded as an explicit ratio but as single REACTION with a new modifier in SF8.

I propose to use `MXD` with the definition in **Dictionary 34**:

`MXD` = spectrum relative to Maxwellian distribution of given temperature

which would have to be given under a new data heading to be added to **Dictionary 24**:

`KT-NORM` Temperature of reference Maxwellian spectrum

Subentry 40535002 would then be coded:

```
REACTION    (98-CF-252(0,F),PR,DE,N,MXD)

COMMON
KT-NORM
MEV
 1.42
ENDCOMMON
DATA
 (continued as in PRELIM 4129)
```

To be added to **Dictionary 36**:

PR,DE,N,MXD	Prompt neutron spectrum relative to Maxwellian distr. of given temperature

2) ,DE/TMP,N and PR,DE/TMP,N "Maxwell distribution of neutrons"

Similar to the above, except that the spectrum temperature is now the DATA coded under REACTION rather than a separate parameter.
I think it needs a new code for SF6, which would be used similarly as AKE and the newly proposed (CP-D/355) KEP (Most probable kinetic energy).

Therefore I propose to add to **Dictionary 32**:

KEM	Temperature of Maxwellian distribution of outgoing particles

The **dictionary 36** entries replacing those of 4C-4/134 and 138 would be

,KEM,N	Temperature of Maxwellian distribution of outgoing neutrons
PR,KEM,N	Temperature of Maxwellian distribution of prompt neutrons

The REACTION of subentry 40472.002 would then be coded

(98-CF-252(0,F),PR,KEM,N)

Distribution:

oblozinsky@bnl.gov
vml@bnl.gov
nordborg@nea.fr
kellett@nea.fr
manokhin@ippe.obninsk.ru
maev@ippe.obninsk.ru
may@obninsk.ru
feliks@polyn.kiae.su
chukreev@polyn.kiae.su
dunaeva@expd.vniief.ru
taova@expd.vniief.ru
varlamov@depni.sinp.msu.ru
chiba@earth.sgu.ac.jp
kato@nucl.sci.hokudai.ac.jp
oba@nrdf.meme.hokudai.ac.jp
yxzhuang@iris.ciae.ac.cn
gezg@iris.ciae.ac.cn
cndc@mipsa.ciae.ac.cn
tarkanyi@atomki.hu
s.takacs@atomki.hu
hasegawa@ndc.tokai.jaeri.go.jp
vlasov@kinr.kiev.ua
kaltchenko@kinr.kiev.ua
ogritzay@kinr.kiev.ua
jhchang@kaeri.re.kr
ohtsuka@nucl.sci.hokudai.ac.jp
m.wirtz@iaea.org
m.lammer@iaea.org
v.pronyaev@iaea.org
schwerer
zerkin

Memo CP-D/355

Date: 21 February 2003

To: Distribution

From: M. Lammer

Subject: **1) Dictionary 24: re MASS-RATIO**
2) Dictionaries 32, 36: New code KEP

1) I assume that the DATA heading keyword

MASS-RATIO Ratio of Atomic Masses of Fission Fragments

Implicitly means: “Ratio of Atomic Masses of **Binary** Fission Fragments”, as I intend to use it for ternary alpha particle data given as function of the (coincident) binary fragment mass ratio, (where the binary fragments are not coded in the reaction string).
I propose to add "Binary" to the explanation in dictionary 24.

2) I propose a new code for Reaction SF6, Dictionary 32:

KEP Most probable kinetic energy of outgoing particle

analogous to AKE, AP and ZP. In the same entry EXFOR30916 mentioned above, most probable kinetic energy values are given for ternary alpha particles (in addition to average kinetic energy).
The use (Dictionary 36) would be the same as for AKE. In particular, the following dictionary 36 quantities are proposed for the present case:

,KEP,A	Most probable kinetic energy of alphas
PRE,KEP,A	Most probable kinetic energy of pre-neutron emission alphas
TER,KEP,A	Most probable kinetic energy of alphas from ternary fission

Distribution:

oblozinsky@bnl.gov
vml@bnl.gov
nordborg@nea.fr
kellett@nea.fr
manokhin@ippe.obninsk.ru
maev@ippe.obninsk.ru
may@obninsk.ru
feliks@polyn.kiae.su
chukreev@polyn.kiae.su
dunaeva@expd.vniief.ru
taova@expd.vniief.ru
varlamov@depni.sinp.msu.ru
chiba@earth.sgu.ac.jp
kato@nucl.sci.hokudai.ac.jp
oba@nrdf.meme.hokudai.ac.jp
yxzhuang@iris.ciae.ac.cn
cndc@mipsa.ciae.ac.cn
tarkanyi@atomki.hu
s.takacs@atomki.hu
hasegawa@ndc.tokai.jaeri.go.jp
vlasov@kinr.kiev.ua
kaltchenko@kinr.kiev.ua
ogritzay@kinr.kiev.ua
jhchang@kaeri.re.kr
ohtsuka@nucl.sci.hokudai.ac.jp
m.wirtz@iaea.org
m.lammer@iaea.org
v.pronyaev@iaea.org
schwerer
zerkin

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

Memo CP-D/351

Date: 13 February 2003
To: Distribution
From: O. Schwerer

Subject: Proposed modified format for DECAY-MON: add heading field

If more than one monitor is given, in many cases pointers cannot be used because their use is restricted to multiple reactions, vector common data and BIB/BIB links (which is sometimes overlooked). Therefore headings MONIT1, MONIT2, etc. must be used often. To link these headings to the appropriate MONIT and MONIT-REF codes, these headings are included as optional fields in the MONIT and MONIT-REF codes, but this is not yet possible for DECAY-MON.

Following a suggestion by V. McLane (in a comment on PRELIM.3112), I propose to include this optional heading field also for DECAY-MON in the same way as for MONIT-REF.

The format of DECAY-MON will then be

((heading)nuclide,half-life,radiation)

Example:

```
DECAY-MON ((MONIT1)21-SC-46-G,83.81D,DG,889.3,0.999840,
                                       DG,1120.5,0.99870)
        ((MONIT2)21-SC-47,3.345D,DG,159.4,0.683)
```

Note that with this, the formats of DECAY-MON and DECAY-DATA are different insofar as DECAY-DATA will not have this new heading field but has (as an option) the "decay-flag" field in the same position.

If agreed, the EXFOR Manual section on DECAY-MON should be updated accordingly.

Branch codes 'DIS' and 'CON' (for γ production)

Attached: CP-C/324, 4C-4/136

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/324

DATE: April 30, 2003
TO: Distribution
FROM: V. McLane
SUBJECT: Use of branch codes ‘DIS’ and ‘CON’

According to the comments received from S. Maev on preliminary TRANS 1314, there seems to be a misunderstanding of the use of the branch codes DIS and CON.

My understanding is that the code DIS is to be used for a range of discrete gamma energies in the continuum region that excludes continuum gammas. It is not useful to use it when a discrete gamma energy is given, or for a gamma energy range below the continuum region. I will not agree to its use in these cases.

The branch field is used to separate different branches of a reaction. When only one of the branches is possible, no branch code is given.

The dictionary explanation should be changed to read similar to the following.

CON	For a range of continuum gammas, discrete gammas excluded.
DIS	For a range of discrete gammas, continuum gammas excluded.

RUSSIA'S NUCLEAR DATA CENTER - RNDC
Alias: CENTR JADERNYKH DANNYKH - CJD
Bondarenko Sq., 1
Institute of Physics and Power Engineering - IPPE
Obninsk 249020
Kaluga Region, Russian Federation

(*Internet*) manokhin@ippe.obninsk.ru Phone: (+7 08439)989-82
FAX: (+7 095)883-3112

MEMO 4C-4/136

DATE: **11 December 2002**
TO: **Distribution**
From: **S. Maev (alias : S. Mayev, S. Maiev)**
Subject: **Addition of Dictionaries 36, 31**

Following additions should be made to

Dictionary 36 (Quantities)

1.

PR,NU,LF	Number of neutrons emitted by the light fission fragment
PR,NU/DE,HF	Number of neutrons emitted by the heavy fission Fragment having an energy given in data table
Reference	ENTRY 22464, ENTRY 22660

2.

PAR/DIS,DA,G	Angular distribution for the discrete gammas of given energy
PAR/CON,DA,G	Angular distribution for the continuous gammas of given energy
DIS,SIG,G	Production Cross Section for discrete gammas
CON,SIG,G	Production Cross Section for continuous gammas
Reference	ENTRY 40496

Consequently, additions should be made to

Dictionary 31 (Branch)

DIS	For discrete spectrum
CON	For continuous spectrum

By the way, at TSUKUBA-2001 there is at least one paper with the data for discrete and continuous spectra gamma production cross sections.

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

Memo CP-D/368

Date: 4 June 2003
To: Distribution
From: O. Schwerer

Subject: Transmission data: New code for SF8 proposed

At present, transmission data are coded in EXFOR

`(N,TOT),,SIG,,RAW`

with free text explanation "transmission" and units NO-DIM.

Actually, a majority of data coded `(N,TOT),,SIG,,RAW` are transmission data, but there are others, i.e. cross sections in barns uncorrected for various effects.

Some users have expressed their wish to retrieve transmission data from EXFOR in a convenient way. Therefore we propose to introduce a new code TRN for REACTION SF8, to be used instead of RAW in case of transmission.

Dictionary additions:

Dictionary 34

`TRN` transmission

Dictionary 36

`,SIG,,TRN` Transmission (with units NO-DIM)
(to be used with reaction SF3 = TOT)

TRANS ID	Preliminary Posted	Final Posted	# Data points	# Entries	# Subentries	Change for period # Data points	# Subentries
NNDC		Neutron					
1305	20020408	20020515	2,991	13	59		
1306	20020607	20020711	13,845	20	84		
1307	20020823	20020924	24,070	32	152		
1308	20021018	20021119	79,772	21	238		
1309	20021202	20030106	30,276	26	108		
1310	20021211	20030203	88,390	28	111		
1311	20030103	20030203	19,336	24	241		
1312	20030207	20030305	19,385	25	155		
1313	20030304	20030411	58,363	36	303		
1314	20030411	20030530	51,230	28	181		
1315	20030530						
For year			333,437	212	1,392	152,227	318
NEADB		Neutron - compiled at CJD					
2155	20021007	20021115	51,589	21	298		
2156	20021217	20030220	24,541	42	278		
2157	20011120	20030220	66,477	32	158		
2158	20030110	20030331	62,370	9	54		
2159	20030319	20030507	40,860	41	401		
2160	20030403						
For year			245,837	145	1,189	175,962	881
NDS		Neutron					
3111	20021018	20021204	2,728	12	111		
3112	20030130	20030318	2,028	18	81		
3113	20030321	20030507	2,576	13	88		
For year			7,332	43	280	1,126	59
CJD		Neutron					
4126	20020427	20020926	8,031	32	183		
4127	20020815	20020925	11,330	60	481		
4128	20021107	20030328	9,889	29	308		
4129	20030127	20030417	11,125	23	117		
For year			40,375	144	1,089	7,772	143
CaJAD		Charged particle					
A053	20020628	20020917	7,314	18	239		
A054	20021014	20030110	3,631	22	94		
A055	20030110	20030228	7,914	20	162		
For year			18,859	60	495	7,427	302
NNDC		Charged Particle					
C056	20020617	20020722	15,425	94	71		
C057	20020827	20021018	7,919	19	87		
C058	20030225	20030328	4,924	10	73		
For year			28,268	123	231	19,444	175

JCPRG		Charged particle					
E020	20020816	20021016	10,039	30	360		
E021	20021203	20030306	18,563	28	413		
E022	20030419	20030609	47,630	20	777		
For year			76,232	78	1,550	38,662	1,173
RNDC		Charged particle					
F013	20020925	20030304	16,983	25	126	14,092	99
F014	20030530						
For year							
NEADB		Compiled at CaJAD					
O011	20021025	20021025	50,939	86	1,316		
O012	20030414						
For year			50,939	86	1,316	24,190	1075
JCPDG		Charged particle - update of Riken data					
R013	20021111	20021112	54	3	9		
For year			54	3	9	-63	-6
NNDC		Charged particle - originally compiled at another center					
T011	20020726	20020827	24,091	16	157		
T012	20030127	20030225	3,539	13	92		
For year			27,630	29	249	22,709	214
NDS		Photon					
G011	20030226	20030327	20	1	3		
For year						-2	-2
CDFE		Photons					
M031	20020425	20020926	7,573	22	215		
M032	20030129	20030303	15,136	14	258		
M033	20030515						
For year			22,709	36	473	7,001	**204
Grand total						470,547	4431

** Sum of L and M.

Stand-alone retrieval system on CD-ROM: EXFOR+CINDA/Java2

V.Zerkin, IAEA-NDS

This product is replacement and enhancement of EXFOR/Access CD-ROM retrieval system, which was based on Microsoft Access-97 with Visual Basic. The new system is based of platform independent programming technology (Java, JDBC), much easier for future updates, offers many advantages for users.

Main applied features of EXFOR+CINDA/Java2

1. EXFOR and CINDA databases are integrated: user can get EXFOR data directly from CINDA-Selection form, CINDA has a full authors list and title from EXFOR where it is possible
2. User-friendly interface based on Java2-Swing forms: input of retrieval criteria are combined with on-line help system using dictionaries
3. Powerful and fast search (based on SQL) with variety of criteria (see Fig.2, 3): any combinations of criteria are available, including multiple parameters, ranges of values and wildcards
4. Results of the search can be sorted by different ways
5. Summary information and bibliography are provided with codes explanation
6. Plots of selected data are generated on request and appear as a static picture; interactive plotting is provided by ZVView package plugged-in to the system
7. Description of the program and instructions for usage are available on-line

Main system's features of EXFOR+CINDA/Java2

1. Works on any platform having Java/JDBC
2. Allows to work with several local and remote databases at the same time
3. Does not need any installation or system configuration: all programs, Java runtime environment, databases, drivers are located on CD-ROM and prepared to run there (for Windows and Linux only)
4. Long time requests of the Help-data are executed asynchronously
5. Installation program allows to optimize speed and usage of disk memory

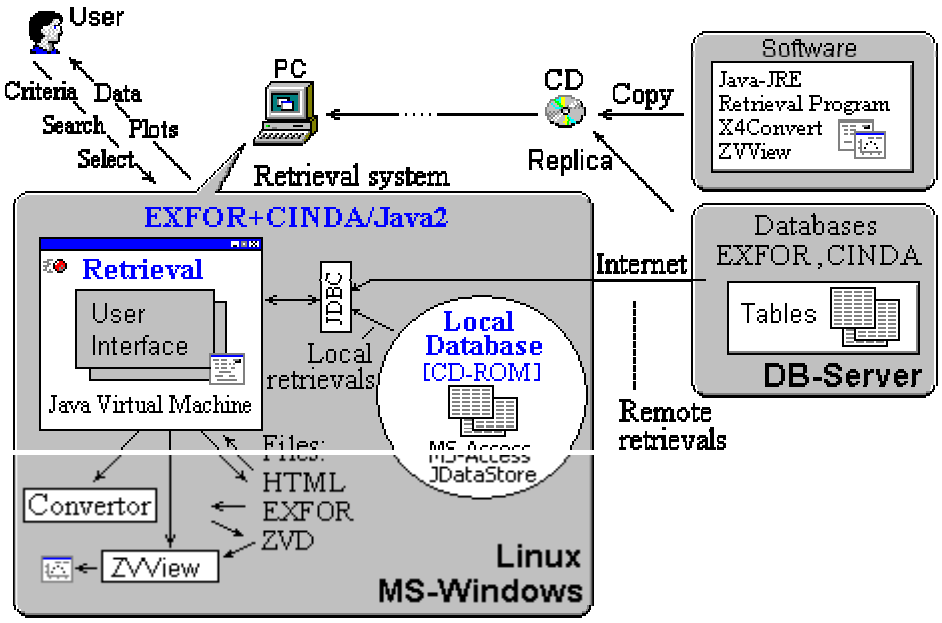


Fig.1. EXFOR+CINDA/Java2: creation and functioning

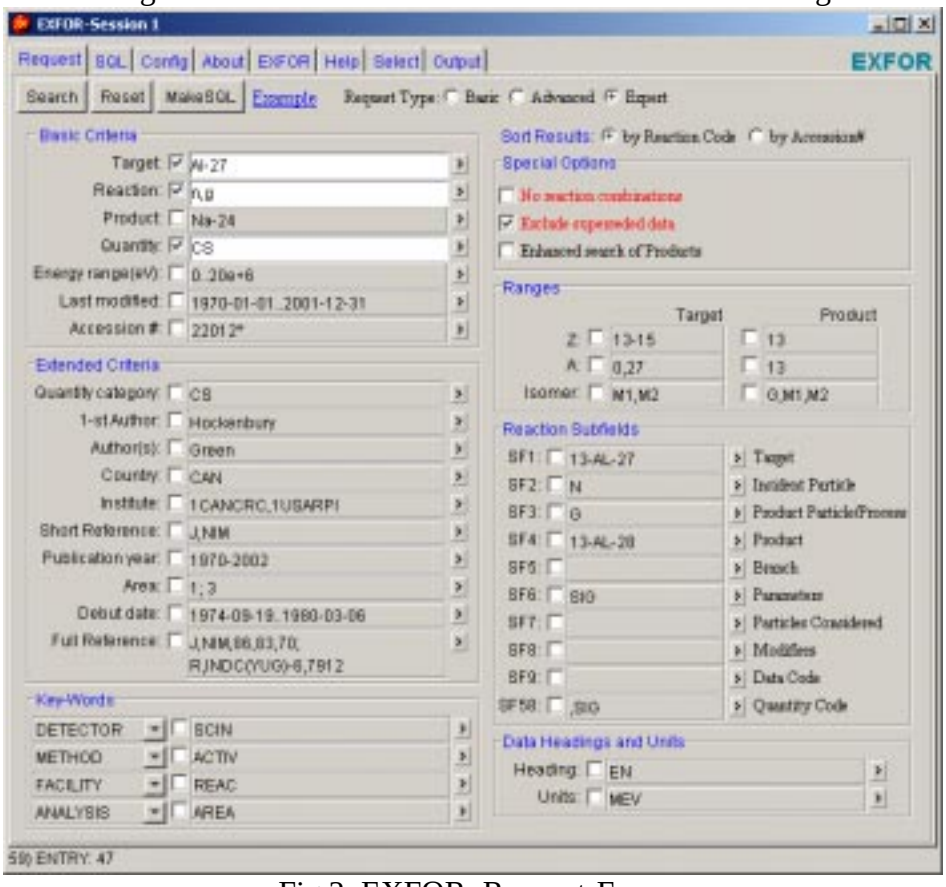


Fig.2. EXFOR: Request-Form

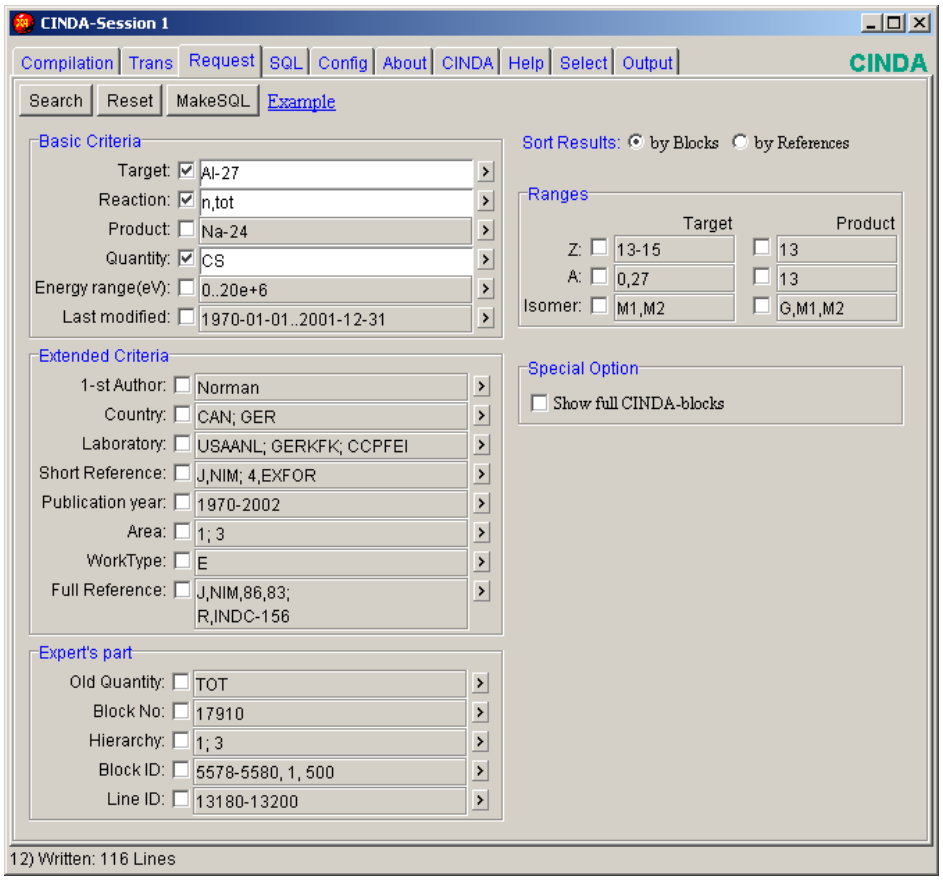


Fig.3. CINDA: Request-Form

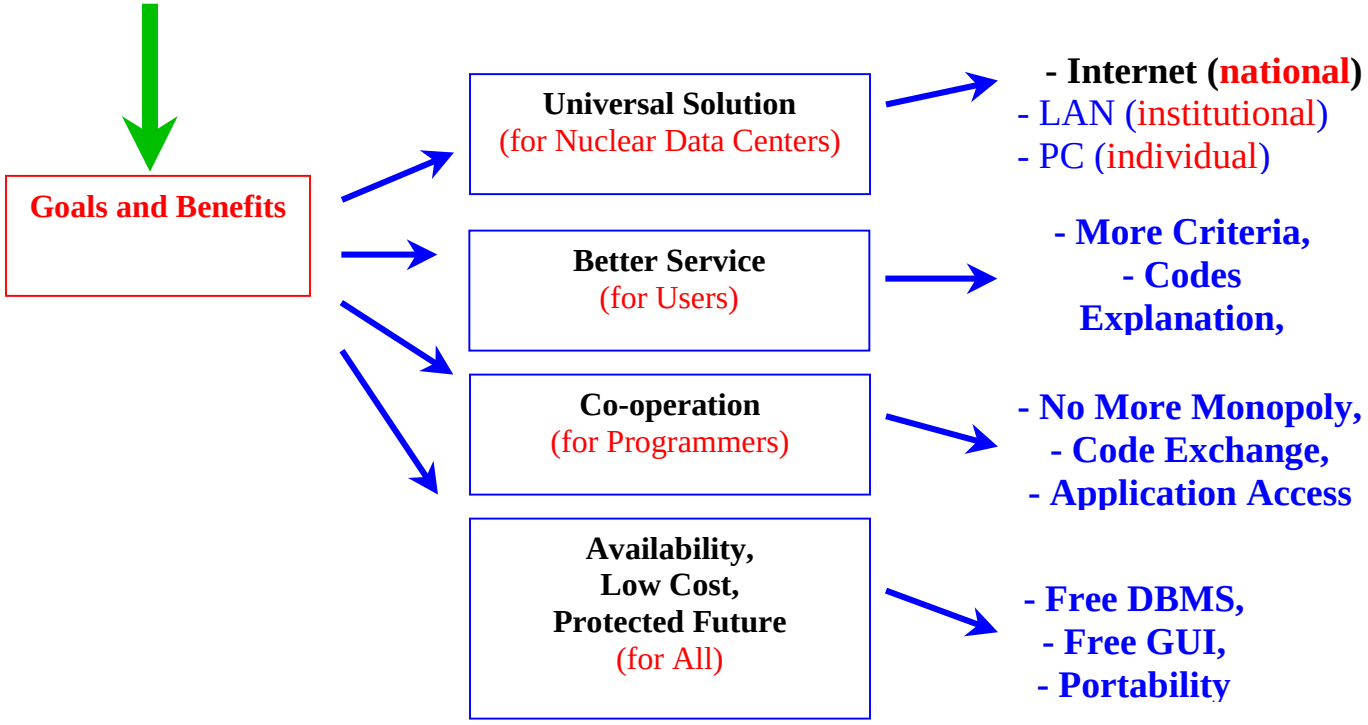
Project "Nuclear Reaction Database Migration" in NDS-IAEA.

V.Zerkin, IAEA-NDS

Nuclear Reaction Databases:	EXFOR, CINDA, ENDF
Nuclear Data Services:	data retrievals (Web, CD) and DB-maintenance
*Migration to New Technology:	Relational Databases + Platform Independent Programs
Basic Elements of Technology:	- Languages: Java, SQL, C; - Operating Systems: Linux, Windows, *(!)VMS - Databases: MS-Access, MySQL, SyBase, others

Result of the "Migration" Project:

New Generation of Nuclear Databases and Services



*Remark: in NDS approach, the term "Migration" changed its original meaning to the development of a new nuclear database software system, which can be used on many platforms including VMS.

Features	**Databases and services**	
	Old	**New**
Operating System	VAX (Alpha)-VMS	Linux, Windows, others
Database	DBMS: technology of 1960-80s	any Relational: MySQL, Access, etc.
Cost	$ 30,000-100,000 (expensive)	$100-5,000 (or free)
Languages	Fortran-77: old-style	Java, SQL, C, *Pascal*, *Basic*, *Fortran*, *etc.*
Further development	only in major Centres	in any place
Access to data	Web, Telnet	Web, Telnet, TCP/IP, on CD-ROM
PC-Applications (CD)	difficult, limited	easier, no limitations
Application development	only on VMS	on any platform (OS, DBMS, language)
Developments	Done in NNDC (BNL, USA), 1985-2000, ~4 programmers	Co-operation established in 2000: - NNDC (BNL,USA): Nuclear Structure - ENSDF: Evaluated Data - NSR: Bibliography - NDS (IAEA): Nuclear Reactions - EXFOR: Experimental Data - CINDA: Bibliography - ENDF: Evaluated Data Schedule: ready for use - 2004

Important dates:

1999: - universal EXFOR reading program
- EXFOR/Access Retrieval System (CD-ROM)

2000: - Testing of programming technologies and DBMS's
- Programming technology selected: Java+JDBC on Windows, Linux with Access, MySQL, SyBase
- Collaboration NDS-NNDC was established for Nuclear Reaction Databases EXFOR, CINDA, ENDF with labor sharing:
  - *Common: db-schema, user's and system requirements, installation in NNDC*
  - *NDS (V.Zerkin) - software design, programming, installation*
  - *NNDC (V.McLane) - criticism, tests, usage in NNDC environment*
- Loading EXFOR via Java to Access, MySQL, Sybase

2001: - Approach selected for Web retrieval: Java-Servlets
- EXFOR Web-retrieval system is done, installed in NDS and NNDC

2002: - EXFOR and Dictionaries: loading via XML
- CINDA loading, Web retrieval started
- EXFOR maintenance started on Linux/SyBase, Manual started
- EXFOR+CINDA/Java2 Standalone Retrieval System for CD-ROM

2003: - EXFOR management: regular updates begun in NNDC in parallel with VMS
- CINDA-Web retrieval finished, installed in NDS and NNDC
- CINDA-compilation/updating: started
- Workshop in Vienna, 1-5 December 2003:

"Relational Databases for Nuclear Data Development, Dissemination and Processing: EXFOR-CINDA Implementation, Maintenance and Compilation"

Completion (June, 2003)

DB	*Schema*	*Load*	*Update*	*Compilation*	*Web*	*CD-ROM*	*Utilities*
EXFOR	Done	Done	Done	-	Done	Done	80%
CINDA	Done	Done	50%	20%	70%	Done	20%
Dictionary	Done	Done	Done	-	-	33%	0%
ENDF	33%	0%	0%	-	0%	0%	+

Size of programs (February, 2003): 36,300 lines (Java: 26,900; C: 9,400)

Appendix: Progress Report received after the meeting

Ukrainian Nuclear Data Centre

Status report to the the 2003 Technical
NRDC Meeting in Vienna

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

Introduction

UKRNDC is subdivision within the Department of Neutron Physics, Institute for Nuclear Research of the National Academy of Sciences Ukraine.

Compilation

We continue collection and compilation of experimental data published in Ukrainian printed sources. After compilation of numerical data and related information using EXFOR format they are sent to NDS IAEA to be included to EXFOR library. After last meeting in 2002 we prepared and revised four entries 32202, 32207, 32208 and 41012.

Collaboration

We continue our collaboration with the Laboratory of Engineering and Technology (LET) of the Chornobyl Center for Nuclear Safety, Radioactive Waste and Radioecology (CCNSRWR), Slavutych in scientific support of Slavutych Nuclear Data Bank and its users. In frame of this activity a series of lectures *("ENDF/B libraries", " Using the NJOY code system for preparation of specialized nuclear data libraries")* was red for this laboratory staff.

- 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* "(68 hours) was lectured in 2002-2003 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 2002-2003 the data for users requests were prepared and adapted (from ENDF, ENSDF and EXFOR libraries) for our institute researchers and for ones from other institutes

(Kyiv National University, Institute of Physics, Kyiv, Kharkiv Institute of Physics and Technology,).

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

Calculation

- Special library for modeling of neutron filters my means the code FILTER_L was extended using ENDF/B-6 (release 8), JENDL-3.3.
- Analysis of self-shielding factors for Cr-52, using all new release of 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-52 samples and will be used in further investigations.
- We (together with LET) started a preparation the first order of nuclear constant library for transport calculation for NPP with RBMK-1000 reactor type.

For all calculations of the pointwise and group cross sections we used PREPRO2002 and/or NJOY99 package codes.

Experimental Neutron Data Measurements

- The total neutron cross section and its self-shielding values for Cr-52 was measured at Kyiv Research Reactor using Neutron Filter Technique. The accuracy of measured cross sections was better than 2%, 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 at International Conference (ISINN-11, Dubna, Russia, May 2003 and MPNP-5, Samarkand, Uzbekistan, August 2003).

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.

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.
- We plan to intensify our work in EXFOR compilation also with charge particles and CINDA references by recruiting the young graduates from Kyiv University.