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Report on the IAEA Consultants' Meeting on the Co-ordination of Nuclear Reaction Data Centres (Technical Aspects)

IAEA Headquarters, Vienna, Austria

28 – 30 May 2001

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

July 2001

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

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Abstract

This report summarizes the results of the IAEA Consultants' Meeting on the Co-ordination of Nuclear Reaction Data Centres (Technical Aspects), hold at the IAEA Headquarters, Vienna, Austria, 28 to 30 May 2001. The meeting was attended by 16 participants from 10 co-operating data centres from six Member States and two International Organizations. The report contains a meeting summary, the conclusions and actions, progress and status reports of the participating data centres and working papers considered at the meeting.

CONTENTS

THE NETWORK OF NUCLEAR REACTION DATA CENTRES

National, regional and specialized nuclear reaction data centres, coordinated by the International Atomic Energy Agency, cooperate in the compilation, exchange and dissemination of nuclear reaction data, in order to meet the requirements of nuclear data users in all countries. A brief summary of the data centres network is given below.

The nuclear reaction data centres:

NNDC	-	US National Nuclear Data Center, Brookhaven, USA
NEA-DB	-	OECD/NEA Nuclear Data Bank, Issy-les-Moulineaux, France
NDS	-	IAEA Nuclear Data Section
CJD	-	Centr Jadernykh Dannykh (= Nuclear Data Centre), Obninsk, Russia
CAJaD	-	Russian Nuclear Structure and Reaction Data Centre, Moscow, Russia
CDFE	-	Centr Dannykh Fotojadernykh Eksperimentov (= Centre for Photonuclear Experiments Data), Moscow, Russia
CNDC	-	China Nuclear Data Center, Beijing, China
JAERI	-	Nuclear Data Center of the Japan Atomic Energy Research Institute, Tokai-Mura, Japan
JCPRG	-	Japan Charged-Particle Nuclear Reaction Data Group, Hokkaido University, Sapporo, Japan
ATOMKI	-	ATOMKI Charged-Particle Nuclear Reaction Data Group, Debrecen, Hungary
UKRNDC	-	Ukrainian Nuclear Data Center, Institute for Nuclear Research, Kyiv, Ukraine
CNPD	-	Center of Nuclear Physics Data, Russian Federal Nuclear Center, RFNC-VNIIEF, Sarov, Russia
KAERI/NDEL	-	Nuclear Data Evaluation Laboratory, Korea Atomic Energy Research Institute, Yusong, Taejon, Republic of Korea
(KACHAPAG)	-	Karlsruhe Charged Particle Group, Karlsruhe, Germany. (Discontinued in 1982, its responsibilities were taken over by CAJaD)
(RIKEN)	-	Nuclear Data Group, RIKEN Institute of Physical and Chemical Research, Wako-Shi, Japan. (Discontinued in 2000)

1. Neutron Nuclear Data

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

1.b Experimental data exchanged in EXFOR format:
Input prepared by NNDC, NEA-DB, NDS, CJD, CNDC, UKRNDC
CD-ROM (with neutron, charged particle and photonuclear data) published by NDS

Online services by NNDC, NEA-DB, NDS and CJD

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

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

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

Online services by NNDC, NEA-DB and NDS

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

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

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

2.a Bibliography NSR published by NNDC
Online services by NNDC and NDS

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

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

3. Photonuclear Data

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

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

3.c Bibiliography published by CDFE and JAERI

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

PAST NRDC MEETINGS

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

Consultants' Meeting on the Co-ordination of Nuclear Reaction Data Centres (Technical Aspects), Vienna, 28-30 May 2001

AGENDA

1. General
1.1 Opening, Adoption of the agenda, announcements
1.2 Brief status reports of the centers
1.3 Review of General Actions from the 2000 NRDC Meeting (A1-A14) ***WP2001-1***

2. CINDA and CINDA-2001
2.1 Review of Actions (A15-A17; see also Conclusion C3) ***WP2001-1***
2.2 CINDA-2001: status, manual, future development
2.21 Status
2.22 Manual (***WP2001-3, WP2001-23)***
2.23 Details needed for trial compilation in new format:
Coding of quantities ***(WP2001-24)*** / Treatment of dual institutes
2.3 Literature coverage and completeness control by centres ***WP2001-28***
2.4 Backlog in CINDA compilation at the centres
2.5 CINDA compilation of Chinese literature and maintenance of CINDA file for Chinese labs (CNDC / NDS)
2.6 CINDA products (book, CD-ROM) ***WP2001-27***

3. EXFOR/CINDA Dictionary System
3.1 Review of Actions (A18-A23; see also Conclusions C4-C5) ***WP2001-1***
3.2 New developments connected to change to relational databases
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3.4 Reform of Dictionary 27 (nuclides) - (to be decided at 2002 NRDC meeting)
3.5 Coding of Chemical Compounds in EXFOR and CINDA: Clarifications ***WP2001-10***
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4.6 Pilot project for archiving experimental data published in Phys.Rev.C
4.7 Ion Beam Analysis data
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5. EXFOR coding rules and dictionary changes: Pending questions

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5.2 "Zero" data errors in TRANS files: to be declared illegal explicitly?
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5.4 Several proposals of polarization quantities, to be consolidated ***WP2001-6***
5.5 Angular and other correlations: clarification and dictionary clean-up needed ***WP2001-7***
5.6 Proposed quantity PAR/M-,DA,G ***WP2001-8***
5.7 Clarifications on some proposed report and journal codes ***WP2001-9***
5.8 Coding of isobaric analog states ***WP2001-11***
5.9 Proposed additions to Dictionary 30 (Process) and 27 (Pions in Nuclide dict.) ***WP2001-12***
5.10 New heading PART-OUT for dictionary 24 ***WP2001-13***
5.11 Units N/PART/SR etc. for dictionary 25 ***WP2001-14***
5.12 Coding of differential neutron multiplicity distributions ***WP2001-15***
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6. Software development on relational database platforms

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6.2 Project of new implementation of a "Nuclear Reaction Database" (CINDA, EXFOR, ENDF, Dictionaries): Status of development, schema, intentions *(McLane)*
6.3 EXFOR as a multi-platform relational database *(Zerkin)* ***WP2001-25***
6.4 CJD activities

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7.1 V. Zerkin (EXFOR)
7.2 M. Kellett (JANICE, High Priority Request List)
7.3 S. Babykina (CPND database)

8. Miscellaneous items

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8.2 Compilation and evaluation of alpha-induced nuclear reaction cross sections for astrophysics ***(WP2001-26)***
8.3 High Priority Request List
8.4 Common paper for Tsukuba conference

9. Closing items

9.1 Review of Actions and Conclusions of this meeting
9.2 Date of 2002 full (AGM) meeting

International Atomic Energy Agency

Consultant's Meeting on
"Coordination of the Nuclear Reaction Data Centres (Technical Aspects)"

28 – 30 May 2001, IAEA Headquarters, Vienna, Austria

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MEETING SUMMARY

Introduction

The IAEA Consultants' Meeting on the Co-ordination of Nuclear Reaction Data Centres was held at the IAEA Headquarters, Vienna, Austria, from 28 to 30 May 2001. Sixteen participants of ten co-operating data centres from China, Hungary, Japan, the Republic of Korea, Russian Federation, USA, NEA and IAEA attended the meeting.

The meeting has considered the technical aspects of the exchange of the bibliographic and experimental data in the conditions when work on the migration to new software platforms has started in some co-operating data centres. The co-ordination of the work on the maintaining, updating and providing full-scale and user-friendly access to the common nuclear databases was one of the tasks of the meeting.

Brief Minutes

The meeting was opened by O. Schwerer, Scientific Secretary of the Meeting. D.W. Muir, Nuclear Data Section Head, welcomed the participants. He stressed the importance of such co-operation between the centres that the whole NRDC network could be viewed from outside as one team. He introduced the last changes in the NDS staff and in the INDC memberships.

M. Kellett was elected as the meeting chairman.

The Agenda was discussed and adopted with minor changes (see p. 13).

Brief status reports of the centers were presented (see pp. 27 to 82).

Actions and Conclusions of the previous NRDC meeting (see WP2001-1) on bibliographic database CINDA were reviewed. New CINDA2001 exchange format (see WP2001-23) was approved with and addition of new hierarchy allowing to compile multiple authors. Five new dictionaries to provide the conversion to the CINDA2001 format are introduced. The A4 page format layout and schedule for CINDA book and CD-ROM publication was fixed. The measures to create the working environment for CINDA compilation in the CJD and CNDC are outlined (see Conclusions C1 – C4 and Actions A6 – A9). A new layout of the CINDA book based on the new CINDA2001 exchange format with the inclusion of non-neutron data will be prepared once the new CINDA/EXFOR dictionaries will be available. The proposal to use the EXFOR reaction string (or truncated part of it) for the EXFOR lines in the CINDA book was declined.

Common EXFOR/CINDA dictionary system was discussed. All actions of last year's meeting were implemented. New rules for coding of the conferences in the EXFOR, new and old CINDA format, and rules for coding of the oxide compounds in the reaction string were approved (see Conclusions C5 – C9 and Actions A10 – A13).

General matters of the EXFOR database were discussed. At present there is no tool which can be used for checking of the completeness of the EXFOR relative to the references on the experimental works compiled in CINDA. This can be done when joint CINDA/EXFOR relational database will be created. The completeness of EXFOR will be checked for data needed for implementation of some CRPs: on Medical Radiosotopes Production (see Actions A15 and A16), on Light Elements Standard Cross Sections, on Data for Th-U Fuel Cycle, on Data for PGAA and IRDF-2001 project (see WP2001-18). All centers should give higher priority to the compilation of new works. The production of system-independent EXFOR checking codes was discussed (see Actions A28 and A29). The functionality of the CHEX code written by V. McLane for DEC/Open VMS environment will be tested on different platforms for use by the network centers as a standard checking code. The problem of merging of the EXFOR master files kept in different centers in one Network master file was discussed. At present, the intercomparison at a few levels was done between the NNDC and NDS files. The inclusion in the intercomparison of the master files of other centers is desirable. The new EXFOR System and LEXFOR Manuals were submitted by V. McLane and, after a round of checking by the centres, will be made available to the users in September 2001.

Technical matters of the EXFOR coding rules and dictionary changes were discussed in details (see proposals in the WP2001-4 – 9, WP2001-11 – 16, WP2001-22). This concerns the most important revisions and cases when the consensus between the network centres was not reached via communication. The result of the discussions is summarized in the conclusions and further actions (see Conclusions C12 to C27 and Actions A34 to A39).

Common problems of the software development for data management and data retrieval in the diverse network multiplatform environment were discussed. The report of the Workshop on Relational Database for Nuclear Data held at the NNDC in September 2000 was presented. Since then there was a big progress and a few full-scale databases (EXFOR, NSR) were tested in the multiplatform hard- and software environment. For this, SQL and Java were used as main programming languages. The report on EXFOR as a multi-platform relational database, which demonstrates this development, was presented by V. Zerkin (see WP2001-25). Some studies were done at the CDFE (ENSDF, EXFOR) and CJD (CINDA). The schema of the joint nuclear reaction database, which will include CINDA, EXFOR, ENDF and Dictionaries and will use the NSR as an additional source of the bibliographic information, was presented by V. McLane. This schema will be used for migration of the reaction databases at the multi-platform SQL/Java environment. It was recommended that the co-ordination of the software development should be given the highest priority. The frameworks of special workshops and regular NRDC network meetings should be used for this purpose.

The demonstration session included a few presentations. The status of the EXFOR development for the multi-platform environment, including computer systems with different hard- and soft-ware and different type of accesses to the database (local on HD or CD-ROM, local network, global Internet) was shown by V. Zerkin. M. Kellett presented JANIS, a computer information system for display and visualisation of nuclear data from ENDF and EXFOR databases, and new Web access to the database of the High Priority (measurements) Request List. Development of the Internet access to the charged particle induced reactions database at the CDFE Web-site was shown by S. Babykina.

Finally, miscellaneous additional items were discussed. The revised version (April 2001) of the ENDF format manual which accounts for all latest changes in the format and misprints found in the last revision is available now from NNDC and NDS Web sites. The project on compilation and evaluation of alpha-induced nuclear reaction cross sections for astrophysics is in good progress (see WP2001-26). The composition of the co-authors for preparation of the invited paper on the nuclear reaction data services for the upcoming Nuclear Data Conference in Tsukuba, Japan, was discussed.

The next meeting on the Co-ordination of the Nuclear Reaction Data Centres will be held at the OECD/NEA Data Bank, Paris, as four days AGM, from 28 May to 31 May 2002.

Acknowledgement

The editor thanks V.G. Pronyaev and M. Lammer for their help in preparing this report.

CONCLUSIONS

CINDA and CINDA2001

C1: The CINDA2001 format as proposed in WP2001-23 is accepted with the addition of hierarchy 7 for multiple authors. The CINDA2001 quantity codes given in a new Dictionary 45 (see WP2001-24, last page) will be reviewed by the NEA Data Bank and be finalized by a working group consisting of McLane, Kellett, Lammer, Maev.
There will be the following new dictionaries:
44 Conversion of EXFOR quantities (Dict.36) to new CINDA quantities (Dict.45)
45 (New) CINDA quantities
46 Conversion of old CINDA quantities (Dict.42) to new CINDA quantities (Dict.45)
47 Reader codes
48 Spectra codes

C2: The 2001 CINDA book will be issued as **Supplement** to CINDA2000. The format will be as shown as **Layout 4** in WP2001-27.

C3: The deadline for receiving CINDA entries to be included in the book is 1 November (for expected publication in January 2002).

C4: NEA will continue to produce the CD version of CINDA which will be distributed together with the book to all recipients.

EXFOR/CINDA Dictionary System

(see also Conclusion C1 above on new dictionaries for CINDA2001)

C5: Dictionary transmissions should be four times a year.

C6: NEA-DB still needs the dictionaries in "TRANS" format (as described in the EXFOR Systems Manual, Chapter 6).

C7: Starting with the year 2000, conferences will be coded with a 4 digit year. The total length will therefore be up to 10 characters. CINDA will use, in all cases, the first 8 characters of the EXFOR code until transmission in the new CINDA 2001 format begins.

C8: The proposal to add the OXI code to EXFOR dictionary 9 (Compounds) and DANIEL dictionary 27 (Nuclides and Compounds) as detailed in Memo 4C-4/113 (= WP 2001-10) is accepted.

C9: The final implementation of "wild cards" in Dictionary 36 is deferred until all centers can use them. (Note: The use of the wild cards '*' (for all particles) and '*F' (for fission fragments) in SF7 (particle considered) of dictionary 36 was agreed in principle at the 1997 NRDC meeting.) *See also Action **A12.***

General EXFOR matters

C10: Reactions with many reaction products should be coded in the variable product nucleus formalism (ELEM/MASS) allowing coding in one subentry rather than individual subentries for each product.

C11: NNDC will be responsible for co-ordinating the compilation of all charged particle data produced at facilities in USA and Canada.

EXFOR coding rules and dictionary changes

C12: The proceedings of the 2000 Tsukuba conference will be published as a Supplement to the Journal Nucl.Sci.Technol. and should be coded in CINDA under both, the conference code and the journal code.

C13: RCL is to be deleted from the "Particle Considered" dictionary (EXFOR Dict.33).

C14: A new heading KT-K for kT in temperature units (e.g. Kelvin) as proposed in WP 2001-4(Rev) is adopted. The old heading KT is kept for kT in energy units.

C15: The reintroduction of the heading WVE-LN, to be used when wavelength is given in place of EN, is adopted as proposed in WP 2001-4(Rev).

C16: Zero errors are not allowed in the COMMON or DATA table. If the value of an error is unknown, the respective data field must remain blank.

C17: The quantity NN,POL/DA/DE,,K as proposed in CP-E/002 is approved. *See Action A34 on the other polarization quantities.*

C18: All angular correlations are coded as DA/CRL, and the existing codes with FY/CRL and KE/CRL remain. The quantities proposed in Memo 4C-4/107 (WP 2001-7) are accepted with COR replaced by DA/CRL. *See also Action A35.*

C19: The case outlined in WP 2001-8 should be coded PR/PAR,DA,G instead of PAR/M-,DA,G.

C20: The new IAEA report codes proposed in WP 2001-9 are not adopted, the proposed codes NEACRP-L- for the report NEANDC(E)-NEACRP-L, and PHCL for the journal Physicalia were adopted. The code HIP has to be clarified *(Action A36)*.

C21: For the coding of isobaric analog states the proposal 1 in Memo CP-C/281, which is equivalent to the proposal in Memo CP-C/264, is adopted (see WP 2001-11).

C22: As a temporary solution, the coding of pions as PIN+PIP+X in REACTION SF3 is permitted (see memo CP-A/107, WP2001-12). However, in addition the coding of PIN/PIP in SF7 is required.
The addition of pions to dictionary 27 is, at this time, not accepted *(see, however, Action A37)*.

C23: The code PI for unspecified pions will be added to EXFOR Dictionary 29.

C24: A new quantity, ds/dN (cross section differential by number of outgoing neutrons) (WP 2001-15) will be coded as SIG/DN. The independent variable is to be coded under the heading N-OUT.

C25: The new units for product yields proposed in WP 2001-14(Rev) are agreed. In addition the unit MB/PRD (millibarns per product particle) is introduced for the quantity proposed in WP 2001-15 *(Conclusion C24)*.

C26: The new headings LVL-INI and LVL-FIN are introduced for those cases where the initial and final levels are given as additional information but not as independent variables (see WP 2001-16). (As independent variables, the existing headings E-LVL-INI, E-LVL-FIN are to be used.)

C27: The quantity PRE,AP/DA,FF as proposed in memo CP-E/001 (WP2001-22) is adopted.

Software development on relational database platforms

C28: It would be useful to have frequent meetings among the people involved in the collaboration on the development of the nuclear reaction database and the associated programs. One meeting could be arranged as part or contiguous to the NRDC meeting. For effective co-operation, a minimum of one additional working group meeting annually is advisable. The means of arranging such a meeting should be investigated.

RECOMMENDATION

The NRDC would like to stress the significance of the forthcoming Nuclear Data Conference in Tsukuba to all members and their organisations. An invited paper, authored by representatives of the four core centers will be presented at this conference. The talk will explore the current and future services provided by the Nuclear Reaction Data Centers. It is highly desirable that representatives from each of these core centers be present at the conference.

The NRDC also plan to have a stand at the conference for the demonstration of online services and products available on CD-ROM, particularly EXFOR/CINDA/data plotting. Appropriate staff are needed to allow fruitful use to be made of this opportunity to discuss its services with nuclear data users, including experimentalists and evaluators.

ACTIONS

General

A1: (All) To inform the NDS of any documents in the IAEA-NDS series which need to be made available online in PDF format.

A2: (Lammer) **(old A5)** To prepare the IAEA-NDS- document for the PC version (by Denschlag et al) of a program package by A.C.Wahl for calculation of fission yield distributions.

A3: (All) **(old A11)** To send contributions on frequently askeds questions regarding nuclear data issues to the NEA-DB who will then include these as a link from the NRDC web page.

A4: (NEA-DB) **(old A12)** To provide a link from the NRDC page to the Network document

A5: All **(old A13)** To provide a link from their home page to the NRDC page

CINDA and CINDA2001

A6: NEA-DB To review the CINDA2001 quantity codes given in the new dictionary 45 *(see also Conclusion C1).*

A7: all CINDA centres: To complete table of WP2001-28 (Journals covered for CINDA) and send it to Meinhart Lammer by 30 June 2001

A8: NDS To create working environment for area 4 CINDA database located at NDS

A9: CNDC To compile Chinese experimental works (journals and conference proceedings) for CINDA and send to NDS in Reader format.

EXFOR/CINDA Dictionary System

A10: All To propose revised format of Dictionary 27 (nuclides) well before the next meeting. (The goal of the reform is to reduce the frequency of updates of this dictionary while some automatic checking of the nuclides should remain possible).

A11: McLane To update the EXFOR manual and LEXFOR sections dealing with chemical compounds with the proposed new oxide codes (WP2001-10).

A12: All To ensure that they can use the "wild cards" in Dictionary 36 *(see Conclusion C9).*

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

General EXFOR matters

A14: All To check/retransmit all entries included in the list of pending retransmissions by McLane distributed at the 2001 NRDC meeting.

A15: Dunaeva **(Old A29)** To make a benchmark test of Chukreev's code TEST-EXF vs. CHEX

A16: Tarkanyi **(Old A30)** To distribute updated list of references missing in EXFOR obtained in the framework of the CRP on Medical Radioisotope Production

A17: CPND centers **(Old A31)** To go through this list and communicate to Tarkanyi which works from their area of responsibility they will compile. Works not covered this way will then be free to be compiled by others.

A18: NEA-DB,NDS **(Old A32)** To convert remaining 60000 and 70000 series entries to proper EXFOR entries of area 2 and 3.

A19: All To delete all entries of the 80000 series from their local EXFOR data base.

A20: All **(Old A33)** In view of the poor statistics for EXFOR compilation of recent works, all centers should give higher priority to new works.

A21: McLane **(Old A34)** Send a memorandum of understanding about the compilation responsibilities resulting from the agreement with Phys.Rev.C to all participating centers.

A22: Dunaeva, Chukreev **(Old A35)** To try to establish an agreement with the publisher of Yadernaya Fizika similar to that between NNDC and Phys. Rev C.

A23: Maev To check with Varlamov on the status of the possible inclusion of Blokhin's compilation of emission spectra of photonuclear reactions in EXFOR (follow-up to old A36).

A24: NDS To make available the Word files of the EXFOR Systems Manual and the LEXFOR Manual on their FTP site in an appropriate subdirectory.

A25: All To send any comments on the above manuals to McLane before the 30th June 2001.

A26:	**McLane**	To update the manuals accordingly and send to NDS for inclusion on their FTP site prior to 31st August 2001.
A27:	**All interested**	To contact Liam Costello in order to obtain access to the NDS version of the CHEX code.
A28:	**Zerkin**	To investigate providing a version of the DANIEL library for use with the system-independent CHEX code, and to provide a version of the code library which interfaces with the new dictionaries. The subroutine names and calling parameters should remain unchanged.
A29	**McLane**	To provide a platform-independent version of the CHEX code using the system-independent library of dictionary subroutines resulting from Action A28.
A30	**Zerkin**	To rerun the list of multiple appearances of main references in EXFOR entries (WP 2001-20) taking into account superseded entries and deleted entries with subentry 1 remaining in the file.
A31	**All**	To correct those entries found to have errors which are given in WP 2001-19 and the revised version of WP 2001-20.
A32	**McLane**	To provide a list of data missing in EXFOR which is needed for the evaluation of alpha-alpha nuclei (that is nuclei with Z divisible by 2, A divisible by 4, e.g. 20Ne, 24Mg, 28Si, 32S) for astrophysical applications.
A33	**CPND centers**	To respond to this list and communicate to McLane which works from their area of responsibility they will compile.

EXFOR coding rules and dictionary changes

A34:	**McLane**	To clarify the questions raised in WP2001-6 on proposed Polarization quantities and update the proposed LEXFOR entry on Polarization.
A35:	**McLane**	To look into all types of 'correlations' and provide a more detailed LEXFOR entry and/or a new proposal.
A36:	**McLane**	To clarify the code HIP proposed in Memo CP-D/278 (WP 2001-9).
A37:	**All**	To consider and propose methods for coding fundamental particles in SF4, in particular negatively charged ones, e.g. negative pions.
A38:	**Babykina**	To send an example for the use of the code PART-OUT as proposed in Memo CP-A/108 (WP 2001-13).
A39:	**McLane**	To update the LEXFOR entry regarding the E-LVL headings, in particular with respect to the new headings LVL-FIN, LVL-INI.

P1

Status Report of the KAERI/NDEL

Jonghwa Chang
(KAERI/NDEL, Taejon, Korea)

1. General

KAERI/NDEL has successfully finished a 4 year national nuclear R&D project, Establishment of Nuclear Data System, and started a new 4 year 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 statistics are as follows:

Item	1997	1998	1999	2000
Hits/year	-	316,096	468,458	908,138
Data retrieved/month	1,592	5,460	7,644	20,138
IP/month	335	581	984	3,689

3. Experimental Facility

Three new facilities have been added for nuclear data measurement capability of Korea.

- E-Linac based TOF; 10.8 m, 60 MeV, 80 mA, 1.5 us, 12 Hz
- Tandem VDG based n-source; 1.7 MV, 300 uA,
- Cyclotron based Vacuum chamber; 50 MeV, (p,p'), etc

4. Future Evaluation Works

Main directions of nuclear data development on next 4 years are the Fission Products data for Transmutation, the data for Thorium cycle, the Photon-production data for in-core detector, and the Intermediate energy data for ADS.

5. Staff and Computers

KAERI/NDEL has 8 regular staffs, 2 post-doctor positions and 1 full time consultant scientist;

- Evaluation: 6,
- Multi-group library generation and benchmark: 3,
- Data services: 1.

Computers;

- A Cluster of Linux PCs for evaluation,
- 4 HP desk side Workstations for the multi-group library ,
- 1 Linux PC for internet web server, 1 Linux PC for backup.

Progress Report of the IAEA Nuclear Data Section

to the Consultants' Meeting
on the Co-ordination of the Nuclear Reaction Data Centres (Technical Aspects)
prepared by V. Pronyaev, O. Schwerer, M. Lammer, V. Zerkin

The Report summarises the work done in the field of nuclear data at the Nuclear Data Section of the IAEA (Web: http://www-nds.iaea.org/, e-mail: services@iaeand.iaea.org) for the period 1 May 2000 – 30 April 2001.

1. General

A new programme of work was prepared for 2002 – 2003. It is based on a constant budget and contains new medium-term and old long-term tasks. High priority is given to the data centres co-ordination and data dissemination activity. If it approved, the budget will allow maintain NDS staff and activity at the present level.

A new NDS Section Head should take up his duties in late summer 2001. The nuclear data centre unit is facing new personnel changes in 2002 – 2003. These will concern the staff dealing with CINDA, evaluated data checking and processing and data processing programs. After Ms. Elisabeth Baumgartner has left the section, Ms. Andrea Scherbaum took over the duties as NDS secretary, and Ms. Rozanna Bojdo the duties of secretary of the Nuclear Data Development Unit.

2.Data compilation

2.1. CINDA

As a contribution to the new format and file 'CINDA-2001', a correspondence list between CINDA quantities and EXFOR reaction codes has been produced. The new format and manual is being studied and comments will be presented at the meeting.

Currently, NDS is scanning over 40 journal titles received regularly in circulation and about 20 titles from on-line indexing services. These include 8 journals originating from area 1 countries, 20 from area 2 and 5 translation series, the rest originating from area 3 countries.

Since the last NRDC meeting, NDS has prepared and transmitted 5 CINDA batches (NDS029 to 033) containing altogether 1765 CINDA entries either in exchange format (area 3 entries) or reader format (for processing by other centers). There is no backlog in entries from

current journal issues, but some backlog in the sublines for translation series and the coverage of INDC reports.

CINDA 2000 was published as cumulative issue including literature published and data files compiled/updated between 1988 and 2000. Recipients on the NDS distribution list for cost-free copies of the CINDA 2000 book were also provided with a copy of the CD-CINDA 2000, produced and supplied by the NEA-DB. NEA-DB and NDS decided to continue the cost free distribution of the book and CD together and dropped the plan to ask recipients for a decision between CD and book. NDS decided not to provide the CD for the sales of the CINDA book in order to maintain the cost-free nature of the CD.

2.2. EXFOR and Dictionaries

After a working version of the EXFOR database updating program CSIMER was obtained and the dictionary maintenance programs DAN2X4 and MAKE_BACK were modified at NDS (to take care of last year's format change of the DANIEL dictionaries), a backlog in processing incoming TRANS files could be worked up and dictionary transmission 9077 was implemented and distributed in spring 2001 (following dictionary transmission 9076 of Summer 2000).

Since last year's meeting, 28 area 3 entries were compiled (including 16 new and 12 revised, the latter ones including some recompilations of incomplete old RIDER file entries). The following TRANS files were distributed: 3106 (final version), 3107 (prelim. + final), 3108 (prelim.). Preliminary TRANS 3109 is expected to be released around the time of the 2001 NRDC meeting. There is a little backlog in area 3 EXFOR compilation for works published in the reports and conference proceedings.

2.3. Evaluated data libraries, files and data processing codes

New evaluated data libraries, files and data processing codes are advertised for distribution to the NDS customers. Some of these products were obtained through the network of co-operating centres, others comprise the results of the IAEA/NDS CRP projects. They include:

- IAEA Photonuclear Library;
- Charged-Particle Cross Section Database for Medical Radioisotope Production;
- FENDL/A in Pictures Presentation;
- PREPRO2000: 2000 ENDF/B Pre-processing Codes;
- Reference Neutron Activation Library (RNAL);
- POINT2000: A temperature Dependent ENDF/B-VI, Release 7 Cross Section Library.

3. Data dissemination

A new general scheme of the NDS document and product distribution will be based on a "wish list" as selected by the customers from the topics of the NDS activity and modes of distribution. The contents of ADLIST, the list of the NDS customer's addresses and the document distribution codes, are now under revision. Therefore, a questionnaire was distributed

by mail and also placed on the NDS Web-site. The users are asked in the questionnaire to inform the NDS about their interest in the receiving our products and about changes in their addresses. The registration of new users is also welcomed. Simultaneously the revision of the addresses in ADLIST is done with the help of the data centres network.

All new products listed in 2.3. can be downloaded by users from the NDS Web site or received up on request on CD-ROMs. An updated version of EXFOR on CD-ROM was released together with a new EXFOR/Access CD-ROM with enhanced search and retrieval capabilities and built-in interactive graphic tools.

Two Nuclear Data Newsletters advertising new NDS products and services were published and distributed as hardcopies and electronically. Twelve INDC NDS and countries' reports were prepared and published as hardcopy and electronically, including the first full translation from Russian to English of the Nuclear Constants (VANT, 2 (1999)) journal. We will try to continue with the practise of full VANT translation. Seven new IAEA-NDS reports with the description of new libraries, files and programs were prepared, and seventeen old reports of this series were converted into PDF format. Altogether, fifty-one of these reports are now available electronically from our Web site. The others, more than hundred reports, are obsolete. Updated EXFOR Basic, EXFOR System and LEXFOR are available electronically. The NRDC network document was updated and the new NSDD network document was published. Three reports of the IAEA-TECDOC series with the results of IAEA/NDS CRPs were prepared and published. They will be made available electronically.

Statistics of accesses and retrievals from NDS and IPEN-mirror Web sites including the geographical distribution of users are shown in Fig. 1. Some growth, mainly due to the opening of the access to new libraries, files, programs and documents, is evident. The absolute and relative number of users from our service area shows a permanent increase. The number of data retrievals through Telnet access to the NDIS system is now settled at the level of 1500 retrievals per year. We distributed to our customers 2467 copies of reports and documents, including 1986 copies upon their requests and 625 CD-ROMs, including 446 CD-ROMs sent to their requests.

4. Software development

The EXFOR CD-ROM relational database under ACCESS-97 was finalized with a further improvement of the functionality, an acceleration of the data search, gathering statistics, simplification of the installation procedure of the plotting utility, CD-ROM Start up utility. An enhanced search facility on reaction products, including fission products specified only in data table, was developed (April 2001 EXFOR/Access version).

The collaboration with other centres in the development of new approaches to the nuclear database management and data dissemination was established.

A unified approach, independent from OS and DBMS platform, was developed. for PC, local network and Internet based services. A test version of simplified but full-scale EXFOR relational database was installed, tested and evaluated on several platforms.

The next version of ZVView, multiplatform interactive graphic package for nuclear data presentation, was prepared and released.

5. Visits and inter-centres co-operation

The following visits, which contributed to the data centre co-operation, have been taken place:

- V. Zerkin (IAEA/NDS) to BNL/NNDC, 11 – 29 September 2000, participation in the Workshop "Relational Databases for Nuclear Data" and common software development of nuclear databases and services.
- W. Costello (IAEA/NDS) to BNL/NNDC, 11 – 15 September 2000, participation in the Workshop "Relational Databases for Nuclear Data".
- O. Schwerer (IAEA/NDS) to JCPRG, Hokkaido University, 29 September – 30 October 2000, conversion of data from NRDF to EXFOR format.
- T. Burrows (BNL/NNDC) to IAEA/NDS, 8 – 13 December 2000, enhancement of existing and installation of new Web retrieval procedures.
- D. Winchell (BNL/NNDC) to IAEA/NDS, 5 – 9 February 2001, development of techniques for achieving greater platform independence of shared databases.
- Y. Ohbayashi (Meme Media Lab., Hokkaido University) to IAEA/NDS, 12 – 23 February, 2001, work on recent JCPRG EXFOR compilations, discussion of NRDF vs. EXFOR (translation, retrieval, statistics) and co-operation JCPRG – NDS.
- V. Zerkin (IAEA/NDS) to BNL/NNDC, 5 – 16 March 2001, design, development and testing of CINDA/EXFOR/ENDF components of Nuclear Reaction Database (NRDB).
- Ms. V. McLane (BNL/NNDC) to IAEA/NDS, 21 – 25 May 2001, development of CINDA, EXFOR, ENDF RDB and common dictionary system.

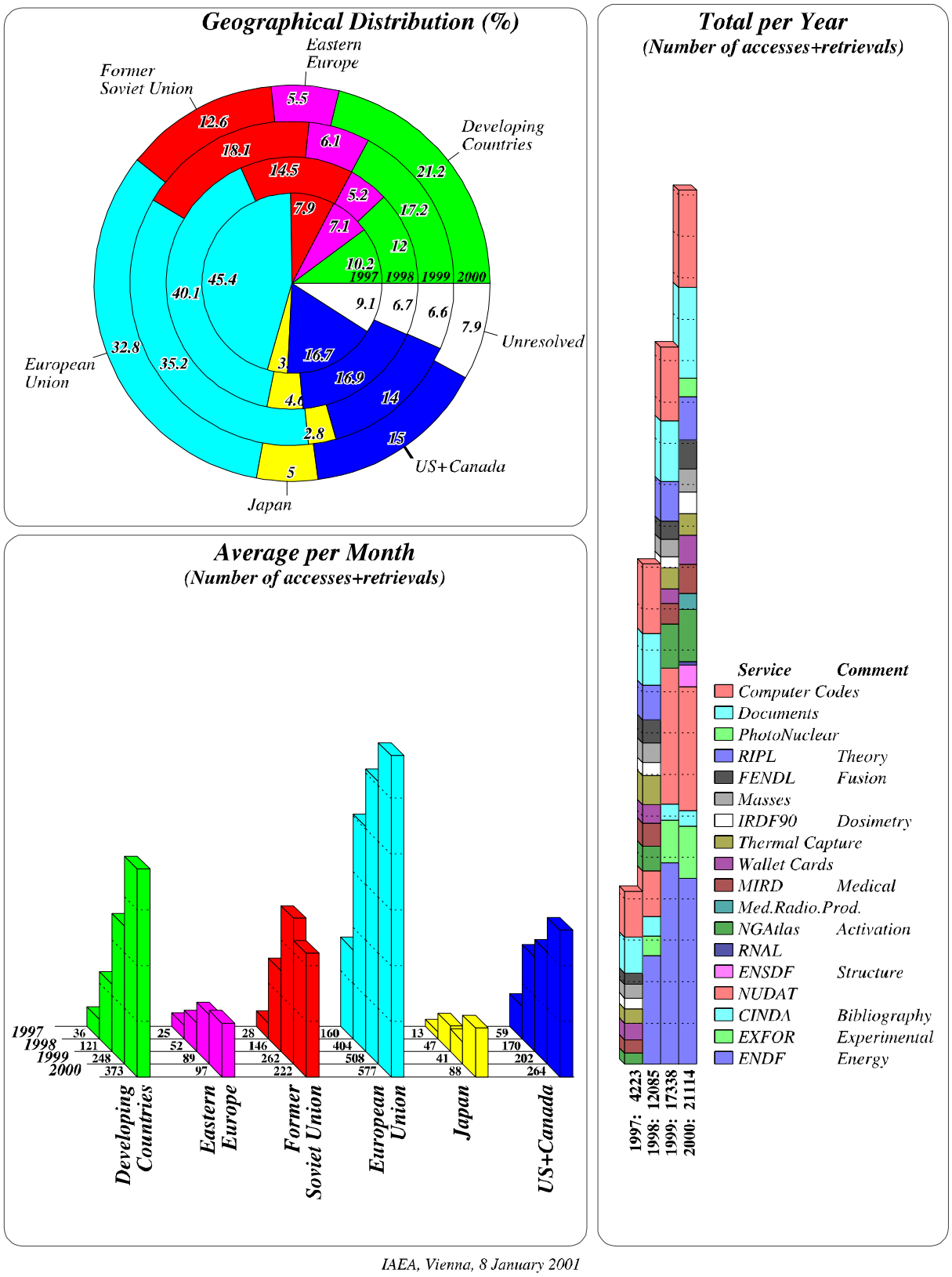


Fig. 1. Statistics of accesses and retrievals from NDS and IPEN (NDS-mirror in Latin America) Web sites.

NATIONAL NUCLEAR DATA CENTER

Status Report to the Consultants' Meeting on Technical Aspects of Co-operation of the Nuclear Reaction Data Centers 21-23 May 2001

General

Since the last meeting of the Nuclear Reaction Data Centers in May 2000, we have hired a full-time staff member to assist in the nuclear reaction data area; one staff member and one support staff member will be retiring within the next year. There are currently 10 FTE scientific/professional and four support staff. See Table I for list of visitors for this period. Also, attached is a list of NNDC visits to other centers.

The NNDC and NPDC (Sarov) have submitted a joint grant proposal to the Civilian Research & Development Foundation (CRDF)[1].

NNDC initiated a workshop on nuclear reaction physics and codes, which was prepared jointly with LANL and LLNL, and was held in Santa Fe, April 10-11, 2001.

Nuclear Data Base Migration

In September the NNDC hosted a workshop for international collaborators to discuss issues related to database migration and use of the relational database concept. It is expected that full migration will take four to five years. The proceedings have been issued[2].

D. Winchell has begun development on the NSR database using Sybase Enterprise. The ADLIST database has been converted to an RDB and installed in a Linux PC. Web-based Java retrievals are being tested.

The preliminary design of the Nuclear Reaction Database has been completed by the Reaction Database Design Team (V. McLane, V. Zerkin, S. Dunaeva), and is being sent out for comment. The nuclear structure team at NNDC, led by T, Burrows, J. Tuli, and A. Sonzogni, has begun investigating options for the nuclear structure databases. A preliminary ENSDF database using Access is being tested.

Computer Facilities

[1] Compilation and Evaluation of Alpha-Induced Nuclear Reaction Cross Sections for Astrophysics, submitted to Civilian Research & Development Foundation, May 2001.

[2] *Workshop on Relational Database and Java Technologies for Nuclear Data*, jointly sponsored by BNL and NEA, report prepared by R. Arcilla, D. Winchell, Y. Sanborn (2001).

The NNDC has recently installed a new ODS-5 disk on the VAX Alpha, which allows upper and lower case long file names. An Apache server has also been installed and is being tested.

A Linux operating system has been installed on two of our PCs, and Apache Tom Cat and the Java servlet JSP are also installed. WINDOWS2000 is also being tested on one of our PCs.

Bibliographies

The NSR compilation activity has continued. About 4,500 references have been entered in the past year.

The CINDA compilation activity continues with respect to those references associated with the experimental data compiled at the Center. In the period from June 2000 to May 2001, 4 CINDA transmissions were sent (BNL163-166).

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 2000 through May 2001, 6 neutron data transmission tapes (TRANS 1289-1294) and 13 charged-particle transmission tapes (C041-C049, P003, T006-T008) were sent containing new and corrected entries.

The contract with Oak Ridge to compile neutron total cross section data measured by J. Harvey has been completed. All recoverable data has been received by NNDC and are being processed or have already been added to the CSISRS database.

The LEXFOR Manual has been updated; a preliminary copy has been distributed for proofreading.

Evaluated Nuclear Reaction Data

NNDC continues to coordinate the work of the Cross Section Evaluation Working Group. ENDF/B-VI, Release 7, was distributed in June 2000. Version 6.12 of the ENDF Utility codes was also distributed in April 2001. The ENDF-102 Data Formats and Procedures Manual[3] has been updated and is available on the NNDC Web site.

Pavel Oblozinsky has continued the cooperation with KAERI on fission product evaluations, focusing on the fast neutron energy range. Thirteen preliminary evaluations have been completed.

Collaboration with LANL and IAEA NDS on the development of a modular code for nuclear reaction data evaluations was initiated. The pre-equilibrium Monte Carlo code HMS was extended to account for angular momentum conservation, of importance for modeling isomer and discrete gamma-ray production. The modular code Empire was extended by adding a module based on the exciton model code DEGAS, motivated by the need to handle direct/semi-direct capture in the fast neutron energy region.

[3] V. McLane, Ed., ENDF-102 Data Formats and Procedures Manual, BNL report BNL-NCS-44945-01/04-Rev. (April 2001).

Nuclear Structure Data

NNDC continues to publish the ***Nuclear Data Sheets***. As of April 2001, issues through Volume 95, #4 have been sent to Academic Press.

The experimental nuclear structure and decay data database (XUNDL) now contains more than 635 data sets for 513 nuclides.

The ENSDF Manual[4] has been revised and is available on the NNDC Web site.

Customer Services

The number of online retrievals continues to increase, primarily due to the availability of most databases on the Web. There are now about 900 customer accounts for the Online Service with about 1,000 users. There are about 20,000 retrievals per month from the combined Online Service, Web site, and anonymous ftp. A chart of online retrievals is attached.

Links to Nuclear Physics Electronic Link Manager were added to CINDA, CSISRS, and NSR HTML retrievals; links to the APS Link Manager were extended back to 1970.

[4] J.K. Tuli, *Evaluated Nuclear Structure Data File – A Manual for Preparation of Data Sets*, BNL report BNL-NCS-51855-01/02-Rev. (February 2001).

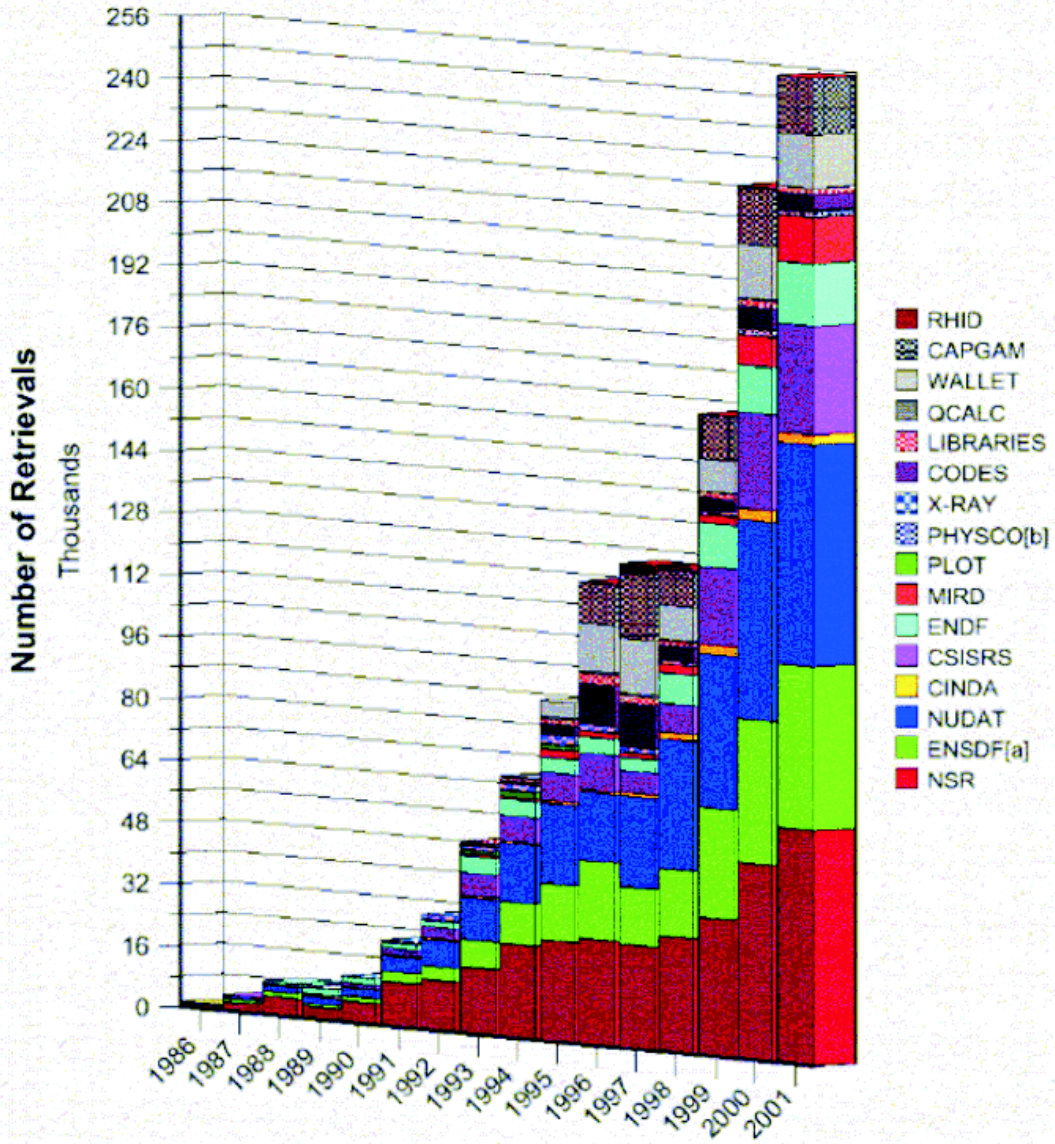
Table I.
Visitors to NNDC from June 1996 to May 1998

Visitor	Host	Duration	Topic
Viktor Zerkin	D. Winchell V. McLane	2 weeks	Nuclear reaction relational databases
Sophie Taova	D. Winchell	1 week	Evaluation programs
Andre Grebennikov	D. Winchell	1 week	Evaluation programs
Svetlana Dunaeva	V. McLane	10 weeks	Neutron reaction data compilation
Yong-Deok Lee	P. Oblozinsky	3 months	Fission product nuclei evaluation
Viktor Zerkin	V. McLane	2 weeks	Nuclear Reaction Database, ZVView
Mike Hermann	P. Oblozinsky	1 week	EMPIRE-2 improvements

Table II.
Visits by NNDC Personnel to Other Centers

Staff Member	Host	Duration	Topic
Victoria McLane	NPDC, Sarov	1 week	ICTP project
Thomas Burrows	IAEA/NDS	1 week	Web and EXFOR services
David Winchell	IAEA/NDS	2 weeks	Database migration strategies
Victoria McLane	IAEA/NDS	1 week	Nuclear reaction database design

*NNDC On-Line Data Service, World Wide Web (W^3), and FTP Retrievals 1986-2001**



* Extrapolated as of April 30, 2001.
[a] Includes XUNDL retrievals since January 1 (OnLine) and January 11 (Web), 1999.
[b] Added to Web August 18, 1999.

CHARGED PARTICLE NUCLEAR DATA GROUP,
Institute of Nuclear Research,
Debrecen, Hungary

S. Takács, F. Tárkányi, F. Szelecsényi, F. Ditrói, A. Fenyvesi

**Progress Report to the
Consultants' Meeting
on Technical Aspects of Co-operation
of the Nuclear Reaction Data Centres
28 - 30 May 2001**

General

The Debrecen Nuclear Data Group is working within the Cyclotron Department of the Institute of Nuclear Research of the Hungarian Academy of Sciences (ATOMKI). The group is dealing with charged particle induced nuclear reaction cross section data measurement, compilation, evaluation and practical application in low and medium energy range. The experimental work and the compilations are carried out in international collaborations with different cyclotron laboratories (INC, FZ Jülich, Germany, VUB Brussels, Belgium, Turku PET Center, Finland, Tohoku University, Japan). We have also connections with theoretical groups in Russia, IPPE, Obninsk, and China, CNDC, Bejing.

Recent Progress

We have continued the experimental determination of cross sections data and yield measurements for charged particle induced nuclear reactions, 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.

Since the last meeting first priority was given to the final preparation of the TECDOC of an evaluated Reference Database for medical isotope production and monitoring light charged particle beams. The work was co-ordinated by the Agency as a CRP under the title of "Development of reference charged particle cross section database for medical radioisotope production". In this final stage the manuscript was completed with all the figures and data tables. The database contains 22 monitor reactions to monitor the beam parameters of p, d, ^{3}He and α bombarding particles, 16 reactions to produce single gamma emitter diagnostic radioisotopes and 10 reactions for production of the most commonly used PET isotopes.

The project included 7 laboratories among them our group. The Debrecen group took a significant part in the CRP, regarding the compilation of the experimental data, the connected

new experiments and finally the preparation of the technical document. The manuscript was completed in the second half of the last year. An online version of the TECDOC also was created and placed on the IAEA Web server under the *http://www-nds.iaea.or.at/medical/* address. The web version still needs some final adjustments.

Further conclusion and remarks on the CRP

- A significant effort was done to produce the database, but in case of some reactions the quality of the result is still requires some adjusting.
- The program and the number of the evaluated reactions were too ambitious for the available limited time, therefore some corrections are needed at some parts of the database.
- In general, most cases the status of the experimental data of the charged particle induced reactions was poor. To produce more reliable recommended data set deep analysis of the available experimental data is required and/or additional experiment is still needed under a well-defined condition.
- In case of some reactions no recommended data was given. Further work is required.
- It was found that a significant part of the experimental data still not compiled in the EXFOR format.
- It was practically impossible to use the results of the model codes to produce recommended data.

Recommendation for additional work regarding the CRP:

- It is essential to collect new experimental data in case of several reactions.
- The quality of the recommended data can be improved significantly by a new evaluation process including the new experimental data gathered since the compilation process was closed.
- We recommend an immediate continuation of the evaluation process since at this time the correction of the presented results to get better quality data requires only moderate additional effort. After a longer period of time it is not a correction work anymore but a complete new evaluation that means much more effort and requires more manpower too.
- At this stage the correction process requires only limited number of participants. It would be enough the joint work of one experimental and one theoretical group.

Compilation in EXFOR format

The Debrecen CP Nuclear Data Group are collecting and compiling charged particle experimental cross section data measured in Debrecen and Jülich.
In the last year this activity was temporary suspended, due to the overload by the program of CRP. After completing the Medical Isotope Reference Database, the compilation work was restarted again in this year. One TRANS was completed by this time. The missing works from Debrecen and Jülich will be compiled soon.

Nuclear data services

The group continue to distribute 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 five physicists, working in different application areas at the Debrecen cyclotron. They can work only in-part time in different percentage on data compilations and other related work. The main problem is the lack of technical support, for data input and to check the compiled data.

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 plan 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.
- Confirmation of the experimental data measured by Levkovski.
- We continue to work on the problems related to the Reference Database for medical isotope production and monitoring light charged particle beams.
- As part of the CRP all the references included in the project will be reviewed again to select the works still are not compiled in EXFOR format.
- We continue to compile new entries in EXFOR from the papers published by the INC, Forschungszentrum Jülich, Jülich, Germany, and Institute of Nuclear Research, Debrecen, Hungary.

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Publications of 2000-2001

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. Several other works are under preparation for presentation at conferences will be held this year or for publication in a scientific journal.

S. Takács, F. Szelecsényi, F. Tárkányi, M. Sonck, A. Hermanne, Yu. Shubin, A. Dityuk, M.G. Mustafa and Zhuang Youxiang: *New cross-sections and intercomparison of deuteron monitor reactions on Al, Ti, Fe, Ni and Cu.*
NIM B 174 (2001) 235-258

F. Szelecsényi, F. Tárkányi, **S. Takács,** A. Hermanne, M. Sonck, Yu. Shubin, M.G. Mustafa and Zhuang Youxiang: *Excitation function for the $^{nat}Ti(p,x)^{48}V$ nuclear process: Evaluation and new measurement for practical applications*
NIM B 174 (2001) 47-64

F. Szelecsényi, **S. Takács,** F. Tárkányi, M. Sonck, A. Hermanne: *New cross section data on natTi(p,x)48V nuclear process: Monitoring of proton beam and production of ^{48}V.*
Synthesis and applications of isotopically labelled compounds. Vol. 7.: Proceedings of the Seventh International Symposium, Dresden, Germany, 18-22 June 2000. Eds: Ulrich Pleiss and Rolf Voges. Chichester, etc., John Wiley and Sons, Ltd. (2001)45.

A. Hermanne, M. Sonck, **S. Takács.** and F. Tárkányi: *Monitoring of proton beams: a practical application of an Evaluated Charged Particle Database.* NIM B (accepted)

F. Ditrói, F. Tárkányi, M.A. Ali, L. Andó, S-J. Heselius, Yu. Shubin, Zhuang Youxiang, M.G. Mustafa: *Investigation of ^{3}He-induced reactions on natural Ti for nuclear analytical and radionuclid production purposes.*, NIM B 168 (2000) 337-346.

F. Tárkányi, F. Szelecsényi, **S. Takács,** A. Hermanne, M. Sonck, A. Thielemans, M.G. Mustafa, Yu. Shubin N. and Z. Youxiang: *New experimental data, compilation and evaluation for the $^{nat}Cu(a,x)^{66}Ga$, $^{nat}Cu(a,x)^{67}Ga$ and $^{nat}Cu(a,x)^{65}Zn$ monitor.*
NIM B 168 (2000)144-168

A. Hermanne, M. Sonck, **S. Takács,** F. Tárkányi: *Experimental study of excitation functions for some reactions induced by deuterons (10-50 MeV) on natural Fe and Ti.*
NIM B 161 (2000) 178-185.

R. Dóczi, **S. Takács,** F. Tárkányi, B. Scholten, S.M. Qaim: *Possibility of production of ^{81}Rb via the $^{80}Kr(d,n)$ reaction at a small cyclotron.* Radiochimica Acta 88 (2000)135.

P5

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

Status report to the IAEA Advisory Group Meeting, May 28-30, 2001.

S.A.Dunaeva

Russian Federal Nuclear Center - VNIIEF.

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

Compilation.

We continue the correction and translation to the EXFOR format of our experimental data and the compilation of the new experimental data. Now we prepare for EXFOR library our experimental data on boron that will be reported in October 2001 on the International Conference in Japan ("Nuclear data and Technology"). We also, compile experimental data in collaboration with NNDC and CJD.

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

Collaboration.

We worked in collaboration with the NNDC during two months. Charged particle data from the "Nuclear Physics" have been scanned (1980 - 2000) and compiled. These data have been compiled with the new identifier - "T".

In collaboration with BBDC we prepared a project to CRDF. The results of our efforts will be clear up in November 2001.

Software.

In collaboration with NNDC and IAEA we take part in the discussion about the migration strategy for existing databases.

Now we develop new SaBa's interface, include to it new nuclei (up to Fluorine) and thermonuclear reaction rates calculations. The results of this work we'll present in October 2001 on the International Conference in Japan ("Nuclear data and Technology").

Evaluation activity.

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

In collaboration with CJD we worked on the ISTC #731 project that was fulfilled. In the frame of this work the following results were achieved:

- New spectra and cross section measurements of γ-production on inelastic 14.3 MeV neutron scattering were performed. There were used wide range of construction materials and liquid-metal carries. There were investigated 28 nuclei. These data were established with such uncertainties (10% for the most nuclei) that they may be used as the standard data for creation evaluated libraries for thermonuclear applications.
- New experimental data were compared with the data from the literature and from EXFOR and ENDF libraries;
- Results of the experiments were compiled into EXFOR in collaboration with CJD.

In the frame of work on the ISTC #731 project we have performed new experiments and prepared adopted data for neutron-gamma-production cross-sections on 28 nuclei.

According to the ISTC #1145 project we develop the evaluated nuclear library for transmutation (TENDL).

103 isotopes including 4 effective fission fragments from the following world libraries of evaluated constants (ENDF/B-IV, ENDL-82, JENDL-3, CENDL-2, BROND-2) were involved into the current version of TENDL library.

The methods and criteria of data selection, the content of TENDL library and functional potentialities of the special program shell are described in the report that will be also presented in October 2001 on the International Conference in Japan ("Nuclear data and Technology").

PROGRESS REPORT
to NRDC Meeting (28 - 30 May 2001, Vienna)

V.N.Manokhin, S.A.Maev

Russia's Nuclear Data Center (CJD, IPPE, Obninsk)

Introduction.

In CJD during the period passed after previous Meeting the current work continued concerning EXFOR compilation and fulfillment of NRDC-2000 Recommendations and Actions. Much efforts were applied for restoring CJD Web page and guarantee access to it from the users. Evaluation works were also in process. The details are given below.

CINDA and EXFOR activity. Compilation into EXFOR continues on ste ady level. Since March 2000 up to April 2001 four TRANS tapes (4119 - 4122) containing 69 Entries (24 - new, 45 - corrected) were prepared and sent to other centers. 25 new EXFOR Entries were compiled.

Unfortunately some technical problems did not permit us to send CINDA Entries during long period of time. We hope to eliminate this backlog this year and to continue compilation into CINDA on the steady level as well.

EVALUATED DATA. An analysis and evaluation are made for the threshold reactions cross sections leading to production of the long-lived radioactive nuclides on the irradiation of steel by thermonuclear neutron spectrum. Fifty excitation functions were evaluated. Many of them are considerably different from available evaluations of other libraries.

During two years, together with JAERI, comparative analysis was performed of (n,2n) and (n,3n) reactions for 150 fission products from available evaluated data libraries. The result of analysis will be published this year. The joint work on consistent evaluation of some (n,2n) and (n,np) excitation functions for even-even isotopes was made on the basis o f empirical systematics.

Together with the specialists from Sarov the work was completed on evaluation of the spec-tra and production cross sections of gamma-rays in inelastic interactions of 14-Mev neutrons
with the number of nuclei: Li-6, Li-7, Al, Ti, Cr, Fe, Cu, Pb, Bi, U-235.

CJD continues the work on evaluation of neutron data for minor actinides. This year Am-242m will be evaluated, and Np-237, Am-241, Am-243, Cm-243, Cm-244 will be tested and improved.

Full file of Bi was prepared. Full files for Pb isotopes are in process of preparation.

There exist a plan to analyze full files for isotopes of Cr, Fe, Ni from existing evaluated data libraries, to select more reliable cross sections, and to create improved files for these isotopes. At the present time the analysis and the new evaluations are being made for th reshold reactions excitation functions.

Together with the Theoretical Department of our Division the work is in progress on the determination of uncertainties of existing evaluated data and development of covariance matrices for some important isotopes.

Some efforts are applied to revise the threshold reactions data from FENDL/A-2.

CUSTOMER SERVICE. Our WWW-site on PC was restored,and the access to it was improved. Some important papers in English, published in Nuclear Constants (=YK) will be inserted.

On the relational data base platform the interface code was developed for access to the CINDA and EXFOR data on PC.

Relational Nuclear Databases
upon the MSU INP CDFE Web-site
and Nuclear Data Centres Network CDFE Activities

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

Progress Report
to the IAEA Technical NRDC Meeting (28 - 30 May 2001, Vienna)

This report contains the only **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 Advisory Group Meeting (15 - 19 May 2000, Obninsk, Russia) till May 2001 and the description of the main results obtained.

1. The **new** CDFE EXFOR **TRANS M030** has been produced and transmitted to the IAEA NDS. The TRANS contains (**Annex 1**) 10 retransmitted and 11 new (M0613 - M0623) ENTRYs with 150 data SUBENTs.

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

- the “1999” part was added to the “Photonuclear Data Index”; the 2000 “part” is in processing; as whole the **“Photonuclear Data Index 1955 -1999”** database was added by a number of entries from /1/;

- in addition to the former data collection of the CDFE database **"Giant Dipole Resonance Parameters"** 180 **new entries** and **150 new** reaction **cross sections** were added; the last database version includes now altogether **1710 entries and 1230** various photonuclear reaction cross section EXFOR data sets available in forms of both table and graph;

- the new CDFE Web-site **Search Engines** were produced using the Linux MySQL database management system (DBMS) instead of former hypertext data presentations for the following databases (the correspondent search forms are presented in **Annexes 2 – 4**):

  - "Giant Dipole Resonance Parameters. Photonuclear Reaction Cross Sections";
  - “Photonuclear Data Index 1955 -1999”;
  - “CAJAD Charge Particle Reaction Cross Section Catalogue”.

3. Using the MySQL Data Base Management System (Linux) two new relational databases **“Nucleus Ground State Parameters”** and **“Nuclear Reaction Database (EXFOR)”** were developed:

- **“Nucleus Ground State Parameters”** database was produced (**Annexes 5, 6**) for all known stable and radioactive nuclei using several well known sources /2, 3/ of nucleus parameters information and new CDFE data /4/ for first isobar analogue state energies includes the following data:

- nucleus Z and A numbers;
- $T_{1/2}$ or Γ or Abundance /2, 3/;
- spin-parity J^{π} /2/;
- atomic mass M (with correspondent uncertainty) /3/;
- mass excess M-A (with correspondent uncertainty) /3/;
- nucleus binding energy (with correspondent uncertainty) /3/;
- nucleus ground state isospin (N-Z) /2 value;
- first isobar analogue $T_{>}$-state energy /4/ (**Annex 7**);
- nucleus dipole and quadrupole moments /5/;

- **"Nuclear Reaction Database (EXFOR)"** database was produced (**test version is available now**); Search Engine (**Annex 8**) gives to one the possibility to find the following data from the complete international EXFOR charge particle and photonuclear reaction data fund (the possibility to add the neutron reaction data fund exists and is under discussion now):

  - Target Nucleus (REACTION SF1);
  - Incident Particle (REACTION SF2);
  - Inc-Source;
  - Outgoing Particle/Process (REACTION SF3)
  - Product nucleus (REACTION SF4);
  - Quantity (REACTION SF5 - SF9);
  - Energy/Angle range;
  - Method;
  - Facility;
  - Detector;
  - Status;
  - Reference;
  - Author;
  - Institute.

4. The "**Relational Nuclear Spectroscopy Database NESSY"** (New ENSDF Search SYstem) has been put upon the CDFE Web-site before. The main advantages of the NESSY PC version search system /6/ are the following:

- configuration on both search conditions and output information is not limited;

- automatic formation of tables containing the search parameters can be included into the common query configuration:

  - Query_1 (ENSDF) $\Rightarrow$ Result_1,
  - Query_2 (Result_1) $\Rightarrow$ Result_2,
  - and so on;

- requests are posed by means of both values and the relations between them;

- Arithmetical and other operations over searched values are possible.

The method of the realisation of the advantages mentioned above has been the using of so-called bank of standard requests /6/. Several new standard requests were realised for the NESSY Internet version /7/ during the period reviewed.

The following searches are available now:

- **"Show Levels"**.
  This query allows one to search the levels of any number of nuclei using several criteria.

- **"Show Decay Modes"**.
  This query shows to one the scheme of decay modes for the selected nucleus.

- **"Show Levels and Gammas"**.
  This query shows to one the scheme of gamma-transitions between the levels of selected nucleus.

- **"Show Scheme of Levels"**.
  This query shows to one the scheme of levels of selected nucleus.

- **"Show Levels with Equivalent Energies"**.
  This query allows one to search the various nuclear levels with energies equivalent to entered.

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. G.Audi, A.H.Wapstra. The 1995 Update to the Atomic Mass Evaluation. Nucl.Phys., A595 (1995) 409.
3. J.K.Tuli. Nuclear Wallet Cards (Sixth Edition), U.S.A. Brookhaven National Laboratory National Nuclear Data Center, January 2000.
4. I.N.Boboshin, B.S.Ishkhanov, V.V.Varlamov. Energy of the first $T_>$–isospin Nuclear State New Formula. 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, JAERI (submitted Abstract N50, **Annex 7**).
5. N.Stone. Table of New Nuclear Moments. 1997 Preprint (A revision of the Table of Nuclear Moments by P. Raghavan (Atomic Data Nuclear Data Tables 42, 189 (1989))).
6. 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 - 119.
7. I.N.Boboshin, V.V.Varlamov, E.M.Ivanov. The CDFE Relational Nuclear Spectroscopy Data Base NESSY in Internet. Report on the IAEA Advisory Group Meeting on Network of Nuclear Reaction Data Centres (15 - 19 May 2000, Obninsk, Russia). INDC(NDS)-418, IAEA NDS, Vienna, Austria, 2000, pp. 142 - 143.

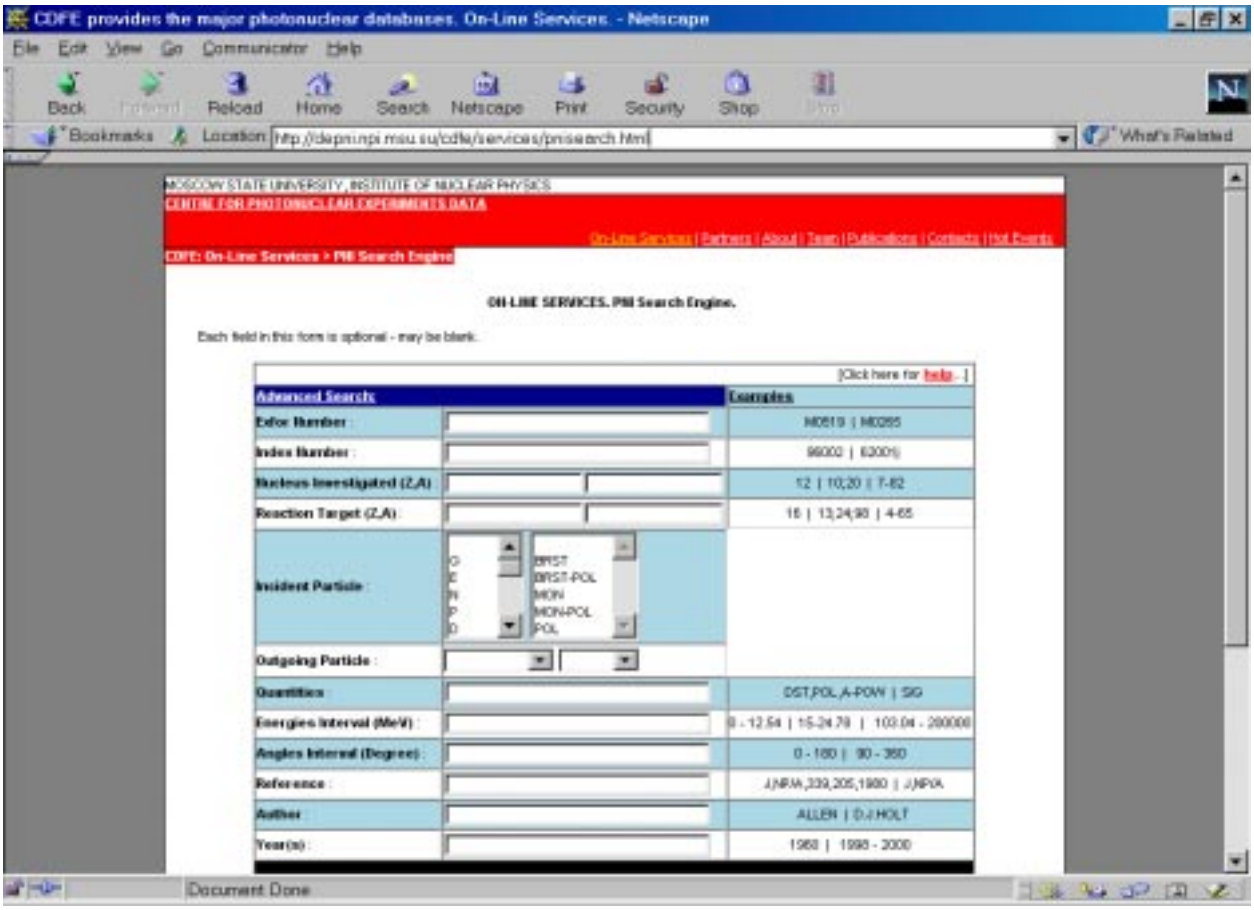
Annex 1.

The CDFE EXFOR TRANS M030 contents (*corrected old* and new ENTRYs)

ENTRY's Number	Amount of DATA TABLEs
M0043	*26*
M0045	*24*
M0166	*2*
M0296	*2*
M0397	*7*
M0428	*11*
M0431	*3*
M0434	*2*
M0539	*10*
M0598	*4*
M0613	2
M0614	6
M0615	5
M0616	5
M0617	2
M0618	10
M0619	12
M0620	3
M0621	3
M0622	3
M0623	9
Total: 21	**Total: 150**

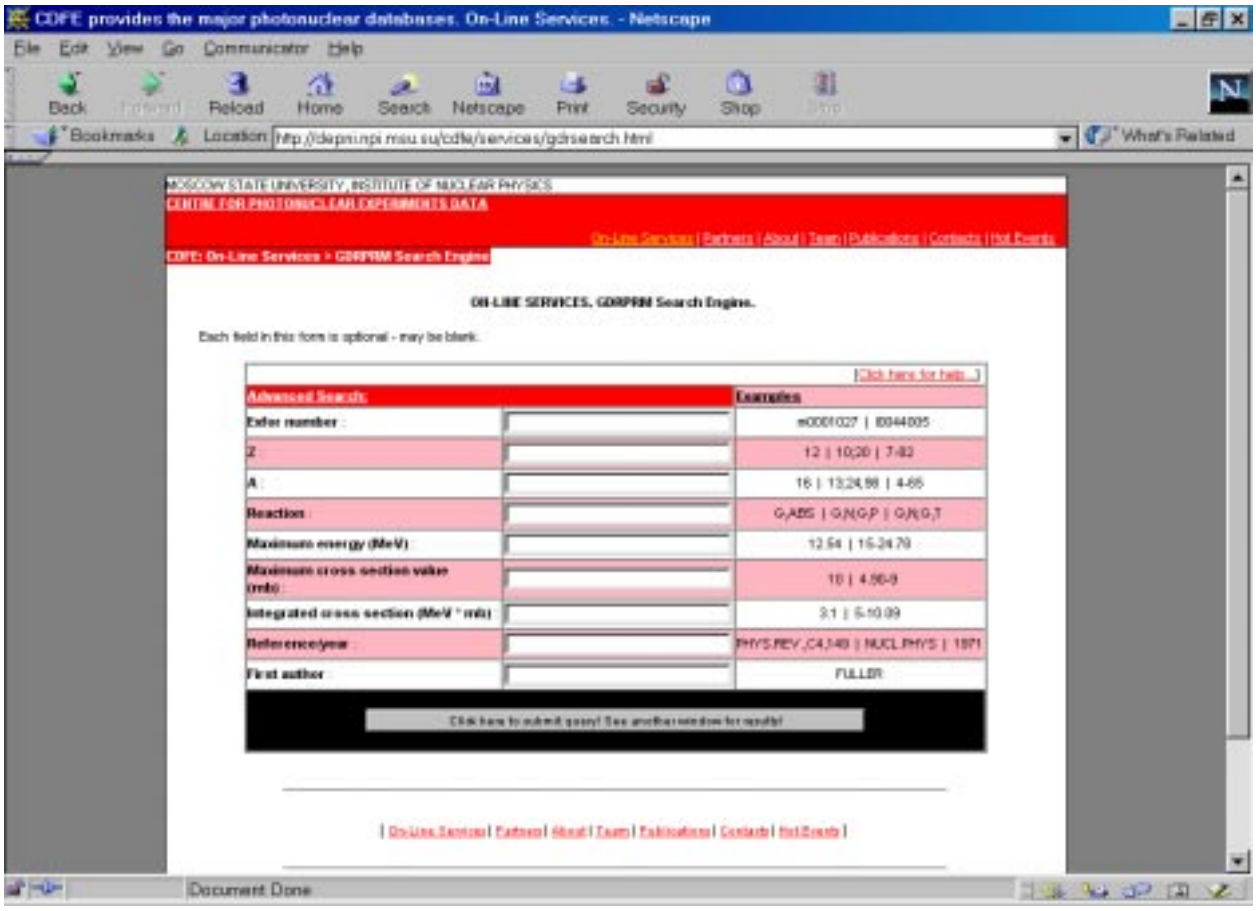
Annex 2.

The search form for the relational database
"Photonuclear Data Index 1955 -1999"



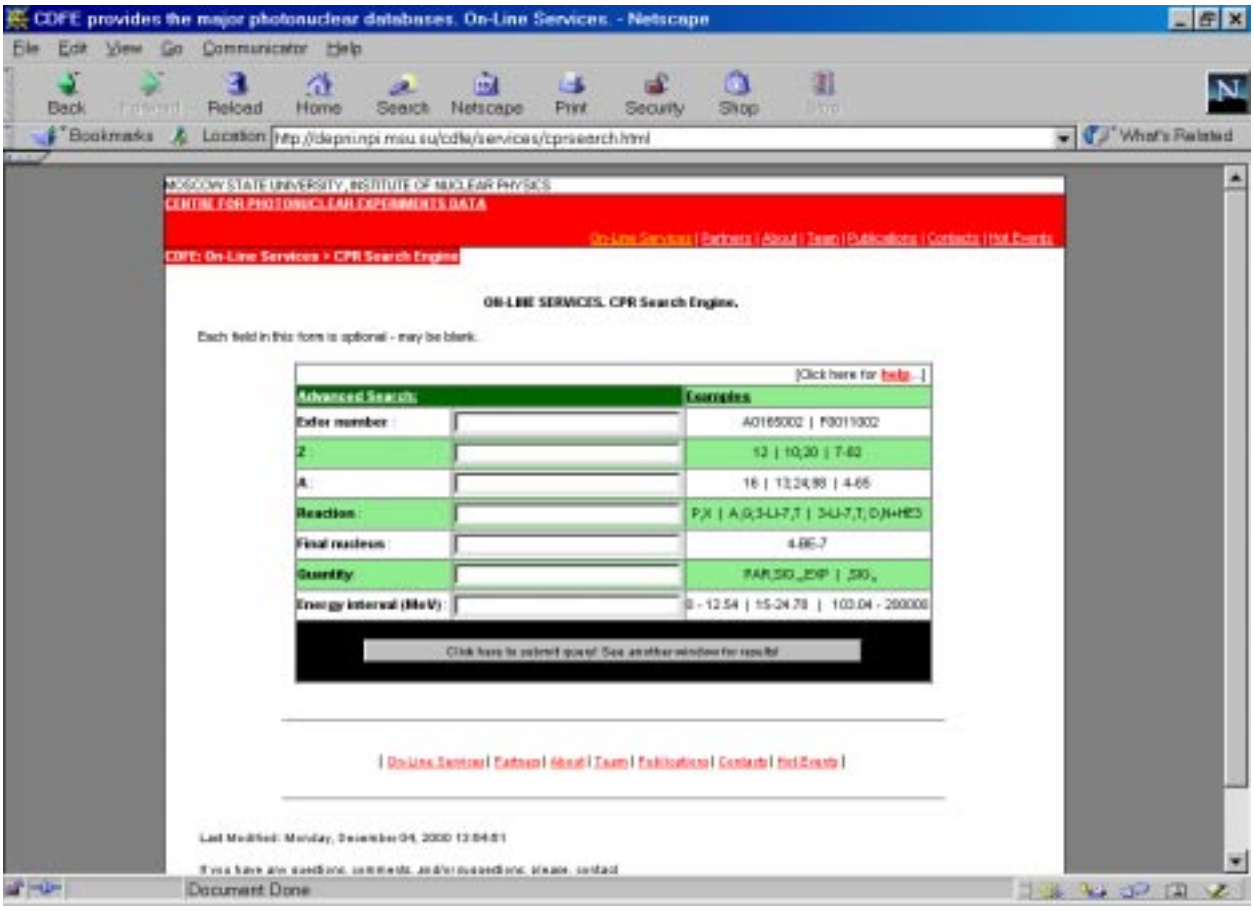
Annex 3.

The search form for the relational database
"Giant Dipole Resonance Parameters. Photonuclear Reaction Cross Sections"



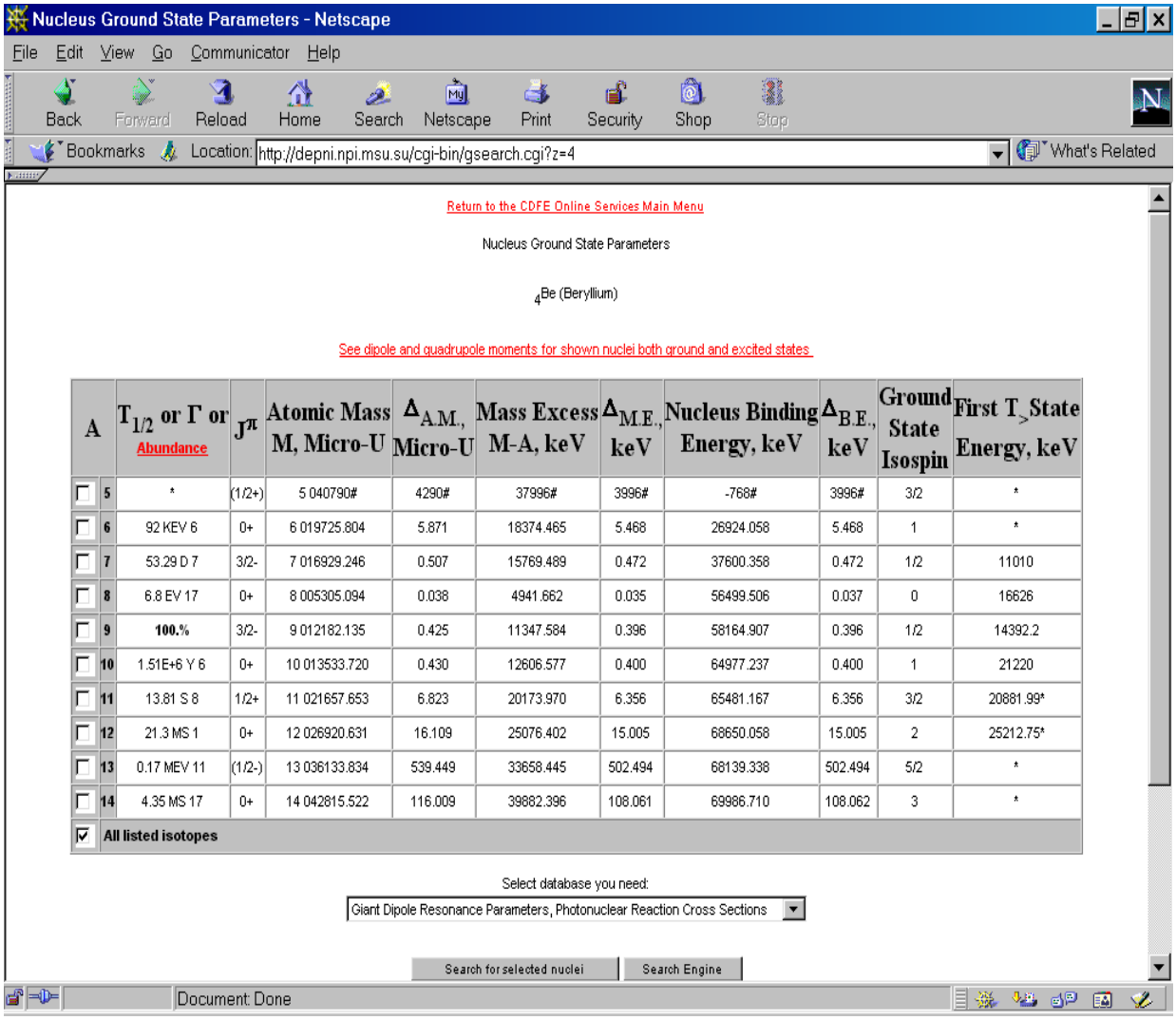
Annex 4.

The search form for the relational database
“CAJAD Charge Particle Reaction Cross Section Catalogue”



Annex 5.

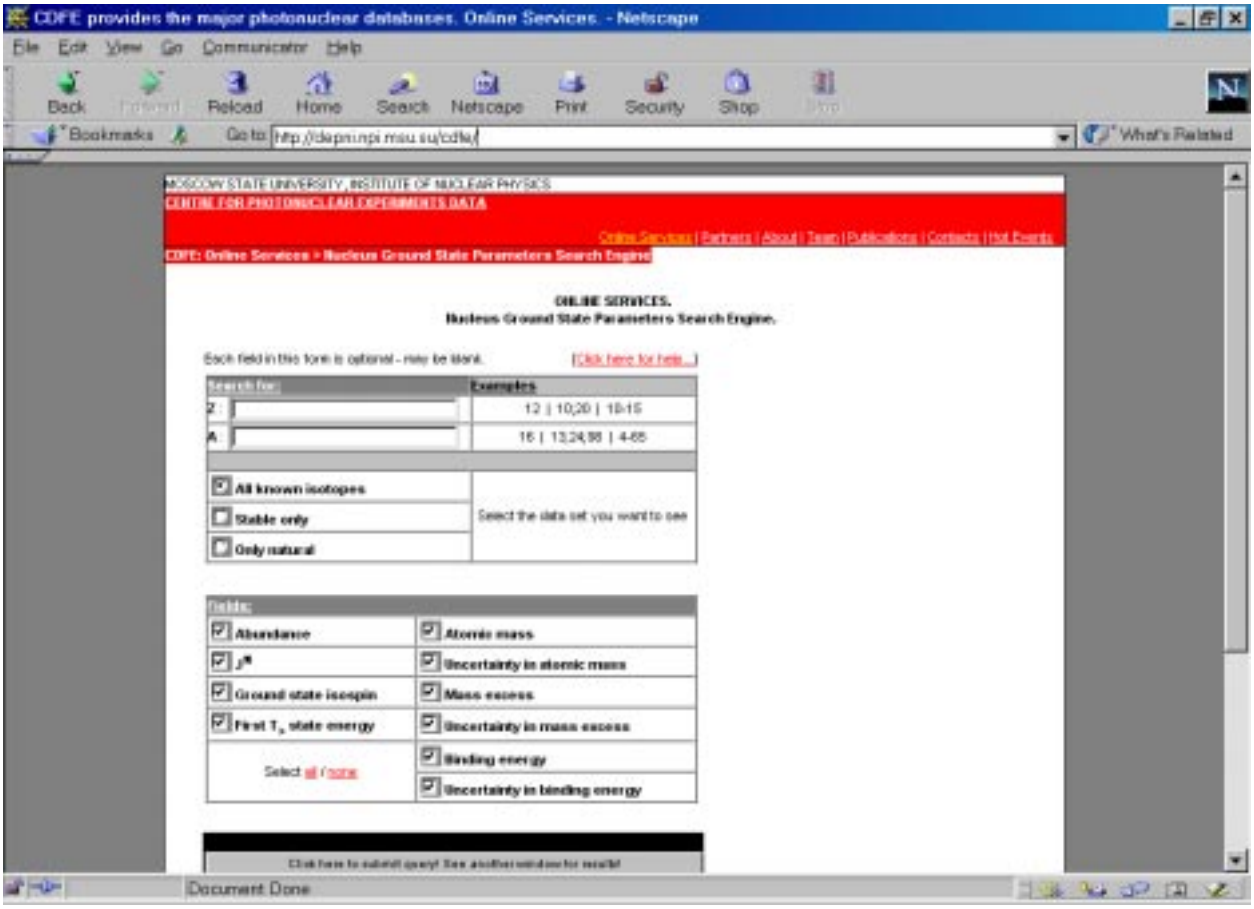
The new relational database “Nucleus Ground State Parameters”
(Berilium isotopes part example)



A	$T_{1/2}$ or Γ or Abundance	J^{π}	Atomic Mass M, Micro-U	$\Delta_{A.M.}$, Micro-U	Mass Excess M-A, keV	$\Delta_{M.E.}$, keV	Nucleus Binding Energy, keV	$\Delta_{B.E.}$, keV	Ground State Isospin	First $T_>$ State Energy, keV
5	*	(1/2+)	5 040790#	4290#	37996#	3996#	-768#	3996#	3/2	*
6	92 KEV 6	0+	6 019725.804	5.871	18374.465	5.468	26924.058	5.468	1	*
7	53.29 D 7	3/2-	7 016929.246	0.507	15769.489	0.472	37600.358	0.472	1/2	11010
8	6.8 EV 17	0+	8 005305.094	0.038	4941.662	0.035	56499.506	0.037	0	16626
9	**100.%**	3/2-	9 012182.135	0.425	11347.584	0.396	58164.907	0.396	1/2	14392.2
10	1.51E+6 Y 6	0+	10 013533.720	0.430	12606.577	0.400	64977.237	0.400	1	21220
11	13.81 S 8	1/2+	11 021657.653	6.823	20173.970	6.356	65481.167	6.356	3/2	20881.99*
12	21.3 MS 1	0+	12 026920.631	16.109	25076.402	15.005	68650.058	15.005	2	25212.75*
13	0.17 MEV 11	(1/2-)	13 036133.834	539.449	33658.445	502.494	68139.338	502.494	5/2	*
14	4.35 MS 17	0+	14 042815.522	116.009	39882.396	108.061	69986.710	108.062	3	*
	All listed isotopes									

Annex 6.

The search form for the relational database
"Nucleus Ground State Parameters"



Annex 7.

The $T_>$-state energy values
for the new relational database "Nucleus Ground State Parameters"

ENERGY OF THE FIRST $T_>$–ISOSPIN NUCLEAR STATE NEW FORMULA

I.N.Boboshin, B.S.Ishkhanov, V.V.Varlamov

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119899 Moscow, Russia

In the frame of nuclear physics isobaric state formalism the lowest isobar-analog state (isospin $T_> = |N-Z|/2+1$) energy value is very important parameter for many research concerned to various nuclear processes (giant dipole resonance decay, various nuclear reaction mechanisms, etc.). But there is evident lack of such information in the modern databases. For example the Evaluated Nuclear Structure Data File (ENSDF) /2, 3/ contains these values for slightly more than 100 nuclei. Therefore a formula for the first $T_>$–isospin state energy value calculation is very actual. As a rule a well-known semi-empirical formula /1/ is used

$$E = E_{be}(N, Z) - E_{be}(N + 1, Z - 1) + 1.444\cdot(Z - 1/2) / A^{1/3} - 1.131, \text{ MeV}$$

where $E_{be}(N, Z)$ and $E_{be}(N + 1, Z - 1)$ are the correspondent nucleus binding energy values (in MeV).

The check of this formula was carried out using the $T_>$–isospin state energy experimental data from the ENSDF modern version for 118 nuclei from ^{6}Li to ^{61}Zn. It was found out that above formula describes correctly the $T_>$–isospin state energy values only for nuclei with $N > Z$. The disagreements between experimental and calculated values for other nuclei are too high, for example, –274.95 keV instead of 12255.00 keV for ^{15}O, 100.44 keV instead of 11192.90 keV for ^{17}F, and –9348.88 keV instead of 5900.00 keV for ^{28}P.

For improving the situation it was proposed that for nuclei with $N \le Z$ the formula must be changed. Using the symmetry assumptions it was shown that the following two formulae must be used instead of the above one:

$$E = E_{be}(N, Z) - E_{be}(N + 1, Z - 1) + 1.484\cdot(Z - 1/2) / A^{1/3} - 1.293, \text{ MeV} \quad \text{for } N > Z,$$

$$E = E_{be}(N, Z) - E_{be}(N - 1, Z + 1) - 1.484\cdot(Z + 1/2) / A^{1/3} + 1.293, \text{ MeV} \quad \text{for } N \le Z.$$

Instead of above formula second parameter 1.131 the neutron-proton mass difference 1.293 MeV parameter was used: the formula term concerned described the isospin symmetry violation. After that the new value of the formulae first parameter (1.484 instead of 1.444) was obtained using the variation of formulae for the same accuracy obtaining.

The averaged disagreement $\Delta = 0.107$ MeV between estimations calculated using proposed two new formulae and experimental ENSDF data has been obtained for 116 nuclei from 118 investigated. The only two exceptions for ^{15}O ($\Delta = 1.40$ MeV) and ^{26}Mg ($\Delta = 5.04$ MeV) have been found out. Both items could be interpreted as results of possible mistakes in the ENSDF. The point is that the spins of states under discussion are not in accordance with the spins of the ground states of the correspondent isobar–analog nuclei. It looks like that in the ENSDF for both nuclei mentioned above the data are presented for not first but second $T_>$–isospin states.

The $T_>$–isospin state energy data calculated for 2560 nuclides using above formulae are available now at the MSU INP CDFE Web-site (http://depni.npi.msu.su/cdfe).

The Grant N 99-07-90015 of Russian Foundation for Basic Research.

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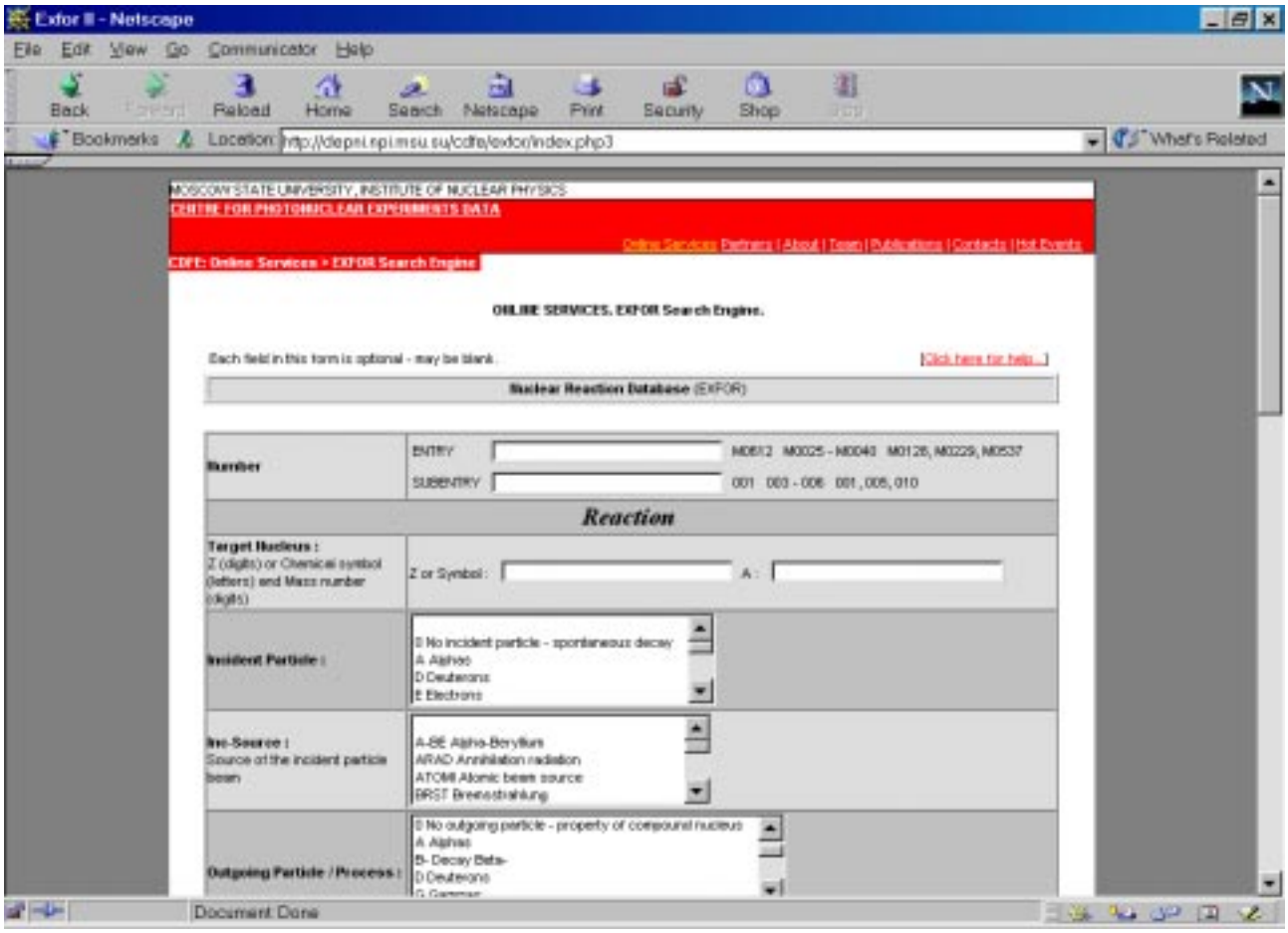
2. T.W.Burrows. Nucl.Instr. & Meth., A286 (1990) 5953.
3. J.K.Tuli. National Nuclear Data Center, Brookhaven National Laboratory. Report BNL–NCS–51655–Rev. 87. 1987.

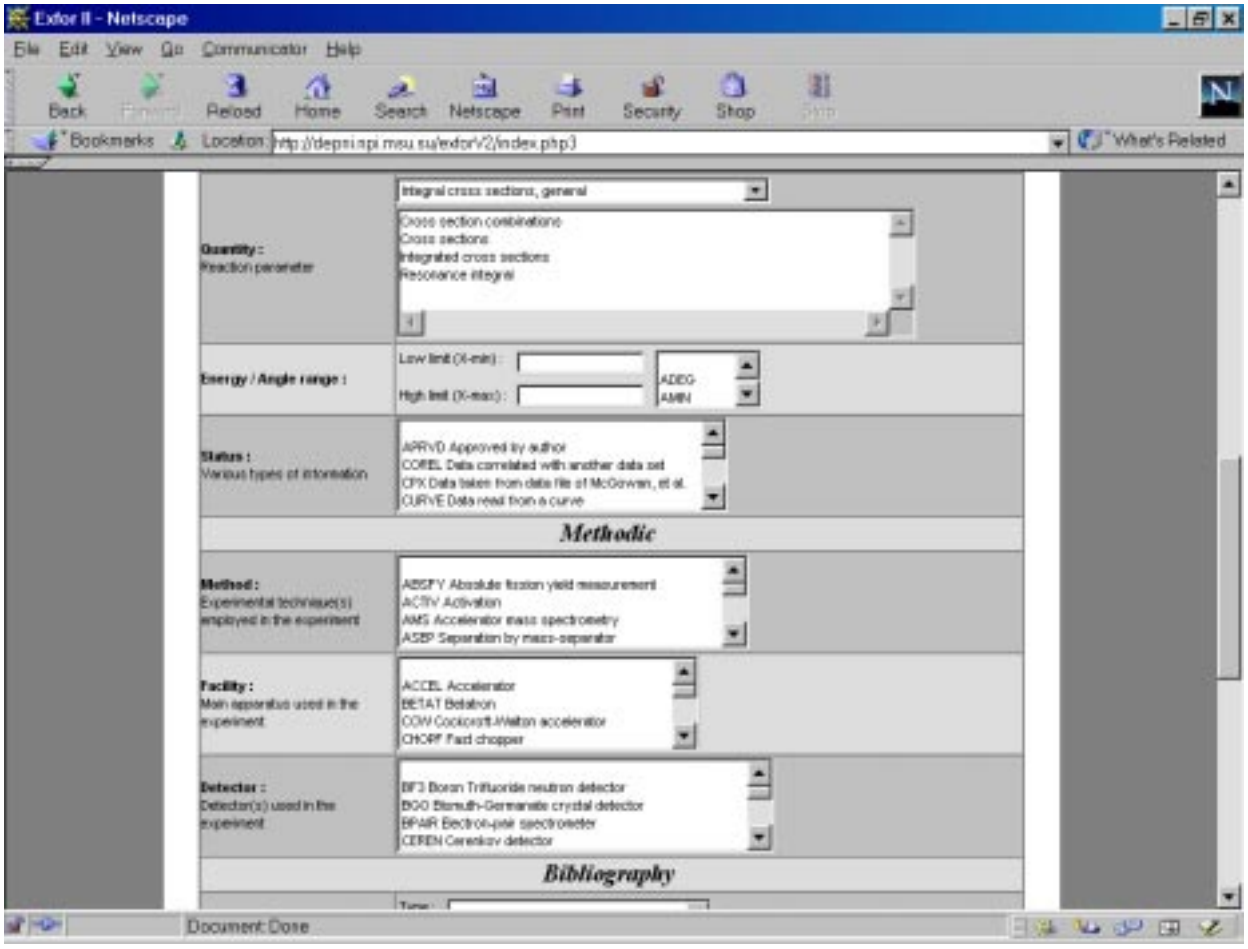
Annex 8.

The search form for the relational database "Nuclear Reaction Database (EXFOR)"



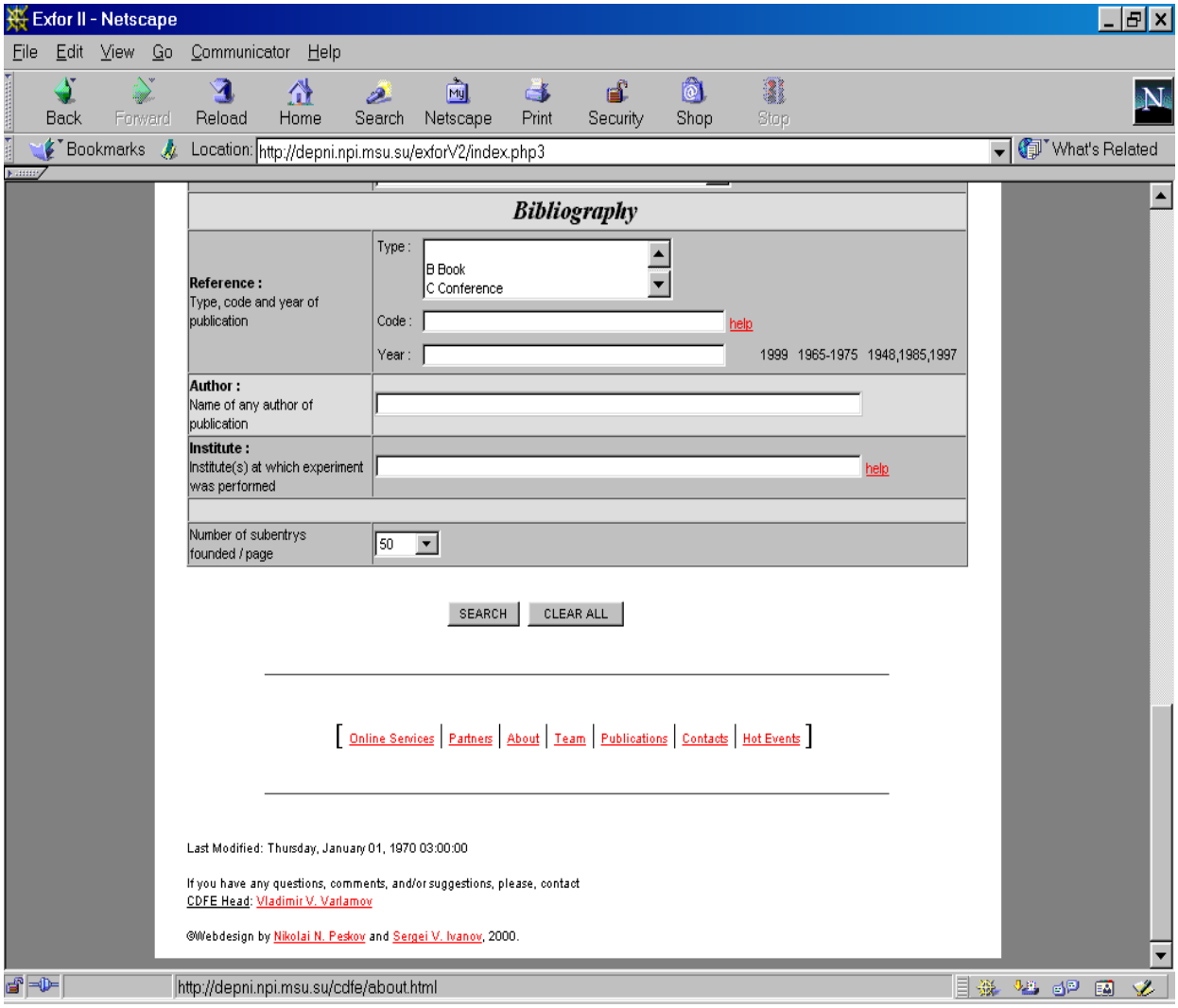
Annex 8 (continuation 1).

The search form for the relational database
"Nuclear Reaction Database (EXFOR)"
(continuation 1)



Annex 8 (continuation 2).

The search form for the relational database
"Nuclear Reaction Database (EXFOR)"
(continuation 2)


Exfor II - Netscape
File Edit View Go Communicator Help
Back Forward Reload Home Search Netscape Print Security Shop Stop
Bookmarks Location: http://depni.npi.msu.su/exforV2/index.php3
What's Related
Bibliography
Reference :
Type, code and year of publication
Type :
B Book
C Conference
Code :
help
Year :
1999 1965-1975 1948,1985,1997
Author :
Name of any author of publication
Institute :
Institute(s) at which experiment was performed
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50
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Ukrainian Nuclear Data Centre
Status report to the Consultants' Meeting on
Co-ordination of the Nuclear Reaction Data Centres
(Technical Aspects)
Vienna, 28-30 May, 2001

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

Compilation

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

Collaboration

- We continue our collaboration with Slavutych Laboratory (SLIRT) in scientific support of Slavutych Nuclear Data Bank and its users. In frame of this activity the teaching course "The use of code NJOY 91/97"(72 hours) was lectured at this laboratory in September 2000.

- The active work under the joint project supported by STCU #1648 *Development and support of Nuclear Data Base in Slavutych for decommissioning of Chornobyl NPP reactor units* will be started this year soon (the period 2001-2004).

- The teaching course "Nuclear Data for Science and Technology " was lectured in 2000-2001 for graduate course students of Kyiv University, Physical Department. This course included the following items:

    1. ENDF/B libraries
    2. EXROR system
    3. ENSDF library
    4. The use of PREPRO codes in the work with ENDF libraries
    5. The Network of Nuclear Data Centers and the use of on-line services

- During 2000-2001 the data for users requests were prepared and adapted (from ENDF, ENSDF and EXFOR libraries) for our institute researchers and from other institutes.

Preparation of Guide for Reactor Dosimetry

- The work on *Neutron Exitation Function Guide for Reactor Dosimetry* was done and it is close to end. The list of included reactions is enclosed in *Appendix*. Each reaction is provided with information file and several graphic functions (from one to nine). Graphics are presented using the code ZVV 9.2 as PS-files. For each reaction in Dosimetry file the excitation functions from ENDF/B formatted libraries are presented. For reactions (n,γ) and (n,f) the resonance area is presented in group-form as in SAND II structure. To facilitate the analysis of discrepances in data from different libraries there are presented the 10, 50 and 90% responce functions and cross sections averaged over U-235 thermal neutron fission spectrum and Cf-252 spontaneous fission spectrum in Tables. Experimental data and short information on date and author of these data are presented on the graphics (more detailed information is given in supplementary Table).

N	Reaction	MT	Reactor Dosimetry Files			Evaluated Nuclear Data Files				
			IRDF-90	D-99	RRDF-98	ENDF/B-VI	JENDL-3	JEF-2	BROND-2	CENDL-2
1.	3-Li-6 (n, t) 2-He-4	105	+	+		+	+	+	+	
2.	3-LI-6 a-prod	207		+						
3.	3-Li-7 (n, n+t) 2-He-4 (t-prod)	205		+			+	+		+
4.	5-B-10 (n, a) 3-Li-7	107	+	+		+	+	+		+
5.	5-B-10 a-prod	207		+						
6.	6-C-12 (n, 2n) 6-C-11	16			+					
7.	8-O-16 (n, 2n) 8-O-15	16			+		+			+
8.	9-F-19 (n, 2n) 9-F-18	16	+	+	+	+	+	+	+	+
9.	11-Na-23 (n, 2n) 11-Na-22	16		+		+	+	+	+	+
10.	11-Na-23 (n, ?) 11-Na-24	102	+	+		+	+	+	+	+
11.	12-Mg-24 (n, p) 11-Na-24	103	+	+	+	+	+			
12.	13-Al-27 (n, p) 12-Mg-27	103	+	+		+	+	+		+
13.	13-Al-27 (n, a) 11-Na-24	107	+	+		+	+	+		+
14.	15-P-31 (n, p) 14-Si-31	103	+	+		+	+	+	+	+
15.	16-S-32 (n, p) 15-P-32	103	+	+		+	+	+		
16.	21-Sc-45 (n, ?) 21-Sc-46	102	+	+		+	+			
17.	22-Ti-0 (n, x) 21-Sc-46	220		+						
18.	22-Ti-0 (n, x) 21-Sc-47	221		+						
19.	22-Ti-0 (n, x) 21-Sc-48	222		+						
20.	22-Ti-46 (n, 2n) 22-Ti-45	16		+	+		+			
21.	22-Ti-46 (n, p) 21-Sc-46	103	+	+	+	+	+			
22.	22-Ti-47 (n, np) 21-Sc-46	28	+	+	+	+	+			
23.	22-Ti-47 (n, p) 21-Sc-47	103	+	+		+	+			
24.	22-Ti-48 (n, np) 21-Sc-47	28	+	+	+	+	+			
25.	22-Ti-48 (n, p) 21-Sc-48	103	+	+	+	+	+			
26.	22-Ti-49 (n, np) 21-Sc-48	28		+	+		+			
27.	23-V-51 (n, a) 21-Sc-48	107	+(00)		+(51)	+(00)		+(00)		+(00)
28.	24-Cr-50 (n, ?) 24-Cr-51	102		+		+	+	+	+	+
29.	24-Cr-52 (n, 2n) 24-Cr-51	16	+	+		+	+	+	+	
30.	25-Mn-55 (n, 2n) 25-Mn-54	16	+	+		+	+	+		+
31.	25-Mn-55 (n, ?) 25-Mn-56	102	+	+		+	+	+		+
32.	26-Fe-54 (n, 2n) 26-Fe-53	16			+	+	+	+	+	+
33.	26-Fe-54 (n, p) 25-Mn-54	103	+	+		+	+	+	+	+
34.	26-Fe-54 (n, a) 24-Cr-51	107			+	+	+	+	+	+
35.	26-Fe-56 (n, p) 25-Mn-56	103	+	+	+	+	+	+	+	
36.	26-Fe-57 (n, np) 25-Mn-56	28		+		+	+	+		+
37.	26-Fe-58 (n, ?) 26-Fe-59	102	+	+		+	+	+	+	+
38.	26-Fe-58 (n, a) 24-Cr-55	107				+	+	+	+	+
39.	27-Co-59 (n, 2n) 27-Co-58	16	+	+		+	+	+		+

40.	27-Co-59 (n, ?) 27-Co-60	102	+	+		+	+	+		+
41.	27-Co-59 (n, a) 25-Mn-56	107	+	+	+	+	+	+		+
42.	28-Ni-58 (n, 2n) 28-Ni-57	16	+	+		+	+	+	+	
43.	28-Ni-58 (n, p) 27-Co-58	103	+	+		+	+	+	+	
44.	28-Ni-60 (n, p) 27-Co-60	103	+	+		+	+	+	+	
45.	29-Cu-63 (n, 2n) 29-Cu-62	16	+	+		+	+			+
46.	29-Cu-63 (n, ?) 29-Cu-64	102	+	+	+	+	+			+
47.	29-Cu-63 (n, a) 27-Co-60	107	+	+	+	+	+			+
48.	29-Cu-65 (n, 2n) 29-Cu-64	16	+	+		+	+			+
49.	30-Zn-64 (n, p) 29-Cu-64	103	+	+				+		
50.	33-As-75 (n, 2n) 33-As-74	16			+		+			
51.	39-Y-89 (n, 2n) 39-Y-88	16	+	+		+	+	+		
52.	40-Zr-90 (n, 2n) 40-Zr-89	16	+	+		+	+		+	
53.	41-Nb-93 (n, 2n) 41-Nb-92	16	+	+	+					
54.	41-Nb-93 (n, n′) 41-Nb-93m	57	+	+	+					
55.	41-Nb-93 (n, ?) 41-Nb-94	102	+			+	+	+	+	+
56.	45-Rh-103 (n, n′) 45-Rh-103m	57	+	+	+					
57.	47-Ag-109 (n, ?) 47-Ag-110	102	+	+		+	+	+	+	+
58.	48-Cd-0 (n, ?)	102	+			+	+	+		+
59.	49-In-115 (n, 2n) 49-In-114	16	+				+			
60.	49-In-115 (n, n′) 49-In-115m	57	+	+	+					
61.	49-In-115 (n, ?) 49-In-116	102	+	+		+	+	+		
62.	53-I-127 (n, 2n) 53-I-126	16	+	+		+	+	+		
63.	57-La-139 (n, ?) 57-La-140	102					+	+		
64.	59-Pr-141 (n, 2n) 59-Pr-140	16			+	+	+	+		
65.	63-Eu-151 (n, ?) 63-Eu-152	102		+		+	+	+		
66.	64-Gd-0 (n, ?)	102	+						+	
67.	69-Tm-169 (n, 2n) 69-Tm-168	16		+						
68.	73-Ta-181 (n, ?) 73-Ta-182	102		+		+	+	+	+	+
69.	74-W-186 (n, ?) 74-W-187	102		+		+	+	+	+	
70.	79-Au-197 (n, 2n) 79-Au-196	16	+	+		+		+	+	+
71.	79-Au-197 (n, ?) 79-Au-198	102	+	+		+		+	+	+
72.	80-Hg-199 (n, n′) 80-Hg-199m	57		+						
73.	82-Pb-204 (n, n′) 82-Pb-204m	57					+		+	
74.	90-Th-232 (n, f)	18	+	+		+	+	+	+	+
75.	90-Th-232 (n,?) 90-Th-233	102	+	+		+	+	+	+	+
76.	92-U-235 (n, f)	18	+	+		+	+	+	+	
77.	92-U-238 (n, f)	18	+	+		+	+	+	+	+
78.	92-U-238 (n, ?) 92-U-239	102	+	+		+	+	+	+	+
79.	93-Np-237 (n, f)	18	+	+		+	+	+		+
80.	94-Pu-239 (n, f)	18	+	+		+	+	+	+	+
81.	95-Am-241 (n, f)	18		+		+	+	+	+	+

PROGRESS REPORT
to 2001 NRDC Meeting on Technical Aspects of Co-operation

ZHUANG Youxiang
CHINA NUCLEAR DATA CENTER (CNDC)

I. General Situation

The first half of 2001, Drs. Zhou Chunmei and Liu Tingjin were retired, and the second half Dr. Shen Qingbiao will be retired; next year Dr. Yu Baosheng will be also retired. That time CNDC will be basically in the younger generation.

II. Evaluation

China Evaluated Nuclear Data Library, version 3 (CENDL-3) were accomplished in 2000.

CENDL-3 contains about 206 nuclides. Among them, the data of 161 nuclei will be newly or reevaluated:

(1) Fissile nuclei 15 ($^{233\sim239}$U, ^{237}Np, $^{238\sim242}$Pu, $^{241,\ 242}$Am)

(2) Structure material nuclei 34

(Natural elements Ni, Cu, Zr, Hf, Pb and their isotopes, ^{23}Na, ^{Nat}Si)

(3) Light nuclei 3 ($^{6,\ 7}$Li, ^{9}Be)

(4) Fission product nuclei 109

(For example, $^{85,\ 87}$Rb, $^{136,\ 138,\ 140\sim144}$Ce, $^{151,\ 153,\ 154,\ 155}$Eu……)

The files 1~4, 6, 12~15 are included in important nuclides (major fissile nuclide, structure materials and light nuclide), only files 1~5 are given for minor fissile and fission product nuclides. The data for structure materials are given for both natural element and their all isotopes. The double differential cross sections (file 6) for light nuclei were calculated with code LUNF and represent experimental data well.

The benchmark testing for CENDL-3 is being carried out. Several problems in physics and format have been found on major fissile nuclides, and are being improved.

III. CINDA and EXFOR Compilation

1. CINDA

118 entries were compiled from the works in “communication of Nuclear Data Progress” in 1999~2000.

2. EXFOR

Two young staffs of CNDC have started the EXFOR compilation, and fished 16 entries measured in China.

IV. Publication

<<***Communication of Nuclear Data Progress***>>(CNDP) has been published for 24 issues by CNDC and Atomic Energy Press science 1989, and it (350 books/each issue) has also been distributed by IAEA nuclear data section as an INDC document.

V. Activities and Cooperation during 2000

1. Meeting Hold in China

1) "The Working Meeting on Fission Nuclei", Mar. 6~8, Beijing;
2) "The Standing Committee Meeting of China Nuclear Data Committee, Aug. 4, Beijing;
3) "The Working Meeting of Multi-group Constant and Benchmark Test", Aug. 23~28, Nanchang;
4) "The Working Meeting on Nuclear Data Measurement", Nov. 27~Dec, 2, Kunming

2. Foreign Scientists Visited in CNDC

Dr. Charles Dunford, NNDC, USA, Jun. 25~29;
Dr. Tokio Fukahori, JAERI, Japan, Sep. 3~10.

3. Staffs of CNDC Worked or Visited in Foreign Country

Han Yinlu worked in KAERI, Oct. 10, 1998~Apr. 7, 2000;
Rong Jian works in JAERI on Aug. 1, 2000, for one year;
Zhuang Youxiang, Zhou Chunmei and Huang Xiaolong visited the Central Research Institute of Management, Economics and Information, Moscow, Russia, Oct. 2~10, 2000.

Japan Charged-Particle Nuclear Reaction Data Group (JCPRG)

Progress Report to the NRDC Meeting
May 28-30, 2001

The Executive Committee of JCPRG

General

In 2000, we have carried out the following businesses:

1. Compiling the CPND(Charged Particle Nuclear Reaction Data) (15 papers) produced in Japan with the NRDF(Nuclear Reaction Data File) format.
2. Translating the NRDF data into the EXFOR data. (Revised 30 papers, New 8 papers)
3. Making retrieval systems using internet and the InteligentPad for the CPND in both of NRDF and EXFOR,
4. Distributing the CPND and promoting utilization in Japan.
5. Making a new system to transform from NRDF to EXFOR based on the InteligentPad.

In 2000 much of our effort was concentrated on the second and fifth subjects mentioned above. We also completed a preliminary version of a new electric editor system for compiling and inputting the NRDF data.

NRDF Data Compiling Activity

In 2000 we newly compiled 15 entries (95 tables, 0.30 MB) based on the data obtained with the accelerators in Japan.

List of Data-entries Installed into NRDF in 2000

1. D1720
   Title: LIFETIME MEASUREMENT OF THE FIRST EXCITED STATE OF ^{64}GA
   First Author: M. TANIGAKI
   Journal: Eur. Phys. J. A 6 p119 1999

2. D1721
   Title: QUADRUPOLE DEFORMATION OF ^{12}BE STUDIED BY PROTON INELASTIC SCATTERING
   First Author: H. IWASAKI
   Journal: Physis Letters B481 p7 2000

3. D1722
   Title: REACTION MECHANISM AND CHARACTERISTICS OF T_{20} IN D+^{3}HE BACKWARD ELASTIC SCATTERING AT INTERMEDIATE ENERGIES
   First Author: M. TANIFUJI
   Journal: Physical Review C61 p024602 1999

4. D723
   Title: PRECISE MEASUREMENT OF DP ELASTIC SCATTERING AT 270 MEV AND THREE-BUCLEON FORCE EFFECTS
   First Author: H. SAKAI
   Journal: Physical Review Letters B84 p5288 2000

5. D1724
   Title: CORE-EXCITED STATES IN THE DOUBLY MAGIC 68NI AND ITS NEIGHBOR ^{69}CU
   First Author: T. ISHII
   Journal: Physical Review Letters B84 p39 2000

6. D1725
   Title: REACTION MECHANISM OF ^{6}LI SCATTERING AT 600 MEV
   First Author: K. SCHWARZ
   Journal: Eur. Phys. J. A 7 p367 2000

7. D1726
   Title: POLARIZATION CORRELATION COEFFICIENT FOR THE ^{3}HE(D,P)4HE REACTION
   First Author: T. UESAKA
   Journal: Physics Letters B467 p199 1999

8. D1727
   Title: (^{6}LI,^{6}HE) REACTION AT 100 MEV/NUCLEON AS A PROBE OF SPIN-EXCITATION STRENGTHS
   First Author: H. UENO
   Journal: Physics Letters B465 p67 1999

9. D1728
   Title: LIFE TIME MEASUREMENTS OF MEDIUM-HEAVY LAMBDA HYPERNUCLEI
   First Author: H. PARK
   Journal: Physical Review C61 p054004 2000

10. D1729
    Title: LEVEL STRUCTURE IN ^{143}ND
    First Author: X. H. ZHOU
    Journal: Physical Review C61 p014303 1999

11. D1730
    Title: TENSOR POLARIZATION OF 12C[2_1^+] in the ^{16}O(^{13}C,^{12}C)^{17}O REACTION AT 50 MEV
    First Author: N. IKEDA
    Journal: Eur. Phys. J. A 7 p491 2000

12. D1731
    Title: ASYMMETRY IN THE NONMESONIC WEAK DECAY OF POLARIZE $^{5}_{\Lambda}$HE HYPERNUCLEI
    First Author: S. AJIMURA
    Journal: Physical Review Letters B84 p4052 2000

13. D1732
    Title: FUSION OF DEFORMED NUCLEI IN THE REACTIONS OF ^{76}GE+^{150}ND AND 28SI+198PT AT THE COULOMB BARRIER REGION
    First Author: K. NISHIO
    Journal: Physical Review C62 p014602 2000

14. D1733
    Title: DOUBLE-PION PRODUCTION INDUCED BY DEUTERON-PROTON COLLISIONS IN THE INCIDENT DEUTERON MOMENTUM RANGE 2.1-3.8 GEV/C
    First Author: T. TSUBOYAMA
    Journal: Physical Review C62 p034001 2000

15. D1734
    Title: NANOSECOND ISOMERS IN NEUTRON-RICH ^{67}CU AND ^{64}CO AND A FAST E3 TRANSITION IN ^{67}CU
    First Author: M. ASAI
    Journal: Physical Review C62 p054313 2000

EXFOR Translation from NRDF

In 2000, we have concentrated our much effort in the field of translation from NRDF to EXFOR. In order to solve the problems that the translation efficiency by the conputational translation system is not high, we had discussions in which O. Schwerere joined. He stayed one month in Sapporo and helped our learning how to make EXFOR file by manual. As a result, we revised E016 (31 entries), E017 (9 entries) and E018 (7 entries) which were pointed to have some problems. Furthermore, we made a new file of E019 (12 entries) during stay of Schwerere in Sapporo, and are now making another new file of E020 (10 entries).

We are now going to have two ways of making EXFOR files from NRDF ones; (1) by manual in addition to the old translational system, and (2) by a new translational system which is constructing by Chiba. To translate from NRDF to EXFOR smoothly, we found that the NRDF dictionary must be completed comparing EXFOR codes. However, it is worthwhile to indicate that there are no problems, in principle, in making EXFOR files based on the NRDF data except for several data concerning evaluation and deduced data in NRDF. Furthermore, several codes, for instance Institute Codes, should be proposed as the EXFOR Codes.

Customer Services

Retrieval services of NRDF and EXFOR data are available by using computers in the Hokkaido University Computing Center. In addition to these services, the WWW homepage (http://nucl.sci.hokudai.ac.jp/ ~nrdf/index.html) has been opened to public.

In order to extend the NRDF data service, we have studied a developed retrieval system based on the IntelligentPad.

ANNEX: Organization and members of JCPRG

Advisory committee:

Yasuhisa ABE (Research Institute for Fundamental Physics, Kyoto Univ.)
Yoshinori AKAISHI (Institute for Nuclear Study, Tokyo Univ.)
Yasuo AOKI (Tsukuba Univ.)
Junsei CHIBA (National Institute for High Energy Physics)
Masayasu ISHIHARA (Tokyo Univ.)
Ichiro KATAYAMA (Institute for Nuclear Study, Tokyo Univ.)
Mituji KAWAI (Kyushu Univ.)
Akira HASEGAWA (Japan Atomic Energy Research Institute)
Tetsuo NORO (Research Center for Nuclear Physics, Osaka Univ.)
Shunpei MORINOBU (Kyushu Univ.)
Hajime OHNUMA (Tokyo Institute of Technology)
Hikonojo ORIHARA (Cyclotron and Radioisotope Center, Tohoku Univ.)
Teijiro SAITOH (Tohoku Univ.)
Hajime TANAKA (Sapporo-Gakuin Univ.)
Yoshihiko TENDO (Institute of Physical and Chemical Research)
Koichi OKAMOTO (Nihon Univ.)
Kiyoshi KATŌ (Hokkaido Univ.)

Executive committee:

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

Secretariat:

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Working Staff:

(1) Data compiling:

Hirokazu TEZUKA(Tohyo Univ.)

Yuka AOKI(RIKEN)

Shigeyoshi AOYAMA(Kitami Institute of Technology)

Yuichi HIRATA(Hokkaido Univ.)

Masayuki AIKAWA(Hokkaido Univ.)

Takayuki MYO(Hokkaido Univ.)

Naohiko OTUKA(Hokkaido Univ.)

Ryusuke SUZUKI(Hokkaido Univ.)

(2) Data input:

Takako ASHIZAWA(Hokkaido Univ.)

Hitomi YOSHIDA (Hokkaido Univ.)

NRDF System Maintenance:

Akira OHNISHI(Hokkaido Univ.)

Working Staff of Transformation from NRDF to EXFOR:

Masaki CHIBA(Sapporo-Gakuin Univ.)

Toshiyuki KATAYAMA (Hokusei-Gakuen Univ.)

Hiroshi NOTO (Hokusei-Gakuen Univ.)

Working Staff of Making a Data-base based on IntelligentPad:

Yoshihide OHBAYASI(Hokkaido Univ.)

Hiroshi MASUI(Hokkaido Univ.)

Working Staff of Making a Compiling Editer System:

Hirokazu OHMI(Hiokkaido Univ.)

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ACTIVITY OF CAJAD

for the

Consultants' Meeting on the Co-ordination of Nuclear Reaction Data Centres (Technical Aspects), Vienna, 28-30 May 2001

S. Babykina

Nuclear Structure and Reaction Data Centre
Kurchatov's Institute, Moscow

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

1. **Compilation A-Library**

   After the last meeting in 2000, we prepared **A048 and A049**

   Transes - The Trans contains monitor reaction data, astrophysical data

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

   During the year 2000, 100 entries were prepared and included in O-library
   These entries contain differential data for elastic and inelastic scattering and production cross section radioactive and stable isotopes. This work is orientated for nuclear wastes transformation and medical applications.

3. **The Data Base**

   The data base has been prepared at the CDFE using the charge particle reaction catalogue data file produced by CAJAD. This data base is the first experience of the reaction index preparation using the problem-oriented retrieval from the charge particle reaction cross sections part of the international EXFOR nuclear data library. The data for stable and radioactive final nuclei production reactionas are included. Numerical data from EXFOR SUBENT DATA tables are available for all catalogue cross sections. Many of the selected cross sections can be obtained in graphical form.

NEA Data Bank Report to the NRDC, Vienna, 28-30 May 2001

Introduction

The Data Bank continues to have its full staff level of two professionals working on Nuclear Data topics, namely Dr Mark Kellett and Dr Ali Nouri.

Experimental (EXFOR) and Bibliographic (CINDA) data compilation

A total of 70 EXFOR entries for neutron induced experiments, were compiled and transmitted to the other data centres in since the last meeting in May 2000. Forty six (46) of these entries concerned new experiments.

More than 600 new entries were compiled into the CINDA database in the same period.

The updated CD-ROM version of the CINDA database has once again been distributed. Little feedback has been received during 2000 following the original distribution, probably due to the extensive testing that was carried out prior to its distribution.

Intermediate Energy Nuclear Data (IEND) for EXFOR

In 2000 the Data Bank compiled ~100 new data sets from charged particle induced experiments and these are currently undergoing testing before being entered into the EXFOR database. Due to additions to the database structure, a complete re-writing of the loading/retrieval programs (conversion from FORTRAN coding to PERL scripts) and hardware upgrades the loading has been delayed somewhat. Currently there are approximately six (6) tapes awaiting loading. The first five (5) of these have undergone the preliminary testing stage in the FTP site at Vienna and will be finally loaded and distributed during June 2001.

The Joint Evaluated Fission and Fusion Project (JEFF)

Two versions of the JEFF-3.T general-purpose starter file were produced in 2000, following improvements to the evaluations through the correction of format and physics errors. New evaluations are incorporated as they become available (e.g. EFF files) or when changes to the initial recommendations (e.g. for Fission Products and Minor Actinides) are decided based on additional evidence. The validation of the file is ongoing in the form of calculations of a subset of the JEF-2.2 benchmarks. Special emphasis is being put on PWR uranium lattices, since earlier results showed a slight systematic underestimation of the reactivity of these lattices.

For the production of the Radioactive Decay Data starter file, comparisons were made between the two libraries recently produced in the UK, UKPADD-6.1 and UKHEDD-2.2, and further evaluations based on NUBASE and ENSDF data. The first version of the JEFF-3.T Decay Data file, containing ~3700 nuclides, was produced in late 2000 and extensive testing was applied including the development of specific methods for energy balance checks. These have been implemented into the FIZCON code, renamed EFIZCON, and the changes have been sent to Charlie Dunford for consideration for inclusion into the official version of the code. The feedback received from this first step is being implemented in the production of a second version of the starter file expected for June 2001. The Fission Yields starter file, consistent with this JEFF-3 Decay Data starter file, still has to be produced based on the UKFY3 evaluations,

normally produced by Robert Mills of BNFL in the UK. It is hoped that this work will be completed by the end of 2001.

The production of the JEFF-3 Intermediate Energy files, by extending the evaluations up to 150 MeV, will take place based on calculations with the TALYS nuclear reaction model code, being developed by Arjan Koning of NRG Petten and colleagues at Bruyeres-le-Chatel in France, as soon as this new code becomes fully operational later in 2001.

The target date for the official release of the first version of the JEFF-3 library is 2002. Current efforts aim at assuring that this library will be of high quality, internally consistent and as free of errors as possible. Following this initial release, the various parts of the file will be completed and improved in subsequent versions. As with past JEF and EFF libraries, improvements of the JEFF-3.0 library will be guided by users' needs and feedback, as well as by the results of the benchmarking studies.

The latest JEFF meeting was held in Aix-en-Provence on 15-18 May 2001. Other workshops were also held in conjunction with this JEFF meeting, including the NJOY users' group and a workshop on the measurement needs of the JEFF project, which incorporated possible contributions from the experimental community. This second meeting was attended by participants from numerous European facilities and following from its success a new sub-group of the JEFF project will meet regularly to discuss experimental measurements and their needs.

Apart from the JEFF files themselves, an extensive effort in year 2000 was devoted to the area of documentation. After the publication of two inter-comparison exercise reports (JEFF reports 15 and 16), the official JEF-2.2 documentation, containing all the results from the benchmark testing of the file, was issued in 2000 as JEFF Report 17. Finally, a reference document on resonance data evaluation, describing the underlying physics, mathematical and statistical background, was published, in cooperation with CEA Cadarache and EdF, as JEFF Report 18. This report was complemented by the organisation, for the second time in two years, of a full week training course on the resonance analysis code SAMMY. All the JEFF reports are available free of charge from the NEA Data Bank or can be downloaded online from our web pages.

Almost all new JEF and EFF documents are received in electronic form prior to the meetings and are made available via the associated web pages. The documents can thus be searched by keywords without the need for scanning and Optical Character Recognition processing. Participants to the meetings are also encouraged to make their presentations directly from a PC as this allows a much better quality to be achieved. Access to these documents is generally restricted to project members as they can contain data and results which may be preliminary in nature. Access can be granted to non-members on an individual basis upon request.

High Priority Request List

The NEA Data Bank has taken an initiative on behalf of the WPEC sub-group concerned with the High Priority Request List. This involves loading the List into an ORACLE database so that online searches can be performed, but more importantly specific users can add comments to the list concerning the quoted requests. This should allow the document to become more accessible and much more "alive". All users will be able to work on the same List at the same time and hence updating and management becomes much more efficient.

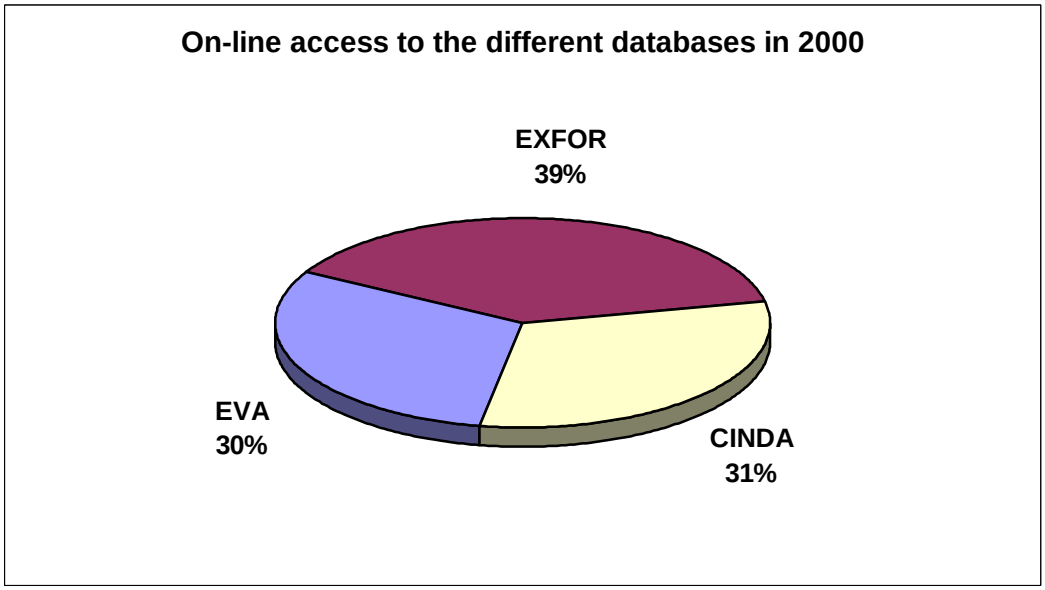
JANIS Software and documentation

JANIS (the Java Nuclear Information System) is a computer program to display different types of nuclear data (experimental, evaluated and processed data). JANIS inherits the features of JEF-PC, while incorporating a number of improvements such as the capability to display resonance parameters, energy and angular distributions, etc.. JANIS was written in JAVA for maximum portability. Beta versions were distributed by the NEA Data Bank to more than sixty users for testing purposes (see http://www.nea.fr/html/dbdata/janis/). This testing has provided interesting feedback, thus enabling the Data Bank to improve the capabilities of the software. The official version will be released in conjunction with the next Nuclear Data Conference to be held in Japan in October 2001.

Services to Nuclear Data Users

The Data Bank answered one hundred and eighty (180) manual data requests in 2000. Most of these were either for copies of the CD-ROM of the JENDL-3.2 general-purpose file (90 copies) or of the JENDL/D-99 dosimetry file (70 copies), made available to the Data Bank by the JAERI Nuclear Data Centre. Other than the distribution of these two CD-ROMs, the number of manual requests continues to decrease as the online service improves and more users become registered for direct data downloads. Most of the requests now coming to the Data Bank do not require data to be directly distributed, but instead relate to giving advice on the use of the data that is available via our online services.

The number of registered on-line accesses in 2000 was slightly more than twenty thousand (20,000). More than 8 Gigabytes of data were retrieved directly on-line. Close to two thousand (2,000) scientists have registered and obtained passwords for access to the databases containing nuclear data. The following figure shows the division of these accesses between our various databases, EVA being the evaluated data database, generally for the main international libraries in the ENDF-6 format.



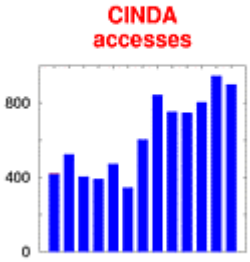
It is planned to improve the nuclear data customer services by providing an on-line graphical display possibility. The on-line graphical display for EXFOR data is in place and allows users to produce high quality output for publication purposes, or to use a JAVA based tool which allows easy online manipulation and zooming. The planned extension to include also evaluated cross section data plotting directly on the Data Bank's Web page or from a distributed CD-ROM is under way and is expected to be available for testing in early summer 2001. This work is being closely co-ordinated with the JANIS development.

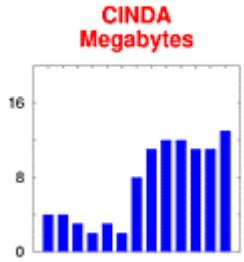
The following figures show the online statistics for the various databases for the preceding 13 months, i.e. April 2000 – April 2001.

Nuclear Data Services Web Statistics April 2000 – April 2001

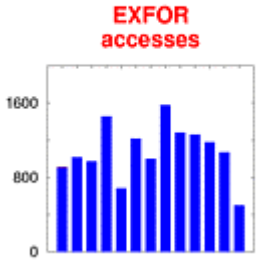
All figures show the last 13 months of activity

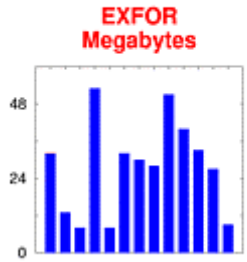
CINDA Bibliographic database



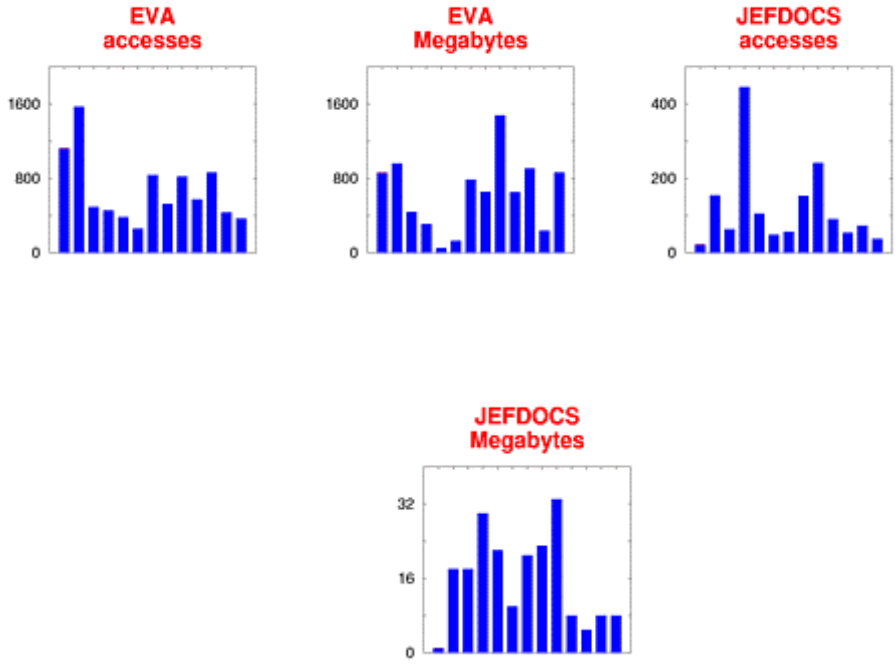


EXFOR Experimental database





Evaluated Data database **JEFF/EFF Project Documents**



List of 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.*

WP2001-1 Actions and Conclusions of the 2000 NRDC Meeting:
see INDC(NDS)-418, pp. 26-31

WP2001-2 Inventory of TRANS files exchanged since the last meeting

WP2001-3 Proposals by S.Maev on the CINDA-2001 draft manual

WP2001-4 Data headings and units for wavelength and kT

WP2001-5 On LEVEL-PROP: *see memos CP-C/269 and CP-A/102*

WP2001-6 Proposed Polarization Quantities

WP2001-7 Correlation / Angular correlation: Clarifications and dictionary cleanup

WP2001-8 Proposed quantity PAR/M-,DA,G

WP2001-9 Clarifications on some proposed report and journal codes
See memos CP-D/323, 4C-4/109, 4C-4/111, 4C-4/116, and CP-C/278

WP2001-10 Coding of Chemical Compounds: Clarifications

WP2001-11 Energy of isobaric analog states: *see memos CP-C/281, CP-A/112, and CP-C/264*

WP2001-12 Proposed additions to Dict.30 (Process) and 27 (Pions in Nuclide Dict.)
See memos 4C-4/120, CP-A/107, and CP-A/103

WP2001-13 Proposed heading PART-OUT for Dict. 24: *see memo CP-A/108*

WP2001-14 Units N/PART/SR etc. for Dict. 25

WP2001-15 Coding of differential neutron multiplicity distributions

WP2001-16 Headings E-LVL-INI, E-LVL-FIN as "additional information"

WP2001-17 Dictionary sorting flags and wildcards

WP2001-18 IAEA/NDS priorities in the EXFOR compilation

WP2001-19 Errors found in EXFOR by X4 C-Utilities

WP2001-20 Multiple appearance of first Reference in EXFOR

WP2001-21 CSISRS Library Statistics (NNDC)

WP2001-22 Proposed quantity PRE,AP/DA,FF
See memo CP-E/001

WP2001-23 CINDA-2001 Manual **(24 May 2001)**

WP2001-24 Correspondence of quantity codes for CINDA-2001

WP2001-25 EXFOR as a multi-platform relational database: current status of development

WP2001-26 Compilation and Evaluation of Alpha-Induced Nuclear Reaction Cross Sections for Astrophysics

WP2001-27 Layout of CINDA 2001 book

WP2001-28 Journal coverage for CINDA

Inventory of EXFOR TRANS files exchanged since the 2000 NRDC Meeting

(Status: 21 May 2001)

Prelim. = "Preliminary" TRANS files still in the "PRELIM" subdirectory of the NDS Open Area (~4 weeks for checking by other centers)

Area 1: (1288 fin.); 1289 through 1294

Area 2: (2150, 2151, 2152, 2153, 2154 fin.)

Area 3: (3106 fin.); 3107; Prelim.: 3108

Area 4: 4119, 4120, 4121, 4122; Prelim.: 4123

Area A: A048; Prelim.: A049

Area B: Prelim.: B018

Area C: (C039 fin.); C040 through C049; Prelim.: C050

Area D: none

Area E: E016Rev., E017 Rev.; (E018 fin.); Prelim.: E019

Area F: (F012 fin.)

Area M: Prelim.: M030

Area O: Prelim.: O009, O010, O011, O012, O013, O014

Area P: P003

Area S: none

Area T: T005, T006, T007, T008

Latest proposal by NNDC:

New heading **KT-K** for kT in Kelvin;

Use heading **KT** for kT in energy units.

Memo CP-D/322

10 May 2001

From: O. Schwerer

To: Distribution

Subject: Data headings and units for wave length and kT

Reference: CP-C/267

The above memo proposes to make temperature units (e.g. K for Kelvin) standard units for spectrum temperature kT, and to resurrect the data heading WVE-LN for cases where wavelength in Angstrom replaces the incident particle energy.

1) kT (current unit code E).

While we agree that every heading should go with only one dimension ("unit code"), we cannot confirm the finding that only 5 data sets are coded with kT and only 3 with kT in energy units.

We found 57 entries coded with kT, of which only 7 use temperature units (K, DEG-K [which is obsolete] or K9), whereas the other 50 use energy units (most often KEV, but also EV and MEV). See **Appendix 1** for list of entry numbers.

We do not believe that energy units are unusual or inappropriate for kT (in several places one finds the statement that *"for Maxwellian spectra EN-MEAN = 3/2 KT").* A typical example for the usage is the TITLE of entry 22145 (Phys.Rev.C35,936): "Stellar Krypton cross sections at kT=25 and 52 keV".

Therefore we propose to keep E as the (only) dimension (unit code) for kT, and to introduce a new heading for those few cases which are in the file with kT in temperature units.

2) Heading WVE-LN

We agree to reintroducing the heading WVE-LN for those cases where wavelength in Angstrom replaces the incident particle energy. Consequently, all check programs must be updated accordingly (no messages "missing incident particle energy" must be issued if WVE-LN is given). A list of all entries with EN in Angstroms is given in **Appendix 2.**

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Appendix 1: Entries coded with kT

Entries with kT in energy units:

13634	22195
13647	22253
13695	22254
21548	22255
21737	22256
21761	22285
21768	22305
21882	22307
21899	22337
21906	22374
21913	22375
21933	22377
21948	22387
21991	22442
22008	22447
22009	22448
22010	22449
22037	40296
22078	40547
22099	40553
22145	40847
22163	40922
22171	D0016
22177	D0018
22182	D0020

Entries with kT in temperature units:

22000	DEG-K
A0653	K
A0654	K
C0108	K
10261	K
F0311	K9
F0421	K9

Appendix 2: Entries with EN in ANGSTROM

10156	12674
10185	12675
10345	12861
10495	13045
11198	13468
11258	13652
11301	21336
11783	21369
11786	30123
11809	30168
11973	30177
11974	30226
12150	30342
12243	40046
12593	40049
12617	41323
12666	88023

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Memo CP-C/267

DATE: June 2, 2000
TO: Distribution
FROM: V. McLane
SUBJECT: Data headings and units for wave length and kT

There presently exist some inconsistencies in the data heading vs. unit codes in Dictionary 24. The checking and processing codes must, therefore, make exceptions for these cases. I propose, as we are looking at new directions in databases, it would be a good time to bring the dictionaries into compliance, that is, to make the unit codes correct in all cases.

Following are 2 cases where the present codes are not adequate.

1.) kT (current unit code E). The data may be given in K (unit code TEM) or eV (unit code E).

In checking the units for kT, I find only 5 sets already coded. Of these, 3 were coded using units of K. For the 2 that were coded using units of eV, both were given in the reference as K.

Therefore, I propose that the standard unit type for kT should be temperature. We should deal with other cases as they come along.

2.) Wave-length (currently coded under the heading EN with unit code E). These are always given as angtröms (unit code L).

At present the I only find neutron data coded vs. wave-length. I propose we resurrect the data heading WVE-LN to be used with units of length (L).

If this proposal is accepted, I volunteer to update the entries and send them to the responsible center for retransmission.

Proposed Polarization Quantities

In several memos new polarization quantities were proposed. Most of them were included in the last dictionary transmission but some still require clarification or consolidation. *All memos are available from NDS.*

CP-C/282	2001-05-15	Spin-spin data. Please clarify what the change is compared to the proposal of CP-C/273 (see below)
CP-D/320	2001-04-26	Clarification requested about Tensor Analyzing Power; General remark on CP-C/271, 272
CP-E/002	2001-03-13	Proposed NN,POL/DA/DE,,K To confirm consistency with quantities proposed in CP-C/271,272 and to include in LEXFOR entry
CP-D/273	2000-09-08	Proposed quantities for neutron-transmission spin-spin measurements. 1) Is the proposed LEXFOR text part of the entry on Polarization? 2) Dict.36 expansion for ,POL,,DSP/ASY?
CP-D/272	2000-09-14	List of Polarization quantities for dictionary 36 (Note: CP-D/272 Rev. is dated 2000-09-08; Dictionary update 9077 was done for original memo version dated 2000-09-14)
CP-D/271	2000-08-14	Polarization LEXFOR entry (Note: no obvious difference to CP-D/271 Rev. of 2000-09-08)

Correlation / Angular correlation: Clarifications and dictionary cleanup

- Memo **4C-4/107** (attached) proposes several new quantities for **angular correlations**, using COR in SF6.
- Existing dictionary 36 entries for angular correlations are **inconsistent**, since similar entries exist with SF6 = COR and SF6 = DA/CRL (e.g. **,COR,N/D** and **,DA/CRL,N/D**, both expanded as "Angular correlation neutrons/deuterons".
- Several years ago it was proposed to change the coding for angular correlations from COR to DA/CRL (There was an Action 20 on McLane of the 1997 NRDC meeting to check the existing EXFOR entries for angular correlations in view of this proposed change.)
- However, the **LEXFOR** page on Correlations, dated November 1997, gives a coding example for angular correlation with SF6=COR.
- If it is agreed that all angular correlations are to be coded with SF6 = DA/CRL, it is not clear whether **COR** should still be used for **other types** of correlations. It should be noted that 2 other types of correlations, not involving angles, were proposed (and added to dictionary 36) also:
  IND,FY/CRL Independent yield of correlated fragment pair, and
  PRE,KE/CRL,LF/HF Total kinetic energy of primary fragment pair
- Different SF6 codes exist for energy, mass, and momentum correlations: ECO, EMC, and MCO.
- It seems that the motivation for the proposed change from COR to DA/CRL for angular correlations was originally, to have different SF6 codes for angular and other types of correlations, e.g. DA/CRL for angular correlations, and COR for other data involving correlated particles. However, the introduction of the above codes with FY/CRL and KE/CRL does not conform to this idea.
- We found only 12 EXFOR entries containing correlations coded with either COR or CRL in SF6, therefore it should not be too difficult to rectify the situation.

  Existing entries with SF6 containing COR or CRL:
  SF6 = COR: 20220, M0035, O0011, O0375
  SF6 = CRL: 30521, 30544, 30916
  SF6 = DA/CRL: T0117
  SF6 = FY/CRL: 13599, 13624, 13648, 13698
  (No entry found with SF6 = KE/CRL.)
- The following steps are proposed (next page).

- **Proposed Actions:**
  - Agree (at this meeting) on a consistent way of coding. Our proposal:
    Code all angular correlations with SF6 = DA/CRL and all other data involving correlated particles which involve no angles with SF6 = COR. (The coding of energy, mass and momentum correlations remains ECO, EMC, and MCO).
  - Draft new LEXFOR entry on angular and other correlations, giving definitions and coding examples for all types (including the required independent variables) and a section (or cross reference) on ECO, EMC and MCO.
  - Update dictionaries accordingly, in particular: obsolete angular correlations with SF6 = COR, include new proposed angular correlations of memo 4C-4/107 using SF6 = DA/CRL instead of COR, and change entries with FY/CRL and KE/CRL to FY/COR and KE/COR, respectively.
  - Except for entry T0117, the 12 entries listed above will have to be retransmitted with corrected REACTION codes, and all centers should check whether any more correlation entries (e.g. in the PRELIM stage) need to be modified.

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MEMO 4C-4/107

DATE: **11 September 2000**
TO: **Distribution**
From: **S. Maev (alias: S.Mayev)**
Subject: **Addition to Dictionary 36**

Following additions to Dictionary are being proposed

Dictionary 36 (Quantities)

Following codes have to be added to Dictionary 36

"TER,COR,G/A,RSD"
Example: REACTION (98-CF-252(0,F),TER,COR,G/A,RSD) Angular Gamma/Alpha correlation

"TER,COR,G/LCP,RSD"
Example: REACTION (98-CF-252(0,F)ELEM/MASS,TER,COR,G/LCP,RSD) Angular Gamma/light-charged-particle correlation

"PR,DA,G,LEG/RS"
Example: REACTION (98-CF-252(0,F),PR,DA,G,LEG/RS) Legendre Coeff. for prompt gamma angular distribution

"TER,COR,G/A,LEG/RS"
Example: REACTION (98-CF-252(0,F),PR,DA,G,LEG/RS) Legendre Coeff. of G/A correlation

"TER,COR,G/LCP,LEG/RS"
Example: REACTION (98-CF-252(0,F)ELEM/MASS,TER,COR,G/LCP,LEG/RS) Legendre coeff. of G/LCP Angular correlation

REFERENCE Phys.Rev.Letters,v.82,#2, p.303,199911
Entry 22461

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Stanislav Maev

Proposed quantity PAR/M-,DA,G

In memo CP-D/311 (200-05-03) quantities PAR/M-,DA,G and PAR/M+,DA,G, were proposed, for compilation of entry31492, but not approved at the 2000 NRDC meeting. Instead, there was Action A40 on all to think of a new, more general way of coding such data. So far no proposals were received.

In memo CP-D/318 (2001-01-18) the proposal for PAR/M+,DA,G was withdrawn. However, we renewed the proposal for PAR/M-,DA,G and suggest to approve it until (or unless) another way of coding is proposed. The proposals we received by e-mail for entry 31492 were based on the wrong assumption that the data measured are for production of the ground state, which is not the case.

Attached are:

Memo CP-D/318 with supporting level scheme from CP-D/311
(Relevant e-mails)

Memo CP-D/318

18 January 2001

From: O. Schwerer

To: Distribution

Subject: EXFOR quantities PAR/M+,DA,G and PAR/M-,DA,G

Reference: Action A40 of the 2000 NRDC Meeting
Memos CP-D/311 and CP-D/301 (or WP2000-4)
Entry 31492 (revised and extended on Preliminary TRANS 3106)

The above quantities had been proposed for compilation of entry 31492. However, they were not approved at the last NRDC meeting; Action A40 **on all** requests new proposals for a general way of coding such cases.

1) For the case **PAR/M-,DA,G** the dictionary entries for the relevant existing components read

PAR,DA,G = differential cross section for production of a certain gamma line, and

M- = excluding formation through isomeric transition.

Combining these 2 definitions precisely describes, in my opinion, the cases compiled in entry 31492.

Since no other proposal was received so far, we therefore renew our old proposal to approve the coding PAR/M-,DA,G.

2) The case for **PAR/M+,DA,G** is however different. Going back to the main reference of entry 31492, we found that the data in question actually are not of a partially cumulative type, as would correspond to M+, but are "delayed" without the prompt component, i.e. describe the de-excitation of an isomeric state (with half-lives in the millisecond range).

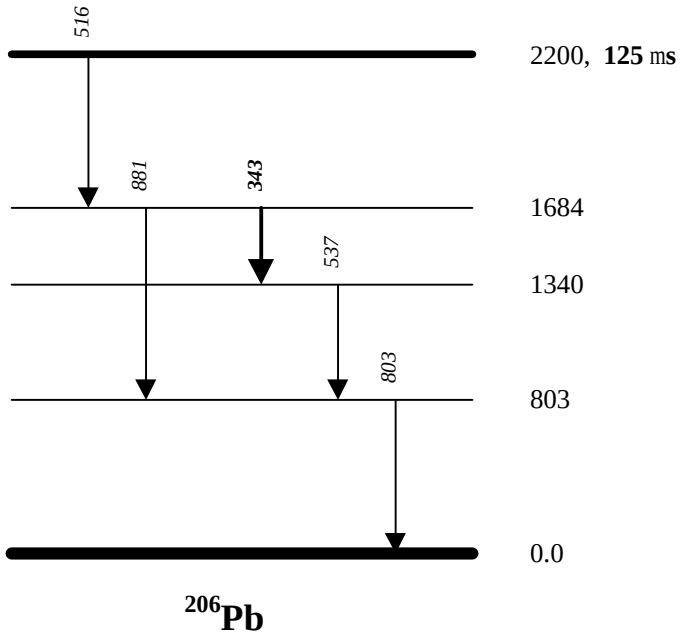
Therefore, these data can be compiled as **….(N,X)…-M,PAR,DA,G**
and no new code is needed.

The final version of TRANS 3106 will therefore contain the code PAR/M-,DA,G but not PAR/M+,DA,G (we withdraw our proposal for the latter one).

Differential γ-production cross section for the 343 keV line in ^{206}Pb:

a) prompt (without contribution from 125 μsec level at 2200 keV): **PAR/M-,DA,G**
b) delayed (with feeding from 125 μsec level): (originally proposed: PAR/M+,DA,G, now coded -M,PAR,DA,G)

See Hongyu Zhou et al., NSE 134,106,2000 and 97TRIEST,1,625 EXFOR 31492)



Coding of Chemical Compounds: Clarifications

- Memo **4C-4/113** (attached) proposes several new entries for EXFOR dictionary 9 (Compounds) and DANIEL dictionary 27 (which contains both Nuclides and Compounds), all with -CMP or -OXI as compound identifier.
- We want to clarify 2 questions:
  - What codes need to be entered in dictionary 9? (-CMP should not be needed!)
  - Should all oxides get a compound code -OXI? (We believe not).

- The EXFOR Systems Manual (page 6.7) says:

  "**Dictionary 9: Chemical Compounds.** (Codes are also used in CINDA). The general compound code CMP can be combined with any element in the form (Z-S-CMP) **without entry in this dictionary**, which only lists special cases…."

  DANIEL dictionary 27, on the other hand, does have the codes -CMP for (almost) all elements, and for some years they now appear also in EXFOR dictionary 9 (because they are both derived from the archive dictionaries). Anyway, all check programs should accept compounds with -CMP independently of an entry the dictionary.

- The LEXFOR page on Chemical Compounds says:

  "In general, chemical compounds are coded under the keyword REACTION by combing the code CMP with the element number and symbol of its main component, e.g. **26-FE-CMP for iron oxide** or any other iron compound. For a **small number of materials of particular importance for users of nuclear reaction data, special compound codes are used.** These are listed in Dictionary 9."

From this I conclude that **not** all oxides should get a special compound code, 26-FE-COMP is even mentioned as the coding for iron oxide. New compound codes should be restricted to very important special cases. (The DANIEL dictionary 27 has many -OXI codes with status INT, i.e. not for EXFOR use - why?)

Or should we change the policy on compounds and introduce codes for all oxides (when there are data) and many other compounds?

Reminder: compound codes are to be used only for certain types of low energy data; otherwise the chemical composition of the sample is given only under SAMPLE. LEXFOR says: "Typical data on compounds entered are low-energy data, where chemical or crystalline binding forces affect the neutron cross sections; an example is the total cross section or thermal-scattering data of water…"

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MEMO 4C-4/113

DATE: 18 Dec 2000
TO: Distribution
From: S. Maev (alias: S.Mayev)
Subject: Exfor Dictionary 09 and Daniel Dictionary 27 update

Exfor Dictionary 9 (Compounds)

67-HO-CMP Holmium compound
67-HO-OXI Holmium oxide

Daniel Dictionary 27

```
 27 PRO 2000nn  27-CO-CMP          COCMP nnnnn1 3      C
                                                        COBALT COMPOUND
 27 PRO 2000nn  27-CO-OXI          COOXI nnnnn1 3      C
                                                        COBALT oxide
 27 PRO 2000nn  50-SN-OXI          SNOXI nnnnn1 3      C
                                                        TIN  oxide
 27 PRO 2000nn  65-TB-CMP          TBCMP nnnnn1 3      C
                                                        TERBIUM compound
 27 PRO 2000nn  65-TB-OXI          TBOXI nnnnn1 3      C
                                                        TERBIUM oxide
 27 PRO 2000nn  67-HO-CMP          HOCMP nnnnn1 3      C
                                                        HOLMIUM COMPOUND
 27 PRO 2000nn  67-HO-OXI          HOOXI nnnnn1 3      C
                                                        HOLMIUM oxide
 27 PRO 2000nn  68-ER-CMP          ERCMP nnnnn1 3      C
                                                        ERBIUM COMPOUND
 27 PRO 2000nn  68-ER-OXI          EROXI nnnnn1 3      C
                                                        ERBIUM oxide
```

==========

EXPLANATION

While compiling data for ultra-cold neutrons coherent scattering I met the necessity to use as targets anf residual neclei oxides and compounds. After running CHEX program this results in following error messages (records are split in two parts):

```
 ENTRY 22450,
 -----------
     REFERENCE  (J,ZP/A,357,297,1997)
```

```
  Illegal use of nuclide                  field  4
  REACTION   (65-TB-CMP(N,THS)65-TB-CMP,COH,AMP)Coherent Scattering
                              ^^^^^^^^^                                  22450  200003
-------------------------------------------------------------------
 Illegal use of nuclide                   field  4
  REACTION   (65-TB-OXI(N,THS)65-TB-OXI,COH,AMP)Coherent Scattering
                              ^^^^^^^^^                                  22450  300003
-------------------------------------------------------------------
 Illegal code in                          field  1
 Illegal code in                          field  4
  REACTION   (67-HO-CMP(N,THS)67-HO-CMP,COH,AMP)Coherent Scattering
              ^^^^^^^^^       ^^^^^^^^^                                  22450  500003
-------------------------------------------------------------------
 Missing independent variable             NUCLIDE                       22450  5
-------------------------------------------------------------------
 Illegal code in                          field  1
 Illegal code in                          field  4
  REACTION   (67-HO-OXI(N,THS)67-HO-OXI,COH,AMP) Coherent Scattering
              ^^^^^^^^^       ^^^^^^^^^                                  22450  600003
-------------------------------------------------------------------
 Missing independent variable             NUCLIDE                       22450  6
-------------------------------------------------------------------
 Illegal use of nuclide                   field  4
  REACTION   (68-ER-CMP(N,THS)68-ER-CMP,COH,AMP) Coherent Scattering
                              ^^^^^^^^^                                  22450  800003
-------------------------------------------------------------------
 Illegal use of nuclide                   field  4
  REACTION   (68-ER-OXI(N,THS)68-ER-OXI,COH,AMP) Coherent Scattering
                              ^^^^^^^^^                                  22450  900003
-------------------------------------------------------------------

and similar messages for  ENTRY 22451.
                            REFERENCE  (J,ZN/A,52,270,1997)

==================================================

 To avoid error messages
  "Illegal code in                         field  1"

it is sufficient to add codes "67-HO-CMP" and "67-HO-OXI"  in Exfor
Dictionary 9 - Compounds.

 To avoid error message
 "Illegal use of nuclide                   field  4"

it would be necessary to add "3" to field 15 in Dict. 27. But this
latter doesn't contain compounds. On this reason this "3" has to be
added in corresponding fields of Daniel Dict.27.

=====================================================================
```

Stanislav Maev

Units N/PART/SR etc. for dictionary 25

For product yields (or thick target product yields), new units had been proposed tot the 2000 NRDC meeting which were not approved; see **Action A42** of last year's meeting.

Note also that in the file there are data in units NUC/PART coded as TTY, although TTY should have units MUCI/MUA or equivalent. Data in NUC/PART or other units of type YLD must be coded as ,PY,,TT (Product yield for thick target).

If units PART/PROJ or "Nucleus for Incident Projectile" are to be used also in place of G/PART and "Neutrons/Particle", will we need to distinguish between yields for the product (SF4) and for (e.g. gamma) particles coded in SF3?

CP-A/109 (14 Feb. 2001)
CP-A/99, p.7 (3 April 2000)

New proposal (NNDC + NDS, 21 May):

Introduce new units using **PRD** for any product (particle or nucleus) and **INC** for the incident particle, to be abbreviated further when necessary. Old units can remain in the file until automatic conversion.

PRD/INC	Product part. per incid.part.
PRD/INC/SR	Prod.part.per incid.part. per SR
PRD/100INC	Prod.part. per 100 incid. part.
PRD/IN/MEV	Prod.part.per incid.part.per MeV
P/IN/SRMEV	Prod.part.per inc.part.per Mev per SR

MEMO CP-A/109

14 Feb 2001

To: **Distribution**
From: **F.E. Chukreev, S.Babykina**
Subject: **Additions to Dictionary 25**

Add to dictionary 25

Vicki McLane proposed to use for O0714018-020 and O0714026-030 data unit:

N/PART/SR = nuclei/inc.proj/Sr

instead of P/PART/SR, which was not approved by the last NRDC meeting.

But N/PART/SR is absent in Dictionary 25 now. Therefore the new data unit must be included in Dictionary 25.

Distribution:

DUNFORD@BNLND2.DNE.BNL.GOV
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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
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TENDOW@POSTMAN.RIKEN.GO.JP
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KALTCHENKO@KINR.KIEV.UA
OGRITZAY@KINR.KIEV.UA

MEMO CP-A/99

Date: 03-April-2000
To: **Distribution**
From: F.E. Chukreev, S.Babykina
Subject: **Dictionary updates**

1. ….

2. **Add to dictionary 25.**

P/PT/MEVSR (Product nuclei per Inc.Proj. per SR per MEV)
P/PART/SR (Product nuclei per Inc.Proj. per SR)
P/PART/MEV (Product nuclei per Inc.Proj. per Mev)
The codes are similar N/PT/MEVSR etc in 25 Dictionary.
In order to eliminate Dictionary increasing is possible to change the comments for existing

N/PT/MEVSR to "Nucleus per Incident Projectile per Sr per MeV"
N/PART/MEV to "Nucleus per Incident Projectile per MeV",
N/PART to "Nucleus per Incident Projectile"

and add

N/PART/SR "Nucleus per Incident Projectile per Steradian"

Your opinion is interest, of course.

3. **Add to dictionary 36**

EM,TTY/DA/DE (Differential emission thick target yield with Respect to the angle and energy of the outgoing particle)

Distribution:

DUNFORD@BNLND2.DNE.BNL.GOV
VML@BNL.GOV
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Coding of differential neutron multiplicity distributions

O.Schwerer

CAJaD wants to compile differential neutron multiplicity distributions as given in the paper by L.Pienkowski et al., PR/C 56, 1909 (1997).

The data are labelled as ds/dN (N being the neutron multiplicity) and given in "millibarns".

The data cannot be compiled with SF6 = MLT because this would require units of type YLD (such as N/PART). They cannot be compiled as neutron production cross section because there is an additional independent variable, N.

The data can be considered either as differential multiplicity, or as a new type of differential neutron production cross section, which is differential by N.

We propose to introduce a new code for SF6, to be used either alone or in combination with MLT, e.g.:

82-PB-0(N,X)0-NN-1,,SDN or
82-PB-0(N,X)0-NN-1,,MLT/DN

Although the data in the above paper are given in mb, I believe that the units should rather be "mb per particle" or equivalent. A new unit type would be needed.

Headings E-LVL-INI, E-LVL-FIN as "additional information"

O.Schwerer

Entry 31492 (transmitted on TRANS 3106) was criticized for "multiple representation of independent variable" because, for a partial gamma production cross section, besides the gamma energy (E) also E-LVL-INI and E-LVL-FIN are given.

While it is clear that only one representation of independent variables is allowed, we believe that this case is different:

1) "Physics" argument: in many cases of complicated decay schemes, the gamma energy alone is not sufficient to define the transition because there may be several transitions with (almost) identical energies. In this particular entry, there are 3 cases where 2 transitions have the same gamma energies (within 1 keV) and could not be resolved, so that we even had to use headings E-LVL-INI1, 2 and E-LVL-FIN1,2 to give both of them.

2) "Formal" argument: Formally, we claim that E-LVL-INI and -FIN are in this case used as "additional information" headings (which are given after the DATA column in the DATA section, or in the COMMON section) but not as the independent variable. The EXFOR Systems Manual (Footnote 1 on page 4.5 of the April 2000 edition) states ***"that some data headings may be used either as independent variables or as additional information".*** And page 6.8 on Dictionary 24 has a Footnote 11 on "Secondary Energy" saying ***"except E-LVL-INI and E-LVL-FIN".*** What is the meaning of this footnote? It could even suggest that these headings are to be used **only** as additional information but not as independent variable.

We propose to state explicitly in the manual that E-LVL-INI and E-LVL-FIN may be used (also) as additional information.

(If necessary, we may also clarify whether or not headings which may be used both ways, may be given not only in the DATA section after the DATA column, but alternatively also in the COMMON section. If not, we might move E-LVL-INI and -FIN to the DATA section to make it clear that here they are used as additional information.)

Appendix: Entry 31492, subentries 2 and 17

```
ENTRY            31492   20010118                                  31492  0    1C
SUBENT        31492001   20010118                                  31492  1    1C
BIB                14         34                                  31492  1    2
AUTHOR     (HONGYU ZHOU,XINGFU WANG,CHAO WANG,MING HUA,           31492  1    3
            GUANGSHUN HUANG,GUOYING FAN,TING LU,SIQING BARTEL)    31492  1    4
INSTITUTE  (3CPRBNU) Institute of Low Energy Nuclear Physics      31492  1    5
REFERENCE  (J,NSE,134,106,2000) Final results                     31492  1    6I
           (C,97TRIEST,1,625,1997)                                31492  1    7
TITLE      Study on total discrete gamma radiation from natural   31492  1    8
           lead under 14.9 MeV neutron bombardment.               31492  1    9
FACILITY   (CCW,3CPRBNU) 400 kV Cockroft Walton accelerator.      31492  1   10
INC-SOURCE (D-T) 3.2 MHz pulsed deuterons.                        31492  1   11
METHOD     (TOF,ASSOP) Neutron flux was determined by counting    31492  1   12
           the associated alpha particles with an Au-Si detector. 31492  1   13
           The TOF technique was used for reducing background     31492  1   14
           from direct and scattered neutrons. Two time gates     31492  1   15
           with 30 ns and 160 ns, covering the time regions       31492  1   16
           containing prompt and delayed gamma's respectively,    31492  1   17
           were set to record the total and delayed gamma-ray     31492  1   18
           spectrum.                                              31492  1   19
DETECTOR   (GELI)                                                 31492  1   20
SAMPLE     Solid cylindrical natural lead, 2.9*3.0 cm in size and 31492  1   21
           230.6 g. in weight.                                    31492  1   22
MONITOR    The neutron flux was monitored by counting             31492  1   23
           the associated alpha particles.                        31492  1   24
CORRECTION -Neutron flux attenuation in the backing and cooling   31492  1   25
            water of the neutron target                           31492  1   26
           -Neutron attenuation in the sample                     31492  1   27
           -Gamma-ray attenuation in the sample                   31492  1   28
           -Secondary neutron effects                             31492  1   29
ERR-ANALYS No error analysis given.                               31492  1   30
STATUS     Data taken from Tables 1,2,3 of Nuclear Science and    31492  1   31C
           Engeneering, vol.134(2000)106-113                      31492  1   32C
HISTORY    (19980630C) HW                                         31492  1   33
           (20010118A) VZ+OS Subentries 2-11: Updated to final    31492  1   34I
             publication and/or REACTION coding corrected;        31492  1   35I
             Subentries 015 to 057 added.                         31492  1   36I
ENDBIB           34          0                                    31492  1   37
COMMON            2          3                                    31492  1   38
EN         EN-ERR                                                 31492  1   39
MEV        MEV                                                    31492  1   40
14.9       0.5                                                    31492  1   41
ENDCOMMON         3          0                                    31492  1   42
ENDSUBENT        41          0                                    31492  199999
```

```
SUBENT        31492002   20010118                                  31492  2    1C
BIB                 3          4                                  31492  2    2
REACTION  1(82-PB-0(N,X)82-PB-206,PAR/M-,DA,G) Prompt.           31492  2    3
          2(82-PB-0(N,X)82-PB-206-M,PAR,DA,G) Delayed.           31492  2    4C
EN-SEC     (E,G)                                                 31492  2    5
DECAY-DATA (82-PB-206-M,.124MSEC,DG,343.3)                       31492  2    6
ENDBIB              4          0                                  31492  2    7
COMMON              3          3                                  31492  2    8
E          E-LVL-INI  E-LVL-FIN                                   31492  2    9
KEV        KEV        KEV                                         31492  2   10
343.3      1684.1     1340.6                                      31492  2   11
ENDCOMMON           3          0                                  31492  2   12
DATA                5          3                                  31492  2   13
ANG        DATA      1DATA-ERR  1DATA      2DATA-ERR  2           31492  2   14
ADEG       MB/SR      MB/SR      MB/SR      MB/SR                 31492  2   15
55.        1.27       .38        5.63       1.13                  31492  2   16
90.        1.47       .34        3.94       1.58                  31492  2   17
140.       1.11       .33        4.10       1.64                  31492  2   18
ENDDATA             5          0                                  31492  2   19
ENDSUBENT          18          0                                  31492  299999

SUBENT        31492017   20000425                                  31492 17    1I
BIB                 2          9                                  31492 17    2
REACTION   ((82-PB-0(N,X)82-PB-207,PAR,DA,G)+                     31492 17    3
           (82-PB-0(N,X)82-PB-206,PAR,DA,G)) Prompt.             31492 17    4
            Sum of 2 unresolved gamma transitions                31492 17    5
            with very close energies                             31492 17    6
EN-SEC     (E,G)                                                 31492 17    7
           (E-LVL-INI1,82-PB-207)                                31492 17    8
           (E-LVL-FIN1,82-PB-207)                                31492 17    9
           (E-LVL-INI2,82-PB-206)                                31492 17   10
           (E-LVL-FIN2,82-PB-206)                                31492 17   11
ENDBIB              9          0                                  31492 17   12
COMMON              5          3                                  31492 17   13
E          E-LVL-INI1 E-LVL-FIN1 E-LVL-INI2 E-LVL-FIN2           31492 17   14
KEV        KEV        KEV        KEV        KEV                 31492 17   15
656.8      3834.0     2728.0     1997.8     1340.6              31492 17   16
ENDCOMMON           3          0                                  31492 17   17
DATA                3          3                                  31492 17   18
ANG        DATA       DATA-ERR                                   31492 17   19
ADEG       MB/SR      MB/SR                                      31492 17   20
55.        4.17       0.17                                       31492 17   21
90.        3.73       0.13                                       31492 17   22
140.       4.10       0.19                                       31492 17   23
ENDDATA             5          0                                  31492 17   24
ENDSUBENT          23          0                                  31492 1799999
```

Dictionary sorting flags and wildcards (Action A18)

O.Schwerer

Action A18 of the 2000 NRDC meeting (on me) was to "check the old Actions 7-13 of the 1997 NRDC meeting" (attached) which dealt with sorting flags, dictionary titles and wildcards.

1) Actions 7-9 (1997), mainly on McLane, are about **additional sorting flags** for EXFOR dictionary 36 and **titles** for some other EXFOR dictionaries.

Since the program producing the EXFOR dictionaries from the archive dictionaries is now maintained at NDS, we will include a more general review of sorting flags in our dictionary maintenance work. Since many quantities actually belong to more than one category, a new approach for a compiler-friendly list of quantities might be considered.

2) Actions 10-12 (1997) deal with **wildcards** for SF7 (particle considered) in dictionary 36.
A year later, there was an Action A20 (1998) on NDS: **"Keep the 'particle considered' (SF7) entries in dictionary 36 until all centers can use the dictionary wildcards."**

Note that archive and DANIEL dictionary 36 (but not EXFOR dictionary 36) do contain a number of codes with wildcards; the proposed wildcard '*FP' for fission fragments (i.e. FF, HF or LF) was however changed to '*F'.

What is now the status of accepting these wildcards at the centers?

3) Action 13 (1997) is about checking whether the restriction "for photonuclear data (only)" applied to certain codes in dictionaries 24, 32 and 36 should be kept.

Dict. 24: Headings M1 etc. (linear momentum of outgoing particle) and POLAR (polarity) are under the title "Used for Photonuclear Data only".
Dict. 32: No restrictions
Dict. 36: Quantities ECO, EMC and MCO are under the title "Energy/momentum/mass correlation (photonculear data)".

Any changes in this should be requested as an Action on NDS to be included in any next dictionary revision.

WP2001-18

IAEA/NDS priorities in the EXFOR compilation

V.G. Pronyaev, IAEA/NDS

Our priorities are related with our data development programs and in May 2001 include:

1. Nuclear data for reaction cross section standards:

^{1}H(n,n) – σ_{el}, $d\sigma_{el}/d\theta$, polarization, 1 keV – 150 MeV, ^{1}H(n,total)

^{3}He(n,p) - σ_{np}, $d\sigma_{np}/d\theta_{n}$, thermal to 1 MeV

^{6}Li(n,t) - σ_{nt}, $d\sigma_{nt}/d\theta_{t}$, thermal to 2 MeV; ^{6}Li(n,total), ^{6}Li(n,n) - σ_{nn}, $d\sigma_{nn}/d\theta_{n}$, polarization, thermal to 2 MeV; ^{4}He(t,n) - σ_{tn}, $d\sigma_{tn}/d\theta_{n}$, threshold to 5 Mev above the threshold; ^{4}He(t,t) - σ_{tt}, $d\sigma_{tt}/d\theta_{t}$, polarization data, to 5 MeV above the ^{4}He(t,n) threshold

^{10}B(n,α) - $\sigma_{n\alpha}$, $d\sigma_{n\alpha}/d\theta_{\alpha}$,; ^{10}B(n,$\alpha_1\gamma$) - $\sigma_{n\alpha1}$, $d\sigma_{n\alpha1}/d\theta_{\alpha1}$; ^{10}B(n,total), ^{10}B(n,n) - σ_{nn}, $d\sigma_{nn}/d\theta_{n}$, polarization; thermal to 250? KeV; ^{7}Li(α,α) - $\sigma_{\alpha\alpha}$, $d\sigma_{\alpha\alpha}/d\theta_{\alpha}$; ^{7}Li($\alpha$,$\alpha_1$) - $\sigma_{\alpha\alpha1}$, $d\sigma_{\alpha\alpha1}/d\theta_{\alpha1}$;

C(n,n) – σ_{tot}, σ_{el}, $d\sigma_{el}/d\theta$, polarization, thermal to 1.8 MeV

^{197}Au(n,γ) – $\sigma_{n\gamma}$, thermal, 0.2 to 2.5 MeV

^{235}U(n,f) – σ_{nf}, thermal, 0.15 to 20 MeV

^{238}U(n,f) – σ_{nf}, threshold to 20 MeV

^{235}U(n,f) – σ_{nf}, thermal, 0.15 to 20 MeV

These cross sections averaged on any well defined spectra in the energy of interest

Any ratio measurements between these cross sections

For high-energy standards:

^{209}Bi(n,f), ^{235}U(n,f), ^{238}U(n,f) – threshold to 1 GeV

Any ratio measurements between these cross sections

2. Nuclear data for nuclides of Th-U fuel cycle:

(n,γ), (n,f), (n,2n) cross sections, $<\nu_p>$, $<\nu_d>$ and fission product yields for ^{232}Th, ^{231,233}Pa, ^{232,233,234,236}U in energy range up to 20 MeV

3. For international reactor dosimetry library IRDF-2002 project:

LI6 (N,A) H3, LI7 (N,T) HE4, B10 (N,A) LI7, C12 (N,2N) C11, O16 (N,2N) O15, LI6 (N,T)HE3, B10 (N,A) LI6, F19 (N,2N) F18, NA23(N,2N) NA22, NA23 (N,G) NA24, MG24 (N,P) NA24, AL27 (N,P) MG27, A27 (N,A) NA24, P31 (N,P) SI31, S32 (N,P) P32, SC45 (N,G) SC46, T0 (N,X) SC46, TI0 (N,X) SC47, TI0 (N,X) SC48, TI46 (N,2N) TI45, TI46 (N,P) SC46, TI47 (N,NP) SC46, TI47 (N,P) SC47, TI48 (N,NP) SC47, TI48 (N,P) SC48, TI49 (N,NP) SC48, V0 (N,A) SC48, V51 (N,A) SC48, CR50 (N,G) CR51, CR52 (N,2N) CR51, MN55 (N,2N) MN54, MN55 (N,G) MN56, FE54 (N,2N) FE53, FE54 (N,A) CR51, FE54 (N,P) MN54, FE56 (N,P) MN56, FE57 (N,NP) MN56, FE58 (N,G) FE59, CO59 (N,2N) CO58, CO59(N,G) CO60, CO59 (N,A) MN56, NI58 (N,2N) NI57, NI58 (N,P) CO58, NI60 (N,P) CO60, CU63 (N,2N) CU62, CU63 (N,G) CU64, CU63 (N,A) CO60, CU65 (N,2N) CU64, ZN64 (N,P) CU64, AS75(N,2N)AS74, Y89 (N,2N) Y88, ZR90 (N,2N) ZR89, NB93 (N,2N) NB92, NB93 (N,N') NB93M, NB93 (N,G) NB94, RH103 (N,N') RH103M, AG109 (N,G) AG110M, IN115 (N,2N) IN114M, IN115 (N,N') IN115M, IN115 (N,G) IN116M, I127 (N,2N) I126, LA139 (N,G) LA140, PR141 (N,2N) PR140, EU151 (N,G) EU152, DY164(N,G)DY165, TM169 (N,2N) TM168, TA181 (N,G) TA182, W186 (N,G) W187, AU197 (N,2N) AU196, AU197 (N,G) AU198, HG199 (N,N') HG199M, PB204 (N,N') PB204M, TH232 (N,F) FP, TH232 (N,G) TH233, U235 (N,F) FP, U238 (N,F) FP, U238 (N,G) U239, NP237 (N,F) FP, PU239 (N,F) FP, AM241 (N,F) FP in energy range from threshold up to 20 MeV.

These cross sections averaged on thermal neutron and thermal neutron induced ^{235}U and ^{252}Cf spontaneous fission neutron spectra.

4. Nuclear data for analysis of prompt gamma rays induced by slow neutron capture (PGAA):

Thermal capture cross sections (microscopic and maxwellian spectrum averaged) for all stable isotopes and elements, partial gamma-production cross sections after thermal neutron capture, number of gamma-quanta for given gamma-line per 100 neutron captured, gamma spectra after thermal neutron capture.

CSISRS Library Statistics

WP2001-21

21-05-01

Area	#entries	#subentries	#data points	Last tape
Neutron				
1	3,629	17,522	3,080,782	1294
2	2,280	14,823	1,567,577	2149
3	1,026	5,442	60,039	3106
4	1,299	8,472	201,543	4122
Total neutron	8,234	46,259	4,909,941	
Charged particle				
A	920	6,599	174,893	A047
B	177	1,500	16,791	B011
C	758	3,705	263,545	C050
D	124	803	16,682	D022
E	171	2,535	42,857	E018
F	422	1,289	110,647	F012
O	370	7,790	203,951	O008
P	91	426	7,074	P003
R	51	431	5,933	R012
S	44	349	5,091	S010
T	126	817	29,401	T008
Total charged particle	3,254	26,244	876,865	
Photonuclear				
G	20	68	1,158	G010
L	59	726	39,619	L005
M	611	3,490	96,125	M029
Q				
Total photonuclear	690	4,284	136,902	
Evaluation				
V	41	618	36,380	V025
Grand total	12,219	77,405	5,960,088	

AREA 1

Year	#entries	#subentries	#data points	Last tape
1995	8	25	8,304	
1996	21	77	57,219	
1997	10	29	2,257	
1998	11	68	51,849	
1999	3	18	13,893	
2000	4	9	29,716	
Total	57	226	163,238	1293

AREA 2

Year	#entries	#subentries	#data points	Last tape
1995	18	79	182,400	
1996	16	93	4,594	
1997	17	91	1,666	
1998	1	9	3,109	
1999				
2000				
Total	52	272	191,769	2149

AREA 3

Year	#entries	#subentries	#data points	Last tape
1995	13	45	311	
1996	3	58	233	
1997	12	86	272	
1998	5	75	130	
1999	3	7	97	
2000	5	64	317	
Total	41	335	1,360	3106

AREA 4

Year	#entries	#subentries	#data points	Last tape
1995	19	64	808	
1996	12	76	1,676	
1997	18	80	3,809	
1998	12	34	1,276	
1999	16	329	3,121	
2000	5	47	423	
Total	82	630	11,113	4122

AREA A

Year	#entries	#subentries	#data points	Last tape
1996	9	552	2,121	
1997	4	490	10,086	
1998	0	0	0	
1999	0	0	0	
2000				
2001				
Total	13	1,042	12,207	A047

AREA C

Year	#entries	#subentries	#data points	Last tape
1996	26	81	5,955	
1997	18	117	3,393	
1998	19	62	3,463	
1999	9	27	1,537	
2000	12	37	6,689	
2001	1	4	490	
Total	85	328	21,527	C050

AREA D

Year	#entries	#subentries	#data points	Last tape
1996	4	10	223	
1997	9	45	999	
1998				
1999				
2000				
2001				
Total	13	55	1,222	D022

AREA E

Year	#entries	#subentries	#data points	Last tape
1996	3	63	1,284	
1997	5	50	1,675	
1998				
1999				
2000				
2001				
Total	8	113	2,959	E018

AREA F

Year	#entries	#subentries	#data points	Last tape
1996				
1997	1	5	62	
1998	1	12	180	
1999				
2000				
2001				
Total	2	17	242	F012

AREA G

Year	**#entries**	**#subentries**	**#data points**	**Last file**
1996				
1997				
1998				
1999				
2000				
2001				
Total	0	0	0	G010

AREA L

Year	#entries	#subentries	#data points	Last tape
1996				
1997				
1998				
1999				
2000				
2001				
Total	0	0	0	L005

AREA M

Year	#entries	#subentries	#data points	Last tape
1996	8	107	1,359	
1997	5	12	708	
1998	2	26	54	
1999	1	5	377	
2000				
2001	1	16	388	
Total	17	166	2,886	M029

AREA O

Year	#entries	#subentries	#data points	Last tape
1996	9	229	663	
1997	5	70	2,630	
1998	6	230	1,304	
1999	1	4	187	
2000				
2001				
Total	21	533	4,784	O008

AREA R

Year	#entries	#subentries	#data points	Last tape
1996				
1997				
1998				
1999				
2000				
2001				
Total	0	0	0	R012

AREA S

Year	#entries	#subentries	#data points	Last tape
1996				
1997				
1998				
1999				
2000				
2001				
Total	0	0	0	S010

AREA T

Year	#entries	#subentries	#data points	Last tape
1996				
1997				
1998	1	6	31	
1999				
2000				
2001				
Total	1	6	31	T008

WP 2001-23

CINDA2001 MANUAL

Revisions as of 24 May 2001

V.McLane, M.Lammer, S.A.Dunaeva, O.Schwerer and V.Zerkin

Attached is a revision of the CINDA2001 manual which we formulated in Vienna the week before the meeting. It is formatted to be inserted into the **EXFOR manual** as **chapter 10: "CINDA Bibliographic System"**. New dictionaries will be designed especially to meet the CINDA needs and will be part of the EXFOR dictionaries. Therefore no special appendices are needed for the CINDA manual.

The revisions include corrections and clarifications in the wording as well as some more substantial changes. The more important items are:

TARGET:
The old MANY and FPROD get the artificial Z value 999 to ensure their sorting at the end of the book/retrieval, and are to be coded as **999MNY** and **999FPR**

REACTION
- In CINDA the REACTION consists of **2 fields: incoming and outgoing** The codes in these fields correspond in the general case to EXFOR REACTION SF2-SF4.
- In the outgoing field, if there are many outgoing nuclides, or, in general, too many codes to fit into the field, they will be replaced by the code **PRD** (= products). the individual products would in this case be listed in a product line (**hierarchy 8)**.

QUANTITY
- The new **Dictionary 45** will contain all quantity codes to be used for CINDA.
- The correspondence between the **old CINDA quantity codes** and the new REACTION + QUANTITY combination will be presented in Dictionary 47 (see WP 2001-24).

ENERGY RANGE
- A **blank energy field** will be used in entries for spontaneous fission and nuclear quantities. Hence the codes 'SPON' and '/' will no longer exist.
- Some changes have been introduced for energy spectra: the new code **THRML** = thermal reactor spectrum will replace the old code PILE, and MAXW will be used only for pure Maxwellian spectra or data corrected for that.
- Entries for energy spectra will contain the **spectrum code** in the E-min field and may give the **numerical equivalent** (corresponding to EN-DUMMY in EXFOR) in the E-max field. These numerical equivalents will replace the previous 'internal sorting value'. Hence we will need distinctions between MAXW-THRML and FAST-FISS (which have the same EN-DUMMY in EXFOR); the default numerical equivalents will be given in the new Dictionary 48.
- These new features have some consequences:
  - A Maxwellian spectrum at 30 keV can be coded as 'MAXW 3.0+04'.
  - It is no longer allowed to combine spectrum codes with numerical energy values (other than the numerical equivalent).
- How these new features will be handled in the CINDA book is still to be decided.

HIERARCHY

Both, hierarchy **8 and 9** entries have now the information in the comments field, and the energy and reference fields are left blank. We have not yet decided whether to include such entries in the CINDA book; this will be discussed and decide upon at the meeting.

Details of the new coding rules as outlined above and coding **examples** will be included when everything is approved and finalized.

CINDA2001

MANUAL

Prepared by Victoria McLane
National Nuclear Data Center

Preliminary Version
May 2001

CINDA Bibliographic System

HISTORY

CINDA2001 was designed to replace the CINDA database which was originally designed in 1958[1] as a Card Index to Neutron Data. CINDA was adopted in the 1970's by the four Neutron Data Centers as an international index to the neutron data; the compilation scheme remained essentially unchanged until 1998.

In the meantime, the Nuclear Reaction Data Network had evolved from the original four centers to a group of thirteen centers involved in the compilation of nuclear reaction data for incident charged particles and photons, in addition to neutrons. The need for an index that would allow the inclusion of all reaction data, and the need to update the format for the year 2000 lead to a complete redesign of the bibliographic system.

The new system is more compatible with EXFOR/CSISRS, and has adopted many of the same the codes used in this database, thereby eliminating the need for users of nuclear reaction data to learn different sets of notation when accessing the bibliographic and data files.

INTRODUCTION

CINDA2001 is a computerized bibliographic file containing references to information on nuclear reactions. Included are references to measurements, calculations, evaluations, and reviews of nuclear reaction and other related data. In the case of experimental or evaluated data, references to the databases where the actual values may be obtained are also included.

Identical copies of this database are maintained by the four core centers in the Nuclear Data Center Network.[2] These master files are updated periodically and exchanged among the centers. Retrievals from CINDA2001, as well as the experimental and evaluated databases, are available through the Internet using World Wide Web or by direct access using TCP/IP's TELNET command.[3]

[1] CINDA was designed by Herbert Goldstein, a professor in the Department Of Applied Physics and Engineering at Columbia University, see Nuclear Development Corporation of America report NDA 2-80 (1958).

[2] These core centers are: the US National Nuclear Data Center, the NEA Data Bank, the IAEA Nuclear Data Section, and the Russian Nuclear Data Center at Obninsk. See Appendix A for complete information on the Nuclear Reaction Data Centers.

[3] See Appendix A for access to your nearest data center.

The information in the CINDA2001 Database is obtained from scanning the available literature, both published and unpublished. Coverage is "complete" for neutron data from 1935 to the present. Coverage for charged-particle data is nearly complete for 1980 to the present, and less complete before 1980. Coverage for photon-induced data is taken from Photonuclear Data[4] which covers the period 1976 to the present.

This manual is intended to be a complete guide to the indexing of information in the CINDA2001 system.

CINDA2001 EXCHANGE FORMAT

The CINDA2001 exchange file consists of a series of 125-character record plus a header record which gives information about the attached file. The format of the header record is:

Columns	Content	Use
1-5	ID	CINDA
6	*(blank)*	
7-15	Type of file	READER or EXCHANGE; left-adjusted
16-22	Exchange number	Area code, number of exchange for area; right-adjusted.
23-33	Date of exchange	8-digit right-adjusted integer: year, month, day (YYYYMMDD)
34-44	Number of records on file	Right-adjusted integer

Files transmitted will be either exchange files or reader files. The format of these files is the same, but the content will differ slightly; the differences are noted under the sections on the appropriate fields.

Exchange files consist of records produced for transmitting entries from a center's own area of responsibility.

Reader files contain records produced by the transmitting center for an area outside its responsibility and transmitted to the responsible center for addition to its database. After the update of its database, the records will be transmitted by the responsible center to all other centers.

[4] V. V. Varlamov, V. V. Sapuchenko, M. E. Stepanov, **Photonuclear Data 1976-1995**, Photonuclear Experimental Data Center, Moscow University (1996).

The fields given in the CINDA2001 exchange format are as follows.

Columns	Contents	Formats	Example
1	Operation code	A1	As in CINDA
2-8	Target Nucleus	2I3,A1	Target Z, A, isomeric state (ZZAAAM)
9-23	Reaction	A15	Generally, EXFOR REACTION SF2-SF4
24-27	Quantity	A4	From DANIEL Dictionary 13.
28-33	Institute	A6	EXFOR code without area code
34-37	Block #	A1,I3	Area code, followed by center assigned block #
38-39	Sequence #	I2	Sequence within block (blank on Reader files).
40	Work type	A1	As in CINDA[5]
41	Reader code	A1	At discretion of center (blanks allowed)[6]
42-55	Energy range	2(E7.1)	Minimum, maximum energy (±n.n±ee)
56	Hierarchy code	I1	Hierarchy for references
57-85	Reference	A23,I6	Type: as in CINDA (A1), Reference code: as in EXFOR (A22), Date: year and month (YYYYMM)
86-125	Comment	A40	As in CINDA

Updates to the formats must be agreed upon by the four core centers.

Any codes to be used in CINDA2001 are included in dictionaries contained in the DANIEL dictionary database. Updates to the dictionaries must be submitted before any code not given in these dictionaries may be used on a CINDA2001 exchange file.

Details for the coding and content of each of the above fields are given on the following pages.

[5] With the exception that the mixed mode codes will be eliminated. For example, entries for theoretical calculations will be separated from experimental data.

[6] That is, centers may choose not to use a reader code.

OPERATION CODE (Column 1)

The operation code is a signal to the database update code as to what operation must be performed. The following list contains the legal operation code and their use.

Code	Meaning	Exchange Use	Reader Use
A	Add record	Block number and sequence number must be specified	Block number may be specified; sequence number must be blank.
D	Delete record	Block number and sequence number must be specified	Block number and sequence number must be specified.
M	Modify record	Block number and sequence number must be specified	Block number and sequence number must be specified

The remainder of the record must be complete for both reader and exchange format.

TARGET NUCLEUS (Columns 2-8)

The target nucleus is given as 2 three-digit integers (Z and A) , both right-adjusted in their field, plus an isomeric state code. All legal Z, A codes are found in DANIEL Dictionary 27. The isomeric state code is blank for a nucleus in the ground state, and consists of the metastable state code M for a nuclide in a metastable state.

For compound nucleus properties, *e.g.*, resonance parameters, the nucleus entered is the target for the reaction(s) analyzed.

For a theoretical work giving systematic trends over many nuclei, the code MNY may be used in the A field; use Z equal to 999. The code MNY may be used either in place of, or in addition to, separate entries for the individual nuclei.

Naturally occurring elements

For naturally occurring elements that contain a mixture of isotopes, a zero is entered in the A-number field. For monoisotopic elements, the Z and A of the isotope are given. For nearly monisotopic elements, *i.e.*, for elements where the principal isotope is more than 99% of the natural isotopic mixture, the Z,A of that isotope may be given if the contribution from other isotopes to the reaction given is negligible.

Compounds and Mixtures

For compounds and mixtures, a 3-character compound code is given instead of the A number and is left adjusted in the field. Single element compounds, *e.g.*, molecular hydrogen, should not be coded as compounds. If information is deduced for a constituent element of a compound or mixture, it should be entered under that element.

The general code zzzCMP, where zzz is the major component of the compound, may be used if the compound is not given specifically in the dictionary. The name of the compound should be given in the comment. If more than one element may be considered a major component, choose the element with the highest Z number.

For data given for mixed fission products, *i.e.*, an aggregate of those fission products produced in a given fission reaction, the code FPR is given in place of the A value; use Z equal to 999.

REACTION (Columns 9-23)

The code for reaction is given as two fields: incident and outgoing, generally, the same as EXFOR REACTION SF2 and SF3. However, in some case, information from reaction SF4 will be included in the outgoing field.

The incident field contains one of the following:

1. A particle code from DANIEL Dictionary 33 which contains a non-blank character in the third position of the Allowed Subfield field, *e.g.*, P or HE3.;

2. A chemical symbol and A-number (SSAAAM) from DANIEL Dictionary 27 which contains a non-blank character in the third position of the Nuclide Uses field; for a nucleus in a metastable state the code is followed by an M, *e.g.*, CL 35 or AM242M.

The outgoing field contains one of the following.

1. A particle code from DANIEL Dictionary 33 which contains a non-blank character in the fourth position of the Allowed Subfield field, *e.g.*, P or HE3;

2. A nuclide code, *i.e.*, chemical symbol and A-number (SSAAA) taken from DANIEL Dictionary 27 which contains a non-blank character in the fourth position of the Nuclide Uses field; for a nuclide in a metastable state, the code is followed by the code M, *e.g.*, CL 35 or AM242M;

3. A process code taken from DANIEL Dictionary 30, *e.g.*, TOT or EL, with the addition of the code PRD for product yield, *e.g.*, X+PRD.

4. A combination of the above with the codes separated by a "+". The order of codes is: particles ordered from lightest to heaviest,[7] followed by nuclide codes ordered from lightest to heaviest, followed by process codes in alphabetical order. The exception to this rule is: when the order in which the reaction proceeds is given explicitly, the codes are given in that order.

5. For complete evaluations covering many reactions, and given over a defined energy range, the code **EVAL** may be entered in the outgoing field.

6. For complex reactions with many outgoing particles, the code **CMPLX** may be used in this field in place of all other codes.

QUANTITY (Columns 24-27)

The legal quantity codes are given in DANIEL Dictionary 45.

For complete evaluations, covering many reactions and quantities, this field contains the code EVL.

INSTITUTE (Columns 28-33)

The institute is given as a six-character code consisting of a country code followed by an institute code. These codes are found in DANIEL Dictionary 3, CINDA Code field.

If more than one institute is involved in the work, the main institute is given. The main institute is defined as the institute at which the principal investigator resides, or the institute at which the work was done. Links to the other institutes are given on Institute Cross Reference Records (hierarchy 9, see Hierarchy Code). An entry is made for each institute containing at least one reference.

BLOCK NUMBER (Columns 34-37)

The block number consists of the area code for the responsible center, followed by a three-digit block number, *e.g.*, L198. The area codes to be used are those assigned for EXFOR.

The block number is assigned only by the center responsible for the entry.

[7] Lightest to heaviest is defined as in order of lightest Z, then in order of A.

SEQUENCE NUMBER (Columns 38-39)

The Sequence Number is a 2-digit, right-adjusted integer denoting the sequence within a block. It is assigned ***only*** by the center responsible for the entry.

WORK TYPE (Column 40)

The one-character Work Type code gives the type of work referenced, *e.g.*, experimental, evaluated. For a reference containing more than one type of work, a separate block should be entered for each type, for example, an experimental work in which extensive[8] model calculations were done.

READER CODE (Column 41)

A one-character Reader Code may be used, at the discretion of the entering center, to identify the compiler of the entry. This field may be left blank. A list of current and formerly used Reader Codes is given in Dictionary 47.

ENERGY RANGE (Columns 42-55)

The energy range field consists of two floating-point numbers (2E7.1) which give the minimum and maximum energies for the data referenced. If the data is presented only at one energy, it is given in the first field; the second field is blank. If an upper limit only is known, it is given in the second field; the first field is blank.

If only the approximate range is known, only the exponents are entered.

A five-character code is used to define the energy for spectrum-averaged values. A list of all legal codes is given in DANIEL Dictionary 48.

If the reference covers two or more distinct energy ranges that may be viewed as separate experiments or calculations, separate entries should be made. *Example*: a measurement at thermal energy of Maxwellian-averaged cross section and a separate measurement over the energy range 5 eV to 6 keV.

If no information on the energy is given, the code NDG (no data given) is used.

For quantities for which an incident energy is meaningless, *i.e.*, nuclear and spontaneous fission quantities, both fields are left blank.

[8] By extensive is meant that each work is extensive enough to warrant publication on its own. For example, a comparison of measured angular distributions with optical model calculations is not regarded as fulfilling this criterion. This comparison should be noted in the comment for the experimental data.

HIERARCHY CODE (Column 56)

The one-digit Hierarchy code is used to distinguish between different types of records, or to denote the importance of a reference. Valid hierarchy codes are defined in the following table.

Code	Use
1	Main publication. Assigned only to a publication known to be the definitive publication.
2	Published reference (journal or conference proceeding).
3	Other major reference, such as, complete laboratory report or a thesis.
4	Translation for reference with hierarchy 1-3.
5	Minor reference, such as, a progress report, a meeting abstract, or a private communication.
6	Data index entry. A reference to an entry in a data library which gives the numerical data referenced in the block.
8	A reaction product record. Gives, in the Comments field, a list of the reaction products measured in a nuclide production or fission product yield measurement (SSAAAM), separated by commas. The energy and reference fields are blank.
9	An institute cross-reference record. Lists, in the Comments field, codes for other institutes involved in the producing the data, separated by commas. The energy and reference fields are blank.

REFERENCE (Columns 57-85)

The reference consists of three fields: reference type, reference code, and reference date. The format of the reference field depends on the reference type. The exceptions are:

For Hierarchy 8 and 9 records, the entire reference field is blank.

Reference type (Column 57)

The Reference Type consists of a one-character code taken from DANIEL Dictionary 4.

Reference Code (Column 58-79)

In general, references are coded as for EXFOR and use the same dictionaries and codes. See the EXFOR Manual for coding rules, and DANIEL Dictionaries 5-7 for document codes.

1. For reference type codes 0 and 4:
   - columns 58-62 EXFOR
   - columns 63-67 EXFOR Accession number (or 00000, if unassigned)
   - column 68 full stop (.)
   - column 69-71 EXFOR Subaccession number

2. For reference type code 3:
   - columns 58-63 evaluated file name (see DANIEL Dictionary 44)
   - columns 64-79 version number, data set number.

Reference Date (Column 80-85)

The reference date is given as an 6-digit integer: 4-digit year, 2 digit month (YYYYMM). If the month is not known, it may be omitted.

COMMENTS (Columns 86-125)

Comments for reference records should start with the first author's last name, terminated with a full stop (.) for a single author or a plus sign (+) for multiple authors. If no author is known, column 86 should contain a full stop.

The author's name is followed by additional, abbreviated information about the work.

The comment should contain information on whether and how the data is presented in the reference.

Examples: NDG (no data given)
GRPH (graphs)
TBL (table)

For allowable character set and translation of Cyrillic characters, see EXFOR Manual, Chapter 1.

Comments for the data index lines should contain:
for EXFOR, the number of data lines, and type of data;
for evaluations, the evaluator.

For Hierarchy 8 and 9 records, the comment filed has a special significance, see Hierarchy Code.

CINDA2001

Correspondence
Old CINDA Quantity - new Reaction-Quantity

by Meinhart Lammer (Nuclear Data Section)

The new quantity codes to be used for CINDA are contained in Dictionary 45 (see Appendix). They consist of codes extracted from DANIEL Dictionary 13 and additional codes not required for EXFOR, selected to meet CINDA needs.

The new quantity codes are more specific than the old ones about the type of data presented. They allow distinctions e.g. between total, partial or differential cross sections which were not possible with the old quantities. Specific examples are:
- NG was used to code total and partial (to isomer) capture cross sections (now distinguished by quantity CS resp. CSP);
- SNG and DNG were used for all γ-ray data: production cross sections, energy spectra, angular distributions, etc.;
- DIN was used for partial cross sections and all kinds of differential data;
- charged particle production cross section (NP,NA, etc.) were used for all types of data involved.

Therefore, in the conversion from old CINDA quantities to the new reaction+quantity formalism there are many cases were a new quantity could not be specified.

The table below lists the old CINDA quantities and the corresponding new codes for reaction and quantity. Where there is no one-to-one correspondence between old and new quantity, as mentioned above, the corresponding "new Q" field is blank in the table. Apart from the conversion, we propose the following important new features:

- **LDL** will be replaced by NQ (nuclear quantity) under which level density parameter, spin cutoff factor, nuclear temperature, etc. will be coded.

- There will be no correspondence for **CHG** for 2 reasons:
  (1) the distinction to code fission product and mass yields as NFY and charge yields as CHG was artificial;
  (2) also fractional yields (before coded as CHG in CINDA) are coded in EXFOR as ratios of fission yields with SF6=FY.

  Present solution (as proposed):
  - everything called fission yield, in EXFOR coded with FY in SF6, will be coded as NFY,
  - all other fission fragment quantities (including ZP and AP) will be coded as FRS.

  My personal thoughts concerning this matter (which I present for your consideration) are as follows: in addition to NFY (fission yields of mass, charge, products) and FRS (fragment kinetic energy, angular distribution, anisotropy etc.) there are parameters of theoretical concepts for distributions such as most probable mass or charge, widths of distributions, odd-even effects etc., which are neither NFY nor FRS (and also not the old CHG: there was no justification to code Ap as NFY and Zp as CHG as they are both theoretical concepts and not yields). Obviously, this third category has no correspondence in EXFOR quantities (although they can be derived from measurements). Therefore I propose to consider 3 quantities for fission product data:

- NFY for all data that are fission yields (PC/FIS) or ratios thereof (= fractional yields);
- FRS for differential with respect to angle, energy (distributions, anisotropy, etc.) fragment data
- PAR for parameters of mass or charge distribution models, either derived from measurements or to be used in entries for theoretical work.

- There will be only one quantity NU for prompt neutrons, which will include entries under the old codes **NU, NUF** and **SFN**.

- There will be no distinction in radiation spectra from fission corresponding to the old codes **SFG, FPG** and **FPB**. The new quantity code will be SPC and the distinction has to be clear from the reaction field (define outgoing particle) and the comments.

- **Strength function** will have no special code but will be coded as resonance parameter with appropriate comment.

- For the quantities defining ratios, **alpha** and **eta**, we allow a slash in the outgoing field that defines the ratio: e.g. alpha has reaction=N,G/F and quantity=ALF.

For the automatic conversion of old CINDA entries we propose the following solution to ensure that due to these changes there will be **no loss of information**:
- For blocks containing EXFOR index lines the coding derived from the EXFOR reaction should be adequate.
- A similar solution should be possible for evaluated data index lines.
- For the remaining entries, abbreviated information corresponding to the extinct codes could be added automatically to the comments, e.g. (CHG - CHG DIST), (NUF - FRAG NS), (SFG - PROMPT GS), (FPG - FP GS), etc., as given in the column "comment" in the table below.

Table: "Q" stands for quantity. The last 2 columns show the old expansion in the CINDA book and my proposals for new expansions, which I put forward for discussion.

old Q	**reaction**	**new Q**	**comment**	**expansion in book:**	
				old	**new**
SEL	N,EL	CS		Elastic	total (n,n)
DEL	N,EL	DA		Diff Elastic	(n,n) angular distribution
POL	N,X	POL		Polarization	(n,X+n) polarization
POT	N,EL	POT		Potential Scat	(n,n) potential scattering
SIN	N,INL	CS		Total Inelastic	total (n,n′)
DIN	N,INL			Diff Inelastic	partial/differential (n,n′)
SCT	N,SCT			Scattering	n-scattering
N2N	N,2N			(n,2n)	(n,2n)
NXN	N,XN			(n,xn) x>2	(n,xn) x>2
NEM	N,X+N			n Emission	(n,X+xn) x=1,2,..: n-emission

old Q	reaction	new Q	comment	expansion in book: old	new
NG	N,G			(n,γ)	(n,γ)
RIG	N,G	RI		Res Int Capt	(n,γ) resonance integral
SNG	N,G			Spect (n,γ)	(n,γ) γ product/spectra
DNG	N,INL+G			Inelastic γ	(n,n′γ) γ product/spectra
NEG	N,X+G			Nonelastic γ	(n,X+γ) nonelastic γ
NP	N,P			(n,p)	(n,p)
NNP	N,N+P			(n,np)	(n,np)
PEM	N,X+P			p Emission	(n,X+p) p-emission
ND	N,D			(n,d)	(n,d)
NND	N,N+D			(n,nd)	(n,nd)
DEM	N,X+D			d Emission	(n,X+d) d-emission
NT	N,T			(n,t)	(n,t)
NNT	N,N+T			(n,nt)	(n,nt)
TEM	N,X+T			t Emission	(n,X+t) t-emission
NHE	N,HE3			(n,He3)	(n,X+He3)
NA	N,A			(n,α)	(n,α)
NNA	N,N+A			(n,nα)	(n,nα)
AEM	N,X+A			α Emission	(n,X+α) α-emission
NF	N,F	CS		Fission	(n,f)
RIF	N,F	RI		Res Int Fiss	(n,f) resonance integral
ALF	N,G/F	ALF		Alpha	alpha = (n,γ)/(n,f)
ETA	N,F/ABS	ETA		Eta	eta = $\bar{n}$ (n,f)/(n,abs)
NU	N,F or 0,F	NU	N-MULTIPL	Nu	(n,f) or (0,f) prompt n
NUD	N,F or 0,F	NUD		Delayed Neuts	(n,f) or (0,f) delayed n
NUF	N,F or 0,F	NU	FRAG-NS	Frag Neutrons	(n,f) or (0,f) prompt n
SFN	N,F or 0,F	NU	N-SPEC	Spect Fiss n	(n,f) or (0,f) prompt n
SFG	N,F or 0,F	SPC	PROMPT GS	Spect Fiss γ	(n,f) or (0,f) prompt γ
FPG	N,F or 0,F	SPC	FP GS	Fiss Prod γ	(n,f) or (0,f) prompt γ
FPB	N,F or 0,F	SPC	FP BETAS	Fiss Prod β	(n,f) or (0,f) prompt γ
NFY	N,F or 0,F	FY		Fission yield	(n,f) or (0,f) fission yield
FRS	N,F or 0,F	FRS		Frag Spectra	(n,f) or (0,f) fragment spectra
CHG	N,F or 0,F	FY	CHG DIST	Frag Charge	(n,f) or (0,f) fission yield
TOT	N,TOT	CS		Total	(n,tot)
SNE	N,NON	CS		Nonelastic	(n,nonelastic)
NX	N,X			Nucl Production	(n,X) nuclide production
ABS	N,ABS	CS		Absorption	(n,absorption)
RIA	N,ABS	RI		Res Int Abs	(n,abs) resonance integral
RES	N,0	RP		Reson Params	(n,0) resonance pars
STF	N,0	RP	STRGTH FN	Reson Params	(n,0) resonance pars
LDL	0,0	NQ		Level Density	nuclear quantity
GN	G,N			(γ,n)	(γ,n)
GF	G,F			Photofission	photofission
EVL	N,X	EVL		Evaluation	neutron data evaluation
TSL	N,SCT	TSL		Thermal Scat	neutron thermal scat

Dictionary 45 (CINDA2001 quantity codes)

ALF	Alpha
AMP	Length or amplitude
COR	Angular correlation
CS	Cross section
CSP	Partial cross section
CST	Temperature dependent cross section
D3A	Triple differential dAngle1/dAngle2/dE'
D3E	Triple differential dAngle/dE1'/dE2'
D4A	Quadruple diff. dAng1/dAng2/dE1'/dE2'
DA	Differential d/dAngle
DAA	Double differential dAngle1/dAngle2
DAE	Double differential dAngle/dE'
DAP	Partial differential d/dAngle
DAT	Temperature-dependent Legendre coefficient
DE	Differential d/dE'
DEP	Energy spectrum for specific group
EC	Energy correlation
ETA	Eta
FRS	Fragment spectra
FY	Fission product yield
INT	Cross section integral over incident energy
KE	Kinetic energy
LMC	Partial linear momentum correlation
EMC	Effective mass correlation
NQ	Nuclear quantity
NU	Nu
NUD	Nu delayed
POL	Polarization
POD	Differential polarization
POT	Potential scattering
PY	Product yield (other than fission)
RI	Resonance integral
RP	Resonance parameter
RR	Reaction rate
SPC	Secondary energy spectrum
TSL	Thermal scattering
TT	Thick target yield
TTD	Differential thick target yield, d/dAngle
TTP	Partial thick target yield

EXFOR as a multi-platform relational database: current status of development

V.Zerkin, NDS-IAEA

The Nuclear Reaction Database (NRDB) will combine CINDA, EXFOR, ENDF and Dictionaries as a united relational database. The EXFOR part on the NRDB project ("EXFOR-relational") is basically continuation of EXFOR/Access database distributed on CD-ROM since 2000. The project aims in developing platform independent software for using EXFOR as a relational database being used on PC, in local network and through the Web. EXFOR-relational suppose to work on most popular operating systems and several DBMS.

Because EXFOR-relational is becoming a part of united Nuclear Reaction Database, further development of EXFOR/Access contained following directions:

1. Study, investigations of a technical solution to be applied in EXFOR-relational, tests of performance on different platforms (see Tables 1, 2, Fig 2.);
2. Development of first version of platform independent software for loading data to database and retrieval Java-program (See Fig.1);
3. Migration to EXFOR/NRDB schema (See Fig.3);
4. Design and development Web version of EXFOR-relational;
5. Practical using of load software for creating EXFOR/Access CD-ROM revisions;
6. Extend functionality and simplify installation of EXFOR/Access;

Improvements of EXFOR/Access on CD-ROM:

1. Enhanced search of product (SF3, SF4, ELEM/MASS)
2. User's Manual in html pages, auto-run program, simpler ZVView installation
3. Accelerated search of data
4. Version without external X4 files (user does not need to read CD-ROM for X4 file reconstruction or install ~100,000 files on Hard Disk)
5. Plugged in Statistics system

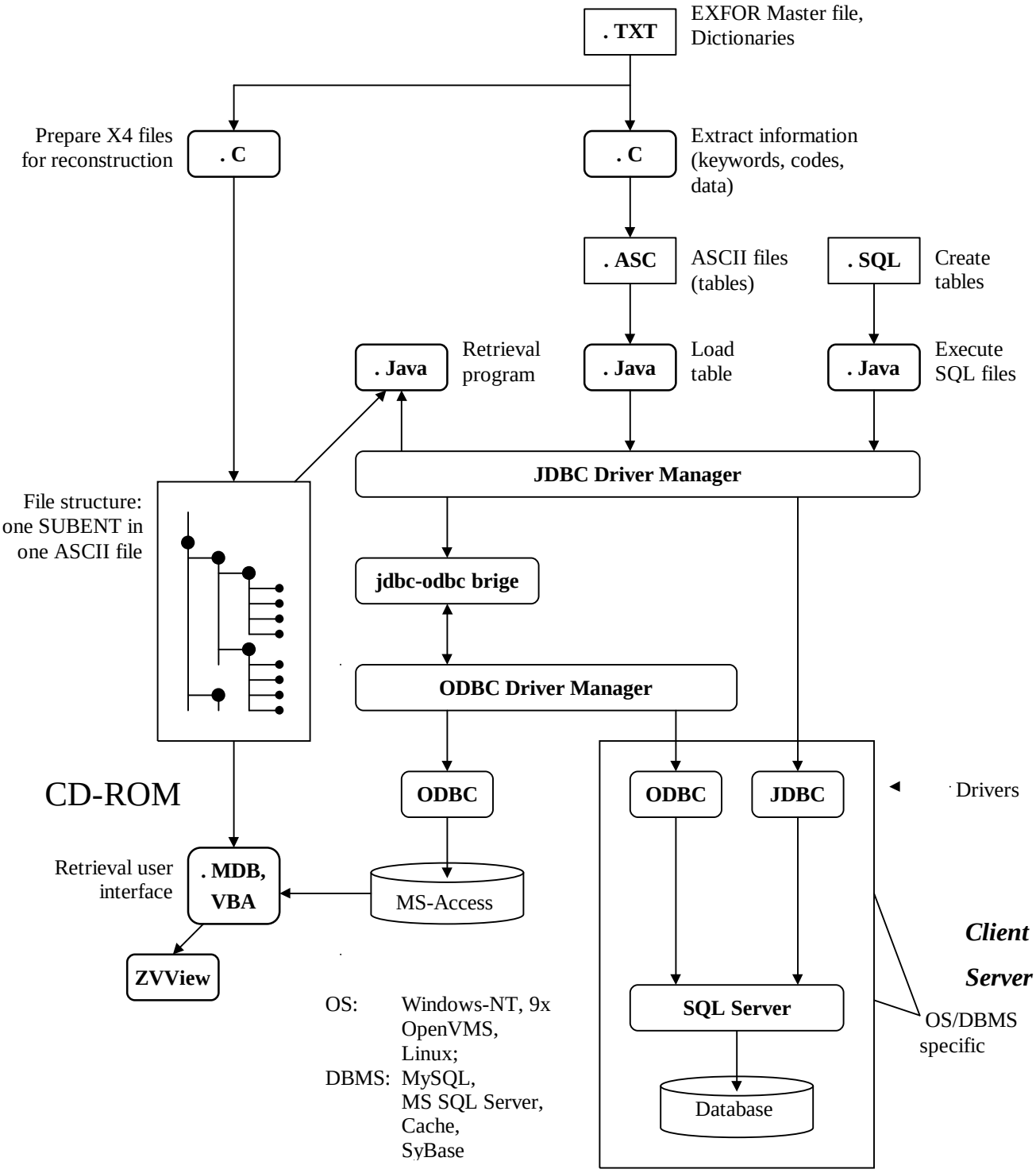

Fig.1. EXFOR Relational: programs and data flow

EXFOR relational on Java/JDBC: performance on different platforms.

Table 1. Access to database by standalone Java programs via JDBC drivers

DBMS on Server	Server OS	Client OS	Load tables (min:sec) ENTRY 12,357rec. 1.5 Mb	SUBENT 79,175rec. 11.5 Mb	REACT 94,703rec. 13.5 Mb	Retrieve data (sec) Execute SQL-1: First time after restart	Fastest time of execution	BLOB checked	N
Access-97	NT*	NT	1:00	6:42	12:20	4.5	0.06	√	1
MS-SQL-6.5	NT*	NT	1:19	8:32	10:36	4.5	0.03		2
Cache[3] 3.2.1.8	NT*	NT	0:24	2:40	5:16	8	3.6		3
	VMS*	VMS	5:18	32:58	78:12 [2]	6.6	0.99		4
		NT	1:18	8:24	13:35	6.5	0.99	√	5
		Linux					0.99		6
Cache[3] 3.2.1 (from Germany)	Linux*	VMS					0.45		8
		NT					0.05		9
		Linux	0:16	1:43	3:35	4.7	0.23		10
	NT	NT				4.7	0.15		11
		Linux				4.6	0.14		12
MySQL v-3.23.27	NT*	NT	0:16	1:40	1:15	12	1.06		13
	Linux*	NT	0:28	4:27	4.56	5.7	0.1		14
		Linux	0:09	0:53	2:06	5.2	0.07		15
	NT	Linux	0:35	3:59	7:41	10.2	1.2		16
ASE-12.5b[4]	Linux	NT	2:16	14:23	35:17		0.06	√	17
ASA-7.0[4]	NT*	NT	0:59	6:24	12:09		1.57	√	18

Table 1a. Web access to database by CGI-Java and Servlets via JDBC drivers

Alpha-VMS > USU-Server > CGI/Perl > JDK-1.1.7 > Cache-3.2.1.8	12-15	11.7		18
LinuxRedHat-6.2 > Apache / JServ / JDK-1.3.0 > MySQL-3.23.27-beta	5.2	0.1		19

* Server was located on the same machine as Client.
[2] Java itself is slow on VMS: e.g. load time of REACT without execution of SQL statements was 26:30
[3] Cache buffers were set up to 16/8 Mb.
[4] Done in NNDC (BNL,USA), March, 2001: NT-RAM=64Mb; LAN: slow

Table 2. Performance with different ways to store original EXFOR data [*].

Store Subentries as	*Read by*	*Extract by*	*MDB file (Mb)*	*Text files (Mb)*	*Time to create[3] X4 (sec)*	*Add cost*
BLOB/Zip	VBA	DynaZIP-32	180	-	25	$200
BLOB/Zip	VBA	Pkunzip/DOS	180	-	107	-
BLOB/Zip|Text[4]	VBA	Pkunzip/DOS	301	-	65	-
BLOB/Text	VBA	-	421	-	16	-
Text Files	VBA	-	105	270[2]	15	-
Text Files	Java	-	105	270[2]	100	-

* Database: Access-97, VBA buffer size: 4096 bytes; [2] Total number of files: 99,523; [4] size limit for zip: 4096 b
[3] Request: "`WHERE (SAN='1000*')`"; Reactions: 99; Subentries: 91; X4: 11.7Mb (144,414 lines)

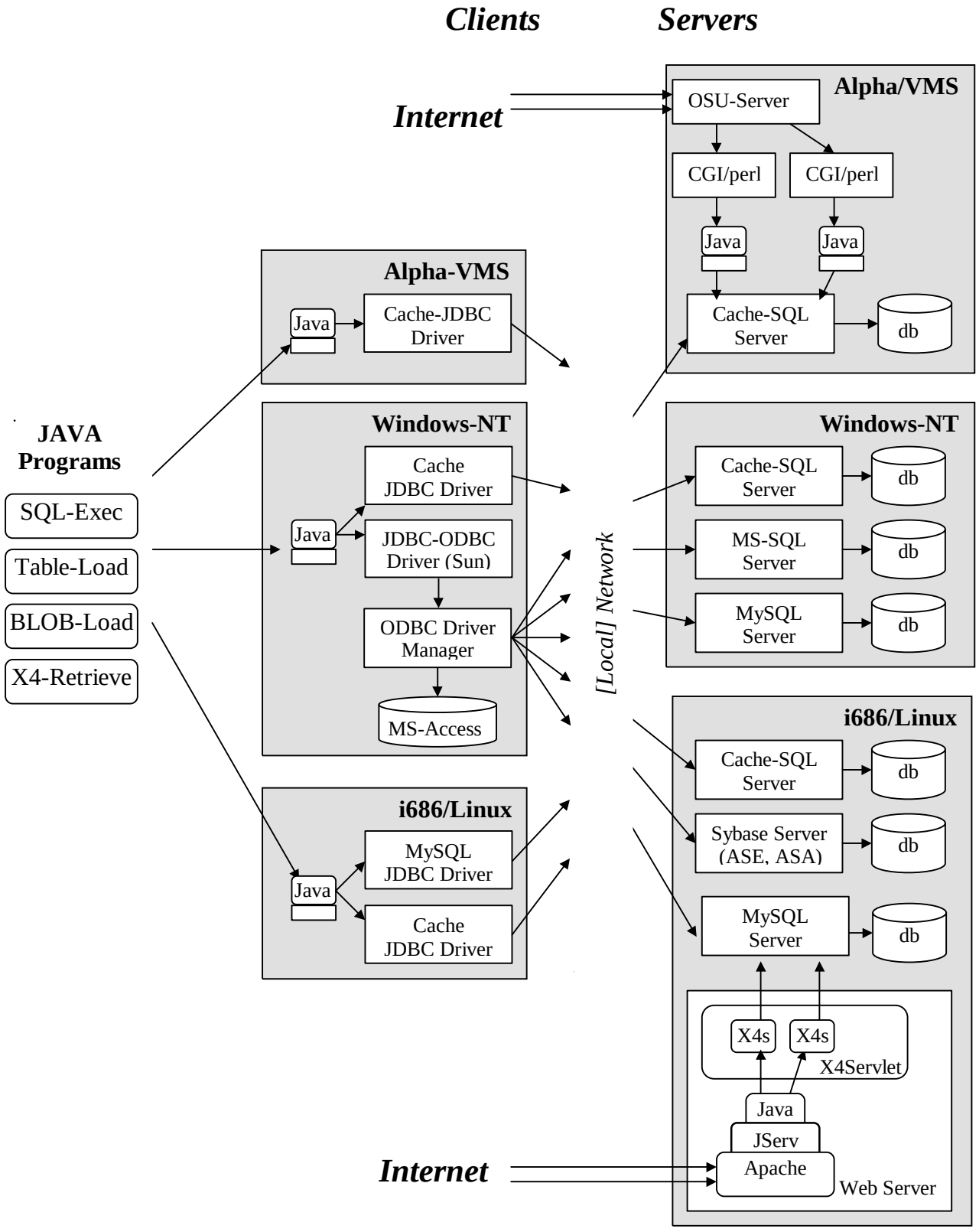

Fig.2. EXFOR multi-platform implementation: studied and tested architectures

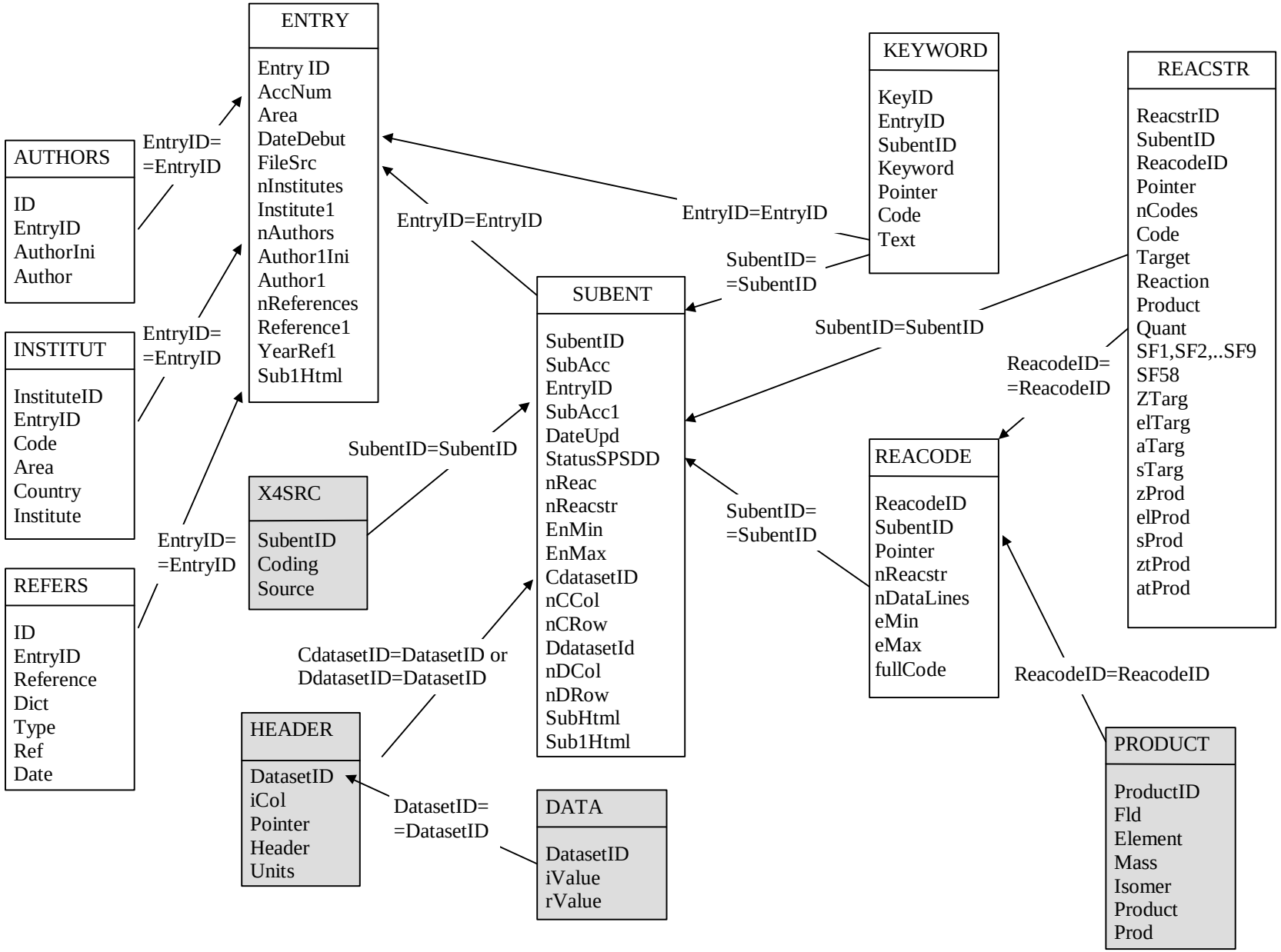

Fig.3. EXFOR Relational: Schema, May-2001

Compilation and Evaluation of Alpha-Induced Nuclear Reaction Cross Sections for Astrophysics

ABSTRACT: Nucleosynthesis and energy production in stellar environments depend critically on nuclear reaction cross sections. Reactions induced by alpha particles are important in the helium burning stage of stars, novae, and supernovae events. They involve light to medium weight nuclei up to about Z=32, and center-of-mass energies up to about 20 MeV. The proposed project involves three components. A complete set of all available experimental data for the alpha-induced reactions for nuclei in the range of interest will be compiled and will be available online to the community. Optical Model (OM) parameters will be adjusted to match elastic scattering and total reaction data. These parameters will also be made available to the community and may be used to calculate data for other isotopes. Finally, a set of cross section evaluations for these reactions will be made and may be used by the astrophysics community to calculate reactions rates. The astrophysical implications of the data and the conversion into reactions rates will be explored.

PROJECT NARRATIVE

A. Participants

Oak Ridge National Laboratory Experimental Nuclear Astrophysics Group (ORNL): The Experimental Nuclear Astrophysics Group is a part of the Oak Ridge National Laboratory Astrophysics Program. In addition to experiments, the group hosts a Nuclear Data for Nuclear Astrophysics Web site, and has recently been involved in the calculation of astrophysical reaction rates for relevant reactions. These rates are derived from laboratory measurements of cross sections convoluted with a thermal (Maxwell-Boltzmann) relative velocity distribution.

National Nuclear Data Center (NNDC): The National Nuclear Data Center is funded by the U.S. Department of Energy to provide services in the field of low and medium energy nuclear physics to users in the United States and Canada. The NNDC databases are available online, both using the telnet protocol and on the Web. All data are provided free of charge.

Since 1962, the National Neutron Cross Section Center (then known as the Sigma Center) has provided information on neutron-induced nuclear reactions. In 1980, the evaluations of nuclear structure and radioactive decay data became part of its responsibility and its name was changed to the National Nuclear Data Center. In 1996, the reaction compilation effort was expanded to include charged-particle induced reaction data with an initial concentration on proton-induced reactions.

In addition to its long history of expertise in compilation, the recent addition of new staff members has again provided the NNDC with expertise in the evaluation of nuclear reaction data.

Nuclear Physics Data Center (NPDC): The Russian Federal Nuclear Center, VNIIEF, originated a project in 1973 to compile data on the interaction of charged particles with light nuclei to support the calculation of thermonuclear reaction rates; this library now contains over 1500 references. As a result of this work, the NPDC was established in 1997. The NPDC staff has achieved an expertise in the compilation and evaluation of these data, including making experimental measurements and developing techniques for the extrapolation of these cross sections to very low energies.

During the last six years specialists of the Center took an active part in the ISTC Projects "Development of the library of evaluated nuclear data on charged particles for International Thermonuclear Reactor (ITER) and other applications of thermonuclear fusion" and "Benchmarks data on γ-ray production for fusion application", which were involved the compilation and evaluation of nuclear data for the International Thermonuclear Energy Reactor (ITER). These projects have been successfully completed.

SaBa, an electronic version of the evaluated and experimental data on charged particles, has been developed by NPDC for thermonuclear applications. It contains an optimal set of data processing procedures and friendly interface, which can be used for various applications in the astrophysical data program.

B. Astrophysical Data Needs

Nucleosynthesis and energy production in stellar environments depend critically on nuclear reaction cross sections. The recent observation of highly energetic star explosions, the so-called hypernovae[1], gamma-ray bursts[2], and the use of type IA supernovae[3] as standard candles to determine the Universe expansion rate are clear examples of new developments in this field.

Due to the success of space missions like Hubble, CGRO, and Chandra, as well as terrestrial observatories such as KEK and ESO among others, scientific activities in Astrophysics have been considerably boosted in recent years. Since new facilities will become operational in the near future and many others are under serious consideration, these activities are only likely to continue growing. A keystone in the field will be the launch, scheduled for 2002, of the gamma-ray observatory Integral. New and exciting results are expected in Nuclear Astrophysics.

Reactions induced by alpha particles are important in the helium burning stage of stars, novae, and supernovae events[4]. They involve light to medium weight nuclei up to about z=32, and center-of-mass energies up to about 20 mev. The most widely used a-potential (McFadden-Satchler)[5] was determined about 35 years ago and is an "average potential", that is, it is applicable for all nuclei, and as a consequence, not suitable for accurate calculations. The availability of a compiled body of cross section data is of prime need for our understanding of stellar physics and the refinement of theoretical models. Such data have been measured, but most have not yet been made available to the community in an easily accessible electronic form.

C. Approach and Objectives

The NNDC, NPDC, and ORNL propose to cooperate on a program to produce nuclear data of use in calculating astrophysical reaction rates. The final product of this project will be evaluations of alpha-induced cross sections for nuclei with 8=Z=32 and $E_{c.m.}$ =20 MeV. The initial phase of this work, which is covered by this project, will focus on the nuclei, ^{24}Mg, ^{28}Si, ^{32}S, ^{36}Ar, and ^{40}Ca.

The project will involve the following three main components.

1. Data compilation

A search will be made of the available literature for experimental measurements of these quantities. The references will be coded by the NPDC compiler in the nuclear reaction bibliographic data format, CINDA2001[6].

All data will be compiled at both the NNDC and the NPDC into the EXFOR format[7]. If we are unable to acquire the actual data, the NPDC will scan the data from the figures given in the literature using a code developed at NPDC to scan and write the data in EXFOR format[8]. All scanned data points will be read at least twice; more if there is a serious discrepancy in the readings. The data will be transmitted by NPDC to the NNDC for entry into the EXFOR data library.

A two-month visit to the NNDC by the NPDC data compiler for training in CINDA and EXFOR compilation is planned. The FSU co-investigator will also visit BNL during this time to set up procedures for producing the bibliographic references and the data compilations.

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[1] Q.D. Wang, Astrophys. Journal **517**, L27 (1998).
[2] L. Amati *et al.*, Science **290**, 953 (2000).
[3] S. Perlmutter *et al.*, Nature **391**, 51 (1998).
[4] See *Opportunities in Nuclear Astrophysics: Origin of the Elements*, http://www.nd.edu/~nsl/kn/whitep.pdf, especially, pp. 20-21, p. 25, and Section XII.
[5] L. McFadden and G. R. Satchler, Nucl. Phys. **84**, 177 (1966).
[6] CINDA2001 database is under development and will be available in the spring of 2002.
[7] V. McLane, *EXFOR Systems Manual*, Brookhaven National Laboratory informal report BNL-NCS-63330-00/04-Rev. (April 2000)
[8] S.A.Dunaeva, A.V.Kuryakin. The software on input, processing and writing data in EXFOR format, Preprint 43-96, RFNC-VNIIEF, Sarov, 1996.

2. Optical Model Fitting

A set of Optical Model (OM) parameters will be produced by matching OM calculations to alpha-induced elastic scattering angular distribution data and total reaction cross sections using the well-established codes SCAT2[9] and ECIS[10] (including its search and fitting version ECISVIEW[11]). These parameters may be used to calculate data for other isotopes.

This work will be done as a joint collaboration between the NNDC and NPDC. During the first year, a visit to the NPDC by a U.S. researcher to the NPDC is planned to initiate contact and set up a work schedule.

3. Cross Section Evaluation

The experimental data for (a,n), (a,p), and (a,?) reactions will be evaluated using the statistical reaction model codes EMPIRE-2[12] and MOST[13], and the above OM parameter set. The code EMIRE-2 currently resides at the NNDC and P. Oblozinsky has extensive experience in its use. NNDC will be acquiring the MOST code in the near future. We plan to make comparisons with results produced using the code NON-SMOKER[14], which is a code heavily used by the astrophysics community. A recommended set of cross sections will be produced for each nucleus.

During the first year, a visit by an NPDC evaluator to NNDC for a period of three months is foreseen to work with the NNDC evaluators and acquire hands-on experience with the codes to be used. The EMPIRE-2 code will be installed at the NPDC. Evaluation work will begin in the second year of the project with evaluations for the nuclei, ^{24}Mg, ^{28}Si, ^{32}S, ^{36}Ar, and ^{40}Ca.

The completed evaluations will be stored in the Evaluated Nuclear Data File (ENDF) format[15] and made available to the community. A retrieval code will be developed to produce data in formats convenient for use by the astrophysics community to calculate thermonuclear reactions rates. A visit of an NPDC programmer to the NNDC for a period of six weeks is foreseen for this purpose. Michael Smith, the ORNL researcher, will plan to visit NNDC during this time.

The astrophysical implications of the data and the conversion into reactions rates will be explored by ORNL in collaboration with the other participants.

D. Milestones and Measurements of Success

First Year of Project

The literature search and bibliography for all nuclei in the range of interest will be completed. All references will be transmitted to the NNDC in the CINDA2001 format. These references will then be made available to the community on the NNDC Web site.

Compilation of the data will be completed for all alpha nuclei (*i.e.*, even Z, A divisible by 4) in the range of interest.

An Optical Model parameter library will be produced for all alpha nuclei in the range of interest. This set of OM parameters will be transmitted to the Nuclear Data Section at the International Atomic Energy Agency in Vienna, Austria for entry into the Reference Input Parameter Library (RIPL)[16], which is available free of charge to the community.

A paper on the project will be submitted to NIC7. Comments from the astrophysics community will be solicited.

Second Year of Project

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[9] O. Bersillon, SCAT2: *Un programme de modele optique spherique*, CEA Saclay report CEA-N-2227 (1981); revision 1991.

[10] J. Raynal, *Notes on ECIS94*, CEA Saclay report CEA-N-2772 (1994); revision 1997.

[11] A.J. Koning, J. van Wijk and J.P. Delaroche, *ECISVIEW: An interactive toolbox for optical model development*, unpublished (2000).

[12] M. Herman, *EMPIRE-2: Statistical model code for nuclear reaction calculations*, unpublished (2000).

[13] S. Goriely, *MOST: An updated HF model of nuclear reactions*, Nuclei in the Cosmos, N. Prantzos et al., Eds. (Editions Frontières, Paris, 1998) p.314.

[14] T. Rauscher, F.K. Thielemann, *Code NON-SMOKER*, At.Data and Nuclear Data Tables **75** (2000) 1-351.

[15] V. McLane, editor, *ENDF-102 Data Formats and Procedures for the Evaluated Data File ENDF-6*, Brookhaven National Laboratory Informal Report BNL-NCS-44945, Rev. 2/97 (1997).

[16] *Handbook for calculations of nuclear reaction data: Reference input parameter library*, International Atomic Energy Agency report IAEA-TECDOC-1034 (Vienna, 1998).

By the end of the second year, data compilation will be completed for all nuclei in the range of interest. All data will be entered into the CSISRS database which is available online and free of charge[17].

Evaluations for the nuclei, ^{24}Mg, ^{28}Si, ^{32}S, ^{36}Ar, and ^{40}Ca will be completed. The data will be made available in the ENDF format on the NNDC Web site.

Participation of FSU personnel	
Dunaeva Svetlana Aleksandrovna	Manager
Kamskaya Elena Vladimirovna	Compilation, evaluation
Pozdysheva Diana Nikolaevna	Compilation, software
Taova Sophia Mihajlovna	Software, database upgrading
Zvenigorodsky Anatoly Grigorievich	Evaluation
Participation of US personnel	
Charles L. Dunford	Manager
Victoria McLane	Compilation, training, coordination.
Pavel Oblozinsky	Evaluation, model code training.
Alejandro Sonzogni	Evaluation, astrophysical theory.
Michael Smith	Astrophysical theory, reaction rates.

[17] All data will be available on the NNDC Web site: ***www.nndc.bnl.gov***.

Journal coverage for CINDA

assembled by M.Lammer

Explanation to Table:

scan: scanning of journal

- circ = received regularly in circulation
- circ stopped = not received in circulation any more; other source to be found
- c.a.s. = current awareness service (current contents, IAEA library SDI service, etc.)
- not specified = listed as being covered but regularity not specified
- stopped cov = coverage stopped

entry: CINDA entries prepared for

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

area	NNDC		NEA-DB		NDS		CJD	
code	scan	entry	scan	entry	scan	entry	scan	entry
area 1								
AJ	regular	exp area 1	not specified					
AND	regular	exp area 1	regular	area 2	circ	area 3 (+1)		
ARN	regular	exp area 1			circ	area 3 (+1)		
CJP	regular	exp area 1			circ	area 3 (+1)		
IRE	stopped cov				circ	area 3 (+1)		
NSE	regular	exp area 1	regular	area 2	circ	area 3 (+1)		
NT	stopped cov				circ	area 3 (+1)		
PR/C	regular	exp area 1	regular	area 2	circ	area 3 (+1)		
PRL	regular	exp area 1	not specified		circ	area 3 (+1)		
area 2								
AEJ					stopped cov			
ANE			regular	all	circ	area 3		
ANP					c.a.s.	area 3		
APA								
ARI					circ	area 3		
EUL					c.a.s.	area 3		
JP/G			regular	all	circ	area 3		
JPJ					c.a.s.	area 3		
KT					circ	area 3		
NC/A					c.a.s.	area 3		
NIM/A			not specified		c.a.s.	area 3		
NIM/B			not specified		c.a.s.	area 3		
NP/A			regular	all	circ	area 3		
NST					circ	area 3		
PL/B					circ	area 3		
PL/C					circ	area 3		

area code	NNDC scan	NNDC entry	NEA-DB scan	NEA-DB entry	NDS scan	NDS entry	CJD scan	CJD entry
area 2 (cont'd)								
PNE					circ	area 3		
PNP					circ	area 3		
RCA			not specified		circ	area 3		
ZN/A					c.a.s.	area 3		
ZP/A			regular	all	c.a.s.	area 3		
area 3								
AAB					circ	all		
AHP					circ stopped			
AJN					c.a.s.	all		
AJSE					c.a.s.	all		
APP/B					c.a.s.	all		
AUJ					circ	all		
BJE					circ	all		
BJP					circ	all		
CNP					circ	all		
CRB					circ	all		
CST					circ	all		
CZC					c.a.s.	all		
CZJ					circ	all		
CZJ/A					circ	all		
FIZ/B					circ	all		
HFH					circ	all		
IJP/A					circ	all		
IPA					circ	all		
JRN					circ	all		
Int.J.Mod.Phys.					c.a.s.	all		
Mod.Phys.Lett.					circ	all		
PHE					circ	all		
PRM					c.a.s.	all		
RJP					circ	all		
RMF					circ	all		
RRIP					circ stopped			
translation series								
AE/T					circ	all		
BAS					circ	all		
HEN					c.a.s.	all		
JEL					c.a.s.	all		
PAN					circ	all		
SRA					circ	all		
area 4								
AE							regular	all
IZV							regular	all
RAK							regular	all
YF			not specified				regular	all
YK							regular	all
ZEP							regular	all