International Atomic Energy Agency

INDC(NDS)-90
Distr. G + Sp.

INDC INTERNATIONAL NUCLEAR DATA COMMITTEE

REPORT ON THE

SECOND CONSULTANTS' MEETING

OF

NUCLEAR REACTION DATA CENTERS

Kiev, USSR, 11 - 16 April 1977

Including the

THIRTEENTH FOUR-CENTER MEETING

and the

THIRD MEETING ON CHARGED PARTICLE NUCLEAR DATA COMPILATION

Edited
by
H.D. Lemmel

October 1977

IAEA NUCLEAR DATA SECTION, KÄRNTNER RING 11, A-1010 VIENNA

Reproduced by the IAEA in Austria
November 1977
77-9574

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FOREWORD

The Second Consultants' Meeting of Nuclear Reaction Data Centers was held by the IAEA at Kiev, USSR, in the week of 11-16 April 1977.

This Second "NRDC Meeting" combined the 13th "Four Centers Meeting" (Consultants' Meeting of the Four Neutron Nuclear Data Centers) with the third "CPND Meeting" (Consultants' Meeting on Charged Particle Nuclear Data Compilation). It was a successor to the preceding meetings under these names held in Vienna, 26-27 April 1976, and reported in INDC(NDS)-77 and INDC(NDS)-78 respectively.

Since the EXFOR System is used for the exchange of neutron data and charged particle data, it appeared appropriate to hold the consultants' meetings of the respective data centers jointly and to report on them in the present joint document. The agenda included also a session on photonuclear reaction data.

In Part I of the Meeting, the neutron data centers held a special session on neutron data matters, in particular on the jointly operated neutron data index CINDA, whereas all items of more general interest, in particular the data exchange system EXFOR, were treated in Part II of the Meeting.

2nd Consultants' Meeting of Nuclear Reaction Data Center (2nd NRDC Meeting)

Kiev, USSR, 11-16 April 1977

Part I: 13th Meeting of the Four Neutron Nuclear Data Centers

Monday 11 April, Tuesday 12 April, Saturday 16 April

List of Participants

CJD (USSR Centr po Jadernym Dannym)

V. Manokhin (Opening of Meeting)
V. Bychkov
N. Pashinko

NNDC (US National Nuclear Data Center)

S. Pearlstein
C. Dunford

CCDN (NEA Neutron Data Compilation Centre)

H. Derrien
A. Schofield

NDS (IAEA Nuclear Data Section)

J.J. Schmidt (Chairman)
H.D. Lemmel (Scientific Secretary)

List of Observers

Y. Abe	Japan, Kyoto University
N. Bakunjaev	USSR, State Committee, Moskva
Ju.I. Grigor'jan	USSR, Kurchatov Inst., Moskva
D. Hermsdorf	German Dem. Rep., Dresden University
H. Ikegami	Japan, Osaka University
Ju.G. Klimov	USSR, State Committee, Moskva
V.T. Kulik	USSR, Director, Information Centre of the Institute of Materials, Kiev
A. Marcinkowski	Poland, Inst. Badan Jadrowych
L. Pintiliescu	Romania, Inst. de Fisica Atomica
L.L. Sokolovskij	USSR, Kurchatov Inst., Moskva
A.P. Trofimenko	USSR, Ukr. Ak. Nauk, Kiev (Local Secretary)
L.N. Usachev	USSR, Fiziko-En. Inst., Obninsk
G. Vasiliu	Romania, Inst. da Fisica Atomic
V.P. Vertebnyj	USSR, Inst. Jad. Issl. Ukr. Ak. Nauk, Kiev
Miss G.M. Zhuravleva	USSR, Kurchatov Inst., Moskva

2nd Consultants' Meeting of Nuclear Reaction Data Center (2nd NRDC Meeting)

Kiev, USSR, 11-16 April 1977

Part II: Meeting of all Nuclear Reaction Data Centers

Wednesday 13 April to Saturday 16 April

List of Participants and Observers

Kachapag (Karlsruhe Charged Particle Group, Germany Fed. Rep.)

H. Münzel

CAJaD (Centr po Atomn. i Jadern. Dannym, Kurchatov Inst., Moskva, USSR)

F.E. Chukreev (Opening of Meeting)
L.L. Sokolovskij
G.M. Zhuravleva
Ju. I. Grigor'jan

Japanese Study Group for information processing in nuclear physics, Japan

H. Tanaka Hokkaido University
H. Ikegami Osaka University
Y. Abe Kyoto University

CJD (Centr po Jadernym Dannym, FEI Obninsk, USSR)

V. Manokhin
V. Bychkov
N. Pashinko

NNDC (National Nuclear Data Center, BNL, USA)

S. Pearlstein
C. Dunford

CCDN (NEA Neutron Data Compilation Centre, Saclay, France)

H. Derrien
A. Schofield

NDS (IAEA Nuclear Data Section, Vienna, Austria)

J.J. Schmidt (Chairman)
H.D. Lemmel (Scientific Secretary)

LIJaF (Leningradskij Inst. Jad. Fiz., USSR)

I.A. Kondurov

Photonuclear Data Group at Fiziko.Energet. Inst. Obninsk, USSR)

A.I. Abramov

ZAED (Zentralstelle für Atomkernenergie-Dokumentation, Karlsruhe, Germany Fed.Rep.)

H. Behrens

Universität Dresden, German Dem. Rep.

D. Seeliger
D. Hermsdorf

Inst. Badan Jadrowych, Warszawa, Świerk, Poland

A. Marcinkowski

Inst. de Fisica Atomica, Bukureşti, Romania

G. Vasiliu
L. Pintiliescu

Fiziko-Energeticheskij Inst. Obninsk, USSR

L.N. Usachev

Information Center of the Institute of Materials, Kiev, USSR

V.T. Kulik

Inst. Jad. Issl. Ak. Nauk Ukr. SSR, Kiev, USSR

V.P. Vertebnyj
A.P. Trofimenko (Local Secretary)

USSR State Commitee on Peaceful Uses of Atomic Energy, Moskva, USSR

Ju. G. Klimov
N. Bakunjaev

2nd Consultants' Meeting of Nuclear Reaction Data Centers ("2nd NRDC Meeting")

Kiev, USSR, 11-16 April 1977

Part I: 13th Meeting of the Four Neutron Nuclear Data Centers

AGENDA

Monday 11 April, Tuesday 12 April, Saturday 16 April

1. Opening, election of Chairman, adoption of agenda

2. Brief status reports of the Centers (on neutron data only)
   - a. Presentation of status reports
   - b. Trends in NND activities
   - c. Review of actions from last meeting

3. Cinda
   - a. Improvements, blocking, data index lines
   - b. Cinda manual and dictionaries
   - c. Publication schedule, archival issue and choice of deadline 4C-2/83 + 84
   - d. Cinda statistics, 4C-2/85
   - e. Cinda coverage control system, 4C-2/76, 4C-3/189, 4C-2/80
   - f. Ref-type codes, 4C-1/116
   - g. Cinda programming, e.g. duplication checks
   - x. Miscellaneous (Lab assignment see below under 6.e)

4. Wrenda

5. Evaluated data

5A. Exchange of experimental neutron data, experiences with TRANS tapes
   - a. Memos 4C-1/111, 4C-3/201, 4C-3/204 and many earlier ones
   - b. Clean-up of 50000 to 80000 series, 4C-1/108
   - x. Miscellaneous

6. Exfor: if related to neutron data only
   - a. (cancelled)
   - b. Revision of Protocol, 4C-1/104
   - c. Completeness: transmission of resonance-parameters
   - d. Scope: fission product yields, capture gamma data
   - e. Lab assignment, 4C-1/116 and correspondence
   - f. Derived Resonance Integrals, 4C-1/105
   - x. Miscellaneous

7. Implementation of Generalized Exfor System for NND 4C-1/84, 4C-3/180, 4C-3/190

8. Miscellaneous

9. Conclusions

Part II: All Nuclear Reaction Data

Wednesday, 13 April to Saturday 16 April

10. Opening, election of Chairman, adoption of agenda

11. Brief status reports of the Centers

12. Exfor Manual

    a. Memo CP-D/13 (CPND Supplement with additions)
    b. Revision of Sections VII and VIII, CP-D/20 and CP-D/23
    c. Coding under the Keyword MONITOR CP-D/26, also CP-C/8 and CP-D/21
    d. 5-char lab. codes? CP-D/19, CP-B/8
    e. Secondary energies CP-D/24
    f. Product Nucleus in case of fission and spallation CP-D/25, CP-C/8
    g. Coding under Keyword STATUS CP-D/21
    h. New Keyword ASSUMED CP-D/21
    i. Monitor-information under DECAY-DATA? CP-C/8, CP-D/21 CP-B/8
    j. Use of pointers CP-B/6
    k. Names of REACTION subfields
    l. Coding under REL-REF
    m. Emission Cross-Sections
    n. Relative Cross-Sections from Natural Targets CP-B/8
    o. Dictionary changes for Lab and Reference Codes
    p. Isomeric ratios etc., CP-D/22, CP-C/11
    x. Miscellaneous items

13. Photonuclear Data, 4C-4/25

14. Cooperation

    a. Distribution of Memos, Dictionaris, Tapes
    b. Experiences with TRANS tapes

        TRANS A000 and Memo CP-A/1, CP-D/14, CP-B/7
        TRANS B002, Memos CP-C/10, CP-D/16, TRANS B003
        TRANS E001 and Memo CP-E/5
        Exfor V1001 (Vienna test entry, not yet distributed)

    c. Computer programs

15. CPND Bibliography

    a. Recent References (tape from CAJaD)
    b. Bibliography for integral CPND, CP-C/7

16. Nuclear Data Tagging and Flagging in INIS

17. Customer Services

    a. Activities and plans of the centers
    b. Special problems of countries starting to have nuclear data files for specific applications

18. Future developments: compilation requirements, relevant recommendations from other meetings, developments in data centers, etc.

18A. Data Center Activities in Data Base Management System

19. "The loss of the barn"

20. Conclusions

21. Date and place of next NRDC Meeting

THE COOPERATING DATA CENTERS

Note that this summary is necessarily brief and incomplete. For further details see in the Minutes of this document.

For explanation of abbreviations see the List of Participants on pages 7-9, and the List of Abbreviations at the end of this document.

Neutron Nuclear Data are compiled and disseminated by the following four centers in a geographical distribution of labour as specified:

NNDC, Brookhaven: USA and Canada (= area 1)

CCDN, Saclay: OECD countries in West-Europe and Japan (= area 2)

NDS, Vienna: Non-OECD countries except USSR (= area 3)

CJD, Obninsk: USSR (= area 4)

Each center maintains the Exfor Master File of its area, and holds copies of the Master Files of the other three areas for retrievals and distribution within its area.
The bibliographic data index CINDA is operated by the same four centers, the Master File is maintained at CCDN, the book is printed by IAEA.

Integral Charged Particle Nuclear Data

KACHAPAG Karlsruhe compiles all integral CPND for which it also maintains the Exfor Master File.

CAJaD compiles integral CPND from USSR and sends them to KACHAPAG.

NNDC compiles large data sets from USA and Canada and sends them to KACHAPAG.

Copies of the KACHAPAG File are held at NNDC, CCDN, NDS, CAJaD and ZAED for distribution to customers.

The bibliographic data index is compiled, maintained and printed by NNDC.

Differential CPND

CAJaD intends to compile in Exfor differential CPND from USSR.

The Japanese Study Group intends to compile in Exfor CPND from Japan and selected differential CPND.

Dr. Marcinkowski's group at IBJ intends to compile in Exfor selected differential CPND.

Dr. Agrawal in India compiles selected CPND.

NNDC, CCDN, NDS, CAJaD and ZAED will act as distribution centers.

Photonuclear Reaction Data

The Photonuclear Data Group at Obninsk intends to compile in Exfor photonuclear data from USSR.

NNDC is the point of contact for formal international exchange of photonuclear data in Exfor format. Existing informal arrangments between the Photonuclear Data Center (NBS) and other groups continue in parallel.

NNDC, CCDN, NDS, the Photonuclear Data Group Obninsk, and ZAED act as distribution centers.

Minutes

1. Opening

The 13th Meeting of the Four Neutron Nuclear Data Centers was opened by Mr. Manokhin who welcomed the participants on behalf of the Centr po Jadernym Dannym.

Mr. Vertebnyj welcomed the participants on behalf of the Ukrainian Academy of Sciences and the National Committee for the Relations with the IAEA.

Mr. Usachev, Chairman of the USSR Nuclear Data Committee, presented opening remarks on behalf of the USSR State Committee on the Peaceful Uses of Atomic Energy.

Mr. Manokhin introduced the participants.

Mr. Schmidt was elected as Chairman.

The Tentative Agenda was adopted with some minor modifications, see page 11. The numbering of items was kept as in the Tentative Agenda, although the sequence of discussions deviated occasionally.

2.a Brief status reports of the Centres (on neutron data only)

Mr. Manokhin presented the report of CJD, see Appendix 1.

Mr. Derrien presented the report of CCDN, see Appendix 2. Concerning the forthcoming amalgamation of CCDN and CPL, participants stressed that during the transition period, when the CCDN computer programs were converted, the smooth and steady operations of Cinda and Exfor programs should be guaranteed.

It is estimated that the conversion of CCDN service programs to Data Base Management System will take about three man-years.

CCDN intends to make the Crouch Library of experimental fission product yield data available in a convenient format. This was welcomed and NDS was asked to report subsequently on the use of this Library. (Action 1) (Note by editor: Compare Memo 4C-2/89).

The Cinda file is still growing at a constant rate showing no indication of a decrease in neutron data activities.

Mr. Pearlstein reported that the name of the previous US National Neutron Cross-Section Center was changed with effect from 1 Jan. 1977 to US National Nuclear Data Center (NNDC). See Action 2. He presented the NNDC progress report as given in Appendix 3.

It was announced that a new Chart of Nuclides by General Electric would be available towards the end of 1977.

Mr. Lemmel presented the brief report on NDS activities as given in Appendix 4. The data request and dissemination statistics of NDS were presently not available and should be provided later (see Action 3).

Mr. Hermsdorf from the Dresden University reported that his group has own programs for handling Exfor data and evaluated data, and that these would contribute to stimulating the use of such data by the industry. There is no decision yet whether experimental data will be coded in Exfor format.

Mr. Marcinkowski reported that his group at the Instytut Badan Jadrowych is doing an evaluation of europium data. The europium data in Exfor are incomplete, since seven experimental data sets mentioned in ENDF/B-4 seem to be missing, including data by Vertebnyj. A compilation and evaluation of Ni-58 (n,2n) has been finished. Mr. Marcinkowski is asked to send his Exfor compilation of europium data to NDS, see action 4. All NND centers are asked to send europium data to Mr. Marcinkowski, see action 5.

Mr. Vasiliu, Romania, reported that data evaluations are being done. The Exfor format is in use and computer programs have been written. Exfor seems to be too incomplete for old data, whereas new data seem to be much better represented.

2.b Trends in NND activities

The question was raised to estimate the trends in NND data center activities.

Mr. Manokhin said that at CJD, during the last 3 - 4 years, there is a constant level of about 50 Exfor entries compiled per year and about 120 data requests received per year. CJD has a staff of 35 including 10 computer staff.

Mr. Derrien said that at CCDN there is a constant level of Exfor compilation and of requests received. CCDN has a staff of 16.

Mr. Dunford and Mr. Pearlstein reported that in the US there is certainly no decrease in NND activities. The compilation work-load continues at about constant level. Whereas some NND producing facilities were closed down, others increased their data output. Requests are balanced between experimental and evaluated data, depending much on whether for the data-types requested recent evaluations are being available or not.

Mr. Schmidt reported that the compilation workload at NDS is about constant, but that the number of data requests received increased strongly during the last two years.

2.c Review of Actions from last Meeting

The actions from the 1976 Four-Centers Meeting have mostly been fulfilled. Those actions which are of a continuing nature, are listed on page

Mr. Usachev pointed out that there are INDC actions on the Four Centers, who are asked to provide the data reviewers of the INDC subcommittees with up-to-date relevant data retrievals. Mr. Salnikov, who reviews the californium fission-neutron spectrum, would prefer to be provided regularly with new data on this topic.

It was felt that NDS should try to improve the communication between INDC and the Four NND Centers, see Actions 6-8. The data reviewers of INDC and NEANDC should submit their standing data requests to the appropriate NND center, see Action 9.

3. Cinda

3.a Improvements, blocking, data index lines

The discussions started on the basis of Memo 4C-2/77 of 3 Nov 1976 which summarizes the items which need improvement in Cinda.

The main item is to complete and improve the blocking of all Cinda entries referring to the same experiment, and to add the Exfor data index lines. The Four Centers agreed on a Cinda Improvement Program (see Conclusion 1) and a number of detailed actions (see Actions 10 - 22), which need not be repeated here.

Some additional items are:

The main items of information to be entered in the comment-field of data-index lines, are: the number of data-points; to define the quantity given in greater detail than indicated by the Cinda quantity; and if space allows, any other relevant information such as the data source, etc.

3.b Cinda Manual and Dictionaries

Mr. Derrien announced that the new Cinda Manual will be issued in a few weeks, and he invites the other centers to submit their comments on it (Action 23). Update pages will be transmitted by CCDN in the same way as NNDC does for the Exfor Manual (Action 24). A Section on Exfor data index lines in Cinda is still to be added (see Action 10).

It is agreed that Cinda and Exfor dictionaries of institute and reference codes are the same. In order to make it possible that both systems can be linked to the same Dictionary-System, the Dictionary of Cinda quantities will be added to the system (Action 26), and the ref-type codes should be unified (Action 27, compare Memo 4C-1/116). NDS should provide external Cinda indexers regularly with up-to-date lab and ref code Dictionaries (Action 25) and send 20 copies to CCDN every three months.

3.c Cinda publication schedule

Concerning the future publication schedule of Cinda it is decided that a fourth and a fifth cumulative supplement to CINDA 76/77 should be issued in 1978 and that an archival issue is envisaged to be published in spring 1979. The Cinda Improvement Program should be scheduled such as to meet the spring-1979 deadline. See Conclusion 2 and Actions 28-30.

It is recognized that the publication of the Cinda book is essentially financed by the bulk orders of CCDN and NNDC. Therefore, decisions on the publication of Cinda should much be left to these two centers.

Mr. Usachev proposes to consider CINDA 76/77 as archival issue, respectively to issue CINDA 79 in a similar way as CINDA 76/77.

3.d Cinda statistics

In Memo 4C-2/85 CCDN had distributed statistics extracted from the Cinda file. This effort was much appreciated and CCDN was encouraged to continue similar statistics (Action 31).

The interpretation of such Cinda statistics should however be treated with caution and wrong conclusions could be drawn by someone not familiar with details of the Cinda system. The statistics were made before the last Cinda update for the spring 1977 publication. The practice of multiple publication of the same work seems to decrease.

3.e Cinda coverage control

Mr. Schofield reported on the progress in the development of the CCDN Cinda coverage control system, which was appreciated. Actions 32-34 were agreed for the purpose of starting to feed information into the Cinda coverage file.

The Agenda item 3.f on Ref-Type codes was covered already above, under 3.b.

3.g Cinda programming

It was realized that several items of the Cinda Improvement Program depend on revisions and additions to CCDN computer programs for checking the Cinda input and the Cinda file. Due to the limited manpower available at CCDN, priorities for such programming must be recognized. For items to be programmed with priority see Actions 35 and 36.

It was found desirable that, in the Cinda book, no block should have more than one data tag. In principle this could be programmed at CCDN as well as at NDS. The action was given to NDS (Action 37); only if such a program change were not possible, NDS should consult back with CCDN.

3.x Miscellaneous Cinda matters

A number of Cinda rules were discussed. The agreements reached are summarized as Conclusions 3-6, Recommendations 1+2, Actions 38-42.

Mr. Pearlstein recommended to include in proceedings of nuclear data conferences and in progress-reports Cinda-type indexes.

Mr. Lemmel supported this recommendation but pointed out that most of these conferences and progress-reports contain many nuclear data other than neutron data, and that therefore the Cinda quantities are not adequate for this purpose. One should think of a wider scope of quantity codes for this purpose, for example similar to the Exfor REACTION quantities.

Mr. Dunford stressed again the idea of adopting uniform philosophies in Cinda and Exfor, in particular with the definition of an experimental block in Cinda and with the lab assignments in Cinda and Exfor. These views were agreed, see Conclusions 7 and 8.

The manpower needed for Cinda is estimated at

CJD	1 1/2	physicists
CCDN	2	(including external Cinda compilers corresponding to 1/2 if work were done at CCDN)
NDCC	1 1/4	
NDS	0.8	
total	5.55	physicists

4. Wrenda

Mr. Schmidt reported that Wrenda is now published every other year. WRENDA 76, which is the last publication, contained revisions to the requests of a number of countries.

Mr. Usachev suggested that NDS should extract and update the status and accuracy comments made by the reviewers.

Mr. Schmidt replied that this has been done, and that the comments to a large number of requests havebeen updated. The next publication is due in spring 1978.

Mr. Pearlstein reported that entries to the US Request List have just been collected. The collection of such entries will start in the US always in the fall of even years. Thus, the US Request List and Wrenda are out of phase. In the US it would be difficult to change the schedule.

NDS and INDC should try to find a solution to bring the cycles of the US Request List and of Wrenda into agreement (Action 43).

Mr. Usachev explained that the USSR considers to define request priorities, giving high priority to microscopic data which are in disagreement with integral experiments. The USSR requests for fast breeders will be kept in Wrenda.

5. Evaluated Data

Mr. Manokhin reported about the status of the Sokrator Library (see Appendix 1). In future, CJD will send new Sokrator data to the three other centers directly (Action 44); meanwhile NDS should check that all earlier evaluations, in particular the tape containing He-3, have been forwarded to the other centers (Action 45). The evaluation on U-238(n,γ) will be included in Sokrator, and also the evaluation on Au-197(n,γ) above 1 keV by Tolstikov.

Mr. Hermsdorf reported that his group finished an evaluation on niobium. This was initially published in the proceedings of the 1975 Kiev Conference, and the data have been submitted to CJD for inclusion in Sokrator.

They are working on an evaluation of iron. For this purpose they would need the iron data of ENDF/B for which they could send back the results of their analysis as feedback information.

Mr. Lemmel asked about possible release of further ENDF/B data and points out that the evaluation activities at Dresden and Bucharest could provide useful feedback information. Mr. Pearlstein replied that a first comparison between ENDF/B and Sokrator data could usefully be made by comparing calculated parameters such as breeding ratios.

Mr. Manokhin pointed out, on a question by Mr. Pearlstein, that the use of the Sokrator Library includes calculating group constants for fast reactors.

Mr. Derrien reported that the Neutron Nuclear Data Evaluation Newsletter (NNDEN) will be issued twice a year from now on.

Mr. Pearlstein reported that ENDF/B-5 will be issued in 1978. The documentation is distributed as ENDF-201. Integral experiments are not included in the documentation although they are used for checking.

Mr. Schmidt pointed out that for the NDS program on actinide nuclear data the release of ENDF/B data for actinides would be most useful.

5A. Exchange of experimental neutron data

5A.a Experiences with TRANS tapes

Mr. Dunford said that more emphasis should be given to the correct coding of data involving metastable states and half-lives.

Mr. Lemmel pointed out that the 4C-Memos that had been exchanged about errors in Exfor entries, were a very useful tool for improving the quality of compilation.

Mr. Pearlstein added that any criticism included in such memos should be expressed in a nice tone.

Mr. Derrien added that the efficiency of such memos could sometimes be improved by expressing a view in a more precise way. So far CCDN had not yet implemented the option of retransmitting corrected entries.

It was found desirable that CCDN continues to transmit Exfor exchange statistics to the other centers (Action 46).

Mr. Manokhin reported that CJD had, during the past year, some computer difficulties which have been overcome meanwhile. He asked the other centers to continue to send data on 7-track tapes starting with a dummy file of at least 100 records. Later during the year, he would request the other centers to start to transmit 9-track tapes with effect from a date to be announced (Actions 47,48).

5A.b Clean-up of 50 000 - 80 000 series

Some years ago, NNCSC had converted the Scisrs Library into the 50 000 - 80 000 series of Exfor entries.

Mr. Dunford expressed that it would be desirable if all these data could be reviewed soon and corrected (Conclusion 9). NNDC is correcting the 50 000 series , checking the data, but not bringing all the BIB information up-to-date. Entries will get entry numbers starting with 11 000.

Mr. Lemmel reported that NDS had communicated in 4C-Memos lists of 70 000 entries that could be deleted because they had been retransmitted as regular 30 000 entries. It was agreed that NDS should retransmit the shortened 70 000 file containing all entries which are still valid (Action 49).

5A.x Miscellaneous

Mr. Dunford said that it would be desirable to transmit, always together with a TRANS tape, a list of entries being in progress but not yet finished. NNDC had been doing so, but not the other centers.

Mr. Lemmel explained, that at NDS, when sending out a TRANS tape, always all available entries are sent. NNDC had always a number of entries waiting for author approval; this is not the case at NDS where entries are transmitted even before author approval, so that a corresponding list of entries waiting for author approval would be zero.

See Conclusion 10

6.b. Revision of the "Protocol"

The revised Protocol as submitted by NNDC in Memo 4C-1/104 was adopted (Conclusion 11). It should however be borne in mind that the scope of the Protocol is to be widened. As a first step CCDN was asked to propose a new Protocol section on the Cinda cooperation (Action 50).

6.c Exfor completeness

Mr. Manokhin presented a table of completeness figures for USSR entries:

period	entries transmitted	entries transmitted plus in progress
1955 - 76	55 %	62 %
1965 - 76	65 %	75 %
1970 - 76	65 %	75 %

Mr. Derrien reported that Exfor entries in area 2 are believed to be 80% complete if one disregards unusual data-types and borderline cases.

Mr. Dunford reported that since the beginning of Exfor 653 entries have been compiled of which 602 or 92% have been completed and transmitted. 21 are ready for transmission, 30 are in progress.

Mr. Lemmel reported that Exfor entries in area 3 are believed to be 90% complete, at least for the last years. For earlier years certain gaps, in particular for data from India, are known. This backlog is gradually being worked off.

It was concluded that, as far as the gaps are known, Exfor appears to have a completeness of 75 to 92%, for the years since 1970. For the earlier years the completeness is worse, considering only the 10 000/40 000 series, but better when including the 50 000/80 000 series. Nevertheless it is realized that there are still gaps even among important data, and it was considered whether the compilation efforts should be selective.

Mr. Dunford reported that NNDC will start soon with the evaluation of resonance-parameters for the new issue of BNL-325. Therefore, resonance-parameters should continue to be compiled with top priority.

Mr. Pearlstein said that the centers should continue to review important data fields for completeness and see that these data are compiled fast and complete. He suggested that NDS may propose a priority list of important data including at least data used as standards, used for important applications, resonance-parameters (Action 51), and that such a list should be made also in view of forth-coming meetings. Due to limited manpower available, priorities must be set. Important data must be completely compiled before they are requested by customers.

Mr. Pearlstein said that data centers should encourage external scientists to spend some time at the centers, for mutual benefit. This proposal was adopted as Recommendation 3.

6.d Exfor scope

Mr. Dunford said that fission-product yield data and capture-γ spectra are "grey areas" which require help from outside the Four Centers. The fission-product yield compilation of Meek and Rider is going to terminate.

Mr. Schofield reported that CCDN converted the Crouch Library of experimental fission-product yield data to Neudada, and thus these data could well be transmitted after performing a simplified Exfor compilation procedure. (see Conclusion 12).

Mr. Dunford said that this converted Crouch Library should do it, although it is known that this does not contain all of the details required in Exfor. NNDC would have no manpower for reviewing the correctness of the Crouch Library. Mr. Dunford pointed out that Meek and Rider's compilation contains about 1000 references, whereas Crouch has about 300 references only, due to quality selections. NNDC could provide a list of references found missing in Crouch's Library (Action 52).

It is concluded that capture gamma spectra data are compiled in Exfor on a voluntary basis (Conclusion 13).

6.e Lab-assignment

If an experiment has been done in two or more laboratories, the primary lab will be assigned in Exfor according to the same rules as in Cinda (see Conclusion 7).

6.f Derived resonance-integrals

If derived resonance-integrals, as distinct from directly measured values, are compiled at all in Exfor, they should be given the Status code DEP combined with the entry-number of the data they were derived from; they should be compiled with the proper energy limits and coded with the quantity-modifier LIM. They must be derived from data of a single experiment, otherwise they are regarded as evaluated data. (Action 53).

7. Implementation of the Generalized Exfor System for Neutron Nuclear Data

It had been agreed earlier that the Generalized Exfor System developed for charged particle nuclear data, should be adopted, sooner or later, also for neutron data.

Mr. Dunford said that NNDC would like to start in two or three months with compiling neutron data in the Generalized Exfor System if this were agreed now.

Mr. Derrien said that CCDN cannot compile charged particle data, but can accept data in REACTION formalism in two to three months. At that time CCDN would not yet be able to check such data. They would not compile data in REACTION formalism before a year from now.

Mr. Lemmel said that NDS could accept data in REACTION formalism immediately and could produce such data probably in summer 1977.

Mr. Manokhin said that CJD would have to write a number of new programs but could accept whatever is decided.

Thus the following time table was written down:

	tentative date when the center is prepared to accept REACTION format data	tentative date when the center is prepared to transmit REACTION format data
NNDC	Aug/Sep 1977	Aug/Sep 1977
CCDN	Jul/Aug 1977	1978
NDS	immediately	about July 1977
agreed	1 Oct. 1977	1 April 1978

It is agreed that the transition to the Generalized Exfor System proceeds as described in Conclusion 14.

8. Miscellaneous

Mr. Dunford said that the NNDC Newsletter is sent also to recipients in other service areas. Additional addresses would be welcome. See Action 54.

Part II of the Meeting: All Nuclear Reaction Data

10. Opening

Mr. Chukreev opened part II of the Meeting on Thursday morning, although some agenda items, in particular item 13 on photonuclear data, had been discussed already on Wednesday.

Mr. Schmidt was elected as chairman.

The tentative agenda was adopted as given on page 12. However, the actual sequence of discussions was sometimes different.

Agenda item 11: Brief status reports of the Centers, re CPND

1. Mr. Chukreev reported on CAJaD (see Appendix 5). In the subsequent discussion, Mr. Chukreev explained, that the method of sending author proof copies of the drafted entries has led to good cooperation with the authors, who supplied additional information and submitted additional articles for compilation.

   CAJaD cooperates with LIJaF with respect to "Recent References" and with CJD with respect to Exfor programs.

   In 1976 CAJaD had received about 300 requests for data from customers inside and outside the Kurchatov Institute. About 50% of the requests could be answered, but for many requests no data were available. The requests included a large fraction of requests for differential data. The main application for which data were requested, is the method of activation analysis in various fields of science and technology.

2. Mr. Kondurov reported briefly on the activities of LIJaF which are in the field of Nuclear Structure and Decay data and therefore not directly related to the present Meeting, except for the compilation of "Recent References" from USSR literature. This activity is done in cooperation with CAJaD. A file covering the period 1972-77 is now available. New entries are regularly submitted to ORNL, but the cooperation is difficult due to the slow speed of mail and replies.

   With respect to numerical data the ENDSF format is used for storing their evaluated data of excited nuclear states, for which primarily the γ-decay data are compiled. Each nuclear level may have up to 20 parameters.

3. Mr. Münzel reported on the past year's activities of KACHAPAG, see Appendix 6.
   He stressed in particular that the limited manpower available should primarily be used for compilation and that he therefore hopes that the development of the Exfor system can now be regarded as final, and that KACHAPAG can obtain additional and improved Exfor programs.

   It is intended to prepare a printed version of the KACHAPAG file. As the topic for the first volume, "integral" data for proton reactions on nuclei with proton numbers of 28 and higher have been envisaged. CAJaD agrees to compile such data from USSR with high priority.
   See Action 60.

4. Mr. Behrens reports on the activities of ZAED. ZAED regards the matter of a CPND bibliography now as solved and has no plans in this field. Planned and completed publications and data evaluation activities by ZAED are described in Appendix 7.

5. Drs. Ikegami and Abe report on the Japanese CPND activities (see Appendix 8) and present a block diagram showing the coordination of various groups and committees. It seems that it is difficult to set up a Japanese CPND Center, and that the assistance by the IAEA in stressing the desirability of such a Center is effective. (Action 61)

   If sufficient staff becomes available, this Center will concentrate on the compilation of differential data, for example by compiling first Japanese experimental data, and then to concentrate on a limited defined topic within the large field of CPND, according to the expressed data needs for application and/or basic sciences.

6. Mr. Derrien reports that CCDN has no mandate to compile CPND, but that CCDN could well act as a CPND distribution center, in particular after the computer programs for the Exfor system will have been unified for NND and CPND. The CCDN storage and retrieval programs are now modified so that NND and CPND are treated in the same way. This includes the generation of Exfor statistics.

7. Mr. Pearlstein reports that NNCSC has taken over the US responsibility of a CPND Center and that the name was therefore changed from NNCSC (National Neutron Cross-Section Center) to NNDC (National Nuclear Data Center). For further details see Appendix 9 . The main effort during the past year was the creation of a CINDA-type computerized bibliography for integral CPND, of which advance copies were submitted to the meeting. It covers the period 1 Jan. 1976 to 31 Jan. 1977 and includes an index to the KACHAPAG file. So far copies are distributed free of charge. Bulk shipments are planned to the distribution centers, who are asked to submit immediately the number of copies they need and to submit later their address lists of distribution. See Action 62.

   The meeting unanimously appreciated the efforts of NNDC to create the CPND bibliographic system and to compile the relevant entries in such a short period.

   Participants inquired whether a cumulative issue of MacGowan's bibliography covering the period up to 1 Jan. 1976 would be issued since the last cumulative issue covers only the period up to 1973. NNDC was asked to investigate (see Action 63).

   Mr. Pearlstein continued, reporting that there will be in the US, on 3 - 5 May, a Panel on intense neutron-sources based on the d-Li reaction.

   There had also been a Panel on Reference Nuclear Data with Attendees from various scientific societies, editors, committees, etc., which represent a large data users group, including the field of environmental research. NNDC is asked to distribute the Report on this Panel to NND, CPND and NSDD Centers. Mr. Münzel asks to be informed of the next similar meeting. See Actions 64 and 65.

8. Mr. Lemmel's report on CPND activities at NDS is given in Appendix 10. It was pointed out by participants that NDS computer programs for the Generalized Exfor System (as well as Exfor programs from other centers) could be useful to other centers and groups. It was recommended to investigate whether Exfor programs could be converted by an outside firm or by the Computer Program Library of NEA for implementation on other computers (including, e.g. conversion from PL/1 to Fortran). See Recommendation 4. NDS was also asked to make the Exfor system known by Actions 75 + 76.

9. Mr. Seeliger reported that his group in Dresden is mainly involved with neutron reactions, but also with some experiments on (p,n) reactions. Other institutes, e.g. at Rossendorf, perform CPND experiments, but so far no compilation activity exists. Mr. Seeliger was asked to inform relevant groups of the international data compilation and exchange efforts (Action 66).

10. Mr. Marcinkowski's statement is given as Appendix 11. Compilation and evaluation of (p,γ) spectra for iron continues using the NSDF format. Examples are given in Appendix 11. He prefers to issue publications on evaluated (p,γ) spectra data in a form convenient for users, rather than only compiling data in Exfor. He has plans for working on charged-particle reaction data on neon.

11. Mr. Vasiliu reports on experimental work on the Bucharest Cyclotron. There is, however, no special effort on CPND compilation.

12. Mr. Lemmel reports that Mr. Agrawal is undertaking the compilation of (d,d) and (d,p) stripping cross-sections as described in last year's report INDC(NDS)-77 Annex 7.

13. Mr. Lemmel reports that Mr. Dearnaley, UK, uses differential CPND for surface investigations but has so far no manpower to compile such data in Exfor format although he would like to cooperate in an international effort.

Agenda item 12: Exfor Manual

Many rules of the Generalized Exfor System were discussed in detail in a Subcommittee consisting of

Mr. Bychkov
Mr. Dunford
Mr. Lemmel
Mr. Münzel
Mr. Schofield
Miss Zhuravleva

The conclusions reached were reported to the plenary meeting. They are listed on pages 47-52. Besides these conclusions only the following items need to be mentioned:

12.b Revision of Chapter VII and VIII of the Manual

Mr. Lemmel introduced the Memos CP-D/20 and CP-D/23. He pointed out that such memos should be transmitted to the other centers at latest one month before the Meeting, and he apologized that this had not been possible with the present memos. Therefore, it cannot be expected that these memos should be considered by the Meeting in detail. Instead, he asked the Meeting for approval of the restructuring of these Manual Chapters as proposed. Details could be corrected later, where necessary, by means of CP-Memos.

Mr. Dunford did not like the alphabetical arrangement of the keywords in Chapter VIII and said that he had to discuss the matter at NNDC before being able to agree or disagree.

Mr. Münzel welcomed the proposed restructuring of the Manual, because this made it much easier for programmers and compilers, in particular for Exfor beginners, to find the rules when needed. He preferred the alphabetical order of Chapter VIII.

See Exfor Conclusion 1.2 and Action 79.

12.d 5-character lab-codes?

Mr. Lemmel reported that for atomic and molecular data a large number of additional lab-codes were required which made it desirable to introduce lab-codes of 5 characters length instead of 3 characters as before.

Mr. Pearlstein suggested that in such case a separate lab-code Dictionary for atomic and molecular data would be preferable.

12.f Fission and Spallation

There was a detailed discussion on how to code under REACTION the product nucleus in the case of fission and spallation. In particular in the case of a table giving the yield of many product nuclei, it would be desirable to have the product nuclei coded in a variable column in the DATA Section. In this case the problem arose how to link information coded under DECAY-DATA to the appropriate product nucleus.

It was concluded that a formalism of a variable product nucleus is desirable (Exfor Conclusions 2.8 - 2.13) and a detailed proposal should be submitted after the Meeting by a CP-Memo.

Mr. Münzel said that the product-nucleus is most essential information to be included in an Exfor data index to be accessible by retrievals in the index. A formalism of a variable product nucleus could not be used at Kachapag before having an Exfor indexing program indexing not only the REACTION code but also the variable product nuclei in the DATA Section.

It was agreed that a formalism for variable product nuclei should be formulated in a general way such that it applies not only for fission but also for similar processes such as spallation. Spallation data should, however, not be coded in Exfor before having a Lexfor entry containing the definition of this process (Action 82).

Mr. Münzel suggested that the formalism for variable product nuclei should be even more general as to include different reactions such as

(p,n + p)
(p,2n + p)
(p,3n + p)
(p,2n + 2p)

The Kachapag file contains several entries where such reactions could be advantageously combined in one subentry with variable product nuclei which sufficiently define the reaction. The REACTION code should then include in SF3 an artificial process code indicating that the particles produced are to be calculated from the balance of target nucleus, incident particle and product nucleus.

Mr. Dunford and Mr. Lemmel replied, that for neutron data the explicit coding in SF3 was usually more important for retrievals than the residual nucleus. Therefore, the formalism proposed by Mr. Münzel would create even greater problems in an indexing program than the case of variable fission product nuclei. Furthermore, the balance of target nucleus, incident particle and product nucleus does not distinguish between

(p,2n + 2p)
(p,2d)
(p,α)

so that the REACTION coding would be ambiguous. These problems require further investigations (Action 86).

Agenda item 12.x: Miscellaneous items on Exfor

Transliteration of author names

Mr. Münzel pointed out that it would be desirable to have in EXFOR a unique transliteration scheme of Russian characters.

Mr. Lemmel reported that the transliteration scheme used in Cinda and Exfor is given in the Exfor Manual on the Lexfor page "AUTHOR". This scheme was based on the old ISO standard, amended for computer-usage to avoid accents (resp. "diacritical marks"). However, since in the literature different transliteration schemes are in use, it is hardly possible that the data compiling physicists strictly follow the EXFOR/ISO scheme. Therefore, when retrieving on authors' names, one will have to retrieve on the various transliterations in use.

Unfortunately, when INIS started, they did not adopt the ISO standard but the Anglo-American scheme of transliteration, which is not logical in two cases:

1. The Russian "Ц" is transliterated in INIS to "ts" (tsentr for centre) rather than "c" (centr), although the character sequence "ТС" = "ts" exists in Russian, too. A back-transliteration of "ts" is therefore ambiguous.

2. The "soft" vowels "Ю" and "Я" are transliterated in INIS to "yu" and "ya" instead of "ju" and "ja" as in the old ISO and in all Slavic languages using Latin characters. This use of "y" for the "soft" vowels is in contradiction with the simultaneous use of "y" for the "hard" vowel "bl".

Despite of these obvious defaults, ISO has meanwhile adopted the Anglo-American transliteration scheme as a second alternative thus abolishing its task of giving unique standards.

It was concluded that in Exfor the transliteration scheme given on the Lexfor page "AUTHOR" should continue to be used (Exfor Conclusion 1.5).

Mr. Grigorian volunteered to investigate whether there exists a USSR National Standard for transliteration (Action 83).

Reference coding

Mr. Grigorian and Miss Zhuravleva questioned whether the coding of references could not be standardized in a more systematic manner.

Mr. Dunford and Mr. Lemmel admitted that the reference coding is really rather complex, but that it is not more complex than required for the many different ways in which references occur. In particular report codes are irregular, even within a given series, and often even journal references are irregular. The coding rules adopted seem to be convenient for the most frequent cases and sufficiently flexible for odd cases. The existing checking programs and their recipees can be made available.

Agenda item 13: Photonuclear Reaction Data

1. Mr. Abramov expresses his interest in using the Generalized Exfor System for the compilation of photonuclear reaction data. He introduces Memo 4C-4/25 of 2 April 1976. Most items of his critique of the old Exfor system have meanwhile been solved in the Generalized Exfor System which can be used for the compilation of photonuclear reaction data without any further changes.

2. He suggests a modification:

the keyword "N-SOURCE" should be generalized to "SOURCE" in order to take care of incident particles other than neutrons. It is concluded to keep, in order to avoid changes of existing computer programs, the keyword N-SOURCE, which instead could be converted to a more generalized keyword in an output-editing program (e.g. to "SOURCE" or "INC-SOURCE"). See Exfor Conclusion 3.3 and Action 74.

3. Mr. Sokolovskij has also tentative plans to compile certain photonuclear data. Similar activities may be possible at the Lebedev-Institute (Lazareva). Mr. Abramov is primarily interested in the compilation of his own experimental data. All these groups are encouraged to compile photonuclear reaction data in Exfor format and make them available to the data dissemination centres.
See Recommendations 5 + 6.

4. Mr. Dunford reports on the activities of Mr. Fuller's Photonuclear Data Centre at NBS. For a more detailed Status Report of this Center see Appendix 12. Mr. Fuller is primarily interested in the evaluation of certain photonuclear reaction data and a publication is planned for June 1977. An index to both, literature and data file, has been published for the years 1973-76.

Fuller's Library has a bibliography but almost none of the BIB-information required in Exfor. It also does not store errors. A conversion of Fuller's Library to Exfor format seems possible if one accepts incomplete BIB-information.

5. Upon question by Mr. Sokolovskij, Mr. Pearlstein explains that Mr. Fuller joins all relevant meetings of NNDC. He has only a small staff and provides answers to customer requests within the limited resources available. Correspondence about photo-nuclear data can be sent to NNDC (with information copy to NDS) for coordination with US activities.

6. Mr. Dunford reports that Berman's Library* for photoneutron cross-sections (which has also been included in Fuller's Library and in the Livermore Library) has been converted by NNDC into an Exfor-similar format. The quantity codes in this conversion were somewhat improvised, since the REACTION format had not yet been defined, but they are self-explanatory. This converted file has been made available to the other centers (compare CINDU-11 page 38).

*[B.L. Berman: Atlas of photoneutron cross-sections obtained with monoenergetic photons, UCRL-74622 (1973). Version as of January 1975 see Atomic and Nuclear Data Tables, vol.15 (April 1975) pages 319-390.]

7. Mr. Dunford reports that Fuller's photonuclear bibliography will continue to be published. Mr. Pearlstein suggests that Mr. Abramov send to Mr. Fuller regularly a list of new USSR references. Mr. Sokolovskij supports this idea.

   Since Mr. Fuller is also using "Recent References", it is finally recommended that USSR references on photonuclear data be included in the regular transmission of USSR "Recent References". Mr. Kondurov says that this is within the responsibility of LIJaF and agrees to include photonuclear references. See Recommendation 7 .

8. Participants are asked to report on any other photonuclear data compilation activities.

   The Japanese participants report that measurements of photonuclear data are performed in Japan, but that the results are published in conventional form and not compiled on magnetic tape. There was also an International Conference on this topic with published proceedings.

   In the GDR only calculations of photonuclear data are performed.

   Mr. Derrien reports that the earlier measurements by Bergère in Saclay (France) have been included in the Berman Library, and that these measurements do not continue.

   Mr. Vasiliu welcomes the exchange of photonuclear data (see Action 80) and feels that there had been some direct contacts between Mr. Fuller and Romania.

9. In order to promote the awareness and availability of Japanese photonuclear data, the Japanese delegation is asked to organize that relevant Japanese references are reported to the other interested Centers in a formless way. Mr. Dunford suggests that small data sets should be transmitted in any convenient form but that large data sets should be transmitted on magnetic tape, possibly in Exfor format, but at least in a format close to Exfor (Recommendation 6). He suggests that NDS should inform Mr. Ikegami for this purpose about the more important features of Exfor such as the 11 columns field width of the DATA-Section and the principle keywords of the BIB-Section. The participants express that such a "Brief introduction to Exfor" would be useful for many experimental nuclear physicists, and NDS is asked to prepare such an introduction. See Action 66.

Agenda item 14: Cooperation

Mr. Dunford proposed a new series of Memos on Exfor matters, since many memos had to get double numbering within the 4C series and CP series.

Mr. Münzel suggested that the exchange of such memos should be reduced to a minimum.

It was decided that CP-Memos are used for all matters of interest to all cooperating centers. (Thus the characters "CP" do no longer stand for "charged particles" but rather for "centers' parliament" or "chat-and-parley" or "compiler's passion" or "confusing and puzzling" whatever applies.) All matters of interest only to the four neutron-data centers continue to be discussed in 4C-Memos. (Conclusion 15)

NDS should continue to maintain the Dictionaries and transmit them regularly to the other centers, as agreed earlier and modified in Conclusion 16 and Actions 71 + 72.

NNDC should continue to be responsible for the Exfor Manual according to the existing rules.

All centers should attach labels to transmission tapes (Conclusion 17).

Mr. Sokolovskij said that some of the Vienna tapes were hard to read. The reason was not found, but perhaps the tape unit used was not correctly adjusted. The last tape received was in order.

Mr. Münzel questioned how data from different centers should be sorted in the Kachapag TRANS tapes, see Action 78.

14.b Experiences with TRANS tapes

The discussions followed the CP-Memos submitted about this topic. Several items discussed relate to agenda item 12 and the Exfor Conclusions given on page 47.

14.c Computer programs

See earlier under agenda item 11., paragraph 8., and Recommendation 4.

Agenda item 15: CPND Bibliography

Mr. Chukreev reported that he had transmitted on magnetic tape "Recent References" from the USSR. This includes charged-particle reactions.

The Meeting appreciated this effort and noted that "Recent References" is part of the network on nuclear structure and decay data, so that no details need to be discussed at the present meeting.

Mr. Dunford presented a preprint of the NNDC Bibliography of integral CPND. This effort was highly appreciated and the format developed was approved. Comments are requested (Action 88).

The present issue includes literature from the period 1 Jan. 1976 (= end of MacGowan's compilation) to 31 Jan. 1977. There are

2761 blocks of entries (in the sense of Cinda),

thereof 1653 experimental blocks,
748 theory
360 reviews.

The blocks include data index lines to the Kachapag file.

NNDC offers to distribute copies, for the time being free of charge, and requests to submit address lists (Action 89).

Mr. Kondurov suggested that reference codes of CODEN, Recent References and Cinda should be unified, and that this topic be discussed at the next Meeting on Nuclear Structure and Decay Data (Action 90).

Mr. Münzel said that the existing systems should not be changed in this matter.

Mr. Lemmel added that the CODEN codes are impractical as the following example shows:

	CODEN	Cinda/Exfor
Phys. Rev. B	PLRBA	PR/B
Phys. Rev. C	PRVCA	PR/C

Agenda item 16: Nuclear Data Tagging and Flagging in INIS

Mr. Lemmel reported that the nuclear data centers have an interest that retrievals from INIS on references containing nuclear data measurements can be improved. With the presently available INIS Thesaurus and Subjects, nuclear data retrievals from INIS are difficult to specify and produce too much noise. Following a meeting of representatives from INIS and data centers (CCDN and NDS) in April 1976, INIS specialists are investigating how to improve nuclear data retrieval facilities by appropriate tagging or flagging of INIS entries.

Mr. Behrens added that an INIS Liaison Officers' Meeting in November 1976 charged a consultant (Mr. Gadjokov) with investigating the matter and working out a proposal. The final proposal, which is expected for the end of 1977, will then be tested in certain INIS and data centers. The proposal should be circulated to data centers (Action 91).

Mr. Behrens reported on a planned comparative analysis of "Recent References" versus INIS and was asked to circulate the results (Action 92).

CCDN was asked to send to NNDC and CJD the retrieval profile of INIS retrievals for the Cinda Scope (Action 93).

Mr. Usachev noted that INIS retrievals so far do not yet work in retrospective. Mr. Behrens replied that this depends on the retrieval facilities and computer capacity at individual INIS centers.

Agenda items 17 and 18 on customer services and future developments were, due to lack of time, touched very briefly. However, many related topics were mentioned under different agenda items.

For future developments priority will have to be given to nuclear data for isotope production, fusion, and neutron sources.

Agenda item 18A: Data Base Management Systems

Mr. Schofield reported that CCDN will go over to a data base management system (IDMS) for certain data storage and retrieval operations.

Mr. Dunford reported that NNDC is using a data base management system (DBMS-10), as a test, for their system of mailing addresses.

There are several systems with different characteristics on the market. The commercial software does the data storage and file maintenance, but the systems are usually difficult to implement. For retrievals the programs are often inefficient so that special indexes have to be constructed.

Mr. Grigorian reported that in the USSR a data base management system is being created and that CAJaD is involved in such considerations. However, there are no results yet. There had been a meeting in Zvenigrad near Moscow for making decisions on a system called "State Service Standard Reference Data".

See Actions 56 + 57.

Agenda item 19: "The loss of the barn"

Mr. Lemmel reported that in 1976 a Council Directive, see Appendix 13, has been issued by the Council of European Communities (CEC), to put the unit of the "barn" into a list of units which should no longer be used with effect from 31 Dec. 1979. This Directive had apparently been based on a decision by the Congrès Général des Poids et Mesures, organized by the Bureau International des Poids et Mesures (BIPM).

Since then the Agency had been approached by various individuals and committees to take initiative against this (for nuclear physicists obviously wrong) decision.

The Agency then wrote to the BIPM and asked for background information for the decision against the "barn". BIPM replied, did however not send any background information, but suggested to contact the CEC directly.

Mr. Pearlstein reported that CSEWG had objected, within the US, against the abolishment of the "barn" and had pursuaded important journals to continue to allow the units "eV" and "barn". The Meeting should perhaps follow the US recommendation.

Mr. Usachev reported that USSR journal editors got advised already now to abandon the "barn".

It was decided to draft a statement against the abandoning of the "barn" and to submit this statement to INDC and to appropriate authorities (e.g. the CEC). The statement was, due to lack of time, not drafted during the meeting, and the action was given to NDS. (see Action 58).

Subsequent to the Meeting, a Resolution was drafted by NDS, distributed by Memo of 29 April 1977 to Meeting participants and adopted with some modification as given on page 55.

Agenda item 20: Conclusions

Conclusions, Recommendations and Actions are compiled on the following pages.

Mr. Abramov suggested that a list of active data centers involved in the Exfor data exchange should be included in the Minutes of the Meeting (Action 55).

Mr. Pearlstein suggested that the meeting materials (actions etc) be distributed after the Meeting as early as possible.(Action59).

Agenda item 21: Date and place of next NRDC-Meeting

Mr. Derrien offered to host the next meeting in Paris resp. Saclay.

It was noted that a cycle of 1 1/2 years would be sufficient and preferable for future meetings. Preferably, the meeting should take place in a week adjacent to the meeting on nuclear structure and decay data, but it seemed to be impossible to reach such a schedule already for 1978. A tentative date of 3 - 8 April 1978 was proposed. Mr. Schmidt was asked to circulate possible dates (Action 94).

Mr. Schmidt reported that it was increasingly difficult at the Agency to find the financial support needed for the NRDC Meetings.

The Meeting participants expressed that these meetings are of great importance for the continuing cooperation of the data centers and the coordinated operation of the Exfor system and other jointly operated systems. It was recommended that the Agency continue to sponsor these meetings and should make it possible that not only technical staff but also the center heads meet regularly at 1 or 1 1/2 year intervals. See Action 95 and Recommendation 8.

CONCLUSIONS

Conclusion 1: CINDA Improvement Program

The Four Neutron Data Centers consider that, for economical and practical reasons, an "archival issue" of Cinda would be desirable, which contains Cinda information up to a date X to be defined, in a final form.
For this purpose several steps have been agreed, as described below, to improve contents and arrangement of Cinda information. Due to the historical development of Cinda, unified efforts of the Four Neutron Data Centers, which became possible only since the last three years, made Cinda, for the first time, to a real neutron data index. The desirability of this new Cinda concept has been proven by means of a questionnaire inquiry performed by NNCSC in 1975/76.

On this basis the Four Neutron Data Centers have agreed on an improvement program for Cinda to be completed in advance of an archival publication of Cinda to be issued in 1979. The centers agree to the following tasks to be performed:

1. All Cinda blocks with data index lines will be reviewed to ensure that they comply with the present definition of a block.

   a) There should be a correspondence between the main reference in CINDA and the main reference in EXFOR.

   b) Comments on data index lines should be corrected to presently adopted standard.

   c) Where practical, important references should be checked to ensure accuracy of energy ranges and comments.

2. All entries with comment " ... data index lines" will be checked. Most should be deleted from the file.

3. All FPG entries will be reviewed and entries under FPB will be generated where necessary.

4. The comment N,3N will be added to the comment field of all entries converted from N,3N to N,XN.

5. Possible duplicates detected by CCDN will be checked and necessary deletions made.

6. All other existing blocks should be reviewed to ensure that they conform to present standards. (Lower priority).

These tasks to be performed by all centers will be supplemented by the following special improvement projects:

Area 1

1. Create blocks and data index lines for entries converted from SCISRS-I.

2. Possible review of all entries for RES, LDL, STF, RI and σ(thermal).

Area 2

1. Write program to check duplications of CINDA entries.

2. CCDN will convert the Cinda master file to the newly adopted ref-type codes.

3. Special retrievals using existing programs will be made to support improvement activities of the other centers.

Area 3

1. Publications from area-3-labs in area-1/2/4 journals not scanned by NDS have to be blocked to appropriate are-3-blocks. This is currently done for new entries but must still be done for a number of older entries.

2. Review of certain quantities (as far as not yet done).

3. Assist in improvements for area 4.

4. As far as possible, to convert Exfor 70 000 series entries to regular 30 000 series entries and to index the corresponding 30 000 series entries in Cinda.

Area 4

1. CJD will check the USSR literature coverage before 1969.

2. CJD should regularly prepare Cinda entries for all USSR preprints and lab-reports which are available to them, even if it is a single issue only. CJD should also obtain preprints and lab-reports regularly from USSR nuclear physics institute.

3. NDS will send CJD a Cinda retrieval with all entries of USSR labs, together with a detailed description of the improvement work to be done. This will mainly involve to change in the lab column the code CCP to the appropriate lab-code whenever this is possible, and to do appropriate blocking.

4. As soon as the rules to EXFOR index lines have been included in the CINDA Manual, CJD is asked to submit with each EXFOR transmission tape the corresponding EXFOR index lines for CINDA.

Conclusion 2: Cinda publication

The Four Centers agree to issue in 1978 a 4th and 5th Supplement to Cinda 76/77 and to postpone the "archival issue" to 1979. The time until then should well be used for improvements in Cinda (as specified in Conclusion 1).

Conclusions about Cinda rules

3. In Cinda, a private communication should not be entered in a block when another reference is available (similar practice should be adopted in EXFOR - subject to approval). However, there may be exceptions. For example, when a center received a private communication containing significant revisions to data published earlier, then this private communication may be added as a reference to the Cinda block.

4. The data tags should be left in the Cinda file as they are, however revision is desirable for the book-editing.

5. Data index lines for superseded EXFOR entries should not be included in Cinda, not even with no-book flags. (see also Action 39).

6. Each Center continues to scan for Cinda all publications from its area; but if the lab is in another area, the entries are sent, without operation code and block-number, to the center responsible for the lab. This center then fills in the appropriate operation code and block-number, and then forwards the entries to CCDN. (In this respect NDS takes care of area 3 and 4). This procedure is to start as soon as practical.

Conclusions about joint matters on Cinda and Exfor

7. The rules on Lab assignment as given in the Cinda Manual on page II.3.1 were accepted for Cinda and Exfor.

8. A CINDA experimental block may be defined as all those references pertaining to the measurement of a single experimental quantity in the EXFOR, not CINDA, meaning of the term quantity. The single experiment should mean a single measurement or a closely related series of measurements at a single laboratory using a single measurement technique or multiple techniques if they are closely correlated. The end product of such an experiment is a single set of experimental data which would normally be coded in a single EXFOR entry. Special exception can be made to the above rule for references to superseded and superseding data which should be blocked together or for any other reason deemed sufficient by the compiler. Blocking of data not already compiled in EXFOR should follow the above rules as far as time and practicality permit.

Conclusions about neutron data

9. All centers agreed to make every effort to convert the 50 000 - 80 000 series data to regular Exfor entries as soon as possible.

10. It was found desirable that centers inform each other, at the time of each Exfor transmission, of entries being compiled or in progress. Due to technical difficulties this idea was dropped, except in cases where certain data-types are urgently needed for well-known specific purposes (e.g. on the occasion of data-reviews, publications, meetings, etc.).

11. The revised Protocol as submitted by NNDC was adopted (NNCSC to be changed to NNDC).

12. In view of the ending of Meek and Riders fission-product yield compilation activities the four centers see the need for regular compilation of FPY data from 1.1.1977 onwards. As a help, the Crouch FPY Library could be converted by CCDN through Neudada to an Exfor-type format and disseminated to the other centers. It must be realized, however, that the Neudada-Exfor conversion is only semi-automatic. In fact, transmission of FPY data to other centers will be more efficient via the Exfor compilation job stream. Only a limited number of works can be transmitted at a time.

13. Capture gamma ray data are compiled on a voluntary basis.

Conclusion about the implementation of the Generalized Exfor System

14. Starting from 1 Oct 1977 until 1 April 1978 Centers are encouraged, but not obliged, to transmit data in the Generalized Exfor format, i.e. using the keywords REACTION and MONITOR instead of ISO-QUANT and STANDARD. From 1 April 1978 onwards the old Exfor format must no longer be used in transmissions except for corrections of older entries, whereby retransmitted entries must be entirely in either the one or the other format.

Miscellaneous Conclusions

15. 4C-Memos continue to be exchanged for the discussion of matters of interest to only the four neutron data centers.
All matters of wider interest, in particular matters on Exfor, are discussed through CP-Memos. The following centers have recognized responsibility for determining Exfor formats and procedures:

1. S. Pearlstein
2. H. Derrien
3. J.J. Schmidt
4. V.N. Manokhin
A. F.E. Chukreev
B. H. Münzel
E. H. Tanaka

Mr. Abramov will be informed through Mr. Manokhin. Any other center or group may be added to the distribution list upon request when starting to produce and transmit Exfor entries.

16. When sending out Dictionary transmission tapes, NDS should also send out printed copies of the Dictionaries:

1 copy to Mr. Behrens
1 copy to NNDC
1 copy to Mr. Abramov

See also Action 25.

17. Labels should be attached to transmission tapes, specifying content and format.

Conclusions on the Generalized Exfor System

(excluding items of interest to NND Centers only)

1. general items
2. items concerning the keyword REACTION
3. items concerning other keywords

1. General items

1.1 So far Exfor transmission tapes contained entries in one file with a single centre-identification code throughout (compare Section I of the Exfor Manual). The KACHAPAG transmission tapes will contain entries originating from different centres. This could be done in

- either a single file with all entries sorted in ascending order,
- or in several files on one transmission tape, where the entries in each file will be sorted in ascending order.

KACHAPAG will decide how to proceed (see Action 8). The Exfor Manual must then be updated correspondingly.

Note: KACHAPAG decided to have a single file (Memo CP-B/13 of 77/7/8).

1.2 The revised Sections VII and VIII of the Exfor Manual as proposed in Memos CP-D/20 and CP-D/23 are accepted in principle, but details require further consideration at the Centers. (See Action 9).

1.3 Centers are reminded that new data-types ("quantities") compiled in Exfor require an explanatory Memo, when the quantity code is not self-evident (compare Exfor Manual page IX.4 items 3 and 4).

1.4 The use of the column heading keywords SUM and RATIO is from now on optional, and the keyword DATA may be used for sums and ratios as well. (requires corresponding Manual updating.)

1.5 The transliteration of Russian into Latin characters is continued according to the original ISO rules, modified according to the Lexfor entry "Author" to avoid accents. This transliteration scheme has been in use since the beginning of Cinda and Exfor. It will be investigated whether there exists a USSR National Standard for transliteration.

1.6 On page VIII.1.3 the text about code expansions should be clarified as to when and by whom the expansion is envisaged.

1.7 It should be clarified in the Manual in which cases of Exfor coding the symbol "/" denotes a devision in contrast to its usual use as a separator.

1.8 It should be explained in the Manual why the unit code PER-CENT is forbidden under a column heading DATA (RATIO etc).

1.9 A subentry shall not contain duplicate information in lab-system and center-of-mass system. In case of doubt, the lab-system is preferred for integral CPND. The compiler may convert data from the center-of-mass system into the lab-system but should document in free text that he did so.

2. Items concerning the keyword REACTION

2.1 The names of the REACTION subfields and their Dictionaries are

Dict.	30	SF3	process
	31	SF5	branch
	32	SF6	parameter
	33	SF7	particle considered
	34	SF8	modifier
	35	SF9	data-type
	36	SF5 - SF8	quantity

2.2 The element symbols No and Ku for the elements 102 and 104 are kept until IUPAC reaches a final decision.

2.3 In the coding rules for nuclides the envisaged but not implemented rule for coding the charge of ions shall be omitted from the Manual.

2.4 The rule to code the natural isotopic composition of an element with mass-number "0" shall be entered in the Manual.

2.5 Under REACTION the rules for coding particles differ somewhat in the REACTION subfields SF2, SF3 and SF7. For ease of checking programs separate particle-code dictionaries should be introduced for each subfield (see Action 73).

2.6 If the incident particle in REACTION subfield SF2 is a nuclide, a metastable state extension is unlikely to occur. However, there should be no rule to exclude it.

2.7 For "emission cross-sections" involving the code "X" in REACTION subfield SF3, the particle, nuclide or gamma-quant considered is always entered in SF4 in the coding format of a nuclide. This involves introducing in SF4 the codes

0-NN-1 for neutrons and

0-G-0 for gammas.

2.8 In the coding of fission reactions the code FF in REACTION subfield SF4 is regarded as redundant and is therefore cancelled. (Compare Memo CP-B/13 of 77/7/8 page 1)

2.9 The process codes SPL for spallation and FUS for fusion are envisaged. NNDC will submit proposals for definitions of these terms (Action 82). The coding of yield data for these reactions shall be analogue to those for fission.

2.10 A decision on the coding of yield data for fission and similar reactions is postponed. (Note by editor: See memos CP-B/9, CP-D/27, CP-B/11 of May 1977.

2.11 A formalism to code product nuclei as independent variable in the DATA table shall be adopted for the case that the reaction code in SF3 is the same for all product nuclei, that is: fission and spallation. This is subject to further discussions.

2.12 It was proposed to extend the formalism of variable product nuclei in a way which makes it possible to enter a simultaneous measurement of the reactions (P,3N), (P,4N), (P,5N) etc in a single subentry, by introducing an artificial process code in SF3 for "different defined reactions". Such a proposal was postponed and KACHAPAG was asked to investigate first the resulting programming difficulties, in particular for indexing and retrieving (Action 86).

2.13 A formalism must be found to code decay data for product nuclei entered in the DATA table. A decision was postponed, and the matter shall be considered in connection with coding of yield data. (See Memos CP-B/9, CP-B/11, CP-C/15, CP-D/36 and others).

2.14 In REACTION coding the codes GND and MS are removed from Dict. 31. Corresponding reactions are coded by using the isomer extension of the product nucleus in SF4.

2.15 The use of the "multiple REACTION" formalism is restricted to

- resonance parameters of the same isotope
- multiple representation of the same data
- isomeric data (branches, ratios, etc) of the same reaction
- data for the same reaction obtained by different experiment reported in the same paper, or by different types of analysis of the same experiment; in this case the same REACTION code has to be repeated for each experiment resp. analysis.

2.16 Vice versa, pointers with column headings DATA (RATIO etc) are permitted only in the cases of

- "multiple REACTION" and
- "vector COMMON data".

2.17 Pointers used under REACTION and with column headings DATA (RATIO etc) may be used also elsewhere in the BIB-Section. In addition, different pieces of information in the BIB-Section may be linked to each other by pointers not referring to DATA or REACTION.

2.18 The examples of pointers given in the Manual, on page VIII.3 REACTION.6 of CP-D/23 and elsewhere, should include characters used as pointers in the style of KACHAPAG.

2.19 On page VIII.3 REACTION.5 of CP-D/23 examples or cross-links to Lexfor for "implicit" sums and ratios should be added to item 4.

2.20 On page VIII.3 ISO-QUANT.4 and on page VIII.3 REACTION.5 of CP-D/23 the separator "+" shall be defined as a mathematical sum. In case that another sum is meant (e.g. weighted by abundance) the modifier FCT shall be used in order to make the sum a mathematical sum.

2.21 Isomeric ratios are coded with the code 'RAT' which is introduced in Dict. 32. The same code is used also for ternary/binary ratios in ternary fission, and for thick-target-yield ratios. The isomer extension of the product nucleus in SF4 may have the mathematical operators "+" and "/" as shows in the following examples; the code "T" is introduced for "total".

isomeric ratio: (...(...,...)Z-S-A-M1/G,,SIG/RAT)

(...(...,...)Z-S-A-M1/T,,SIG/RAT)

isomeric sum : (...(...,...)Z-S-A-M1+M2,,SIG)

Note that SIG/SUM will not be coded (but compare CP-B/13 of 77/7/8 page 2 and CP-D/37 of 77/9/7 item 1); SIG/RAT is coded to indicate that this quantity has, as distinct from SIG, not the dimension of a cross-section.

ternary/binary fission ratio: (...(...,F)TER/BIN,SIG/RAT)

thick-target-yield ratio: (...(...,...)...,,TTY/RAT)

2.22 The coding of the Product Nucleus (resp. Residual Nucleus) in SF4 under REACTION is obligatory, except when undefined (TOT,ABS etc.).

2.23 For the factor "abundance" the modifier FCT is used under REACTION and ISO-QUANT, rather than REL. (Compare Lexfor "General Quantity Modifiers")

2.24 The coding of reactions where, e.g. inelastic scattering leads to an excited level which decays by fission or particle emission, requires further consideration.

2.25 Page VIII.3 REACTION.3 of CP-D/23 contains a mistake in the second example of item 15 which should be corrected.

3. Items concerning other keywords

3.1 When an Exfor entry contains two or more INSTITUTE codes and a coded facility, an institute code should be added to the facility code, whenever the location of the facility can be determined.

3.2 The new coding rules under EN-SEC as proposed in Memo CP-D/24 (4C-3/200) are adopted.

3.3 The keyword "N-SOURCE" is kept unchanged, but its meaning is generalized to "Source of incident particles or gammas". In output-editing programs it could be converted to, e.g., "SOURCE" or "INC-SOURCE".
See Action 74.

3.4 The coding under the keyword REL-REF is changed to the string

(code from Dict.17,subaccession-number,author,reference).

The author is written in the same style as under the keyword AUTHOR.

3.5 Item 2 of page VIII.3 RESID-NUC of CP-D/23 contains an obvious mistake which should be corrected.

3.6 Under STATUS the codes SPSDD, DEP, COREL must be followed by a subaccession-number. NDS will write a memo on the use of the code COREL (Action 87). (Note by editor: the discussion on this topic is continuing: see Memo CP-D/39.)

3.7 (Cancelled).

3.8 Under the keyword STATUS the coding in the form

(DEP,12345002,23456005)

is not accepted but replaced by

(DEP,12345002)
(DEP,23456005)

3.9 On the Manual page VIII.3 ANALYSIS a note should be added in front to explain the purpose of this keyword.

3.10 Decay data for monitor values must not be entered under the keyword DECAY-DATA but rather under a new keyword DECAY-MON, which has the same coding rules as the keyword DECAY-DATA. It is essential to note that under DECAY-MON that decay-data are entered which had been assumed by the author for the monitor value given.

3.11 The coding under the keyword MONITOR is revised and shall follow the same rules as under REACTION. The keyword MONITOR shall be obligatory except when not relevant. CAJaD will prepare a CP-Memo (Lexfor entry) to define for which kinds of data the monitor is not relevant, similar to the existing Lesfor entry under "STANDARD".(Action 85)

3.12 The remaining information previously coded under the keyword MONITOR shall be coded under a new keyword "MONIT-REF" with the following subfields:

SF1 = Exfor (sub)accession-number of monitor data

SF2 = first author, written in the same style as under the keyword AUTHOR, followed by '+' when more than one author exists

SF3 to SF7 or SF8 = reference in same format as under "REFERENCE"

The keyword MONIT-REF is not obligatory.

3.13 Thus the coding is similar to that under "REL-REF". In the case that (sub)accession-number and author are omitted, the corresponding commas must be given, for example

MONIT-REF (,,reference)

3.14 The new keyword MONIT-REF and its coding rules shall be reviewed at the centers and any objection communicated soon in a CP-Memo. Since this proposal arose at the Meeting, the staff of the centers must be given the opportunity to review it before it is formally adopted. (Action 84). (Note by editor: see Memo CP-C/15 item VI.)

3.15 Entries under MONITOR and MONIT-REF may be linked by pointers.

3.16 The new keyword ASSUMED and its coding rules were adopted as proposed in CP-D/21.

3.17 On the Exfor Manual page VIII.4.4 it is stated that the column-heading keyword FLAG must not be used in a DATA-section containing only one data point. Though this is generally correct, there are cases that, for example, a certain flag may be given in several subentries of which, incidentally, one contains only one data point. The Manual page VIII.4.4 should be corrected accordingly.

Recommendations about Cinda

Nr.	to whom	Recommendation
1	all	Proceedings of neutron physics conferences and neutron physics progress-reports should possibly have a Cinda-type index; if such documents include also non-neutron data, it should be considered to index also these in a Cinda-type form. (Note: This recommendation is supported by NEANDC) See also Action 38
2	CCDN and all	Cinda being an alive file, from which frequent retrievals are made, should be updated frequently and not only at book-production time. In area 2, at least journals and conference proceedings should be covered within the Center

Miscellaneous recommendations

3	all	Data centers should encourage data users to spend an appropriate time at the data-centers for mutual acquaintance and benefit
4	NDS	To investigate with outside firms and CPL to adapt Exfor programs for use at other centers and computers

Recommendations about Photonuclear Reaction Data

5		The photonuclear research group of FEI Obninsk is encouraged to compile their data in Generalized Exfor format and provide them to the data distribution centers (NDS,CCDN,NNDC). Cooperation with CJD and/or CAJaD, where necessary computer programs are in operation, is recommended. The compilation activity may start by sending a list of data sets or references to be compiled
6		The Nuclear Reaction Data Centers wish to encourage also other photonuclear research groups to compile their results in Generalized Exfor format and to provide them to the Four Centers for dissemination to interested users. At least, large data tables should be made available on tape in an Exfor-similar structure, e.g. using data fields in FORTRAN E-11 format.
7		Bibliographic information on photonuclear data would preferably be included in the exchange of "Recent References" information. The Japanese representatives are encouraged to promote Japanese references on photonuclear data to be reported in any aconvenient format to NNDC and CAJaD/LIJaF.

Recommend-
ations

Recommendation about future NRDC Meetings

Nr.	Who?	What?
8	IAEA	It is recommended that the Agency continue to sponsor meetings of the nuclear reaction data centers and should make it possible that technical staff and center heads meet regularly at intervals of 1 or 1 1/2 year.

R E S O L U T I O N

Subject: The unit of the "barn" for nuclear cross sections

The Second IAEA Consultants' Meeting of Nuclear Reaction Data Centers, which took place in Kiev, USSR, from 11 to 16 April 1977,

representing the major national and international Nuclear Data Centers and their communities of measurers and users of nuclear reaction data,

took note of the EEC Council Directive of 27 July 1976 (published in the Official Jounal of the European Communities No. L 262 of 27.9.1976, pages 204 ff, see Table 11) which, among others includes the Directive to cease, with effect from 31 December 1979 at latest, the use of the unit of the "barn". (See Appendix 13.)

The meeting opposed to this Directive with the following arguments:

1. The unit of the "barn", despite of having the dimension of an area does not represent an area but rather a likelihood (so-called "cross-section") for the occurrence of a nuclear reaction or atomic collision process under certain conditions.

2. The unit of the "barn" is part of the metric system, and hence there is no need to change it.

It is used world-wide, exclusively and uniformly for cross-sections of nuclear reactions and atomic collisions, and hence its abolishment does not contribute to uniformity of units.

It is, together with its multiples and submultiples (microbarn, millibarn, kilobarn) optimized for the dimensions of nuclear cross-sections, whereas the units proposed to replace the "barn" are impractical and a potential source of errors.
For example, the important thermal fission cross-section of uranium 235 of about 585 barns would become 58 500 fm^2 or 0,0585 pm^2. The majority of nuclear data would assume numerical values of similar inconvenience. Lectures and discussions in nuclear sciences, where cross-section values must be quoted frequently, would become considerably less comprehensible.

3. The meeting was not aware of any body representing the field of nuclear sciences that had been consulted about the "barn" before the Directive had been issued. Indeed, the Directive to abandon the "barn" is not in agreement with the 1977 edition of "Le Système International d'Unités (SI)" by the Bureau International des Poids et Mesures.

4. Participants of the Meeting had been informed by many nuclear scientists and committees, that the Directive to abolish the unit of the "barn" is regarded as unfortunate. Two resolutions, issued by the Nuclear Energy Agency Nuclear Data Committee (NEANDC) and by the US Cross Section Evaluation Working Group (CSEWG) are attached. The latter one indicates that the system of SI units is likely to loose its international recognition if the Directive of abandoning the "barn" were not revised. (See Annexes to Appendix 13.) - Note by editor: Subsequent to the Meeting the INDC issued a recommendation on the same topic which is also included in Appendix 13.

Resolution

Recommendation

Having in mind the arguments presented above, the Meeting recommends that, with reference to above-mentioned Council Directive and its Annex, the unit of the "barn" be removed from Table 11, and that it be entered instead in Table 1.4.2 (headed "Special names and symbols of decimal multiples and submultiples of SI units which may be used only in specialized fields") by the following entry:

Quantity	: Nuclear "cross-sections"
Unit name	: barn
Unit symbol	: b
Unit value	: 1 b = 10^{-28} m^2

It is also recommended that, with reference to the 3rd Edition of "Le Système International d'Unités (SI)" by the Bureau International des Poids et Mesures, the unit of the "barn" be removed from Table 10 (Units to be maintained temporarily with the SI), and that it be entered instead in Table 8 (Units to be used with the SI).

Continuing Actions

from the 1976 Four-Centers Meeting

The numbering is the same as in INDC(NDS)-78 pages 33-37.

Nr.	Who?	Action
3	all centres	advise Cinda-indexers to include in the comments "NDG" whenever appropriate.
10	CJD	provide NDS with coverage control-entries of Soviet laboratory-reports.
18	all centres	review the lab-dictionary and provide NDS with information and cross-references about related labs and codes for inclusion in the Dictionary.
20	all centres	exchange views and information about existing practice in style and content of comments in data index lines.
21	CCDN	retrieve from Cinda, by area, the N3N and the FPG entries and send them to the centres responsible.
28	CCDN	investigate how "neutron" as a target can be entered in Cinda, and to contact NDS how this would affect the book printing programme.
33	all	(continuing action 44 from 11th 4C-meeting) to inform other centres about documentation of evaluations and about evaluations or comparisons of available evaluations going on within the centre's area.
34	all	(continuing action 43 from 11th 4C-meeting) try to get from users feedback information on status and quality of evaluated data files.
37	all centres	to provide the other centres with any information available about which types of data were never or rarely requested and whether preliminary data are needed by customers.
42	all centres	(action 31 from 11th 4C-meeting continuing) compare the translated SCISRS-I data (50000 and 80000 series tapes) with regular Exfor entries and communicate correspondences. Continue to clean up the 50/80 000 series.
47	NNDC, CCDN, NDS	for the time being tapes sent to CJD should start with a short dummy file.

Continuing Actions

Nr.	Who?	Action
49	all centres	when quoting errors, include in 4C-Memos precise reference to the EXFOR-Manual.
54	all centres	send suggestions for reports to be referred to in the LEXFOR Manual to NNCSC.
56	all centres	(action 2 from 10th 4C-meeting continuing) (a) Centres having received specialized compilations in any format should signal their existance to other centres.
	NDS	(b) Inform interested centres of any significant changes in EXFOR.
57	all centres	(action 29 from 10th 4C-meeting continuing) Requests from other centres should be acknowledged within a few days of receipt, giving a detailed status for each request, including "no data available" if applicable.
58	all centres	(action 30 from 10th 4C-meeting continuing) Inform the other centres when initiating a data review or special-purpose compilation, so that appropriate data may be transmitted with preference.

Actions

Miscellaneous actions on NND

Nr.	Who?	What?
1	NDS	Send comments to CCDN on the use of the Crouch Library of experimental fission product yields (Compare Memo 4C-2/89).
2	all	Change NNCSC to NNDC in addresses (= National Nuclear Data Center)
3	NDS	To provide data request and dissemination statistics for 1976, as far as possible
4	Marcinkowski	Send his Exfor compilation of europium data to NDS on magnetic tape when ready
5	NND Centers	Send available europium data, in particular Neudada data not yet in EXFOR, to NDS for forwarding to Marcinkowski
6	NDS	Make sure that the chairmen of the technical subcommittees of INDC and NEANDC send the list of reviewers and their data-review topics to the Four NND Centers
7	NDS	Report to INDC the concern of the Four NND Centers about the late publication of INDC Meeting-Minutes causing undue delay in the information of the Centers and their related actions
8	NDS	Distribute to other data centers list of actions from INDC Meetings as soon as possible
9	all	To satisfy continuously the standing data requests of data reviewers of INDC and NEANDC technical subcommittees

Actions about CINDA Improvement

10	CCDN	Add to CINDA Manual instructions on data index lines
11	CCDN	Investigate to write a CINDA entry duplication check program. If possible, supply other centers with retrievals of duplicate entries from their areas
12	NDS	To send CJD CINDA retrieval of entries for USSR labs with accompanying discription of clean-up operations to be performed
13	CJD	To do the clean-up for USSR entries

Actions
CINDA

Nr.	Who?	What?
14	CJD	To provide complete and regular coverage for USSR preprints and lab-reports, at least for report series or even single issues easily available to CJD
15	all	Review existing CINDA blocks whether they correspond to existing rules, whether CINDA and EXFOR main references agree, whether the energy ranges in CINDA and EXFOR agree. Top priority should be given to blocks of current EXFOR data
16	NNDC	(action without deadline) to block and index the 50 000 series
17	all	Check and revise the remaining automatic Neudada index lines (having comments of the type "1 data index line")
18	all	To revise the comments for "NXN" entries to specify "N3N" etc
19	CCDN	Retrieve FPG entries from Cinda and distribute retrievals to other centers
20	all	To prepare FPB entries where necessary
21	CCDN	To review rules about no-book flags and submit a 4C-Memo about this topic
22	CCDN	To avoid "lonely" data index lines in CINDA

Actions about CINDA Manual and Dictionaries

23	all	Review the CINDA Manual submitted by NDCC and submit comments to NDCC within 4 weeks
24	CCDN	(continuing) transmit CINDA Manual up-date pages whenever a new 4C agreement has been reached
25	NDS	To send 20 copies every 3 months of up-dated lab and reference disctionaries to NDCC for their external CINDA indexers. Compare Conclusion 16.
26	NDS	To include in the Exfor/Cinda Dictionary system the Dictionary of CINDA quantities
27	CCDN, NDS	To review the feasibility of Memo 4C-1/116 aiming at unifying ref-type codes in CINDA and EXFOR. If no objection is received within 4 weeks after the meeting, Memo 4C-1/116 is regarded as accepted

Actions about CINDA publication

28	NDS	To collect information about page-number and sales price of a 4^{th} and 5^{th} cummulative

Nr.	Who?	What?
		supplement to CINDA 76/77 for 1978 and inform the centers and organizations concerned including INDC and NEANDC
29	NDS	To submit a new proposal for an archival CINDA issue in 1979, including price estimates and number of copies to be printed, as soon as possible
30	all	To think of any other technical details about the Cinda archival issue to be timely considered before the next 4C-Meeting

Actions about CINDA statistics and coverage control

31	CCDN	To try to extract from CINDA, as far as possible, other meaningful statistics
32	CCDN	To provide NNDC and NDS with latest status of instructions for input to coverage control system, and to include them in the CINDA Manual
33	NDS	To submit the NDS coverage list on punched cards to CCDN and to start making use of the "modify" operation for these coverage control entries
34	CJD	To study the CINDA coverage for USSR literature for the period before 1969

Actions on CINDA programming

35	CCDN	(continuing action) to improve in the CINDA programs the treatment of "main lines" (as discussed earlier) and inform other centers in 4C-Memo
36	CCDN	To provide in CINDA programs that the neutrons as a target can be entered, and inform NDS in time before the next book production so that NDS can adapt the book production programs accordingly
37	NDS	To provide in the book production program a feature that not more than one data tag per block is printed. This tag should preferably be in the first line of a block, but could alternatively, also be in the last line of a block. If this program change is not possible, consult back with CCDN

Miscellaneous actions on CINDA

38	CJD	To include in the proceedings of the 1977 Kiev Conference an index in CINDA format (see also Recommendation 1)

Nr.	Who?	What?
39	all	To remove from CINDA data index lines for superseded data (see also Conclusion 5).
40	NDS	to inform CJD about treatment in CINDA of preliminary preprints and final reports, in particular in the case of JINR.
41	NDS	Change a Conference Dictionary "71ALBAN2" to "71ALBANY".
42	all	To remind compilers that using a new code before its formal adoption, is at the risk of the originating center, which may have to change the code in the case that it does not find 4C-approval.

Action on Wrenda

43	NDS, INDC	To consider that WRENDA publication schedule is now out of phase with schedule of US request list. The US schedule, where the collection of information to be included in the request list starts in the fall of every even year, will not be changed. This situation suggests that INDC reconsider the schedule for the next WRENDA editions.

Actions on neutron data

44	CJD	When releasing new evaluated data send them to all other centers directly
45	NDS	Forward the recent USSR evaluations (He-3 et al) to CCDN and NNDC
46	CCDN	Continue to send regularly (e.g. half-annually) the EXFOR exchange statistics to the other centers
47	NNDC CCDN NDS	Until further notice from CJD continue to send to CJD data on 7-track-tapes but increase the dummy file in the beginning to at least 100 records
48	CJD	To inform other centers when CJD is ready to receive 9-track tapes in 800 b.p.i. (Note that after this date the EXFOR data exchange will entirely use 9-track-tapes)
49	NDS	To delete from the 70 000 file all entries that have been transmitted as regular EXFOR entries and transmit the remaining 70 000 file to the other centers
50	CCDN	Submit a new Protocol Section on the Cinda cooperation of the Four Centers as soon as possible

Nr.	Who?	What?
51	NDS	To propose a priority list of important data to be compiled fast and at 100% completeness and send it for comments to the other centers. Among others this list is to include resonance parameters for all nuclides (as being needed for nuclear systematics). It is vital that such data are completely compiled before they are requested by customers.
52	NNDC	To provide a list of references found missing in Crouch's Library of fission-product yield data to the other centers for their compilation
53	CCDN	Write a Lexfor entry on the compilation of derived values such as resonance integrals and fission spectrum integrals. (Such data are considered as evaluated data if they are based on more than a single experiment.)
54	NNDC	Inform the other centers of their foreign distribution of the NNCSC Newsletter. (NNDC will accept additions to this distribution list for scientists with real interest.)

Miscellaneous Actions

55	NDS	To include in the Minutes a list of data centers participating in the Exfor data exchange
56	CCDN NNDC CAJaD	Inform NDS and other interested centers about any progress with data base management systems, and distribute relevant meeting materials and other literature which might be of interest to data centers
57	NDS	To include on the Agenda of the next NRDC Meeting the topic of data base management systems
58	NDS	To draft a statement against the CEC Directive of abandoning the "barn" and to give it appropriate distribution.
59	NDS	to distribute all Meeting materials to the participants immediately after the Meeting (Action fulfilled 25 April 1977).

Actions on CPND

Nr.	Who?	What?
60	KACHAPAG and CAJaD	To aim at agreements on the scope of data handbooks to be published and to compile relevant data with high priority
61	IAEA	To support the foundation of a Japanese CPND Center (see letter by Glubrecht end of April 1977)
62	CCDN NDS CAJaD et al.	The data distribution centers should immediately communicate to NNDC how many copies of the CPND bibliography they require for distribution, and should later submit their address lists of distribution.
63	NNDC	To inquire about the possibility of a cumulative issue of MacGowan's CPND bibliography up to 1 Jan 1976. (See CP-C/22 of 77/9/15)
64	NNDC	To distribute the Report on the US Panel on Reference Nuclear Data to NND, CPND, NSDD Centers
65	NNDC	To inform Mr. Münzel about the next Panel on Reference Nuclear Data
66	Seeliger	To inform relevant institutes in the GDR of the international data compilation and exchange efforts
67	NDS	To send the Kachapag file to Vasiliu
68		(cancelled)

Actions on Photonuclear Data

69	photonuclear group, NDS	Exfor entries on photonuclear data should be sent to the data distribution centers. Initially they could be sent to NDS for further distribution
70	NDS	Provide Vasiliu with Berman's photonuclear data Library

Actions on Dictionaries

Nr.	Who?	What?
71	NDS	when updating Dictionaries of lab and ref-codes check back with the responsible center
72	NDS	to continue transmitting Dictionaries at least every three months, but more often when there are significant changes
73	NDS	to introduce separate dictionaries for particle codes for each relevant REACTION subfield
74	NDS, NNDC	to change in Dictionaries 2 and 19, and in the Manual, the meaning of the keyword "N-SOURCE" to "Source of incident particles or gammas".

Actions on EXFOR rules

Nr.	Who?	What?
75	NDS	to prepare a revised "Brief description of EXFOR" based on the Generalized Exfor, for distribution to data center customers, with the aim of informing experimental nuclear physicists of the principles of Exfor, so that they can issue their numerical results on magnetic tape in a format close to Exfor.
76	NDS	to currently inform interested scientists of latest revisions to the Exfor system.
77	CCDN	write a Lexfor entry on the compilation of derived values such as resonance integrals and fission spectrum integrals. (Such data are considered as "derived" values only if they are based on a single experiment; if they were based on more than one experiment they are considered as "evaluated" data.)
78	KACHAPAG	to investigate how to merge in KACHAPAG tapes entries originating from different data centers, such that entries are in ascending order in each file. (see Memo CP-B/13 of 77/7/8 p.1)
79	all	to comment on memos CP-D/20 and CP-D/23
80	all	to send to CAJaD programs and documentation on checking the coding under REFERENCE
81	NDS	to retransmit entry 30139 (partial reactions through excited states of Li-7) in REACTION formalism
82	NNDC	to prepare a Lexfor entry on the definitions of spallation and fusion
83	Grigorian	to check whether there is a USSR National Standard for the transliteration of Russian into Latin characters
84	all	to review the proposed new keyword MONIT-REF and its coding rules and submit objections, if any, in a CP-Memo soon
85	CAJaD	to prepare a Lexfor entry defining for which kinds of data the monitor is not relevant
86	all	to investigate the programming difficulties which may result from extending the formalism of "variable product nuclei" to reactions other than fission and spallation
87	NDS	to write a memo on the use of the status code COREL

Actions on Bibliography

Nr.	Who?	What?
88	all	To submit comments on the NNDC Bibliography on integral CPND.
89	all	To submit to NNDC distribution lists for the CPND Bibliography
90	NDS NNDC	To investigate possibilities for unifying the reference codes in the different bibliographic systems and to put this topic on the agenda of the next Meeting on Nuclear Structure and Decay Data.
91	NDS	To circulate to other centers Mr. Gadjokov's final proposal on data tagging in INIS.
92	Behrens	To circulate results of "Recent References"/INIS comparative analysis.
93	CCDN	To send Cinda profile for INIS retrievals to NNDC and CJD.

Actions about next Meeting

94	Schmidt	To circulate possible dates for the next NRDC Meeting in Paris/Saclay
95	Schmidt	To investigate about the financial aspects of future NRDC Meetings

A P P E N D I C E S

See on page 4 for a
list of Appendices

Appendix 1

THE CJD PROGRESS REPORT

1. After the 12 th 4C-Meeting the CJD has transmitted the tapes 4026 - 4028, which contain 40 works. Other 50 works are in process of putting on magnetic tapes and 50 works are compiled. Thus the status of compiling into EXFOR is as fol - lows:

Period	Total	Trans-mitted	In process	Data on request
1965-1976	490	321	100	69

During the period under review there were some technical difficulties connected with the CJD'S computer operation. This did not allow to use the EXFOR checking program and also delayed the transmission of magnetic tapes.

2. From the middle of 1976 the CJD began to develop the EXFOR programmes in PL/1 for the EC-1030 computer; the primary programmes have been written. The CJD's programmers took part in developing the programmes which allow to transmit an information from the M-222 computer to the EC-1030 computer.

Now the CJD is ready to exchange of nuclear data with other centres on the 9-track magnetic tapes.

3. After the 12-th meeting the CJD has sent to NDS the evaluated data for Pu-238, Am-243, Cm-244, He-3, He-4, Pu-240. The report on the Pu-240 evaluation has been sent to NDS, the detailed description of the evaluated data of Pu-238, Am-243, Cm-244 has been published in "Nuclear Constants" №23. The compilation "The Nuclear Physical Constants of γ-Emitting Isotopes of Reactor Technology Materials" (Supplement to "Nuclear Constants" №22) and the work "Neutron Cross Sections of Natural Erbium and Its Stable Isotopes (group constants)" (Supplement to "Nuclear Constants" №21) have been published.

A method of the evaluation of the particle emission spectra of the neutron and proton induced reactions has been developed. The recommendations on using the theoretical model description of the direct reaction cross section for the analysis and evaluation of nuclear data has been developed too.

The evaluation of the (n,p), (n,α), (n, 2n) reaction cross sections for some isotopes and evaluation of some reac - tions for the Na, Al, Ca, U-238 inelastic scattering cross sections of are carried out.

4. During the period after the 12 th 4 C - meeting the CJD has published "Nuclear Constants NN№ 21, 22, 23 the two supplements and collections of abstracts NN№ 22, 23.

5. In 1976 the CJD answered the 125 requests on nuclear data:

on documents	- 40
on evaluated data	- 65
on experimental data	- 20

Appendix 1, Annex a.

Content of TRANS 4028

1	40330	Belanova	AE,37,437,74	EN,RES	OS
2	40352	Fomushkin	YFI-19,9,74	NF	Cf-249
3	40378	Fomushkin	YFI-21,7,76	NF	Cf-252
4	40389	Skovorodkin	AE,35,409,73	NF,YLD	Am-241, Pu-241
5	40395	Babenko	YF,10,233,69	NF	Ra-226
6	40398	Zakharova	YF,18,710,73	NF	U-233, U-235
7	40406	Gochberg	YFI-22,10,76	NF	Pu-244
8	40407	Fomushkin	YFI-22,11,76	NF	Pu-244
9	40408	Alchazov	YFI-22,12,76	NF	U-235
10	40412	Poletaev	FEI-274, 76	ALF	U-235, Pu-239
11	40430	Belanova	AE,38,430,75	EN,RES	Ta-181
12	40431	Panitkin	AE,39,17, 75	NG	U-238
13	40434	Fomushkin	AE,39,295,75	NF	Pu-240
14	40435	Bergman	AE,39,291,75	ALF	Pu-239
15	40469	Kalebin	Lowell-76	EN,RES	Lu-175, Lu-176

Appendix 1, Annex b.

of

The list works being processed in CJD

N	First author	Reference			Reaction	Elements
1	Nesterov	YF 4	5	399	66 NF	U-233,235; Pu-239
2	Rjabov	AE 24	4	351	68 ALF	U-235, Pu-239
3	Broder	FEI-155			69 NF, DNG	F, Co, Sb, Ta
4	Bak	FEI 8	17		69 RIF	U, Pu, Am
5	Babenko	YF 11		1006	70 NF	Ra
6	Nikolaev	KIEV 2	85		71 NFY	Pu-238,239,240
7	Petrzhak	KIEV 2	44		71 NU BAR	Cf-252
8	Muradjan	KIEV 1		309	71 ALF	Pu-239
9	Andreev	YF 15	5	856	72 DNG	Rr-141, Mo-165
10	Kbitek	KIEV 2		160	73 NA	Nd-143
11	Dovbenko	KIEV 3		138	73 NG	Zn-68
12	Vorobjeva	YK 15	3		74 NU BAR	U-238; Pu-240,241
13	Aldea	YFI 17	28		74 NG	Sm-147
14	Karzhavina	YFI 17	30		74 RES	Cd-111,113; Gd-157; Dy-161,163
15	Dvuhsherstnov	YFI 19	4		74 ALF	U-235
16	Belanova	AE 37		437	74 EN, RES	Os-187, Os-188
17	Doilnitsin	FEI - 678			75 TOT	Fe-58
18	Savin	FEI 20	11		75 NNF	Al, Fe
19	Belovitskiy	LENINGRAD		348	75 NP	Sb, Bi
20	Aleksandrova	AE 38	2	108	75 NF	Pu-239, U-235
21	Pojarkov	YF 21	3	468	75 SNG	O-16, C-12

N	First author	Reference					Reaction	Elements
22	Vertebny	YF	22	4	674	75	LDL	Os, Pt
23	Karzhavina	YF	22	1	3	75	RES	Dy-161, Dy-163
24	Karzhavina	KIEV	3		229	75	STF	Nd-143,145,147,149; Gd-155,157; Dy-161,163; Er-167; Yb-173; Hf-177,179
25	Nurpeisov	AE	39	3	199	75	NU BAR	U-233, 238; Pu-239
26	Belanova	AE	39	5	369	75	EN, RES	Cm-244,245,246,248
27	Zhuravlev	AE	39	4	285	75	NF, RIF	Pu-239; Am, Cm, Cf-249
28	Gavrilov	KIEV	3		229	75	STF	Am-241,243; Bk-249
29	Vertebny	KIEV	3		151	75	TOT	Cf-249
30	Mostovaya	KIEV	6		76	75	NF	U-235
31	Zhuravlev	KIEV	3		229	75	STF	U-235, Pu-239
32	Balabanov	KIEV	4		60	75	NA	Pd-105, Sm-149, Gd-157, Yb - 171
33	Fursov	KIEV	6		3	75	NF	Pu-239, U-235
34	Kondurov	KIEV	6		97	75	NF	U-235, Pu-239, Cf-252, U-233
35	Gangrsky	KIEV	5		245	75	NF	U, Pu, Am
36	Lebedev	KIEV	4		187	75	SCAT	Al, Fe
37	Biryukov	KIEV	4		113	75	DIN	Cr, Fe, Co, Ni, Y
38	Aleksandrov	AE	39		137	75	NP	Al, Si, Cl, K, Cr
39	Baryba	FEI - 671				76	DIN, (N,2N), (N,3N)	U-238
40	Govor	FEI - 21			12	76	DIN	Pd- 104, 106

N	First author	Reference			Reaction	Elements
41	Demidov	YFI - 21	12	76	DIN	Mo-92
42	Lebedev	YFI - 21	15	76	DIN	Al, Fe
43	Pshenichny	YFI - 21	29	76	ETA	U-233
44	Demidov	Baku-76	84	76	DNG	Cd-114, 116
45	Razbudey	YFI - 22	19	76	TOT	Eu-152, 154
46	Razbudey	YFI - 22	21	76	ABS	Eu-152
47	Razbudey	YFI - 22	22	76	TOT	Eu-153
48	Ivanov	Lowell		76	EN, RES	Th-230, Ra-226
49	Anufriev	Lowell		76	EN, RES	Cs-133, Cs-134
50	Adamov	YFI - 22	14	76		U-235, U-238

Appendix 1, Annex c.

Recent Neutron Nuclear Data Evaluations
in the USSR

The evaluation of the ^{238}U capture cross sections in the neutron energy range 0.001 ÷ 7 Mev and the evaluation of the ^{197}Au capture cross sections in the neutron energy range 1 - 100 kev have been made in Dr. Tolstikov's group (FEI, Obninsk).

The Prof. Nikolaev's group (FEI, Obninsk) is going to complete the evaluation of full file for oxygen this year; the evaluation of fission product cross sections are carried out and the group constants for the main fast reactor materials are revised.

The evaluation of full nuclear data file for ^{241}Pu has been carried out in Minsk. Late in 1977 Dr.Konshin's group plans to complete the evaluation of full file for ^{242}Pu. They have developed a number of programmes for fissile nuclei cross section calculations.

Appendix 2

CCDN PROGRESS REPORT TO THE 13TH 4-C MEETING

Kiev, 11th-16th April, 1977

I. GENERAL SITUATION

The CCDN's situation has been affected by the decision, taken last October by the NEA Steering Committee, to postpone the settlement of the amalgamation of CPL and CCDN until April, 1977. In accordance with the new structure which had to be laid down, the post of Head of the Centre, vacant since the end of October, 1976 has not been filled; this has somewhat restricted certain activities started at the beginning of 1976.

The conversion work corresponding to the preliminary phase of the amalgamation of the two centres has been partially realised, especially with regard to the possibility of using a Data Base Management System and the study of the computer facilities necessary for such a modern system of data file handling. The results of the preliminary investigations into the DBMS field will be presented at this meeting.

The traditional mandate of CCDN in the neutron data field has been pursued in rather good conditions.

II. EXPERIMENTAL DATA

A. Generalities on the compilation of data

Due to the shortage of physicist personnel during the past 2 or 3 years, the main compilation effort was concentrated on the large set of data (total, capture and fission cross-sections of heavy elements; total and capture cross-sections of structural material nuclei etc.,) of great importance to users, to the detriment of a systematic scanning of all the data available in the laboratories. This systematic scanning, performed from a file based on the progress reports of the laboratories, has now been completed for some countries, and is being actively pursued.

The Progress Report last year mentioned some relatively recent data (posterior to 1974) which had not then been compiled. This backlog can now be considered as absorbed because it will disappear with the systematic scanning mentioned above, and data having a priority character are compiled as they arrive at CCDN. However, it must be pointed out that some laboratories are reticent to send us their data; more than 50% of the CCDN's letters to physicists remain unanswered, and only half of the replies contain tables of experimental data.

Two types of experimental data have been somewhat neglected in the past : the energies and intensities of the gamma-rays following neutron capture, and the fission yields. The latter are regularly compiled by E.A.C. Crouch at Harwell (U.K.). The CCDN has perfected a system of programs which allows these data to be translated into the NEUDADA and EXFOR formats as well as producing suitable output for users. The corresponding file will be regularly updated by the Harwell group and is available via the CCDN, in agreement with the authors, for all users within the 4-Centre network. The utilisation of the CROUCH file is an example of the co-operation between the CCDN and national evaluation groups.

As far as the gamma-ray spectra data are concerned, one has to evaluate to what extent these data are compiled within the framework of the international effort in collection, evaluation and dissemination of the Nuclear Structure and Decay Data (NSDD). The CCDN is already in contact with the group at Jülich (which is a part of the international network in the NSDD field) which compiles the gamma-ray data. The results of this compilation could be handled at CCDN, after agreement with the authors and made available within the 4-Centres, in a similar manner as the Crouch file.

The compilation of both fission yields and gamma-ray data constitutes a field in which there is a significant overlap between pure neutron physics, the principal affair of the CCDN, and charged-particle physics. Handling of the above-mentioned files could be the first step to an eventual broadening of the CCDN's activities.

B. The data which have been compiled

Approximately 150 works, concerning especially cross-sections, resonance parameters and resonance integrals, have been compiled during the period May, 1976 - January, 1977. Part of these data have not yet been exchanged in EXFOR; four EXFOR tapes, corresponding to 60 references and 600 data tables, are awaiting a final verification. The number of data points is relatively small; this is a consequence of the systematic scanning of less important work as mentioned above.

C. Data to be compiled

From the progress reports of the laboratories, we have evaluated the number of experiments completed but not yet compiled, plus those which are still in progress. The total number is approximately 150, so the volume of compilation for the next year should be roughly the same as last year.

D. Data received from the other Centres

Since 1st May, 1976 the CCDN has received 7 EXFOR tapes from the other Centres. The translation of these tapes into the NEUDADA format was done without problems. The most recent updating of the NEUDADA file was performed in February, 1977.

III. CINDA

Following the last, full edition of CINDA in July, 1976 (Vols. I and II, CINDA 76/77), work on the CINDA file at CCDN has fallen into two categories :.

(a) updating the file by entering references published since March, 1976 and publication of the first supplement 76/77: The number of new entries demonstrates a continuing growth of neutron physics litterature at the rate of approximately 15% per year. As yet, this trend does not show any sign of decreasing as a result of the harsher economic climate in scientific research.

(b) continuation of the work of correction, cleaning and blocking of existing entries with a view to an archival volume in 1978, and for the conversion of the computer file to a hierarchical data base structure.

Two series of extensive, systematic modifications have been made to the existing CINDA file. Firstly, following a recommendation of the CINDA Readers' Seminar and discussions between the 4-Centres, some modifications have been made to the CINDA Quantities Dictionary (code of neutron reactions). Secondly, in preparation for the conversion of the computer file to a hierarchical data base structure, an effort has been made to unify diverse and irregular reference codes. This has involved about 5000 modifications to existing records, and will be finished shortly.

The review, correction and blocking of new and existing entries has continued at CCDN. Everyone realises that a great deal of work must be done to obtain a perfect version of CINDA. The numerous imperfections in CINDA are inherent in the nature of CINDA and in the large number of people who have been involved in its elaboration. The CCDN is doing its best to ensure that the eventual 1978 archival volume will be as clean as possible. However, we must realize that the amount of work to be done should not be disproportionate with the expected results; the main criterion is the satisfaction of the users and the imperfections of CINDA should be considered as minor in comparison to the immense service that it renders to users of neutron data.

The problem of CINDA publication after 1978 has been considered at CCDN. The cut-off date could be determined by examining the statistics on CINDA entries presented in Annex 1.

The list of journals, reviews and reports to be directly scanned by the CCDN CINDA Readers has been established in agreement with the readers. It appears that the laboratory reports from some countries will not be completely covered. However, we can expect collaboration from some INIS indexers. The CCDN staff will also use the INIS file by systematically scanning a retrieval provided by the Central Library of the French C.E.A. at Saclay.

IV. EVALUATED DATA

The following files have been added to the evaluated data files available at CCDN :

(i) From CNEN, Bologna, an evaluation in ENDF/B-format for 12 fission product nuclei of the elements Zr, Ru, Ce, Pr, Nd and Eu.

(ii) The ENSDF library, i.e., the Evaluated Nuclear Structure Data File;

(iii) A library of 22 neutron dosimetry reactions by A.A. Lapenas, Riga, USSR, in EXFOR format.

(iv) Russian evaluations of He-3, -4 and partial evaluations of Pu-238, Am-243 and Cm-244, in SOKRATOR format.

(v) Resonance parameters for 26 fission products by P. Ribon, E. Fort, J. Krebs and T. Quoc Thuong, C.E.A., France.

(vi) Library IV, a 50 group, 101 isotope library in CCCC-III format. Multigroup constants generated from ENDF/B-IV.

V. SERVICES TO CUSTOMERS

The number of requests is about the same as last year. Approximately 200 requests were recorded during the period 1st April, 1976 to 15th January, 1977 :

45% for experimental data,
45% for evaluated data, and
10% of retrievals from the CINDA file.

VI. DEVELOPMENTS IN PROGRAMMING AND COMPUTER NEEDS

A. Current work

The following work has been undertaken :

(i) improvements in the EXFOR-NEUDADA conversion programs;

(ii) a system of programs for the handling of the CROUCH file;

(iii) final testing of the ZZ program (computerized CINDA coverage control system);

(iv) assisting CPL staff during a mission at Saclay;

(v) assisting the staff of the Nuclear Development Division (test on the IBM 370/125 of the codes Fuel Cycle, NUFUEL, Fuel Cost);

(vi) maintenance of the system (especially : generation of the DOS/VS system, release 32).

B. Work undertaken with a view to the implementation of the Data Base Management System (DBMS) and for the possible CPL-CCDN amalgamation

1. Although the amalgamation of the CPL and CCDN has not been definitely decided, an important effort has been made at CCDN to realize a large part of the programme proposed for the preliminary phase of the conversion. The aid of DBMS specialists has been procured and a training course for the CPL and CCDN staffs was held in September, 1976 at Saclay.

2. The work undertaken is enumerated in the following points :

(i) A general study of the implementation of a DBMS. At the present time, the CCDN uses 123 files corresponding to 52 different format structures, and 74 retrieval and maintenance programs. The structure and relationships of all the information items were logically analysed and a proposed integrated Data Base Scheme was drawn up; a preliminary version of the scheme according to IDMS specifications was established in consultation with an IDMS specialist.

(ii) Discussions and reflections on the scheme optimisation.

(iii) The generation of an IDMS system and the program CULPRIT ("utilitaires" on IDMS) on the IBM 370/125 computer at CCDN; compilation of the schema.

(iv) A study of the general procedures for loading of the Data Base;

(v) The writing and testing of :

(a) the programs for partial loading of the "Reaction" and CINDA sections of the schema;

(b) the corresponding retrieval programs.

(vi) reformatting of the files connected with CINDA, EXFOR and NEUDADA with a view to the loading of all related information together with their logical links and utilization modes.

(vii) conversion into EXFOR from the NEUDADA file of data anterior to 1970 in order to integrate them in the Data Base. The Saclay data have been converted. The work still to be done is important and will be pursued in 1977 and 1978. Independent of the Data Base, the realisation of this work constitutes an improvement of the international EXFOR file.

VII. PARTICIPATION IN INTERNATIONAL MEETINGS AND MISSIONS

1. NEANDC/NEACRP Specialists Meeting on Fast Neutron Fission Cross-Sections. Argonne, 28-30 June, 1976.

The CCDN participated actively in this meeting by performing a special update of the experimental data files for the elements and cross-sections concerned.

2. IAEA/OECD Technical Committee Meeting on Differential and Integral Nuclear Data Requirements for Shielding Calculations. Vienna, 12-15 October, 1976.

A contribution was presented by a representative of CCDN on "A graphical comparison of cross-section evaluations for some structure materials." Severe discrepancies between several evaluations were pointed out and some comparisons with experimental data were drawn. The CCDN also participated in the discussions of the sub-group on "fusion reactors", for the establishment of priorities concerning the needs of experimental and evaluated data.

3. IAEA Advisory Group Meeting on Atomic and Molecular Data for Fission. Culham, 1-5 November, 1976.

The aim of this meeting was to identify the data needs for atomic and molecular processes in plasma, and to discuss the establishment of an international network of centres for the collection and dissemination of bibliographical and numerical data. A representative of CCDN attended this meeting as an observer. The use of a file similar to CINDA should be considered for the compilation of atomic and molecular data. It appears that the group headed by Professor Delcroix at Orsay (France) have developed the most sophisticated system in this field and collaboration between the Orsay group and the CCDN should be envisaged for the future.

4. International Specialists Symposium on Neutron Standards and Applications. NBS, Gaithersbury (U.S.) 28-31 March, 1977.

A session on Li-6 was organised within the symposium in collaboration with the NEANDC. A representative of CCDN was invited to present a review paper on the present status of the experimental data with a view to obtaining a solution to the disagreement raised by the reaction Li-6(n,alpha) cross-section.

Appendix 2

ANNEX 1

THE CHOICE OF A CUT-OFF DATE FOR THE ARCHIVAL VOLUME OF CINDA

(Peter Johnston)

The choice of a suitable cut-off date for the separation of CINDA into an archival volume and subsequent cumulative supplements depends on the balance between the size of the supplements and the degree of overlap between entries in the supplements and 'blocked' entries in the archival volume.

The block structure in CINDA means that whatever the cut-off date, some blocks will exist, and will be created, with entries dated before and after the chosen date. The statistical survey presented here is based on the assumption that only blocks with no entries dated after the cut-off date will appear in the Archival volume, and that all blocks with entries dated since the cut-off date will appear in the cumulative supplements.

The alternatives of splitting blocks, or including the existing 'overlapping' blocks in both the archival volume and the supplements, appear less appropriate; the first owing to the loss of information, and the second because of duplication (approximately 14,000 entries).

Table 1 and Figure 1 show a simple breakdown of CINDA, ignoring the block structure, showing the number of CINDA entries for each publication date.

TABLE 1

Total entries January, 1977 138241

Publication Date		Entries	Publication Date		Entries
*	1976	4755		1959	2176
*	1975	7401		1958	4116
	1974	8725		1957	2607
	1973	10325		1956	1933
	1972	9321		1955	1620
	1971	9787		1954	570
	1970	11067		1953	728
	1969	8077		1952	515
	1968	8004		1951	577
	1967	7429		1950	628
	1966	6653		1949	455
	1965	7246		1948	151
	1964	5205		1947	353
	1963	3471		1946	118
	1962	2958	before	1946	1337
	1961	3541			
	1960	3684			

* incomplete.

CINDA 23/2/'77

DATE	AREA 1		AREA 2		AREA 3		AREA 4	
	NNCSC		CCDN		NDS		CJD	
TOTAL	55,388		34,761		21,236		25010	
	Total	X-4	Total	X-4	Total	X-4	Total	X-4
'76	2,406	569	1,822	714	693	245	439	-
'75	3,084	485	2,101	175	733	129	1,116	38
'74	2,297	478	3,174	938	1,051	132	1,742	210
'73	2,261	331	2,952	146	3,041	263	1,696	221
'72	2,647	308	2,129	103	2,138	357	2,121	156
'71	3,105	153	2,158	324	3,044	257	1,407	126
'70	2,739	25	3,154	87	3,504	412	1,590	158
'69	2,373		2,383		1,690		1,559	
'68	2,527		2,167		1,097		2,176	
'67	3,100		1,729		888		1,630	
'66	2,670		1,839		672		1,461	
'65	2,950		1,777		644		1,774	
'64	2,426		1,089		415		972	
'63	1,662		933		334		486	
'62	1,722		742		222		242	
'61	2,259		625		195		431	
'60	2,654		464		176		340	
'59	1,313		420		86		354	
'58	2,788		518		34		740	
'57	1,503		448		35		627	
'56	1,311		273		34		308	
'55	1,027		275		129		176	
'54	452		95		19		1	
'53	602		108		1		-	
'52	394		120		1		-	
'51	469		98		8		-	
'50	478		147		-		-	
'49	409		47		-		-	
'48	96		52		3		-	
'47	324		28		1		-	
'46	104		12		-		-	

Table 2 presents a summary of the structure of CINDA blocks for which the most recent entry is dated between January, 1972 and January, 1975 (i.e. dates 72, 73, 74). The figures presented show the percentages of entries in these blocks dated before the most recent entry. For example, YEAR - 2 refers to entries dated 1971 in blocks for which the most recent date is 1973.

TABLE 2

Date	% of Total number of entries	Cumulative % of entries before given date
Most recent year	60.7	
Year - 1	10.7	39.3
Year - 2	9.0	28.6
Year - 3	5.0	19.6
Year - 4	3.5	14.6
Year - 5	2.8	11.1
Year - 6	2.1	8.3
Year - 7	1.7	6.2
Year - 8	1.6	4.5
Year - 9	1.2	2.9
Year - 10	0.9	1.7
Before Year - 10	0.8	0.8

The numbers in Table 2 are derived from differences in the numbers of entries for each date found in retrieve tapes for each publication year. The percentage of 1971 entries in blocks for which the most recent year is 1973 does not therefore include those 1971 entries which are in blocks for which the most recent publication is 1972 or 1974. These figures can be simply inverted to predict for instance that 11 percent of 1975 entries will be eventually blocked with entries dated from 1980 onwards, if the blocking philosophy remains unchanged. It is by such a process of inversion that the figures for probable duplication in Table 3 have been derived.

These figures on the date distribution of CINDA blocks can be used to estimate the extent to which new entries in cumulative supplements would be blocked with entries in an archival volume.

The following assumptions have been made :

(1) the number of new entries to CINDA remains constant over the period 1978-1983.

(2) The date structure of CINDA blocks remains the same as for the period 1972-1974.

TABLE 3

YEAR	PERCENTAGE DUPLICATION IN 1983
Year of cut-off for the Archival volume (All blocks containing entries earlier than the given date)	Percentage of duplicated supplement entries dated earlier than the cut-off, but included because of blocking with 1978-1983 entries.(*)
1970	2.3%
1971	3.1%
1972	4.6%
1973	6.4%
1974	8.8%
1975	12.0%
1976	16.3%

(*) This assumes that all entries between the cut-off date and 1978 are already blocked with all appropriate older entries before the separation is made into archival volume and supplements, so that all such blocked older entries do not appear in the archival volume.

This extent of duplication between the archival volume and the supplements must be balanced against the increased size of the supplements for earlier cut-off dates.

TABLE 4

Cut-off date	Archival volume		1st Supplement(*)	5th Supplement(*)
	No. Entries	Pages (60/page)+	CINDA 1978	CINDA 1982
1972	87,000	1,450	66,000	116,000
1973	96,000	1,600	56,000	106,000
1974	109,000	1,800	44,000	94,000
1975	120,000	2,000	33,000	83,000
1976	132,000	2,200	21,000	71,000

(*) Estimated on the basis of the annual growth between 1970 and 1975.

On the basis of the figures in Table 4, a choice of date between 1974, 1975 and 1976 would seem preferable. 1975 provides a compromise between excessive duplication and the size of the supplements.

+ The approximate conversion in Table 4 of numbers of entries into the number of pages (60/page) is based on the figures for the CINDA 76/77 books and does not take into account an increased use of the 'no book flag'. The recent experience at CCDN has shown that this may reduce the size of future books by between 10 and 20 percent.

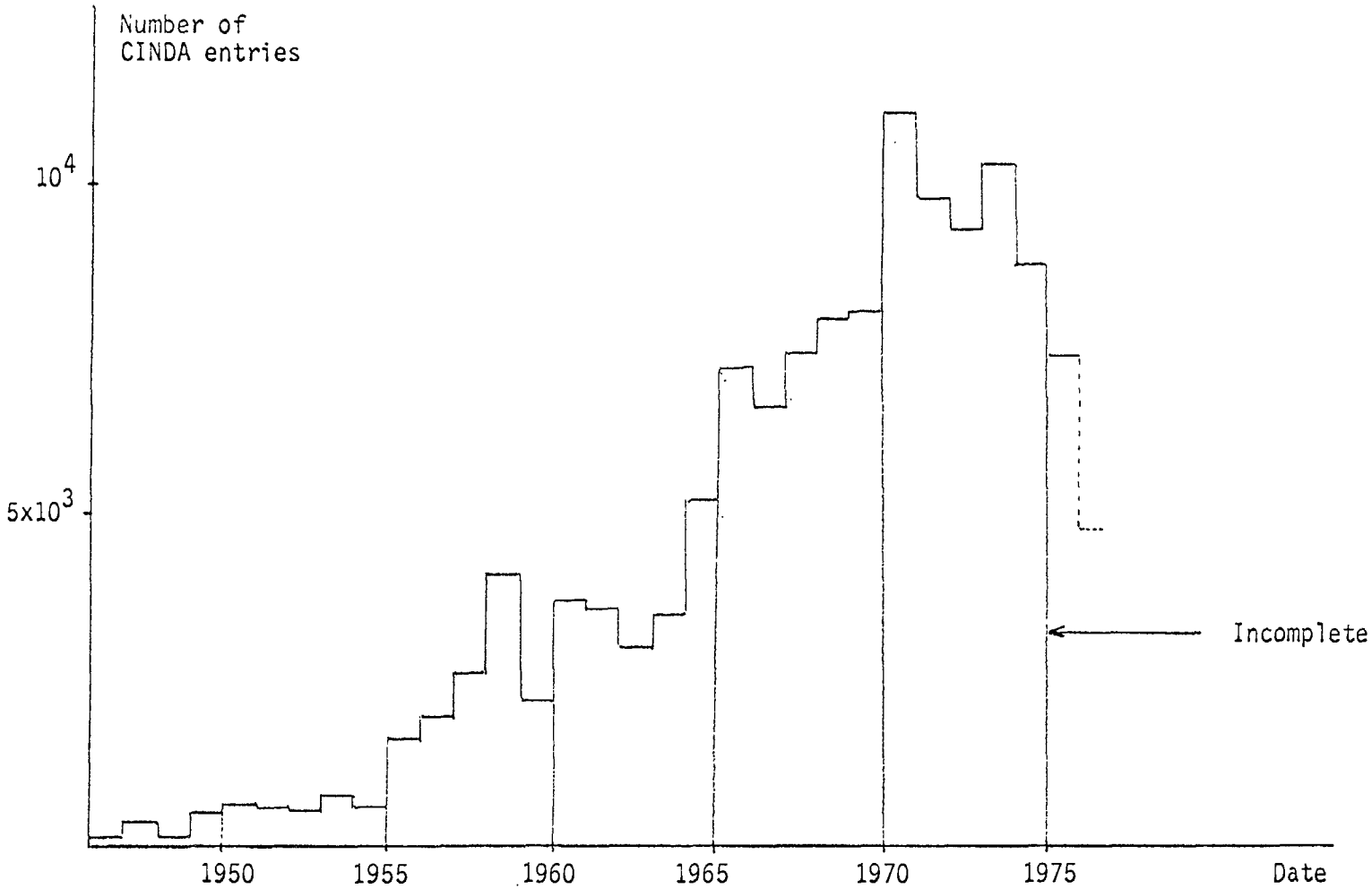
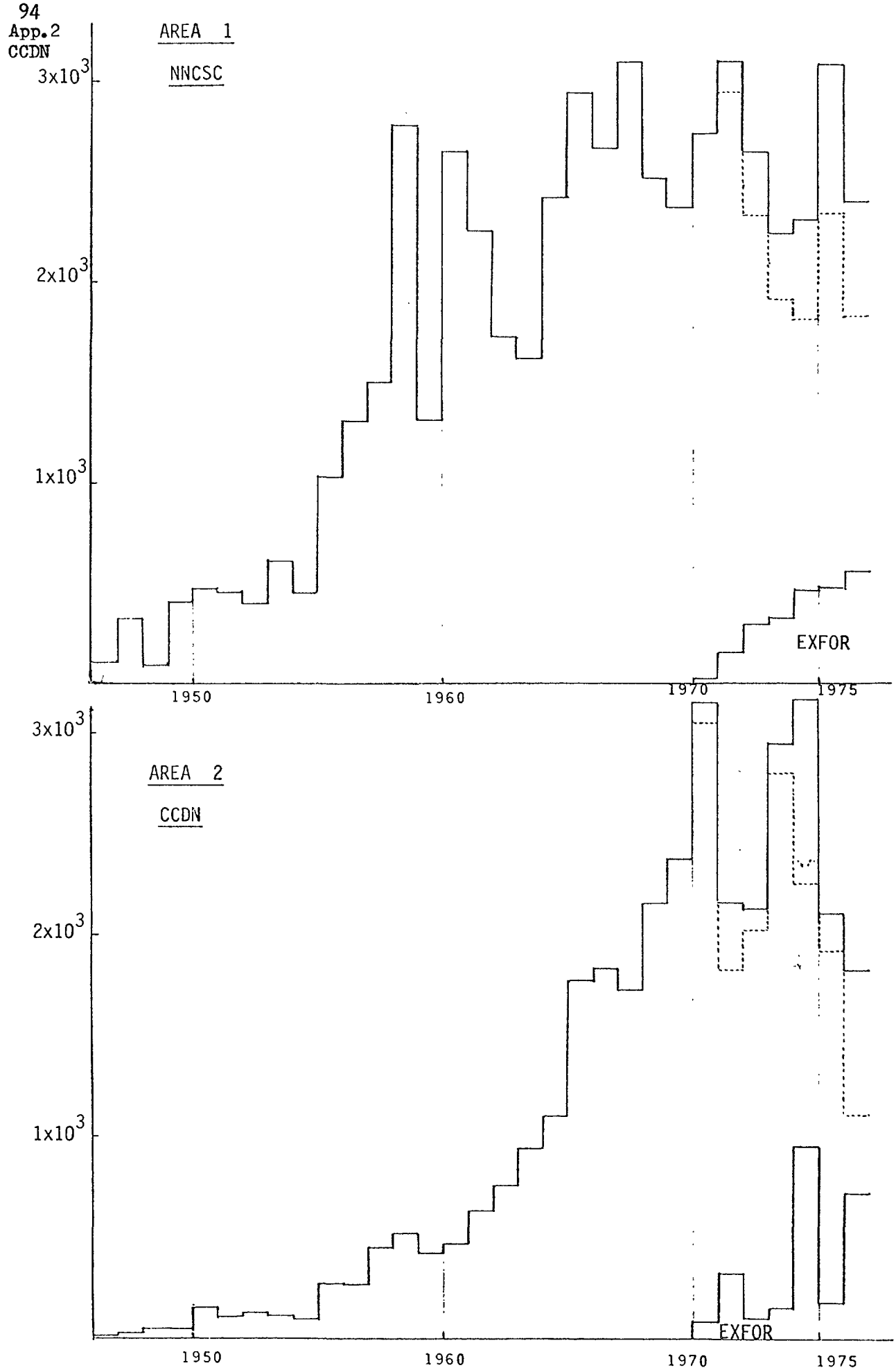
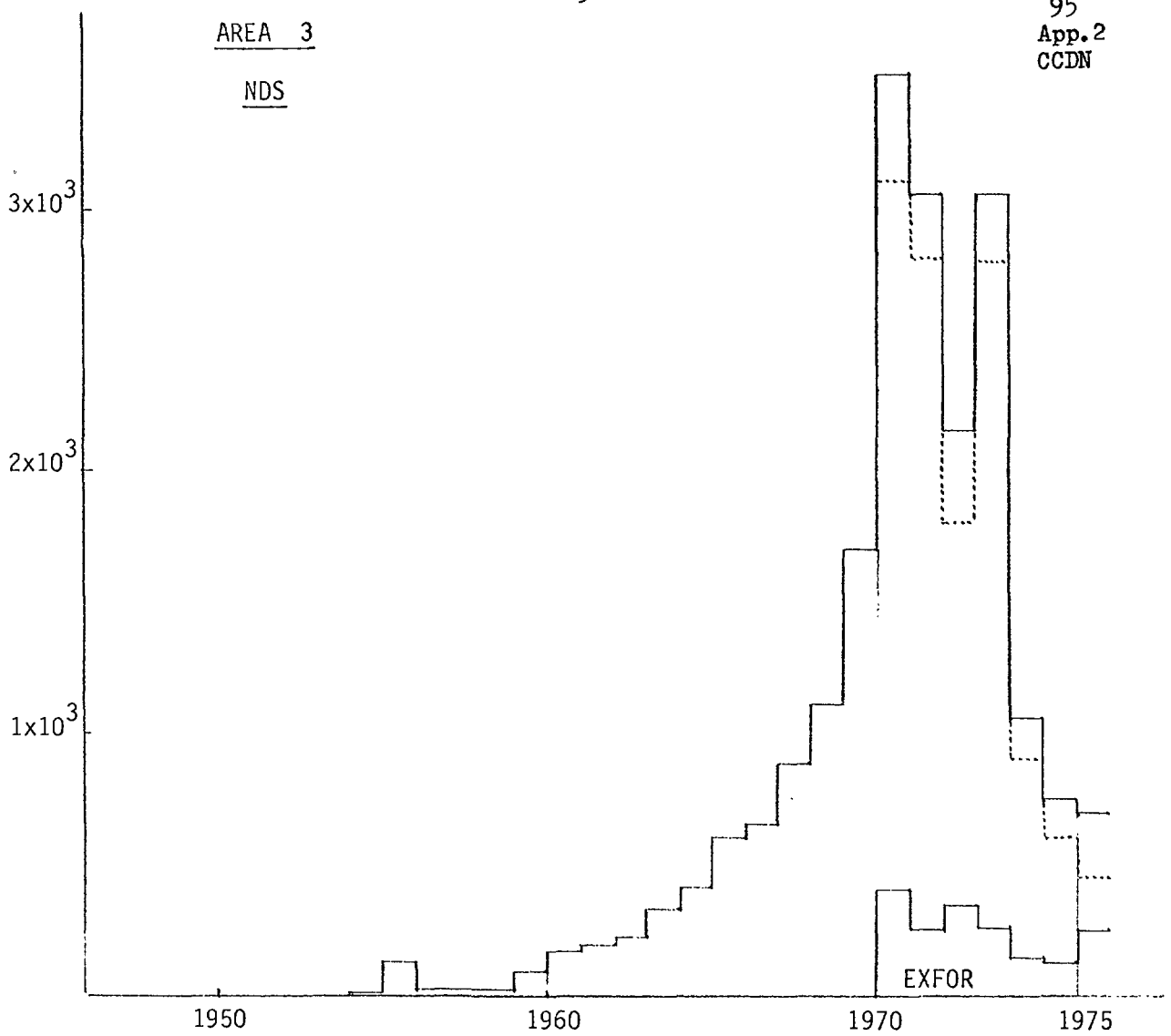
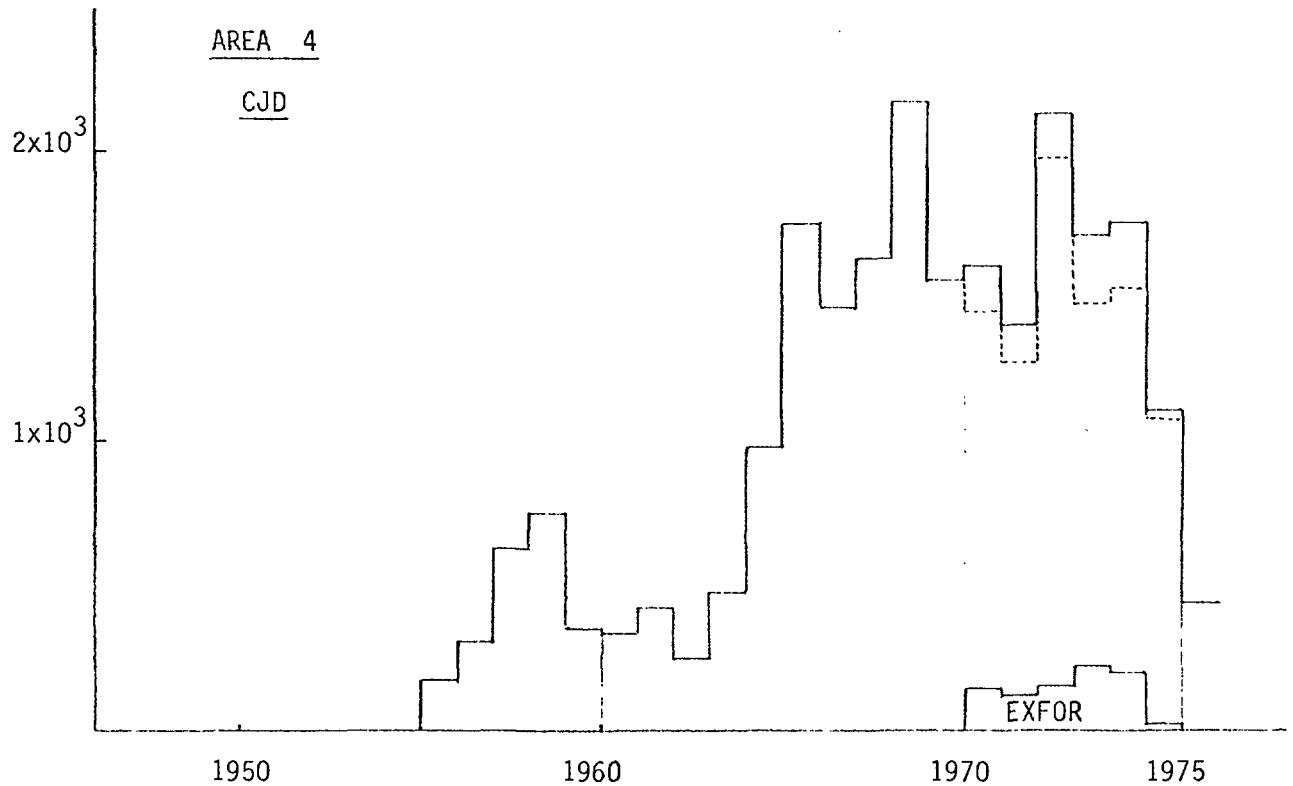


Figure 1. THE NUMBER OF CINDA ENTRIES FOR EACH YEAR SINCE 1946. (CINDA - JANUARY, 1977)

94
App.2
CCDN


AREA 1
NNCSC
3x10^3
2x10^3
1x10^3
EXFOR
1950
1960
1970
1975
AREA 2
CCDN
3x10^3
2x10^3
1x10^3
EXFOR
1950
1960
1970
1975


AREA 3
NDS
3x10^3
2x10^3
1x10^3
EXFOR
1950
1960
1970
1975


AREA 4
CJD
2x10^3
1x10^3
EXFOR
1950
1960
1970
1975

Appendix 3

Progress Report
of
National Nuclear Data Center
to
the Thirteenth Four Centres Meeting
April 11-12, 1977

I. General

As a result of the addition of responsibilities in the new areas of charged particle and nuclear structure data, on March 1, 1977 the National Neutron Cross Section Center became the National Nuclear Data Center (NNDC). The organization of the center has remained unchanged. Two new positions, one in nuclear structure evaluation and one in computer systems work were created. One scientist has been shifted to charged particle nuclear data activities from neutron data evaluation. The center is planning a substantial upgrade of its present computer system within 18 months in order to replace obsolete hardware and provide additional capacity for handling the center's new responsibilities.

II. WRENDA

The US Request List entries were completely reviewed. More than 100 new entries and numerous revisions were transmitted to NDS in WRENDA format.

III. CINDA

The center continues to devote approximately one man year to its CINDA compilation function. The neutron physics coverage for United States and Canadian literature has been kept current with frequent batch transmissions to CCDN. All new file entries are blocked when appropriate, and all entries relating to EXFOR data transmissions are blocked before the EXFOR tapes are sent to the other centers.

During the past year, special CINDA indices have been prepared for the annual ERDA-NDC Status Reports, and the proceedings of 1976 Lowell conference. We are currently preparing the CINDA index for the 1977 ERDA-NDC Status reports and hope to prepare an index for the recent standards conference at NBS.

IV. EXFOR

Experimental neutron data compilation and related activities continues to be supported at the two-man level. During the past year, 97 new references have been compiled and numerous corrections made to existing entries. This information has been transmitted on seven exchanges tapes 1052 through 1058.

The old area 1 data has been converted to legal EXFOR format. These entries differ from our normal EXFOR entries in that only a minimal SAN001 has been constructed. All formal errors detected by our checking programs have been corrected. As a final check on accuracy all the original data sources are being compared with the contents of the EXFOR entries. Appoximately nine man-months have been devoted to this task and we forsee another six before completion. Any missing data sets especially in the areas of thermal cross sections and resonance parameters are being added.

NNDC continues to maintain the EXFOR and LEXFOR Manuals on behalf of the Four-Centres Network. Significantly more effort has been accorded this activity because of the heavy flow of 4-C memos in the past year proposing modifications to the EXFOR system.

V. Evaluated Data

Work has begun on the assembly of ENDF/B-V with a completion date in early 1978 expected. The standards evaluations have been completed as has a preliminary actinide file.

Extensive programming effort has been devoted to the improvement of processing and checking programs.

VI. Customer Services

The request service statistics for the period 1 January 1976 and 1 January 1977 are attached.

Requesters may now receive data displays similar to those in BNL-325. Vol II as we now can process requested data through the system developed for BNL-325 production. Two computation formats have been designed, and will be implemented in phases.

VII. Publications

A new edition of BNL-325 Vol II was published in July 1976 with copies available at the 1976 Lowell conference. Currently in press are the 1977 ERDA Nuclear Data Committee Status Reports and ERDA-NDC Request List for Nuclear Data. A report by N. Holden on the Isotopic composition of the Elements is now being prepared. We are now in the initial phase of planning for a revision of BNL-325 Vol I, Resonance Parameters and Thermal Cross Sections.

1h

Appendix 3, Annex a

ZAQ REQUEST STATISTICS

1 Jan. 1976 to 31 Dec. 1976

Area 1

ELEMENT	TOTAL (TOT)	ELAS. SCAT. (EL)	INEL. SCAT. (INL)	OTHER SCAT. (C/S)	RES. PAR. (RES)	GAMMA & NEUTRON EMISSION (NG)	CHARGED PARTICLE EMISSION (NX)	FISSION (NF)	OTHERS	TOTAL REQUESTS
1-H	4	9				1			2	16
2-He	10	7			3	3	6		1	30
3-Li	11	13	8	11	6	30	36		6	121
4-Be	4	3	2	3	5	8	6		3	34
5-B	14	12	6	5	33	26	32		15	143
6-C	12	14	7	7	17	33	14		8	112
7-N	3	2	1		10	3	4		1	24
8-O	5	4	2	3	17	9	10		1	51
9-F	3	4			8	5			1	21
10-Ne	8	2	2		17					29
11-Na	2	1	1		7	14	2			27
12-Mg		5			21	12				38
13-Al	2	1		5	11	14	20		1	54
14-Si	5	6	4	1	14	9	9			48
15-P	1				10	7	2			20
16-S	3	5			22	8	3			41
17-Cl	2	3			22	6	9		1	43
18-Ar	2	3			8	2				15
19-K	2				16	1	4		2	25
20-Ca	1	4			25	4			1	35
21-Sc	1	2			11	4	1		1	20
22-Ti	7	14	6		46	16	37		1	127

ELEMENT	TOTAL (TOT)	ELAS. SCAT. (EL)	INEL. SCAT. (INL)	OTHER SCAT. (C/S)	RES. PAR. (RES)	GAMMA & NEUTRON EMISSION (NG)	CHARGED PARTICLE EMISSION (NX)	FISSION (NF)	OTHERS	TOTAL REQUESTS
23-V	7	8	3		16	14	6		3	57
24-Cr	25	21	11	4	48	61	21	2	5	198
25-Mn	3	3	1		11	11	1	9	1	40
26-Fe	22	25	16		63	28	25		1	180
27-Co	6	6	5	2	12	31	28	1	4	95
28-Ni	39	36	15	11	118	61	49	1	4	334
29-Cu	2	5	3	5	29	23	25		4	96
30-Zn	4	5	1		18	11	25			64
31-Ga	4	4			26	8				42
32-Ge		12	4		47	23	2			88
33-As	1	1		1	7	7				17
34-Se	6	12			55	20	5			98
35-Br	3	3			13	9				28
36-Kr	3	5			2	11	2			23
37-Rb		4			30	8				42
38-Sr	1	4			14	8	1			28
39-Y		1			19	14	4			38
40-Zr	9	9			47	20	2	1		88
41-Nb	4	4		3	19	13		2	1	46
42-Mo	9	9			43	21	1	1		84
43-Tc	2	2			21	5			1	31
44-Ru	4	6			6	16		1		33
45-Rh	2	2			15	7	5			31
46-Pd	1	2			17	12	1			33
47-Ag	4	5			31	16	3		2	61

ELEMENT	TOTAL (TOT)	ELAS. SCAT. (EL)	INEL. SCAT. (INL)	OTHER SCAT. (C/S)	RES. PAR. (RES)	GAMMA & NEUTRON EMISSION (NG)	CHARGED PARTICLE EMISSION (NX)	FISSION (NF)	OTHERS	TOTAL REQUESTS
48-Cd	11	19	1		62	34				127
49-In	5	3	10	1	23	15	1			58
50-Sn	3	11			44	17	2			77
51-Sb	7	7			36	20	1			71
52-Te	13	17			72	28	1			131
53-I	2	2		3	23	10	1		1	42
54-Xe	15	18			54	23	1			111
55-Cs	1	3			12	8				24
56-Ba	7	15	2		57	15				96
57-La	2	2			23	6				33
58-Ce		4			15	14				33
59-Pr	1	1			4	1				7
60-Nd	19	14			79	25	1			138
61-Pm	4	4			7	10				25
62-Sm	14	15			61	25	2		4	121
63-Eu	4	4			14	22				44
64-Gd	19	16			93	39				167
65-Tb	22	1		2	2	4	3		1	35
66-Dy	2	14			60	9				85
67-Ho	4	3		2	18	6			1	34
68-Er	12	12			59	11				94
69-Tm	2	6			8	7				23
70-Yb	7	20			54	16				97
71-Lu	2	2			9	4				17

ELEMENT	TOTAL (TOT)	ELAS. SCAT. (EL)	INEL. SCAT. (INL)	OTHER SCAT. (C/S)	RES. PAR. (RES)	GAMMA & NEUTRON EMISSION (NG)	CHARGED PARTICLE EMISSION (NX)	FISSION (NF)	OTHERS	TOTAL REQUESTS
72-Hf	2	2			33	3				40
73-Ta	4	6			15	17				42
74-W	12	11			27	12				62
75-Re	2	4			24	5				35
76-Os		12			48	1				61
77-Ir	7	6	2	1	21	11	2		1	51
78-Pt	1				7	1				9
79-Au	4	3		4	3	22	1	1	3	41
80-Hg						3				3
81-Te					15					15
82-	9	9	4	1	29	17				69
83-Bi		1	1		6	7	2			17
88-Ra	1	1			6	1			1	10
89-Ac										
90-Th	6	8	2	2	19	18		17	4	76
91-Pa	2				4	2		1		9
92-U	1	1	1		2					5
92-U-230										
92-U-231										
92-U-232	1				6	1		2		10
92-U-233	4	3		1	27	4		44	6	89
92-U-234	2	2			5	2		8		19
92-U-235	9	8	2	3	32	29		90	21	194
92-U-236	2	4		1	15	5		12		39

ELEMENT	TOTAL (TOT)	ELAS. SCAT. (EL)	INEL. SCAT. (INL)	OTHER SCAT. (C/S)	RES. PAR. (RES)	GAMMA & NEUTRON EMISSION (NG)	CHARGED PARTICLE EMISSION (NX)	FISSION (NF)	OTHERS	TOTAL REQUESTS
92-U-237	1	1			3	1		4		10
92-U-238	9	12	7	1	12	26	1	35	3	106
92-U-239								2		2
93-Np	4	2		2	7	7	1	16		39
94-Pu-238	4	3			12	6		5	1	31
94-Pu-239	8	7		2	44	10		41	12	124
94-Pu-240	2	2		2	9	2		19		36
94-Pu-241	5	5			11	5		24	4	54
94-Pu-242	4	5		1	13	5		6	1	35
94-Pu-244								1		1
95-Am	8	8			13	15		9	2	55
96-Cm	7	13			32	4		41	1	98
97-Bk								1		1
98-Cf		1			6			14		21
99-Es					3			2		5
TOTAL	562	661	130	90	2454	1284	421	413	138	6191

Request Statistics

TABLE

1 Jan. 1976 to 31 Dec. 1976

Area 1

N u m b e r o f r e q u e s t s f o r d a t a

Country Origin	Experimental	Evaluated	Bibliographic	Codes	Documents	Total
USA	166	162	14	58	173	573
Canada	1	2	0	0	0	3
Total	167	164	14	58	173	576

Data Dissemination

TABLE II

1 Jan. 1976 to 31 Dec. 1976

Area 1

Data Type			Amount	
Experimental	29,215	Data Sets	containing	1,917,666 Data Points
Evaluated (Total)	8,571	Data Files		
ENDF	6,368	Data Files		
Other	2,203	Data Files		
Bibliographic	322	CINDA Entries		
Codes and Documents	151 434	codes documents		
Miscellaneous	32	Requests		

Request Statistics

TABLE

1 Jan. 1976 to 31 Dec. 1976

Area 1

Number of requests for data

Originating Organization	Experimental	Evaluated	Bibliographic	Codes	Documents	Total	Total Previous Year
Government Labs.	106	83	7	20	76	292	255
University	20	32	1	11	49	113	100
Industry	16	32	0	16	48	112	92
Other	25	17	6	11	0	59	15
Total	167	164	14	58	173	576	462

Request Statistics

TABLE

1 Jan. 1976 to 31 Dec. 1976

Area 1

Number of requests for data

Request Disposition	Experimental	Evaluated	Bibliographic	Codes	Documents	Total	Total Previous Year
Fulfilled	167	164	14	58	173	576	459
Partially Fulfilled	0	0	0	0	0	0	0
Unfulfilled	0	0	0	0	0	0	3
Standing	0	0	0	0	0	0	0
Total	167	164	14	58	173	576	462

Appendix 4

BRIEF NDS REPORT TO THE 1977 4C-MEETING

1. STAFF

Since the last 4C-Meeting M. Khalil has left the Section, who was mainly responsible for evaluated and other non-Exfor data.
H. Marin-Guzman joined the Section as a programmer.
The additional physicists' post which was likely to become available in 1977, will at earliest become available in 1978.
A new Unit for Atomic and Molecular Data for Fusion has been started with two physicists (E. Beaty, K. Katsonis) and a programmer (R. Seamon).

2. CINDA

a. Entries

The Cinda coverage of areas 3 and 4 has been reported in a 4C-Memo. We are sure that there are no significant gaps except, still, for USSR lab reports. A number of Cinda relevant articles from rare report series and theses are regularly found from INIS Atomindex and INIS retrievals.
The Cinda clean-up work is continuing for area 3, mainly in connection with Exfor compiling. A special problem used to be, that many labs from area 3 publish in publications of areas 2 and 1. We now prepare, at regular intervals, retrievals on the entries prepared in areas 1 and 2 for labs of area 3, in order to get these entries correctly blocked.
NDS receives the complete Cinda master tape 4 or 5 times per year from NDCC, and various specialized retrievals are made at NDS for the Exfor compilers and for Cinda clean-up work.
Some clean-up of area 4 entries has been done when adding Exfor index lines for this area.
The Cinda input checking programs have been brought up-to-date, including the use of Exfor dictionaries for lab and references, and the new "kill and link" operations.

b. publication

CINDA 76/77 and its first Supplement havebeen published, the second Supplement is in preparation. The book is now produced on a Digiset machine instead of a Linotron previously. The photo-composition programmes have been revised to prepare tapes for either a Linotron or a Digiset photo-typesetting machine.

3. EXFOR

a. compilation

The compilation of Exfor data continued, and in 1976 considerably more data were compiled than in 1974-75. See the corresponding statistics in Figure 1. Exfor data tapes were sent to the other centers in regular intervals of about 3 months.

The situation is not yet quite satisfactory: Whereas NDS is probably quite complete and often even fast with the compilation of newest data, the backlog accumulated during the 1974 period, when several posts were vacant, could be worked off only partially, due to the increased workload with request services. Also, a large number of entries of the 70000 series has still to be converted, although a long list of converted 70000 entries which can be deleted could be distributed a few days ago.

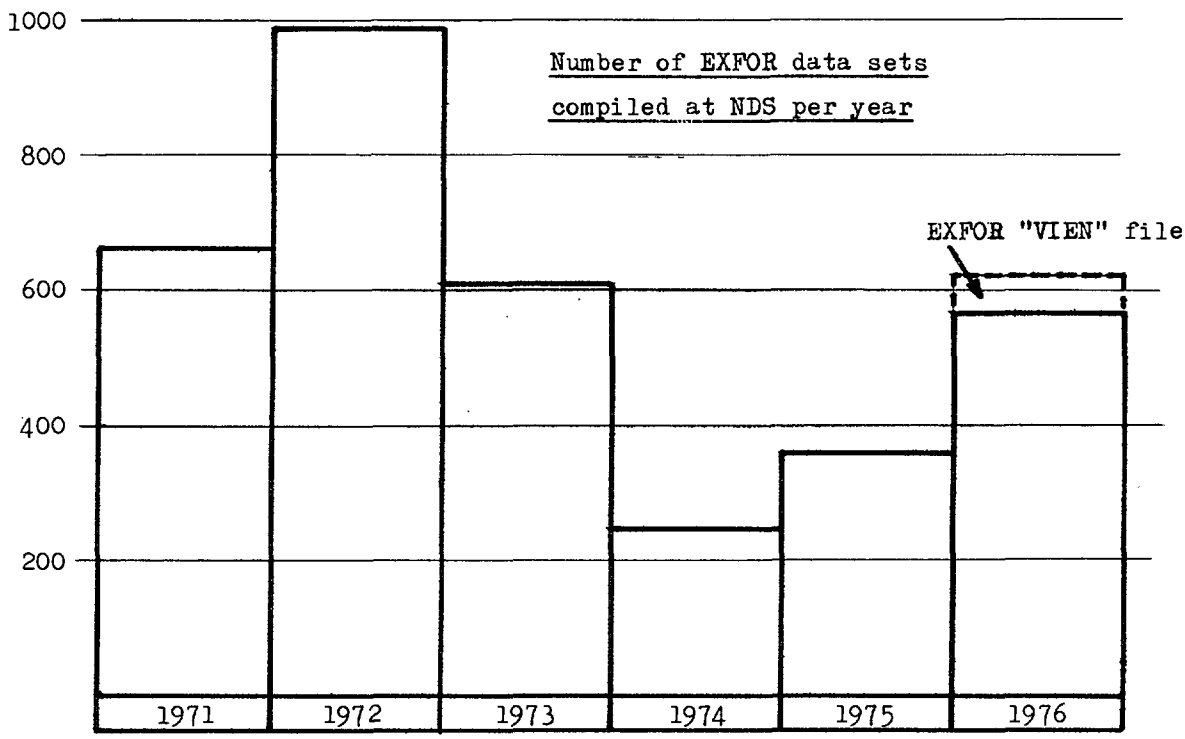
The Exfor input checking programs were much improved and updated to take care of new rules.

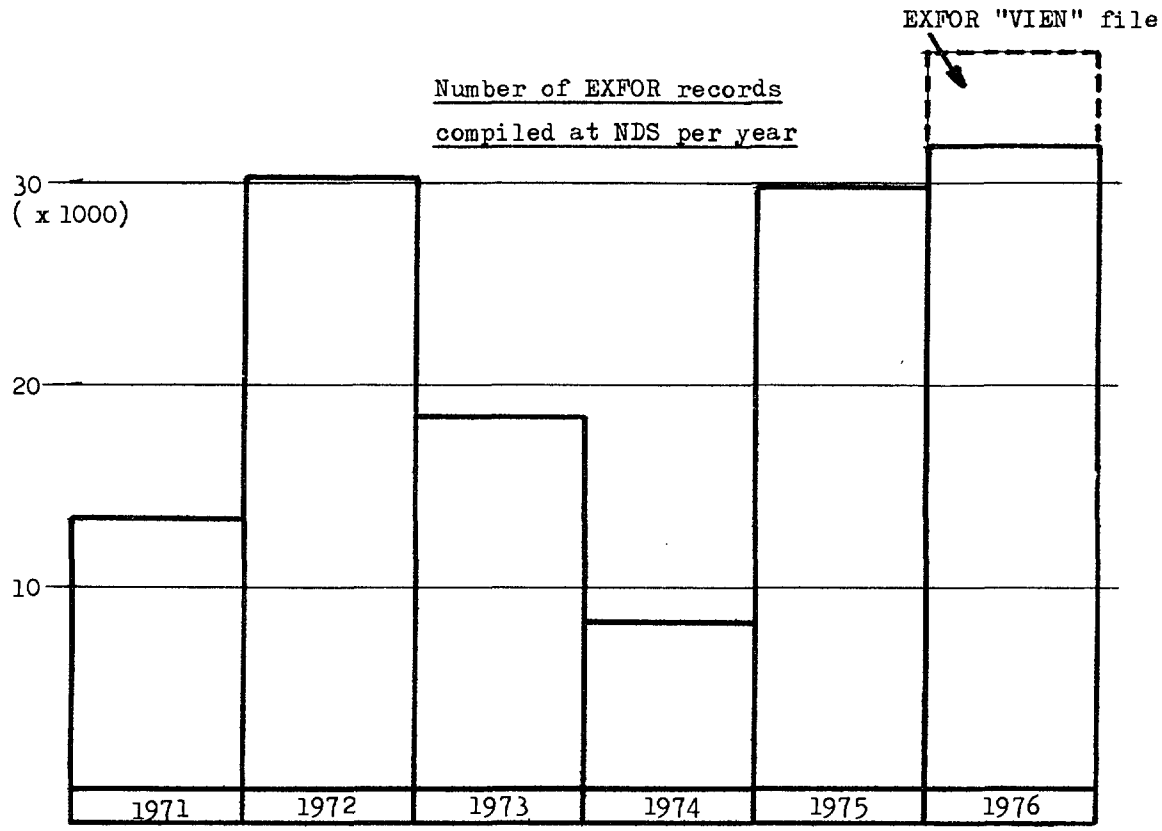
b. Intercenter cooperation

The Exfor/Cinda dictionaries were frequently updated whenever a new code was introduced, and updates were regularly sent to the cooperating centers.

Much emphasis was given to reviewing and revising Exfor rules and the Manual, as can be seen from number and volume of 4C-Memos distributed.

Figure 1


1000
800
600
400
200
Number of EXFOR data sets
compiled at NDS per year
EXFOR "VIEN" file
1971
1972
1973
1974
1975
1976


EXFOR "VIEN" file
Number of EXFOR records
compiled at NDS per year
30
(x 1000)
20
10
1971
1972
1973
1974
1975
1976

c. Conversion to Generalized Exfor format

NDS is prepared to start using for NND the Generalized Exfor formalisms developed for CPND. In particular, a new indexing program has been developed, which indexes "ISO-QUANT" and "REACTION" type entries, using in the index the "REACTION" formalism for data definitions. Also the Exfor Edit program for easier readability of entries works for both types of entries. However, in all programs for the Generalized Exfor format, a number of less important features still remain to be added.

4. CUSTOMER SERVICES

A supplement to CINDU-11 is being issued listing all the data files received or revised since the issue of CINDU-11. This type of data index has been well received by the customers and has stimulated a number of requests.

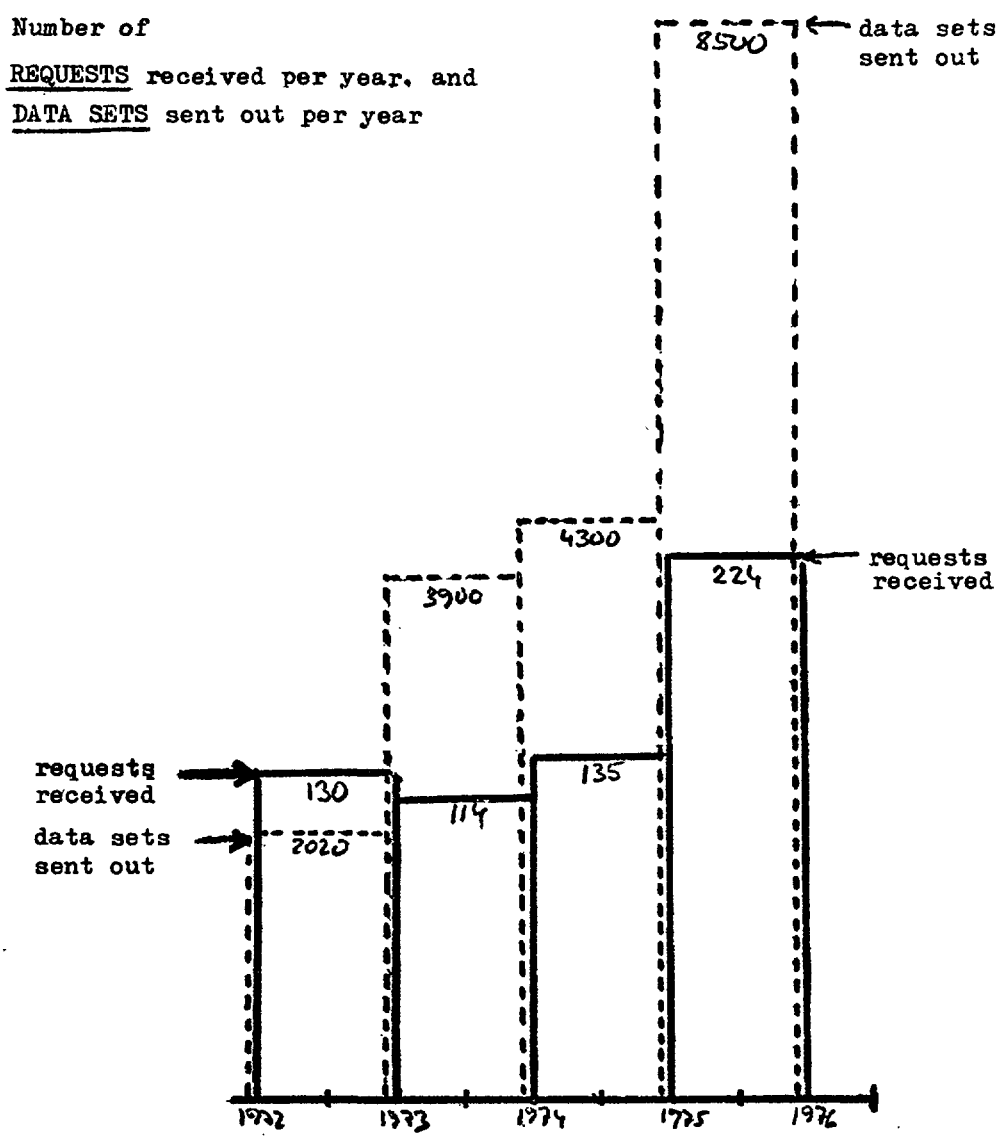
Many data files are available in standard format or in edited format, whatever the customer prefers. In particular, the edited format for Exfor, which also edits multidimensional tables and tables with more than six columns, has become very useful. A preliminary version of it is also working for CPND Exfor data.

This time we cannot present a detailed request statistics. A summary statistics is shown in figure 2 indicating the increasing numbers of requests received and data sent out.

5. EVALUATED DATA

We gratefully acknowledge the receipt of a number of new or revised files of evaluated data. There are more and more developing countries starting to operate nuclear power stations and therefore needing evaluated data files for reactor calculations. They also need advise on available computer programs, and for this purpose NDS has increasing contacts

Figure 2


Number of
REQUESTS received per year, and
DATA SETS sent out per year
8500
data sets
sent out
4300
3900
224
requests
received
requests
received
130
135
114
data sets
sent out
2020
1972
1973
1974
1975
1976

with CPL Ispra.

A few more evaluated data sets, which are not part of one of the major evaluated data libraries, have been compiled in the EXFOR-VIEN series and distributed to the other centers and to customers.

6. DATA RIVIEWS

M. Vlasov is continuing to contribute to the international coordination and evaluation of neutron reactions used for neutron dosimetry.

H. Lemmel is continuing to watch the development of thermal fission data. However, except for a revised value of the Pu-239 half-life, no important new results became available during the past two years. Thus, a paper presented at the recent Gaithersburg Nuclear Data Conference only stressed the necessity to investigate the origin of the well-known discrepancy between 2200 m/s and 20° C Maxwellion capture and fission data for U-233 and U-235.

Activities also continue in the field of fission product nuclear data (Meeting foreseen in September 1977, and regular Newsletters) and in the field of Actinide nuclear data.

7. OTHER ACTIVITIES

WRENDA 76 has been published.

Translation of USSR documents relevant to nuclear data continues. They are distributed as INDC-documents.

Forthcoming Meetings:

9 - 13 May 1977	Atomic and Molecular Data Centers
14 - 15 May 1977	Joint Committee of INDC and Int. Fusion Research Council
16 - 20 May 1977	INDC Meeting
5 - 9 Sept 1977	Fission Product Nuclear Data, Petten
14 - 18 Nov 1977	Nuclear Structure Data, Oak Ridge
16 Jan - 10 March 1978	Winter Courses on Nuclear Physics and Reactors, Trieste

Requests received at NDS for unreleased ENDF/B data

Name of Requester	Address (Institute, University etc.)	Date	Comment
D. Seeliger	TU Dresden G.D.R.	June 1976	Fe All Reactions (explicit request to ENDF file)
S. Pszona	Radiation Protection Department Institute of Nuclear Research, Swierk, Otwock, Poland	Sep. 1976	N,O, 0.5-30 MeV [Tissue Element] (explicit request to ENDF file)
M. Najzer	Institute "Jozef Stefan", Ljubljana, Yugoslavia	Nov. 1976	Li-7, B-11, O-16, Al-27, Zr, Fe, Ni, Zr, Ag, Cd, Eu, Gd, Pb, U-236, U-238, Pu-239, Pu-240, Pu-241 (n,γ) Total, elastic, non- and inelastic. (nf). 5.10^{-3} - 1.5 . 10^{7} eV [Reactor Calculation] (General request for Evaluated Data)
H. Fernandez Gianotti	Comisión Nacional de Energia Atomica, Argentina	Dec. 1975	all ENDF/B-IV [for his nuclear Data Bank] (General Request)
		July 1976	Requested Cm-244 (ENDF/B-IV) (the requester has received this from NNCSC)
		Feb. 1977	Requested Bk-249, Bk-250, Cf-250 Cf-251, Cf-252.
Chin-Lung Wang	Institute of Nuclear Energy Research Taiwan, Rep. of China	April 1975	ENDF/B and KEDAK Nuclear data file needed for research.

(continued)

Name of Requester	Address (Institute, University etc.)	Date	Comment
S. Rapeanu	State Committee for Nuclear Energy Bucharest- Romania	May 1976	ENDF/B-4 All. for reactor calculation
M. Matausek	Boris Kidro Inst. Vinča, Beograd, Yugoslavia	July 1976	needs all ENDF/B-4 for reactor calculation
O.G.P. Grosskopf	Atomic Energy Board-Pelindaba, Republic of South Africa	May 1976	requested ENDF/B-4 Fission Product Library and four other libraries. Needs for reactor calculation

Appendix 5

77-3684
Translated from Russian by IAEA (April 1977)

I.V. Kurchatov Institute of Atomic Energy
Centre for Data on the Structure of the Atomic Nucleus

EXPERIENCE OF EXCHANGING DATA ON NUCLEAR REACTIONS WITH CHARGED PARTICLES

third Meeting on Charged Particle Nuclear Data Compilation
(second Meeting of Nuclear Reaction Data Centers)

Y.I. Grigoryan, G.M. Zhuravleva
L.L. Sokolovsky, F.E. Chukreev

Moscow, 1977

1. The Centre for Data on the Structure of the Atomic Nucleus and on Nuclear Reactions (USSR State Committee on Atomic Energy) consists, as earlier, of 16 workers of whom three spend part of their time preparing data on nuclear reactions with charged particles (CPND) in the "generalized EXFOR" format.

Since the previous meeting, in May 1976, the Centre's main activity in the CPND field has been the preparation of numerical material in the "generalized EXFOR" format and of the corresponding software.

As earlier, in the preparation of numerical material we send a rough version of the prepared material to the authors of an entry so that they can check it carefully. So far we have not considered it necessary to make a substantial increase in the number of compiled entries and have concentrated our efforts on the compilation of entries of as many laboratories and groups as possible so as to make clear the difficulties which can arise when the "generalized EXFOR" format is used and to gain experience. At the same time we have exchanged magnetic tapes, and we were very pleased about MEMO CP-D/14 as the "characters" of the Agency's computer and the Centre's computer have proved to be the most different in recent years. Experience at the Centre with tapes from other centres has shown that tapes from the United States and the Federal Republic of Germany can be read without trouble, whereas the reading of Agency tapes presents us each time with a difficult problem requiring a careful choice of reading conditions.

Much has also been done as regards software. In this we were greatly assisted by the CSEXCK program kindly sent by Charlie Dunford. We could not use it directly in our computer as PDP-10 system programs constitute a substantial part of the program, but the Centre's programmers were able to study the acceptance structure and processing logic for EXFOR texts.

In later sections of this report we discuss actual difficulties which arise during compilation. We hope that the difficulties will be resolved at this meeting.

2. MEMO CP-D/13 is on the whole acceptable. However, we would draw attention to a number of difficulties which arise during verification that the formal EXFOR rules are being observed. In some cases it is impossible to use a computer for removing errors made by the technical personnel in important parts of a description. We consider MONITOR, REACTION and REFERENCE - as well as DATA and GENERAL DATA - to be important parts of a description; MONITOR and REACTION are important for search programs and REFERENCE for rapid retrieval of the initial publication.

The description of a reaction has been well formalized in "generalized EXFOR", and the rule for using the REACTION keyword is clearly stated: "The REACTION keyword must be in all SUBENTRIES except the first."* Nevertheless, we should like to make suggestions regarding use of the REACTION keyword.

2.1. Complete the separation of the dictionaries so that there is a dictionary for each reaction code field. The present dictionary 33 contains the codes of fields 2, 3 and 7. This makes it difficult for authors to check material prepared at the Centre.

2.2. Extend the proposal made by G. Lemmel in MEMO CP-D/11 to all complex reactions, not limiting it just to fission.

Without using such a formalism it is impossible to describe the results of investigation 1 - a study of the relative yield of francium and radon isotopes when a natural mixture of iridium is irradiated with neon-20 ions. We do not know of any clear description of the reaction except

(77 -IR-0 (10-Ne - 20, X) Z - EL-A, ...).

If one attempts to use indices for each partial reaction, the results cannot be presented in machine-readable form.

2.3. Let us now turn to dictionary 8, in which the chemical symbol for element 102 is NO - "nobelium". We can assure our colleagues that the Centre will not have (APRVD) in the status if this designation is used. Soviet scientists working in the field of very heavy elements do not use the word "nobelium". There is obviously no sense in discussing the reasons for this attitude at the meeting; they are well known. In the neutron EXFOR this problem has not yet arisen as no one has carried out experimental studies of the interaction of neutrons with element 102. In relation to nuclear reactions with charged particles it does arise, however, and such reactions will yield new elements which may not receive their new name at once. If there is no agreement on the name of a chemical element, we suggest that the element in question be referred to by, say, the designation "ZZ", with an indication of the atomic number. Thus, element 102 could be referred to either as "102-NO" or as "102-ZZ".

2.4. While the description of a reaction is satisfactorily formalized in "generalized EXFOR" and its use clearly defined, this is not so for MONITOR. It is suggested that it be used in all cases where that makes sense. Chance omission of the word "MONITOR" from the text is therefore

* (Note added by H.D. Lemmel:) ...or in the first SUBENTRY and not in the following SUBENTRIES.

possible, and it will not be detected by the computer - and, as our experience has shown, this defect may be missed even by man. It would therefore be useful to introduce the following rule: "The keyword MONITOR must be included in all SUBENTRIES if it was not in the first SUBENTRY. If it was in the first SUBENTRY, it must not be in any other one." In cases where the measurements are absolute and there is no monitor-reaction (reaction-monitor?), one can use as code a letter after the opening bracket. For example, MONITOR (NOT USED).

In cases where there is a monitor-reaction, the first symbol after the opening bracket is always a number. In this way it will be very easy to program. There is no need to convert material already prepared by KACHAPAG. However, the introduction of such a rule will offer the advantage of "fool-proofness".

2.5. Let us now turn to the REFERENCE. Here we have two comments.

2.5.1. The first relates to the type of publication. At present we have journals (J), reports (R), progress reports (P), theses (T) and private communications (W). In compiling works from JINR we encountered difficulties due to the fact that JINR publications are of two types.

A note on the inside cover of, for example, JINR publications R1-9987 and E4-9926 reads:

"JINR preprints and communications are independent publications. They are issued in accordance with Article 4 of the JINR Statute. The difference between preprints and communications is that the text of a preprint will subsequently be reproduced in a scientific journal or a non-periodic collection."

The existing publication categories in EXFOR do not permit a distinction to be made between these two types of publication, although a distinction should be made. Our suggestion is the following: in dictionary 6 keep the designation JINR-.... for JINR preprints and introduce the designation CJINR... for communications. This will not mean going beyond what is prescribed by the EXFOR rules.

2.5.2. The second comment relating to the REFERENCE concerns the construction of the code within the brackets. The rules for constructing this code, as set forth in the EXFOR Manual, do not allow for computer checking. For example, the general form in coding a preprint is (R, code-number, (volume or part), page, date), whereas in the example on the same

page (VIII.8) of the Manual we see (R, UCRL - 5341, 5806), there being no volume or page. Obviously, in this case the report consists of a single part and is devoted entirely to one subject. However, this is very inconvenient for automated checking, for the same reasons as in the case of the keyword MONITOR. The Centre's programmers were very puzzled by the uncertainty regarding the arrangement of information until they received the CSEXCK program and discovered that only the code for the type of publication and the report code are checked. Similar examples can be given for other types of publication. Does this, however, lead to the missing of substantial errors?

In this case, unlike the MONITOR case, we cannot at present suggest a modification of the rules which would not require substantial changes in the neutron EXFOR. The Centre might try to find an acceptable form for writing the REFERENCE which, without major changes in the neutron EXFOR, would make computer checking possible. For this purpose we would need to see other centres' block-diagrams or programs for REFERENCE checking.

3. The difficulties arising in the application of the generalized EXFOR can be divided into three categories:

3.1. Fundamental;

3.2. Important but not fundamental;

3.3. Easily solvable.

In the preceding section we drew attention to the last two categories, but the first one is obviously the most important.

A fundamental error is undoubtedly the fact that different participants in our common enterprise appear to have different ideas regarding the final result of the compiling of experimental investigations.

3.1.1. In our opinion, only those works deserve to be compiled in the EXFOR format in which, besides data in machine-readable format, errors (uncertainties) in the data can be given. From this point of view, the tremendous labours of Prof. Münzel and his KACHAPAG co-workers are, in many cases, considerably reduced in value owing to the absence of DATA-ERR columns.

The regional data centres could render KACHAPAG great assistance in filling this gap. For example, they could send the KACHAPAG results to authors and ask them to look through the tables of data and give more precise information about the experimental uncertainties.

If the authors are inaccessible, the compiler must be able to introduce in the "experimental error" column what he considers to be the maximum error, noting the fact under COMMENTS.

3.1.2. The reference data used in the MONITOR keyword should not be allowed to appear as in B0016, where there are no measurement errors, no place of publication and no authors' approval. In such a situation, the Centre must recommend not using data obtained on the basis of this MONITOR. The help of the regional data centres is also needed in refining such reference results.

4. At present, the application of the "generalized EXFOR" to new types of data (photonuclear reactions, differential CPND, etc.) can hardly become widespread:

- firstly, because the position is different for different categories of such data. In the case of photonuclear reactions some experience has been gained in the United States, and Dr. A.I. Abramov has done work in the Soviet Union. In the case of differential CPND, however, up to the time of this meeting there was virtually no experience of compiling them in the EXFOR format;
- secondly, given the enormous variety of differential data one cannot but be pessimistic about reducing such data to a single format in the near future.

Nevertheless, without some differential data even a collection of integral CPND will be incomplete. For example, only differential quantities (energy spectra of light products of the interaction of neon-22 with thorium-232) were measured in Ref.[2]. However, an analysis performed by the authors showed that, in a number of cases, reaction products were emitted after the attainment of statistical equilibrium. If this is indeed so, an experienced evaluator should also be able to obtain integral cross-sections from these data.

Data of this type should, in our opinion, already be included in the present CPND file, the advantage being that they could be used for integral CPND.

However, it will hardly be possible in the immediate future to present the entirety of differential CPND in an exchange format (with a reasonable expenditure of resources).

Thus, there is a contradiction in the differential CPND area - some CPND are needed now and all will be needed at some time in the future, but if we start to translate all differential data indiscriminately into EXFOR without some system, we risk drowning the present needs in the general flood.

The only way out of this contradiction is to prepare specialized compilations in the EXFOR format for specific applications. There are already groups of scientists in various countries who can and want to prepare specialized compilations. The task of the existing nuclear data centres, groups and sections should be to help them in mastering EXFOR and to convince them that EXFOR is what they ought to use. The centres should take on the task of reading the prepared material, check that it complies with the EXFOR rules and render all the assistance they can.

4.1. The Centre does not intend to embark on a major compilation of specialized differential data before the next meeting. For the present we do not wish to assume new responsibilities in this area. We can best help new groups by letting them have the texts of articles appearing in small-circulation Soviet publications and passing on the material prepared by them to the Soviet authors for checking.

4.2. As new groups join in the compilation of nuclear data, the Nuclear Data Section will have to ensure that they all have the EXFOR Manual and that they receive any supplements to it in good time.

5. The requirements of Soviet scientists in the CPND area are dealt with by the Centre on the basis of actual requests. About 300 requests were received in 1976; about half of them were met. The reasons for failing to meet requests were: 1. the absence of experimental data; 2. a "value of estimate/cost of estimate" ratio less than unity.

REFERENCES

[1] A.P. KABACHENKO et al., JINR preprint 7-9566, Dubna, 1976.

[2] A.G. ARTYUKH, JINR preprint E7-9974, Dubna, 1976.

Appendix 6

KACHAPAG

KARLSRUHE CHARGED PARTICLE GROUP

Opening Statement

6. 4. 1977

Since the last Meeting the recommendations in respect to the generalized EXFOR were implemented and the routine compilation started. There are now data for about 450 reactions available on the file. Two Transmission tapes were distributed in October 1976 and March 1977. We received comments on tape B002 suggesting some changes and pointing to some obvious errors. The latter mistakes were corrected on tape B003 but other alterations are not included, because some of them should first be discussed here in Kiew.

We received revised test compilations from the Kurchatov Institute. They were thoroughly checked and the resulting questions and suggestions are summerized in Memo CP-B/7.

The program system used to handle the data was improved. However, many important programs are still not available or should be improved, e.g. the Indexing program or the checking program. We would very much like to have them, but - due to the fixed man power available to us - any time spend to write them has to be withdrawn from the compiling activities.

Especially in the last 3 month a tremendous number of Memo-pages has arrived at Karlsruhe. Among them were the new Manual and LEXFOR pages. Here, NDS has done a very fine job. However, reading and discussing them consumes a lot of time which is then not longer available for the compilation. We therefore hope strongly that the generalized EXFOR is now nearly implemented.

In the future we will continue to compile CPND and distribute every half year a transmission tape containing the complete file. Eventually necessary alterations of the older entries will be already added in the transmission tape and a written record of these changes will be provided.

In addition we are planning a written version of the content of the file. Many of the details are still under discussion. However, it was decided, that it should contain the data for proton reactions with heavier target materials. The last CPX-Report contained targets up to $Z \leqslant 28$. Therefore, we will concentrate now on target nuclides with $Z \geqslant 29$.

ZAED

Appendix 7

Status report

Zentralstelle für Atomkernenergie-Dokumentation (ZAED)
Federal Republic of Germany

H. Behrens

I Actions on ZAED at the Second CPND Consultants' Meeting

a) Action 1 will be dealt with separately as it requires more detailed discussions than those customary in opening statements.

b) Action 7
After careful consideration we have decided against publishing the cumulative bibliography of integral CPND for the years before 1976, the reason being that the efforts to be invested in things like programme modifications, elaboration of special procedures, etc. were thought to be too high for something which is not to be used again in the future.

II Activities of ZAED

a) The bibliography of Data Compilations in Physics, as announced during the second meeting on CPND, has been published in the meantime (Physikdaten/Physics data 3-1 1976). This publication contains the bibliographic data of 1457 data compilations. Last meeting's participants have been sent one copy each. With the exception of the Nuclear Data Section, no comments according to Action 2a have been received yet. A supplement to the publication mentioned above with more than 5oo bibliographic items is almost ready to go into print. It will contain all data compilations published in the meantime, and those

which were not available at the time of the publication for the main bibliography.

b) With reference to Physikdaten/Physics data 2-1 1976: "Stopping cross sections of elements with Z = 2 to 87 for Li ions with energies between 8o keV and 84o keV",it is intended to publish further issues of this kind for other types of ions. Furthermore, these stopping cross sections are also to be extended to chemical compounds.

c) Physikdaten/Physics data 1-1 1975: "Survey index of pion-nucleon scattering data, together with the corresponding files which contain the actual data such as differential cross sections and polarization data for pion nucleon scattering including charge exchange scattering), will be brought up to date.
In this connection it might be of interest that it is intended by us to publish a data compilation "Photoproduction of pions".

III Other aspects

As agreed on the occasion of the IAEA Advisory Group meeting on nuclear structure and decay data for applications, we have begun in February to compile and evaluate the nuclear data for the mass region 81 -1oo, whereby - to start with - we have concentrated on the mass A = 86. In this context, Dr.Tepel of the ZAED attended a training seminar at the Nuclear Data Group, Oak Ridge, in March 1977. In addition,we intend to engage more actively than so far in the field of atomic and molecular data, in which a network of data centers is organized under the coordination of the IAEA Nuclear Data Section.

Appendix 7, Annex a.

Recent and planned publications by ZAED

		Price/Preis plus postage/zuzügl. Porto*
1–1 (1975):	**Survey Index of Pion-Nucleon Scattering Data.** By K. H. Augenstein, G. Höhler, E. Pietarinen and H. M. Staudenmaier. 56 pages.	4,50 DM
An index to references on differential cross section and polarization measurements up to June 1975 for the reactions $\pi^+ p \to \pi^+ p$, $\pi^- p \to \pi^- p$ and $\pi^- p \to \pi^0 n$. The data themselves are available on magnetic tape.		
2–1 (1976):	**Stopping Cross Sections of Elements with Z = 2 to 87 for LI Ions with Energies between 80 keV and 840 keV.** By W. Neuwirth, W. Pietsch and U. Hauser. 6 pages.	3,50 DM
A compilation of experimental and calculated stopping cross sections.		
3–1 (1976):	**Datensammlungen in der Physik. Data Compilations in Physics.** By H. Behrens and G. Ebel. 206 pages.	14,– DM
A bibliography of about 1450 existing tables and compilations from all fields of physics.		
4–1 (1976):	**Compilation of Coupling Constants and Low-Energy Parameters. 1976 Edition.** M. M. Nagels, J. J. de Swart, H. Nielsen, C. C. Oades, J. L. Petersen, B. Tromborg, G. Gustafson, A. C. Irving, C. Jarlskog, W. Pfeil, H. Pilkuhn, F. Steiner and L. Tauscher. 90 pages. Reprinted from Nuclear Physics B.	6,– DM
A compilation of coupling constants and other parameters which characterize the interactions of elementary particles at low energies.		
5–1 (1976):	**Gases and Carbon in Metals (Thermodynamics, Kinetics and Properties).** Part I: Alkali Metals, Alkaline Earth Metals, Light Metals (Li, Na, K, Rb, Cs, Ca, Sr, Ba, Be, Mg, Al). By E. Fromm, H. Jehn and G. Hörz. 26 pages.	9,50 DM
6–1 (1976):	**Shapes of Beta Spectra.** By H. Behrens and L. Szybisz. 43 pages.	4,50 DM
A compilation of all measured beta spectrum shape factors.		

In preparation:

Datensammlungen in der Physik. Data Compilations in Physics.
By H. Behrens and G. Ebel. – Supplement to No. 3–1 (1976).

Photoproduction of Pions.
By W. Pfeil et al.

Optical Properties of Some Insulators in the Vacuum Ultraviolet Region.
By R.-P. Haelbich, M. Ivan and E. E. Koch.

Survey Index of Pion-Nucleon Scattering Data.
By G. Höhler et al. – Supplement to No. 1–1 (1975).

Bibliography of Microwave Spectroscopy 1945–1975.
By A. Boggs, M. Botskor, M. Jones, K. Kettemann, R. Mutter, Ch. Spreter and B. Starck.

* Im Inland kommen zu den angegebenen Preisen 5,5 % Mehrwertsteuer.

Copies can be ordered from ZAED, Kernforschungszentrum Karlsruhe, D-7514 Eggenstein-Leopoldshafen 2, Fed.Rep. of Germany

ZAED

Appendix 7, Annex b.

Retrieval of integral CPND from INIS

Zentralstelle für Atomkernenergie-Dokumentation (ZAED)
Federal Republic of Germany

H. Behrens

In the past, the retrieval of integral cross sections and exitation functions from INIS tapes was made difficult by the lack of specific descriptors for these terms. Therefore, one had to turn to a rather complicated search formulation in order to retrieve the integral CPND. This is illustrated by the following example [1]:

```
QX01    PROTON REAC$+DEUTERON R$+HELIUM 3 R$+TRITON REACTIONS+ALPHA R$+
QX01    HEAVY ION R$
QX02    NUCLEOSY$+ISOTOPE PRODUCTION+FUSION$+PROTON SPECTRA+ALPHA
        SPECTRA+
QX02    SPAL$+CHEMICAL A$+SC#D$+SC#B1$
QX03    QX02*CROSS SECTIONS
QX04    BORN A$+DISTORTED$+SPIN$+POLARIZ$+SCATTERING$+SPECTROSCOPIC$
QX05    QX04*DIFFERENTIAL CROSS$
QX06    OPTICAL MODEL$+BORN A$+NUCLEAR PROP$+PARTIAL W$
QX07    QX06*ELASTIC SCATTERING
QX08    POLARIZ$+ANGULAR$+BORN A$
QX09    SPIN$+HIGH SPIN$+SCATTERING$+ISOMERIC TRANSITIONS
QX10    QX09*QX08*EXCITATION F$
QX11    BORN A$*ANGULAR$*SCATTERING
QX12    QX05+QX07+QX10+QX11
QX13    GEV RANGE+MESONS+ANTIBA$+HYPERONS+RESONANCE P$
QX14    CROSS SECTIONS*-QX12
QX15    QX14+QX03+NUCLEAR REACTION Y$
QX16    QX15*QX01*MEV RANGE
QX17    QX15*QX01*-QX13
QX18    QX16+QX17
```

Despite of this complicated formulation only about 25% of the retrieved documents were relevant.

As a result of a proposal by ZAED new specific descriptors, i.e.

- integral cross sections
- excitation functions

were added to the INIS thesaurus. With the aid of these new descriptors, searches can be formulated much more simply, as the following example demonstrates:

```
QX01    PROTON REACTIONS + DEUTERON REACTIONS + HELIUM 3
        REACTIONS+TRITON REACTIONS + ALPHA REACTIONS + HEAVY
        ION REACTIONS
QX02    INTEGRAL CROSS SECTIONS + EXCITATION FUNCTIONS
QX03    SC#A33 + SC#A34 + SC#B1$
QX04    QX01 * QX02 * QX03
```

No experience has been made so far with this new method, but there is justified hope that the results will be considerably better.

1) + = or
   * = and
   *- = and not
   $ = truncation
   # = functional character for discrimination of scopes against descriptors

} logical operations

Appendix 8

Status Report of Japanese Study Group

(1) Our aim in the NRDF-2 is to develop the working system for the compilation of basic charged particle reaction data, such as angular distributions, polarization, asymmetries, excitation functions, etc. Associated information such as experimental conditions should also be stored in order to make future evaluation possible. The NRDF-2 will in future supplement the "Nuclear Structure Data File"(NSDF).

(2) Our schedule of completing the working system NRDF-2 has unfortunately been delayed about half a year.

(3) Data collection form of NRDF-2 for physicists has been settled, after repeated filling-up tests of the form, first by the members of our group and second by several research associates in experimental and theoretical nuclear physics

(4) In the filling-up tests, all the papers with charged particle reactions were taken up, in some recent issues arbitrarily picked up from Nuclear Physics and Physical Reviews. Most materials were found to be satisfactorily recorded. At the same time some difficulties were found as for heavy ion reactions etc., for example, distributions of mass, charge, and kinetic- and intrinsic excitation-energies of reaction products. Special forms are necessary to be added with partial modification in the standard one. Such cases will occur frequently in future, with development of nuclear science. [see (6)].

(5) Machine intelligible data input format has been just devised. It includes some modification to that of NRDF-1, in order to be compatible with EXFOR.

(6) Efforts in designing NRDF-2 are mainly devoted to following up a variety of charged particle nuclear data at present and in future. A new system will be capable of accepting data which are coded in some different formats optimized to specific type of reactions respectively. The system will be completed by this summer.

(7) Collection of data will follow according to the scope reported by Ohnuma at the Second CPND Meeting, i.e., first, all kinds of CPND produced in Japan, and second, CPND of specific reaction types produced in the world. This is not only preliminary data compilation activities, but also a completion test of the system, which might guarantee a smooth switching over to an actual permanent nuclear data compilation activities.

(8) We will continue to make efforts to:

i) Keep close contact with the nuclear physics community in Japan, until nuclear data compilation will be regarded as a part of physicists' daily research activities which they are responsible for;

ii) promote interest of young physicists in nuclear data compilation and thus prepare future compilers and evaluaters;

iii) establish a permanent nuclear data center or section after the three years' period.

(9) Nuclear Data Committee is working as a joint meeting between our group and JAERI. Among the members of the committee are Tanaka, Ikegami (chairman), Ohnuma and Hasegawa from our group, and Fuketa from JAERI.

(10) Regular input of Japanese language publication to existing bibliographic systems will be provided under the charge of JAERI for the time being.

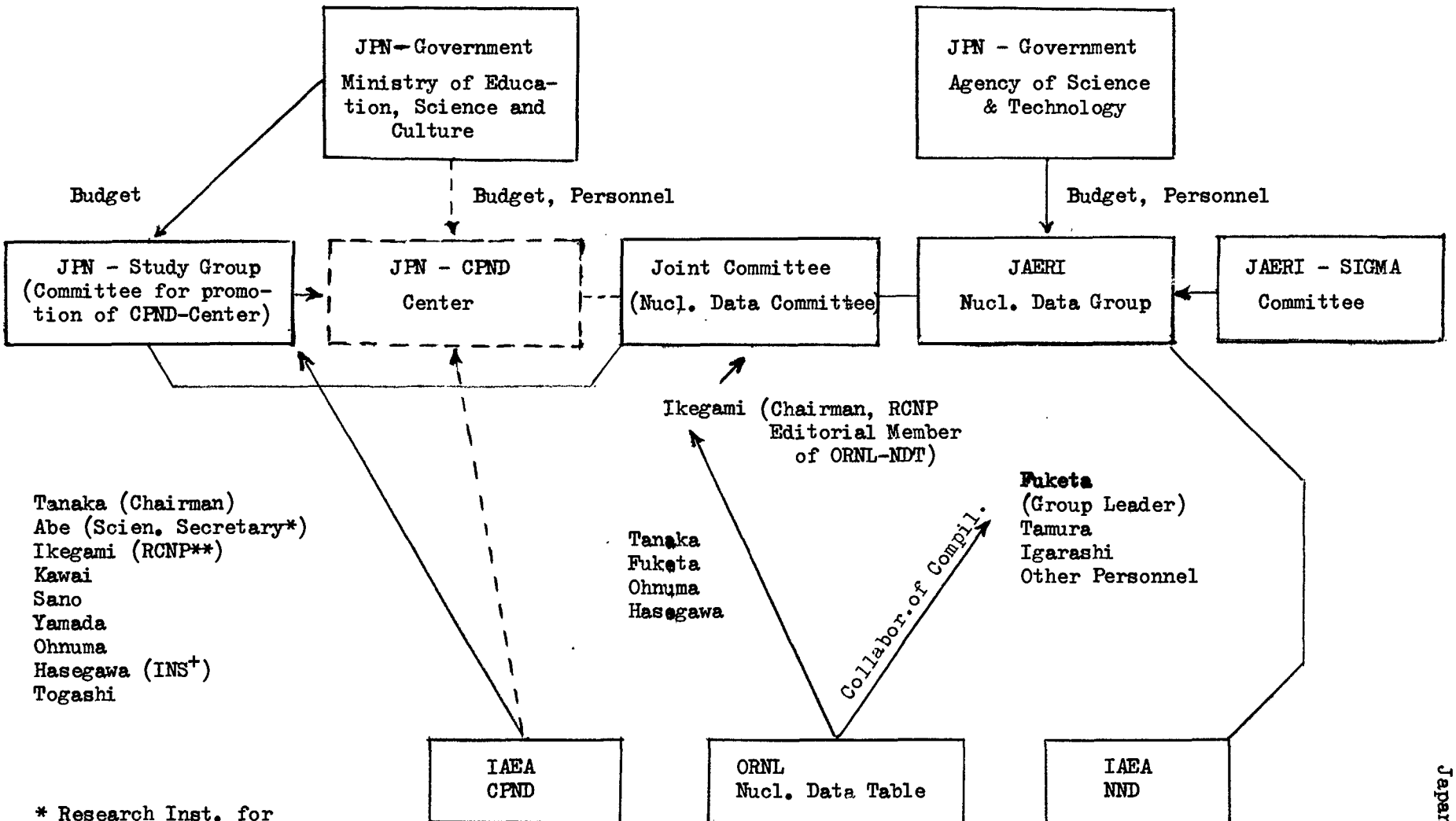
Appendix 8, Annex a.

Block Diagram of Organization

Our group is actually a committee for promotion of permanent CPND center in Japan. We are working in two respects. The first is actions against Japanese Government (Ministry of Ed, Sci and Cul) in order to construct the data center. The second is preparations of soft and brain wears which will be necessary in the center. Another three years' period started at April 1976 under the financial support of the Government through the Special Funds for the Promotion of Science. We have our computer system including discs and magnetic tapes at Hokkaido University. Further the computer facilities at RCNP, Osaka University are also available for our purpose. In the present stage we have no permanent proper staffs or personnels. Our group consists of 8 physicists and a system engineer (Togashi).

See attached block diagram.

STATUS OF "JAPANESE STUDY GROUP" IN NUCLEAR DATA ACTIVITIES IN JAPAN



* Research Inst. for Fundamental Phys.
** Research Center for Nucl. Phys.
\+ Institute for Nucl. Study

Appendix 9

National Nuclear Data Center
Brookhaven National Laboratory
USA

Progress Report
to
Third Consultants' meeting
on
Charged Particle Nuclear Data Compilation
Kiev, April 1977

I General

On 1 October 1977, the National Neutron Cross Section Center of Brookhaven National Laboratory assumed responsibility for all charged particle data compilation activity within the U.S. Because of this additional responsibility and because of the addition of nuclear structure data responsibilities, the center was renamed the National Nuclear Data Center (NNDC).

II CPND Bibliography

The major project at NDCC for the past six months has been the production of a bibliography for integral CPND. Literature produced during the period 1 January 1976 and 1 February 1977 has been covered in our publication, first introduced at this meeting. In general, coverage of journals previously scanned by McGowan and Milner, begins after the last issue covered in their final publication. Additional journals, laboratory reports and other forms of publication have been included.

The format chosen for the data file is similar to CINDA and to that presented by us to the previous consultants' meeting. Retrievals of various types can be obtained from the file by sorting and then selection of desired records. An example of such a retrieval is the publication which you have been given.

The bibliography has been produced from an all upper-case, limited character set file. The special printing features such as lower case, boldfacing and convenient reaction representation has been accomplished by a computer program. The output is converted to microfilm using an FR-80 microfilm plotter which is in turn used to produce the printing plates.

III CPND EXFOR

NNDC has actively participated in the development of EXFOR for experimental charged particle data compilation. Although we have not yet compiled any CPND, NNDC feels that the logical links between neutron charged-particle reaction data are such that each can benefit from experiences and developments of the other.

IV Future Plans

NNDC will continue to cover the integral CPND literature and publish an annual bibliography. Specialized retrievals from this file will be available probably on microfische.

We will begin to modify our neutron data processing system to handle the generalized EXFOR. In this way we can produce all the services currently offered to neutron data customers.

Some evaluation activity will be initiated in the areas of

1) fusion related data
2) neutron source reactions
3) isotope production reactions for medical applications

Appendix 10

BRIEF REPORT BY NDS ON CPND ACTIVITIES

Since the last meeting the activities of NDS with respect to CPND concentrated on the following items:

1. Manual: A CPND Supplement to the Exfor Manual was prepared. Several items were subsequently clarified and added to the CPND Manual. A number of items are still pending and will hopefully be solved at this Meeting.

   In addition to fixing the CPND rules our programmers noticed that Chapters VII and VIII of the Manual had to be restructured in order to become a more convenient tool for the programmers. Thus a revision of these chapters was presented by Mrs. Attree. This includes both NND and CPND keywords. The second part of it was presented so short before the Meeting that we do not expect that the Meeting will consider or even approve all details of it, but we would like to have the approval for the restructuring in principle.

2. Dictionaries: The Dictionaries have been updated regularly and tape copies or printed copies distributed according to the agreed distribution list.

3. Computer Programs: All Exfor computer programs of NDS accept now both types of Exfor entries: in old "ISO-QUANT" format and in the new "REACTION" format, although not yet all new keywords and codes are checked or otherwise machine processed.

   Due to the expectation that the "REACTION" formalism will soon be implemented also for NND, the programming of the required additional branches of the input check program has received higher priority, and a number of CPND keywords and their coding were included in the check program, however others have still to be programmed.

   The programs for correcting an entry or updating a master file work on both types of entries.

The program for producing edited listings also works for both types of entries, although for CPND not yet all codes are expanded that should be expanded. The editing of tables with more than 6 columns works also for CPND.

The indexing program works for both types of entries, however a number of items which are foreseen to be included in the index do not yet work.

All programs were written in PL/1.

4. Compilation: In principle NDS will not do CPND compilation due to lack of manpower. However, an evaluation of the Be-9 (A, N+X) reaction from Canada has been compiled, partly as a test material for the input check program. The compilation was only recently finished.

5. Customer services: Like all other libraries the available CPND data are advertised to customers in the catalogue CINDU-11. A few requests for CPND have been received which however concerned data which were not on hand and therefore had to be satisfied from different sources.

In principle, answering requests for CPND requires identical operations as for NND and thus creates no problems.

Appendix 11

Statement by A. Marcinkowski, IBJ

A computer code for tabelarization and compilation, in the NSDF format, of the gamma-rays following the nucleon capture and/or accompanying other nuclear reactions has been prepared. The compilation of the proton capture data on Ne and Fe are advanced.

For the purposes of mikroanalysis the compilation of charged-particles cross sections has been initiated on Ne isotopes.

56FE(P,G) PROTON ENERGY = 1651.9 4 KEVRESONANCE ENERGY = 7652.2 28 KEV

GAMMA RAY ENERGIES AND INTENSITIES

EG(KEV)	IG(REL.)	E(LEVEL)	EG(KEV)	IG(REL.)	IG(REL.)	E(LEVEL)
		3993.3 25 ,				
		3856.4 23 ,				
		3723.5 64 ,				
		3700.8 24 ,				
		3357.0 18 ,				
4383.9 48	7 4	3268.3 56 ,	3268.3 56	7.0 41	1.00 10	0.0 0
		3176.9 3 ,				
		3108.2 5 ,				
		2983.8 20 ,				
		2879.7 20 ,				
		2803.9 2 ,				
		2730.6 2 ,				
5519.3 27	8 4	2132.9 3 ,	2132.9 3	8.0 41	1.00 10	0.0 0
5732.7 27	13 4	1919.5 2 ,	1919.5 2	13.0 42	1.00 10	0.0 0
		1896.5 4 ,				
		1757.6 2 ,				

```
56FE     56FE(P,G)      E= 1651.90      71LE21                770224
56FE  L    7652.2  283/2
56FE  G    6274.6  27  55     6
56FE  G    6147.5  27  17     5
56FE  G    5732.7  27  13     4
56FE  G    5519.3  27   8     4
56FE  G    4383.9  48   7     4
56FE  L    3993.3  25
56FE  G    3993.3  25  .90    9                                  2
56FE  G    2235.7  24  .10    3                                  2
56FE  L    3856.4  23
56FE  G    2478.8  22 1.00   10                                  2
56FE  L    3723.5  64
56FE  G    3723.5  64 1.00   10                                  2
56FE  L    3700.8  24
56FE  G    3700.8  24 1.00   10                                  2
56FE  L    3357.0  18
56FE  G    1979.4  17 1.00   10                                  2
56FE  L    3268.3  56
56FE  G    3268.3  56 1.00   10                                  2
56FE  L    3176.9   35/2-
56FE  G    3176.9   3 1.00   10                                  2
56FE  L    3108.2   55/2-
56FE  G    1730.6   4 1.00   10                                  2
56FE  L    2983.8  20
56FE  G    1087.3  19 1.00    1                                  2
56FE  L    2879.7  20
56FE  G    2879.7  20 1.00   10                                  2
56FE  L    2803.9   23/2-,5/2-
56FE  G    2803.9   2 1.00   10                                  2
56FE  L    2730.6   25/2-,3/2-
56FE  G    2730.6   2 1.00   10                                  2
56FE  L    2132.9   35/2-
56FE  G    2132.9   3 1.00   10                                  2
56FE  L    1919.5   25/2-
56FE  G    1919.5   2 1.00   10                                  2
56FE  L    1896.5   47/2-
56FE CG               BRANCHING RATIOS TAKEN FROM REF.
56FE  G    1896.5   4  .45    5                                  2
56FE  G     673.0   4  .55    6                                  2
56FE  L    1757.6   23/2-,5/2-
56FE  G    1757.6   2 1.00   10                                  2
56FE  L    1504.7   21/2-
56FE  G     127.1   2 1.00   10                                  2
56FE  L    1377.6   23/2-
56FE  G    1377.6   2 1.00   10                                  2
56FE  L    1223.5   49/2-
56FE  G    1223.5   4 1.00   10                                  2
```

Appendix 12

Status report of the US Photonuclear Data Center (E.G.Fuller,H.M.Gerstenberg)

The major effort over the last year has been to complete work on a compilation of evaluated photonuclear reaction cross section data for the p-shell nuclei. Of the nine stable nuclides to be included in the final compilation, preliminary evaluations for all except ^{13}C and ^{14}N have been completed and are undergoing internal review. Barring unforeseen complications, the complete evaluation should be submitted for publication to the editor of the Journal of Physical and Chemical Reference Data by the end of June 1977.

At the time of the Gordon Photonuclear Conference in August 1976, the Data Center issued an interim draft index "New Photonuclear Data, January 1973-May 1976." In addition to indexing the data published since the cutoff date for inclusion in NBS Special Publication 380, Photonuclear Reaction Data, 1973, this report contains a complete index to the 1100 data sets now in the Center's digital cross section library. This report is an interim version of the first supplement to NBS SP-380 which will include an index to data publishing through 1976. This is planned for publication in late spring.

The Center has continued to respond to an average of about 1.5 requests per month from various segments of the scientific and technological community for information from its files. During the last year, the results of a calculation based on data provided as a result of one of the more unusual requests, were published in The Astrophysical Journal 205, 638 (1976). The paper, by J. L. Puget, F. W. Stecker, and J. H. Bredekamp of the NASA Goddard Space Flight Center, gives the results of a calculation of the interaction of ultrahigh energy cosmic ray nuclei (^{56}Fe and lighter) with the intergalactic radiation fields. These fields, when Lorentz-shifted into the rest frame of the nuclei, contain appreciable fluxes of photons capable of inducing photonuclear reactions.

Appendix 12, Annex a.

The Digital Data Files of the Photonuclear Data Center

Henry M. Gerstenberg

The various files of digital data maintained by the Photonuclear Data Center are specified by the acquisition number assigned to a particular data set. Ample allowance has been made for any conceivable future demands on the system from this relatively small branch of nuclear physics. By the use of appropriate designators, each associated with a well-defined sub-area of physics, the file system could be expanded for use in other sub-areas. The major categories now being used are listed in Table I. The various categories are then defined and discussed in detail. Finally, specific examples are given.

Table I.

File Categories	Series	Range of Acquisition Number
Cross Section	00,000	1 - 9999
Spectra	10,000	10001 - 19999
Angular Distribution	20,000	20001 - 29999
Manipulated	30,000	30001 - 39999
Combination	40,000	40001 - 49999
(Not yet designated)	50,000-80,000	50001 - 89999
Evaluated Cross Section	90,000	90001 - 99999

Each file consists of a number of data sets. A particular data set consists of an identifier card and two label cards followed by an arbitrary number of comment cards and a series of data points. A data point is defined as a set of either two or three numbers depending upon whether or not a flag is indicated in the appropriate position on the identifier card for that particular data set. In the more usual case the two-number set gives abscissa and ordinate values. When the three-number set is flagged, abscissa, ordinate, and uncertainty in ordinate, are given for each data point.

The identifier card uses eight fields to specify the information contained in a given data set. The information given in these fields and their position on a card is indicated in Table II. The two label cards following the identifier card simply explain the abscissa and ordinate axes. A total of 32 character spaces is allowed on each card; the information normally starts in the first column.

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Table II.

Information	Field Position	Start of Field -Right or Left Adjusted
Acquisition Number	1 - 5	Right
Number of Data Points	7 - 11	Right
Photonuclear Data Center Reference Number	13 - 18	Left
Nuclide for which data are given- (target nuclide for photon's incident, residual nucleus for capture reactions)	24 - 30	Left
Reaction	32 - 43	Left
No entry: indicates data were digitized by Data Center. 1: flag to indicate digital data were obtained directly from source.	45	-
No entry: two-number format for each data point used 1: flag to indicate three-number format for each data point, i.e., uncertainties in ordinate values are given.	47	-
Modification Code - used only for manipulated data file to define successive manipulations carried out on some original data set. Manipulations are defined by comment cards.	49 - 50	Right

Cross Section File - 00,000 Series (1 to 9999)

Any reaction cross section normally listed in the Photonuclear Data Index may be placed in this file. This may be digital data sent to the Center by authors or data digitized from journal articles. The intent is to use this file only for experimental cross section data that have not been modified. Thus, (γ,sn) data, derived from measured (γ,xn) data by a calculation, are not included. The acquisition number assigned to any data set is the lowest number currently available between 1 and 9999.

Spectra File - 10,000 Series (10001 to 19999)

This file contains data dealing with spectra of outgoing neutrons, protons, alpha particles, photons, etc. The acquisition number assigned to a data set is the lowest number currently available between 10001 and 19999. The energy or energies of the particles in the incident beam inducing the reaction is given on a comment card.

Angular Distribution File - 20,000 Series (20001 to 29999)

Angular distributions of any reaction product with respect to the incident beam direction are contained in this file. The acquisition numbering system is identical to that of the spectra file except that the range of numbers is between 20,001 and 29999. Data are normally given in terms of a Legendre polynomial expansion of the angular distribution. Point-wise data, i.e., angle vs differential cross section or yield may also be entered. The energy or range of energies of the detected particles is given as a comment.

Manipulated File - 30,000 Series (30001 to 39999)

Data from the cross section file that have been modified are found in this file. Typical examples of manipulated data would be (1) the inverse cross section as obtained by detailed balance, and (2) normalization of a cross section measured at a single angle for comparison with integrated over angle cross section data.

The acquisition number of the manipulated data is found by adding 30,000 to the acquisition numbers of the unmodified data set. If more than one manipulation of the original data set is made, then an additional two-digit integer code (a number between 1 and 99) is punched on the identifier card. These modifications are defined on the comment cards of the manipulated data sets.

Combination File - 40,000 Series (40001 to 49999)

At the present time this file contains data sets that are the combination of two or more data sets from the cross section file. Most of the data in this series are created with the program COMBIN. Examples of data sets in this file are: (1) the (γ,xn) data set as obtained from the (γ,n), (γ,2n), and (γ,3n) data sets kept in the cross section file; (2) the cross section for a 'composite' natural element as made with the isotopic data for that element.

The data used to create this file as well as the data in the file itself are not smoothed. The emphasis is to modify the data as little as possible in obtaining the desired result. The acquisition number assigned to a data set in this file is the lowest number currently available between 40,001 and 49999.

Evaluated Cross Section File - 90,000 Series (90001 to 99999)

The contents of this file contain the 'recommended or best value' data to be used in the Atlas of Evaluated Photonuclear Cross Section Data. This file will generally consist of those cross sections which make the largest contribution to the total nuclear absorption cross section.

Except where data warrant a finer resolution, points are given at every half MeV. Cross sections are obtained by interpolating and 'smoothing' data presented in the cross section file. Cross section magnitudes are those obtained from the basic data. Any renormalizations that are felt to be necessary to obtain a 'best value' or consistency with other measurements are indicated on the comment cards. Acquisition numbering is accomplished by adding 90,000 to the cross section being evaluated.

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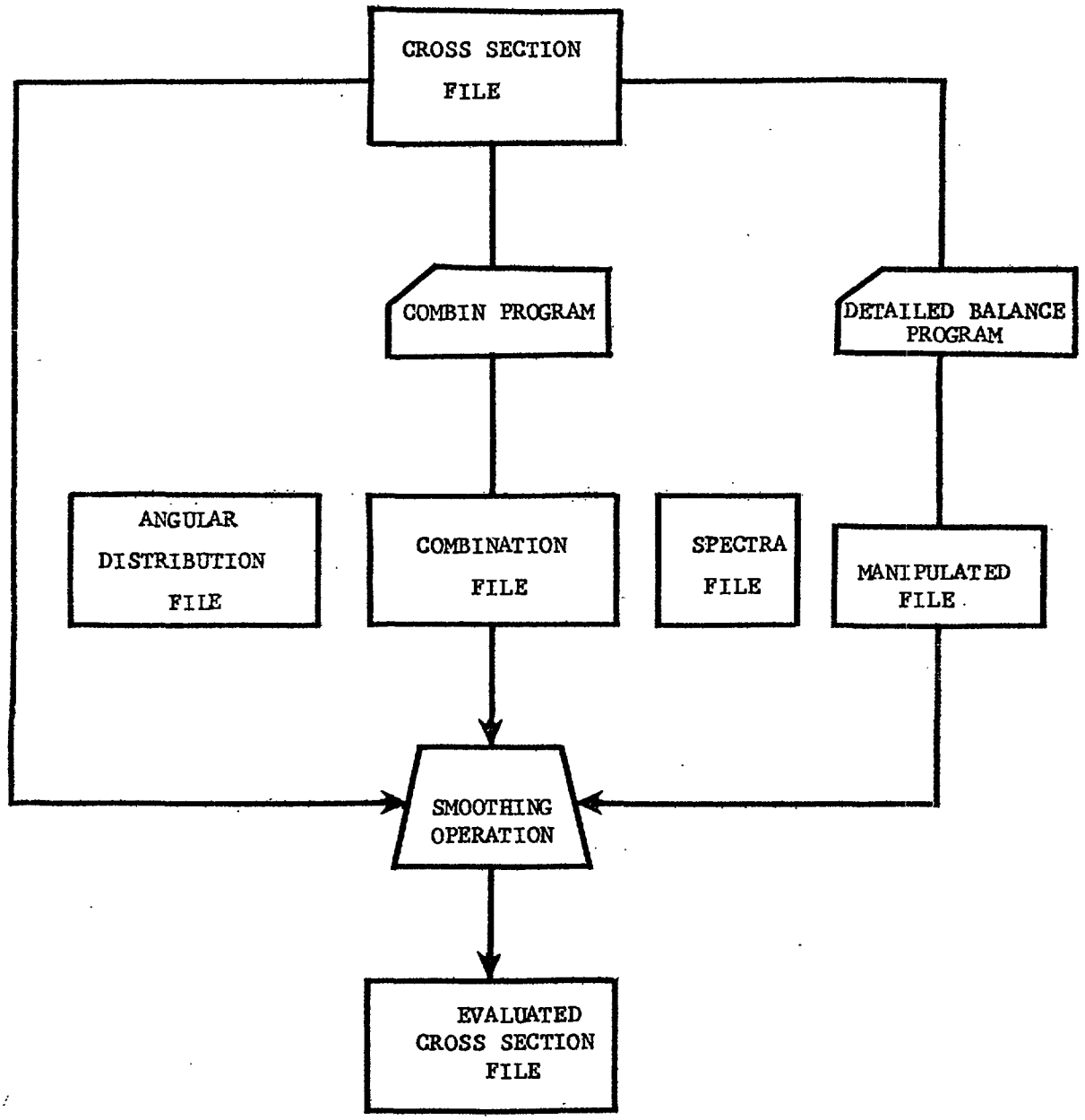

Relationships of files and programs are discussed in the preceding pages.

Example 1. Cross Section File

The four cross sections listed here are used later to indicate how the basic measured data are used to generate other files.

```
**********************************************************************************

  304     69 66BR1       59PR141 (G,N)         1
PHOTON ENERGY, (MEV)
CROSS SECTION, (MB)

 .8788+01, .4410+01, .9097+01, .0000   , .9407+01, .1517+02, .9717+01, .3175+02
 .1003+02, .3388+02, .1034+02, .4524+02, .1065+02, .4320+02, .1096+02, .5829+02
 .1126+02, .6455+02, .1158+02, .7315+02, .1188+02, .8025+02, .1219+02, .9955+02

 .2861+02, .3124+02, .2892+02, .3022+02, .2923+02,-.5320+01, .2954+02,-.2570+01
 .2985+02,-.1719+02,


  305     47 66BR1       59PR141 (G,2N)        1
PHOTON ENERGY, (MEV)
CROSS SECTION, (MB)

 .1560+02, .5370+01, .1591+02, .6320+01, .1622+02,-.1300+01, .1653+02, .9110+01
 .1684+02, .1920+01, .1715+02, .2000-01, .1746+02, .1950+01, .1777+02, .7230+01
 .1808+02, .2061+02, .1839+02, .3436+02, .1870+02, .3488+02, .1901+02, .3688+02
 .1932+02, .4834+02, .1963+02, .4282+02, .1994+02, .5934+02, .2025+02, .5613+02
 .2056+02, .5293+02, .2087+02, .4660+02, .2118+02, .5070+02, .2148+02, .4256+02
 .2180+02, .4267+02, .2211+02, .4832+02, .2241+02, .4309+02, .2272+02, .3143+02
 .2303+02, .3408+02, .2334+02, .3081+02, .2365+02, .2518+02, .2396+02, .3309+02
 .2427+02, .3137+02, .2458+02, .1378+02, .2489+02, .1157+02, .2520+02, .2037+02
 .2551+02, .2993+02, .2582+02, .1243+02, .2613+02, .1324+02, .2644+02, .1967+02
 .2675+02, .4420+01, .2706+02, .1024+02, .2737+02, .2020+02, .2768+02, .2820+02
 .2799+02, .2320+02, .2830+02, .1800+01, .2861+02, .6000+01, .2892+02, .7200+01
 .2923+02, .8000+01, .2954+02, .3000+01, .2985+02, .1670+02,


  306     17 66BR1       59PR141 (G,3N)        1
PHOTON ENERGY, (MEV)
CROSS SECTION, (MB)

 .2799+02, .7400+00, .2830+02, .5730+01, .2861+02,-.6800+00, .2892+02, .3810+01
 .2923+02, .1670+01, .2954+02, .4170+01, .2985+02, .4050+01, .3015+02, .7600+01
 .3045+02, .9180+01, .3078+02, .7500+01, .3108+02, .8780+01, .3138+02, .7620+01
 .3170+02, .1275+02, .3202+02, .1010+02, .3233+02, .1068+02, .3265+02, .1650+02
 .3296+02, .1078+02,


  225    231 64AL2        6C 12  (P,G)
PROTON ENERGY, (MEV)
CROSS SECTION, (MB)

 .9790+00, .1293-01, .1047+01, .1389-01, .1093+01, .1580-01, .1138+01, .1675-01
 .1183+01, .1771-01, .1229+01, .1961-01, .1297+01, .2104-01, .1365+01, .2295-01
 .1388+01, .2343-01, .1456+01, .2486-01, .1524+01, .2582-01, .1616+01, .2488-01

 .1331+02, .1989-01, .1335+02, .2370-01, .1345+02, .2086-01, .1354+02, .1896-01
 .1361+02, .1755-01, .1370+02, .1851-01, .1379+02, .1947-01

**********************************************************************************
```

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Example 2. Spectra File

This file contains data dealing with the spectra of neutrons, protons, alpha-particles, photons, etc. Shown below is an example of a neutron spectrum obtained with a peak bremsstrahlung energy of 14 MeV.

```
**************************************************************************

10033    14 65MU1       73TA181 (G,N)
NEUTRON ENERGY, (MEV)
(DN/DE)/E
C   DATA TAKEN WITH A PEAK BREMSSTRAHLUNG ENERGY OF 14 MEV.

 .6020+00, .3091+05, .1005+01, .1691+05, .1391+01, .8331+04, .1793+01, .4042+04
 .2212+01, .1931+04, .2598+01, .9804+03, .3001+01, .5613+03, .3404+01, .3679+03
 .3807+01, .2640+03, .4210+01, .1757+03, .4598+01, .1299+03, .5017+01, .7663+02
 .5403+01, .4730+02, .5804+01, .1418+02

**************************************************************************
```

Example 3. Angular Distribution File

Angular distribution of any reaction products are contained in this file. The sample below gives $-A_2/A_0$ for a Legendre polynomial fit to the neutron angular distribution obtained with a peak bremsstrahlung energy of 13 MeV. The neutron energy ranged from about .5 to 3.5 MeV.

```
**************************************************************************

20001    12 66MU1       73TA181 (G,N)
NEUTRON ENERGY, (MEV)
ANGULAR DISTRIBUTION, (-A2/A0)
C   BREMSSTRAHLUNG BEAM WITH PEAK ENERGY OF 13 MEV WAS USED.  NEUTRON
C   ENERGY RANGED FROM ABOUT .5 TO 3.5 MEV.

 .5999+00,-.3185-02, .1187+01, .2535-02, .1672+01, .5184-02, .2132+01, .1104-01
 .2541+01, .2970-01, .2912+01, .5158-01, .3270+01, .8940-01, .3577+01, .1177+00
 .3909+01, .1460+00, .4228+01, .1616+00, .4394+01, .1678+00, .4561+01, .1740+00

**************************************************************************
```

Example 4. Manipulated File

The (γ,p) cross section derived from the (p,γ) cross section, given by data set 225, by means of the detailed balance program.

```
**************************************************************************

30225   231 64AL2       6C 12  (G,P)
PHOTON ENERGY, (MEV)
CROSS SECTION, (MB)
C   (P,G) CROSS SECTION USED TO GET (G,P) CROSS SECTION USING DETAILED
C   BALANCE PROGRAM.

 .1687+02, .2809+00, .1693+02, .3203+00, .1697+02, .3785+00, .1701+02, .4158+00
 .1705+02, .4548+00, .1710+02, .5206+00, .1716+02, .5852+00, .1722+02, .6669+00

 .2846+02, .1863+01, .2854+02, .1967+01, .2863+02, .2070+01

**************************************************************************
```

Example 5. Combination File

A sample of the data set in the combination file. This data set gives the total neutron yield cross section, (γ,xn). It was obtained by combining data sets #s 304, 305, and 306 from the cross section file along with the appropriate neutron multiplicity factors.

```
**************************************************************************

40020    69 66BR1      59PR141 (G,XN)        1
PHOTON ENERGY, (MEV)
CROSS SECTION, (MB)
C   (G,XN) OBTAINED FROM (G,N)+2*(G,2N)+3*(G,3N). USED DATA SETS NUMBER 304,
C   305, AND 306. DATA CUTS OFF AT 29.85 MEV-THE LIMIT OF THE N AND 2N DATA.

 .8788+01, .4410+01, .9097+01, .0000   , .9407+01, .1517+02, .9717+01, .3175+02
 .1003+02, .3388+02, .1034+02, .4524+02, .1065+02, .4320+02, .1096+02, .5829+02
 .1126+02, .6455+02, .1158+02, .7315+02, .1188+02, .8025+02, .1219+02, .9955+02
 .1250+02, .1221+03, .1281+02, .1379+03, .1312+02, .1614+03, .1343+02, .1933+03
 .1374+02, .2229+03, .1405+02, .2510+03, .1436+02, .2894+03, .1467+02, .3143+03
 .1498+02, .3356+03, .1529+02, .3310+03, .1560+02, .3199+03, .1591+02, .2923+03
 .1622+02, .2661+03, .1653+02, .2404+03, .1684+02, .2094+03, .1715+02, .1837+03
 .1746+02, .1656+03, .1777+02, .1572+03, .1808+02, .1512+03, .1839+02, .1371+03
 .1870+02, .1250+03, .1901+02, .1288+03, .1932+02, .1385+03, .1963+02, .1116+03
 .1994+02, .1345+03, .2025+02, .1219+03, .2056+02, .1167+03, .2087+02, .9241+02
 .2118+02, .9423+02, .2148+02, .9906+02, .2180+02, .1033+03, .2211+02, .9612+02
 .2241+02, .9840+02, .2272+02, .8668+02, .2303+02, .9568+02, .2334+02, .8204+02
 .2365+02, .7299+02, .2396+02, .8762+02, .2427+02, .7864+02, .2458+02, .5461+02
 .2489+02, .4046+02, .2520+02, .5160+02, .2551+02, .6190+02, .2582+02, .5890+02
 .2613+02, .3172+02, .2644+02, .4221+02, .2675+02, .3158+02, .2706+02, .4130+02
 .2737+02, .5490+02, .2768+02, .5117+02, .2799+02, .5864+02, .2830+02, .3354+02
 .2861+02, .4120+02, .2892+02, .5605+02, .2923+02, .1569+02, .2954+02, .1594+02
 .2985+02, .2836+02

**************************************************************************
```

Example 6. Evaluated Cross Section File

Samples of evaluated data for Pr-141. Smoothing of the data was done on data sets #s 305 and 306 as found in the cross section file.

```
**************************************************************************
90305    26 66BR1      59PR141 (G,2N)        1
PHOTON ENERGY, (MEV)
CROSS SECTION, (MB)
C   SMOOTHED DATA POINTS.  MARCH,74 HMG

 .1750+02, .4977+01, .1800+02, .1624+02, .1850+02, .2960+02, .1900+02, .4227+02
 .1950+02, .5442+02, .2000+02, .5734+02, .2050+02, .5566+02, .2100+02, .5236+02
 .2150+02, .4833+02, .2200+02, .4441+02, .2250+02, .4064+02, .2300+02, .3675+02
 .2350+02, .3326+02, .2400+02, .3023+02, .2450+02, .2688+02, .2500+02, .2367+02
 .2550+02, .2062+02, .2600+02, .1760+02, .2650+02, .1541+02, .2700+02, .1303+02
 .2750+02, .1090+02, .2800+02, .9070+01, .2850+02, .7234+01, .2900+02, .5760+01
 .2950+02, .4018+01, .3000+02, .2760+01


90306    12 66BR1      59PR141 (G,3N)        1
PHOTON ENERGY, (MEV)
CROSS SECTION, (MB)
C   SMOOTHED DATA POINTS.  MARCH,74 HMG

 .2750+02,-.4751+00, .2800+02, .8382+00, .2850+02, .2111+01, .2900+02, .3367+01
 .2950+02, .4655+01, .3000+02, .5976+01, .3050+02, .7235+01, .3100+02, .8504+01
 .3150+02, .9755+01, .3200+02, .1100+02, .3250+02, .1223+02, .3300+02, .1348+02
**************************************************************************
```

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US Photo ND

Examples of Computer-Drawn Cross Section Data

Figure 1 is an example of the computer-drawn cross section data for praseodymium. The open circles show the $\sigma(\gamma,n)$ data from the data set #305 as found in the cross section file. The points show these data after smoothing. The smoothed data were then interpolated, to obtain values at every half MeV, and placed in the evaluated cross section file as data set #90305. The $\sigma(\gamma,3n)$ data (the crosses show the basic data and the line shows the smoothed data) were handled in a similar way.

Figure 2 shows the $\sigma(p,\gamma)$ data set #225 as found in the cross section file. These data were used as input to the detailed balance program; the output was the inverse reaction cross section and is shown in Fig. 3. The output was placed in the manipulated file as data set #30225.

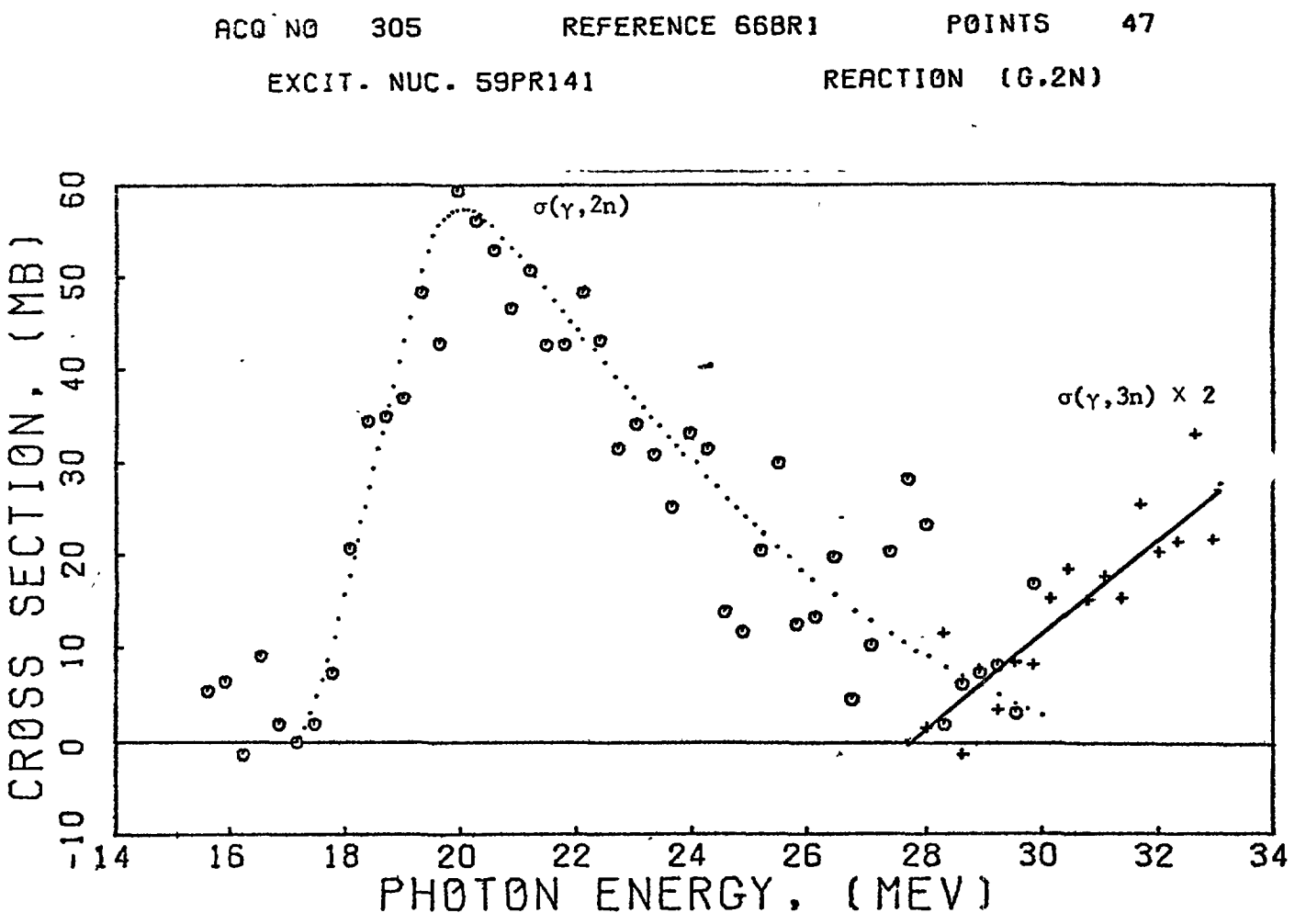

Fig. 1

ACQ NO 225 REFERENCE 64AL2 POINTS 231

EXCIT. NUC. 6C 12 REACTION (P,G)

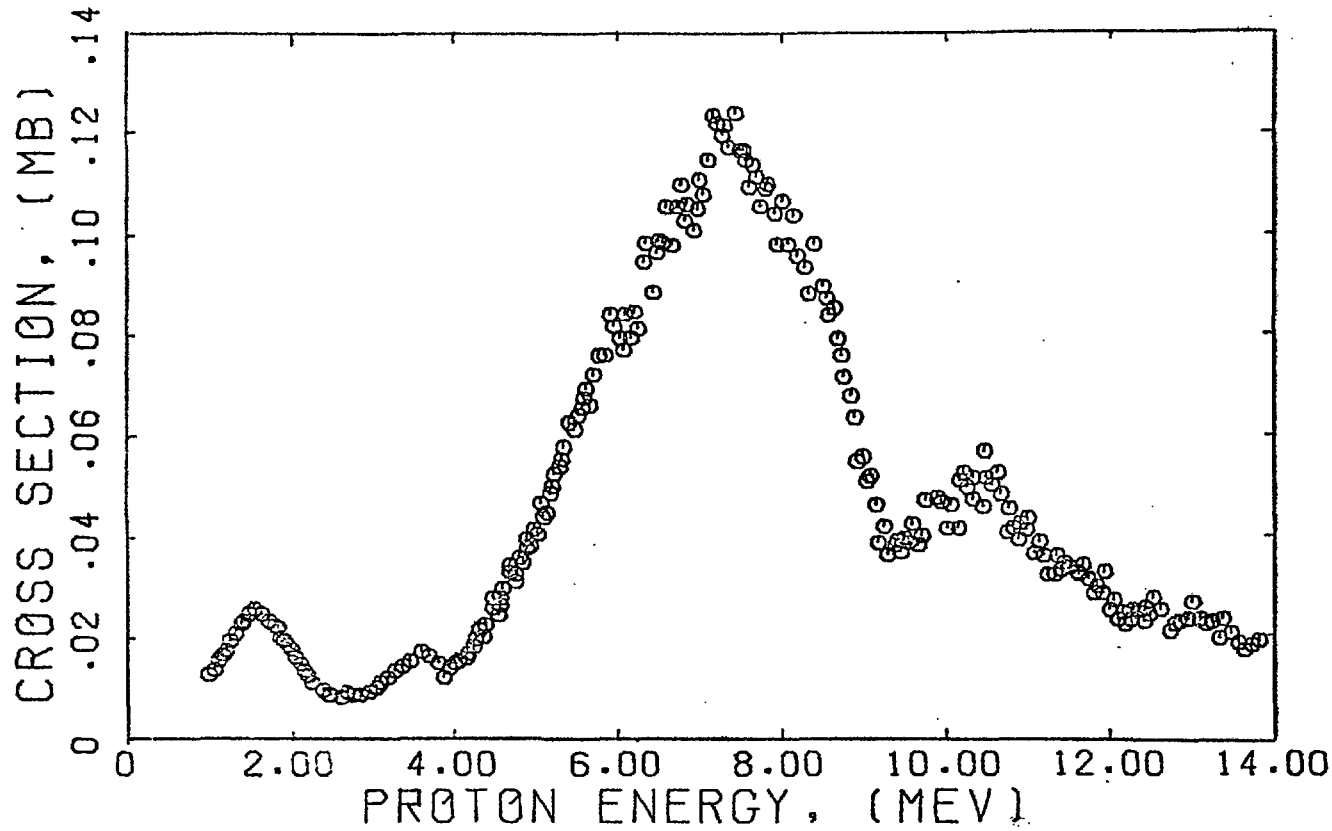

Fig. 2

ACQ NO 30225 REFERENCE 64AL2 POINTS 231

EXCIT. NUC. 6C 12 REACTION (G,P)

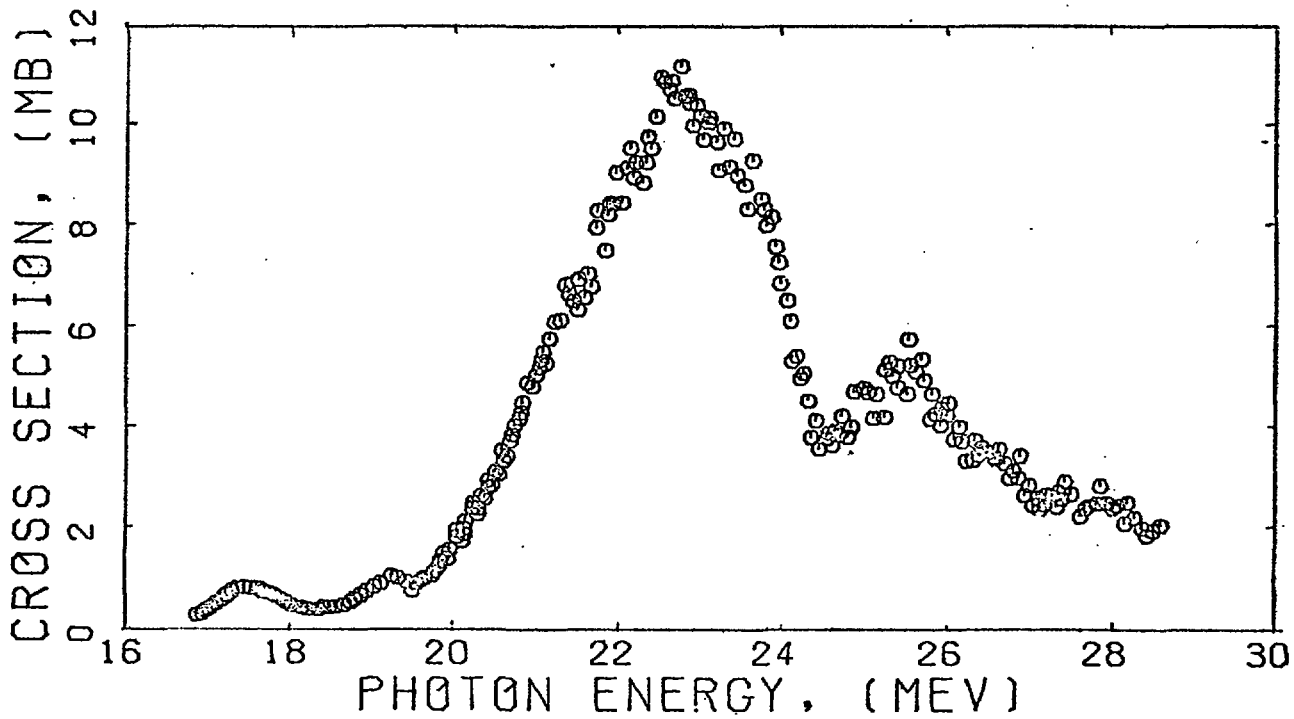

Fig. 3

Appendix 12, Annex b

Digital Data Input Format

Photonuclear Data Center

November 1974

Over the last few years, the Photonuclear Data Center has developed a library of digitized photonuclear reaction data. Provisions are made in this library to file any of the various types of data normally presented in graphical form which are germane to the field. Included among the types of data in these files are total reaction cross section data as a function of energy for any of the reactions of concern to the Center, differential cross section data (angular) as a function of energy, reaction product spectral data, angular distribution data, etc. While a large part of the existing data in the library were obtained by "deplotting" (i.e., digitizing) published graphs in the Center, a considerable body of data have been obtained directly in digital form from the original experimenters. On the basis of the Center's experience in entering these digital data into its library, the format described in the following paragraphs has developed. Use of this format by those sending digital data to the Center will greatly facilitate entering the information into the final library file.

Data should be sent to the Center either on 80 character punch cards or recorded on BCD magnetic tape (7 or 9 track) with one 80-character punch card image per record and one record per block. If punch cards are used to exchange data, the cardpunching code used should be defined. If possible, we would prefer to receive cards punched in either the BCD I.B.M. 026 or the C.D.C. STANDARD HOLLERITH codes as defined in the table of acceptable card-punching codes published in Instruction to Authors, Vol. 1, No.1 of Computer Physics Communications (July 1969) (copy attached). If neither tape nor cards are feasible, a simple tabular listing of the data would be acceptable.

In the Photonuclear Data Center's Digital Library, the information needed to define, identify, and reproduce a specific graph in a published article is defined as a data set. A data set is visualized as a series of 80-character punched card images. Each such set starts with an identifier card, followed by two label cards, an arbitrary number of comment cards, and then a series of data cards giving data points. A data point is defined as a set of two, three, or four numbers depending upon the entry made in a specified position of the identifier card for the particular data set. In the more usual case the two-number set gives abscissa and ordinate values. The three-number set provides for giving a value for a symmetrical uncertainty in the ordinate value while the four-number set provides for quoting an asymmetrical uncertainty in the ordinate (positive uncertainty followed by negative).

The identifier card uses nine fields to specify the information contained in a given data set. The information given in these fields and their position on the card is given in the Table. The two label cards following the identifier card give the labels and units for the abscissa and ordinate axes. The first 32 character spaces on each card may be used for this purpose. Data points are entered on the data cards in one of the three following formats:

0 Two-number data set [E9.4,7(',',E9.4)]

1 Three-number data set [E9.4,5(',',E9.4)]

2 Four-number data set [E9.4,7(',',E9.4)]

Table I. Description of Identifier Card Fields

Field Number	Information		Field Position	Start of Field Left or Right Adjusted
1	Data Set Number (see comments below)		1- 5	Right
2	Number of Data Points (Data Points as defined in text)		7-11	Right
3	Photonuclear Data Center Reference Number - (leave blank if unknown)		13-18	Left
4	Nuclide for which data are given - (target nuclide with photon or electron incident, final nuclide for capture reactions)	Z Symbol A	24-25 26-27 28-30	Left Left Left
5	Reaction		32-43	Left
6	Data Source No Entry: Data were digitized by Data Center 1 : Digital data provided by original source		45	-
7	Data Point Format (see text for definitions) 0 : Two-number format per Data Point 1 : Three-number " " " " 2 : Four-number " " " "		47	-
8	Modification Code - An internal code used by Photonuclear Data Center - Leave blank		49-50	-
9	Identification notes needed to completely specify data in set		52-80	Left

Data Set Numbers: These numbers are assigned by the Group or Laboratory sending digital data to the Photonuclear Data Center. They should run consecutively. Each group of data sets sent to the Center should be accompanied by an index which associates each Data Set Number of the group with a specific figure or part of a figure in the paper where the data either have been or are scheduled to be published. A complete bibliographic reference should be associated with each data set. This Data Set Number will be changed to a Photonuclear Data Center Acquisition Number when the Set is entered into the library.

The following examples give typical data sets taken from the Center's library. Note that the appropriate Center acquisition and reference numbers have been entered on the identifier card for each set.

```
  304    69 66BR1      59PR141 (G,N)        1
PHOTON ENERGY, (MEV)
CROSS SECTION, (MB)

 .8788+01, .4410+01, .9097+01, .0000   , .9407+01, .1517+02, .9717+01, .3175+02
 .1003+02, .3388+02, .1034+02, .4524+02, .1065+02, .4320+02, .1096+02, .5829+02
 .1126+02, .6455+02, .1158+02, .7315+02, .1188+02, .8025+02, .1219+02, .9955+02

 .2861+02, .3124+02, .2892+02, .3022+02, .2923+02,-.5320+01, .2954+02,-.2570+01
 .2985+02,-.1719+02,


  225   231 64AL2       6C 12  (P,G)
PROTON ENERGY, (MEV)
CROSS SECTION, (MB)

 .9790+00, .1293-01, .1047+01, .1389-01, .1093+01, .1580-01, .1138+01, .1675-01
 .1183+01, .1771-01, .1229+01, .1961-01, .1297+01, .2104-01, .1365+01, .2295-01
 .1388+01, .2343-01, .1456+01, .2486-01, .1524+01, .2582-01, .1616+01, .2488-01

 .1331+02, .1989-01, .1335+02, .2370-01, .1345+02, .2086-01, .1354+02, .1896-01
 .1361+02, .1755-01, .1370+02, .1851-01, .1379+02, .1947-01


  10033    14 65MU1      73TA181 (G,N)
  NEUTRON ENERGY, (MEV)
  (DN/DE)/E
  C   DATA TAKEN WITH A PEAK BREMSSTRAHLUNG ENERGY OF 14 MEV.

   .6020+00, .3091+05, .1005+01, .1691+05, .1391+01, .8331+04, .1793+01, .4042+04
   .2212+01, .1931+04, .2598+01, .9804+03, .3001+01, .5613+03, .3404+01, .3679+03
   .3807+01, .2640+03, .4210+01, .1757+03, .4598+01, .1299+03, .5017+01, .7663+02
   .5403+01, .4730+02, .5804+01, .1418+02


  20001    12 66MU1      73TA181 (G,N)
  NEUTRON ENERGY, (MEV)
  ANGULAR DISTRIBUTION, (-A2/A0)
  C   BREMSSTRAHLUNG BEAM WITH PEAK ENERGY OF 13 MEV WAS USED.  NEUTRON
  C   ENERGY RANGED FROM ABOUT .5 TO 3.5 MEV.

   .5999+00,-.3185-02, .1187+01, .2535-02, .1672+01, .5184-02, .2132+01, .1104-01
   .2541+01, .2970-01, .2912+01, .5158-01, .3270+01, .8940-01, .3577+01, .1177+00
   .3909+01, .1460+00, .4228+01, .1616+00, .4394+01, .1678+00, .4561+01, .1740+00
```

COUNCIL DIRECTIVE

of 27 July 1976

amending Directive 71/354/EEC on the approximation of the laws of the Member States relating to units of measurement

(76/770/EEC)

THE COUNCIL OF THE EUROPEAN COMMUNITIES,

Having regard to the Treaty establishing the European Economic Community, and in particular Article 100 thereof,

Having regard to the Act of Accession, and in particular Article 29 thereof,

Having regard to Council Directive 71/354/EEC of 18 October 1971 on the approximation of the laws of the Member States relating to units of measurement (1), as amended by the Act of Accession, and in particular Article 1 (4) thereof,

Having regard to the proposal from the Commission,

Having regard to the opinion of the European Parliament (2),

Having regard to the opinion of the Economic and Social Committee (3),

Whereas, pursuant to the Act of Accession, the classification in Annex I to Directive 71/354/EEC of the units of measurement listed in Annex II to that Directive is to be decided on by 31 August 1976 at the latest;

Whereas, in Directive 71/354/EEC, provision is made for the review before 31 December 1977 of the situation as regards the units and names of units listed in Chapter II of Annex I to that Directive;

Whereas the 15th General Conference of Weights and Measures (CGPM), convened on 27 May 1975 in Paris by the International Committee of Weights and Measures (CIPM), adopted new international resolutions concerning the international system of units,

HAS ADOPTED THIS DIRECTIVE:

Article 1

Article 1 of Directive 71/354/EEC is replaced by the following:

'*Article 1*

1. Member States shall make the provisions of Chapter A of the Annex mandatory by 21 April 1978 at the latest.

2. Member States shall, with effect from 31 December 1977 at the latest, cease to authorize the use of the units of measurement listed in Chapter B of the Annex.

3. Member States shall, with effect from 31 December 1979 at the latest, cease to authorize the use of the units of measurement listed in Chapter C of the Annex.

4. The units of measurement, names and symbols listed in Chapter D of the Annex shall be reviewed before 31 December 1979.

5. The use of the units of measurement temporarily retained in accordance with the provisions of Chapters B, C and D of the Annex may not be made mandatory by Member States where they have not been authorized since 21 April 1973.'

Article 2

The following Article is added to Directive 71/354/EEC:

'*Article 2a*

Member States may authorize the use of products, equipment and instruments using units which are not authorized under this Directive, which were already on the market prior to the dates laid down in this Directive and the manu-

(1) OJ No L 243, 29. 10. 1971, p. 29.
(2) OJ No C 125, 8. 6. 1976, p. 9.
(3) OJ No C 131, 12. 6. 1976, p. 55.

facture, placing on the market and use of products and equipment necessary to complete or replace components or parts of such products, equipment and instruments.'

Article 3

Annexes I and II to Directive 71/354/EEC are replaced by the Annex hereto.

Article 4

1. Member States shall bring into force the laws, regulations and administrative provisions necessary in order to comply with this Directive by 31 December 1977 at the latest and shall forthwith inform the Commission thereof.

2. Member States shall communicate to the Commission the texts of the main provisions of national law which they adopt in the field covered by this Directive.

Article 5

This Directive is addressed to the Member States.

Done at Brussels, 27 July 1976.

For the Council

The President

M. van der STOEL

ANNEX

LIST OF CONTENTS

1.3. Prefixes and their symbols used to designate certain decimal multiples and submultiples

Factor	Prefix	Symbol	Factor	Prefix	Symbol
10^{18}	exa	E	10^{-1}	deci	d
10^{15}	peta	P	10^{-2}	centi	c
10^{12}	tera	T	10^{-3}	milli	m
10^{9}	giga	G	10^{-6}	micro	μ
10^{6}	mega	M	10^{-9}	nano	n
10^{3}	kilo	k	10^{-12}	pico	p
10^{2}	hecto	h	10^{-15}	femto	f
10^{1}	deca	da	10^{-18}	atto	a

The names and symbols of the decimal multiples and submultiples of the unit of mass are formed by attaching prefixes to the word 'gramme' and their symbols to the symbol 'g'.

Where a derived unit is expressed as a fraction, its decimal multiples and submultiples may be designated by attaching a prefix to units in the numerator or the denominator, or in both these parts.

Compound prefixes, that is to say prefixes formed by the juxtaposition of several of the above prefixes, may not be used.

1.4. Special authorized names and symbols

1.4.1. Special names and symbols of decimal multiples and submultiples of SI units

Quantity	Unit		
	Name	Symbol	Value
Volume	litre	l	1 l = 1 dm^3 = 10^{-3} m^3
Mass	metric ton	t	1 t = 1 Mg = 10^3 kg
Pressure, stress	bar	bar	1 bar = 10^5 Pa

1.4.2. Special names and symbols of decimal multiples and submultiples of SI units which may be used only in specialized fields

Quantity	Unit		
	Name	Symbol	Value
Area of farmland and building land	are	a	1 a = 10^2 m^2
Mass per unit length of textile yarns and threads	tex* (1)	tex*	1 tex = 10^{-6} kg · m^{-1}

(1) The character * after a unit name or symbol indicates that these do not appear in the lists drawn up by the CGPM, CIPM, or BIPM. This applies to the whole of this Annex.

Note: The prefixes and their symbols listed in 1.3 may be used in conjunction with the units and symbols contained in Tables 1.4.1 and 1.4.2.

The multiple 10^2 a is, however, called a 'hectare'.

CHAPTER C

UNITS OF MEASUREMENT TO IN ARTICLE 1 (3)

9. IMPERIAL UNITS*

Quantities, names of units, symbols and approximate values

9 1. Length	
hand	1 hand = 0·1016 m
yard	1 yd = 0·9144 m
9 2. Area	
square inch	1 sq in = $6{\cdot}452 \times 10^{-4}$ m²
square yard	1 sq yd = 0·8361 m²
square mile	1 sq mile = $2{\cdot}59 \times 10^{6}$ m²
9.3. Volume	
cubic inch	1 cu in = $16{\cdot}39 \times 10^{-6}$ m³
cubic foot	1 cu ft = 0·0283 m³
cran	1 cran = $170{\cdot}5 \times 10^{-3}$ m³
9.4. Mass	
grain	1 gr = $0{\cdot}0648 \times 10^{-3}$ kg
stone	1 st = 6·35 kg
quarter	1 qr = 12·70 kg
hundredweight	1 cwt = 50·80 kg
ton	1 ton = 1 016 kg
9.5. Force	
pound-force	1 lbf = 4·448 N
9.6. Energy	
British thermal unit	1 Btu = 1055·06 J
foot pound-force	1 ft lbf = 1·356 J
therm	1 therm = $105{\cdot}506 \times 10^{6}$ J
9.7. Power	
horsepower	1 hp = 745·7 W
9.8. Temperature	
degree Fahrenheit	$1\ °F = \left(\frac{5}{9}\right) K$

10. CGS UNITS

Quantities, names of units, symbols and values

Quantity	Unit		
	Name	Symbol	Value
Force	dyne	dyn	1 dyn = 10^{-5} N
Energy	erg	erg	1 erg = 10^{-7} J
Dynamic viscosity	poise	P	1 P = 10^{-1} Pa · s
Kinematic viscosity	stokes	St	1 St = 10^{-4} m² · s^{-1}
Acceleration of free fall	gal	Gal	1 Gal = 10^{-2} m · s^{-2}

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App. 13
barn

11. OTHER UNITS

Quantities, names of units, symbols and values

Quantity	Unit		
	Name	Symbol	Value
Wavelength, atomic distances	ångström	Å	1 Å = 10^{-10} m
Effective cross-sectional area	barn	barn	1 b = 10^{-28} m²
Mass	quintal* (a)		1 quintal = 10^{2} kg
Pressure	standard atmosphere	atm	1 atm = 101 325 Pa
Blood pressure	millimetre of mercury* (conventionally: 1 mmHg)	mmHg*	1 mmHg = 133·322 Pa
Volume (forestry and timber trade)	stere	st	1 st = 1 m³

(a) No international symbol exists.

Note: The prefixes and their symbols listed in 1.3 may be used in conjunction with the units and symbols contained in sections 10 and 11, apart from the 'quintal'.

Appendix 13, Annex a

Extract from:

Bureau International des Poids et Mesures

Le Système International d'Unités (SI)

3rd edition (1977)

TABLEAU 8

Unités en usage avec le Système International

Nom	Symbole	Valeur en unité SI
minute	min	1 min = 60 s
heure [a]	h	1 h = 60 min = 3 600 s
jour	d	1 d = 24 h = 86 400 s
degré	°	$1° = (\pi/180)$ rad
minute	′	$1' = (1/60)° = (\pi/10\,800)$ rad
seconde	″	$1'' = (1/60)' = (\pi/648\,000)$ rad
litre [a]	l	$1\ l = 1\ dm^3 = 10^{-3}\ m^3$
tonne [a]	t	$1\ t = 10^3\ kg$

[a] Le symbole de cette unité est inclus dans la Résolution 7 de la 9e C.G.P.M. (1948). La définition du litre est dans la Résolution 6 de la 12e C.G.P.M. (1964).

TABLEAU 10

Unités à maintenir temporairement avec le Système International

Nom	Symbole	Valeur en unité SI
mille marin [a]		1 mille marin = 1 852 m
nœud		1 mille marin par heure = (1 852/3 600) m/s
ångström	Å	$1\ Å = 0{,}1\ nm = 10^{-10}\ m$
are [b]	a	$1\ a = 1\ dam^2 = 10^2\ m^2$
hectare [b]	ha	$1\ ha = 1\ hm^2 = 10^4\ m^2$
barn [c]	b	$1\ b = 100\ fm^2 = 10^{-28}\ m^2$
bar [d]	bar	$1\ bar = 0{,}1\ MPa = 10^5\ Pa$
atmosphère normale [e] ..	atm	1 atm = 101 325 Pa
gal [f]	Gal	$1\ Gal = 1\ cm/s^2 = 10^{-2}\ m/s^2$
curie [g]	Ci	$1\ Ci = 3{,}7 \times 10^{10}\ Bq$
röntgen [h]	R	$1\ R = 2{,}58 \times 10^{-4}\ C/kg$
rad [i]	rad	$1\ rad = 1\ cGy = 10^{-2}\ Gy$

[a] Le mille marin est une unité spéciale employée en navigation maritime et aérienne pour exprimer les distances. Cette valeur conventionnelle fut adoptée par la Première Conférence Hydrographique Internationale Extraordinaire, Monaco, 1929, sous le nom de « mille marin international ».

[b] Cette unité et son symbole ont été adoptés par le Comité International en 1879 (*Procès-Verbaux CIPM*, 1879, p 41).

[c] Le barn est une unité spéciale employée en physique nucléaire pour exprimer les sections efficaces.

[d] Cette unité et son symbole sont inclus dans la Résolution 7 de la 9e CGPM (1948).

[e] Résolution 4 de la 10e CGPM (1954).

[f] Le gal est une unité spéciale employée en géodésie et en géophysique pour exprimer l'accélération due à la pesanteur.

[g] Le curie est une unité spéciale employée en physique nucléaire pour exprimer l'activité des radionucléides (12e CGPM (1964), Résolution 7).

[h] Le röntgen est une unité spéciale employée pour exprimer l'exposition des rayonnements X ou γ.

[i] Le rad est une unité spéciale employée pour exprimer la dose absorbée de rayonnements ionisants. Lorsque le mot rad peut entraîner une confusion avec le symbole du radian, on peut utiliser rd comme symbole du rad.

Appendix 13, Annex b

Extract from the Minutes of the 1976 Meeting at Stockholm of the Nuclear Data Committee of the OECD Nuclear Energy Agency (NEANDC)

SEN/NEANDC/M(76)1 - 10 -

12. Possible displacement of the 'barn' as the unit of nuclear cross-section

Dr. Cross explained that a recent CEC directive /Council Directive 76/770/EEC/ required member states to cease authorisation of a number of units inconsistent with the SI scheme, among them the barn, as from the end of 1979. The magnitude of most cross-sections was such that the use of international units would be cumbersome : the work of conversion would be enormous, and no clearly useful object would be served. The nuclear physics community had apparently not been consulted.

The Committee agreed that the barn should be retained as the unit of nuclear cross-section, and directed the Chairman to write to the appropriate international bodies (in particular CEC and BIPM) expressing their opposition to any change of cross-section unit. Members should inform their national authorities and physical societies of this resolution, while Dr. Cross should arrange for journal publication of his note about the question.

Appendix 13, Annex c

RESOLUTION
on ANS Publication Policy
Adopted by the Cross Section Evaluation Working Group
October 28, 1976

WHEREAS, the Congress General des Poids et Mesures (CGPM) has developed a system of units known as SI units which is being adopted by the industrial and scientific communities, and has approved the use of certain units in conjunction with SI units in specialized fields such as nuclear engineering; and

WHEREAS, the Publications Committee of the ANS has gone beyond the guidelines of the CGPM, and adopted very restrictive use of SI units, which in our opinion, will adversely affect the nuclear energy field, such as the abandonment of the barn, electron volt and others,

BE IT RESOLVED that the Cross Section Evaluation Working Group (CSEWG), composed of many contributors to ANS publications, which provides much of the nuclear reference data used in the nuclear community, supports the principle of the conversion to SI units as currently defined by the CGPM and communicates their conviction to the Board of Directors of the ANS and its Publication Committee that the adoption of a restrictive definition of the SI system of units and other units which may be used with it in ANS publications is inappropriate and should be reversed.

Sol Pearlstein, Chairman
Brookhaven National Laboratory
Upton, N.Y. 11973

Appendix 13, Annex d

Recommendations on the Status of the Barn by the INDC, May 1977

The Conférence Générale des Poids et Mesures (CGPM) has decided[1], as part of the general adoption of the International System of Units (SI) that the "barn" may be used as a unit of nuclear cross section for an unspecified time but that it should eventually be replaced by the m^2 or by one of the preferred submultiples of the m^2. This decision was originally made in 1969, without consultation with representatives of the nuclear physics and nuclear energy communities most concerned with the use of nuclear cross sections, who became aware of this decision only a few months ago.

The INDC has carefully considered the consequences of the replacement of the barn suggested above. The committee emphasizes that a nuclear cross section - the number of nuclear interactions of a specified type per unit fluence and per target nucleus - is a critical nuclear quantity requiring a special unit. Although a nuclear cross section has the dimensions of area it is not an area.

The barn is a metric unit. The CGPM recognizes the need of special metric units for use along with the SI. A special unit of nuclear cross section would permit use of SI prefixes differing by factors of 10^3, whereas the preferred sub-multiples of the m^2 (except for the cm^2) differ by factors of 10^6. The INDC considers that the barn, which for many years has been used universally as the unit of nuclear cross section, would be the most appropriate unit. The disadvantage that it does not conform to the preferred set of SI sub-multiples is strongly outweighed by its convenience, by the possible consequences of the errors in nuclear reactor calculations that would inevitably result from its replacement and by the considerable economic penalties which would result from the conversion of reactor computer programmes and data files.

Similar conclusions have recently been reached by the Nuclear Energy Agency Nuclear Data Committee, by the Kiev meeting of the Nuclear Reaction Data Centres, by nuclear data committees in the USA and United Kingdom and by other representative bodies.

The INDC recommends that the IAEA support the continued use of the barn ($10^{-28} m^2$) as a special unit of nuclear cross section and inform the appropriate international organizations - particularly the Comité International des Poids et Mesures (CIPM) and the International Standards Organization - of this position.

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(1) Le Système International d'Unités (SI).
Bureau International des Poids et Mesures, Sèvres, France, 1977.

List of Abbreviations used in this Document

CAJaD	Centr po dannym o stroenii atomnogo jadra i jadernykh reakcikh GKAE CCCP (Center for nuclear structure and reaction data of the USSR State Committee of the Utilization of Atomic Energy) at the Kurchatov Institute, Moscow.
CCDN	Centre de Compilation de Données Neutroniques; same as NDCC.
CINDA	A specialized bibiliography and data index on neutron nuclear data operated jointly by NNCSC, NDCC, NDS and CJD. The master file is maintained at NDCC. Publications are made by IAEA.
CINDU	A catalogue of numerical data libraries available from NDS.
CJD	Centr po Jadernym Dannym, the USSR Nuclear Data Center at F.E.I. Obninsk.
CPND	Charged-particle nuclear reaction data.
CSISRS	NNDC's internal Exfor-compatible storage and retrieval system for experimental data, superseding the earlier system SCISRS-1.
EXFOR	Exchange Format, initially developed for the international exchange of experimental neutron nuclear data, then extended to toher nuclear reaction data ("Generalized Exfor").
Four Centers (4C)	The four neutron nuclear data centers NNDC, CCDN, NDS and CJD.
IBJ	Instytut Badan Jadrowych (Institute of Nuclear Research), Warsaw.
INDC	International Nuclear Data Committee.
INIS	International Nuclear Information System, a bibliographic system operated by the IAEA.
Japanese Study Group	Study group for information processing in nuclear physics at the Hokkaido University.
JAERI	Japan Atomic Energy Research Institute.
JNDC	Japanese Nuclear Data Committee
KACHAPAG	Karlsruhe Charged Particle Group, Germany Fed. Rep.
LIJaF	Leningradskij Institut Jadernoj Fiziki, Ak. Nauk SSSR (Leningrad Institute of Nuclear Physics, USSR Acad.Sci.).

NDCC	Neutron Data Compilation Centre (Centre de Compilation de Données Neutroniques - CCDN) of the OECD Nuclear Energy Agency, at Saclay near Paris.
NDP	Nuclear Data Project at Oak Ridge for nuclear structure and decay data.
NDS	IAEA Nuclear Data Section, Vienna.
NNCSC	USA National Neutron Cross-Section Center, since 1977 changed to NNDC.
NND	Neutron Nuclear Reaction Data
NNDC	USA National Nuclear Data Center at the Brookhaven National Laboratory, Upton, N.Y.
NRDC	Nuclear Reaction Data Center
NRDF	Nuclear Reaction Data File System developed by the Japanese Study Group.
"Reaction List"	The bibliography of the Oak Ridge CPND group, now merged with the Oak Ridge Nuclear Data Project. Published in "Atomic Data and Nuclear Data Tables".
"Recent References"	The bibliography of the Oak Ridge Nuclear Data Project for nuclear structure data, including many references on CPND. Published in "Nuclear Data Sheets".
SCISRS-1	The old storage and retrieval system of the Sigma Center, now NNDC.
WRENDA	World Request List for Nuclear Data Determinations
ZAED	Zentralstelle für Atomkernenergie Dokumentation (documentation center for atomic energy) at Kerlsruhe.