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**Memo CP-D/407**

**Date:** 2 August 2004

**To:** Distribution

**From:** O. Schwerer

**Subject:** EXFOR compilation scope

**Reference:** CP-A/156, CP-C/336, CP-D/385, CP-A/151, CP-E/043, CP-C/343

The criteria proposed by Vicki McLane in CP-C/343 (incident-projectile energies up to 1 GeV, incident charged particles from A=1-12, excluding "fundamental" particles) are a suitable basis for discussion. But we must realize that they are not only (as she said herself) arbitrary; they exclude many data already compiled long ago, partly even at NNDC.

This does not mean that this or a similar cut-off for compulsory compilation should not be introduced, but it needs careful consideration, and a few more questions to be answered. The criteria of CP-C/343 are not sufficient for a practical solution.

While I agree that the scope of compulsory compilation needs to be defined more clearly, I agree also with V. McLane that no center needs to stop compilation of any data they want to compile. We just need to find a suitable way to flag such data so centers which are (perhaps only at present) not interested in them can keep them outside their database.

Apart from worrying about the size of the database, my concerns are the following:

- What are the priorities? Should the network more explicitly give priority to low and medium energy data which are needed for applications today?
- What about new dictionary codes and LEXFOR definitions for quantities specific for e.g. high energy data? Who will check their consistency and who will write the appropriate LEXFOR entries? I do not feel that e.g. I myself have the expertise for this.
- What to do with (perhaps) many "borderline" works (e.g. excitation functions from 100 MeV to 10 GeV, or works containing both "normal" and "exotic" quantities). Also, special consideration is needed for "inverse reactions" (e.g. heavy ion projectile on hydrogen target).
- Where is the end? I do agree with Vicki that also the scope of these "additional" data must be defined. There are limits set by the format, the expertise of the compilers, and the needs and expectations of the user community.

- What do we do with data outside the agreed range which are already in the file (see below)? Should they get new accession numbers?

These questions should be answered at the NRDC meeting, so that all centers can compile the data they need within an agreed framework.

### **Data above 1 GeV and heavy ion data already in EXFOR**

NNDC recently excluded some transmitted entries from their database because of high energy or very heavy ion projectiles. This is of course perfectly all right, but for the sake of clarity in the discussion we should remember that the NNDC database contains, since many years, many data for energies  $> 1$  GeV and many data for heavy ions with  $A > 12$ , some of them compiled at NNDC. (This is why I put question marks on these criteria in my earlier memo on this topic, CP-D/385).

Therefore the appearance of high energy and heavy ion data in EXFOR is by no means new (new is only the appearance of "unusual" projectiles such as pions, but there are only a few entries so far). Many years ago, we even introduced linear momentum (MOM) as an alternative to the incident particle energy (EN), given in GEV/C or MEV/C, a representation typical for high energy data.

**The NNDC EXFOR database** (as of 30 July 2004) contains 346 entries with 9620 subentries having data which are totally or partly above 1 GeV.

It also contains data for the following incident heavy ions with  $A > 12$ :

Ne-19,20,22; Mg-24,26; Al-27; Si-28,30; S-32,34; Cl-35,37; Ar-40; Ca-40,44,48; Cr-54; Fe-56,58; Ni-58,60,64; Cu-63; Ge-74,76; Se-82; Kr-84; Sn-112; Xe-129,132,136; N-14,15; Au-197; O-16,17,18; Pb-208; F-17,18,19; U-238

(I used the NNDC database for this search of such data already in our databases, in order to exclude those recently transmitted data which were not added to the NNDC file.)

**Entries compiled at NNDC:** There are 17 neutron data (Area 1) entries (all works before 1977) and 78 CPND (Area C) entries with 417 subentries (some of them compiled in the past years) with energies  $> 1$  GeV. There are many heavy ion data in Area C, including projectiles with  $A > 12$ . As an example, these are some of the entries containing exclusively data for  $A > 12$  projectiles: C0407, C0410, C0422, C0468.

### **Proposal**

Coming back to my proposal of CP-D/385, we could have these 4 categories of data:

**A - Compulsory compilation.** For this, I think Vicki's criteria (1 GeV, projectiles with  $A < 13$ ) can be used.

**B - Voluntary** (lower priority data): Transmitted on regular TRANS files but compilation voluntary. This would include

- data with EN-MIN > 1 GeV. In view of the fact (see above) that many such data are already in the database as part of ordinary transmissions, I am inclined to support F. Chukreev's suggestion to flag them with a special flag e.g. in the BIB record, rather than using a separate Center Identification Character, provided that the quantities are already in the dictionary or can be added without major implications for the system.
- Data for "very heavy" ions ( $A > 12$ ). Same treatment as for high energy data
- Exotic quantities such as Vector and Tensor Polarization data

**C - Separate transmission** (different Center Identification Character) could be introduced for exotic projectiles such as pions, antiprotons etc. I think here this is practical because these projectiles are easy to sort out.

**D - Data not to be compiled in EXFOR** (e.g. nuclear structure data, theoretical data, ...)

It would be understood that

- The network and its coordinator would aim at complete coverage of category A data. (Note that this is already an extension - heavy ions with  $6 < A < 12$  were not completely covered so far.) Categories B and C would be compiled as additions (as it was in the past for all CPND).
- Each center will announce its compilation scope to the network. Also the scope for separate transmissions (category C) must be defined and agreed.
- Those centers compiling data in categories B and C will take the responsibility of proposing new dictionary codes, writing new LEXFOR entries, and checking the correctness and consistency of their compilations. All data must be compatible with the basic format requirements so that they can be processed at NDS the same way as category A data. NDS will check category B and C data only for formal correctness (without obligation to make changes in any programs such as the check program) and will keep and distribute all data transmitted within the agreed scopes of categories A, B and C.

MEMO CP-A/156

27-July-2004

To: **Distribution**  
From: **F.E. Chukreev**  
Subject: **Scope of data compilation (See Memos CP-C/336, CP-D/385, CP-A/151, CP-E/043, CP-C/343)**

*What will be lost, if the EXFOR scope will be limited by the scope, which has been proposed in CP-C/343?*

Let us see first proposal:

- **"Incident charged particles from A=1-12, and excluding "fundamental" particles (pions, kaons, antiprotons, etc.)."**

If particles with A>12 will be excluded, then

- 1.1 We must refuse to help users, which use a little accelerators for material investigations, because heavy ions (Si, S, O etc.) are needed for Rutherford backscattering method. INDC took our attention for the problem, constantly.
- 1.2 We must stop all compilations of the papers, where interactions radioactive nuclei have been investigated, because the experiments use "inverse" geometry. The investigations are very important to solve physical and astrophysical problems. The majority of experimental data, which were measured in "inverse" geometry must not be compiled too.
- 1.3 We must stop all compilations of the papers, where fission of exotic fissioning systems were investigated. But we heard constantly, that physics of fission is most important problem.
- 1.4 I would like to support JCPRG opinion (see item 3 of CP-E-043). Our experience show, that numerical data are available short time only after publication and the data will be lost if good experiments with "fundamental" particles will not be compiled. CAJAD compiled "fundamental" particles data, when the data are presented in the paper together with 'non-fundamental" particles.

Let us see second proposal:

- **"Incident-projectile energies up to 1 GeV."**  
The limit on incident-projectile energies is not suitable. If a limit is needed, then EN-CM must be limited. For example, PR/C,53,347,1996 contains data for interaction of neon-20 (beam energy - 6680 Mev) with hydrogen target. The data are same as 10-Ne-20(p, data for proton energy 334 MeV (Coulomb barrier is negligible for similar energies).

**Technical question for proposed limitation:**

CP-C/343 contains proposal:

*"Any center that wishes to compile the data outside the scope agreed upon should make a proposal and request a new area code. The scope of these areas must also be defined.*

*The following area codes are now free: I, J, K, U, W, X, Y."*

The proposal is *ad hoc* proposal. Today JCPRG and CAJAD can use I and J codes for identification data outside the

scope agreed. But tomorrow somebody will refuse to include in his data collection, for example, tensor polarization data. The "somebody" has the right! Then the seven identification codes will be exhausted very quickly.

Therefore our proposal to use N3 field of SUBENTRY (or N3 of BIB record) is more suitable. For example, **A** in 34 column will designate that EN-CM is larger than 1 GeV. **B** in the column will designate, that EN-CM is larger than 10 GeV etc. 35-th column may be used, for example, to distinguish integral and differential data; 36-th column may be used for mass numbers of beam and target etc. Obviously, our proposal requests additional responsibility from compilers.

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**Memo CP-C/343**

**DATE:** May 3, 2004  
**TO:** Distribution  
**FROM:** V. McLane  
**SUBJECT:** Scope of data compilation (See Memos CP-C/336, CP-D/385, CP-A/151, CP-E/043)

I am making the following proposal on the scope of compilation in the hope that we can get an agreement soon. I suggest we try to agree by June 1, 2004.

Scope of data to be included in normal charged-particle data exchanges:

- Incident charged particles from  $A=1-12$ , and excluding "fundamental" particles (pions, kaons, antiprotons, *etc.*). This break-off is arbitrary, but the break-off should imply that the data are consistently compiled for this  $A$  range. (At present, I have been doing this only up to  $A=7$ ).
- Incident-projectile energies up to 1 GeV.

Any center that wishes to compile the data outside the scope agreed upon should make a proposal and request a new area code. The scope of these areas must also be defined.

The following area codes are now free: I, J, K, U, W, X, Y.

Concerning Otto's point about exotic quantities, this will be taken up in separate memos, as it requires a careful study of the dictionaries and the data already compiled.

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## Memo CP-E/043

**Date:** April 28, 2004  
**To:** Distribution  
**From:** OTSUKA Naohiko and KATO Kiyoshi  
**Subject:** EXFOR compilation scope for charged-particle data  
**Reference:** CP-A/151, CP-C/336 and CP-D/385

The EXFOR compilation scope for charged-particle data was discussed in JCPRG:

- (1) We understand that the EXFOR is unique database as worldwide nuclear reaction data both for the energy field and for the non-energy field.
- (2) The boundary of the “energy field” is being extended. In Japan, GeV is familiar in the energy field. The high intensity 3 GeV proton accelerator (under construction at JAERI) will be used for nuclear transmission studies. BNL-AGS 14.6 GeV/c proton data compiled into EXFOR H library are one of the important starting point to tune transport codes relevant to this project.
- (3) *EXFOR is alive* - EXFOR should be maintained so that it will be useful for our child and grandchild generations. JCPRG hopes to include all charged-particle nuclear reaction data into the EXFOR as long as these data are fit for the EXFOR format.
- (3) We agree to assign new centre identification characters (CIC) for meson induced, high energy, and heavy-ion induced reaction. The implementation of this separation is useful for centres which are not interested in data with such conditions of incoming particle. We hope NDS will maintain entire entries irrespective to CIC.
- (4) On the decision of cutoffs, some cases must be carefully studied, for example,
  - Light particle induced reactions on unstable nuclei which are studied by inverse reactions
  - Excitation functions which contain both lower and higher energies than cutoff energy
- (5) New CIC entries must be well qualified as well as present EXFOR entries. Present rules for code additions should be applied to new CIC entries. Dictionary and LEXFOR must be maintained to enable compilation and checking of new CIC entries by any network centre.

MEMO CP-A/151

15-Mar-2004

To: **Distribution**  
From: **F.E. Chukreev**  
Subject: **MEMOs CP-C/336 and CP-D-385.**

I believe that two axioms are the base of NRDC data exchange:

1. Each Center can compile the data, which are needed for its users.
2. Each Center can save in its collection the data from EXFOR, which are interesting for its area.

I would like to remember, that scope priority changes constantly. Some years ago astrophysical data have lowest priority. Now the data have highest priority. If scope limit from MEMO CP-D/385 will be assumed very interesting data from Nucl. Phys. A658 (1999) 47-66 (see ENTRY A0099) "Systematic experimental survey on projectile fragmentation and fission induced in collisions of 238U at 1 A GeV with lead" will be lost. When similar data will be assumed as needed by all NRDC community, data tables will be lost and we will be forced to scan a little figures again.

Another example:

"Neutron multiplicity distributions for 1.94 to 5-GeV/c proton-, antiproton-, pion-, kaon- and deuteron induced spallation reactions on thin and thick targets." The paper has been published in PR/C,56,1909,1997 and compiled as O0848. The data tables were received from authors for all data. If we refuse to compile all the data now, we will not receive data tables in future, when NRDC community will increase scope for antiproton, kaon and another beams.

**My conclusion: First axiom must be saved.**

But second axiom must be saved too obligatory, of course. In order to save the axiom MEMO CP-D/385 proposed:

- If a centre wished to compile such additional data (permitted by the format but not part of the regular exchange agreement), they should do so using different centre identification characters, and the other centres can then decide whether or not to include these transmissions in their local database. This practice is referred to in memo CP-C/336. As an example, the EXFOR "O" series (by NEA/DB + CAJAD) was originally introduced as a separate medium energy transmission series (in this case, all centres were interested, because the files contained largely "non-exotic" data; however, content and interest have changed lately).

**The proposal is not suitable.**

Why? We have 15 free letter for Centre identification and (may be?) 5 digits only. It is not enough for nuclear physics experiment now.

Therefore, I would like to remember, that NRDC community had a trial for data separation, which was proposed by H. Munzel. He proposed to use free space in SUBENT record to separate the data. Some times ago NRDC refused from the method.

We have ten free space in SUBENT (as minimum). If we return to Munzel proposal we will have distinguish up to 260 data types. Naturally, we must have agreement for coding of data types.

**Obviously, Nuclear Data Section must save all ENTRIES and SUBENTRIES**

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**Memo CP-D/385**

**Date:** 9 March 2004  
**To:** Distribution  
**From:** O. Schwerer

**Subject:** EXFOR compilation scope and priorities

**Reference:** Memo CP-C/336

Over recent months, there has been a proliferation of data compiled in EXFOR that are outside the agreed scope of the NRDC-shared work programme, either by extending the definition of what are charged-particle data or by adding very exotic data types of low priority for our major users. Not all boundaries of the compilation scope of the NRDC have been clearly defined (not felt necessary), but in view of these recent "extensions" and the limited manpower, we believe it is important to set our priorities more clearly. This question will be on the agenda of the NRDC meeting in October 2004. NDS observations and opinions are as follows:

- Not all data permitted by the format are automatically within the scope of NRDC exchange (e.g., originally EXFOR was restricted to data below 20 MeV although the format always permitted entering data of higher energy). The scope will always be determined by the needs of the user community and appropriate decisions by the NRDC to compile particular data types.
- If a centre wished to compile such additional data (permitted by the format but not part of the regular exchange agreement), they should do so using different centre identification characters, and the other centres can then decide whether or not to include these transmissions in their local database. This practice is referred to in memo CP-C/336. As an example, the EXFOR "O" series (by NEA/DB + CAJAD) was originally introduced as a separate medium energy transmission series (in this case, all centres were interested, because the files contained largely "non-exotic" data; however, content and interest have changed lately).
- We believe that examples of data types outside the main scope of EXFOR are (without claiming completeness):
  - ◆ Data for incident particles other than neutrons,  $\gamma$ s, "normal" charged particles (e.g., pions, kaons, antiprotons, etc.) Codes for such particles were introduced for reactions producing them as **product** particles (not projectiles)
  - ◆ High energy data (> 1GeV?)
  - ◆ Heavy ion data (A>12?)
  - ◆ Differential Kerma factors (note that even "integral" kerma factors are not compiled at present; the quantity exists in the dictionary, but occurs only in 1 entry of the EXFOR-V series of evaluated data)

- ◆ Very exotic quantities even if the reaction as such is within the normal scope (e.g., certain parameters for triple-differential polarization data)
- It is stressed that for the addition of any new quantity types, except trivial generalisations, explicit agreement of the core centres is required. This approach represents an implicit mechanism to prevent part of the proliferation of exotic data. Also, any new data types which need major changes of the format or compilation rules must be carefully considered and should only be introduced with good justification.
- We think that the various data types could be categorized into the following four categories:
  - ◆ **Core** data (high priority, compilation obligatory)
  - ◆ **Voluntary** (low priority, compilation voluntary, but can be part of regular transmission; at present, neutron-capture  $\gamma$  spectra fall into this category)
  - ◆ **Separate** transmission (may be compiled but must be sent on separate transmissions with different Centre Identification Character)
  - ◆ **Outside** scope, not to be compiled, because data do not fit to EXFOR format and/or are far from the interests of our user communities.
- A starting point for defining the "core scope" would be the definition used for the coverage completeness exercise for the year 1998 which was agreed upon at the last NRDC meeting: projectiles up to  $\alpha$ , energies up to 1 GeV. However, this should be discussed further and agreed at the next NRDC meeting.
- In the meantime, we ask centres to bear these considerations in mind leading up to the NRDC meeting in October 2004, and ensure they are evaluating priority items. Further debate should occur at this meeting to ensure we can agree all data types and their categories as outlined above.

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**Memo CP-C/336**

**DATE:** February 5, 2004  
**TO:** Distribution  
**FROM:** V. McLane  
**SUBJECT:** Scope of data compilation

According to current agreements, the NRDC exchange is limited to the compilation of neutron, charged-particle, and photonuclear data.

Lately there has been a proliferation of data outside the agreed scope. Also, the definition of charged-particle has greatly expanded. I think it is now necessary to agree on what will be included in charged-particle exchange files. While a center is free to compile such data, not all centers are interested in maintaining files of such data. Other data that a center may wish to compile can be assigned a new Center Identification Character (CIC). When NNDC began compiling data from RHIC, as a test, the data was not included in the exchange files.

The types of data that I feel should be given a new CIC if they are compiled are:

- Data for reactions induced by other particles (pions, kaons, antiprotons, *etc.*);
- Data for very high energies (*e.g.*, 1 GeV);
- Data for heavy ions (*e.g.*, charged-particles with  $A > 12$ ).

The cutoffs I have given are arbitrary, and open for discussion, but I think the principle should be agreed.