Memo 4C-3/182

To: Distribution

From: H.D.Lemmel & K.Okamoto

Subject: Quantity Dictionaries

Reference: Memo 4C-1/93

    1.) NEM - NPR
    2.) NPA (involves Manual update)
    3.) 4PI
    4.) EN-DUMMY

Reference: Memo 4C-1/96

    5.) Binary and ternary fission ratios
    6.) Alfa and eta
    7.) Resonance Parameters
    8.) CMPD-QUANT

1.) <u>NPR — NEM.</u> According to memo 4C-1/93 NNCSC entered for the first time "neutron-production cross-sections"(NPR) into Exfor, aside from "neutron-emission cross-sections"(NEM) existing in Exfor since long. The definitions, according to Cinda, are:

n Production

Definition: The sum cross-section for all processes from which emergent neutrons can be detected, weighted for the number of neutrons produced:

$$\sigma_{nP} = \sigma_{n,n} + \sigma_{n,n'} + 2\sigma_{n,2n} + 3\sigma_{n,3n} + \bar{\nu}\sigma_{n,f} + \ldots \ldots$$

n Emission

Definition: The sum cross-section for all nonelastic processes resulting in neutron emission, weighted for the number of neutrons produced:

$$\sigma_{nM} = \sigma_{n,n'} + 2\sigma_{n,2n} + 3\sigma_{n,3n} + \bar{\nu}\sigma_{n,f} + \sigma_{n,np} + \ldots \ldots$$

Sum rules:

NPR = NEM plus elastic scattering, or

NEM = inelastic scattering plus neutron producing processes
NPR = total scattering plus neutron producing processes.

[Thus, in general, this distinction may come up in all cases where the emitted particle considered equals the projectile. For example, for the neutron-induced gamma-emission cross-section this distinction makes no sense.]

This raises the question how to code these two quantities in REACTION formalism.

Under REACTION the code ((N,N+X),,SIG) has been introduced for NEM, whereas NPR has not yet been considered due to lack of such data.

First question: Are the data which NNCSC entered really to be coded as NPR instead of NEM? Have earlier NEM data been entered correctly or should they rather be coded as NPR? That is to say: does the difference between NEM and NPR really exist within experimental data?

Second question: (if the answer to the first question is "yes"):

How shall these two different sum-reactions be coded?
The following proposals seem possible:

a)   NEM   ⟶ $((N,N+X),,SIG)$ as before

      NPR   ⟶ $((N,N+X),PRD,SIG)$

b)   NEM   ⟶ $((N,N+X),EM,SIG)$

      NPR   ⟶ $((N,N+X),PRD,SIG)$

c)   NEM   ⟶ $((N,INL+N+X),,SIG)$

      NPR   ⟶ $((N,SCT+N+X),,SIG)$

Proposal c) may be the clearest, but so far we did not have the case
of a process-code plus particle codes in SF3.

(Prof. Münzel, do you have similar problems for CPND? If yes, how
would you solve it?)

This discussion should not be related to Cinda where the difference
between NEM and NPR is small enough for coding both, as agreed, under
the single Cinda quantity code NEM.

2.) NPA: Is it really a proper $(n,p\alpha)$ reaction at high projectile energies
which NNCSC wants to code? or rather a light-element reaction on
lithium or boron which should be coded differently since also neutrons
are emitted?

We would like to emphasize again, that such proposals which are not
self-evident should be accompanied with a bibliographic reference
and/or explanation.

Note that introducing NPA requires also updating of the Lexfor page
on "Particle-out Reactions". [This example is easily solved in REACTION
format and may therefore stimulate centres to adopt the REACTION format
at an early date !]

3.) 4PI : We cannot verify NNCSC's remark that the code 4PI had not been
added to Dict. 12 as requested in 4C-1/72. Memo 4C-1/72 was despatched
on 76/2/4 but came through surface mail only. The code 4PI was added
to Dict. 12 on 76/4/14 (see update sheets 229–231) and included in the
subsequent Dictionary transmission of 76/6/9.

4.) EN-DUMMY: Indeed, the change of the EN-DUMMY flag in Dict. 24 from A to
E occurred inadvertently. We would like to apologize for the incon-
venience caused by this error.

5.) Binary and ternary fission ratios: These codes have been changed in
Dict.36 and 41 as proposed in 4C-1/96.

6.) Alfa and eta: When writing memo 4C-1/96 dated 76/10/7 NNCSC apparently
had not yet received our memo 4C-3/176 dated 76/9/23. Our arguments
for coding alfa and eta as given in items 1. and 2. on page 2 still
apply. In particular we feel strongly that the codes ALF and ETA
remain in SF6=Dict.32. We would prefer

$(N,G),,ALF$ or $(N,F),,ALF$ or $(N,G/F),,ALF$ (with G/F in Dict.30)
or $(N,G+F),,ALF$ corresponding to item 1.c) above, respectively

$(N,ABS),,ETA$ when fission is not present, and
$(N,F),,ETA$ when fission is present, since this has the convenient
result that the closely related quantities nu-bar and eta will show
up close together in an index.

7.) <u>Resonance Parameters</u>. We <u>did</u> enter the code RES in the modifier field=Dict.34 as requested by NNCSC, but the examples given by NNCSC in memo 4C-1/96 left-hand column are wrong, since RES slipped in the particle field.

8.) <u>CMPD-QUANT</u>. Agreed. No problems with conversion of CMPD-QUANT codes.