WP 2004-21

Order of SF1, SF2 in REACTION code

Proposal: CP-C/327
Opposition: CP-A/147
Potential compromise proposal: CP-D/371

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Memo CP-C/327

DATE: October 8, 2003
TO: Distribution
FROM: V. McLane
SUBJECT: Order of SF1, SF2 in REACTION code.

In the Manuals, REACTION SF2 is defined as the incident projectile. Since we are now compiling data for heavy ion beams, this definition needs to be updated.

When the incident beam energy is given in the laboratory system, the above definition holds. However, when the incident energy is given in the center-of-mass system an update is needed.

The center-of-mass energy is the relative energy of the center-of-mass of incident beam/target pair, and the data should be the same for an incident beam A and a target B as for an incident beam B and a target A. Therefore, I propose that in this case the lightest particle of the pair should be given in SF2. This also allows for the case where A and B are colliding beams.

An updated LEXFOR entry is attached. The LEXFOR Incident-Projectile Energy entry has been renamed to Incident Projectile.

Incident-Projectile

Where energy is given in the laboratory system, the incident projectile is given in SF2 of the REACTION code.

For energies given in the center-of-mass system, where the energy is the relative energy of the center-of-mass of the incident beam/target pair (or for two colliding beams), the lightest particle is given in SF2 of the REACTION code.

Incident Projectile Energy

The laboratory energy of the incident projectile, or the center-of-mass energy of the incident projectile/target pair is entered in the COMMON or DATA section under the appropriate data heading (*i.e.*, a data heading from Dictionary 24 having an A in column 66).

Compare: **Secondary Particles, Secondary Energy, Center-of-Mass System**.

The wavelength of an incident neutron corresponds to the neutron energy:

$$E(eV) = \frac{hc}{\lambda} = \frac{0.0818}{\lambda\,/\text{Å}}$$

(Angstrom)	E(eV)
1.0	0.0818
1.8	0.0253
2.0	0.0205
4.0	0.0051
6.0	0.0023
10.0	0.0008

It is entered under the data heading WVE-LN with units ANGSTROM.

For data averaged oven an incident-particle spectrum, see **Spectrum Average** for energy specification.

Information on the characteristics of the resolution and the spectrum of the incident-projectile beam is entered in free text under the keyword INC-SPECT. (See EXFOR Manual Chapter 8, INC-SPECT).

Nuclear Quantities

Since there is no incident projectile for nuclear quantities, a 0 (zero) is entered in REACTION SF2. In general, no energy is entered. For nuclear properties such as the **Nuclear Temperature**, for which the incident-projectile energy is not quite irrelevant, the energy may be given in free text but should not be entered in the data table.

MEMO CP-A/147

10-Oct-2003

To: **Distribution**
From: **F.E. Chukreev**
Subject**: about MEMO CP-C/327**

MEMO CP-C/327 proposed to change our old rule, that SF1 is target, SF2 is beam. I believe, that proposed new rule is unacceptable.

The old rule gives possibility for the presentation of nuclear reaction, as it is assumed in scientific literature by authors. The old rule gives to our users possibility to see used beam and target without any additional comments.

I would like to take your attention, that a change the beam by target can produce another experimental data. For example, A0228002 (He-3 is target, D is beam) and A0228003 (D is target, He-3 is beam) give different results for screening potential of D+He-3 interaction.

If new rule will be assumed, then very much correction will be needed for old entries with light nuclides.

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Memo CP-D/371

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

Subject: Order of SF1, SF2 in REACTION code

Reference: CP-C/327, CP-A/147

There seems to be a difference of opinion on the coding of REACTION SF1 and SF2 in cases where the projectile is heavier than the target.

I agree with the argument that it does make sense to conserve the information about the actual target/projectile constellation within the REACTION code. On the other hand, identical data should be retrievable in one go.

As an alternative (or compromise) I suggest the following:

1. By default, the actual target / projectile must always be coded in the REACTION.

2. If the projectile is heavier than the target, and reversing SF1 and SF2 does not change the numerical data given in the particular subentry (e.g. cross section measured in CM system), then - and only then - the second "spelling" of the reaction will be given using the "tautology" formalism:

   ((A(B,C)D,,SIG)=(B(A,C)D,,SIG)) with B being heavier than A.

   Therefore:
   The REACTION describing the actual experimental constellation is coded first.
   If the target is anyway heavier than the projectile, no tautology should be given.