LEXFOR "Multiple Reaction Formalism"
(N. Otsuka, 2022-05-25, Memo CP-D/1048)

This paper seeks an approval to revision of LEXFOR "Multiple reaction formalism" to clarify when we can use the formalism for production cross sections defined by the same REACTION SF1 and SF4.

LEXFOR "Multiple Reaction Formalism" gives the following example as a legal use of the formalism:

Multiple Reaction Formalism

At present, the following classes of data may be coded using Multiple Reaction Formalism8 (compare EXFOR Formats Manual Chapter 6). In all cases, SF1 and SF2 of the REACTION string must be the same. See Example on following page.

…

4. Data measured simultaneously for the production of specific particles or nuclides <u>where the author has assigned values to given reactions based on systematics or theoretical considerations</u>.

Examples:
```
REACTION  1(…(P,2N)…)
          2(…(P,3N)…)
          3(…(P,4N)…)

REACTION  1(…(N,A)…)
          2(…(N,NA)…)
```

I think the underlined part is routinely forgotten by us.

Example of legal use (EXFOR A0068.064)

```
SUBENT        A0068064   20210628
BIB                4          11
REACTION  1(24-CR-52(P,N)25-MN-52,,SIG,,,DERIV)
          2(24-CR-52(P,2N)25-MN-51,,SIG,,,DERIV)
          P(24-CR-52(P,X)24-CR-51,,SIG)
ANALYSIS   Cr.section was derived by separation of the measured
           neutron spectra by using the statistical model with
           adjusted level density parameters of the
           Fermi gas model.
STATUS     (TABLE) Tbl. II from Yad.Fiz.,39(1984)264
           (DEP,A0068009)
HISTORY    (20200331T) SD: From A0271.003.
           (20210628A) SD: SF3=X -> N in REACTION (1) code.
ENDBIB            11
NOCOMMON           0          0
DATA               3          1
DATA      1DATA      2DATA      P
MB         MB         MB
  431.       188.        352.
ENDDATA            3
ENDSUBENT         19
```
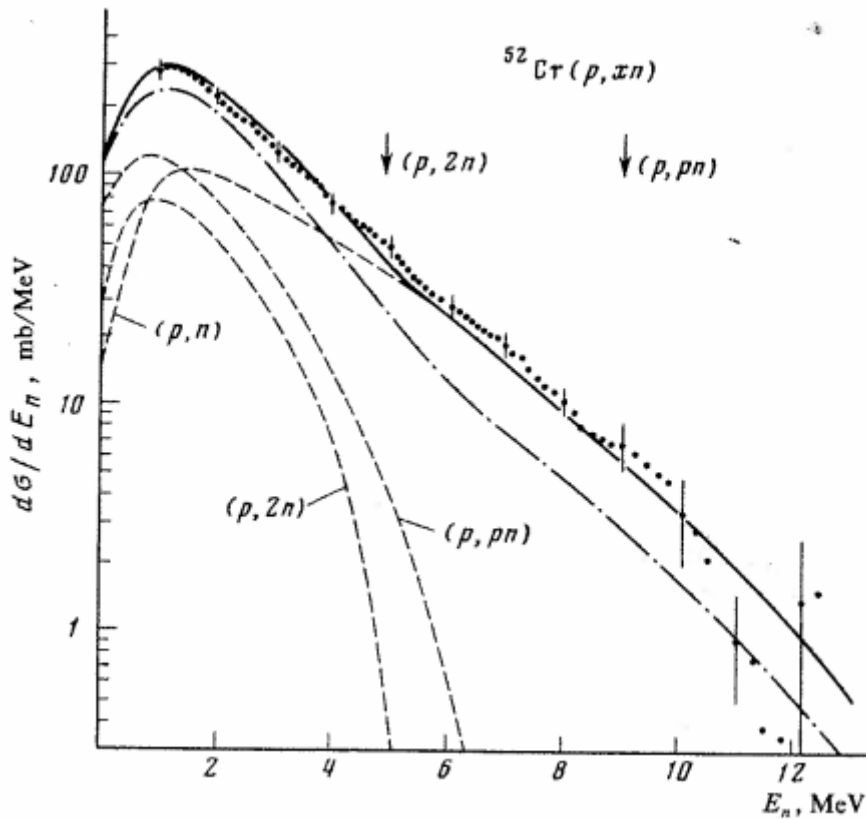
Fig.2 of B.V. Zhuravlev et al., Sov.J.Nucl.Phys.**39**(1984)164 shows these cross sections were derived by decomposition of the (p,xn) neutron spectrum, and we see a reason to compile the set of the cross sections in the multiple reaction formalism.

I would like to remind the condition when we can use the multiple reaction formalism, and propose the following revision of the example:

Multiple Reaction Formalism

…

4. Data measured simultaneously for the production of specific particles or nuclides where the author has assigned values to given reactions based on systematics or theoretical considerations.

Examples:
```
REACTION  1(24-CR-52(P,2N)25-MN-52,,SIG,,,DERIV)
          2(24-CR-52(P,3N)25-MN-51,,SIG,,,DERIV)
ANALYSIS   Derived by decomposition of the measured (p,xn) spectra
           by using the statistical model

REACTION   1(…(N,A)…)
           2(…(N,NA)…)
```