Branch Codes IND, CUM, M+ and M-

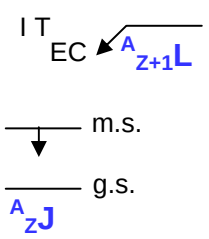
(N. Otsuka, 2013-04-15, CP-D/783 Rev.)

The usages of branch codes to indicate contributions of precursors (`IND`, `CUM`, `M+`, `M-`) are explained in LEXFOR "Independent and Cumulative Data".

When a nuclide ^{A}J has an isomer, the cross section derived by observation of the ground state of nuclide ^{Ag}J (e.g., detection of β delayed gamma from ^{Ag}J) is

$$\sigma_{obs}\,(^{Ag}\mathrm{J}) = \sigma_{dir}(^{Ag}\mathrm{J}) + a\,\sigma_{dir}(^{Am}\mathrm{J}) + \Sigma_i\, b_i\,\sigma_{pre,i}\ ,$$

where "dir" is for the cross section for direct production of the nuclide wihtout decay, and "pre,*i*"is for contribution of the precursor *i* which may decay to ^{Ag}J. The figure shows a β^{+}+EC decay precusour ^{A}L contributes to the 3rd term. For simplicity we assume there is only one precursor, and



$$\sigma_{obs}\,(^{Ag}\mathrm{J}) = \sigma_{dir}(^{Ag}\mathrm{J}) + a\,\sigma_{dir}(^{Am}\mathrm{J}) + b\,\sigma_{pre}.$$

The coefficient *a* and *b* may depend on decay data ($T_{1/2}$, IT transition probability etc.) as well as measurement condition like cooling time. Combinations of SF4 and SF5 are summarized below for various conditions for *a* and *b*:

	***a*=0**	**0<*a*<1**	***a*=1**	***a*=?**	**No *a***
***b*=0**	`Z-S-A-G,IND`	`Z-S-A-G,IND/M+`	`Z-S-A,IND`	`Z-S-A-G,(M)`	`Z-S-A,IND`
0<*b*≤1	`Z-S-A-G,CUM/M-`	`Z-S-A-G,CUM`	`Z-S-A,CUM`	`Z-S-A-G,CUM`	`Z-S-A,CUM`
***b*=?**	`Z-S-A-G,(CUM)/M-`	`Z-S-A-G,(CUM)/M+`	`Z-S-A,(CUM)`	`Z-S-A-G,(CUM)`	`Z-S-A,(CUM)`
No b	`Z-S-A-G`	`Z-S-A-G,M+`	`Z-S-A`	`Z-S-A-G,(M)`	`Z-S-A`

=0: Contribution is excluded (*e.g.*, subtraction of its contribution, short cooling time, decay-curve analysis, on-line separation etc.)

=1: Full contribution is expected (*e.g.*, 100% branching ratio to ^{Ag}J, long cooling time, $T_{1/2}(^{Ag}\mathrm{J}) >> T_{1/2}(^{Am}\mathrm{J})$ or $T_{1/2}$ (^{A}L) etc.)

No: ^{A}J is physical shielded from ^{Am}J or ^{A}L (*e.g.*, stable state, no decay branch to ^{Ag}J, $T_{1/2}(^{Ag}\mathrm{J}) << T_{1/2}(^{Am}\mathrm{J})$ or $T_{1/2}$ (^{A}L)).

<u>Proposed corrections to LEXFOR "Independent and Cumulative Data"</u>

1. Addition of the above table.

2. Corrections to the explanation of `(CUM)` and `(M)`.
   The current LEXFOR explanation is inconsistent with dictionary 31, and I would believe the parenthesized codes will be more useful if we define `(CUM)` and `(M)` as above. The corresponding expansions in dictionary 236 should be corrected so that they are consistent with the expansions in dictionary 31.

Branch Code	Definition
...	*...*
(CUM)	*Uncertain if the formation via radioactive decay and isomeric transition are included.*
...	*...*
(M)	*Uncertain if the formation by partial feeding via isomeric transition is included.*