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Memo CP-D/748

Date: 11 June 2012
To: Distribution
From: N. Otsuka
Subject: **CRL (correlation) and COR (angular correlation)**
Reference: WP2001-7, CP-D/429

The parameter code CRL (correlation) and COR (angular correlation) have been often used to compile quantities labeled “correlation” by authors without deep consideration of their real definition. Discussion on this problem is seen in WP2001-7. The code COR is now obsolete, and now used in only one entry (O0011). All DA/CRL quantity codes are also obsolete as reminded in Memo CP-D/429. Some CRL quantity codes are not obsolete, but I found many of them can be replaced with more appropriate existing quantity code. Corrections are proposed at the end of this memo. We also should remember that CRL was recently discussed as a typical encrypted EXFOR code [1] and should remove and avoid it.

An open question about CRL for me is coding of fission yields FY ($A_L, Z_L; A_H, Z_H$) measured by J.H. Hamilton (Vanderbilt Univ., Nashville) et al. by detection of prompt gammas by gamma sphere. All CRL data sets in are 1 (EXFOR 13599, 13648, 13698, 13747, 13749, 13751, 13807) are from this group. To distinguish from normal fission yields FY(A,Z), e.g.,

(98-CF-252(0,F)ELEM/MASS,IND,FY)

Hamilton’s yield FY(A_L, Z_L, A_H, Z_H) has been coded with

(98-CF-252(0,F)ELEM/MASS,IND,FY/CRL,LF/HF)

with A_L and A_H under MASS1 and MASS2, and Z_L and Z_H under ELEM1 and ELEM2. A coding sample (EXFOR 13599.002) is shown below:

SUBENT	13599002	20030107	
BIB	3	5	
REACTION	(98-CF-252(0,F)ELEM/MASS,IND,FY/CRL,LF/HF) Yield of correlated fragment pairs.		
...			
COMMON	4	3	
ELEM1	ELEM2	MONIT1	MONIT2
NO-DIM	NO-DIM	PC/FIS	PC/FIS
40.	58.	1.0	2.2
ENDCOMMON	3		
DATA	4	14	
MASS1	MASS2	DATA	DATA-ERR
NO-DIM	NO-DIM	PC/FIS	PC/FIS
98.	146.	0.04	0.01
98.	148.	0.04	0.01
...			

A further exclusive quantity $FY(A_L, Z_L, A_H, Z_H; A_{LCP}, Z_{LCP})$ is newly compiled in 14331 in PRELIM.1379. For example $LCP=^4\text{He}$ case is coded as below

SUBENT	14331002	20120407	
BIB	3	3	
REACTION	(98-CF-252(0,F)ELEM/MASS,TER,FY/CRL,A)		
...			
COMMON	2	3	
ELEM1	ELEM2		
NO-DIM	NO-DIM		
58.0	38.0		
ENDCOMMON	3	0	
DATA	4	9	
MASS1	MASS2	DATA	DATA-ERR
NO-DIM	NO-DIM	PC/FIS	PC/FIS
146.0	98.0	0.06	0.02
148.0	95.0	0.08	0.02
...			

Two and three fragments are identified in coincidence in these two examples, but the relation is not clearly seen in two REACTION codes in 13599.002 and 14331.002.

If we want to have a quick solution for 14331.002 which is consistent with 13599.002, coding of three fragments (LF, HF and A) in SF7 would be a better solution, for example

(98-CF-252(0,F)ELEM/MASS,TER,FY/CRL,LF/HF/A)

. Another possible solution without CRL could be use of a new branch code (say, COI) in SF5. For example,

1. Independent yield where one (Z,A) is specified:

(98-CF-252(0,F)ELEM/MASS,IND,FY)

2. Independent yield where two (Z,A) are specified (e.g., 13599.002):

(98-CF-252(0,F)ELEM/MASS,IND/COI,FY)

3. Independent yield where three (Z,A) are specified (e.g., 14331.002);

(98-CF-252(0,F)ELEM/MASS,IND/TER/COI,FY)

Namely, COI explains two or more particles/nuclides detected in coincidence are coded for ELEM and/or MASS in SF4. It is also a question whether or not we should code COI when both fragment masses are given for primary fragments (sum of two masses is equal to the compound mass).

Reference

[1] S. Simakov, EXFOR difficulties, INDC(NDS)-0614, p14 (2012).

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Proposed corrections to CRL and COR entries (2012-05-18)

Subentry	REACTION (Current)	Remark
13599.002	98-CF-252(0,F)ELEM/MASS,IND,FY/CRL,LF/HF	(for discussion in this memo)
13599.003	98-CF-252(0,F)ELEM/MASS,IND,FY/CRL,LF/HF	(for discussion in this memo)
13648.002	98-CF-252(0,F)ELEM/MASS,IND,FY/CRL,LF/HF	(for discussion in this memo)
13648.003	98-CF-252(0,F)ELEM/MASS,IND,FY/CRL,LF/HF	(for discussion in this memo)
13648.004	98-CF-252(0,F)ELEM/MASS,IND,FY/CRL,LF/HF	(for discussion in this memo)
13648.005	98-CF-252(0,F)ELEM/MASS,IND,FY/CRL,LF/HF	(for discussion in this memo)
13648.006	98-CF-252(0,F)ELEM/MASS,IND,FY/CRL,LF/HF	(for discussion in this memo)
13698.002	98-CF-252(0,F)ELEM/MASS,TER,FY/CRL,LF/HF	(for discussion in this memo)
13698.003	98-CF-252(0,F)ELEM/MASS,IND,FY/CRL,LF/HF	(for discussion in this memo)
13698.004	98-CF-252(0,F)ELEM/MASS,IND,FY/CRL,LF/HF	(for discussion in this memo)
13698.005	98-CF-252(0,F)ELEM/MASS,IND,FY/CRL,LF/HF	(for discussion in this memo)
13698.006	98-CF-252(0,F)ELEM/MASS,IND,FY/CRL,LF/HF	(for discussion in this memo)
13747.002	94-PU-242(0,F)ELEM/MASS,SEC,FY/CRL,,REL	(for discussion in this memo)
13747.003	94-PU-242(0,F)ELEM/MASS,SEC,FY/CRL,,REL	(for discussion in this memo)
13749.002	98-CF-252(0,F)ELEM/MASS,IND,FY/CRL,LF/HF	(for discussion in this memo)
13751.002	98-CF-252(0,F)ELEM/MASS,IND,FY/CRL,LF/HF	(for discussion in this memo)
13751.003	98-CF-252(0,F)ELEM/MASS,TER,FY/CRL,LF/HF	(for discussion in this memo)
13751.004	98-CF-252(0,F)ELEM/MASS,TER,FY/CRL,LF/HF	(for discussion in this memo)
13807.002	98-CF-252(0,F)ELEM/MASS,PRE,FY/CRL,LF/HF	(for discussion in this memo)
20220.007	6-C-12(N,INL)6-C-12,PAR,DA/CRL,G/N,REL	(6-C-12(N,INL)6-C-12,PAR,DA/DA,G/N,NCP) / (6-C-12(N,INL)6-C-12,PAR,DA); E->E-LVL; Add ANG-AZ= 0 or 90 deg.
22152.010	92-U-235(N,F)MASS,PRE,KE/CRL,LF/HF,MXW	Use PRE,KE,LF+HF,MXW
22461.003	98-CF-252(0,F),TER,DA/CRL,G/A,RSD	Superseded by 22461.005?
22461.005	98-CF-252(0,F),TER,DA/CRL,G/A,RSD	Use 2-HE-4,TER,DA,G+FF,RSD
22461.006	98-CF-252(0,F)ELEM/MASS,TER,DA/CRL,G/LCP,RSD	Use ELEM/MASS,TER,DA,G+FF,RSD

22461.008	98-CF-252(0,F),TER,DA/CRL,G/A,LEG/RS	Use 2-HE-4,TER,DA,G+FF,LEG/RSD
22461.009	98-CF-252(0,F)ELEM/MASS,TER,DA/CRL,G/LCP,LEG/RS	Use ELEM/MASS,TER,DA,G+FF,LEG/RSD
22464.012.1	92-U-235(N,F),PR,KE/CRL,N/HF,MXW	For future discussion
22464.012.2	92-U-235(N,F),PR,KE/CRL,N/LF,MXW	For future discussion
23012.005	94-PU-239(N,F)MASS,PRE,KE/CRL,LF/HF,MXW	Use PRE,KE,LF+HF,MXW
23014.002	92-U-233(N,F)MASS,PRE,KE/CRL,LF/HF,MXW	(same)
23014.003	92-U-235(N,F)MASS,PRE,KE/CRL,LF/HF,MXW	(same)
30521.002.H	(92-U-235(N,F)ELEM/MASS,TER,FY/CRL,LCP/HF,MXW) / (92-U-235(N,F)2-HE-4,TER,FY/CRL,A/HF,MXW)	Use TER,FY,,MXW/MS for both numerator and denominator
30521.002.L	(92-U-235(N,F)ELEM/MASS,TER,FY/CRL,LCP/LF,MXW) / (92-U-235(N,F)2-HE-4,TER,FY/CRL,A/LF,MXW)	(same)
30521.002.R	(92-U-235(N,F)ELEM/MASS,TER,FY/CRL,LCP/LF,MXW) / (92-U-235(N,F)ELEM/MASS,TER,FY/CRL,LCP/HF,MXW)	(same)
30544.003	92-U-235(N,F),PR/PAR,DA/CRL,N/N	Use PR/PAR,DA,N+N,,REL
30916.006	98-CF-252(0,F),PRE/TER/PAR,FY/CRL,A/FF,REL	Use PRE/TER,FY/TKE,A,REL
E1974.003	96-CM-248(P,F)MASS,PRE,KE/CRL,LF/HF	Use PRE,KE,LF+HF
E2089.002.2	92-U-238(P,F)MASS,PRE,KE/CRL,LF/HF	Use PRE,KE,LF+HF
L0101.002	92-U-238(G,F)MASS,,KE/CRL,LF/HF,BRA	Use ,KE,LF+HF,BRA
M0035.011	2-HE-4(G,N+P)1-H-2,,DA/CRL,N/P,BRA	Use ,DA,N+P,BRA/REL
M0035.014	2-HE-4(G,N+P)1-H-2,,DA/CRL,P/D,BRA	Use ,DA,P+D,BRA/REL
M0035.017	2-HE-4(G,N+P)1-H-2,,DA/CRL,N/D,BRA	Use ,DA,N+D,BRA/REL
O0011.002	90-TH-232(P,F),,COR,FF/FF,,EXP	Use ,DA/DA,FF/FF+FF; ANG -> ANG-RL; add ANG=90 deg
O0011.003	90-TH-232(P,F),,COR,FF/FF,,EXP	(same)
O0011.004	90-TH-232(P,F),,COR,FF/FF,,EXP	(same)
O0011.005	90-TH-232(P,F),,COR,FF/FF,,EXP	(same)
O0011.006	90-TH-232(D,F),,COR,FF/FF,,EXP	(same)
O0011.007	90-TH-232(D,F),,COR,FF/FF,,EXP	(same)
O0011.008	90-TH-232(D,F),,COR,FF/FF,,EXP	(same)
O0011.009	90-TH-232(D,F),,COR,FF/FF,,EXP	(same)

O0011.010	92-U-233(A,F),,COR,FF/FF,,EXP	(same)
O0011.011	92-U-233(P,F),,COR,FF/FF,,EXP	(same)
O0011.012	90-TH-232(A,F),,COR,FF/FF,,EXP	(same)
O0011.013	90-TH-232(A,F),,COR,FF/FF,,EXP	(same)
T0117.003	6-C-12(7-N-14,D+A)10-NE-20,PAR,DA/CRL,D/A,REL	Use ISP/PAR,DA/DA,D/D+A,REL