Memo CP-D/737

Date:	4 April 2012
To:	Distribution
From:	N. Otsuka

Subject: **Charge and mass conservation in REACTION**

I was informed by Sandor Takács that the projectile of the following subentries must be alpha particles, or sample target must be tellurium (Z=52):

O1582.002	(51-SB-0(D,X)53-I-124,,TTY,,DT)
O1582.003	(51-SB-0(D,X)53-I-123,,TTY,,DT)
O1582.004	(51-SB-0(D,X)53-I-125,,TTY,,DT)
O1582.005	(51-SB-0(D,X)53-I-126,,TTY,,DT)

Because of the charge conservation law, we cannot produce iodine isotopes by irradiation of ^{nat}Sb by deuteron beam at 20 MeV. Finally we found that the article gives these data sets for *alpha*-induced reactions.

Motivated by his comment, I searched REACTION satisfying the following conditions:

1. $Z_{fin,tot} > Z_{proj} + Z_{targ}$

     Example (22933.002): (43-TC-99(N,X)44-RU-100,,SIG)

     Note that this is allowed above the meson production threshold.

2. $Z_{fin,tot} \neq Z_{proj} + Z_{targ}$ (for REACTION specifying all particles/nuclides in SF3-SF4)

     Example (10375.002): (82-PB-0(N,EL)92-U-0,,DA)

3. $A_{fin,tot} > A_{proj} + A_{targ}$

     Example (A0468.002.5): (24-CR-50(A,X)25-MN-56,,TTY)

4. $A_{fin,tot} \neq A_{proj} + A_{targ}$ (for REACTION specifying all particles/nuclides in SF3-SF4)

     Example (10107.002): (14-SI-0(N,INL)14-SI-28,PAR,DA)

     Example (D0164.004): (34-SE-0(P,2N)35-BR-77,,SIG)

where $Z_{fin,tot}$ and $A_{fin,tot}$ are the sums of charge and mass numbers coded in the final channel. It would be useful if checking programs can perform a similar test.

A list is appended for the 1st to 3rd items. I could not analyze all cases for the 4th item, but two examples above show typical situations. Without checking articles carefully, it is impossible to know whether data are for a natural sample or enriched sample.

1. The total charge in the final channel exceeds $Z_{proj}+Z_{targ}$ (Subentries indicated with * are not erroneous.)

Subentry	REACTION	Remark
22836.002	`(83-BI-209(N,X)84-PO-210,,SIG,,SPA)`	SF3: `X` → `G`, SF4: `84-PO-210` → `83-BI-210-G`
22933.002	`(43-TC-99(N,X)44-RU-100,,SIG)`	Delete this entry. No reaction data given (decay constant)
23058.005	`(90-TH-232(N,X)91-PA-233,,SPC)`	Delete this entry. No reaction data given (delayed gamma intensity)
22603.006.1	`(64-GD-160(N,X)65-TB-161,CUM,SIG,,MXW)`	SF3: `X` → `G`, SF4: `65-TB-161` → `64-GD-161`, SF5: Delete `CUM`.
22603.006.2	`(64-GD-160(N,X)65-TB-161,CUM,SIG,,MXW,DERIV)`	SF3: `X` → `G`, SF4: `65-TB-161` → `64-GD-161`, SF5: Delete `CUM`.
*A0427.002	`(23-V-0(P,X)25-MN-52,CUM,SIG)`	Compiled as given in Table 1. Ep=800 MeV
*A0461.002.3	`(79-AU-197(D,X)81-TL-196-M/G,,SIG/RAT)`	The compiler mentions the point under `COMMENT`. Ep=7.3 GeV
C0347.019	`(53-I-127(P,X)55-CS-127,,SIG)`	`DATA` → `DATA-MAX`
*J1484.007	`(1-H-1(KN,X)1-KP-0,,DA/DP)`	Compiled as given in Fig.5. p_{K^-} = 1.65 GeV/c
O0418.026	`(29-CU-0(PIN,X)29-CU-61,CUM,SIG)`	SF5: `CUM` → `IND` (E_π->50 MeV)
*O0542.054	`(29-CU-0(P,X)31-GA-65,,SIG)`	The compiler mentions the point under `COMMENT`. Ep=3.9 GeV
*O0542.055	`(29-CU-0(P,X)31-GA-66,,SIG)`	The compiler mentions the point under `COMMENT`. Ep=3.9 GeV
*O0542.056	`(29-CU-0(P,X)32-GE-69,,SIG)`	The compiler mentions the point under `COMMENT`. Ep=3.9 GeV
O1582.002	`(51-SB-0(D,X)53-I-124,,TTY,,DT)`	SF2: `D` → `A`
O1582.003	`(51-SB-0(D,X)53-I-123,,TTY,,DT)`	SF2: `D` → `A`
O1582.004	`(51-SB-0(D,X)53-I-125,,TTY,,DT)`	SF2: `D` → `A`
O1582.005	`(51-SB-0(D,X)53-I-126,,TTY,,DT)`	SF2: `D` → `A`
*O1665.003.2	`(90-TH-232(P,X)92-U-230,,TTY,,DT,CALC)`	Yield derived from ^{230}Pa yield. Is this allowed?

2. The total charge in the final channel is not equal to $Z_{proj}+Z_{targ}$

Subentry	REACTION	Remark
10375.002	`(82-PB-0(N,EL)92-U-0,,DA)`	SF4: `92-U-0` → `82-PB-0`
11321.010	`(74-W-0(N,EL)56-BA-0,,DA)`	SF4: `56-BA-0` → `74-W-0`
O1117.002	`(18-AR-40(PIP,5P)13-AL-35,,SIG)`	SF4: `13-AL-35` → `14-SI-35` ?
O1117.012	`(18-AR-40(PIP,6P)12-MG-34,,SIG)`	SF4: `12-MG-34` → `13-AL-34` ?

3. Sum of mass numbers in the final channel exceeds $A_{proj}+A_{targ}$

Subentry	REACTION	Remark
A0468.002.5	`(24-CR-50(A,X)25-MN-56,,TTY)`	Impossible reaction. Contribution of another Cr target isotope?
O1582.013	`(52-TE-124(D,X)53-I-131,,TTY,,DT)`	Impossible reaction. Contribution of another Te target isotope?