

## Thick Target Production Yield in Charged-Particle Induced Reaction

(N. Otsuka, 2013-04-19, CP-D/785)

There are two conventions in normalization of the thick target production (*e.g.*, neutron) yields:

- $Y_1$ : number of products per incident particle (*e.g.*, 1 neutron/1 inc. proton)
- $Y_2$ : number of products per incident charge (*e.g.*, 1 neutron/1  $\mu\text{Coulomb}$ )

The second convention is more convenient for people who want to calculate yields from the beam current available at the facility.

These two normalizations are related by a simple (projectile type dependent) constant:

$$Y_2 = Y_1 / (Ze),$$

where  $Z$  is the ionization charge state of the projectile and could be different from the atomic number of the projectile. Currently they are distinguished in both REACTION code and web quantity code levels.

**Example:** Thick target neutron production yield in  $^{209}\text{Bi}+p$  reaction

	REACTION code	Web quantity	Unit code
$Y_1$	(83-BI-209(P,X)0-NN-1,,PY,,TT)	PY	PRD/INC
$Y_2$	(83-BI-209(P,X)0-NN-1,,TTY/PY)	TT	PRD/MUCOUL

There are several disadvantages due to this differentiation:

- Users should specify two web quantities PY and TT to receive a complete set of data sets;
- REACTION SF6=TTY and Web quantity= TT applied to  $Y_2$  are also used for thick target radioisotope activity  $A$  (*e.g.*, Bq/  $\mu\text{Coulomb}$ ), for example, (42-MO-0(P,X)43-TC-99-M,,TTY) - Saturated activity of  $^{99m}\text{Tc}$ .

I would like to propose the following two changes:

1. Web quantity:  
Apply PY to both  $Y_1$  and  $Y_2$  while apply TT to thick target induced activity.
2. REACTION code (SF5-SF8):  
Apply ,PY, ,TT for both  $Y_1$  and  $Y_2$ .

If we still need to differentiate  $Y_1$  and  $Y_2$ , I want to see very similar code, *e.g.*, ,PY, ,TT for  $Y_1$ , and ,PY, ,XX/TT for  $Y_2$ , where a new modifier xx stands for “per electric charge”.

**Examples with proposed new rules** (modified parts are underlined>:

	REACTION code	Web quantity	Unit code
$Y_1$	(83-BI-209(P,X)0-NN-1,,PY,,TT)	PY	PRD/INC
$Y_2$	(83-BI-209(P,X)0-NN-1,, <u>PY</u> ,,TT) or (83-BI-209(P,X)0-NN-1,, <u>PY</u> ,, <u>XX/TT</u> )	<u>PY</u>	PRD/MUCOUL
$A$	(42-MO-0(P,X)43-TC-99-M,,TTY)	TT	MBQ/COUL

I can volunteer to make retroactive corrections for entries maintained by other centres.