

Japan Charged-Particle Nuclear Reaction Data Group

Division of Physics, Graduate School of Science
Hokkaido University
060-0810 Sapporo, JAPAN

E-mail: nrdf@jcprg.org
Internet: <http://www.jcprg.org/>

Telephone +81(JPN)-11-706-2684
Facsimile +81(JPN)-11-706-4850

Memo CP-E/044

Date: June 11, 2004
To: Distribution
From: OTSUKA Naohiko
Subject: Quantities and units for thick/thin target yields
Reference: CP-C/334, CP-C/340, CP-C/344, CP-D/397

I appreciate the addition of codes with “TT” into the table of CP-D/397. I would like to propose further small corrections.

General remarks

- First, let us confirm the dimension codes for thick target quantities because the definition for double differential quantities are contradicted among memos.

| Types of data compiled (CP-C/334) | | 1 | d/dA | d/dE | d ² /dA/dE |
|--------------------------------------|----------------------------------------|-----|-------|-------|-----------------------|
| 1)Saturated thick/thin-target yield | | TTY | TDA | TDE? | TD2 |
| 2)Production thick/thin-target yield | | TTT | TTDA | TTTE | |
| 3)Physical thick/thin-target yield | | | | | |
| 4a)Thick target product yield | as a function of incident beam number | YLD | 1 / A | 1 / E | 1 / AE |
| 4b)Thick target yield multiplicity | as a function of incident beam current | PYT | PYTA | | PYT2 |

- Expansions are little different between CP-C/334 and CP-C/344. For example, “ , TTY / PY ” is “Thick target product yield” in CP-C/334, but “*Saturated* thick/*thin* target product yield” in “CP-C/344”. I prefer to use the same expansions both in LEXFOR and in the dictionary if the differences are meaningless. In the tables shown below, I assume that the terminology of newer memo CP-C/344 is correct, and I add “Saturated” and “/thin” for some codes. These words should be added to the draft of LEXFOR (CP-C/334) if we need them, otherwise “Saturated” and “/thin” should be removed from the expansions of codes proposed below.
- In the table below, some pairs have same expansions, e.g. both “ , PY , TT ” and “ , TTY / PY ” are expanded as “Saturated thick/thin target product yield. Additional explanation (e.g. “as a function of incident beam number/current”) may be needed.

- “PY, ,DT” is not defined in LEXFOR, so I do not know the correct dimension code for it (now YLD).
- No correction is made for *thick target cross section* and its differentials, because I do not understand the definition of thick target cross section.

**Tables from CP-C/344 with
comments by NDS (in *red bold italic*)
and comments by JCPRG (in *green bold italic*)**

Quantity Dictionary

These were found on database or recently proposed.

| | | |
|--------------------------|------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| (CUM) , TTY | TTY | Saturated <i>thick/thin</i> target yield (assumed cumulative) |
| (M) , TTY | TTY | Saturated <i>thick/thin</i> target yield (uncert. if isom. trans. incl) |
| , TTY | TTY | Saturated thick/thin target yield |
| , TTY , , DT | TTT | Production thick/thin target yield |
| , TTY , , PHY | TTT | Physical thick/thin target yield |
| , TTY / DA | TDA | Saturated thick/thin target yield d/dA <i>So far used only with REL (entry M0036), no corresponding units exist in dict. 25</i> |
| , TTY / DE , , DT | TTTE | Production thick/thin target yield d/dE |
| , TTY / MLT | PYT | Saturated thick/thin target yield multiplicity |
| , TTY / MLT / DA | PYTA | Saturated thick/thin target <i>yield</i> multiplicity d/dA |
| , TTY / MLT / DA , G | PYTA | Saturated thick/thin multiplicity d/dA (gammas) |
| , TTY / MLT / DA / DE | (TD2) <i>PYT2</i> | Saturated thick/thin target <i>yield</i> multiplicity d2/dA/dE <i>Unit dimension code will be changed to PYT2 (because it's the double-differential form of PYT)</i> |
| , TTY / PY | PYT | Saturated thick/thin target product yield |
| , TTY / PY / DA | PYTA | Saturated thick/thin target product yield d/dA |
| , TTY / PY / DA / DE | (TD2) <i>PYT2</i> | Saturated thick/thin target product yield d2/dA/dE <i>Unit dimension code will be changed to PYT2</i> |
| CUM , TTY | TTY | Cumulative saturated thick/thin target yield |
| CUM , TTY , , DT | TTT | Cumulative production thick/thin target yield |
| IND , TTY ? | TTY | Independent saturated thick/thin target yield <i>Will be added to dict.36</i> |
| IND , TTY , , DT | TTT | Independent production thick/thin-target yield |
| IND / M+ , TTY | TTY | Independent saturated <i>thick/thin</i> target yield incl. isom. transit. |
| IND / M+ , TTY , , DT | TTT | Independent production <i>thick/thin</i> target yield incl. isom. transit. |
| M+ , TTY | TTY | Saturated <i>thick/thin</i> target yield incl. isom. transit. |
| M+ , TTY , , DT | TTT | Production <i>thick/thin</i> target yield incl. isom. transit. |
| PAR , TTY | TTY | Partial saturated <i>thick/thin</i> target yield |
| PAR , TTY / MLT / DA | PYTA | Partial saturated <i>thick/thin</i> target <i>yield</i> multipl. d/dA |
| PAR , TTY / MLT / DA , G | PYTA | Partial saturated <i>thick/thin</i> target multipl. d/dA (gammas) |

This found only for C0108 and C0118; both corrected to PAR , TTY /MLT /DA (both given as REL); make quantity obsolete. *Found also in A0388 with (P,X)0-G-0 and obsolete units G/PT/SR. REACTION should be changed to PAR,PY/DA,,TT and units to PRD/INC/SR.*

| | | |
|---------------|-----------------------|---------------------------------------------------------------------------------------|
| PAR , TTY /DA | (TDP) TDA | Partial saturated <i>thick/thin</i> target yield d/dA <i>Will be made obsolete</i> |
|---------------|-----------------------|---------------------------------------------------------------------------------------|

This found only for A0527 and C0838; both should be corrected to , TTY /PY /DA /DE; make quantity obsolete. *A0527 is a different case, giving (N,X)0-NN-1 in obsolete units N/PT/MEVSR. REACTION should be changed to PY/DA/DE,,TT and units to P/IN/MEVSR.*

| | | |
|---------------|---------------------------|---------------------------------------------------------------------------|
| , TTY /DA /DE | (1 /AE) * TD2 | Saturated thick/thin target yield d/dA/dE <i>Will be made obsolete</i> |
|---------------|---------------------------|---------------------------------------------------------------------------|

* If not deleted, correct unit code.

This found on entry O0530; should be coded as IND , PY , , TT, or more correctly giving authors original data in KBQ/MUAHR: IND , TTY , , DT

| | | |
|-----------------|------|-------------------------------------------------------------------------|
| IND , PY , , DT | YLD? | Independent product yield per unit time <i>Will be made obsolete</i> |
|-----------------|------|-------------------------------------------------------------------------|

These were not found on library; may be removed if not needed.

All these codes will be made obsolete:

| | | |
|----------------------|---------------------------|-----------------------------------------------------------------------------------------------------------------|
| (CUM) , TTY , , DT | TTT | Production <i>thick/thin</i> target yield (assumed cumulative) <i>(Used in superseded subentry B0084008)</i> |
| , TTY /DA , , DT | TTDA | Production thick/thin target yield d/dA |
| , TTY /DE | (1 /E) * TDE | Saturated thick/thin target yield d/dE |
| , TTY /RAT | NO | Saturated thick/thin target yield ratio |
| CUM , TTY /RAT | NO | Cumul. saturated thick/thin target yield ratio |
| CUM / (M) , TTY | TTY | Cumul. saturated <i>thick/thin</i> target yield (uncert. isom. trans. Incl.) |
| CUM /M- , TTY | TTY | Cumul. saturated <i>thick/thin</i> target yield, excl. isom. trans |
| EM , TTY /DA /DE | (1 /AE) * TD2 | <i>Saturated thick/thin target yield for emission d/dA/dE</i> |
| IND , TTY /RAT | NO | Independent saturated <i>thick/thin</i> target yield ratio |
| M- , TTY | TTY | Saturated <i>thick/thin</i> target yield, excl. isom. trans. |
| PAR , TTY , G | TTY | Partial saturated thick/thin target gamma yield |
| SEQ , TTY | TTY | Saturated <i>thick/thin</i> target yield for specif. reaction seq. |

* If not deleted, correct unit codes.

These were not found on library; may be removed if not needed.

Not correct in any case; SF6 should be ,TTY /PY; units should be PYT.

Both these codes will be made obsolete:

| | | |
|-----------------|------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| , PY , , DT | YLD? | Product yield per unit time <i>(Made obsolete in last dictionary transmission)</i> <i>Used in entries B0167 and B0175, either with REL or with units MUCI/MUAHR.</i> <i>REACTION should be changed to ,TTY,,DT</i> |
| CUM , PY , , DT | YLD? | Cumulative product yield per unit time <i>Used in B0175.002 with units MUCI/MUAHR.</i> <i>REACTION should be changed to CUM,TTY,,DT</i> |

Units Dictionary

| | | |
|------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|
| CI / AHR / MEV | Curie/Ampere-hour/MeV <i>In dict.36 there is no quantity yet with this unit-dimension. See proposed new quantity ,TTY,,TM in memo CP-D/396</i> | TTTE |
| DPS / MUAHR | decays per sec/micro-Ampere-hour | TTT |
| GBQ / COUL | Giga-Becquerel/Coulomb | TTT |
| GBQ / MUA | Giga-Becquerel/micro-Ampere | TTY |
| KBQ / MUAHR | Kilo-Becquerel/micro-Ampere-hour | TTT |
| MBQ / MUA | Mega-Becquerel/micro-Ampere | TTY |
| MBQ / MUAHR | Mega-Becquerel/micro-Ampere-hour | TTT |
| MCI / MUA | milli-Curie/micro-Ampere | TTY |
| MCI / MUAHR | milli-Curie/micro-Ampere-hour | TTT |
| MUCI / HRMEV | micro-Curie/micro-Ampere-hour/MeV <i>Not introduced, same as CI/AHR/MEV (see CP-D/388)</i> | TTTE |
| MUCI / MUA | micro-Curie/micro-Ampere | TTY |
| MUCI / MUAHR | micro-Curie/micro-Ampere-hour | TTT |
| P / MEVMUCSR | particles/(MeV muC sr) <i>Dimension code changed to PYT2</i> | (TD2) PYT2 |
| PART / MUAHR | Particles/micro-Ampere-hour <i>Obsolete, replaced by PRT/MUAHR which has dimension PYT</i> | (TTY) PYT |
| PRD / MUAHR | products/micro-Ampere-hour | PYT* |
| PRD / MUC / SR | products/micro-Coulomb/steradian | PYTA |
| PRD / MUCOUL | products/micro-Coulomb | PYT |
| PRT / MUAHR | particles/micro-Ampere-hour | PYT |
| PRT / MUC / SR | partcles/micro-Coulomb/steradian | PYTA |
| (PPRT / MUCOUL) PRT / MUCOUL | particles/micro-Coulomb | PYT |

* Unit code corrected.

Thick target quantities not listed in CP-C/344 with comments by JCPRG (in *green bold italic*)

These are all quantities with SF8 = TT. These have the same units dimension as the corresponding quantities with blank SF8. Nevertheless it is important to include them in the list of thick target quantities (also in LEXFOR) for reference.

The following quantities are used in the database or in a PRELIM file or were proposed recently in a memo.

| Quantity | Type | Dim. | Expansion |
|-------------------------|------|---------|-------------------------------------------------------------------------------------------------------------------------------------|
| , DA , , TT | DA | DA | Diff. cross section d/dA for thick target |
| , DA / DE , , TT | DAE | DAE | Double-diff. cross section for thick target |
| , MLT , , TT | * | YLD | <i>Saturated thick/thin target yield multiplicity (Used in C0596.002 correctly. Can be replaced by ,PY,,TT for the other cases.</i> |
| , MLT , N , TT | * | YLD | <i>(See below)</i> |
| , MLT / DA , , TT | DA* | 1 / A | <i>(See below)</i> |
| , MLT / DA , , TT / IPA | DA* | YLD | <i>(See below)</i> |
| , MLT / DE , , TT | DE | (YLD) | <i>Saturated thick/thin target yield multiplicity d/dE</i> |

| | | | |
|--------------------|----------------------------|------------|----------------------------------------------------------------------------------------------------|
| | | 1/E | Dim. to be corrected to 1/E |
| , PY, , TT | PY | YLD | <i>Saturated thick/thin target product yield</i> |
| , PY/DA, , TT | (PY+) PYA | 1 / A | <i>Saturated thick/thin target product yield d/dA</i> React. type to be corrected to PYA |
| , PY/DA, , TT/ IPA | PYA | YLD | <i>Saturated thick/thin target product yield d/dA, int. ang. range</i> |
| , PY/DA/DE, , TT | PY2 | 1 / AE | <i>Saturated thick/thin target product yield d2/dA/dE</i> |
| , SIG, , TT | CS | B | Cross section for thick target |
| , SPC, , TT | SP | YLD | Gamma spectrum for thick target |
| IND, PY, , TT | PY | YLD | Independent <i>saturated thick/thin target product yield</i> |
| PAR, DA, , TT | DAP | DA | Thick-target angular distr., partial reaction |
| PAR, PY, , TT | PYP | YLD | Partial <i>saturated thick/thin target product yield</i> |
| PAR, PY, G, TT | PYP | YLD | <i>Saturated thick/thin target product yield</i> for a given gamma |
| PAR, PY/DA, , TT | PYA | 1 / A | Partial <i>saturated thick/thin target product yield d/dA</i> |
| PAR, DA, G, TT | DAP | DA | Diff. partial gamma emission cross section for thick target |
| PAR, SIG, G, TT | CSP | B | Partial gamma emission cross section for thick target |

The following quantity's deletion was requested in CP-C/340. Since it is used (correctly, I believe) in entries E1756 and E1759, it will be kept. **Yes. But “,MLT/DA/DE,,TT” in E1756 and E1759 was replaced by “,PY/DA/DE,,TT” in PRELIM.E028 along the draft of LEXFOR (CP-C/334). So I propose to delete this code (or make obsolete).**

| | | | |
|-------------------|----------------------------|--------|-------------------------------------------------------------------------------------------------------------|
| , MLT/DA/DE, , TT | (D2*) YAE | 1 / AE | <i>Saturated thick/thin target yield multiplicity d2/dA/dE</i> React. type to be corrected to YAE |
|-------------------|----------------------------|--------|-------------------------------------------------------------------------------------------------------------|

The following quantities were used in E1756 and E1759. But these were replaced by “,PY/DA,,TT” and “,PY/DA,,TT/ IPA” in PRELIM.E028 along the draft of LEXFOR (CP-C/334, see also CP--E/040). So I propose to delete these codes (or make obsolete).

| | | | |
|---------------------|-----|-------|----------------------------------------------------------------------------|
| , MLT/DA, , TT | DA* | 1 / A | <i>Saturated thick/thin target yield multiplicity d/dA</i> |
| , MLT/DA, , TT/ IPA | DA* | YLD | <i>Saturated thick/thin target yield multiplicity d/dA</i> int. ang. range |

This found only for C0115.005 with 4-BE-9(A,N)6-C-12, ,MLT,N,TT. This N is redundant and REACTION can be changed to MLT, ,TT.

| | | | |
|--------------|---|-----|-------------------------------------------------------------------------------------------------|
| , MLT, N, TT | * | YLD | <i>Saturated thick/thin target neutron yield multiplicity</i> (Will be made obsolete) |
|--------------|---|-----|-------------------------------------------------------------------------------------------------|

The following quantities were introduced in 2003 or before but were so far not used.

| | | | |
|------------------|----|-----|------------------------------------------------------------------------------|
| CUM, PY, , TT | PY | YLD | Cumulative <i>saturated thick/thin target product yield</i> |
| CUM/M-, PY, , TT | PY | YLD | Cumul. <i>saturated thick/thin target product yield</i> excl. isom. transit. |
| M+, PY, , TT | PY | YLD | <i>Saturated thick/thin target product yield</i> , incl. via isom. transit |

Distribution:

| | | | |
|----------------------|---------------------|---------------------|----------------------|
| S. Babykina, CAJaD | J.H. Chang, KAERI | M. Chiba, JCPRG | F.E. Chukreev, CAJaD |
| S. Dunaeva, NDS | Z.G. Ge, CNDC | O. Gritzay, KINR | A. Hasegawa, JAERI |
| A. Kaltchenko, KINR | K. Katō, JCPRG | M. Kellet, NEA-DB | M. Lammer, NDS |
| M. Lammer, NDS | S. Maev, CJD | V.N. Manokhin, CJD | V. McLane, NNDC |
| M.Mikhaylyukova, CJD | C. Nordborg, NEA-DB | P. Oblozinsky, NNDC | N. Otsuka, JCPRG |
| O. Schwerer, NDS | S. Takacs, ATOMKI | S. Taova, VNIIEF | T. Tárkányi, ATOMKI |
| V. Pronyaev, NDS | V. Varlamov, CDFE | M. Vlasov, KINR | M. Wirtz, NDS |
| H.W. Yu, CNDC | V. Zerkov, NDS | Y.X. Zhuang, CNDC | EXFOR, NEA-DB |