International Atomic Energy Agency

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Data Corrected or Derived by Other Than Authors

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1. Introduction

Usual Source of EXFOR Compilation

- Articles published by the *experimentalist*

- Unpublished data provided by the *experimentalist*

- Unpublished comments from the *experimentalist*

- Comments from the *compiler and/or EXFOR users* (must be distinguished from experimentalist's ones)

"EXFOR is a compilation of the author's original published experimental data."

EXFOR Basics (IAEA-NDS-206 June 2008, p5)

What is Correction?

A simple data reduction model:

$$y = a(x - b)$$

where

y: quantity of interest (*e.g.*, cross section)

x: measurable (*e.g.*, count)

a, b: parameters (*e.g.*, correction factor, nuclear data)

Parameters a and b are typically (1) evaluated by a model, (2) adopted from a nuclear database, (3) measured separately.

y may be <u>improved</u> if a or b is improved. (Correction)

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2. Renormalization by Non-Author

Renormalization by Nuclear Data Update

Multiplication factor a adopted from a nuclear database

$$y = ax$$

If a is updated to a', then y is updated to y':

$$y' = a'x$$

$$= (a'/a)\, y$$

Renormalization of the quantity of interest y to y' due to update of the nuclear data from a to a'.
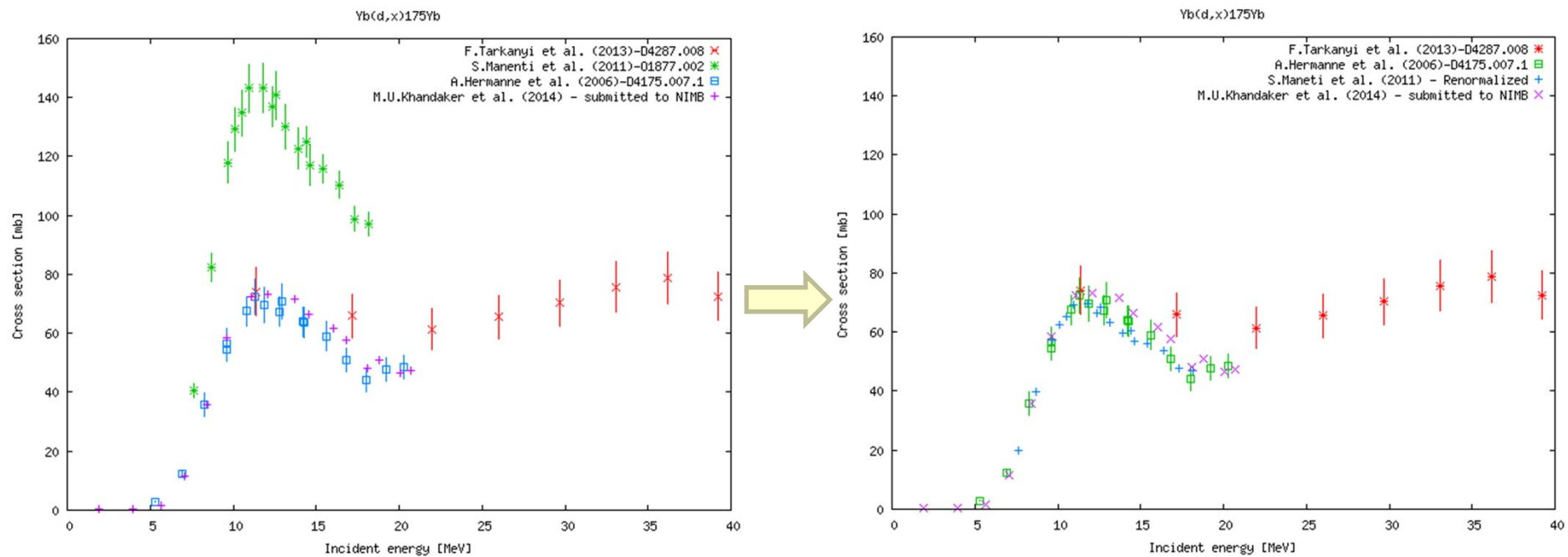
Examples of nuclear data a:

standard cross section, gamma intensity

Example of Renormalization by ND Update

^{nat}Yb(d,x)^{175}Yb cross sections determined by 396 keV γ line.

ENSDF changed I $_γ$ from 6.4% to 13.2% in 2004.

Very simple renormalization. Can be done by EXFOR users.

LEXFOR Guideline - Renormalized Data

LEXFOR "Status" mentions that

… **Only** in exceptional cases should renormalizations or reassessments of the data as given by an evaluator be compiled. …
… Renormalization, in general, should be done by the compiler **only** with the advice and/or consent of the author. …

(~25 data sets renormalized by other than the author are in EXFOR, mainly compiled <u>in 1980s</u>.)

Recommendation from INDC

INDC WG2 Recommendation 1.10

(M. Herman ,T. Kawano, N.B. Janeva, F. Leszcyński, N. Van Do, C.Nordborg, J.-C.Sublet, A. Blokhin)

The working group recommends … parallel database of experimental data derived from EXFOR by renormalizing the data according to the current standards, newer decay data, etc.

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Renormalization on NDS EXFOR System

☐ Apply(8A) ⌃ Data re-normalization (for advanced users, results in: C4, TAB and Plots)

☑ Auto corrections:

```
22338043  x4u:20060614  #1991 Ercan
 #Reaction: 25-MN-55(N,A)23-V-52,,SIG
 #Monitor:  13-AL-27(N,A)11-NA-24
 #En=1.46E7
```

☐ User's corrections

⌄ Input your own Monitor data

```
22338043  x4u:20060614  #1991 Ercan
 #Reaction: 25-MN-55(N,A)23-V-52,,SIG
 #Monitor:  13-AL-27(N,A)11-NA-24,,SIG
 #En=1.46E7
 a0=[MONIT];                  #old monitor point
 a1=recom$al27na[EN];         #new monitor point
 dy=dy/y;                     #to rel. uncertainties
 y=y*a1/a0;                   #corrected CS
 dy=dy*y;                     #to abs. uncertainties
```

	n	Display					Year Author-1	Energy range,eV	Points	Reference	Subentry#P NSR
							25-MN-55(N,A)23-V-52,,SIG	C4: MF3 MT107			

Quantity: [CS] Cross section

n		Info	X4+	X4±	T4	Cov	Year	Author-1	Energy range,eV		Points	Reference	Subentry#
1	☐	Info	X4+	X4±	T4	Cov	2012	Yanbin Zhang+	1.41e7	1.47e7	2	+ J,IPC,81,(10),1563,2012	32701002
2	☐	Info	X4+	X4±	T4	Cov	2000	A.Fessler+	1.61e7	2.03e7	5	+ J,NSE,134,(2),171,2000	22414016
3	☐	Info	X4+	X4±	T4	Cov	1999	A.A.Filatenkov+	1.35e7	1.48e7	8	+ R,RI-252,199905	41240011
4	☐	Info	X4+	X4±	T4	Cov	1994	M.Bostan+	6.33e6	1.20e7	7	+ J,PR/C,49,266,1994	22292007
5	☐	Info	X4+	X4±	T4	Cov	1993	A.Grallert+	1.46e7		1	+ R,INDC(NDS)-286,131,1993	31496007
6	☐A	Info	X4+	X4±	T4	Cov	1991	A.Ercan+	1.46e7		1	+ C,91JUELIC..376,199105	22338043

Proposal 1: Renormalized Data

Compilation of renormalized data is <u>not recommended</u> in general.

3. Non-Trivial Correction by Non-Author

Non-Trivial Correction

Recent examples of data sets corrected by other than authors by less straightforward procedures:

1. ^{3}He neutron elastic ang. diff. cross section measured by B.Haesner et al. (1982, EXFOR 21883), and corrected by M.Drosg et al. (2012).

2. Uranium inelastic cross sections measured by M.Baba et al. (1989, EXFOR 22158), and corrected by R.Capote (2013).
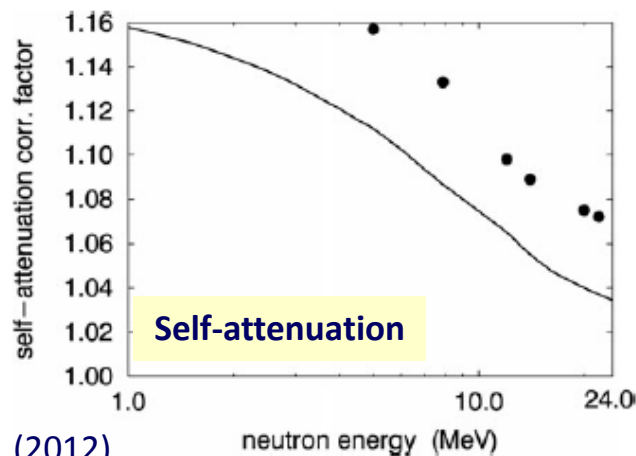
³He+n Elastic Data Corrected by Drosg

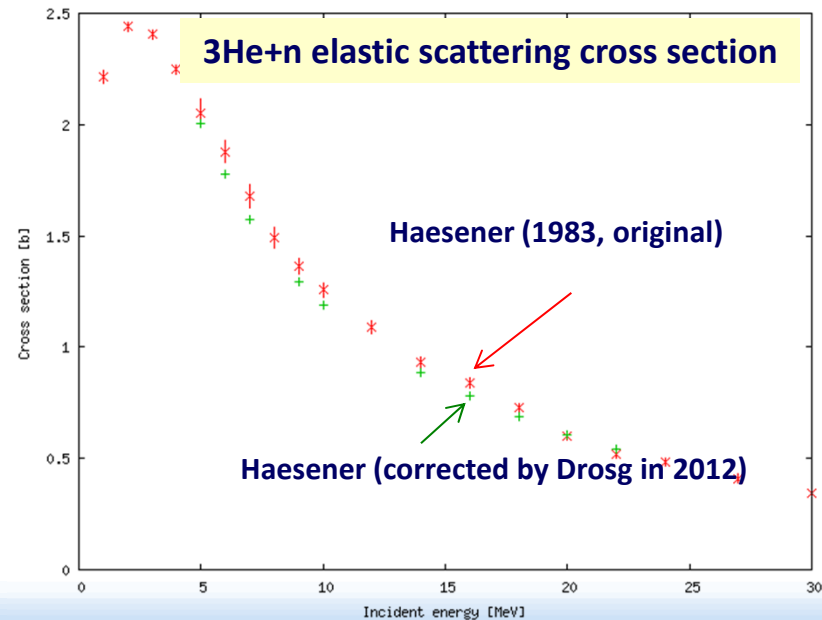Drosg corrected the original data published in KFK-3395 (1982) for

- sample-size (self-attenuation) effect
- relativistic kinematics instead of non-relativistic kinematics
- NE213 detection efficiency

, and published the result in Nucl.Sci.Eng.172(2012)87.

M.Drosg et al. (2012)

Fig. 1. Self-attenuation correction. ●: $k_{p,t}$ (incoming neutrons); the curve is for k_{out} (outgoing neutrons).
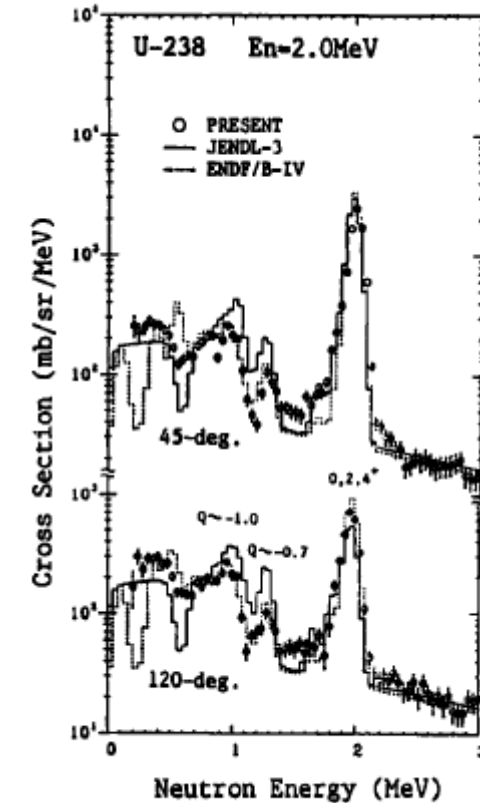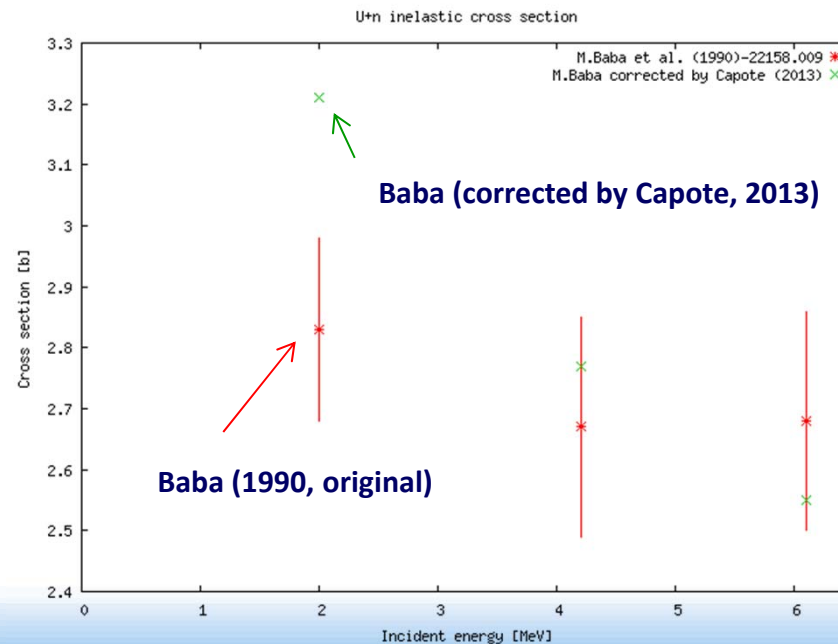
Self-attenuation

3He+n elastic scattering cross section

Haesener (1983, original)

Haesener (corrected by Drosg in 2012)

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U+n Inelastic Data Corrected by Capote

The compound process is not included in derivation by M.Baba et al. (1990):

$$\sigma_{exp}(inl)=\sigma_{exp}(cont.)+\sigma_{exp}(Q\sim0.7\text{ MeV})$$
$$+\sigma_{model,direct}(2+,4+,6+)\text{ [with ECIS79],}$$

and Capote corrected it.

M.Baba et al. (1990)

LEXFOR Guideline – Non-Trivial Corrections

LEXFOR "Corrections" mentions that

… evaluators frequently re-assess old data using improved corrections because they may have better knowledge on the theory of the experiment than that which was available to the author at the time of the experiment.…

… In such cases, the re-assessed data is useful information to the user of EXFOR data and **should**, therefore, be compiled.

Proposal 2: Data from Non-trivial Correction

Compilation of data corrected by non-trivial correction (i.e., more complicated by renormalization) is <u>obligatory</u> when it is well documented (e.g., published).

When it is not well documented, it must be clearly recorded under the keyword **CRITIQUE**.

4. Data Derived by Other Than Author

Data Derived by Other Than Author

Recent examples of data sets derived by other than authors:

1. $^{13}C(\alpha,n)^{16}O$ cross section measured by J.K.Bair et al. (1973, EXFOR C0489) and converted to $^{16}O(n,\alpha)^{13}C$ by C.H.Johnson et al. (1972).

2. Double differential cross sections for 14 MeV neutrons on various targets measured by J.L.Kammerdiener (1972, EXFOR 14329), and fitted by Legendre polynomial by T. Kawano (2013).
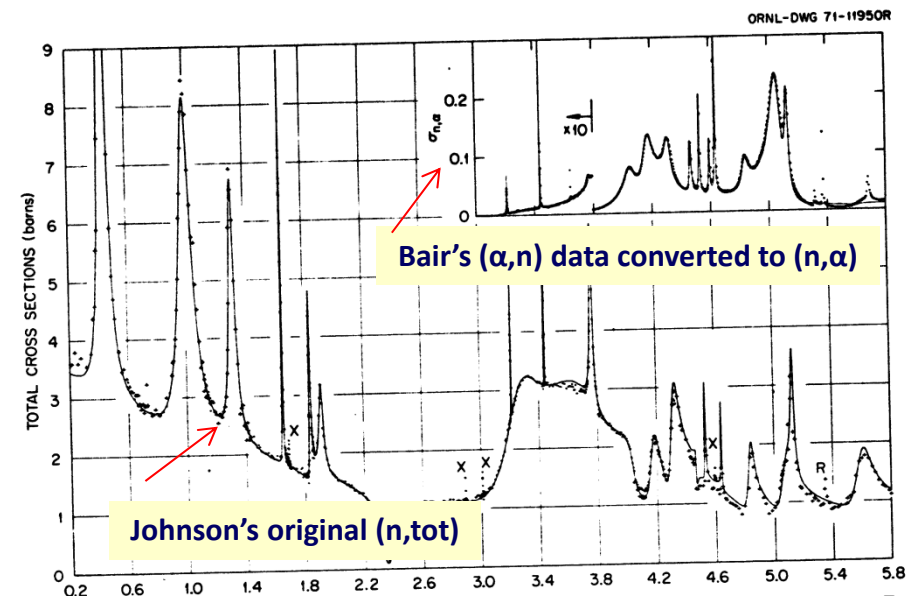
$^{16}O(n,\alpha)^{13}C$ by Data Corrected by Johnson

$^{13}C(\alpha,n)^{16}O$ cross section measured by J.K.Bair et al. (1973) were converted to $^{16}O(n,\alpha)^{13}C$ cross section by C.H.Johnson et al. (1972) by the <u>detailed-balance relation</u> (and compiled in EXFOR in 2005)

An experimentalist proposed to compile Bair's data <u>converted by himself</u> in EXFOR (this year).

When we receive the third one??

(See more details in Stanislav's talk tomorrow.)

ORNL-DWG 71-11950R

Bair's (α,n) data converted to (n,α)

Johnson's original (n,tot)

C.H. Johson et al. (1972)

^{235}U(n,n+x) DEX Derived by Kawano

^{235}U(n,n+x) neutron double diff. cross section measured by J.L.Kammerdiener (1972) was fitted by Legendre polynomial to obtain the corresponding energy diff. cross section (DEX).

Legendre fitting to the double differential

cross section is straightforward.
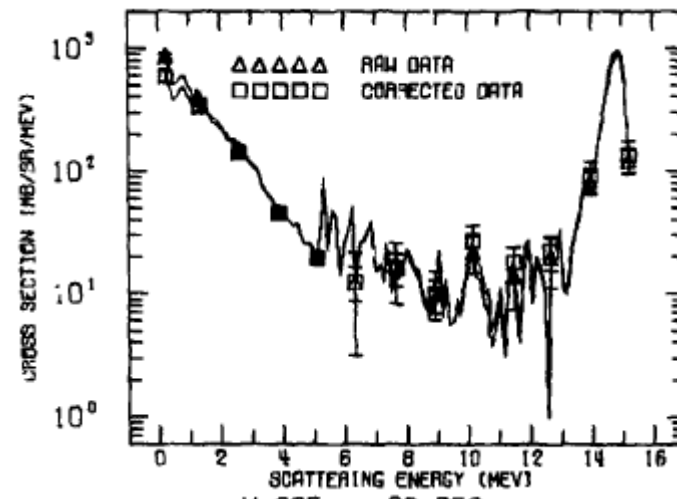
J.L.Kammerdiener et al. (1972)

Our Opinion on Data Derived by Non-author

We should be restrictive for compilation of data derived by other than author:

◆ to keep the database "clean" in its definition as being a trustworthy database for original experimental data. If it should be "flooded" with derived data, this could endanger the proper profile (and even reputation) of EXFOR,

◆ to make sure that compilers will not suddenly be expected to compile any numbers somebody happens to derive from somebody else's experiment.

Proposal 3: Data Derived by Non-Author

Data derived by other than the author <u>will not be compiled</u> in EXFOR (except for recommended or evaluated data widely used in the community).

5. Technical Implementation

Technical Questions

1. Should we compile the original data and data corrected or derived by other than the author **in the same entry? or different entry?**

2. How we clearly make **cross reference** between the original data and corrected/derived data?

3. How we can clearly **notify the unusual data type/status** ("corrected or derived other than author") to the EXFOR users?

Sample – Data Corrected by Non-Author

Original

```
ENTRY            21883   20110227
SUBENT         21883001   20110227
BIB               15          48
AUTHOR     (B.Haesner)
REFERENCE  (R,KFK3395,1982)
…
(Description on the experimental procedure)
…
SUBENT         21883010  20110227
BIB                3           4
REACTION   (2-HE-3(N,EL)2-HE-3,,DA)
REL-REF    (N,,M.Drosg+,J,NSE,172,87,2012)
            Corrected data given
STATUS     (TABLE) Appendix (p66) of KFK-3395
           (OUTDT,29883002) Data corrected by
            M.Drosg available
ENDBIB             4
NOCOMMON           0          0
DATA               4        183
EN        ANG-CM     DATA-CM    DATA-ERR
MEV       ADEG       MB/SR      MB/SR
 5.0       33.1       409.6      41.0
 5.0       58.7       264.0      15.8
…
```

Corrected

```
ENTRY            29883    20140506
SUBENT         29883001    20140506
BIB               15          48
AUTHOR     (M.Drosg, R. Avalos Ortiz, P.W. Lisowski)
REFERENCE  (J,NSE,172,87,20
…
(Description on the correct
…
SUBENT         29883002    20140506
BIB                3           4
REACTION   (2-HE-3(N,EL)2-HE-3,,DA,,,CRCTD)
ANALYSIS   Corrections with better knowledge on …
REL-REF    (R,,B.Haesner,R,KFK3395,1982)
            Original data given
STATUS     (TABLE) Table VIII of
                   Nucl.Sci.Eng.172(2012)87
           (CRCTT,21883010) Original data given
  BIB              4
NOCOMMON           0          0
DATA               4        183
EN        ANG-CM     DATA-CM    DATA-ERR
MEV       ADEG       MB/SR      MB/SR
 5.0       33.1       399.      43.
 5.0       58.7       259.      18.
…
```

A new data type code to indicate the property

Cross reference

Sample – Data Derived by Non-Author

Original

```
ENTRY             14329    20130626
SUBENT         14329001    20130626
BIB               15          68
AUTHOR     (J.L.Kammerdiener)
REFERENCE  (R,UCRL-51232,1972)
…
(Description on the experimental procedure)
…
SUBENT         14329090    20130626
BIB 3 3
REACTION   (92-U-235(N,X)0-NN-1,,DA/DE)
REL-REF    (N,19329002,T.Kawano,W,KAWANO,20130509)
            EDX derived from DDX given
STATUS     (CURVE) Fig.87 of UCRL-51232 (1972)
…
DATA                  3       67
E          DATA
MEV        MB/SR/MEV
  9.329E-02   7.850E+02
  1.399E-01   5.686E+02
…
```

Derived

```
ENTRY             19329    20140506
SUBENT         19329001    20140506
BIB               15          68
AUTHOR     (T.Kawano)
REFERENCE  (W.KAWANO,201305
…
(Description on the derivat
…
SUBENT         19329002    20140506
BIB                3          4
REACTION   (92-U-235(N,X)0-NN-1,,DE,,,DERIV/OTH)
REL-REF    (R,14329090,J.L.Kammerdiener+,R,UCRL-51232
            Double differential cross section given
STATUS     (TABLE) Data received from T.Kawano
           (DEP,14329090)

E-MIN      E-MAX      DATA
MEV        MEV        MB/MEV
  6.5        8.0        127.01
  8.0        9.5         69.8
```

A new data type code to indicate the property

Cross reference

6. Summary

Summary

1. **Compile? Not compile?**

   - ◆ Renormalized data (Compilation is not recommended?)

   - ◆ Corrected data (Compilation is mandatory under certain conditions?)

   - ◆ Derived data (Not for compilation?)

2. **Clear separation with tight connection**

   - ◆ Where should we compile the data obtained by non-author? Same entry? Different entry?

   - ◆ Introduce new data type codes (SF9) for data corrected (`CRCTD`) and derived (`DERIV/OTH`) by other than author?

   - ◆ Introduce new link under keyword **STATUS** (e.g., `OUTDT`↔`RNORM`, `OUTDT`↔`CRRCT`)?