DAT/324-0

BROOKHAVEN NATIONAL LABORATORY

MEMORANDUM

Memo CP-C/119

DATE: March 26, 1984

TO: Distribution

FROM: V. McLane VM

SUBJECT: Errors

Enclosed are the revised manual pages for ERR-ANALYS and the revised LEXFOR entry on Errors incorporating the agreement on the coding of correlation factor which was reached at the NRDS Meeting in September 1983.

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VM:df

Enclosures

2

INFORMATION

84/04/02

ACKNOWLEDGMENT

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ERR-ANALYS

1. This keyword is used to explain the sources of errors and the values given in the COMMON or DATA sections under data headings of the type ERR- or -ERR. See also LEXFOR Errors.

2. The keyword is optional. May be free text or coded information with free text. However, if only one heading is to be defined, the coded information may be omitted. See also "Links between BIB, COMMON and DATA," page 6.9.

3. The coded information is of the form:

(heading,correlation factor) free text

Heading field. Contains the data heading to be defined.

Correlation Factor Field. Contains the correlation factor, coded as a floating point number. This field is optional and may be used only with systematic data uncertainty headings of the form ERR-1, etc.

4. If two or more error fields are given, then the data headings are repeated as codes for this keyword, each starting in column 12, followed by free text explanation.

For example:

```
BIB
...
ERR-ANALYS  (EN-ERR) followed by explanation of energy error
            (DATA-ERR1) followed by explanation of first error
            (DATA-ERR2) followed by explanation of second error
ENDBIB
....
DATA
EN          EN-ERR     DATA       DATA-ERR1  DATA-ERR2
MEV         MEV        MB         MB         PER-CENT
...         ...        ...        ...        ...
```

EXP-YEAR

1. This keyword is used to define the year in which the experiment was performed if it differs significantly from the date of the references given. (Example: Classified data that was published only years later).

2. This keyword is optional, but if present, it must have coded information.

3. The format of the code is (yy) where yy is the two digits of the year, e.g., (65).

Errors

See also Covariance.

Information-Identifier Keyword ERR-ANALYS

Free text explanation of the error sources and of the numerical values of the uncertainties is given under the keyword ERR-ANALYS. In order to link the explanations to the numerical data given, the relevant data headings are in parentheses, starting in column 12, followed by free text; when only one data error is given, the data heading need not be given (see EXFOR page 8.E.2). Free text should contain a statement of error types included in the quoted uncertainties, and also those error types which are not included in the quoted uncertainties.

The numerical uncertainty values quoted in the COMMON or DATA section are of relevance only in conjunction with an appropriate entry under ERR-ANALYS, explaining the type of uncertainty and percentage of contributing uncertainties. Therefore, the compiler should be most careful in defining the information given and should be aware of the following aspects which are required for a precise definition of the uncertainty:

1. error-type

   Such as:

   - statistical or random uncertainty (uncorrelated)
   - systematic uncertainties (may be correlated)
     sample related: mass, geometric effects, multiple scattering, self-absorption.
     detector related: efficiency, calibration
     normalization: monitor cross section, flux determination

2. total error or partial error

   For example, the statistical uncertainty, which is most often a partial along with other uncertainties, may be the total uncertainty if other sources of uncertainty are negligible.

3. shape of error function

   Such as:

   - Gaussian, symmetric
   - triangular, symmetric
   - unsymmetric, for example 8.5+0.5/-0.2

4. error measure

   Such as:

   - standard deviation = half-width at half-maximum of Gaussian error distribution function.

     = 2/3 probability that the true value is within error bars

   - confidence limits: when the errors are given as confidence limits, various definitions exist, for example, 95% probability which corresponds to approximately two standard deviations.

   - errors supposed not to exceed: approx. 100% probability value is within error bars.

5. error correlations: within systematic uncertainties and with other quantities measured in same experiment; see also Interdependent Data.

Numerical Data Uncertainties

Numerical data are entered into the COMMON or DATA section under the Data-Heading Keywords of the type ERR- or -ERR, as given in Dictionary 24.

See specific uncertainty types on following pages.

If two or more errors of different types are given referring to the same data, Data-Heading Keywords of the type DATA-ERR1, DATA-ERR2 are used.

Unsymmetric errors are identified using Data-Heading Keywords of the type +DATA-ERR and -DATA-ERR.

Data Uncertainties

Information on the uncertainties associated with the data compiled is entered in one of two ways depending on whether a complete analysis of the uncertainties has been done.

In the case where a detailed analysis of the uncertainties has not been done or the compiler does not have enough information to know if a complete analysis has been done, the uncertainties should be entered either:

1. in the COMMON or DATA section under the Data-Heading Keywords, DATA-ERR, RATIO-ERR or SUM-ERR, with an explanation in free text under ERR-ANALYS. If two or more errors of different types are given referring to the same data, Data-Heading Keywords of the type DATA-ERR1 and DATA-ERR2 are used. Unsymmetric errors are identified with, e.g., +DATA-ERR and -DATA-ERR.

2. as free text information under ERR-ANALYS.

Detailed error formats are used when a complete analysis of the uncertainties associated with the data has been given.

1. Error fields will be identified as statistical (uncorrelated), systematic (correlated) or total. The numerical values for the uncertainties will be entered in the COMMON or DATA section under the headings ERR-S, ERR-T, ERR-1, etc. (see Dictionary 24). The definition of the different systematic uncertainties will be given in free text comments under ERR-ANALYS. Constant systematic uncertainties may, alternately, be entered in free text under ERR-ANALYS.

2. Only uncertainties which are one standard deviation (or the equivalent for systematic uncertainty) will be entered in this format. If the author gives 2- or 3-sigma uncertainties, they should be converted to one-sigma uncertainties. Other types of uncertainty information may be entered in free text.

3. The correlation factor for the systematic uncertainties should be coded under ERR-ANALYS following the Data-Heading code.

See example, following page.

Priority should be given to the compilation of detailed information on the uncertainties for experimental data on neutron cross sections for standards (see Standards) and dosimetry reactions (see Dosimetry Reaction Data) in new and retransmitted data sets. When the required error information for these data types is not given in the literature, every effort should be made to obtain it from the experimentalists.

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SUBENT        10921002     821014
BIB                3          25
REACTION   ((29-CU-63(N,A)27-CO-60,,SIG)/(92-U-238(N,F),,SIG))
ERR-ANALYS UNCERTAINTY IN NEUTRON ENERGY ABOUT 10 KEV.
           (ERR-T) TOTAL ERROR
           (ERR-S) STATISTICAL ERROR
           SOURCES OF SYSTEMATIC UNCERTAINTIES (CORRELATION
              FACTORS IN PARENTHESIS AFTER HEADING)
           (ERR-1,1.0) GAMMA-RAY DETECTION EFFICIENCY.
           (ERR-2,0.0) IRRADIATION GEOMETRY.
           (ERR-3,1.0) URANIUM DEPOSIT,MASS,AND ISOTOPE CONTENT.
           (ERR-4,1.0) EXTRAPOLATION CORRECTION FOR FISSIONS AND
                       CORRECTION FOR FINITE THICKNESS OF DEPOSIT
           (ERR-5,1.0) CORRECTION FOR NEUTRON ABSORPTION IN
                       CU SAMPLE
           (ERR-6,0.5) NEUTRON SOURCE CHARACTERISTICS.
COVARIANCE ONLY ABOVE DIAGONAL ELEMENTS OF SYMETRIC MATRIX ARE
            GIVEN IN PERCENT ON SAME ENERGY GRID AS DATA.
                          100   17   19   29   23   14   13
                               100   37   39   45   28   23
                                    100   42   48   29   26
                                         100   50   31   26
                                               100   35   30
                                                     100   22
                                                           100
ENDBIB              25           0
COMMON               3           3
ERR-1       ERR-7
PER-CENT    PER-CENT
 1.5         1.5
ENDCOMMON            3           0
DATA                 9           7
EN          EN-RSL-HW  DATA        ERR-T       ERR-S       ERR-2
ERR-3       ERR-4      ERR-5
MEV         MEV        NO-DIM      PER-CENT    PER-CENT    PER-CENT
PER-CENT    PER-CENT   PER-CENT
 3.800       0.081      2.42   -04  13.         12.         3.3
 1.0         0.2        1.8
 3.800       0.082      1.84   -04  22.         21.         2.6
 1.0         0.2        1.8
 4.065       0.041      5.142  -04   6.5         4.7        2.0
 1.0         1.5        1.8
 4.361       0.041      9.769  -04   5.7         3.8        2.0
 1.0         0.7        1.8
 4.656       0.042      1.475  -03   5.6         3.6        2.0
 1.0         1.0        1.8
 4.954       0.043      2.409  -03   5.0         2.4        2.0
 1.0         1.2        1.9
 5.268       0.045      3.912  -03   8.7         7.5        1.7
 1.3         1.0        1.9
ENDDATA             18           0
ENDSUBENT           52           0
```

Energy, Secondary Energy and Angle Uncertainties

Numerical values for the uncertainty in the energy, secondary enery and angle should be entered in the COMMON or DATA section under the appropriate heading (see following) with a free text explanation under ERR-ANALYS.

Uncertainty in monochromatic incident-neutron energy or the uncertainty of the central energy in an incident-neutron spectrum: EN-ERR or other data heading given in Dictionary 24 with family B.

Uncertainty in mean secondary energy: E-ERR or other code from Dictionary 24 with family F.

Uncertainty in mean angle: ANG-ERR or COS-ERR.

See also page 8.E.2.

Note: The terms error and resolution are often misused in the literature. Distinguish where possible. See Resolution.

Other Uncertainties

Numerical values for the uncertainty on standards, half-lives, beam polarization, etc., should be entered in the COMMON or DATA section under the appropriate heading (see Dictionary 24) with a free text explanation under ERR-ANALYS.