WP2009-15

Ranged uncertainty values

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Partial uncertainties (`ERR-S`, `ERR-1` etc.) are useful when we guess covariance matrices of the data. We often see authors give range of uncertainty values instead of point-wise uncertainty values. See Example.

Example (G.H.Zhang et al., Nucl. Sci. Eng.134(2000)312)

Source of Uncertainty	Relative Error (%)
$H(n,p)$ or $^{238}U(n,f)$ cross section	1.0 to 2.5
Determination for the number of recoil proton or statistics for fission counts	1.5 to 2.5
Statistics for alpha-particle or triton counts	3.0 to 5.0
Normalization in background subtraction and neutron flux determination	3.0
Atom number of ^{238}U in the fission foil or H in the polyethylene foil	0.5
Atom number of ^{6}Li in the ^{6}LiF sample	0.5
Total	5.0 to 7.0

Action A58 of the last meeting asks compilers not to give uncertainty ranges in COMMON section. Some compilers still want to keep such ranges as coded information. There have been 3 proposals so far:

1. Keep it in free text under ERR-ANALYS (Memo CP-D/522)

```
ERR-ANALYS H(n,p) or 238U(n,f) cross section (1.0-2.5%)
```

2. Keep it as coded information under ERR-ANALYS (Memo CP-D/530 Rev.)

```
ERR-ANALYS (ERR-1,1.0,2.5) H(n,p) or 238U(n,f) cross section
```

3. Keep it as coded information under `ERR-1-MAX` etc. (Memo 4C-4/176)

```
ERR-ANALYS (ERR-1) H(n,p) or 238U(n,f) cross section
...
ERR-1-MIN  ERR-1-MAX
PER-CENT   PER-CENT
1.0        2.5
           5          0
```

Questions:

1. Are users really need uncertainty ranges as coded information?
2. Which option is more helpful for compilers?

Remarks:

1. The current computational format (C4) cannot include uncertainty ranges.
2. The maximum uncertainty of columns is 18 in the common section.
3. The 1st option hides the ranged values in free text.
4. The 2nd option will yield numerous error messages until update of chex.
5. The 3rd option requires many new headings (e.g. `ERR-1-MIN`, `ERR-2-MIN`…)

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Memo CP-D/530 (Rev.)

Date: 24 February 2009
To: Distribution
From: N. Otsuka, V. McLane, S. Dunaeva, O. Schwerer

Subject: Coding of uncertainty ranges under ERR-ANALYS

Since in many cases partial systematic uncertainties are given as maximum, minimum, or a range, and to make specification of such uncertainties usable by computational codes, we propose a new method for the coding of systematic uncertainties. The revision of the EXFOR Format Manual is proposed below:

ERR-ANALYS. Explains the sources of uncertainties and the values given in the COMMON or DATA sections under data headings of the type ERR- or -ERR. See also **LEXFOR, Errors**.

1. Presence is obligatory, except when not relevant. May contain free text or coded information with free text. However, coded information is obligatory when more than one error field associated to the dependent variable is given in the data set.

2. The coded information is of the form: (heading, minimum value, maximum value, correlation factor) free text

   Heading field. Contains the data heading or the root of the data heading to be defined. Root means that the data heading given also defines the heading preceded by + or -.

   Minimum value field The minimum value is given in per-cent. Used to give an uncertainty expressed as a minimum value or the lower limit of a range. A single value is given in this field and the maximum value field. This field must not be used when constant or point-wise values are coded in the COMMON or DATA sections.

   Maximum value field The maximum value is given in per-cent. Used to give an uncertainty expressed as a maximum value or the upper limit of a range. A single value is given in this field and the minimum value field. This field must not be used when constant or point-wise values are coded in the COMMON or DATA sections.

   Correlation Factor Field. Contains the correlation factor, coded as a floating point number. This field is optional and is used only with systematic data uncertainty headings of the form ERR-1, *etc*. If this field is not given, the trailing comma is omitted.

3. If two or more error fields are given, then the data headings are given as codes under this keyword, each on a separate record, starting in column 12, and followed by free text explanation.

4. If the uncertainty value is a constant, it must be coded in the COMMON or DATA section. Point-wise values are coded in the DATA section.

***Example*:**

```
ERR-ANALYS (ERR-T) Total uncertainty, includes statistical and
             systematic uncertainties summed in quadrature.
           (ERR-1) detector efficiency (0.7%);
           (ERR-2) gamma-ray self-absorption (1%);
           (ERR-3) cascade gamma coincidence (1%);
           (ERR-4,,0.5) sample weight (<0.5%);
           (ERR-S,1.,3.) counting statistics (1-3%);
           (MONIT-ERR,1.5,3.0) monitor cross sections (1.5-3%).
...
COMMON               3          5
ERR-1      ERR-2      ERR-3
PER-CENT   PER-CENT   PER-CENT
0.7        1.         1.
ENDCOMMON            5          0
DATA                36          0
EN         EN-ERR     DATA       ERR-T
MEV        MEV        MB         MB
...
```

The second field of ERR-ANALYS has been used for the correlation factor. This should be shifted to the 4-th field when this proposal is approved.
Affected subentries: 12869.005 12921.001-003

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MEMO CP-4/176

DATE:	14 May 2009
TO:	Distribution
From:	M.Mikhaylyukova
Subject:	Reply to Memo CP-D/530rev

As reply to Memo **Coding of uncertainty ranges under ERR-ANALYS,**
it's proposed to code minimal and maximal errors like we code data (DATA-MAX):
ERR-1-**MAX**, ERR-1-**MIN** and so on.
Errors and error units (per-cents or absolute units) could be given in COMMON/DATA section.

Example 1, Entry 41487,
Subent 012 :

ERR-8 Maximal Error due to admixtures in Bi target :
5.% in 27 -50 MeV , 0.6% in 50-100 MeV,
0.1% in 100 -200 MeV energy range.

Subent 013 :

ERR-7 - admixtures in target <3.0% in 60-100 MeV
energy range , <0.5 in 100 -200 MeV range.

Now in such cases, these errors are given only in free text.
The proposed in Memo CP-D/530 format does not let to present such errors as coded information.
As proposed in this Memo CP-4/176, such errors could be presented in DATA section as
ERR-8-MAX, ERR-7-MAX .

Example 2, Entry 40116,
Subent 001 :

ERR-ANALYS Energy error of gamma-ray was 3-6 keV.

Error units are KEV, but not per-cents.
The proposed in Memo CP-D/530 format does not let to present the units of max/min errors.
As proposed in this Memo CP-4/176, such errors could be presented in COMMON or DATA section as E-RSL-MAX, E-RSL-MIN with proper units headings – KEV.

Example 3, Entry 41502,

Subent 001 :

Resolution of COS of angle about 0.07.

Error units are NO-DIM in this case, but not per-cents.
The proposed in Memo CP-D/530 format does not let to present the units of max/min errors.
As proposed in this Memo CP-4/176, such errors could be presented in COMMON or DATA section as COS-RSL-MX, COS-RSL-MN (or COS-ER-MAX, COS-ER-MIN) with proper units headings – NO-DIM.