Corrections of experimental data given in computational formats.

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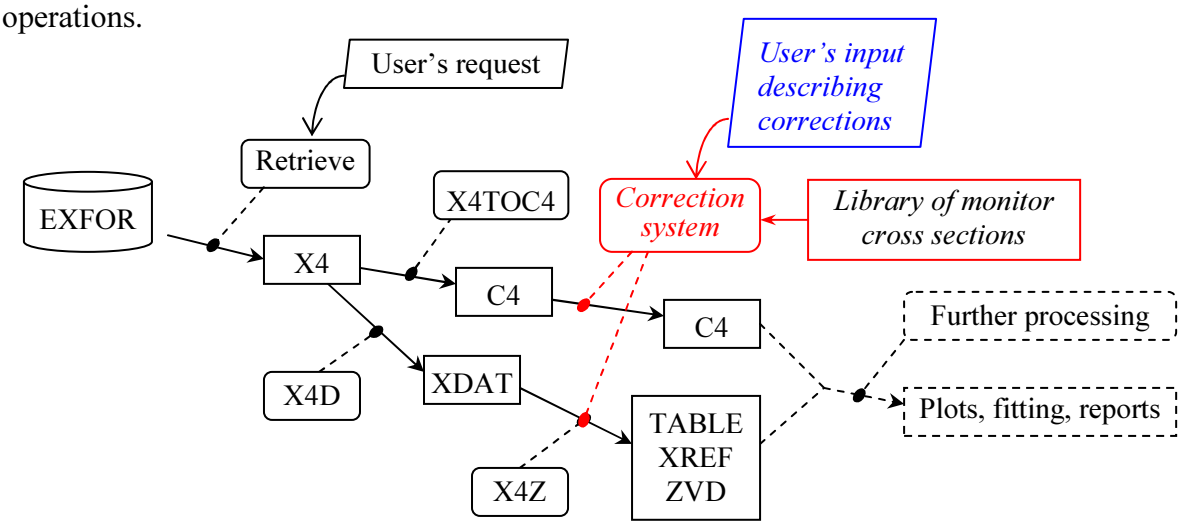
Usage of experimental data for applications often requires to correct (modify) data given in original publication and compiled to EXFOR database according to modern scientific knowledge, experience of an evaluator, or to some additional assumptions. This paper describes syntax of modifications (corrections) of experimental data in computational formats C4 and TABLE/XREF with following propagation to data processing codes and presentations (including plots, tables, comparison with evaluated data, etc.) in Web retrieval system. The system makes syntax analysis of corrections and produces a report of all performed operations.



Corrections are described as sequence of instructions causing cascade of simple calculations of data in given data point of given dataset. There are three types of instructions: declarations, commands and data corrections. Instructions are implemented sequentially, so that result of an instruction can influence to the next calculation. Using logical names user describes corrections, for example: E - projectile incident energy, dE - projectile incident energy uncertainty, Y - data (cross section, angular distribution, etc.), dY - data uncertainty, m0, m1 – values of monitor cross sections for energy in given experimental point. Example of correction: dY=dY+Y*0.02 means increase data uncertainty by 2% of data value. Full description of modifications is given in the Table.1.

For the moment, the "correction-system" is able to perform:

- simple data multiplications by given factor;
- re-calculate any data (including data values, energies, angles and their uncertainties) by inter-data expressions using several math operations;
- any manipulations can be limited by an energy range;
- re-normalize data using other monitors and recent standards;
- set up uncertainties if they are not given;
- delete part of a data set;
- convert ratios to absolute numbers;
- calculate ratios;
- change incident energies;
- to correct wrong units, etc.

This work is in progress, but the system is already available: http://www-nds.iaea.org/exfor/

Illustration

Correction of cross section data $^{27}Al(n,\alpha)^{24}Na$ provided by K.Zolotarev (INDC(NDS)-0546 Rep., p13, http://www-nds.iaea.org/reports-new/indc-reports/indc-nds/indc-nds-0546.pdf):

```
Comment. : ZKI supposed, that uncertainty due to the neutron flux
           determination in the original experimental data
           was around 10 %
Code   6 : cross sections were corrected to the integral of
           cross section calculated from experimental data of
           Mannhart and Schmidt [2] in the overlapping energy
           range 8.40 - 14.00 MeV ;
           total Fc=(1.01441E-1/7.45134E-2)=1.36146, SIGc=SIGo*Fc
References:
1. H.A.Tewes, A.A.Caretto, A.E.Miller, D.R.Nethaway, Report
   UCRL-6028-T, June 1960, http://www-nds.iaea.org/EXFOR/11504.003
2. W.Mannhart, D.Schmidt Measurement of Neutron Activation Cross
   Sections in the Energy Range from 8 to 15 MeV. Report PTB-N-53,
   Braunschweig, January 2007
```

This correction can be presented in the system in several ways, for example:

```
11504003  y=y*1.36146; dy=y*0.1
```

Alternatively:

```
11504003  Fc=1.01441E-1/7.45134E-2; y=y*Fc; dy=y/10;
```

Using the correction system on NDS Web we can get Fig.1. As result of this correction, χ^2 has improved from 3.073 to 0.563

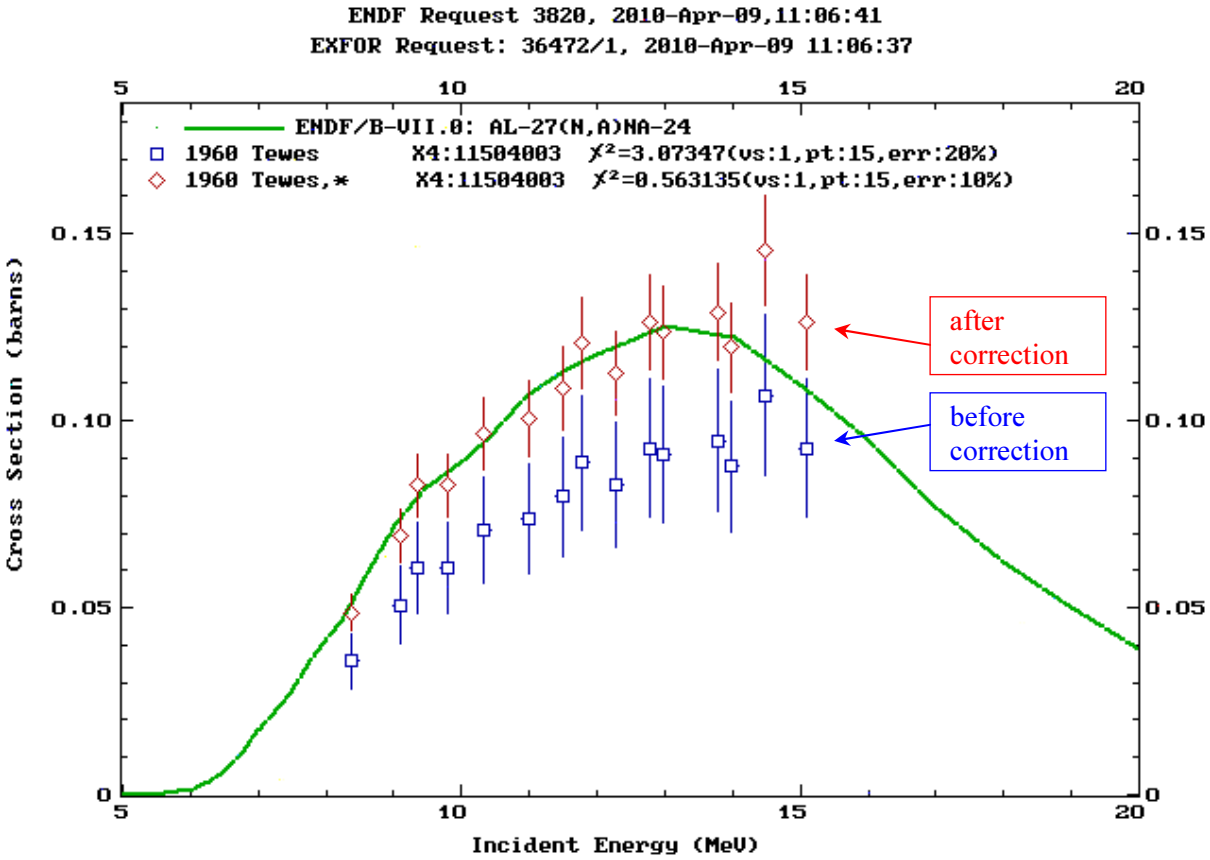
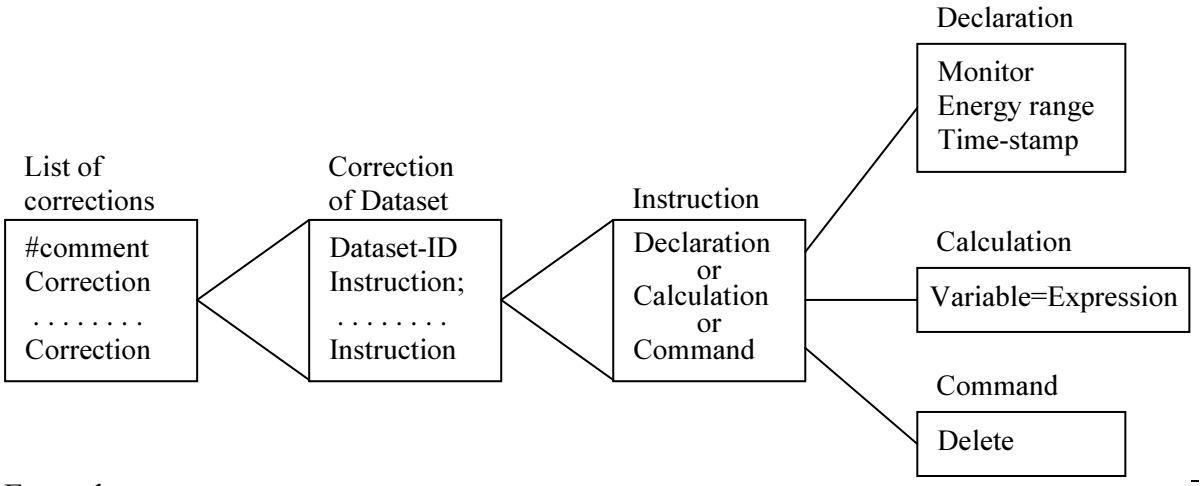


Fig.1

Corrections are normally given in a "List of corrections" – just sequential text, which can be stored (copy-paste) in a user's text file with the following structure:



Examples:

1. `40274002A Y=Y*0.85; dY=dY*0.85;`

This means: take data from Subentry 40274.002, filter data for reaction with Pointer=<A>; for every data point perform two actions: multiply data and data uncertainties by factor 0.85.

2. Delete data from energy range from 180 to 265 KeV; then multiply data and data errors to 0.87; then modify data errors as: half of previous value plus 5% of data; set errors of energy equal to 20 KeV.

```
41225015 e:1.8e5 265e3; del; e:*; y=y*0.87; dy=dy*0.87/2+y*0.05; de=2e4;
```

3. Introduce systematic uncertainties: for Subentry 10221039, set systematic uncertainties equal to 2% of data.

```
10221039  dSys=y*0.02;
```

4. Renormalize data with shifted energy. Define old and new monitors: CS from ENDF-B/IV, reaction U-235(n,f) and modern data from IAEA Standards-2006 library; calculate ratio from absolute data obtained by using old monitor; then shift energy by -0.4MeV; calculate absolute values using new monitor. Note: sequence is very important here.

```
10221039  m0: endfb4 $ u235nf;  m1: iaeastd2006 $ u235nf;
10221039  y=y/m0; dy=dy/m0; e=e-0.4e6;  y=y*m1;  dy=dy*m1;
```

5. Calculate ratios using CS from ENDF-B/IV, reaction U-235(n,f)

```
10221039 mf=203; m0:endfb4 $ u235nf; Y=Y/m0; dY=dY/m0; A=18.9; dA=92235.9
```

6. Show cross section data from monitor reaction (for debugging)

```
10221039 m0:endfb4 $ u235nf; y=m0; mt=18;
```

7. Show correction factors of re-normalization (debugging)

```
10221039  m0:endfb4 $ u235nf;   m1: iaeastd2006 $ u235nf;
10221039  y=m1/m0;  mf=203;  mt=18;
```

Table 1. Description of modifications.

Construction	*Syntax*	*Meaning, comments*
List of modifications	**#**comment **$A** Date, Evaluator Modification . . . . . . Modification	Describes corrections to many datasets. Text after **#** will be ignored. It can be used as users' comment – reminder for themselves. **$A** stands for the Author of the modifications: when and who made this file. *Not yet supported.*
Modification	Dataset Instruction**;**…Instruction	Describes corrections to one dataset; can be presented in several lines
Dataset	`SubentryPointer`	9 symbols: Entry(5), Subentry(3 digits), Pointer(1). Subentry can not have blanks - zeros should be used. Pointer can be blank.
Instruction	Declaration	conditions and parameters
	Calculation	describes how to modify data
	Command	

Declaration	`E: EnMin EnMax;`
	`E: * EnMax;`
	`E: EnMin;`
	`E: *;`
	`E:;`
		Specify interval of incident energy (eV). EnMin, EnMax are real numbers. Symbol * means no limit. All further manipulations will be done only within this interval.

	`M0: library $ reaction;` `M1: library $ reaction;`	Specify files with monitor data which will be used for re-normalizations
	`X4U: Date;`	Specify date of last modification of the given Subentry. To used for checking, whether given modifications are out of date. *Not yet fully supported.*
Calculation	Variable = Expression	
Variable	`E, dE, Y, dY, A, dA, E2, dE2`	Data in C4 file – real array [8]
	`MF, MT`	MF, MT from C4 file
	`dSys`	Systematic uncertainty. *Not supported in TABLE format.* *Not yet officially supported in C4 format.*
	`c0, c1, c2, c3, c4, c5, c6, a0, a1, a2, a3, Fc`	Parameters, intermediate variables
Expression	<Operand>	For the moment, parentheses are not supported
	<Operand><Operation>...<Operand>	
Operand	Variable	See above
	Numerical value	Number (REAL in Fortran format)
	`M0, M1`	Value from Monitor-file approximated for current energy
Operation	`^ * / + -`	
Command	`Del;`	Within given energy range: exclude data from the Dataset. If energy range is not given – causes ignoring whole dataset.