Instructions for the "Excel2ENSDF" Java program

1. **Purpose of this program**:

   To generate an ENSDF file from tabulated data in an input Excel file (see details below for how to prepare such an Excel file). It also has the reverse function to convert an ENSDF file to an Excel file that can be converted back to an ENSDF file (almost identical to the initial ENSDF file except for some possible minor differences in text formatting).

2. **The input excel file:**

   This file must at least have two sheets named "**Header**" and "**Data**".

   *"**Header**" sheet:*

   contains header information to be put in an output file such as nuclide name, reaction name, general comments, and so on. It must have two columns and at least six rows, as shown below. The names of the first column must be the same as shown below. Order and case don't matter. The content in the second column is for example.

column1	column2
Nuclide	178Hf
Reaction	174YB(12B,xng)
NSR	2011Ko16
Reference	F.G. Kondev et al., Phys. Lett. B492 (2011) 112-124
Comment	2011Ko16: This was obtained using data …….
Compiler	Compiled by W. Murray (DePaul U/ANL) and F.G. Kondev (ANL): November 13, 2011
CL (or CG,CA,…)	E,J$From Adopted Levels
Command	NEWLINE
LCD1 (or LCD2,…)	|G{-0}{+2}/|G{-|g}
GCD1(or GCD2,…)	anisotropy
LCD1_KEYNUMBER	1994Pa27 (Note: keynumber to be put at the end of each LCD1 data)
GCD1_KEYNUMBER	1994Pa27 (Note: keynumber to be put at the end of each GCD1 data)
LUDD1_KEYNUMBER	1994Pa27 (Note: keynumber to be put at the end of each LUDD1 data)
RI_MULTIPLY,…	1.34(2)
DRI_FORMAT	REAL
LCD1_UNIT	eV

Explanations (for names in column1 in table above):

- ***Nuclide***:
  Nuclide name to be put in col1-5 each line in output file.

- ***Reaction***:
  Reacion name to be put as dataset DSID in col10-39 of the first line in output file.
- ***NSR***:
  NSR keynumber.
- ***Reference***:
  Reference of the paper being compiled.
- ***Compiler***:
  Information of compiler
- ***Comment***:
  General comments of the dataset to be put before data table. Multiple "Comment" headers can be used.
- ***CL (or CG,CB,CA,…)***:
  General comments for specified type of records, eg, "CL" for level record, "CG" for gamma records. Multiple headers can be used.
- ***Command***:
  For controlling display of data-as-comment in output. Multiple "command" headers can be used. Available commands are:

  "NEWLINE":
  put each data-as-comment (LCD1, LCD2, …, GCD1, GCD2, …, DCD1,…, PCD1,…, GUDN1,…, see instructions for data sheet for descriptions) in a new line. By default they are put in the same line.
  "LCD1_NEWLINE" (or "LCD2_NEWLINE",…):
  put data-as-comment LCD1 in a new line. Other data-as-comment are put in the same line by default if not specified.
  "UPPERCASE":
  put comments in uppercase "C". It is in lowercase by default.
  "LIMIT=25":
  Set uncertainty round-off limit to 25. It is set to be 99 by default.

- ***LCD1 (or LCD2,…, GCD1, GCD2,…, DCD1,…, PCD1,…)***:
  value in column2 is the replacement of the column name (see notes for "data sheet") in the output. This is useful for putting data-as-comment values in comment, like "E(p)(lab)=1204 {I5}". To use it, put data in a column called "LCD1" in data sheet and rename "LCD1" to "E(p)(lab)" in the "Header" sheet, like the example "Header" sheet above.
- ***LCD1_KEYNUMBER (or GCD1_KEYNUMBER,LUDD1_KEYNUMBER,GUDD1_KEYNUMBER):***
  keynumber to be put at the end of each data-as-comment.
  (Note: LUDD---user-defined-data for level, alternative to LCD but can have units to be put in a LUDU column in data sheet, same for GUDD)
- ***RI_MULTIPLY***:
  Multiply all values in "RI" column in data sheet with a constant value in column2.
  Also apply to all data fields that can have uncertainty.
  Format of the keyword in column1: Field_name+"_"+operaton_name
  Available operation_name: *ADD, MULTIPLY, SUBTRACT, APPEND (or APPENDAFTER), APPENDBEFORE.*

APPENDAFTER, APPENDBEFORE: to append the string text as is in column2 before or after the data string in data field of Field_name
Multiple operations on the same filed is allowed, but note that order of operation is their order in the header sheet.

- ***DRI_FORMAT***:
  Indicates the format of the values in the separate "DRI" uncertainty column in data sheet. If "REAL" is given, the values in "DRI" column will be processed as real values. By default, all numerical uncertainties in separate columns in data sheets are in ENSDF format.
  The keyword in column1: uncertainty Field_name+"_FORMAT"
  Available format: REAL, ENSDF (default if not set)
- ***LCD1_UNIT(or GCD1_UNIT):***
  unit to be put in each data-as-comment.
  Format of the keyword in columns: Field_name+"_UNIT" (note: in lower-case "c" comment)
- ***DELAY_TYPE***:
  "P" for delayed proton, "N" for delayed neutron, "A" for delayed alpha. It is optional. One can also specify the type in the data column name in data sheet, like, "EDP" for delayed-proton energy, "EDA" for delayed-alpha energy.

- ***Other available optional settings***:
  <u>*For parent record in decay dataset*</u>*:*

PID	parent nuclide name
EP,DEP	parent level energy and uncertainty
JPA	parent spin-parity
TP,DTP,TPU	parent half-life,uncertainty,unit
QP,DQP	Parent Q-value and uncertainty
CP	Parent comments
PDOC	Parent document comments. (NOTE: "DP" in delay-particle)

<u>*For N record*</u>*:*
NR, DNR, NT, DNT, BR, DBR, NB, DNB, NP, DNP (refer to ENSDF manual for these names)
CN: comments
NDOC: document comments (NOTE: "DN" reserved for delayed neutron)

<u>For PN record</u>:
NRBR, DNRBR, NTBR, DNTBR, NBBR, DNBBR, NP, DNP (refer to ENSDF manual)
PNCOM: PN COM in col77
PNOPT: PN option in col78
CPN: PN comments
PNDOC: PN document comments

<u>*For Q record in Adopted dataset*</u>:
Q, DQ, SN, DSN, SP, DSP, QA, DQA

QREF: keynumber
CQ: Q record comments
QDOC: Q record document comments

*"**Data**" sheet:*

- ✓ Column names have to be selected from the list below. Values can be given as "value(uncertainty)" in one column , or 'value' and 'uncertainty' in two separate columns.
- ✓ Uncertainty must be in ENSDF format by default. For example, level energy **274.2(4) can be put in one column "EL" as "274.2(4)" or in two separate columns "EL" and "DEL" as "274.2" and "4", respectively**. Other examples, "<=1" in "RI" column or "1" and "<=" in "RI" and "DRI" columns, respectively. Similar for "~1". If real values for uncertainties are used instead of default ENSDF format, it must be indicated in the "Header" sheet. See example in the first page.
- ✓ Records of a gamma from a level must be put in the same row as the level record.
- ✓ Records of a decay from a level must be put in the same row as the level record.
- ✓ If there are more than one gamma records, the records for these gammas can be put in new rows with the fields for the level blank except the level energy, which tells the program which level these gammas are from.
- ✓ If the level energy field in a row for gamma record is blank, this gamma is treated as from the level in the previous row.
- ✓ Multiple flags are allowed in 'LFLAG', 'GFLAG', 'DFLAG' and 'PFLAG' fields. If this is the case, the first flag will be put in column 77 and the rest will be put in continuation record following 'FLAG='. If there is a band flag, it will be put in column 77 and all 'LFALG' will be put in continuation record.
- ✓ **Placements of levels with "X","Y" or "Z"**, … in energy records: for example, use "X=1000" in "EL" column to place the "X" level at E(level)=1000; if only "X" is used, this level will be placed right above the one before it in the "EL" column.

For Level record:

Column name	description	Column name	description
'EL','DEL'	Level energy	***'BAND','SEQ','LFLAG'***	Band flag, Seq. flag and level flags
'JPI'	Spin-parity	***'CL'***	Level comment
'T','DT'	Half-live	***'LQUE'***	Question mark for level
'TU'	Half-live unit	***'LCD1','DLCD1'***	Data1 to be put in level comment
'L'	Angular mom.	***'LCD2','DLCD2'***	Data2 to be put in level comment
'S','DS'	C2S factor	***'LCD3','DLCD3'***	Data3 to be put in level comment
'ISPIN'	isospin	***'BE1UP','DBE1UP','BE1WUP',***	Transition prob., up to E5 and M5
'XREF'	XREF	***LUDN***	Name of user-defined data in comm.
'DL'	Level document	***LUDU,LUDD,DLUDD***	unit, data value, uncertainty
'GF','DGF'	g-factor	***MOMM1,MOMM2,…***	Nuclear moment
'MS'	Metastable mark	***'SL'***	Calculated data

Explanation:

- For ‘CL’, the ENSDF convention should be followed. For example, “E$....” is for level energy comment, “$...” is for general level comment, and so on. Multiple ‘CL’ columns are allowed.
- Columns ‘LCD1’ and ‘DLCD1’ is for data of value and uncertainty to be put in the level comment with the name=’LCD1”, for example, the output will look like “178HF CL $LCD1=value uncertainty”. Right now, maximum of three such data are allowed to be put this way. It is useful to put data like level widths in the comment. One can rename “LCD1” in “Header” sheet. See explanation for “Header” sheet for details.
- Columns ‘LUDN’,’LUDU’,’LUDD’: similar to ‘LCD1’ for putting values of non-standard records in comments. The difference is that, ‘LUDN’, which stands for user-defined data name in level record, allows users to set a name for each value. Also the ‘LUDU’ column can be used to set a unit for each value. This is useful for column mixed with different type of values, like T1/2 and width.

For Gamma record:

Column name	description	Column name	description
‘EG’,’DEG’	gamma energy	***‘GFLAG’***	gamma flags
‘RI’,’DRI’	Gamma intensity	***‘CG’***	Gamma comment
‘EF’,’JF’	For final level	***‘DG’***	Gamma document comments
‘MUL’	Multi-polarity	***‘GQUE’***	Question mark for gamma
‘MR’,’DMR’	Mixing ratio	***‘GCD1’,’DGCD1’***	Data1 to be put in gamma comment
‘CC’,’DCC’	Conversion coeff.	***‘GCD2’,’GLCD2’***	Data2 to be put in gamma comment
‘TI’,’DTI’	Total intensity	***‘GCD3’,’GLCD3’***	Data3 to be put in gamma comment
‘DCO’,’DDCO’	DCO ratio	***‘BE1’,’DBE1’,’BE1W’,…***	Transition prob., up to E5 and M5
‘POL’,’DPOL’	polarization	***‘A2’,’DA2’,…***	Angular distribution coeff. (up to A6)
‘ECC’,’DECC’	Exp. total CC	***‘EKC’,’DEKC’,’ELC’,…***	Sub-shell exp. CC (up to M shell)
‘GCOIN’	Coincidence mark	***GUDN,GUDU,GUDD,DGUDD***	User-defined data-as-comment
‘SG’	Calculated data		

The usage of ‘CG’, ’GCD1’, ‘GUDN’, … is the same as ‘CL’, ‘LCD1’, ‘LUDN’, … for the level record.

For Decay record:

Column name	description	Column name	description
‘EB’,’DEB’	Beta energy	***‘EA’,’DEA’***	Alpha decay energy
‘IB’,’DIB’	Beta branch (B-)	***‘IA’,’DIA’***	Alpha decay branch
‘IBE’,’DIBE’	Beta branch (B+)	***‘HF’,’DHF’***	Alpha decay HF factor
‘IE’,’DIE’	EC branch	***‘DQUE’***	Question mark for decay record
‘LOGFT’,’DLOGFT’	Logft value	***‘CA’***	Comment for alpha decay record
‘TIE’,’DTIE’	EC+B+ total intensity	***‘DFLAG’***	also used for coin. mark if given as “C”
‘DFLAG’	Decay flags (B+/-,EC)	***‘UN’***	Forbiddenness, e.g., “1U”, “2U”
‘CB’,’CE’	Comments for B-,B+/ EC	***‘DB’,’DE’,’DA’***	Document comments
‘DCD1’,’DDCD1’,..	Data-as-comment	***‘SB’,’SE’,’SA’***	Calculated data

For Delay record:

Column name	description	Column name	description
'EDP','DEDP'	Delayed-proton energy	***'EDN','DEDN'***	Delayed-neutron energy
'IP','DIP'	Particle intensity	***'EDA','DEDA'***	Delayed-alpha energy
'EI'	Intermediate level energy	***'LP'***	Transfer angular-momentum
'WIDTH','DWIDTH'	Transition width (keV)	***'PFLAG'***	Delayed-particle flags
'PCOIN'	Coincidence mark	***'PQUE'***	Question mark
'CDP','CDA','CDN'	comments	***'PCD1',…***	Data-as-comment
'DDP','DDA','DDN'	Document comments		

3. Use of this program

In the program window, either click "Open file" or drag and release a file to the message area to load an input file (either ENSDF or Excel, the program can recognize the type), and then click on "Convert" to complete the conversion.

Options:

"all real uncertainty" checkbox: check it if all uncertainties in the input Excel file are in real format instead of ENSDF format, e.g., in 1234.5(12) the uncertainty "12" will be read as a real value of 12.0, while it is corresponding to a real value of 1.2 if "12" is in ENSDF format.

"uncertainty" limit: set the maximum uncertainty in ENSDF format to display. It is 25 by default. For example, 1234.5 +/- 5.6 will be put in the file as 1235(6) in ENSDF format if limit=25, and as 1234.5(56) if limit=99.

Comment case: set lower-case "c" or upper-case "C" comment case

4. The output file is "output.ens" for converting Excel to ENSDF or "output.xls" for converting ENSDF to Excel.

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