# Instructions for the "xls2ens" python program

## 1. **Running requirements**:

python 2.7.6 (not working with python 3.0.x), xlrd package (version 0.9.4)

## 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 |

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,…, see instructions for data sheet for descriptions) in a new line. By default they are put in the same line.
  *"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
  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)

- ***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***:
  *For parent record in decay dataset:*

| | |
|---|---|
| ***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) |

  *For N record:*
  ***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)

  For PN record:
  ***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

  *For Q record in Adopted dataset*:
  ***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. 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".

- ✓ 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.

For Level record:

| Column name | description | Column name | description |
|---|---|---|---|
| ***'EL','DEL'*** | Level energy | ***'BAND','LFLAG'*** | Band 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 |
| ***'DFLAG'*** | Decay flags (B+/-,EC) | ***'DFLAG'*** | also used for coin. mark if given as "C" |
| ***'CB','CE'*** | Comments for B-,B+/ EC | ***'UN'*** | Forbiddenness, e.g., "1U", "2U" |
| ***'DCD1','DDCD1',..*** | Data-as-comment | ***'DB','DE','DA'*** | Document comments |
| ***'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 |
| ***'ED'*** | 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

type in a terminal,

"***python xls2ens***"

and then you will be asked for the name of the excel file (with or without .xls extension are both ok). The output file is "outfile.ens"

Other function: you can print out all conversion data into a file that can be used as the input for the BrIccMixing program by typing "PRINT_CC" after the excel file name, for example,

"***2014ThAA PRINT_CC LEVEL***"

You can order the output by "LEVEL" or "GAMMA" energy, just by specifying "LEVEL" or "GAMMA" following "PRINT_CC". The output file is "PRINT_CC.out".

## 4. The output file is "outfile.ens"

Jun Chen
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