Computation Formats for Experimental Reaction Data

The CSISRS computation formats are output formats for the CSISRS data library which contain specified data given in fixed fields and in standard units. Two types of computation formats are provided for cross sections:

Line Format: All information necessary to define a datum is included on one line and each line is, therefore, independent. The format has been restricted to a 132-character line to allow for processing and listing at most computer facilities.

This format has the obvious advantage to the user of simplifying file handling. Resorting of the file can be done easily with standard sort routines. The line format is also very readable from the human standpoint.

Table Format: The data are presented in a two-dimensional table of 'x' versus 'y' with their associated uncertainties and an identification tag. Other associated information necessary to define each datum may be presented as header records at the beginning of the table. The table format eliminates the repetition necessary on self-contained lines.

No attempt has been made to allow for conversion of all data to the computation formats; formats have been developed to handle the needs of most users.

1 Cross Section Formats

Formats are, currently, limited to:

Data versus energy (σ), including partial cross sections for a given secondary energy or isomeric state.

Angular distributions ($d\sigma/d\Omega$), including partial distributions for a given secondary energy or isomeric state.

Secondary energy distributions ($d\sigma/dE$).

Double differential data ($d\sigma/d\Omega/dE$).

Associated uncertainties are given in the same units as the variables to which they apply. Blank are used (instead of zeros) where no value is given.

Standard variables and their units are:

- Incident energy in eV
- Secondary energy in eV
- Angle in degrees
- Data which is either:
  - cross section in barns
  - angular distribution in barns/steradian
  - energy distribution in barns/eV
  - double differential cross section in barns/steradian/eV
  - special quantities ,*i.e.*, α, η, ν (no dimensions)

Angular distributions are given in the laboratory system. Secondary energies are given in a representation suitable for the data presented, with a flag specifying which representation is used.

2 Line Format

A retrieval in the line computation format consists of two files, a bibliographic data file and a numeric data file. A third file is produced in EXFOR format which will contain any data sets which could not be converted to the line format.

1. **BIB File**

The BIB file is headed by an identification record:

Columns	1 - 11:	`BFILE`
	12 - 22:	Request number
	23 - 33:	Date of retrieval
	34 - 44:	Request type (`3`)
	67 - 79:	line ID (`0 0 0)`

BIB information is given in sections resembling the EXFOR format. All records are tagged with a record identification as follows:

Columns	67 - 71:	Accession #
	72 - 74:	Subaccession #
	75 - 79:	Sequence #

Each section is headed by a record containing:

Columns	1 - 11:	`BIB`
	12 - 22:	CSISRS Subaccession number
	23 - 33:	Number of records in section

Each section is terminated by an end record containing:

Columns	1 - 11:	`ENDBIB`

The BIB File is terminated by an end record containing:

Columns	1 - 11:	`ENDBFILE`
	12 - 22:	Number of tables in retrieval

2. Data File

The data file contains the following information:

Columns	1 - 3:	Atomic number
	4 - 6:	Atomic weight
	7:	Isomeric state (G = ground, M = 1st metastable state, etc.)
	8 - 11:	Incident projectile (particle code or, for A>4, chemical symbol + last 2 digits of atomic weight)
	12 - 14:	Reaction code (see list of codes, following)
	15 - 16:	Quantity code (see list of codes, following)
	17:	Modifier code (see list of codes, following)
	18:	Secondary energy code (see list of codes follrowing)
	19 - 20:	Standard code (see list of codes, following)
	21 - 23:	Laboratory code
	24 - 25:	Year of latest publication
	26 - 33:	CSISRS subaccession #
	34 - 44:	Energy
	45 - 55:	Energy error
	56 - 66:	Secondary energy or lower limit of secondary energy range
	67 - 77:	Upper limit of secondary energy range
	78 - 88:	Angle
	89 - 99:	Angle uncertainty
	100 - 110:	Data
	111 - 121:	Data uncertainty
	122 - 132:	Value of standard

The records may be read with the following format:

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(2I3, A1, A4, A3, A2, 2A1, A2, A3, I2, A8, 9E11.4).
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3. Codes Used in Line Formatted Files

Reaction Codes

TOT	Total	T	triton (t)	ETA	η
ABS	Absorption	HE3	^{3}He	NU	$\bar{\nu}$
NON	Nonelastic	A	α	NUP	$\bar{\nu}_{prompt}$
SCT	Scattering	2N	2n	NUD	$\bar{\nu}_{delayed}$
EL	Elastic	3N	3n	GEM	γ emission
INL	Inelastic	NP	n+p	NEM	n emission
F	Fission	ND	n+d	PEM	p emission
X	Production	NT	n+t	DEM	d emission
G	γ ray	N3	n+^{3}He	TEM	t emission
N	neutron (n)	NA	n+α	3EM	^{3}He emission
P	proton (p)	PA	p+α	AEM	α emission
D	deuteron (d)	ALF	σ_c/σ_f		

Quantity Codes

CS	-	Cross section
DA	-	$d\sigma/d\Omega$
DE	-	$d\sigma/dE$
D2	-	$d\sigma/d\Omega/dE$
*	-	special quantity (*e.g.* η)

Modifier Codes

A	-	Averaged

Secondary Energy Codes

E	-	Secondary particle energy
L	-	Level energy
Q	-	Q-value
X	-	Excitation energy
D	-	Energy degradation
+	-	Energy gain
N	-	Level number
G	-	Ground state
M	-	1st metastable state
2	-	2nd metastable state
3	-	3rd metastable state

Standard Codes

H	-	^{1}H(n,el)^{1}H cross section
HE	-	He(n,el) cross section
LI	-	^{6}Li(n,t)α cross section
B	-	B(n,abs) cross section
B1	-	^{10}B(n,α) cross section
C	-	C(n,el) cross section
AA	-	^{27}Al(n,α cross section
AP	-	^{27}Al(n,p) cross section
P	-	^{31}P(n,p) cross section
S	-	^{32}S(n,p) cross section
MN	-	^{55}Mn(n,p) cross section
CO	-	^{59}Co(n,σ) cross section
NI	-	^{58}Ni(n,p) cross section
CU	-	^{65}Cu(n,2n) cross section
IN	-	^{115}In(n,γ) cross section
I	-	^{127}I(n,σ) cross section
AU	-	^{197}Au(n,γ) cross section
TH	-	^{232}Th(n,f) cross section
U3	-	^{233}U(n,f) cross section
U5	-	^{235}U(n,f) cross section
U8	-	^{238}U(n,f) cross section
CF	-	^{252}Cf(spon. fission) $\bar{\nu}$

3 Table Format

A retrieval in the line table format consists of two files, a bibliographic data file and a numeric data file. A third file is produced in EXFOR format which will contain any data sets which could not be converted to the line format.

1. **BIB File**

The BIB file is headed by an identification record:

Columns	1 - 11:	`BFILE`
	12 - 22:	Request number
	23 - 33:	Date of retrieval
	34 - 44:	Request type (`3`)
	67 - 79:	line ID (`     0  0      0`)

BIB information is given in sections resembling the EXFOR format. All records are tagged with a record identification as follows:

Columns	67 - 71:	Table number
	72 - 74:	Set number (`0`)
	75 - 79:	Reference number

The file is headed by a record containing:

Columns	1 - 11:	`BIB`
	12 - 22:	CSISRS subaccession #
	23 - 33:	Number of records in section

Each bib section is terminated by an end record containing:

Columns	1 - 11:	`ENDBIB`

The BIB File is terminated by an end record containing:

Columns	1 - 11:	`ENDBFILE`
	12 - 22:	Number of tables in retrieval

2. Table File

The table file is headed by an identification record:

Columns	1 - 11:	`REQUEST`
	12 - 22:	Request number
	23 - 33:	Date of retrieval
	34 - 44:	Request type (3)
	67 - 79:	line ID (0 0 0)

A table consists of all data for a given quantity (*e.g.* Li(n,t) angular distributions). Each table is further divided into sets, with each set being defined by the common variables given in a header record.

All records are tagged with a record identification as follows:

Columns	67 - 71:	Table number
	72 - 74:	Set number
	75 - 79:	Reference number

Each table is headed by a record containing (set # and reference # are 0):

Columns	1 - 11:	`PHYSENT`
	12 - 22:	Table type (see following)
	23 - 33:	Secondary energy type
	34 - 44:	# of points in the table
	45 - 66:	Energy range (2E11.4)

Each data set is headed by a record (HEADER) containing (reference # is 0):

Columns	1 - 33:	1st common variable and uncertainties (as defined by table type, see following)
	34 - 66:	2nd common variable and uncertainties (as defined by table type, see following)

3. Table Types

Data versus energy
(type 1)

The HEADER record contains:

Columns	1 - 11:	Lower limit of secondary energy range
	12 - 22:	Upper limit of secondary energy range
	23 - 66:	blank

The DATA records contain:

Columns	1 - 11:	Energy
	12 - 22:	+Energy uncertainty
	23 - 33:	—Energy uncertainty
	34 - 44:	Data
	45 - 55:	+Data uncertainty
	56 - 66:	—Data uncertainty

Differential data ($d\sigma/d\Omega$) and double differential data ($d\sigma/d\Omega/dE$)
(type 2)

The HEADER record contains:

Columns	1 - 11:	Energy
	12 - 22:	+Energy uncertainty
	23 - 33:	—Energy uncertainty
	34 - 44:	Secondary energy
	45 - 55:	+Secondary energy uncertainty
	56 - 66:	—Secondary energy uncertainty

The DATA records contain:

Columns	1 - 11:	Angle
	12 - 22:	+Angle uncertainty
	23 - 33:	—Angle uncertainty
	34 - 44:	Data
	45 - 55:	+Data uncertainty
	56 - 66:	—Data uncertainty

Energy Spectrum ($d\sigma/dE$)
(type 3)

The HEADER record contains:

Columns	1 - 11:	Energy
	12 - 22:	+Energy uncertainty
	23 - 33:	—Energy uncertainty
	34 - 66:	blank

The DATA records contain:

Columns	1 - 11:	Secondary energy
	12 - 22:	+Secondary energy uncertainty
	23 - 33:	—Secondary energy uncertainty
	34 - 44:	Data
	45 - 55:	+Data uncertainty
	56 - 66:	—Data uncertainty

The table records may be read in the following format: (`6E11.4, I5, I3, I5`).