The method of digitization of the graphical data of cross-section values for compilation into the EXFOR

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Introduction

The cross-section value is an important parameter not only to understand the structure of nucleus but also to estimate the output of an isotope through a particular reaction . It is as such important that the cross-section data be compiled carefully in such a manner so that it is not only accessible but also easy to understand. The EXFOR database is one such format.

The compilation of the data in EXFOR requires the experimental data in either tabulated form or graphical form. The tabulated form of data can be easily transferred to the format. But the graphical data needs to be digitized first. There are quite a few digitizing softwares which can be used and some of them are compatible both in windows and Linux. One such software which is compatible in windows is discussed here.[1]

Illustration through example

First of all the graph to be digitized is scanned and saved as a bitmap file. The digitizer software has a set of programs and a data feeding window .The graph data is fed to the digitizing software in the input mode. The graph may have one or more curves. All the curves may or may not have the same format of axes. Each curve is digitized separately by marking using a given cursor. The fed data is saved in two parts AXS and SRC files. This is then fed to a program called the graf_new which gives the output if there is no error, otherwise we get no output and only an error message. This can be easily illustrated through a example from a graph of figure 11 for alpha particles at 30° of the paper [2] as shown in the following figure. Marking is started with the axes end points and then tic points for X axis and then Y-axis with a mention of logrithmic or linear scale.. After that the data points are marked one by one for all curves with the same set of axes . In the present example only one curve is chosen for simplicity.

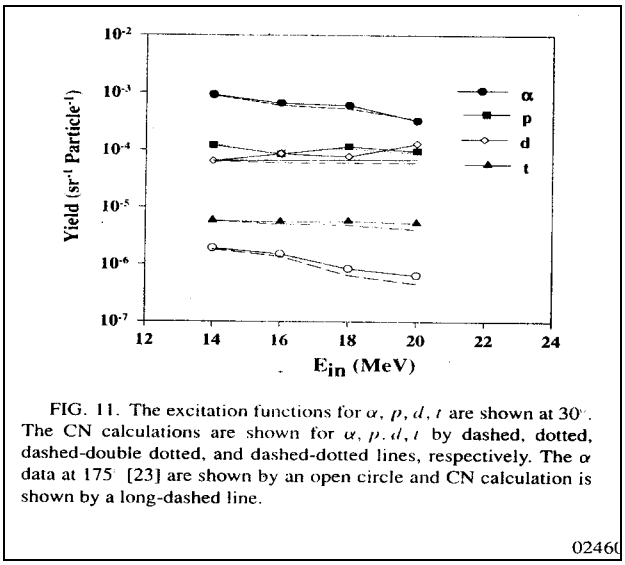

FIG. 11. The excitation functions for α, p, d, t are shown at 30°. The CN calculations are shown for α, p, d, t by dashed, dotted, dashed-double dotted, and dashed-dotted lines, respectively. The α data at 175° [23] are shown by an open circle and CN calculation is shown by a long-dashed line.

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The data is saved as following in the AXS and SRC files as shown below with a common name but different extensions. Here the name was chosen 'example'so the following files were generated for saving the input data:

example.AXS file

```
ANG
ADEG
-999
E
MEV
DATA
ARB-UNITS
12, 14, 16, 18, 20, 22, 24
.0000001, .000001, 0.000010, 0.000100,
```

```
 0.001000, 0.010000
Figure 11
30
```

example.SRC file`

```
BEGW
BEGG
LNX
   0479 1287
   1880 1302
END
SCX
LIN
   0479 1286
   0710 1289
   0943 1292
   1177 1295
   1413 1296
   1647 1299
   1880 1302
END
LNY
   0478 1286
   0491 0113
END
SCY
LOG
   0479 1287
   0481 1052
   0483 0818
   0486 0584
   0488 0348
   0491 0113
END
BEGC
   0720 0359
   0953 0396
   1186 0406
   1421 0471
ENDC
ENDG
ENDW
```

This saved data when fed to the graf_new program of the digitizer gives the digitized data in an output file with the same name as the SRC & AXS files as shown below, if there is no error in feeding of data , otherwise there is no output but only an error message. So here the output is in a file called example.EXF.

example.EXF

```
ENTRY          ample     201010
SUBENT       ample001
BIB               6         6
TITLE
AUTHOR
INSTITUTE
REFERENCE
FACILITY
HISTORY    (20101003C)
ENDBIB
NOCOMMON
ENDSUBENT
SUBENT       ample002
BIB               4         4
REACTION
ERR-ANALYS (E-ERR-DIG)  Digitizing error
        (ERR-DIG)    Digitizing error
STATUS     (CURVE)Figure 11
ENDBIB
COMMON            2         3
E-ERR-DIG  ERR-DIG
MEV        PER-CENT
0.31132E-020.49835E-02
ENDCOMMON
DATA              3         4
ANG        E          DATA
ADEG       MEV        ARB-UNITS
 30.000    13.993     0.92194E-03
 30.000    15.989     0.65733E-03
 30.000    17.983     0.61076E-03
 30.000    19.999     0.33096E-03
ENDDATA
```

And as this output is in the EXFOR format so this can be directly included in the EXFOR file as one of the data subentries.

References

[1] S.Adhikari et al, Physical review C 74 (2006) 024602.

[2] Course material on EXFOR for the theme meeting held on 4-8 September ,2006, Lectures by O.Schwerer, IAEA Nuclear data section, Vienna, Austria..