Data assessment of $^{12}C(\alpha,\alpha)^{12}C$ Cross sections

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Summary

The data sets in IBANDL were compared with the data in the original references. Some discrepancies between original data and data published in IBANDL are detected and reported in Table 1. It was found that only part of data from original publications was digitized and transferred to IBANDL database. For instance, IBANDL contains data from [5] but only for 106,7º although original publication reports cross sections for three other lab angles 124º, 136º and 160º. As this is a case for several publications, all published data not included in IBANDL or files already uploaded to IBANDL but where some mistakes were found are marked red. Data for all angles are digitized and available in EXFOR data base in R33 format. However comparison of data from original publication [5] and R33 files shows disagreement for all angles except for 160°. For all other angles shape of the excitation curve is in agreement with data from original publication but intensity is not correct. All data where R33 files generated from EXFOR are not in agreement with data from original publication are marked in blue.

Angle Lab	energy (keV)	Author	Comment
170º	4100-7640	J.A. Davies et al.,Nucl. Instr. and Meth. B85 (1994) 28 Ref. [1]	In IBANDL CS at 5.5 MeV is missing and is given in original publication to be 493 mb/sr Corrected in R33 file and uploaded to IBANDL
172º	4035-4635	R. Somatri et al. Nucl. Instr. and Meth. B113 (1996) 284 Ref. [2]	The energies in original publication are for 5 keV lower than energies given in IBANDL
165º	1810-9052	Y. Feng et al., Nucl. Instr. and Meth. B86 (1994) 225 Ref. [3]	In original publication CS for 3543 keV is 5.95 instead of 5.92 in IBANDL Corrected in R33 file and uploaded to IBANDL
170.5º	1564-4976	J.A.Leavitt, Nucl. Instr. and Meth. B40/41 (1989) 776 Ref. [4]	Published data in agreement with IBANDL
106.7º	2500-4800	C. Miller Jones at al.,Nucl. Phys.37 (1962)1 Ref. [5]	Data already exist in IBANDL and are in agreement with data from original publication
124º	2500-4800	Ref. [5]	R33 generated from EXFOR is not in agreement with data published in original publication
136º	2500-4800	Ref. [5]	R33 generated from EXFOR is not in agreement with data published in original publication
160º	2500-4800	Ref. [5]	Data from EXFOR uploaded to IBANDL EXFOR data are in agreement with data published in original publication

170º	5000-9000	H.-S. Cheng etal., Acta Phys. Sinica 43 (1994) 1569 Ref. [6]	Data published in IBANDL were not compared with original publication (not available)
149º	4000-13300	T.P.Marvin et al., Nucl.Phys.A180 (1972) 282 Ref. [7]	Data already exist in IBANDL and are in agreement with data from original publication
143.9º	4000-13300	Ref. [7]	R33 generated from EXFOR is not in agreement with data published in original publication
136.7º	4000-13300	Ref. [7]	R33 generated from EXFOR is not in agreement with data published in original publication
125.1º	4000-13300	Ref. [7]	R33 generated from EXFOR is not in agreement with data published in original publication
113.9º	4000-13300	Ref. [7]	R33 generated from EXFOR is not in agreement with data published in original publication
106.8º	4000-13300	Ref. [7]	R33 generated from EXFOR is not in agreement with data published in original publication
166.6º	640-1170 1910-3980	R.W. Hill, Phys.Rev.90 (1953) 845 Ref. [8]	Digitized data available in IBANDL but from 640 –1170 keV and from 1910 - 3980 keV, the part from 1170 to 1910 keV should be digitized and added to IBANDL
133.3º	2500-4000	Ref. [8]	Data already exist in IBANDL and are in agreement with data from original publication
107.2º	2500-4000	Ref. [8]	R33 generated from EXFOR is not in agreement with data published in original publication
167º	3800-7600	J.W. Bittner et al., Phys. Rev. 96 (1954) 374 Ref. [9]	Data already exist in IBANDL and are in agreement with data from original publication
134.3º	3800-7600	Ref. [9]	R33 generated from EXFOR is not in agreement with data published in original publication
125.2º	3800-7600	Ref. [9]	Data from EXFOR uploaded to IBANDL EXFOR data are in agreement with data published in original publication
104.8º	3800-7600	Ref. [9]	R33 generated from EXFOR is displaying cm CS and not LAB CS, not in agreement with data published in original publication
27° - 167° in steps of 5°.	5000 and 6000	C. W. Wang et al.,J. Phys. Soc. Jpn. 51(1982)3093 Ref. [11]	EXFOR R33 files downloaded for angles > 100° Data from EXFOR uploaded to IBANDL Original publication not available

170°	5000-9000	Shen Hao et al., Acta Physica Sinica 43 (1994) 1569 Ref. [12]	EXFOR R33 files downloaded, data are given as ratio-to-Rutherford Data from EXFOR uploaded to IBANDL Original publication not available
165°	5900-7100	Zhou Zhuying et al., Conf. High Energy and Heavy Ion Beams in Material Analysis, 1989, p. 183 Ref. [13]	EXFOR R33 files downloaded, data are given as ratio-to-Rutherford Data from EXFOR uploaded to IBANDL but not yet visible Original publication not available
167°	5040-6000	C.J.Wetteland et al. LA-UR-98-4867 Ref. [14]	Data uploaded to IBANDL Original publication not available
170°	5412-5964	M.Berti et al., Nucl. Instr.and Meth.B143 (1998)357 Ref. [15]	Data uploaded to IBANDL Data in agreement with data in original publication Data in original publication are given as ratio-to-Rutherford
169°	6400-7900	H. Yonezava et al. Nucl. Instr. and Meth.B88(1994)207 Ref. [16]	Data uploaded to IBANDL Data in agreement with data in original publication
165°	9000-11700	J.C. Banks et al. Nucl. Instr. and Meth. B249 (2006)101 Ref [17]	Data uploaded to IBANDL Data in agreement with data from original publication
107°	3540-3630	M.A. Kovash et al. , Phys.Rav.C31 (1985) 1065 Ref [18]	R33 generated from EXFOR is not in agreement with data published in original publication
136°	3540-3630	M.A. Kovash et al. , Phys.Rav.C31 (1985) 1065 Ref [18]	R33 generated from EXFOR is not in agreement with data published in original publication
152°	3540-3630	M.A. Kovash et al. , Phys.Rav.C31 (1985) 1065 Ref [18]	R33 generated from EXFOR is not in agreement with data published in original publication
35 angles from 22° to 163°	1460-6560	R. Plaga et al. Nucl. Phys. A465 (1987) 291 Ref. [19]	Data uploaded to IBANDL Original data not available

Table 1: Comparison between data from original publications and data published in IBANDL

Ref. [5]: In original publication data are reported only in the graphical form. Authors report measurements with alphas in the energy range from 2.5 to 4.8 MeV. Excitation functions were measured at the c.m. angles 70.1º, 90º, 99.3º, 109.9º, 125.3º, 140.3º, 149.5º and 166.6º. If we assume that only backscattering angles greater than 100º are of importance for IBA community, and

convert c.m. to lab angles, excitation functions reported in the original publications are available for 160º, 136º, 124º and 106.7º in the energy range from 2.5 to 4.8 MeV. Cross sections are reported as c.m. cross sections. However, in IBANDL only data for 106.7º are tabulated and are in agreement with data from original publication. Data for 160° are in agreement with original data but are not yet tabulated in IBANDL. R33 files for two other angles (124° and 136°) generated from x4 are not in agreement with data from original publication.

Ref. [7]; In the paper data are reported only in the graphical form. Data are reported for c.m. angles from 30.6º up to 158.8º and laboratory energies from 4 to 13.3 MeV. Again, we are interesting only for backscattering angles greater than 100º while they are important for IBA. Excitation functions are plotted for 125.3º, 131.4º, 140.8º, 149.4º, 155º and 158.8º in the c.m. that corresponds to 106.8º, 113.9º, 125.1º, 136.7º, 143.9º and 149º in the lab frame, respectively. However, in IBANDL only data for 149º are tabulated. Digitized data for all other angles exist in EXFOR data base but they do not correspond with data from original publication. It seems that digitalization process is not correctly done.

Ref. [8]; In the paper data are reported only in the graphical form. Data are reported for c.m. angles from 92º, 125.5º, 147.2º and 171º that correspond to 73.7º, 107.2º, 133.3º and 166.6º lab angles. For 171º c.m. (166.6º lab), differential cross sections in the c.m. system are measured from 600 – 4000 keV. In IBANDL data are published for energies from 640 –1170 keV and from 1910 -3980 keV. For 147.2º c.m. (133.3º lab) digitized data are available in IBANDL from 2.5 to 4 MeV. This file is in agreement with data from original publication. Comparison of R33 files made from EXFOR with data from original publication gives that data for 166.6° are in agreement with data from original publication but data for 107.2° are not.

Ref. [9]; In the original publication data are presented only in the graphical form. c.m. cross sections are presented for c.m. angles 171.2º, 147.9º, 140.8º, 123.2º and 90.0º that corresponds to lab angles of 166.9º, 134.3º, 125.2º, 104.1º and 72º. If we assume that only backscattering angles greater than 100º are important for IBA community, excitation functions for 167°, 134.3º, 125.2º and 104.1º are studied. For 167° data can be found in IBANDL and are in agreement with original data. R33 data from x4 for 125.2° are in agreement with original data but for two other angles 134.3° and 104.8° are not.

There are three data sets in EXFOR [11], [12] and [13] and one in IBANDL [14] for $^{12}C(\alpha,\alpha)^{12}C$ cross sections that can not be compared with data from original publications due to the fact that original publications are not available to the author of this text. In [11] authors have measured differential cross sections at two energies 5 and 6 MeV for scattering angles from 27° to 167° in steps of 5°. R33 files are downloaded for angles > 100°. In [12] cross section ratio to Rutherford is reported for energies from 5-9 MeV and 170°. In [13] the same is reported for energies from 5.9-7.1 MeV and 165°.

R33 files of data from Ref. [15], [16] and [17] are compared and it is found that they are in agreement with data from original publications.

Authors from ref. [18] reported excitation functions for four lab angles 92°, 107°, 136° and 152°. Again, EXFOR generated R33 files were compared with data from original publication but they are not in agreement with it. Digitized data are in agreement but transformation from c.m. to lab cross sections was not properly done for all angles.

In ref. [19] authors report angular distributions of cross sections for 35 angles in the range from θ_{lab}=22° - 163°. Angular distributions have been obtained at 51 energies in the energy range from 1.466 to 6.558 MeV. It was not possible to check all original data because they are part of PhD thesis. Part of the data was checked in ref [19] for some energies and was found that those data are in agreement with x4 generated R33 files. Data for 103°, 108°, 112°, 118°, 122°, 128°, 132°, 138°, 143°, 148°, 157° and 163° will be uploaded to IBANDL.

Comparison of published data for different scattering angles

Around 135º, there are only three data sets that can be compared. Data from [10] and [8] are in good agreement up to 3500 keV as can be seen from Fig. 1. For energies higher than 3500 keV discrepancy between all three data sets exist.

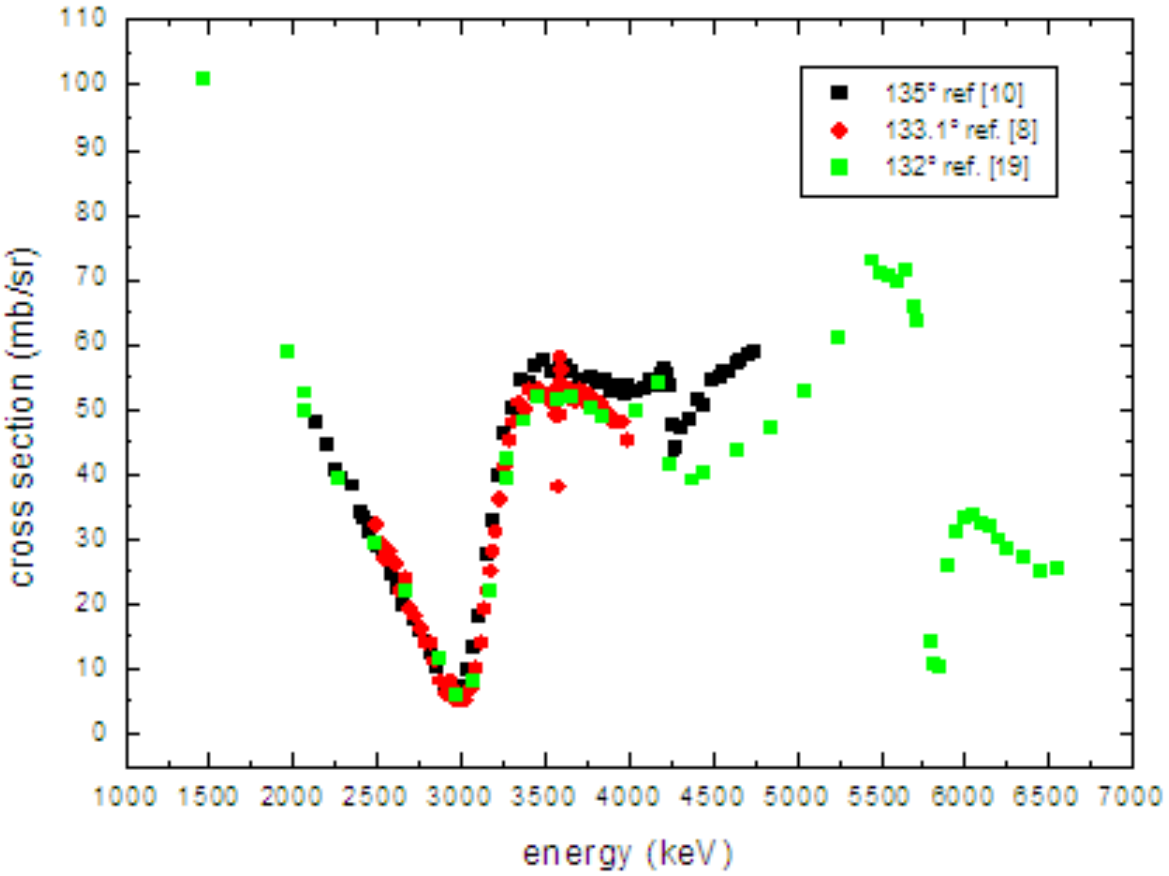

Fig.1 Three sets of data from [8], [10] and [19]

Around 150º there are data from [7] for 149º, from [10] for 150º and from [19] for 148°. Data overlap in the region where strong resonance exists. As can be seen from Fig.2 two sets of data differ in both, resonance position and intensity.

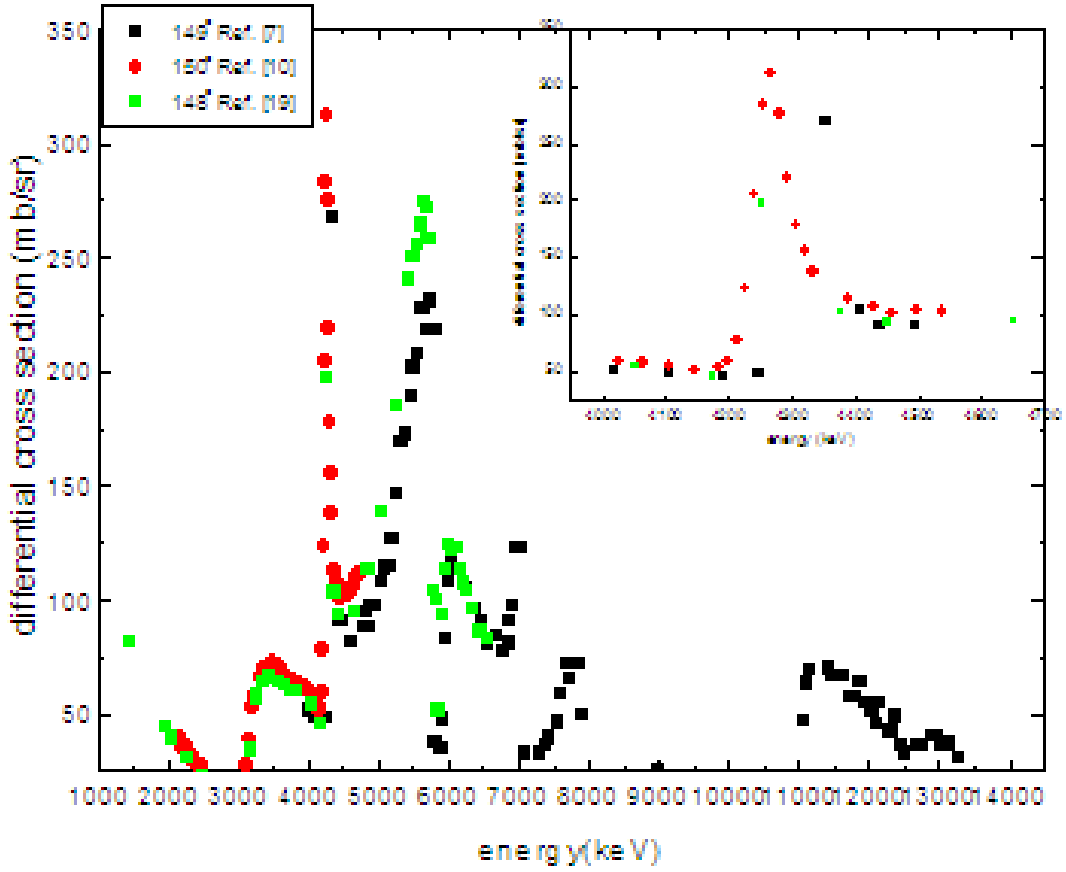

Fig. 2 Three sets of data for $^{12}C(\alpha,\alpha)$ differential cross sections from Ref. [7], [10] and [19].

Around 165º there are 5 databases available. Agreement between experimental points from [9], [19] and [3] is good for ~ 4250 keV resonance, difference in resonance position between data sets is about 10 keV as can be seen from Fig.3. Data also differ in the height of the resonance.

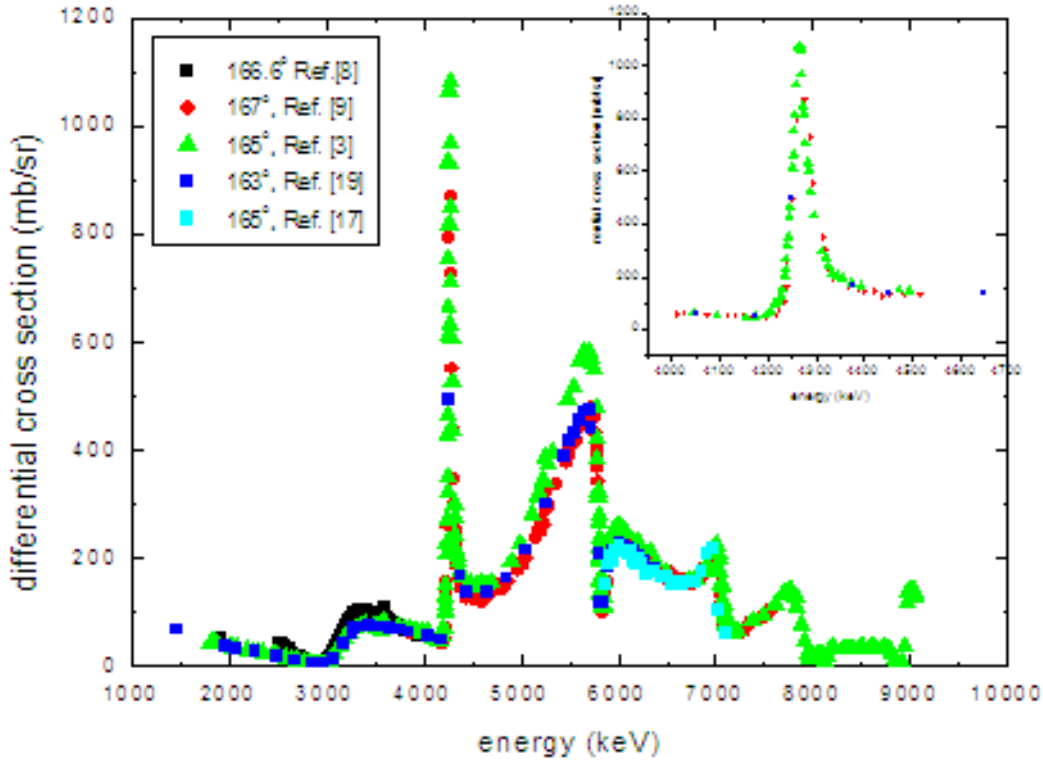

Fig 3. Available data sets for $^{12}C(\alpha,\alpha)$ differential cross sections around 165º published in IBANDL.

Around 170° there are 6 data sets available in IBANDL. For 4275 keV three data sets can be compared but as can be seen from the magnified part of Fig.4. Data from ref [4] and [2] are in agreement concerning height as well as position of 4275 keV resonance.

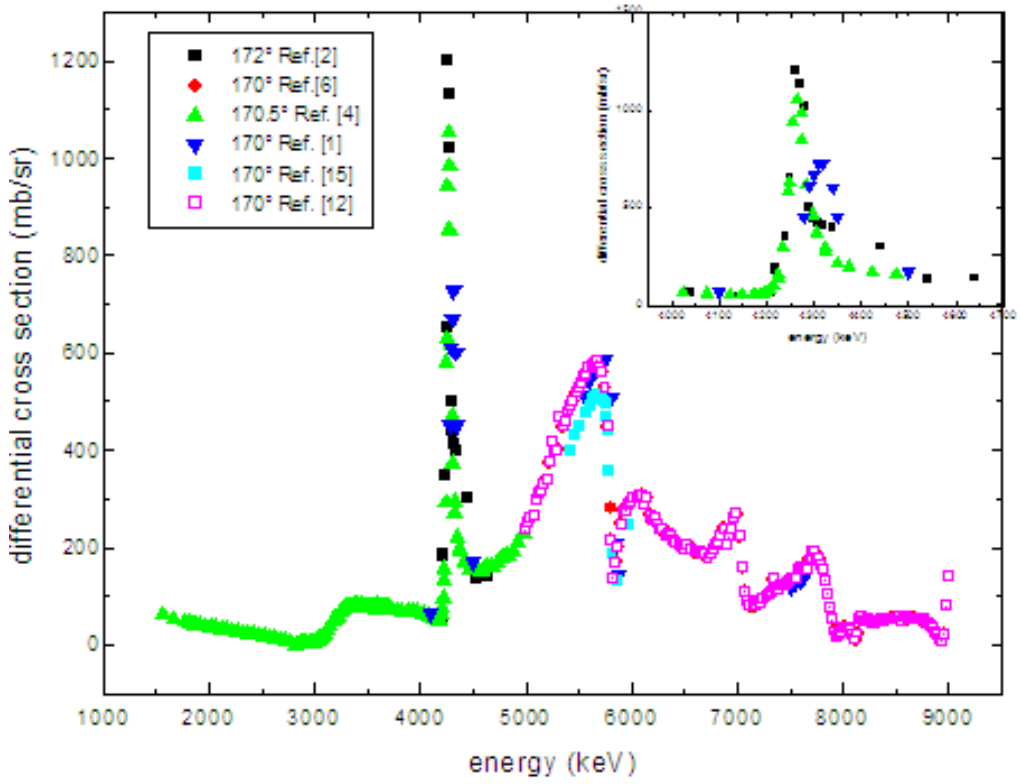

Fig 4. Available data sets for $^{12}C(\alpha,\alpha)$ differential cross sections around 170º published in IBANDL.

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