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 laboratory angles 124º, 136º and 160º. As this is a case for several publications, all published data not included in IBANDL are marked red. As they are published only in graphical form, it is necessarily to digitize them.

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
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
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]	Digitized data transferred to IBANDL
124º	2500-4800	Ref. [5]	Need to be digitized Not included to IBANDL, see Add.1
136º	2500-4800	Ref. [5]	Need to be digitized Not included to IBANDL, see Add.1
160º	2500-4800	Ref. [5]	Need to be digitized Not included to IBANDL, see Add.1
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]	Digitized data transferred to IBANDL
143.9º	4000-13300	Ref. [7]	Need to be digitized Not included to IBANDL, see Add.2
136.7º	4000-13300	Ref. [7]	Need to be digitized Not included to IBANDL, see Add.2
125.1º	4000-13300	Ref. [7]	Need to be digitized Not included to IBANDL, see Add.2
113.9º	4000-13300	Ref. [7]	Need to be digitized Not included to IBANDL, see Add.2
106.8º	4000-13300	Ref. [7]	Need to be digitized Not included to IBANDL, see Add.2
104º	4000-13300	Ref. [7]	Need to be digitized Not included to IBANDL, see Add.2

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]	Digitized data available in IBANDL
107,2º	2500-4000	Ref. [8]	Need to be digitized Not included to IBANDL, see Add.3
167º	3800-7600	J.W. Bittner et al., Phys. Rev. 96 (1954) 374 Ref. [9]	Digitized data available in IBANDL
134.3º	3800-7600	Ref. [9]	Need to be digitized Not included to IBANDL, see Add.4
125.2º	3800-7600	Ref. [9]	Need to be digitized Not included to IBANDL, see Add.4
104.8º	3800-7600	Ref. [9]	Need to be digitized Not included to IBANDL, see Add.4

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

Add.1 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 centre-of-mass angles 70º7', 90º, 99º15', 109º54', 125º16', 140º16', 149º27' and 166º35'. If we assume that only backscattering angles greater than 100º are of importance for IBA community, and convert centre-of-mass angles to the laboratory 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 CM cross sections. However, in IBANDL only data for 106.7º are tabulated.

Add.2 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 122.6º, 125.3º, 131.4º, 140.8º, 149.4º, 155º and 158.8º in the c.m. that corresponds to 104º, 106.8º, 113.9º, 125.1º, 136.7º, 143.9º and 149º in the laboratory frame, respectively. However, in IBANDL only data for 149º are tabulated. Data for other angles should be digitized and added to IBANDL.

Add.3 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 corresponds to 73.7º, 107.2º, 133.3º and 166.6º

laboratory 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.

Add.4 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 134.3º, 125.2º and 104.1º should be digitized from the original publication. As c.m. cross sections are given, they should be converted also to the laboratory frame.

Comparison of published data for different scattering angles

Around 135º, there are only two data sets published in IBANDL. 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 this two data sets exist. Data from [9], [7] and [5] cover this higher energy region and can give some more information about cross-section behavior. They should be digitized from original publications.

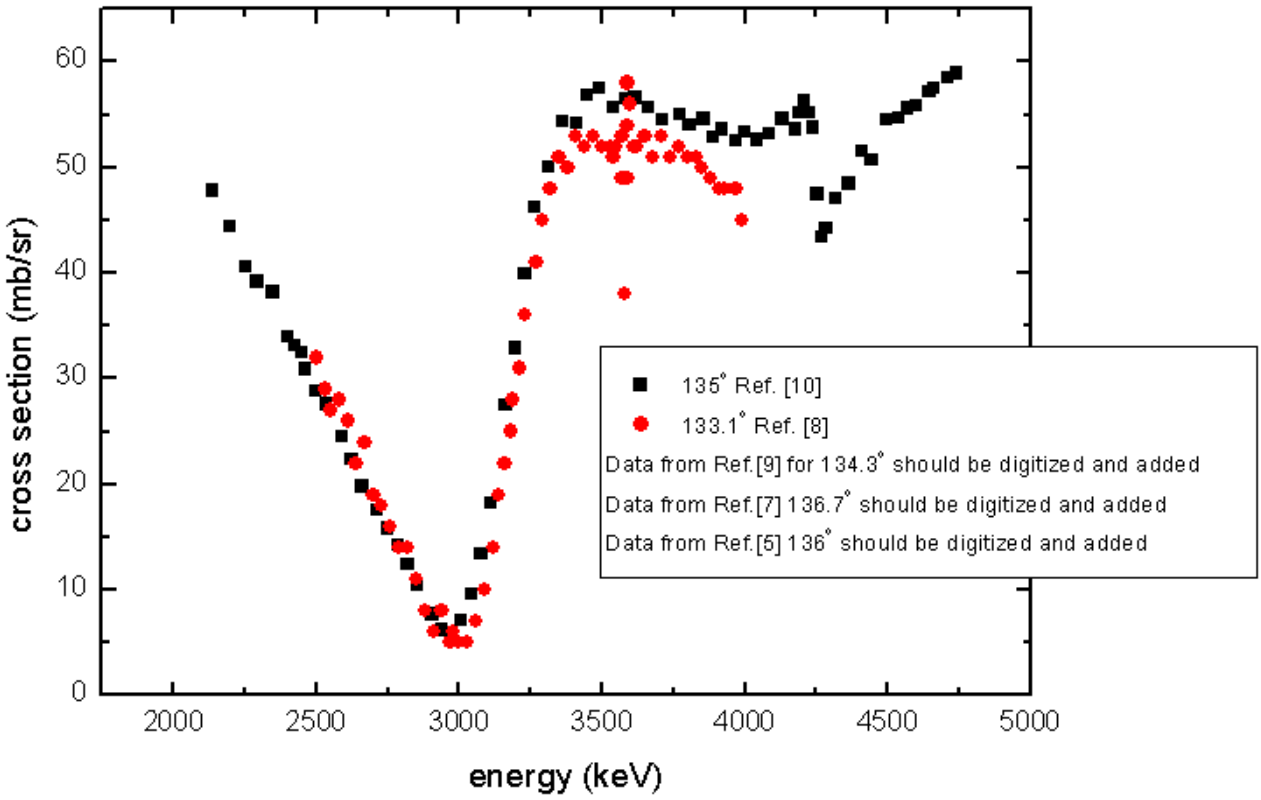

Fig.1 Two sets of data from [8] and [10], both sets are already published in IBANDL

Around 150º there are data from [7] for 149º and data from [10] for 150º. 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.

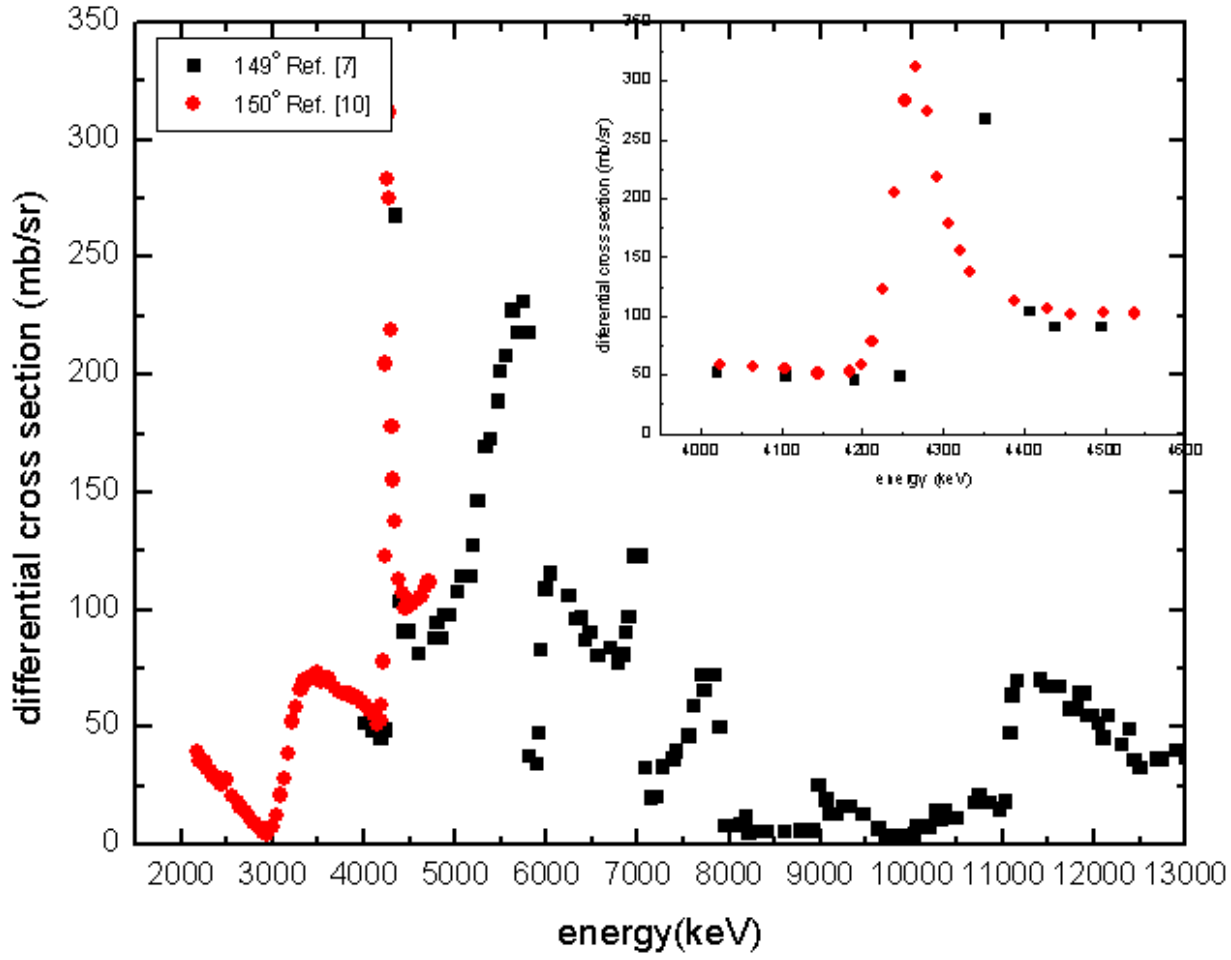

Fig. 2 Two sets of data for $^{12}C(\alpha,\alpha)$ differential cross sections from Ref. [7] and [10], both are already published in IBANDL.

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

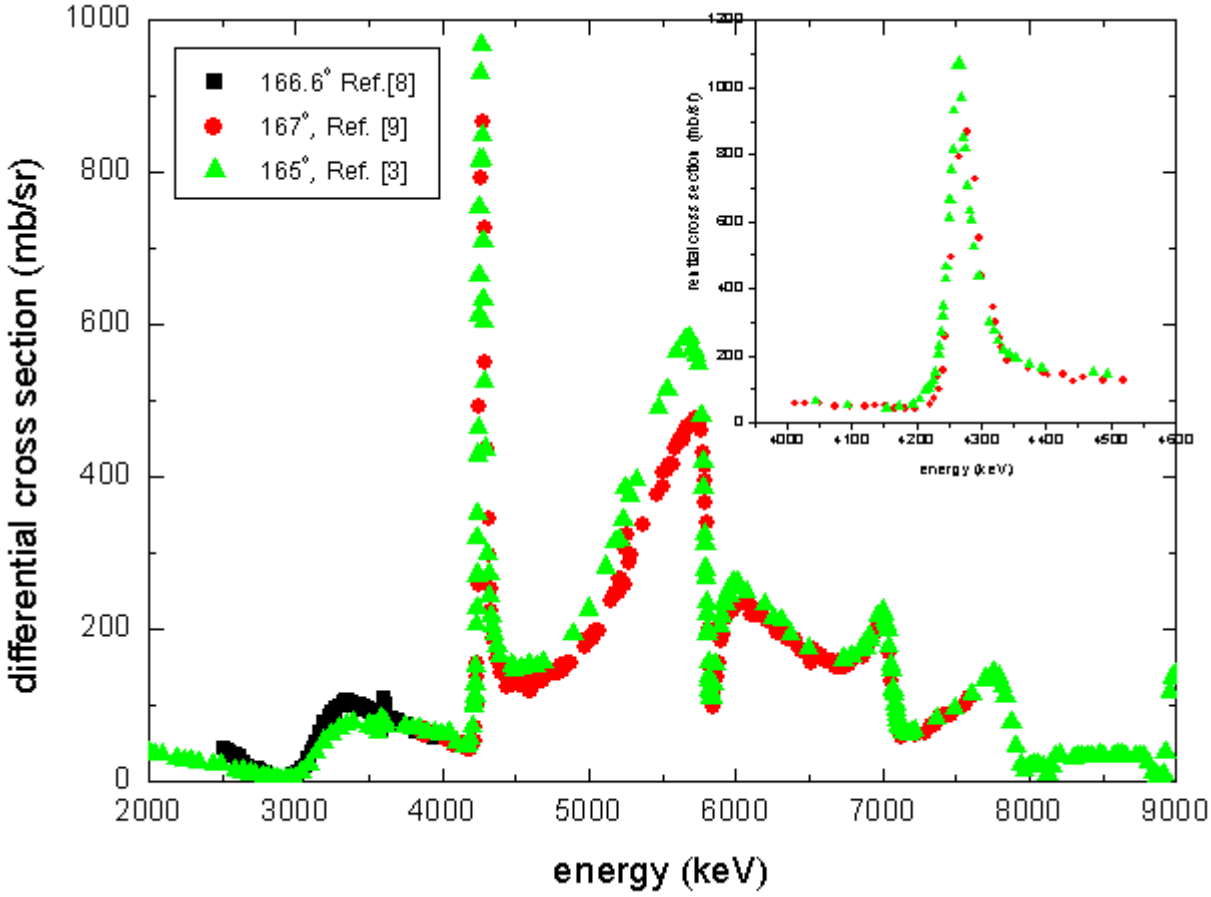

Fig 3. Available data sets for $^{12}C(\alpha,\alpha)$ differential cross sections around 165º published in IBANDL.

Around 170° there are four data sets available in IBANDL. For 4250 keV three data sets can be compared but as can be seen from the magnified part of Fig.4. they all differ concerning resonance height. Two data sets [5] and [2] are in good agreement concerning resonance position.

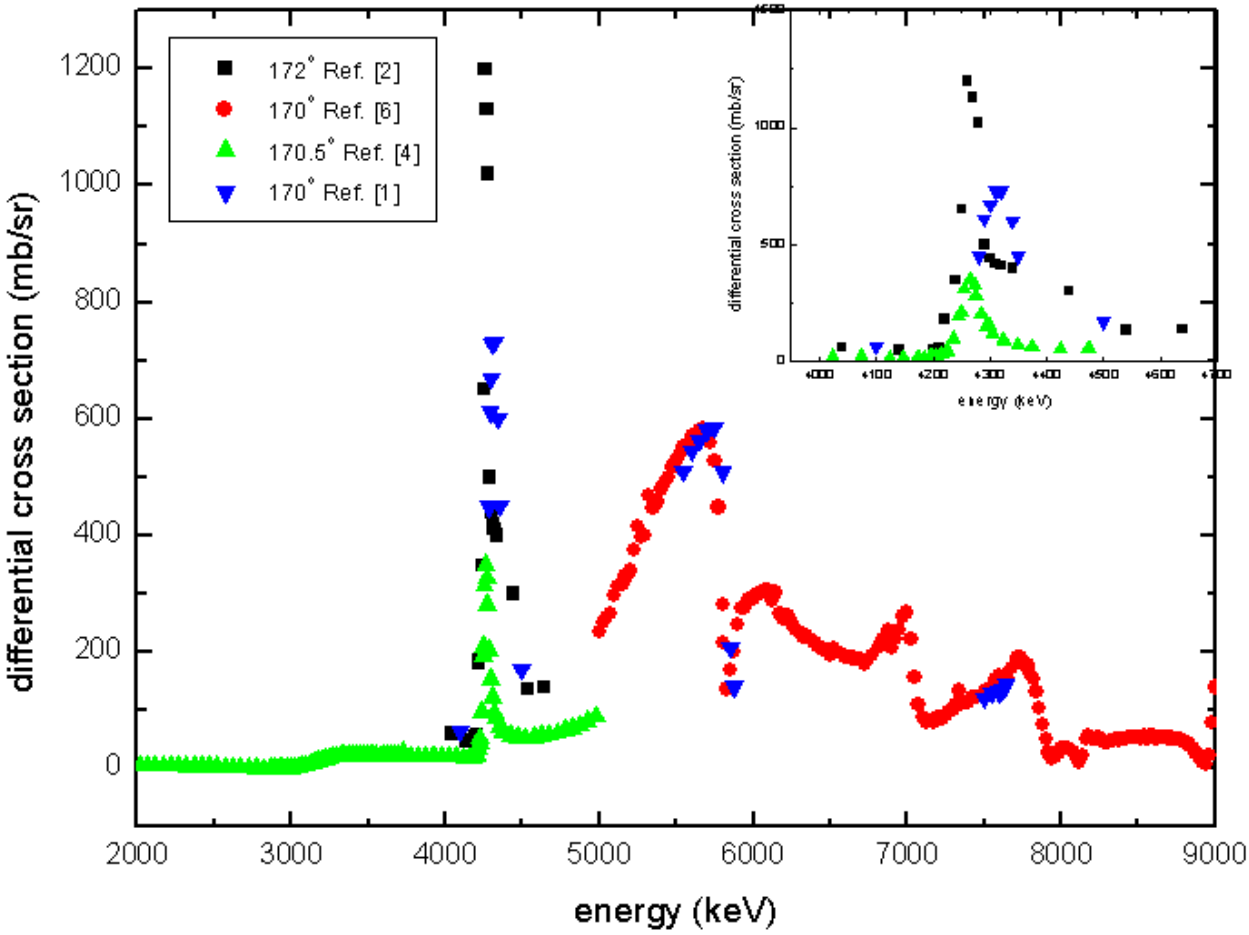

Fig 4. Available data sets for $^{12}C(\alpha,\alpha)$ differential cross sections around 170º published in IBANDL.

References:

[1] J.A. Davies et al.,Nucl. Instr. and Meth. B85 (1994) 28

[2] R. Somatri et al., Nucl. Instr. and Meth. B113 (1996) 284

[3] Y. Feng et al., Nucl. Instr. and Meth. B86 (1994) 225

[4] J.A.Leavitt, Nucl. Instr. and Meth. B40/41 (1989) 776

[5] C. Miller Jones at al., Nucl. Phys.37 (1962)1

[6] H.-S. Cheng et al., Acta Phys. Sinica 43 (1994) 1569

[7] T.P.Marvin et al., Nucl.Phys.A180 (1972) 282

[8] R.W. Hill, Phys.Rev.90 (1953) 845

[9] J.W. Bittner et al., Phys. Rev. 96 (1954) 374

[10] I. Bogdanović Radović et al. , Nucl. Instr. and Meth. B190 (2002) 10