^{164}Tb β^- decay (3.0 min) 1971Gu18

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	Balraj Singh and Jun Chen[#]	NDS 147, 1 (2018)	30-Nov-2017

Parent: ^{164}Tb: E=0; $J^\pi=(5^+)$; $T_{1/2}$=3.0 min *1*; Q(β^-)=3.89×10^3 *10*; %β^- decay=100.0

^{164}Tb-J^π,$T_{1/2}$: From ^{164}Tb Adopted Levels.

^{164}Tb-Q(β^-): From 2017Wa10.

The decay scheme of ^{164}Tb β^- decay is not considered (by evaluators) as well established. A large number of reported γ rays (with a total intensity of≈22%) remain unplaced. Several transitions are multiply placed which lead to intensity-balance problems for many levels.

1971Gu18: measured Eγ, Iγ, E(β^-), I(β^-), $\gamma\gamma$, $\beta\gamma$, $T_{1/2}$. Comparisons of experimental branching ratios with theory.

Others:

1971Ka02 (also 1969KaZP,1970HeZH,1968DeZZ): measured Eγ, Iγ, E(β^-), I(β^-), $\gamma\gamma$, $\beta\gamma$. 1971Ka02 mention that 109 γ rays were seen and 88 of these were placed in a level scheme. The authors show a partial level scheme in the paper with about 40 transitions.

1968Mo14: measured Eγ, Iγ, E(β^-), $T_{1/2}$. A total of 40 γ rays reported.

Thesis by H.R. Martin, University of Arkansas (1967) (quoted by 1971Gu18). 39 γ rays reported.

An 1804 level (decaying by 579γ and 681.4γ) proposed by 1971Ka02 has been omitted here, since both these γ rays are ascribed by 1971Gu18 to long-lived impurities.

1960Al33: a 23-h activity assigned to ^{164}Tb decay. This long-lived activity in ^{164}Tb has not been confirmed in any of the later studies of ^{164}Tb decay.

^{164}Dy Levels

E(level)[†]	J^π[‡]	Comments
0.0	0^+	
73.37 *5*	2^+	
242.22 *7*	4^+	
501.36 *16*	6^+	
761.75 *10*	2^+	
828.11 *9*	3^+	
916.00 *10*	4^+	
976.83 *10*	2^-	
1024.72 *11*	5^+	
1039.21 *10*	3^-	
1122.79 *10*	4^-	
1155.8 *4*	$(6)^+$	
1225.08 *11*	$(5)^-$	
1393.8 *4*	(2^+)	
1587.88 *13*	$(4)^-$	
1607.7 *4*	(4^+)	
1686.4 *3*	$(5)^-$	
1725.3 *4*		E(level): the existence of this level is questioned by 2017Go07 in (n,n′γ).
1770.2 *3*	$(4,5,3^+)$	
1932.5 *4*	$(4,5^+)$[&]	
1953.0 *4*	(4^+)	
1998.63 *13*	(4^+)	
2157.72 *18*	(4^+)	
2173.13 *23*	$(4)^+$	
2194.70 *22*	(4^+)	
2205.69 *18*	(4^+)	
2247.7 *5*	(4^+)	
2312.5?[#@] *3*		
2752.7?[#@] *5*	(4)	

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^{164}Tb β^- decay (3.0 min) 1971Gu18 (continued)

^{164}Dy Levels (continued)

E(level)[†]	Jπ[‡]
3001.6[#] *4*	(4+,5+)
3005.5[#] *5*	(4+,5,6+)
3014.3 *4*	(4+,5+)

† From least-squares fit to Eγ data.
‡ From Adopted Levels.
# From 1971Ka02 only.
@ This level is treated as uncertain (evaluators) since the deexciting transitions reported by 1971Ka02 are either not seen by 1971Gu18 or are placed elsewhere in the level scheme.
& Gammas to 3+ and 5−, probable allowed/first forbidden β decay from (5+). J=(2,3)+ from (n,γ) E=res for a 1932 level may correspond to a different level.

β^- radiations

The decay scheme is incomplete as many γ rays are unplaced. The RADLST code gives total energy absorbed=4612 keV *114* in disagreement with Q(β−)=3890 keV *100*.
Singles β spectrum (1971Gu18) indicate three branches of E(β−) (I(β−)): 2950 *150* (≈6%), 2260 *150* (≈20%), 1700 *100* (74%).
βγ coin data (1971Gu18): E(β−)=1600 and 2200 with gate at 168.8γ; 1600 and 2250 with gate at 211.05γ+215.0γ; 1900 with gate at 344.83; 1800 with gate at 410.34; 1600 and 2200 with gate at 610.98; 1600 with gate at 617.82.

E(decay)	E(level)	Iβ−[†#]	Log *ft*[†]	Comments
(8.8×10^2 *10*)	3014.3	7.0	5.0	av Eβ=289 *40*
(8.8×10^2 *10*)	3005.5	0.4	6.2	av Eβ=293 *40*
(8.9×10^2 *10*)	3001.6	1.2	5.8	av Eβ=294 *40*
(1.14×10^3[@] *10*)	2752.7?	1.4	6.1	av Eβ=393 *41*
(1.58×10^3[@] *10*)	2312.5?	2.1	6.4	av Eβ=577 *43*
(1.64×10^3 *10*)	2247.7	2.7	6.4	av Eβ=605 *44*
(1.68×10^3 *10*)	2205.69	32.6	5.3	av Eβ=623 *44* E(decay): ≈1600 from B(617.82γ) (1971Gu18).
(1.70×10^3 *10*)	2194.70	11.3	5.8	av Eβ=628 *44*
(1.72×10^3 *10*)	2173.13	4.0	6.3	av Eβ=637 *44*
(1.73×10^3 *10*)	2157.72	4.0	6.3	av Eβ=644 *44*
(1.89×10^3 *10*)	1998.63	6.7	6.2	av Eβ=713 *44* E(decay): ≈1800 from B(410.34γ) coin (1971Gu18).
(1.94×10^3 *10*)	1953.0	3.5	6.6	av Eβ=733 *44*
(1.96×10^3 *10*)	1932.5	8.7	6.2	av Eβ=742 *44* E(decay): ≈1900 from B(344.8γ) coin (1971Gu18).
(2.12×10^3[@] *10*)	1770.2	1.6	7.0	av Eβ=813 *45*
(2.16×10^3[@] *10*)	1725.3	0.4	7.7	av Eβ=833 *45*
(2.20×10^3 *10*)	1686.4	2.6	6.9	av Eβ=850 *45*
(2.28×10^3 *10*)	1607.7	4.6	6.7	av Eβ=885 *45*
(2.30×10^3 *10*)	1587.88	6.2	6.6	av Eβ=894 *45* E(decay): ≈2200 from B(610.89γ) coin (1971Gu18).
(2.50×10^3[@] *10*)	1393.8	2.6	7.1	av Eβ=981 *45* log *ft*=7.1 is too low for ΔJ=(3), Δπ=no. Apparent Iβ=2.6 may be due to missing γ feeding to the 1394 level.
(2.66×10^3 *10*)	1225.08	2.7	7.2	av Eβ=1057 *45*

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^{164}Tb β^- decay (3.0 min) 1971Gu18 (continued)

β^- radiations (continued)

E(decay)	E(level)	Iβ^-[†][#]	Log *ft*[†]	Comments
(2.73×10^3 *10*)	1155.8	1.0	7.7	av Eβ=1088 *46*
(2.77×10^3 *10*)	1122.79	2.0	7.4	av Eβ=1103 *46*
(2.85×10^3[@] *10*)	1039.21	<4.8[‡]	>8.4[1u]	av Eβ=1121 *45*
(2.91×10^3[@] *10*)	976.83	<3.2[‡]	>7.3	av Eβ=1169 *46*
(3.65×10^3[@] *10*)	242.22	<5.2[‡]	>7.5	av Eβ=1503 *46*

[†] All β feedings and associated log *ft* values are considered as approximate since the level scheme is not well established. From $\beta\gamma$ coin data of 1971Gu18, large β feeding of 74% to 2190 *100* levels is indicated. Intensity balance leads to unrealistic negative feedings of≈5% each to the 762, 828, and 916 levels, which must be due to unresolved problems in the level scheme.

[‡] No evidence of any β feeding from $\beta\gamma$ coin (1971Gu18). Apparent β feeding from intensity balance is most likely due to decay scheme problems.

[#] Absolute intensity per 100 decays.

[@] Existence of this branch is questionable.

$\gamma(^{164}Dy)$

Iγ normalization: Σ (I(γ+ce) of γ rays to g.s.)=100. No β^- feeding is expected to g.s. and 73 level, supported also by βγ coin. About 21% of the intensity is unplaced and the intensity balance for several levels is not satisfactory. In calculating normalization factor, it is assumed that all the ground-state transitions are accounted for.

E_γ	I_γ[d]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[†]	α[c]	Comments
37.7 *3*	1.0 *5*	2194.70	(4^+)	2157.72	(4^+)	[M1]	6.57 *19*	α(L)=5.14 *15*; α(M)=1.13 *4* α(N)=0.261 *8*; α(O)=0.0381 *11*; α(P)=0.00216 *6*
x39.9 *3*	1.0 *5*							
x57.2&								
x68.16&								
x70.0&								
73.37 *5*	39 *5*	73.37	2^+	0.0	0^+	E2	8.89	α(K)=2.15 *3*; α(L)=5.19 *8*; α(M)=1.247 *18* α(N)=0.279 *4*; α(O)=0.0331 *5*; α(P)=9.41×10^{-5} *14*
x84.3 *3*	2.0 *5*							
x86.7 *3*	1.5 *5*							
98.09 *10*	1.5 *5*	1122.79	4^-	1024.72	5^+	E1	0.325	α(K)=0.271 *4*; α(L)=0.0422 *6*; α(M)=0.00925 *14* α(N)=0.00210 *3*; α(O)=0.000286 *4*; α(P)=1.247×10^{-5} *18*
x98.72 *10*	1.0 *5*							
x104.3 *5*	1.5 *5*							
123.22 *5*	7.0 *7*	1039.21	3^-	916.00	4^+	[E1]	0.1765	α(K)=0.1480 *21*; α(L)=0.0224 *4*; α(M)=0.00490 *7* α(N)=0.001115 *16*; α(O)=0.0001537 *22*; α(P)=7.03×10^{-6} *10*
131.0 *5*	1.5 *5*	1155.8	$(6)^+$	1024.72	5^+	M1	1.109 *20*	α(K)=0.934 *17*; α(L)=0.1369 *25*; α(M)=0.0301 *6* α(N)=0.00695 *13*; α(O)=0.001018 *18*; α(P)=5.81×10^{-5} *11*
x141.0 *5*	2.0 *5*							
148.76 *5*	18.5 *15*	976.83	2^-	828.11	3^+	E1	0.1066	α(K)=0.0896 *13*; α(L)=0.01330 *19*; α(M)=0.00291 *4* α(N)=0.000664 *10*; α(O)=9.23×10^{-5} *13*; α(P)=4.37×10^{-6} *7*
x152.6 *5*	4 *2*							
154	0.27[b] *5*	916.00	4^+	761.75	2^+	[E2]	0.573	I_γ: deduced from branching ratio in Adopted Gammas.
159.45 *20*	2.0 *5*	2157.72	(4^+)	1998.63	(4^+)	[M1+E2]	0.57 *7*	α(K)=0.42 *12*; α(L)=0.12 *4*; α(M)=0.027 *10* α(N)=0.0061 *22*; α(O)=0.00080 *22*; α(P)=2.4×10^{-5} *10*
168.86 *5*	120 *6*	242.22	4^+	73.37	2^+	E2	0.419	α(K)=0.262 *4*; α(L)=0.1210 *17*; α(M)=0.0285 *4* α(N)=0.00643 *9*; α(O)=0.000801 *12*; α(P)=1.200×10^{-5} *17*
174.4 *3*	1.0 *5*	2173.13	$(4)^+$	1998.63	(4^+)	[M1+E2]	0.44 *6*	α(K)=0.33 *9*; α(L)=0.083 *23*; α(M)=0.019 *6* α(N)=0.0044 *13*; α(O)=0.00058 *13*; α(P)=1.8×10^{-5} *8*
x176.7 *3*	1.0 *5*							
185.84 *20*	1.5 *5*	1225.08	$(5)^-$	1039.21	3^-	E2	0.302	α(K)=0.197 *3*; α(L)=0.0811 *12*; α(M)=0.0191 *3* α(N)=0.00430 *7*; α(O)=0.000540 *8*; α(P)=9.25×10^{-6} *14*
196.75 *15*	1.0 *5*	1024.72	5^+	828.11	3^+	[E2]	0.250	α(K)=0.1666 *24*; α(L)=0.0641 *10*; α(M)=0.01504 *22* α(N)=0.00340 *5*; α(O)=0.000429 *7*; α(P)=7.92×10^{-6} *12*
200.50 *15*	2.0 *10*	1225.08	$(5)^-$	1024.72	5^+	[E1]	0.0483	α(K)=0.0408 *6*; α(L)=0.00591 *9*; α(M)=0.001292 *19* α(N)=0.000296 *5*; α(O)=4.16×10^{-5} *6*; α(P)=2.06×10^{-6} *3*

$^{164}_{66}Dy_{98}$-4

^{164}Tb β^- decay (3.0 min) 1971Gu18 (continued)

$\gamma(^{164}Dy)$ (continued)

E_γ	I_γ[d]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[†]	α[c]	Comments
206.80 *5*	7.9 *10*	1122.79	4^-	916.00	4^+	E1	0.0446	α(K)=0.0376 *6*; α(L)=0.00544 *8*; α(M)=0.001189 *17* α(N)=0.000272 *4*; α(O)=3.84×10^{-5} *6*; α(P)=1.91×10^{-6} *3*
211.09 *5*	29 *3*	1039.21	3^-	828.11	3^+	E1	0.0422	α(K)=0.0357 *5*; α(L)=0.00515 *8*; α(M)=0.001125 *16* α(N)=0.000258 *4*; α(O)=3.63×10^{-5} *5*; α(P)=1.82×10^{-6} *3*
215.07 *5*	100	976.83	2^-	761.75	2^+	E1	0.0402	α(K)=0.0340 *5*; α(L)=0.00490 *7*; α(M)=0.001017 *15* α(N)=0.000245 *4*; α(O)=3.46×10^{-5} *5*; α(P)=1.732×10^{-6} *25*
[x]242.2[‡] *5*								
[x]246.5 *5*	2.0 *5*							
259.09 *20*	20 *5*	501.36	6^+	242.22	4^+	E2	0.1018	α(K)=0.0739 *11*; α(L)=0.0216 *3*; α(M)=0.00502 *8* α(N)=0.001137 *17*; α(O)=0.0001474 *21*; α(P)=3.74×10^{-6} *6*
277.47 *5*	40 *3*	1039.21	3^-	761.75	2^+	E1	0.0209	α(K)=0.01771 *25*; α(L)=0.00251 *4*; α(M)=0.000549 *8* α(N)=0.0001259 *18*; α(O)=1.79×10^{-5} *3*; α(P)=9.27×10^{-7} *13*
294.65 *5*	33.5 *20*	1122.79	4^-	828.11	3^+	E1	0.0180	α(K)=0.01524 *22*; α(L)=0.00216 *3*; α(M)=0.000471 *7* α(N)=0.0001080 *16*; α(O)=1.54×10^{-5} *22*; α(P)=8.02×10^{-7} *12*
309.08 *5*	8.5	1225.08	$(5)^-$	916.00	4^+	E1	0.01597	α(K)=0.01354 *19*; α(L)=0.00191 *3*; α(M)=0.000417 *6* α(N)=9.57×10^{-5} *15*; α(O)=1.366×10^{-5} *20*; α(P)=7.15×10^{-7} *10*
[x]311.5[‡] *5*								
[x]337.6[‡] *5*								
344.8 *5*	25 *5*	1932.5	$(4,5^+)$	1587.88	$(4)^-$			
363[@g]		1587.88	$(4)^-$	1225.08	$(5)^-$			E_γ: from 1971Ka02.
386.3 *5*	4.0 *10*	2157.72	(4^+)	1770.2	$(4,5,3^+)$			
410.34 *20*	29 *2*	1998.63	(4^+)	1587.88	$(4)^-$			
415 *1*	1.0 *5*	916.00	4^+	501.36	6^+			
425 *1*	4.4 *10*	2194.70	(4^+)	1770.2	$(4,5,3^+)$			
[x]434.9 *10*	2.2 *5*							
[x]447.4[‡] *5*								
461.5[#@g] *5*	2.5[#]	1686.4	$(5)^-$	1225.08	$(5)^-$			
465.05 *20*	4.4 *8*	1587.88	$(4)^-$	1122.79	4^-			
478.0	1.5	1393.8	(2^+)	916.00	4^+			E_γ,I_γ: from figure 13 of 1971Gu18.
[x]480.8 *5*	1.5 *5*							E_γ: may be the same as 480.0 in figure 13 of 1971Gu18.
484.7 *5*	2.0 *5*	1607.7	(4^+)	1122.79	4^-			
508[#@g] *1*	6.5[#]	2194.70	(4^+)	1686.4	$(5)^-$			
519.6[e] *5*	2.0[e] *5*	761.75	2^+	242.22	4^+	[E2]	0.01372	α(K)=0.01109 *16*; α(L)=0.00205 *3*; α(M)=0.000461 *7* α(N)=0.0001056 *15*; α(O)=1.461×10^{-5} *21*; α(P)=6.22×10^{-7} *9*
519.6[e] *5*	2.0[e] *5*	2205.69	(4^+)	1686.4	$(5)^-$			Placement from 1971Ka02.
523.31 *20*	3.0 *5*	1024.72	5^+	501.36	6^+			
548.54 *20*	40 *3*	1587.88	$(4)^-$	1039.21	3^-			
559.42 *20*	4.2 *5*	1953.0	(4^+)	1393.8	(2^+)			
563.8[#@g] *5*	12[#]	1686.4	$(5)^-$	1122.79	4^-			
567 *1*	2.0 *5*	1393.8	(2^+)	828.11	3^+			
[x]579[a] *1*	1.2							

$^{164}_{66}Dy_{98}$-5

$\gamma(^{164}Dy)$ (continued)

E_γ	I_γ[d]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[†]	δ[†]	α[c]	Comments
583.5 *5*	3 *1*	1607.7	(4^+)	1024.72	5^+				
585.90 *20*	19.7 *20*	828.11	3^+	242.22	4^+	M1+E2	+5.4 *+32−15*	0.0105 *4*	α(K)=0.0086 *3*; α(L)=0.00148 *4*; α(M)=0.000331 *8* α(N)=7.60×10^{-5} *17*; α(O)=1.06×10^{-5} *3*; α(P)=4.88×10^{-7} *18*
607#@g *1*	4.1#	2194.70	(4^+)	1587.88	$(4)^-$				
610.89 *20*	95 *6*	1587.88	$(4)^-$	976.83	2^-	E2		0.00916 *13*	α=0.00916 *13*; α(K)=0.00750 *11*; α(L)=0.001294 *19*; α(M)=0.000289 *4* α(N)=6.63×10^{-5} *10*; α(O)=9.29×10^{-6} *13*; α(P)=4.26×10^{-7} *6*
617.82 *20*	57 *4*	2205.69	(4^+)	1587.88	$(4)^-$				
626.0#@ *5*	2.7#	2312.5?		1686.4	$(5)^-$				
633.0 *5*	2 *1*	1393.8	(2^+)	761.75	2^+				
647.3f *5*	14.5f *30*	1686.4	$(5)^-$	1039.21	3^-				Additional information 1. I_γ: total Iγ=29 *3*.
647.3f *5*	14.5f *30*	1770.2	$(4,5,3^+)$	1122.79	4^-				
654.5 *5*	1.5 *2*	1155.8	$(6)^+$	501.36	6^+				
671.2 *5*	4.5 *10*	1587.88	$(4)^-$	916.00	4^+				
673.67 *20*	44 *4*	916.00	4^+	242.22	4^+	M1+E2	+0.87 *+13−11*	0.0111 *5*	α(K)=0.0093 *5*; α(L)=0.00138 *5*; α(M)=0.000302 *11* α(N)=7.0×10^{-5} *3*; α(O)=1.01×10^{-5} *4*; α(P)=5.6×10^{-7} *3*
x681.4a *5*	2.4								
x683‡ *1*									
688.46 *20*	100 *6*	761.75	2^+	73.37	2^+	E2		0.00690 *10*	α=0.00690 *10*; α(K)=0.00569 *8*; α(L)=0.000940 *14*; α(M)=0.000209 *3* α(N)=4.80×10^{-5} *7*; α(O)=6.78×10^{-6} *10*; α(P)=3.26×10^{-7} *5*
691g		1607.7	(4^+)	916.00	4^+				
x695.5 *2*	2.5 *5*								
701.0 *5*	2.2 *5*	1725.3		1024.72	5^+				
707.7 *10*	1.5 *5*	1932.5	$(4,5^+)$	1225.08	$(5)^-$				
x715.5 *10*	2.0 *5*								
724.5e *10*	2.0e *10*	1225.08	$(5)^-$	501.36	6^+				
724.5e *10*	2.0e *10*	2312.5?		1587.88	$(4)^-$				Placement from 1971Ka02. E_γ,I_γ: 724.5, 4.7 (1971Ka02).
744.4 *5*	1.5 *5*	1770.2	$(4,5,3^+)$	1024.72	5^+				
754.77 *20*	110 *7*	828.11	3^+	73.37	2^+				
761.71 *20*	81 *5*	761.75	2^+	0.0	0^+	E2		0.00547 *8*	α=0.00547 *8*; α(K)=0.00455 *7*; α(L)=0.000726 *11*; α(M)=0.0001608 *23* α(N)=3.70×10^{-5} *6*; α(O)=5.25×10^{-6} *8*; α(P)=2.61×10^{-7} *4*
770.2 *10*	2.5 *5*	1686.4	$(5)^-$	916.00	4^+				
779.0g *10*	6.5 *5*	1607.7	(4^+)	828.11	3^+				
782.62 *20*	27.0 *25*	1024.72	5^+	242.22	4^+	M1+E2	−5.5 *+21−61*	0.00530 *23*	α=0.00530 *23*; α(K)=0.00441 *20*; α(L)=0.000693 *25*;

$^{164}_{66}Dy_{98}$-6

$\gamma(^{164}Dy)$ (continued)

E_γ	I_γ[d]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[†]	α[c]	Comments
								α(M)=0.000153 *6* α(N)=3.53×10^{-5} *13*; α(O)=5.03×10^{-6} *19*; α(P)=2.54×10^{-7} *13*
[x]790.3 *10*	8.4 *15*							
796.7 *5*	4.0 *15*	1039.21	3$^-$	242.22	4$^+$			
802.0[g] *5*	3.0 *10*	2194.70	(4$^+$)	1393.8	(2$^+$)			
807.0 *15*	10 *3*	3014.3	(4$^+$,5$^+$)	2205.69	(4$^+$)			
810[e] *1*	5.7[e] *15*	1725.3		916.00	4$^+$			I_γ: 1.5 in figure 13 of 1971Gu18.
810[e] *1*	5.7[e] *15*	1932.5	(4,5$^+$)	1122.79	4$^-$			
810[eg] *1*	5.7[e] *15*	2205.69	(4$^+$)	1393.8	(2$^+$)			I_γ: 4.2 in figure 13 of 1971Gu18.
[x]821 *1*	1.0 *5*							E_γ: may arise from 211.09γ+610.89γ.
827.0[g] *5*	3.9 *10*	1953.0	(4$^+$)	1122.79	4$^-$			E_γ: may arise from 215.07γ+610.89γ.
[x]835.2 *10*	2.9 *10*							
843.0 *10*	15 *2*	916.00	4$^+$	73.37	2$^+$	E2	0.00437 *7*	α=0.00437 *7*; α(K)=0.00365 *6*; α(L)=0.000566 *8*; α(M)=0.0001250 *18* α(N)=2.88×10^{-5} *5*; α(O)=4.11×10^{-6} *6*; α(P)=2.10×10^{-7} *3* I_γ: from $\gamma\gamma$. Other: Iγ=28 *3*, based on Branching for 843γ in Adopted Gammas and Iγ(673.76γ)=44 *4* (1971Gu18).
845 *1*	17 *4*	1607.7	(4$^+$)	761.75	2$^+$			I_γ: from figure 13 of 1971Gu18. Iγ=27 *4* quoted in authors' table seems high since it creates an intensity imbalance at 762 level.
[x]848 *1*	4.7 *15*							
856[g] *1*	2.0 *5*	1770.2	(4,5,3$^+$)	916.00	4$^+$			
856[g] *1*	2.0 *5*	3014.3	(4$^+$,5$^+$)	2157.72	(4$^+$)			
874.7 *10*	2.0 *5*	1998.63	(4$^+$)	1122.79	4$^-$			
[x]882 *2*	1.0 *5*							
[x]889 *2*	1.5 *5*							
903.0 *5*	1.5 *5*	976.83	2$^-$	73.37	2$^+$			I_γ: may include contribution from 215.0γ+688.46γ.
910[g]	1.5 *5*	1155.8	(6)$^+$	242.22	4$^+$			Placement based on (n,γ) results (evaluators).
[x]934.0 *5*	2.2 *5*							
934.0 *5*	2.2 *5*	2157.72	(4$^+$)	1225.08	(5)$^-$			
[x]945.2 *5*	2.2 *5*							
[x]952.5 *10*	4.0 *15*							
965[g]	[b]	1725.3		761.75	2$^+$			
966.0 *5*	7 *2*	1039.21	3$^-$	73.37	2$^+$			I_γ: may include contribution from 277.47γ+688.4γ.
969[g] *1*	2	2194.70	(4$^+$)	1225.08	(5)$^-$			
[x]976.5 *10*	2 *1*							E_γ: may arise from 215.07γ+761.71γ.
983 *1*	4.0 *5*	1225.08	(5)$^-$	242.22	4$^+$			
[x]1002 *1*								
1015.5[e] *10*	3.5[e] *10*	1932.5	(4,5$^+$)	916.00	4$^+$			
1015.5[e] *10*	3.5[e] *10*	3014.3	(4$^+$,5$^+$)	1998.63	(4$^+$)			
1022.0[e] *10*	2.2[e] *5*	1998.63	(4$^+$)	976.83	2$^-$			
1022.0[e] *10*	2.2[e] *5*	2247.7	(4$^+$)	1225.08	(5)$^-$			
[x]1029 *1*	2.0 *5*							
1034.6[e] *10*	2.5[e] *5*	1953.0	(4$^+$)	916.00	4$^+$			

$\gamma(^{164}Dy)$ (continued)

E_γ	I_γ[d]	E_i(level)	J_i^π	E_f	J_f^π	Comments
1034.6[e] *10*	2.5[e] *5*	2157.72	(4^+)	1122.79	4^-	
1050 *1*	1.0 *5*	2173.13	$(4)^+$	1122.79	4^-	
1083[g]		1998.63	(4^+)	916.00	4^+	
1104.3 *10*	5.5 *10*	1932.5	$(4,5^+)$	828.11	3^+	
[x]1106 *1*	2.0 *5*					
[x]1113 *1*	1.0 *5*					
1123.4 *10*	7.0 *20*	1953.0	(4^+)	828.11	3^+	
1125.0 *10*	2.0 *5*	2247.7	(4^+)	1122.79	4^-	
[x]1128.8[‡] *5*						
1135 *1*	1.5 *5*	2173.13	$(4)^+$	1039.21	3^-	
1148.5 *5*	8.6 *15*	2173.13	$(4)^+$	1024.72	5^+	
1152.0 *10*	4.3 *10*	1393.8	(2^+)	242.22	4^+	
1154.8 *10*	5.2 *10*	2194.70	(4^+)	1039.21	3^-	
1166.2 *10*	9.5 *20*	2205.69	(4^+)	1039.21	3^-	
1169.4[f] *10*	6.0[f] *20*	1998.63	(4^+)	828.11	3^+	I_γ: total Iγ=11.5 *20*.
1169.4[f] *10*	5.5[f] *20*	2194.70	(4^+)	1024.72	5^+	
1180.6[f] *5*	4.0[f] *20*	2157.72	(4^+)	976.83	2^-	
1180.6[f] *5*	4.0[f] *20*	2205.69	(4^+)	1024.72	5^+	I_γ: total Iγ=8.0 *20* (1971Gu18).
1189.7 *5*	1.5 *5*	1953.0	(4^+)	761.75	2^+	
1196.2 *5*	1.5 *5*	2173.13	$(4)^+$	976.83	2^-	
1217.2 *5*	4.5 *5*	2194.70	(4^+)	976.83	2^-	
1224 *1*	1.0 *5*	2247.7	(4^+)	1024.72	5^+	
[x]1228.5 *10*	1.0 *5*					E_γ: may arise from 610.89γ+617.82γ.
[x]1233.1 *10*	1.0 *5*					
1257.5 *10*	1.0 *5*	2173.13	$(4)^+$	916.00	4^+	
1270.6 *10*	3 *1*	2247.7	(4^+)	976.83	2^-	Additional information 2.
1278.2 *5*	11.2 *20*	2194.70	(4^+)	916.00	4^+	
1288[#] *1*	1.0[#]	2312.5?		1024.72	5^+	E_γ,I_γ: not reported by 1971Gu18, but it may be part of strong 1289.8γ.
1289.8[f] *5*	20[f] *3*	2205.69	(4^+)	916.00	4^+	I_γ: total Iγ=28 *3*.
1289.8[f] *5*	8[f] *3*	3014.3	$(4^+,5^+)$	1725.3		
[x]1301.2 *10*	1.0 *5*					E_γ: may arise from 610.89γ+688.46γ.
[x]1307.6 *10*	1.5 *5*					E_γ: may arise from 617.82γ+688.46γ.
1320.1 *15*	5 *2*	1393.8	(2^+)	73.37	2^+	
1330[e] *2*	2.5[e]	2157.72	(4^+)	828.11	3^+	
1330[e] *2*	2.5[e]	2247.7	(4^+)	916.00	4^+	Additional information 3.
[x]1334.3 *20*	4 *2*					
1366.0 *5*	9.3 *25*	2194.70	(4^+)	828.11	3^+	
[x]1372 *1*	1.0 *5*					E_γ: may arise from 610.89γ+761.71γ.
1377.5 *5*	25 *4*	2205.69	(4^+)	828.11	3^+	
1393.0 *15*	2.0 *5*	1393.8	(2^+)	0.0	0^+	
1395.0[e] *15*	1.5[e] *5*	2157.72	(4^+)	761.75	2^+	

$^{164}_{66}Dy_{98}$-8

$\gamma(^{164}Dy)$ (continued)

E_γ	I_γ[d]	E_i(level)	J_i^π	E_f	J_f^π	Comments
1395.0[e] *15*	1.5[e] *5*	2312.5?		916.00	4^+	Placement from 1971Ka02. E_γ,I_γ: 1396.7, 3.1 (1971Ka02).
1411.0 *15*	1.0 *5*	2173.13	$(4)^+$	761.75	2^+	E_γ: 1511 in table (1971Gu18) is a misprint. Energy taken from level scheme.
1426.2 *5*	2.5 *5*	3014.3	$(4^+,5^+)$	1587.88	$(4)^-$	
1433[#@] *1*	2.2[#]	2194.70	(4^+)	761.75	2^+	
1443.9 *5*	40 *4*	2205.69	(4^+)	761.75	2^+	
1484.5[#@] *5*	2.2[#]	2312.5?		828.11	3^+	
1485.2[eg] *15*	1.5[e] *5*	1725.3		242.22	4^+	
1485.2[eg] *15*	1.5[e] *5*	2247.7	(4^+)	761.75	2^+	
[x]1576.0 *15*	1.0 *5*					
1652.5 *15*	2.0 *5*	1725.3		73.37	2^+	
1656.7 *15*	4.5 *15*	2157.72	(4^+)	501.36	6^+	
[x]1665.0 *15*	3.0 *10*					
[x]1740 *2*	1.5 *5*					
[x]1860.2[‡] *5*						
1878 *3*	1.5 *5*	1953.0	(4^+)	73.37	2^+	
1889 *3*	1.0 *5*	3014.3	$(4^+,5^+)$	1122.79	4^-	
[x]1898 *2*	1.0					
[x]1905 *2*	1.0 *5*					
1916 *2*	1.0 *5*	2157.72	(4^+)	242.22	4^+	
1926 *2*	1.0 *5*	1998.63	(4^+)	73.37	2^+	
1932 *3*	1.5 *5*	2173.13	$(4)^+$	242.22	4^+	
1951 *2*	2.2 *5*	2194.70	(4^+)	242.22	4^+	
1963.5 *15*	3.5 *5*	2205.69	(4^+)	242.22	4^+	
[x]1983 *2*	1.5 *5*					
1990 *2*	<1	3014.3	$(4^+,5^+)$	1024.72	5^+	
[x]2011 *2*	1.5 *5*					E_γ: from spectrum figure 3 of 1971Gu18. Eγ=27011 in table 2 of 1971Gu18 is a misprint.
[x]2048 *2*	1.5					
2070.4[#@] *5*	0.6[#]	2312.5?		242.22	4^+	
2084.0[e] *15*	1.5[e] *5*	2157.72	(4^+)	73.37	2^+	
2084.0[e] *15*	1.5[e] *5*	3001.6	$(4^+,5^+)$	916.00	4^+	Placement from 1971Ka02. E_γ,I_γ: 2085.4, 2.1 (1971Ka02).
2100[e]	1.5[e]	2173.13	$(4)^+$	73.37	2^+	E_γ: from level scheme figure of 1971Gu18, γ not listed in authors′ table 2.
2100[e]	1.5[e]	3014.3	$(4^+,5^+)$	916.00	4^+	
2121.4[#@] *10*	1.7[#]	2194.70	(4^+)	73.37	2^+	
2132.0 *10*	4.0 *15*	2205.69	(4^+)	73.37	2^+	
2174.5[e] *15*	2.0[e] *5*	2247.7	(4^+)	73.37	2^+	
2174.5[e] *15*	2.0[e] *5*	3001.6	$(4^+,5^+)$	828.11	3^+	Placement from 1971Ka02. E_γ,I_γ: 2173.0, 1.7 (1971Ka02).
[x]2219 *2*	1.0 *5*					
[x]2240.5 *20*	3.8 *10*					

$^{164}_{66}Dy_{98}$-9

$\gamma(^{164}Dy)$ (continued)

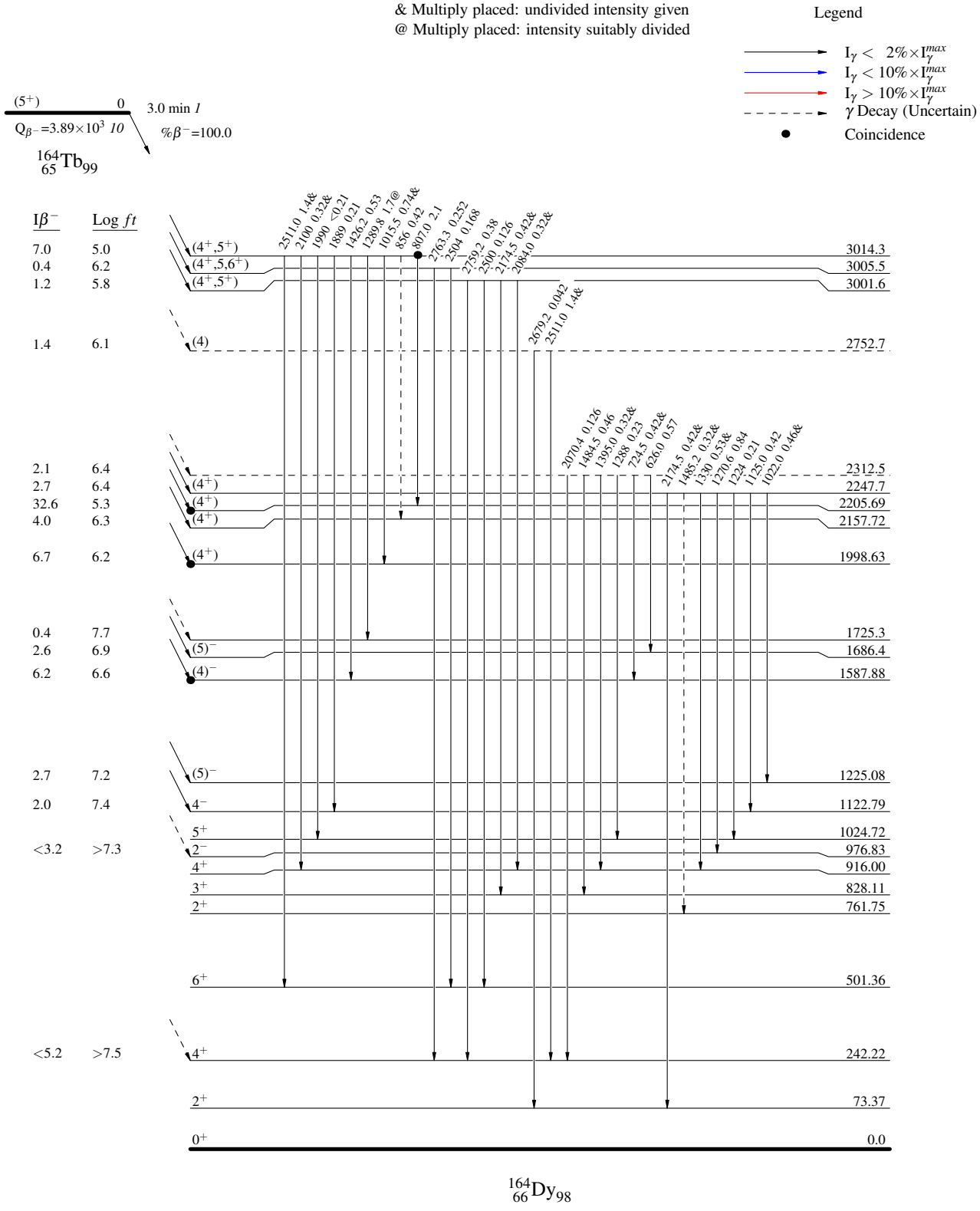
E_γ	I_γ[d]	E_i(level)	J_i^π	E_f	J_f^π	Comments
[x]2311.5 *20*	1.0 *5*					
[x]2391.7[‡] *5*						
[x]2414.1[‡] *5*						
2500[#] *1*	0.6[#]	3001.6	$(4^+,5^+)$	501.36	6^+	
2504[#] *1*	0.8[#]	3005.5	$(4^+,5,6^+)$	501.36	6^+	E_γ,I_γ: 2502 *2*, 2.5 *5* (1971Gu18) probably for a doublet.
2511.0[e] *15*	6.5[e] *15*	2752.7?	(4)	242.22	4^+	Placement from 1971Ka02. E_γ,I_γ: 2510.2, 5.0 (1971Ka02).
2511.0[e] *15*	6.5[e] *15*	3014.3	$(4^+,5^+)$	501.36	6^+	
[x]2627 *2*	1.5 *5*					
[x]2632.8[‡] *5*						
2679.2[#@] *5*	0.2[#]	2752.7?	(4)	73.37	2^+	
2759.2[#] *5*	1.8[#]	3001.6	$(4^+,5^+)$	242.22	4^+	E_γ,I_γ: 2763 *3*, 2.0 *5* (1971Gu18) probably for a doublet.
2763.3[#] *5*	1.2[#]	3005.5	$(4^+,5,6^+)$	242.22	4^+	E_γ,I_γ: see also comment for 2759.2γ.
[x]2786 *3*	1.5 *5*					

[†] From Adopted Gammas.
[‡] From 1970HeZH and/or 1968DeZZ (as listed in Nuclear Data Sheets for α=164 by 1974Bu30) only. The assignment to ^{164}Tb decay is uncertain, since it is not confirmed by 1971Gu18.
[#] Eγ, Iγ and placement from 1971Ka02.
[@] γ not reported by 1971Gu18.
[&] Questionable γ from spectrum figure #2 of 1971Gu18.
[a] γ from 1971Ka02 only. Placement from an 1804 level is omitted here since this γ may be from a long-lived impurity as indicated by 1971Gu18.
[b] Weak γ ray, intensity is not available from 1971Gu18.
[c] Additional information 4.
[d] For absolute intensity per 100 decays, multiply by 0.21 *2*.
[e] Multiply placed with undivided intensity.
[f] Multiply placed with intensity suitably divided.
[g] Placement of transition in the level scheme is uncertain.
[x] γ ray not placed in level scheme.

^{164}Tb β^- decay (3.0 min) 1971Gu18

Decay Scheme

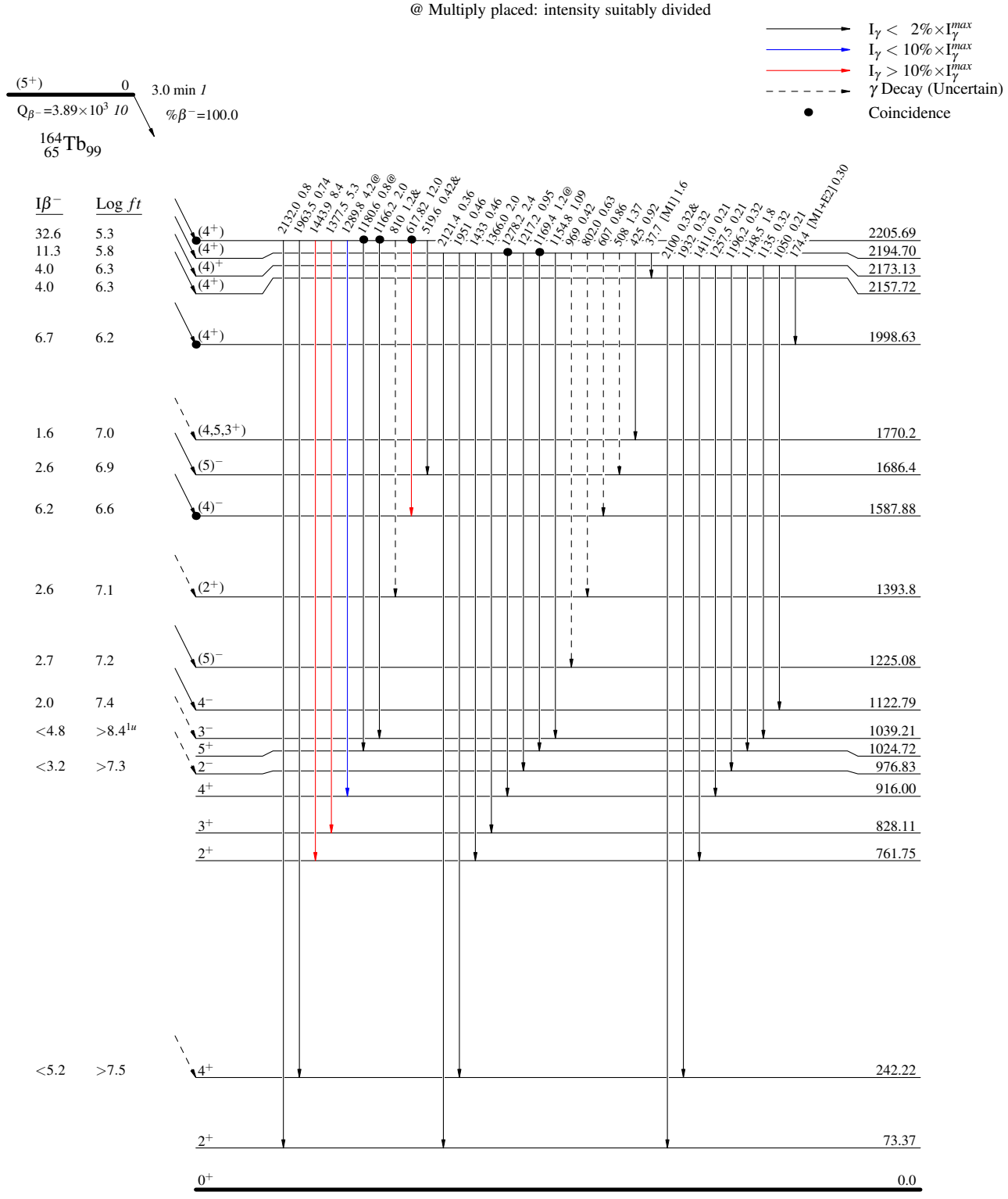
Intensities: $I_{(\gamma+ce)}$ per 100 parent decays
& Multiply placed: undivided intensity given
@ Multiply placed: intensity suitably divided



^{164}Tb β^- decay (3.0 min) 1971Gu18

Decay Scheme (continued)

Intensities: $I_{(\gamma+ce)}$ per 100 parent decays
& Multiply placed: undivided intensity given
@ Multiply placed: intensity suitably divided

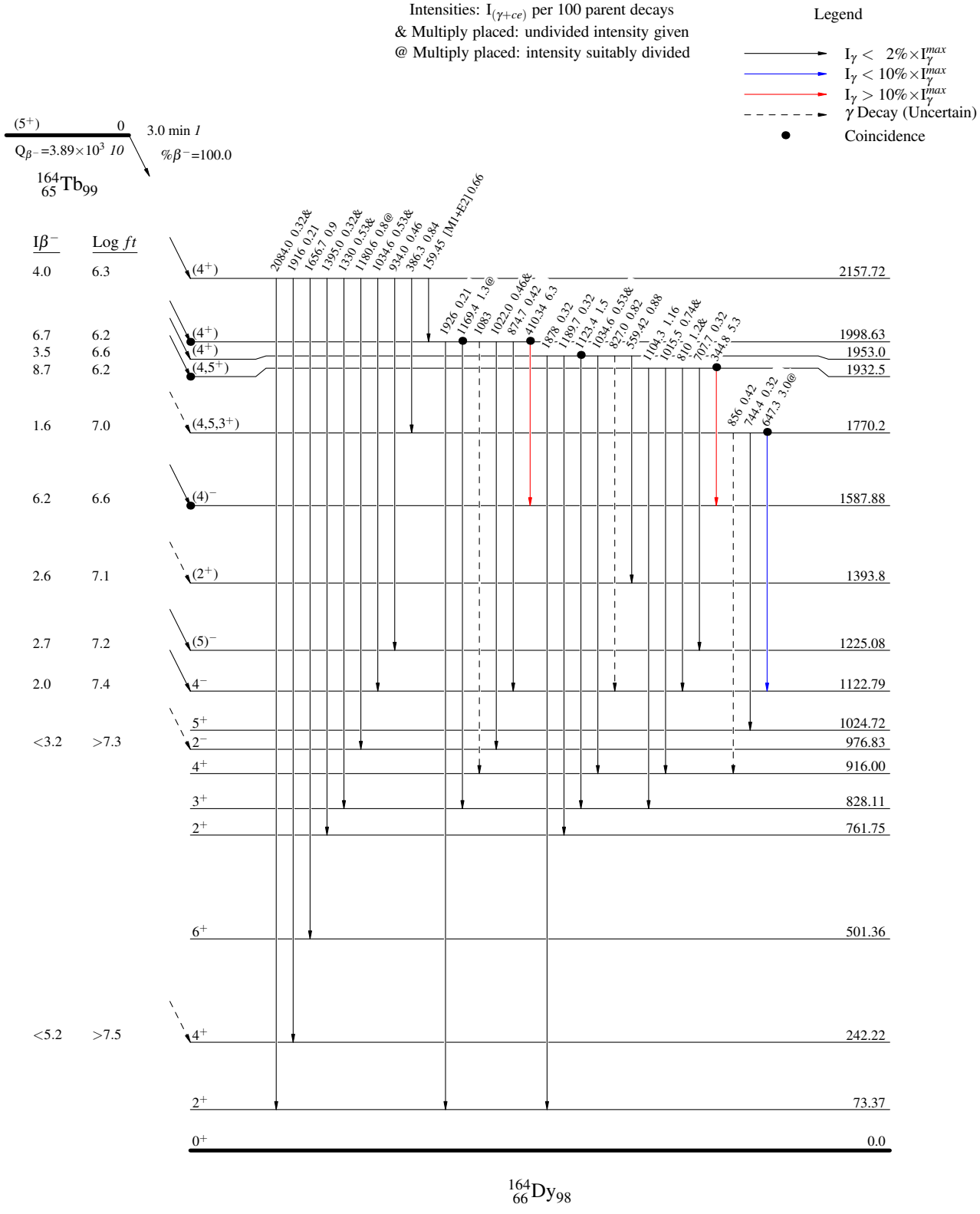


$^{164}_{66}Dy_{98}$

^{164}Tb β^- decay (3.0 min) 1971Gu18

Decay Scheme (continued)

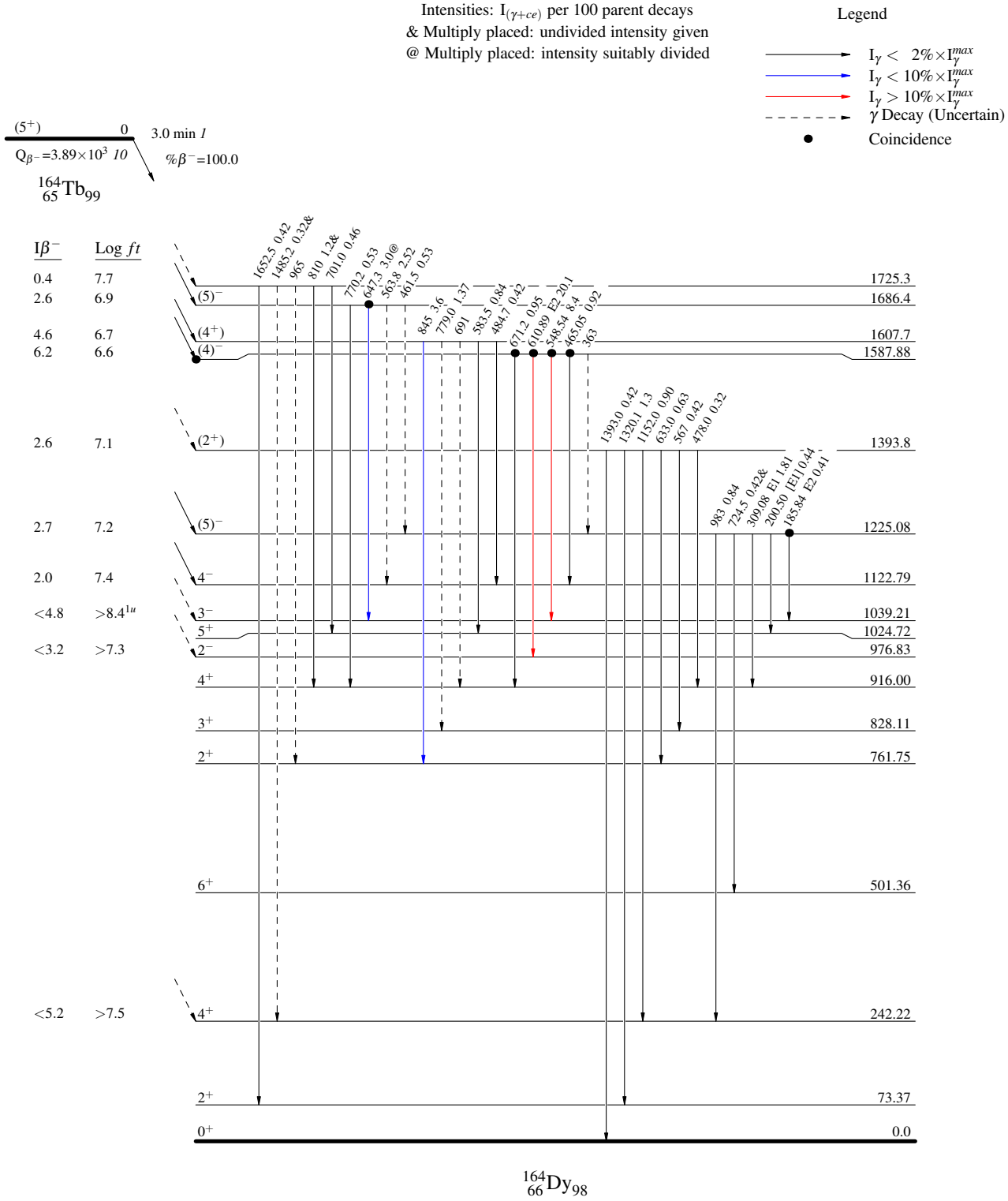
Intensities: $I_{(\gamma+ce)}$ per 100 parent decays
& Multiply placed: undivided intensity given
@ Multiply placed: intensity suitably divided



^{164}Tb β^- decay (3.0 min) 1971Gu18

Decay Scheme (continued)

Intensities: $I_{(\gamma+ce)}$ per 100 parent decays
& Multiply placed: undivided intensity given
@ Multiply placed: intensity suitably divided



^{164}Tb β^- decay (3.0 min) 1971Gu18

Decay Scheme (continued)

Intensities: $I_{(\gamma+ce)}$ per 100 parent decays
& Multiply placed: undivided intensity given
@ Multiply placed: intensity suitably divided