$^{234m}_{91}\mathrm{Pa}_{143}$

1 Decay Scheme

Pa-234m disintegrates 99.85 (1) % by beta minus emissions to levels in U-234 and 0.15 (1) % through isomeric transition to the Pa-234 ground state.

Le protactinium 234 métastable se désintègre par émission bêta moins vers des niveaux excités de l'uranium 234 et par transition isomérique vers le niveau fondamental du protactinium 234.

2 Nuclear Data

$T_{1/2}(^{234m}\mathrm{Pa})$	:	1,159	(11)	min
$T_{1/2}(^{234}\mathrm{U})$	:	2,455	(6)	10^5 a
$T_{1/2}(^{234}\mathrm{Pa})$	:	6,70	(5)	h
$Q^-(^{234m}\mathrm{Pa})$	:	2269	(4)	keV + x keV ($x < 10$)
$Q^{IT}(^{234m}\mathrm{Pa})$	:	73,92	(2)	keV + x keV ($x < 10$)

2.1 β^- Transitions

	Energy (keV)	Probability (%)	Nature	lg ft
$\beta^-_{0,30}$	299 (4)	0,00389 (22)		6,8
$\beta^-_{0,29}$	332 (4)	0,0108 (3)		6,6
$\beta^-_{0,28}$	358 (4)	0,0452 (8)		6
$\beta^-_{0,27}$	394 (4)	0,0258 (3)		6,4
$\beta^-_{0,26}$	406 (4)	0,00311 (19)		7,4
$\beta^-_{0,25}$	460 (4)	0,0146 (7)		6,9
$\beta^-_{0,24}$	473 (4)	0,0021 (3)		7,7
$\beta^-_{0,23}$	488 (4)	0,0357 (18)		6,6
$\beta^-_{0,22}$	575 (4)	0,0024 (3)		8
$\beta^-_{0,21}$	602 (4)	0,0061 (3)		7,6
$\beta^-_{0,20}$	667 (4)	0,00127 (23)		8,5
$\beta^-_{0,19}$	677 (4)	0,0249 (5)		7,2
$\beta^-_{0,18}$	698 (4)	0,00231 (19)		8,4
$\beta^-_{0,17}$	715 (4)	0,0320 (6)		7,2

	Energy (keV)	Probability (%)	Nature	lg ft
$\beta^-_{0,16}$	768 (4)	0,0131 (6)		7,7
$\beta^-_{0,14}$	834 (4)	0,0092 (11)		7,9
$\beta^-_{0,13}$	1032 (4)	0,0121 (11)		8,2
$\beta^-_{0,12}$	1095 (4)	0,0046 (3)		8,7
$\beta^-_{0,9}$	1224 (4)	1,006 (13)		6,5
$\beta^-_{0,4}$	1459 (4)	0,945 (12)		6,8
$\beta^-_{0,3}$	1483 (4)	0,049 (3)		8
$\beta^-_{0,0}$	2269 (4)	97,599 (24)	Allowed	5,5

2.2 Gamma Transitions and Internal Conversion Coefficients

	Energy (keV)	$P_{\gamma+ce}$ (%)	Multipolarity	α_K	α_L	α_M	α_N	α_T
$\gamma_{2,1}$(Pa)	< 10	0,15 (1)						
$\gamma_{6,4}$(U)	41,82	0,0136 (7)						
$\gamma_{1,0}$(U)	43,49 (2)	1,414 (26)	E2		520 (8)	143,7 (21)	38,9 (6)	713 (11)
$\gamma_{8,7}$(U)	62,70 (1)	0,0019 (6)	E1		0,320 (5)	0,0791 (11)	0,0209 (3)	0,426 (6)
$\gamma_{1,0}$(Pa)	73,92 (2)	0,15 (1)	(M1+E2)		7,96 (25)	1,94 (7)	0,520 (18)	10,6 (4)
$\gamma_{2,1}$(U)	99,86 (2)	0,0082 (7)	E2		9,77 (14)	2,71 (4)	0,736 (11)	13,42 (19)
$\gamma_{18,14}$(U)	135,32 (8)	0,0000052 (6)	[E1]	0,190 (3)	0,0428 (6)	0,01043 (15)	0,00278 (4)	0,247 (4)
$\gamma_{11,8}$(U)	137,23 (5)	0,000059 (21)	[E1]	0,184 (3)	0,0413 (6)	0,01006 (15)	0,00268 (4)	0,239 (4)
$\gamma_{8,5}$(U)	140,1 (10)	< 0,008	M1+E2	2,9 (22)	1,76 (25)	0,47 (9)	0,127 (23)	5,3 (18)
$\gamma_{20,14}$(U)	166,5 (1)	0,000000273 (6)	[E1]	0,1179 (17)	0,0253 (4)	0,00613 (9)	0,001636 (23)	0,1514 (22)
$\gamma_{12,8}$(U)	185,0 (4)	0,00172 (15)						
$\gamma_{9,6}$(U)	193,4 (8)	0,00133 (28)	[E2]	0,163 (3)	0,500 (12)	0,138 (4)	0,0374 (9)	0,847 (18)
$\gamma_{14,13}$(U)	197,91 (15)	0,000081 (39)	[M1,E2]	1,3 (12)	0,473 (22)	0,122 (4)	0,033 (1)	2,0 (12)
$\gamma_{11,7}$(U)	199,9 (10)	0,0017 (8)	(E0+E2+M1)	1,3 (12)	0,473 (22)	0,122 (4)	0,033 (1)	1,9 (12)
$\gamma_{8,3}$(U)	203,3 (8)	0,0029 (5)	M1+E2	0,8 (4)	0,420 (12)	0,1109 (23)	0,0300 (7)	1,4 (4)
$\gamma_{23,18}$(U)	209,9 (4)	0,00132 (15)						
$\gamma_{10,6}$(U)	233,6 (2)	≈ 0,00085						
$\gamma_{10,5}$(U)	235,9 (3)	0,000096 (43)	[E1]	0,0532 (8)	0,01067 (16)	0,00258 (4)	0,000689 (10)	0,0673 (10)
$\gamma_{9,4}$(U)	236 (1)	0,074 (8)	E0					
$\gamma_{13,8}$(U)	247,7 (8)	0,0019 (8)	[M1,E2]	0,7 (7)	0,22 (5)	0,056 (8)	0,0151 (20)	1,0 (7)
$\gamma_{9,3}$(U)	258,227 (3)	0,0778 (8)	(E1)	0,0434 (6)	0,00859 (12)	0,00207 (3)	0,000554 (8)	0,0548 (8)
$\gamma_{11,6}$(U)	275,5 (8)	0,00056 (22)	[M1,E2]	0,5 (5)	0,16 (4)	0,039 (8)	0,0106 (21)	0,8 (6)
$\gamma_{10,3}$(U)	299 (1)	0,00067 (14)	[E1]	0,0315 (5)	0,00608 (10)	0,001467 (24)	0,000392 (7)	0,0395 (7)
$\gamma_{13,7}$(U)	311 (1)	0,00054 (11)	[E1]	0,0289 (5)	0,00556 (9)	0,001339 (22)	0,000358 (6)	0,0363 (6)
$\gamma_{11,4}$(U)	316,7 (1)	0,00022 (6)	[E2]	0,0677 (10)	0,0674 (10)	0,0182 (3)	0,00494 (7)	0,1597 (23)
$\gamma_{24,15}$(U)	338,1 (8)	0,00113 (23)						
$\gamma_{11,3}$(U)	340,2 (1)	0,000074 (22)	[E1]	0,0239 (4)	0,00453 (7)	0,001090 (16)	0,000292 (4)	0,0298 (5)
$\gamma_{28,17}$(U)	357,5 (10)	0,00080 (17)						
$\gamma_{24,14}$(U)	362,8 (10)	0,00069 (15)						
$\gamma_{13,5}$(U)	387,6 (8)	0,000512 (44)	[E2]	0,0463 (7)	0,0321 (5)	0,00858 (14)	0,00232 (4)	0,0899 (14)
$\gamma_{12,3}$(U)	387,6 (8)	0,00097 (15)						
$\gamma_{13,4}$(U)	427,4 (2)	0,000020 (5)	[E1]	0,01488 (21)	0,00274 (4)	0,000657 (10)	0,0001758 (25)	0,0185 (3)
$\gamma_{14,8}$(U)	445,91 (10)	0,000037 (9)	[M1,E2]	0,15 (12)	0,036 (16)	0,009 (4)	0,0024 (10)	0,20 (14)
$\gamma_{13,3}$(U)	450,98 (10)	0,00385 (16)	M1+E2	0,187 (3)	0,0400 (6)	0,00979 (14)	0,00264 (4)	0,241 (4)
$\gamma_{28,15}$(U)	453,58 (10)	0,00282 (16)	[M1]	0,258 (4)	0,0495 (7)	0,01193 (17)	0,00321 (5)	0,324 (5)
$\gamma_{22,13}$(U)	456,7 (10)	0,00095 (20)	[M1]	0,253 (4)	0,0485 (8)	0,01171 (18)	0,00315 (5)	0,318 (5)
$\gamma_{17,10}$(U)	468,43 (10)	0,00206 (12)						
$\gamma_{28,14}$(U)	475,74 (10)	0,00305 (17)	[M1]	0,227 (4)	0,0434 (6)	0,01048 (15)	0,00282 (4)	0,285 (4)
$\gamma_{18,10}$(U)	485,44 (7)	0,0000217 (28)	[M1,E2]	0,12 (10)	0,028 (13)	0,007 (3)	0,0019 (8)	0,16 (11)
$\gamma_{19,10}$(U)	507,6 (10)	0,00158 (15)						
$\gamma_{17,9}$(U)	509,3 (8)	0,0022 (3)						
$\gamma_{20,10}$(U)	516,74 (6)	0,000015 (2)	(M1)	0,182 (3)	0,0347 (5)	0,00837 (12)	0,00226 (4)	0,228 (4)
$\gamma_{18,9}$(U)	526,16 (10)	0,0000110 (12)	[M1]	0,1732 (25)	0,0331 (5)	0,00797 (12)	0,00215 (3)	0,217 (3)
$\gamma_{23,13}$(U)	544,14 (10)	0,00349 (15)						
$\gamma_{20,9}$(U)	557,41 (6)	0,0000098 (13)	(M1)	0,1485 (21)	0,0283 (4)	0,00682 (10)	0,00184 (3)	0,186 (3)
$\gamma_{25,13}$(U)	572,2 (10)	0,00102 (20)	[M1]	0,1384 (21)	0,0264 (4)	0,00636 (10)	0,00171 (3)	0,173 (3)

	Energy (keV)	$P_{\gamma+ce}$ (%)	Multipolarity	α_K	α_L	α_M	α_N	α_T
$\gamma_{18,8}$(U)	581,37 (10)	0,000081 (9)	[E1]	0,00815 (12)	0,001445 (21)	0,000345 (5)	0,0000924 (13)	0,01006 (14)
$\gamma_{14,4}$(U)	624,8 (10)	0,000117 (12)	[E1]	0,00712 (11)	0,001252 (18)	0,000299 (5)	0,0000800 (12)	0,00877 (13)
$\gamma_{16,6}$(U)	649,2 (10)	0,0010 (3)						
$\gamma_{14,3}$(U)	649,2 (10)	0,000064 (9)	[M1,E2]	0,06 (4)	0,012 (7)	0,0031 (15)	0,0008 (4)	0,08 (5)
$\gamma_{23,11}$(U)	655,5 (10)	0,00139 (15)						
$\gamma_{15,3}$(U)	671 (1)	0,0004 (1)	[M1,E2]	0,05 (4)	0,011 (6)	0,0028 (14)	0,0008 (4)	0,07 (5)
$\gamma_{28,13}$(U)	674,1 (10)	0,00071 (14)	[M1]	0,0894 (13)	0,01695 (25)	0,00408 (6)	0,001100 (16)	0,1118 (17)
$\gamma_{25,11}$(U)	683,7 (10)	0,00058 (12)	[E1]	0,00603 (9)	0,001050 (15)	0,000250 (4)	0,000067 (1)	0,00741 (11)
$\gamma_{16,4}$(U)	691,3 (3)	0,00898 (19)						
$\gamma_{23,10}$(U)	695,8 (10)	0,00164 (14)						
$\gamma_{29,13}$(U)	699,28 (10)	0,0058 (3)						
$\gamma_{17,6}$(U)	702,26 (10)	0,00721 (16)						
$\gamma_{5,2}$(U)	706,20 (12)	0,0052 (6)	[E1]	0,00568 (8)	0,000987 (14)	0,000235 (4)	0,0000630 (9)	0,00698 (10)
$\gamma_{6,2}$(U)	708,5 (10)	< 0,00072	[E2]	0,01537 (22)	0,00489 (7)	0,001247 (19)	0,000337 (5)	0,0219 (4)
$\gamma_{18,6}$(U)	719,29 (7)	0,0000271 (24)	[M1+E2]	0,05 (3)	0,009 (5)	0,0023 (12)	0,0006 (3)	0,06 (4)
$\gamma_{30,13}$(U)	732,8 (10)	0,00130 (15)						
$\gamma_{19,6}$(U)	740,40 (8)	0,0118 (3)						
$\gamma_{3,1}$(U)	743,115 (5)	0,0946 (30)	E1	0,00518 (8)	0,000895 (13)	0,000213 (3)	0,0000571 (8)	0,00636 (9)
$\gamma_{20,6}$(U)	750,42 (6)	0,0000184 (22)	(M1)	0,0672 (10)	0,01272 (18)	0,00306 (5)	0,000825 (12)	0,0841 (12)
$\gamma_{18,4}$(U)	760,84 (15)	0,0000046 (10)	[M1]	0,0648 (9)	0,01226 (18)	0,00295 (5)	0,000795 (12)	0,0811 (12)
$\gamma_{4,1}$(U)	766,708 (20)	0,3290 (41)	(E2)	0,01336 (19)	0,00396 (6)	0,001004 (14)	0,000271 (4)	0,0187 (3)
$\gamma_{19,4}$(U)	782,05 (10)	0,00782 (18)						
$\gamma_{7,2}$(U)	783,7 (1)	0,000040 (7)	[E2]	0,01285 (18)	0,00374 (6)	0,000946 (14)	0,000255 (4)	0,0179 (3)
$\gamma_{3,0}$(U)	786,573 (22)	0,0539 (7)	E1+M2	0,00467 (7)	0,000804 (12)	0,000191 (3)	0,0000512 (8)	0,00573 (8)
$\gamma_{20,4}$(U)	792,25 (5)	0,0000106 (14)	[M1]	0,0582 (9)	0,01100 (16)	0,00265 (4)	0,000713 (10)	0,0728 (11)
$\gamma_{5,1}$(U)	806,05 (10)	0,0062 (8)	[E1]	0,00447 (7)	0,000768 (11)	0,000183 (3)	0,0000489 (7)	0,00549 (8)
$\gamma_{6,1}$(U)	808,52 (10)	0,00281 (17)						
$\gamma_{4,0}$(U)	810,3 (7)	0,72	E0					
$\gamma_{21,5}$(U)	818,6 (5)	0,0010 (3)						
$\gamma_{28,10}$(U)	825,9 (2)	0,0014 (4)						
$\gamma_{22,5}$(U)	844,5 (8)	0,00109 (23)						
$\gamma_{6,0}$(U)	852,0 (1)	0,00707 (15)	[E2]	0,01109 (16)	0,00302 (5)	0,000760 (11)	0,000205 (3)	0,01514 (22)
$\gamma_{28,9}$(U)	867,2 (10)	0,00116 (16)						
$\gamma_{21,3}$(U)	880,93 (4)	0,00392 (5)						
$\gamma_{7,1}$(U)	883,65 (3)	0,00386 (5)	E2	0,01040 (15)	0,00276 (4)	0,000692 (10)	0,000187 (3)	0,01409 (20)
$\gamma_{28,8}$(U)	922,13 (10)	0,01275 (20)						
$\gamma_{7,0}$(U)	927,05 (10)	0,00127 (13)	(E2)	0,00956 (14)	0,00245 (4)	0,000613 (9)	0,0001653 (24)	0,01284 (18)
$\gamma_{26,7}$(U)	936,75 (100)	0,00102 (17)						
$\gamma_{10,2}$(U)	942,39 (10)	0,00253 (9)	[E2]	0,00929 (13)	0,00236 (4)	0,000589 (9)	0,0001587 (23)	0,01244 (18)
$\gamma_{8,1}$(U)	946,362 (16)	0,01064 (14)	(E1)	0,00337 (5)	0,000571 (8)	0,0001355 (19)	0,0000363 (5)	0,00412 (6)
$\gamma_{25,5}$(U)	960,4 (10)	0,0009 (3)						
$\gamma_{23,3}$(U)	996,5 (20)	0,0059 (17)						
$\gamma_{9,1}$(U)	1001,441 (18)	0,856 (8)	E2	0,00835 (12)	0,00204 (3)	0,000507 (8)	0,0001367 (20)	0,01107 (16)
$\gamma_{10,1}$(U)	1042,1 (1)	0,00122 (8)	[E2,M1]	0,018 (11)	0,0036 (18)	0,0009 (4)	0,00023 (11)	0,023 (13)
$\gamma_{28,6}$(U)	1059,9 (8)	0,00111 (22)						
$\gamma_{28,5}$(U)	1062,46 (10)	0,00224 (9)						
$\gamma_{11,1}$(U)	1082,5 (10)	0,00094 (20)	(M1)	0,0255 (4)	0,00478 (7)	0,001151 (17)	0,000310 (5)	0,0318 (5)
$\gamma_{10,0}$(U)	1084,84 (10)	0,00081 (40)	[E2]	0,00726 (11)	0,001694 (24)	0,000419 (6)	0,0001130 (16)	0,00952 (14)
$\gamma_{30,5}$(U)	1121,2 (8)	0,00173 (15)						
$\gamma_{28,3}$(U)	1125,54 (10)	0,00347 (9)						
$\gamma_{11,0}$(U)	1125,54 (10)	0,00039 (9)	[E2]	0,00681 (10)	0,001558 (22)	0,000385 (6)	0,0001036 (15)	0,00888 (13)
$\gamma_{12,0}$(U)	1174,8 (10)	0,00192 (19)						
$\gamma_{13,1}$(U)	1194,51 (3)	0,01363 (18)	E1	0,00226 (4)	0,000377 (6)	0,0000892 (13)	0,0000239 (4)	0,00277 (4)
$\gamma_{13,0}$(U)	1237,93 (10)	0,00529 (11)	E1	0,00213 (3)	0,000354 (5)	0,0000838 (12)	0,0000225 (4)	0,00262 (4)
$\gamma_{14,1}$(U)	1393,5 (9)	0,0029 (11)	E1	0,001743 (25)	0,000288 (4)	0,0000682 (10)	0,0000183 (3)	0,00221 (4)
$\gamma_{15,1}$(U)	1414,87 (10)	0,00229 (8)	[E1]	0,001700 (24)	0,000281 (4)	0,0000664 (10)	0,00001780 (25)	0,00217 (3)
$\gamma_{14,0}$(U)	1435,05 (10)	0,00975 (16)	E1	0,001660 (24)	0,000274 (4)	0,0000648 (9)	0,00001737 (25)	0,00213 (3)
$\gamma_{16,1}$(U)	1459,6 (15)	0,0019 (5)						
$\gamma_{16,0}$(U)	1501,8 (20)	0,0013						
$\gamma_{17,1}$(U)	1511,29 (10)	0,01308 (19)						
$\gamma_{18,1}$(U)	1528,42 (10)	0,00237 (8)	M1+E2	0,007 (4)	0,0014 (6)	0,00033 (14)	0,00009 (4)	0,009 (4)
$\gamma_{19,1}$(U)	1551,4 (10)	0,00137 (15)						
$\gamma_{17,0}$(U)	1554,52 (10)	0,00826 (14)						
$\gamma_{20,1}$(U)	1559,7 (10)	0,00074 (9)	M1	0,00971 (14)	0,00181 (3)	0,000434 (7)	0,0001169 (17)	0,01228 (18)
$\gamma_{18,0}$(U)	1571,93 (10)	0,00111 (8)	M1	0,00951 (14)	0,001769 (25)	0,000425 (6)	0,0001145 (16)	0,01204 (17)
$\gamma_{19,0}$(U)	1594,8 (1)	0,00235 (12)						
$\gamma_{20,0}$(U)	1603,1 (15)	0,00048 (22)	(M1)	0,00902 (13)	0,001679 (24)	0,000403 (6)	0,0001086 (16)	0,01146 (17)
$\gamma_{21,0}$(U)	1668,9 (10)	0,00118 (6)						
$\gamma_{22,0}$(U)	1695,4 (10)	0,00038 (2)						
$\gamma_{23,1}$(U)	1739,36 (10)	0,0214 (3)						

	Energy (keV)	$P_{\gamma+ce}$ (%)	Multipolarity	α_K	α_L	α_M	α_N	α_T
$\gamma_{25,1}$(U)	1767,14 (10)	0,0084 (6)						
$\gamma_{24,0}$(U)	1798,0 (9)	0,00031 (5)						
$\gamma_{25,0}$(U)	1810,77 (10)	0,00376 (7)						
$\gamma_{26,1}$(U)	1821,58 (10)	0,00089 (5)						
$\gamma_{27,1}$(U)	1833,13 (10)	0,01759 (23)						
$\gamma_{26,0}$(U)	1864,81 (10)	0,00120 (5)						
$\gamma_{28,1}$(U)	1869,6 (1)	0,00932 (12)						
$\gamma_{27,0}$(U)	1876,8 (1)	0,00819 (14)						
$\gamma_{29,1}$(U)	1895,55 (11)	0,00218 (6)						
$\gamma_{28,0}$(U)	1913,20 (11)	0,00628 (9)						
$\gamma_{30,1}$(U)	1928,5 (10)	0,00045 (4)						
$\gamma_{29,0}$(U)	1939,01 (13)	0,00285 (5)						
$\gamma_{30,0}$(U)	1972,4 (8)	0,00041 (4)						

3 Atomic Data

3.1 U

ω_K : 0,970 (4)
$\bar{\omega}_L$: 0,500 (19)
n_{KL} : 0,794 (5)

3.1.1 X Radiations

		Energy (keV)	Relative probability
X_K			
	$K\alpha_2$	94,666	62,47
	$K\alpha_1$	98,44	100
	$K\beta_3$	110,421	36,08
	$K\beta_1$	111,298	
	$K\beta''_5$	111,964	
	$K\beta_2$	114,407	12,34
	$K\beta_4$	115,012	
	$KO_{2,3}$	115,377	
X_L			
	$L\ell$	11,6185	
	$L\alpha$	13,4382 - 13,6146	
	$L\eta$	15,399	
	$L\beta$	15,7268 - 18,2061	
	$L\gamma$	19,5072 - 20,7141	

3.1.2 Auger Electrons

	Energy (keV)	Relative probability
Auger K		
KLL	71,776 - 80,954	100
KLX	88,153 - 98,429	59,6
KXY	104,51 - 115,59	8,88
Auger L	5,9 - 21,6	

4 Electron Emissions

		Energy (keV)	Electrons (per 100 disint.)
e_{AL}	(U)	5,9 - 21,6	0,523 (10)
e_{AK}	(U)		
	KLL	71,776 - 80,954	0,00073 (14)
	KLX	88,153 - 98,429	
	KXY	104,51 - 115,59	
e_{AL}	(Pa)	5,9 - 20,9	0,054 (5)
$ec_{1,0\ L}$	(U)	21,73 - 26,32	1,030 (19)
$ec_{8,5\ T}$	(U)	24,5 - 140,1	0,0067 (23)
$ec_{1,0\ M}$	(U)	37,94 - 39,94	0,285 (5)
$ec_{1,0\ L}$	(Pa)	52,82 - 57,19	0,103 (8)
$ec_{9,6\ T}$	(U)	77,8 - 193,4	0,00061 (13)
$ec_{11,7\ T}$	(U)	84,3 - 199,9	0,0011 (7)
$ec_{8,3\ T}$	(U)	87,7 - 203,3	0,00167 (49)
$ec_{13,8\ T}$	(U)	132,1 - 247,7	0,0010 (7)
$ec_{9,3\ T}$	(U)	142,625 - 258,218	0,00404 (7)
$ec_{11,6\ T}$	(U)	159,9 - 275,5	0,00025 (19)
$ec_{13,3\ T}$	(U)	335,38 - 450,97	0,000747 (34)
$ec_{28,15\ T}$	(U)	337,98 - 453,57	0,00069 (4)
$ec_{22,13\ T}$	(U)	341,1 - 456,7	0,000229 (48)
$ec_{28,14\ T}$	(U)	360,14 - 475,73	0,000675 (38)
$ec_{25,13\ T}$	(U)	456,6 - 572,2	0,000151 (30)
$ec_{3,1\ T}$	(U)	627,513 - 743,106	0,000598 (21)
$ec_{4,1\ T}$	(U)	651,106 - 766,700	0,00604 (12)
$ec_{3,0\ T}$	(U)	670,971 - 786,564	0,000307 (6)
$ec_{4,0\ T}$	(U)	694,4 - 789,0	0,72
$ec_{6,0\ T}$	(U)	736,3980 - 851,9915	0,0001054 (27)
$ec_{9,1\ T}$	(U)	885,839 - 1001,432	0,00938 (16)
$\beta^-_{0,30}$	max:	299 (4)	0,00389 (22)
	avg:	83,0 (13)	

		Energy (keV)		Electrons (per 100 disint.)
$\beta^-_{0,29}$	max:	332	(4)	0,0108 (3)
	avg:	93,0	(13)	
$\beta^-_{0,28}$	max:	358	(4)	0,0452 (8)
	avg:	101,0	(13)	
$\beta^-_{0,27}$	max:	394	(4)	0,0258 (3)
	avg:	112,3	(13)	
$\beta^-_{0,26}$	max:	406	(4)	0,00311 (19)
	avg:	116,0	(13)	
$\beta^-_{0,25}$	max:	460	(4)	0,0146 (7)
	avg:	133,3	(13)	
$\beta^-_{0,24}$	max:	473	(4)	0,0021 (3)
	avg:	137,4	(14)	
$\beta^-_{0,23}$	max:	488	(4)	0,0357 (18)
	avg:	142,3	(14)	
$\beta^-_{0,22}$	max:	575	(4)	0,0024 (3)
	avg:	171,2	(14)	
$\beta^-_{0,21}$	max:	602	(4)	0,0061 (3)
	avg:	180,1	(14)	
$\beta^-_{0,20}$	max:	667	(4)	0,00127 (23)
	avg:	202,5	(14)	
$\beta^-_{0,19}$	max:	677	(4)	0,0249 (5)
	avg:	205,8	(14)	
$\beta^-_{0,18}$	max:	698	(4)	0,00231 (19)
	avg:	213,3	(14)	
$\beta^-_{0,17}$	max:	715	(4)	0,0320 (6)
	avg:	219,2	(14)	
$\beta^-_{0,16}$	max:	768	(4)	0,0131 (6)
	avg:	237,6	(15)	
$\beta^-_{0,14}$	max:	834	(4)	0,0092 (11)
	avg:	261,1	(15)	
$\beta^-_{0,13}$	max:	1032	(4)	0,0121 (11)
	avg:	333,1	(15)	
$\beta^-_{0,12}$	max:	1095	(4)	0,0046 (3)
	avg:	356,7	(15)	
$\beta^-_{0,9}$	max:	1224	(4)	1,006 (13)
	avg:	405,6	(16)	
$\beta^-_{0,4}$	max:	1459	(4)	0,945 (12)
	avg:	496,0	(16)	
$\beta^-_{0,3}$	max:	1483	(4)	0,049 (3)
	avg:	505,3	(16)	
$\beta^-_{0,0}$	max:	2269	(4)	97,599 (24)
	avg:	820,5	(17)	

5 Photon Emissions

5.1 X-Ray Emissions

		Energy (keV)	Photons (per 100 disint.)	
XL	(U)	11,6185 - 20,7141	0,541 (10)	
XKα_2	(U)	94,666	0,0070 (9)	Kα
XKα_1	(U)	98,44	0,0112 (14)	Kα
XKβ_3	(U)	110,421	0,0040 (5)	K$'\beta_1$
XKβ_1	(U)	111,298		K$'\beta_1$
XKβ''_5	(U)	111,964		K$'\beta_1$
XKβ_2	(U)	114,407	0,00138 (18)	K$'\beta_2$
XKβ_4	(U)	115,012		K$'\beta_2$
XKO$_{2,3}$	(U)	115,377		K$'\beta_2$
XL	(Pa)	11,3676 - 20,1126	0,0486 (25)	

5.2 Gamma Emissions

	Energy (keV)	Photons (per 100 disint.)
$\gamma_{1,0}$(U)	43,49 (2)	0,00198 (2)
$\gamma_{8,7}$(U)	62,70 (1)	0,0013 (4)
$\gamma_{1,0}$(Pa)	73,92 (2)	0,0129 (9)
$\gamma_{2,1}$(U)	99,86 (2)	0,00057 (5)
$\gamma_{18,14}$(U)	135,32 (8)	0,0000042 (5)
$\gamma_{11,8}$(U)	137,23 (5)	0,000048 (17)
$\gamma_{8,5}$(U)	140,1 (10)	< 0,00127
$\gamma_{20,14}$(U)	166,5 (1)	0,000000237 (5)
$\gamma_{12,8}$(U)	185,0 (4)	0,00172 (15)
$\gamma_{9,6}$(U)	193,4 (8)	0,00072 (15)
$\gamma_{14,13}$(U)	197,91 (15)	0,000027 (7)
$\gamma_{11,7}$(U)	199,9 (10)	0,00058 (12)
$\gamma_{8,3}$(U)	203,3 (8)	0,00119 (9)
$\gamma_{23,18}$(U)	209,9 (4)	0,00132 (15)
$\gamma_{10,5}$(U)	235,9 (3)	0,00009 (4)
$\gamma_{(-1,1)}$(U)	243,5 (8)	0,00050 (9)
$\gamma_{13,8}$(U)	247,7 (8)	0,00097 (22)
$\gamma_{9,3}$(U)	258,227 (3)	0,0738 (8)
$\gamma_{11,6}$(U)	275,5 (8)	0,00031 (6)
$\gamma_{10,3}$(U)	299 (1)	0,00064 (13)
$\gamma_{13,7}$(U)	311 (1)	0,00052 (11)
$\gamma_{11,4}$(U)	316,7 (1)	0,00019 (5)

	Energy (keV)	Photons (per 100 disint.)
$\gamma_{24,15}$(U)	338,1 (8)	0,00113 (23)
$\gamma_{11,3}$(U)	340,2 (1)	0,000072 (21)
$\gamma_{28,17}$(U)	357,5 (10)	0,00080 (17)
$\gamma_{24,14}$(U)	362,8 (10)	0,00069 (15)
$\gamma_{13,5}$(U)	387,6 (8)	0,00047 (4)
$\gamma_{12,3}$(U)	387,6 (8)	0,00097 (15)
$\gamma_{13,4}$(U)	427,4 (2)	0,000020 (5)
$\gamma_{14,8}$(U)	445,91 (10)	0,000031 (7)
$\gamma_{13,3}$(U)	450,98 (10)	0,00310 (13)
$\gamma_{28,15}$(U)	453,58 (10)	0,00213 (12)
$\gamma_{22,13}$(U)	456,7 (10)	0,00072 (15)
$\gamma_{17,10}$(U)	468,43 (10)	0,00206 (12)
$\gamma_{28,14}$(U)	475,74 (10)	0,00237 (13)
$\gamma_{18,10}$(U)	485,44 (7)	0,0000187 (17)
$\gamma_{19,10}$(U)	507,5 (10)	0,00158 (15)
$\gamma_{17,9}$(U)	509,2 (8)	0,0022 (3)
$\gamma_{20,10}$(U)	516,60 (6)	0,0000122 (16)
$\gamma_{18,9}$(U)	526,02 (10)	0,000009 (1)
$\gamma_{23,13}$(U)	543,98 (10)	0,00349 (15)
$\gamma_{20,9}$(U)	557,24 (6)	0,0000083 (11)
$\gamma_{(-1,2)}$(U)	557,3 (10)	0,00072 (17)
$\gamma_{25,13}$(U)	572 (1)	0,00087 (17)
$\gamma_{18,8}$(U)	581,19 (10)	0,000080 (9)
$\gamma_{14,4}$(U)	624,6 (10)	0,000116 (12)
$\gamma_{(-1,3)}$(U)	647,7 (8)	0,00158 (15)
$\gamma_{14,3}$(U)	649 (1)	0,000059 (8)
$\gamma_{16,6}$(U)	649 (1)	0,0010 (3)
$\gamma_{23,11}$(U)	655,3 (10)	0,00139 (15)
$\gamma_{15,3}$(U)	670,8 (10)	0,00037 (9)
$\gamma_{28,13}$(U)	673,9 (10)	0,00064 (13)
$\gamma_{25,11}$(U)	683,4 (10)	0,00058 (12)
$\gamma_{16,4}$(U)	691,0 (3)	0,00898 (19)
$\gamma_{23,10}$(U)	695,5 (10)	0,00164 (14)
$\gamma_{29,13}$(U)	699,02 (10)	0,0058 (3)
$\gamma_{17,6}$(U)	702,0 (1)	0,00721 (16)
$\gamma_{5,2}$(U)	705,94 (12)	0,0052 (6)
$\gamma_{6,2}$(U)	708,2 (10)	$< 0,0007$
$\gamma_{18,6}$(U)	719,01 (7)	0,0000256 (20)
$\gamma_{30,13}$(U)	732,5 (10)	0,00130 (15)
$\gamma_{19,6}$(U)	740,10 (8)	0,0118 (3)
$\gamma_{3,1}$(U)	742,813 (5)	0,094 (3)
$\gamma_{20,6}$(U)	750,12 (6)	0,000017 (2)
$\gamma_{(-1,4)}$(U)	760,3 (10)	0,00158 (15)
$\gamma_{18,4}$(U)	760,53 (15)	0,0000043 (9)
$\gamma_{4,1}$(U)	766,361 (20)	0,323 (4)
$\gamma_{19,4}$(U)	781,75 (10)	0,00782 (18)
$\gamma_{7,2}$(U)	783,4 (1)	0,000039 (7)
$\gamma_{3,0}$(U)	786,272 (22)	0,0536 (7)

	Energy (keV)	Photons (per 100 disint.)
$\gamma_{20,4}$(U)	791,94 (5)	0,0000099 (13)
$\gamma_{5,1}$(U)	805,75 (10)	0,0062 (8)
$\gamma_{6,1}$(U)	808,2 (1)	0,00281 (17)
$\gamma_{21,5}$(U)	818,2 (5)	0,0010 (3)
$\gamma_{28,10}$(U)	825,5 (2)	0,0014 (4)
$\gamma_{22,5}$(U)	844,1 (8)	0,00109 (23)
$\gamma_{6,0}$(U)	851,6 (1)	0,00696 (15)
$\gamma_{28,9}$(U)	866,8 (10)	0,00116 (16)
$\gamma_{21,3}$(U)	880,52 (4)	0,00392 (5)
$\gamma_{7,1}$(U)	883,24 (3)	0,00381 (5)
$\gamma_{(-1,5)}$(U)	887,29 (100)	0,00708 (14)
$\gamma_{28,8}$(U)	921,72 (10)	0,01275 (20)
$\gamma_{7,0}$(U)	926,61 (10)	0,00125 (13)
$\gamma_{26,7}$(U)	936,3 (10)	0,00102 (17)
$\gamma_{10,2}$(U)	941,96 (10)	0,00250 (9)
$\gamma_{8,1}$(U)	945,961 (16)	0,01060 (14)
$\gamma_{25,5}$(U)	960 (1)	0,0009 (3)
$\gamma_{23,3}$(U)	996,1 (20)	0,0059 (17)
$\gamma_{9,1}$(U)	1001,026 (18)	0,847 (8)
$\gamma_{10,1}$(U)	1041,7 (1)	0,00119 (8)
$\gamma_{28,6}$(U)	1059,4 (8)	0,00111 (22)
$\gamma_{28,5}$(U)	1061,86 (10)	0,00224 (9)
$\gamma_{11,1}$(U)	1081,9 (10)	0,00091 (19)
$\gamma_{10,0}$(U)	1084,25 (10)	0,0008 (4)
$\gamma_{30,5}$(U)	1120,6 (8)	0,00173 (15)
$\gamma_{28,3}$(U)	1124,93 (10)	0,00347 (9)
$\gamma_{11,0}$(U)	1124,93 (10)	0,00039 (9)
$\gamma_{12,0}$(U)	1174,2 (10)	0,00192 (19)
$\gamma_{13,1}$(U)	1193,77 (3)	0,01359 (18)
$\gamma_{(-1,6)}$(U)	1220,37 (10)	0,00091 (9)
$\gamma_{13,0}$(U)	1237,28 (10)	0,00528 (11)
$\gamma_{(-1,7)}$(U)	1353,0 (15)	0,0015 (5)
$\gamma_{14,1}$(U)	1392,6 (9)	0,0029 (11)
$\gamma_{15,1}$(U)	1413,89 (10)	0,00229 (8)
$\gamma_{14,0}$(U)	1434,16 (10)	0,00973 (16)
$\gamma_{16,1}$(U)	1458,5 (15)	0,0019 (5)
$\gamma_{16,0}$(U)	1501 (2)	0,0013
$\gamma_{17,1}$(U)	1510,22 (10)	0,01308 (19)
$\gamma_{18,1}$(U)	1527,28 (10)	0,00235 (8)
$\gamma_{19,1}$(U)	1550,1 (10)	0,00137 (15)
$\gamma_{17,0}$(U)	1553,77 (10)	0,00826 (14)
$\gamma_{20,1}$(U)	1558,4 (10)	0,00073 (9)
$\gamma_{18,0}$(U)	1570,67 (10)	0,00110 (8)
$\gamma_{19,0}$(U)	1593,5 (6)	0,00235 (12)
$\gamma_{20,0}$(U)	1601,8 (15)	0,00047 (22)
$\gamma_{21,0}$(U)	1667,6 (10)	0,00118 (6)
$\gamma_{22,0}$(U)	1694,1 (10)	0,00038 (2)
$\gamma_{(-1,8)}$(U)	1720,5 (15)	0,00033 (15)

	Energy (keV)	Photons (per 100 disint.)
$\gamma_{(-1,9)}$(U)	1732,2 (15)	0,0019 (3)
$\gamma_{23,1}$(U)	1737,77 (10)	0,0214 (3)
$\gamma_{(-1,10)}$(U)	1759,81 (10)	0,00146 (5)
$\gamma_{25,1}$(U)	1765,44 (10)	0,0084 (6)
$\gamma_{24,0}$(U)	1796,3 (9)	0,00031 (5)
$\gamma_{25,0}$(U)	1809,05 (10)	0,00376 (7)
$\gamma_{26,1}$(U)	1819,69 (10)	0,00089 (5)
$\gamma_{27,1}$(U)	1831,37 (10)	0,01759 (23)
$\gamma_{26,0}$(U)	1863,09 (10)	0,00120 (5)
$\gamma_{28,1}$(U)	1867,7 (1)	0,00932 (12)
$\gamma_{27,0}$(U)	1874,9 (1)	0,00819 (14)
$\gamma_{29,1}$(U)	1893,51 (11)	0,00218 (6)
$\gamma_{28,0}$(U)	1911,20 (11)	0,00628 (9)
$\gamma_{30,1}$(U)	1926,5 (10)	0,00045 (4)
$\gamma_{29,0}$(U)	1937,01 (13)	0,00285 (5)
$\gamma_{30,0}$(U)	1970,3 (8)	0,00041 (4)
$\gamma_{(-1,11)}$(U)	2022,24 (12)	0,000186 (3)
$\gamma_{(-1,12)}$(U)	2041,23 (13)	0,00011 (1)
$\gamma_{(-1,13)}$(U)	2065,80 (13)	0,00007
$\gamma_{(-1,14)}$(U)	2093,19 (38)	0,00002
$\gamma_{(-1,15)}$(U)	2102,14 (15)	0,00006
$\gamma_{(-1,16)}$(U)	2136,69 (14)	0,00007

6 Main Production Modes

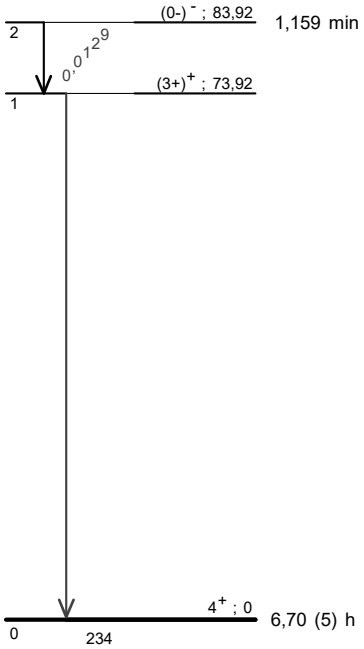
U – 238 decay chain

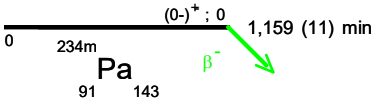
7 References

- N.Feather, E.Bretscher. Proc.Roy.Soc.(London) 165A (1938) 530
  (IT Branching Ratio)
- H.Bradt, P.Scherrer. Helv.Phys.Acta 18 (1945) 405
  (IT Branching Ratio)
- F.Barendregt, S.Tom. Physica 17 (1951) 817
  (Half-life)
- W.L.Zijp, S.Tom, G.J.Sizoo. Physica 20 (1954) 727
  (Half-life)
- Ong Ping Hok, J.T.Verschoor, P.Born. Physica 22 (1956) 465
  (Half-life)
- J.H.Forrest, S.J.Lyle, G.R.Martin, J.J.Maulden. J.Inorg.Nucl.Chem. 15 (1960) 210
  (IT Branching Ratio)
- S.Bjornholm, O.B.Nielsen. Nucl.Phys. 42 (1963) 642
  (Gamma ray energies, intensities and emission proba)
- A.H.Wapstra. Nucl.Phys. A97 (1967) 641
  (Gamma ray energies and intensities)
- M.Saeki, K.Kimura, T.Ishimori. JAERI-1178 (1969) 25
  (Half-life)

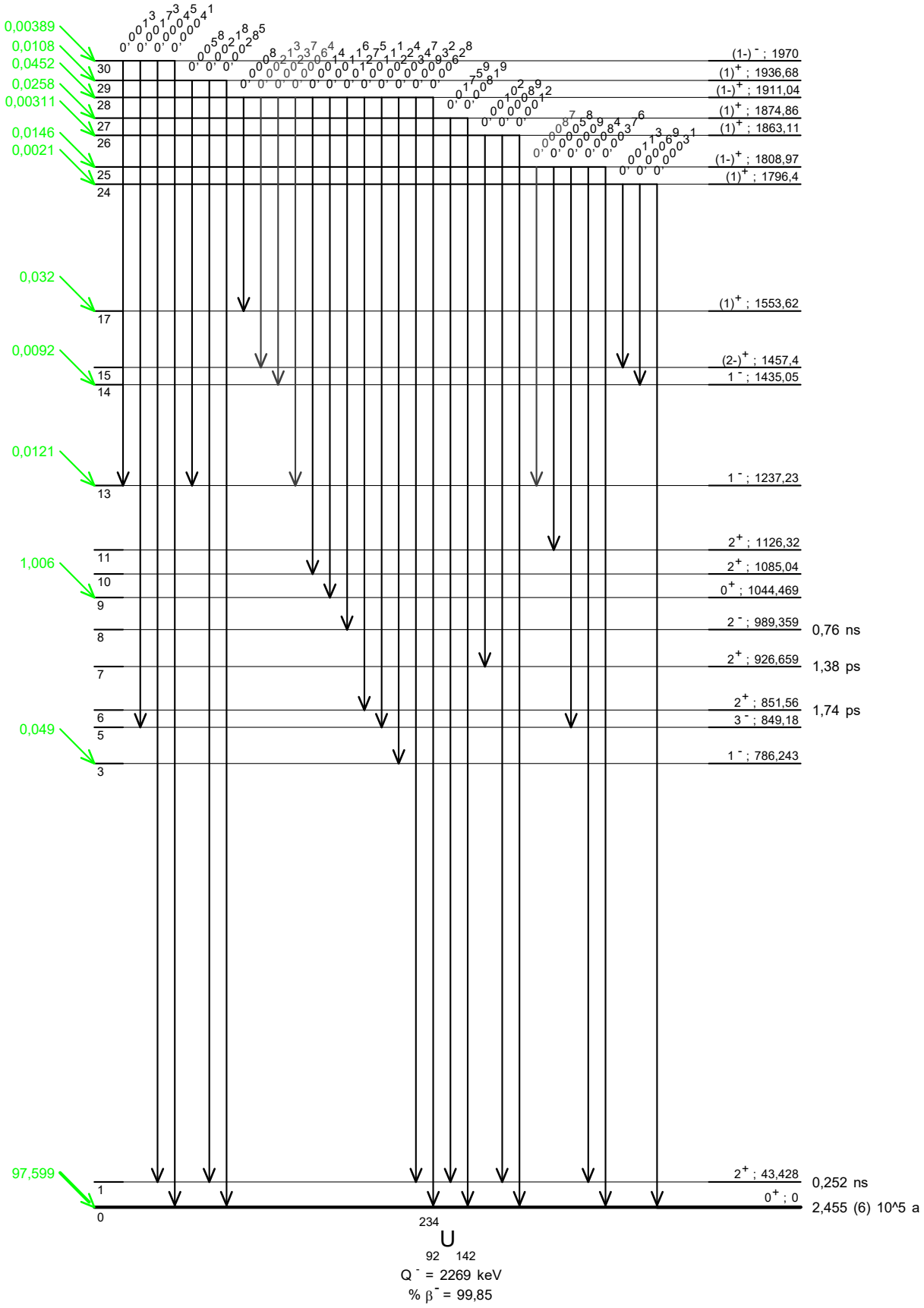
- R.Denig, N.Trautmann, N.Kaffrell, G.Herrmann. Proc. Int. Conf. Protactinium, 3rd. Schloss Elmau Germania (1969)
  (Half-life)
- R.Gunnink, J.F.Tinney. UCRL-51086 (1971)
  (Gamma ray energies, intensities and emission proba)
- T.E.Sampson. Nucl.Instrum.Methods 98 (1972) 37
  (Gamma ray energies)
- J.Godart, A.Gizon. Nucl.Phys. A217 (1973) 159
  (IT Branching Ratio)
- G.Ardisson, C.Marsol. Nuovo Cim. 28A (1975) 155
  (Gamma ray energies and intensities)
- Y.Y.Chu, G.Scharff-Goldhaber. Phys.Rev. C17 (1978) 1507
  (IT Branching Ratio)
- M.H.Momeni. Nucl.Instrum.Methods 193 (1982) 185
  (Gamma ray emission probabilities)
- C.E.Moss. Radiat.Eff. 94 (1986) 81
  (Gamma ray emission probabilities)
- H.L.Scott, K.W.Marlow. Nucl.Instrum.Methods Phys.Res. A286 (1990) 549
  (Gamma ray emission probabilities)
- P.Jagam, J.J.Simpson. J.Radioanal.Nucl.Chem. 166 (1992) 393
  (Gamma ray emission probabilities)
- W.J.Lin, G.Harbottle. J.Radioanal.Nucl.Chem. 157 (1992) 367
  (Gamma ray emission probabilities)
- K.Siemon, R.A.Esterlund, J.Van Aarle, M.Knaack, W.Westmeier, P.Patzelt. Appl.Radiat.Isot. 43 (1992) 873
  (Gamma ray emission probabilities)
- G.A.Sutton, S.T.Napier, M.John, A.Taylor. Sci.Total Environ. 130/131 (1993) 393
  (Gamma ray emission probabilities)
- E.Schönfeld, H.Janssen. Nucl. Instrum. Meth. Phys. Res. A369 (1996) 527
  (Atomic data)
- I.Adsley, J.S.Backhouse, A.L.Nichols, J.Toole. Appl.Radiat.Isot. 49 (1998) 1337
  (Evaluated Gamma ray emission probabilities)
- S.Anilkumar, N.Krishnan, M.C.Abani. Appl.Radiat.Isot. 51 (1999) 725
  (Gamma ray emission probabilities)
- A.C.Nzuruba. Nucl.Instrum.Methods Phys.Res. A424 (1999) 425
  (Compiled data)
- Y.Nir-El. Radiochim.Acta 88 (2000) 83
  (Gamma ray energies and intensities)
- I.M.Band, M.B.Trzhaskovskaya, C.W.Nestor Jr., P.O.Tikkanen, S.Raman. At. Data Nucl.Data Tables 81 (2002) 1
  (Theoretical ICC)
- G.Audi, A.H.Wapstra, C.Thibault. Nucl. Phys. A729 (2003) 129
  (Q)
- H.Yucel, H.Karadeniz, M.A.Cetiner, H.Demirel, S.Turhan. J.Radioanal.Nucl.Chem. 258 (2003) 445
  (Gamma ray emission probabilities)
- M.J.Woods, S.M.Collins. Appl.Radiat.Isot. 60 (2004) 257
  (Evaluated Half-life)
- V.B.Brudanin, K.Ya.Gromov, S.I.Vasiliev, A.A.Klimenko, A.A.Smolnikov, V.I.Fominykh, V.G.Chumin. Part. and Nucl., Lett. 122 (2004) 84
  (Gamma ray energies and intensities)
- F.S.Al-Saleh, Al-J.H.Al-Mukren, M.A.Farouk. Nucl.Instrum.Methods Phys.Res. A568 (2006) 734
  (Gamma ray energies, and emission probabilities)
- E.Browne, J.K.Tuli. Nucl.Data Sheets 108 (2007) 681
  (NDS)

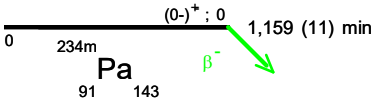
γ Emission intensities
per 100 disintegrations



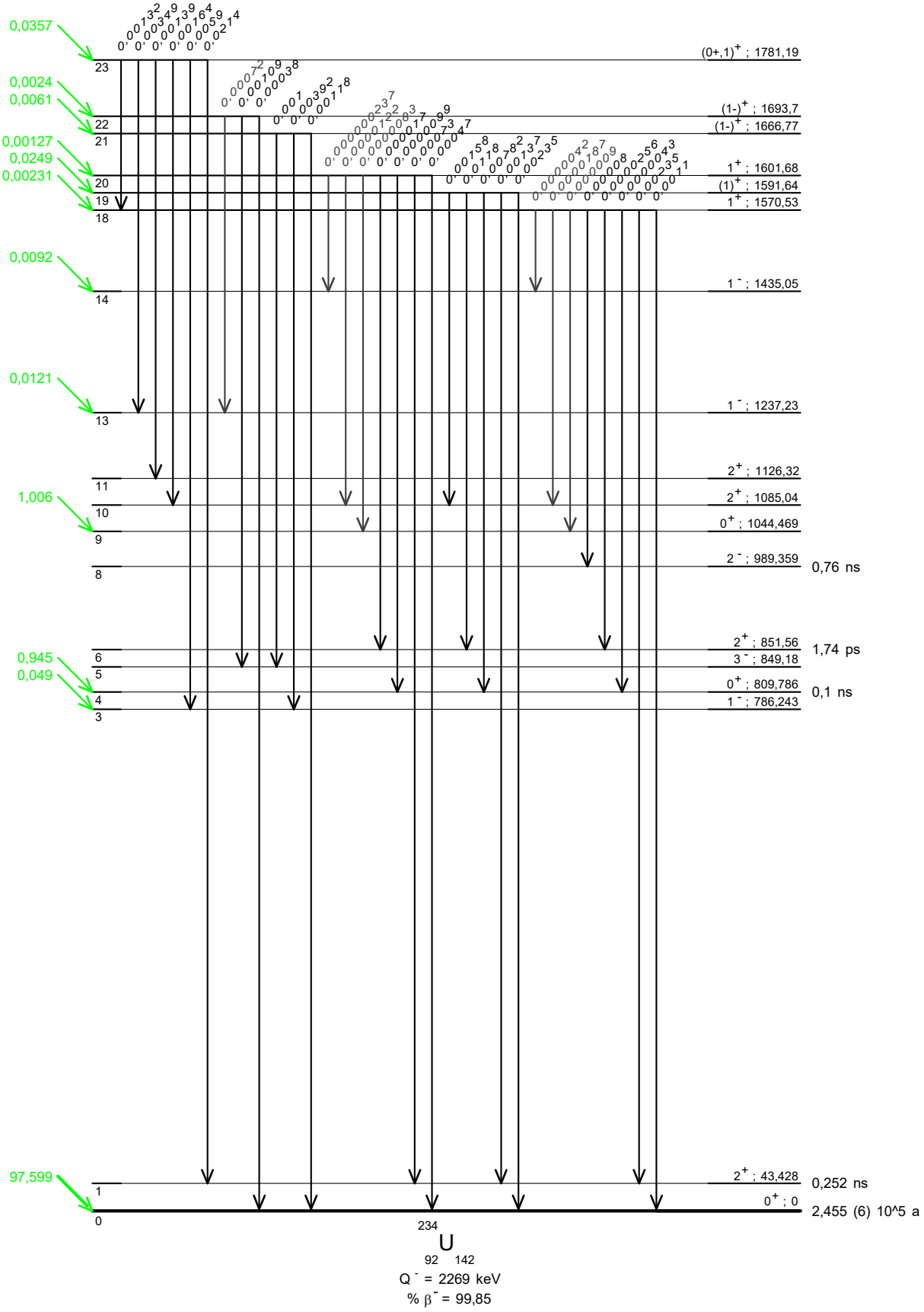


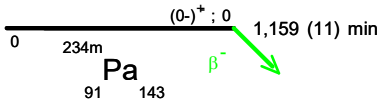
γ Emission intensities per 100 disintegrations



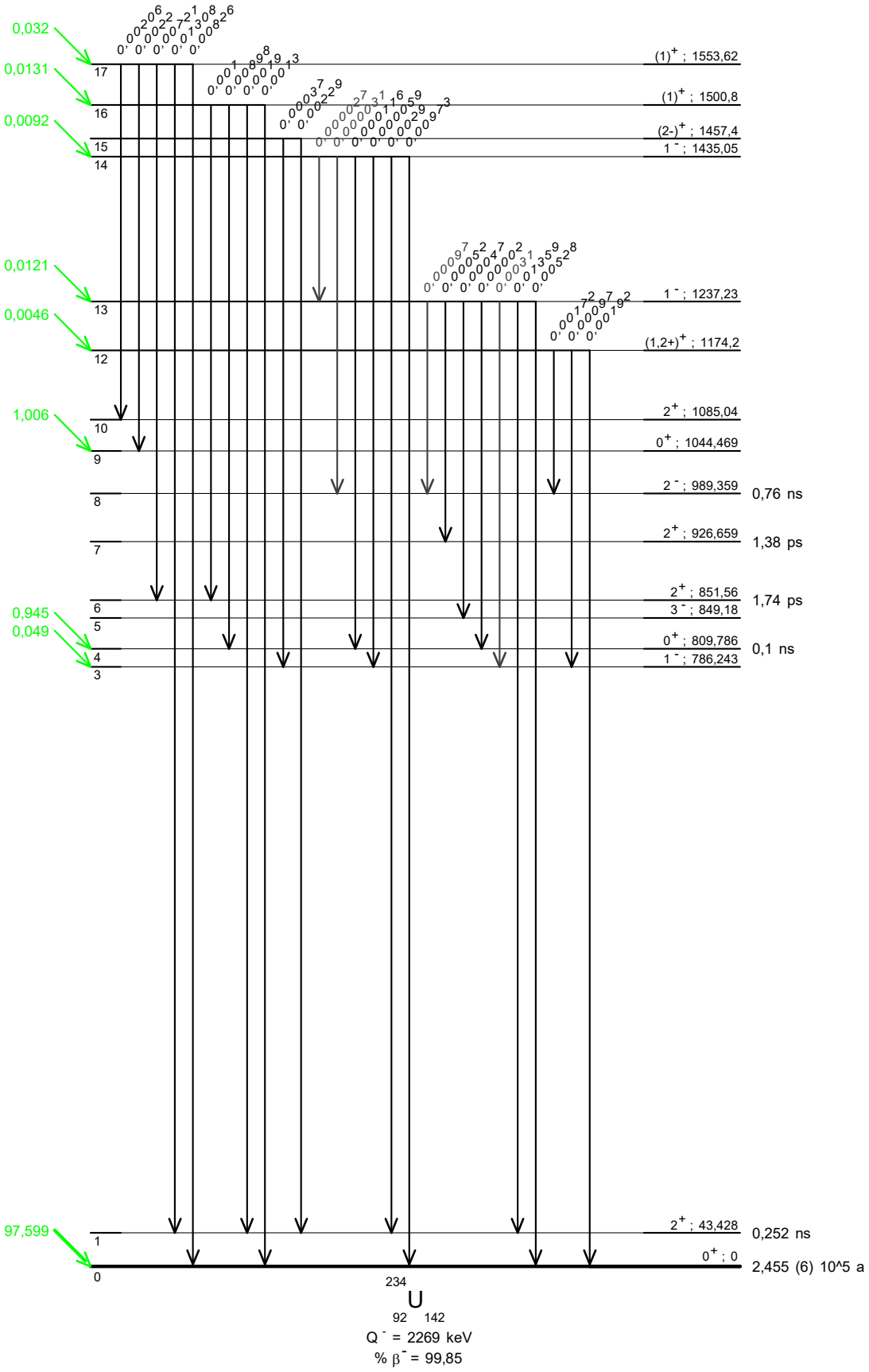


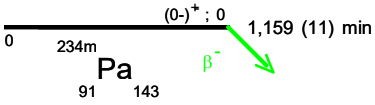
γ Emission intensities per 100 disintegrations



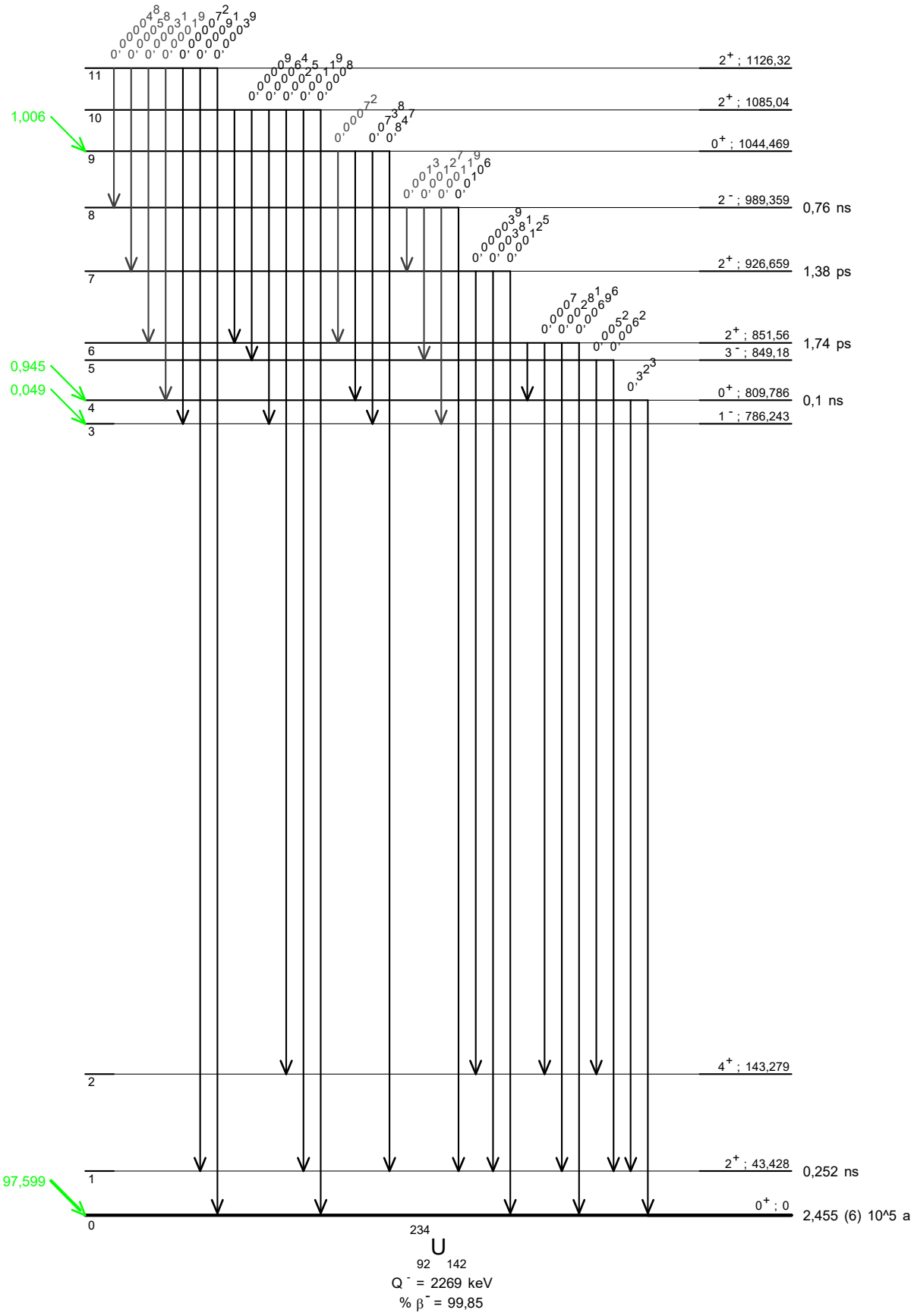


γ Emission intensities per 100 disintegrations





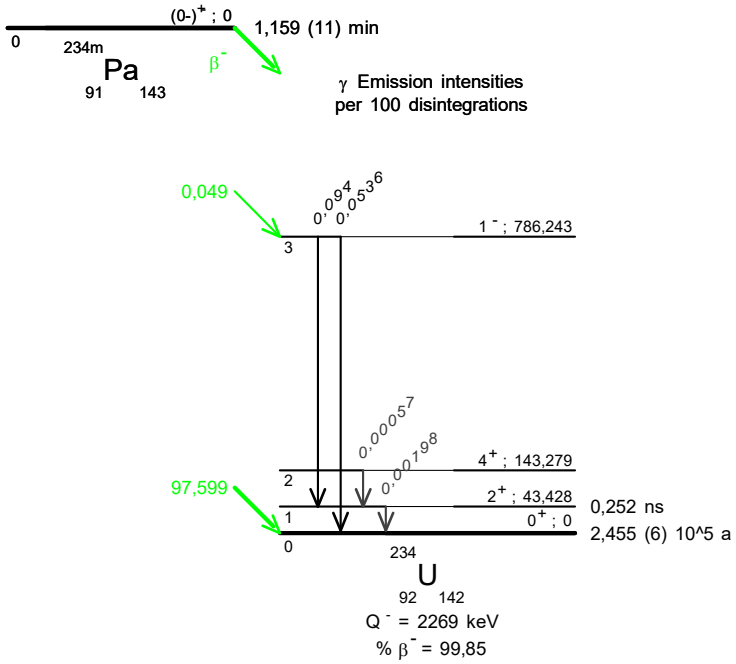
γ Emission intensities per 100 disintegrations



$^{234}_{92}U_{142}$

$Q^- = 2269$ keV

$\%\ \beta^- = 99,85$


(0-)* ; 0
1,159 (11) min
0
234m
Pa
91 143
β-
γ Emission intensities
per 100 disintegrations
0,049
0,09
0,4
0,05
3,6
0,0
0,0
1 - ; 786,243
3
0,0005
7
0,
0,001
98
4+ ; 143,279
2
97,599
0,
2+ ; 43,428
0,252 ns
1
0+ ; 0
2,455 (6) 10^5 a
0
234
U
92 142
Q - = 2269 keV
% β- = 99,85