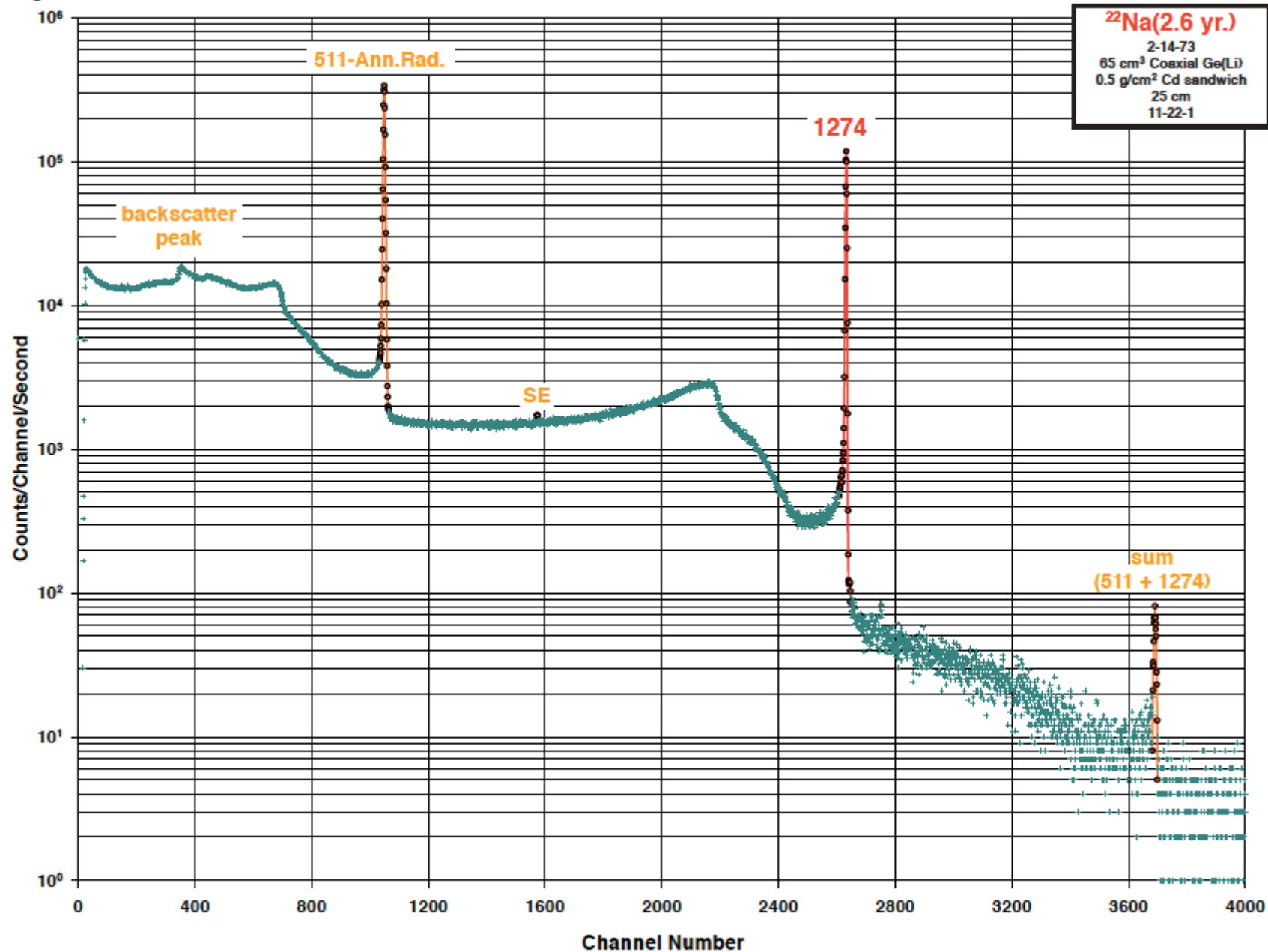
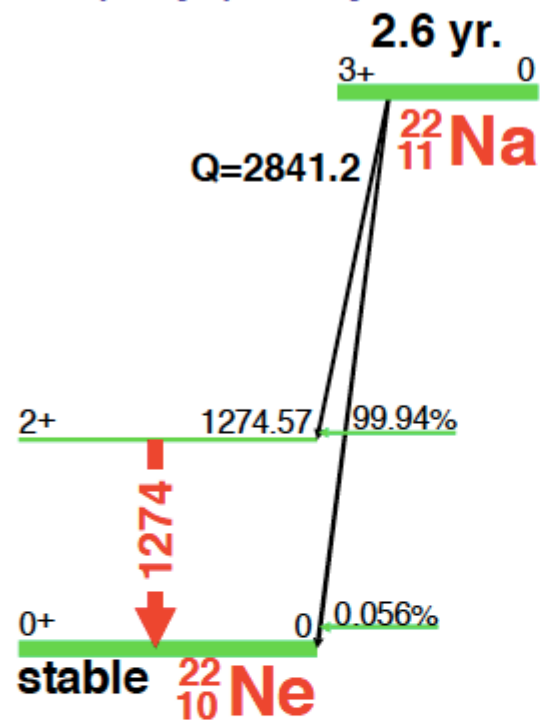


Table of Precise γ -ray Energies for Ge Detector Calibration

| Nuclide | E_γ (keV) | ΔE_γ | Nuclide | E_γ (keV) | ΔE_γ | Nuclide | E_γ (keV) | ΔE_γ | Nuclide | E_γ (keV) | ΔE_γ | Nuclide | E_γ (keV) | ΔE_γ |
|-------------------|------------------|-------------------|--------------------|------------------|-------------------|--------------------|------------------|-------------------|--------------------|------------------|-------------------|--------------------|------------------|-------------------|
| ¹⁷² Hf | 23.9330 | 2 | ^{95m} Tc | 204.1161 | 17 | ¹⁹² Ir | 588.581 | 7 | ¹⁸² Ir | 884.5365 | 7 | ^{110m} Ag | 1384.2931 | 20 |
| ¹⁶¹ Tb | 25.65135 | 3 | ¹⁹² Ir | 205.7943 | 9 | ¹⁵⁴ Eu | 591.755 | 3 | ^{110m} Ag | 884.6781 | 13 | ¹⁸² Ta | 1387.39 | 3 |
| ²⁴¹ Am | 26.3446 | 2 | ¹⁸⁰ Tb | 215.6452 | 11 | ¹²⁵ Sb | 600.597 | 2 | ⁴⁶ Sc | 889.271 | 2 | ¹⁵² Eu | 1408.013 | 3 |
| ⁹⁹ Mo | 40.58323 | 17 | ¹⁸² Ta | 222.1085 | 3 | ¹²⁴ Sb | 602.726 | 23 | ⁸⁸ Y | 898.036 | 4 | ⁶⁶ Ga | 1418.754 | 5 |
| ¹⁶¹ Tb | 48.91533 | 5 | ¹³³ Ba | 223.2368 | 13 | ¹⁹² Ir | 604.41105 | 25 | ¹⁵⁴ Eu | 904.064 | 3 | ¹²⁴ Sb | 1436.554 | 7 |
| ¹³³ Ba | 53.1622 | 6 | ¹⁸² Ta | 229.3207 | 6 | ¹²⁵ Sb | 606.713 | 3 | ¹⁵² Eu | 919.337 | 4 | ¹⁵² Eu | 1457.643 | 11 |
| ¹⁶¹ Tb | 57.1917 | 3 | ¹⁵² Eu | 244.6974 | 8 | ¹⁹² Ir | 612.46215 | 26 | ^{110m} Ag | 937.485 | 3 | ^{110m} Ag | 1475.7792 | 23 |
| ²⁴¹ Am | 59.5409 | 2 | ¹⁵⁴ Eu | 247.9288 | 7 | ^{108m} Au | 614.276 | 4 | ¹⁶⁰ Tb | 962.311 | 3 | ¹⁴⁴ Ce | 1489.148 | 3 |
| ¹⁶⁹ Yb | 63.12044 | 4 | ¹⁶⁹ Yb | 261.07712 | 9 | ^{110m} Ag | 620.3553 | 17 | ¹⁶⁰ Tb | 966.166 | 2 | ¹⁵⁴ Eu | 1494.048 | 5 |
| ¹⁸² Ta | 65.72215 | 15 | ¹⁸² Ta | 264.074 | 3 | ¹²⁵ Sb | 635.95 | 3 | ¹²⁴ Sb | 968.195 | 4 | ^{110m} Ag | 1505.028 | 20 |
| ⁷⁵ Se | 66.0518 | 8 | ⁷⁵ Se | 264.6576 | 9 | ¹²⁴ Sb | 645.852 | 19 | ⁵⁶ Co | 977.363 | 4 | ⁶⁶ Ga | 1508.158 | 7 |
| ¹⁸² Ta | 67.7497 | 10 | ¹³³ Ba | 276.3989 | 12 | ^{110m} Ag | 657.76 | 11 | ⁵⁶ Co | 1037.8333 | 24 | ^{110m} Ag | 1562.294 | 18 |
| ¹⁵³ Sm | 69.67300 | 13 | ²⁰³ Hg | 279.1952 | 10 | ¹³⁷ Cs | 661.657 | 3 | ⁶⁶ Ga | 1039.22 | 3 | ¹²⁴ Sb | 1690.971 | 4 |
| ¹⁶¹ Tb | 74.56669 | 6 | ⁷⁵ Se | 279.5422 | 10 | ¹²⁵ Sb | 671.441 | 6 | ^{95m} Tc | 1039.26 | 6 | ²⁰⁷ Bi | 1770.228 | 9 |
| ¹⁷² Hf | 78.7422 | 6 | ¹⁵² Eu | 295.9387 | 17 | ¹⁹⁸ Au | 675.8836 | 7 | ¹²⁴ Sb | 1045.125 | 4 | ⁵⁶ Co | 1771.327 | 3 |
| ¹⁷² Hf | 81.7509 | 5 | ¹⁹² Ir | 295.9565 | 15 | ^{110m} Ag | 677.6217 | 12 | ²⁰⁷ Bi | 1063.656 | 3 | ⁵⁶ Co | 1810.726 | 4 |
| ¹⁷⁰ Tm | 84.25474 | 8 | ¹⁶⁰ Tb | 298.5783 | 17 | ¹⁵² Eu | 678.623 | 5 | ¹⁵² Eu | 1085.837 | 10 | ⁸⁶ Y | 1836.052 | 13 |
| ¹⁸² Ta | 84.68024 | 26 | ¹³³ Ba | 302.8508 | 5 | ²⁰³ Pb | 680.515 | 3 | ¹⁹⁸ Au | 1087.6842 | 7 | ⁸⁴ Rb | 1897.751 | 11 |
| ¹⁶⁰ Tb | 86.7877 | 3 | ⁷⁵ Se | 303.9236 | 10 | ^{110m} Ag | 687.0091 | 18 | ¹⁵² Eu | 1089.737 | 5 | ⁶⁶ Ga | 1898.823 | 8 |
| ¹⁶⁹ Yb | 93.61447 | 8 | ¹⁶⁹ Yb | 307.73586 | 10 | ¹⁵² Eu | 688.67 | 5 | ⁵⁶ Fe | 1099.245 | 3 | ⁶⁶ Ga | 1918.329 | 5 |
| ⁷⁵ Se | 96.734 | 9 | ¹⁹² Ir | 308.45507 | 17 | ¹⁵⁴ Eu | 692.4205 | 18 | ¹⁵² Eu | 1112.076 | 3 | ⁵⁶ Co | 1963.703 | 11 |
| ¹⁵³ Sm | 97.431 | 21 | ¹⁹² Ir | 316.50618 | 17 | ¹⁴⁴ Ce | 696.505 | 4 | ⁶⁵ Zn | 1115.539 | 2 | ⁵⁶ Co | 2015.176 | 5 |
| ¹⁸² Ta | 100.10595 | 7 | ⁵¹ Cr | 320.0824 | 4 | ⁹⁴ Nb | 702.639 | 4 | ⁴⁶ Sc | 1120.537 | 3 | ⁵⁶ Co | 2034.752 | 5 |
| ¹⁵³ Sm | 103.18012 | 17 | ¹⁵² Eu | 344.2785 | 12 | ^{110m} Ag | 706.676 | 15 | ¹⁸² Ta | 1121.29 | 3 | ¹²⁴ Sb | 2090.93 | 7 |
| ¹⁶⁹ Yb | 109.77924 | 4 | ¹³³ Ba | 356.0129 | 7 | ¹²⁴ Sb | 713.776 | 4 | ⁶⁰ Co | 1173.228 | 3 | ⁵⁶ Co | 2113.092 | 6 |
| ¹⁸² Ta | 113.6717 | 22 | ¹⁵² Eu | 367.7891 | 20 | ¹²⁴ Sb | 722.782 | 3 | ⁵⁶ Co | 1175.0878 | 22 | ¹⁴⁴ Ce | 2185.645 | 5 |
| ¹⁸² Ta | 116.4179 | 6 | ¹³³ Ba | 383.8485 | 12 | ¹⁵⁴ Eu | 723.3014 | 22 | ¹⁶⁰ Tb | 1177.954 | 3 | ⁶⁶ Ga | 2189.616 | 6 |
| ¹⁶⁹ Yb | 118.1894 | 14 | ¹¹³ Sn | 391.698 | 3 | ⁹⁵ Zr | 724.193 | 3 | ¹⁸² Ta | 1189.04 | 3 | ⁵⁶ Co | 2212.898 | 3 |
| ⁷⁵ Se | 121.1155 | 11 | ⁷⁵ Se | 400.6572 | 8 | ^{110m} Ag | 744.2755 | 18 | ¹⁵² Eu | 1212.948 | 11 | ⁵⁶ Co | 2598.438 | 4 |
| ¹⁵² Eu | 121.7817 | 3 | ²⁰³ Hg | 401.32 | 3 | ¹⁵⁴ Eu | 756.802 | 23 | ¹⁸² Ta | 1221.395 | 3 | ²²⁹ Th | 2614.511 | 10 |
| ⁵⁷ Co | 122.06065 | 12 | ¹⁵² Eu | 411.1165 | 12 | ^{110m} Ag | 763.9424 | 17 | ¹⁸² Ta | 1231.004 | 3 | ⁶⁶ Ga | 2751.835 | 5 |
| ¹⁵⁴ Eu | 123.0706 | 9 | ¹⁹⁸ Au | 411.80205 | 17 | ^{95m} Tc | 765.803 | 6 | ⁵⁶ Co | 1238.2736 | 22 | ²⁴ Na | 2754.008 | 11 |
| ¹⁶⁹ Yb | 130.52293 | 6 | ¹⁹² Ir | 416.4688 | 7 | ¹⁵² Eu | 778.9045 | 24 | ¹⁵⁴ Eu | 1246.121 | 4 | ⁵⁶ Co | 3009.559 | 4 |
| ⁷⁵ Se | 136.0001 | 6 | ¹²⁵ Sb | 427.874 | 4 | ^{95m} Tc | 786.1922 | 27 | ¹⁸² Ta | 1257.407 | 3 | ⁵⁶ Co | 3201.93 | 11 |
| ⁵⁷ Co | 136.47356 | 29 | ^{108m} Au | 433.937 | 4 | ¹²⁴ Sb | 790.706 | 7 | ¹⁶⁰ Tb | 1271.873 | 5 | ⁶⁶ Ga | 3228.8 | 6 |
| ⁹⁹ Mo | 140.511 | 1 | ¹⁵⁴ Eu | 444.4924 | 19 | ¹⁵² Eu | 810.451 | 5 | ¹⁸² Ta | 1273.719 | 3 | ⁵⁶ Co | 3253.402 | 5 |
| ¹⁴¹ Ce | 145.4433 | 14 | ^{110m} Ag | 446.812 | 3 | ⁵⁶ Co | 810.7593 | 20 | ¹⁵⁴ Eu | 1274.429 | 4 | ⁵⁶ Co | 3272.978 | 6 |
| ¹⁸² Ta | 152.42991 | 26 | ¹²⁵ Sb | 463.365 | 4 | ^{110m} Ag | 818.0244 | 18 | ²² Na | 1274.537 | 7 | ⁶⁶ Ga | 3380.85 | 6 |
| ¹⁸² Ta | 156.3864 | 3 | ¹⁹² Ir | 468.06885 | 26 | ^{95m} Tc | 820.622 | 7 | ¹⁸² Ta | 1289.145 | 3 | ⁶⁶ Ga | 3422.04 | 8 |
| ¹³³ Ba | 160.612 | 16 | ⁷ Be | 477.6035 | 2 | ⁶⁶ Ga | 833.5324 | 21 | ⁵⁰ Fe | 1291.59 | 6 | ⁵⁶ Co | 3451.119 | 4 |
| ¹⁵³ Sm | 172.85307 | 19 | ¹⁹² Ir | 484.5751 | 14 | ⁵⁴ Mn | 834.838 | 5 | ¹⁵² Eu | 1299.142 | 8 | ⁶⁶ Ga | 4085.853 | 9 |
| ¹²⁵ Sb | 176.314 | 2 | ¹⁵² Eu | 488.6792 | 20 | ^{95m} Tc | 835.146 | 6 | ¹²⁴ Sb | 1325.504 | 4 | ⁶⁶ Ga | 4461.202 | 9 |
| ¹⁶⁹ Yb | 177.21307 | 6 | ¹⁰⁶ Ru | 511.8534 | 23 | ⁵⁶ Co | 846.7638 | 19 | ⁶⁰ Co | 1332.492 | 4 | ⁶⁶ Ga | 4806.007 | 9 |
| ¹⁸² Ta | 179.39381 | 25 | ⁸⁵ Sr | 514.0048 | 22 | ¹⁵² Eu | 867.38 | 3 | ⁶⁶ Ga | 1333.112 | 5 | | | |
| ¹⁶⁰ Tb | 197.0341 | 10 | ²⁰⁷ Bi | 569.698 | 2 | ⁹⁴ Nb | 871.114 | 3 | ⁵⁶ Co | 1360.196 | 4 | | | |
| ¹⁶⁹ Yb | 197.95675 | 7 | ^{95m} Tc | 582.0775 | 21 | ¹⁵⁴ Eu | 873.1834 | 23 | ¹²⁴ Sb | 1368.157 | 5 | | | |
| ¹⁸² Ta | 198.35187 | 29 | ²²⁸ Th | 583.187 | 2 | ¹⁶⁰ Tb | 879.378 | 2 | ²⁴ Na | 1368.625 | 5 | | | |
| ⁷⁵ Se | 198.606 | 12 | ¹⁵² Eu | 586.2648 | 26 | ⁸⁴ Rb | 881.6041 | 16 | ¹⁸² Ta | 1373.824 | 3 | | | |

* Uncertainty applies to the last digit or two digits of the energy.



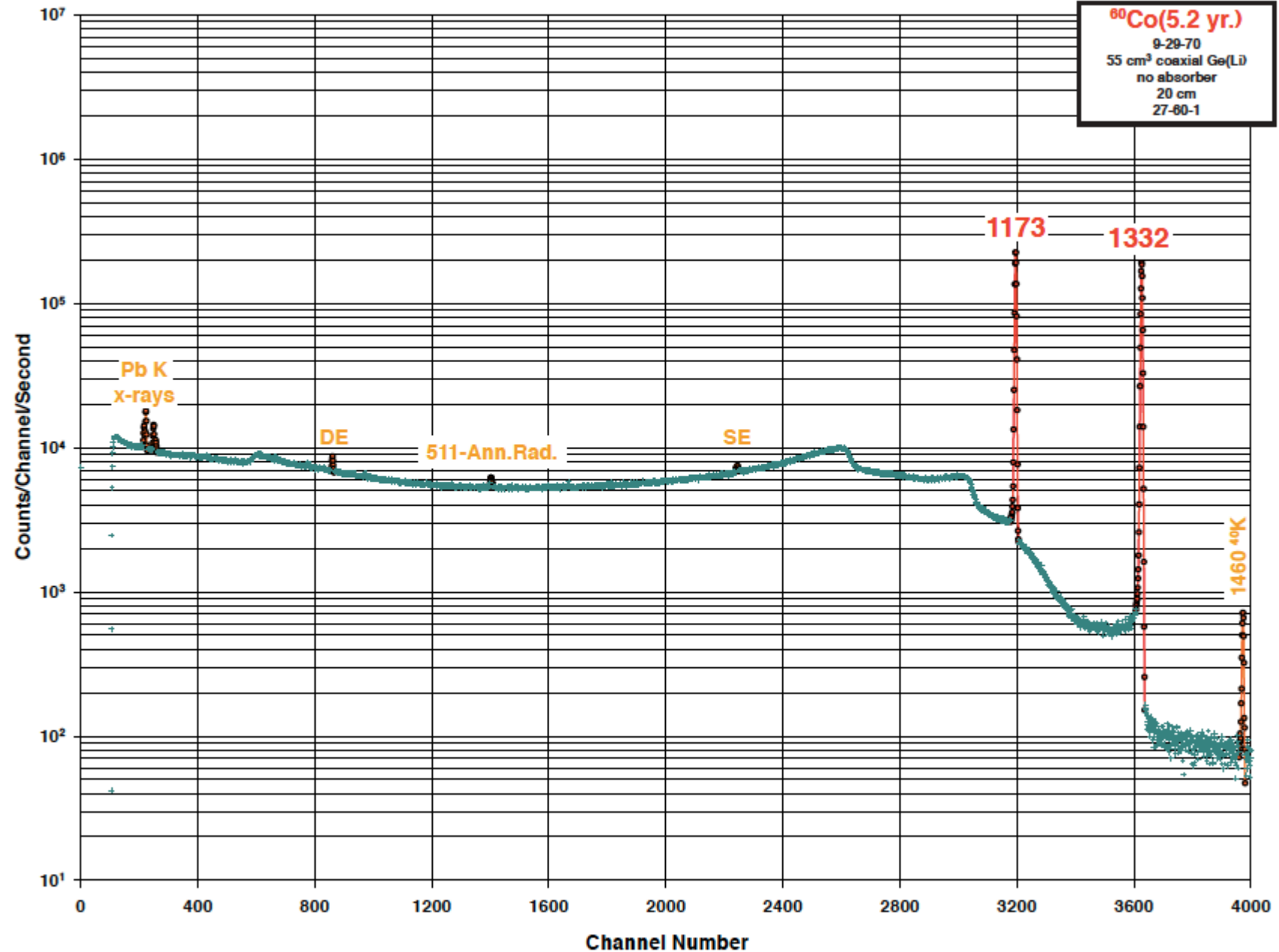
^{22}Na (2.6 yr.) Decay Scheme**GAMMA-RAY ENERGIES AND INTENSITIES**Nuclide: ^{22}Na

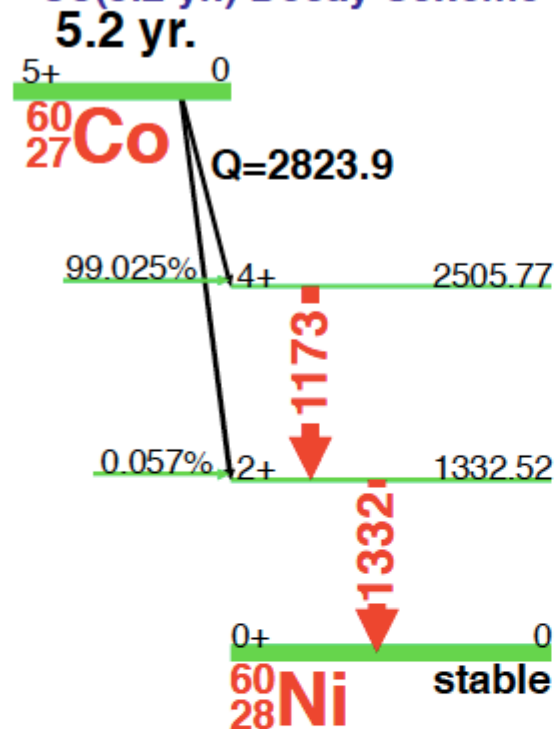
Half Life: 2.6019(4) yr.

Detector: 55 cm³ coaxial Ge (Li)Method of Production: Ne(³He,p)

| | E_γ (keV) | σE_γ | I_γ (rel) | I_γ (%) | σI_γ | S |
|------|------------------|-------------------|------------------|----------------|-------------------|---|
| Ann. | 511.006 | | 100 | 178.0 | 0.6 | 1 |
| | 1274.53 | 0.02 | 62.2 | 99.944 | 0.014 | 1 |

 E_γ , σE_γ , I_γ , σI_γ - 1998 ENSDF Data



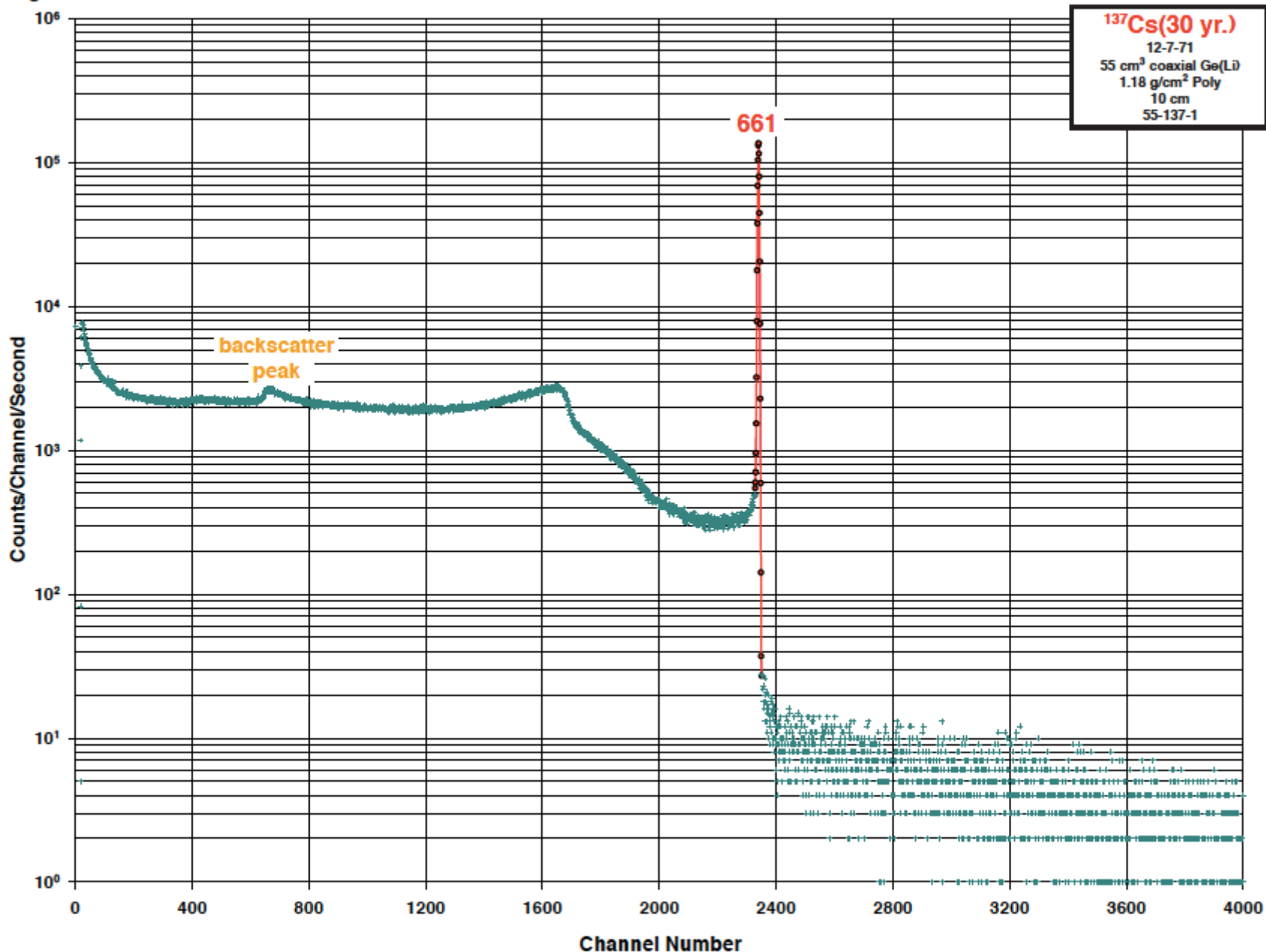
^{60}Co (5.2 yr.) Decay Scheme**GAMMA-RAY ENERGIES AND INTENSITIES**Nuclide: ^{60}Co

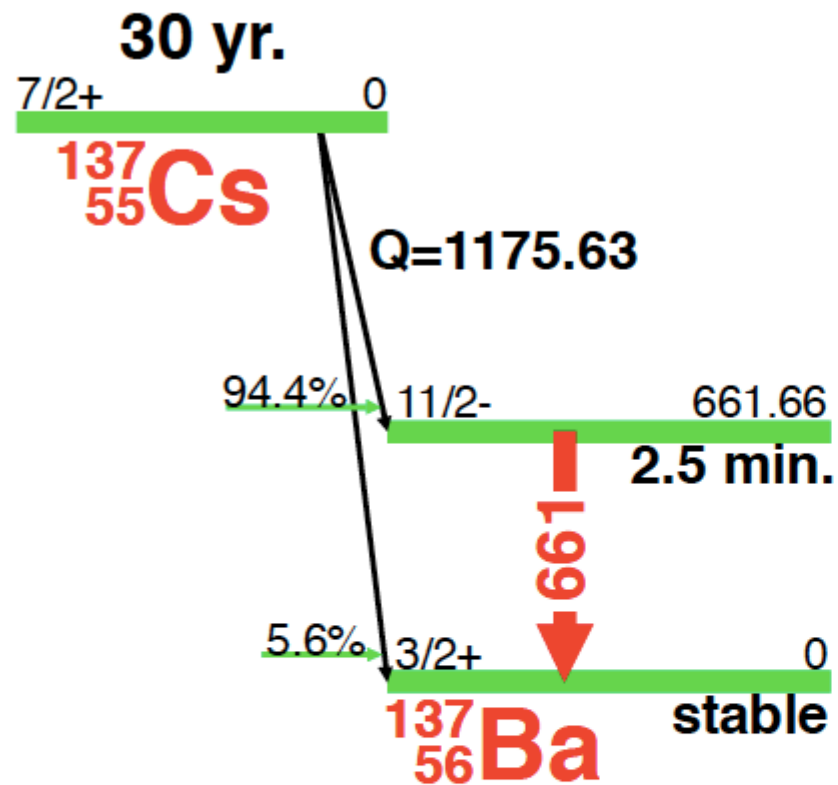
Half Life: 5.2714(5) yr.

Detector: 55 cm³ coaxial Ge (Li)Method of Production: $^{59}\text{Co}(n,\gamma)$

| E_γ (keV) | σE_γ | I_γ (rel) | I_γ (%) | σI_γ | S |
|------------------|-------------------|------------------|----------------|-------------------|---|
| 346.93 | 0.07 | | 0.0076 | 0.0005 | 4 |
| 826.28 | 0.09 | | 0.0076 | 0.0008 | 4 |
| 1173.237 | 0.004 | 100 | 99.9736 | 0.0007 | 1 |
| 1332.501 | 0.005 | 100 | 99.9856 | 0.0004 | 1 |
| 2158.77 | 0.09 | | 0.0011 | 0.0002 | 4 |
| 2505. | | | | | 4 |

 E_γ , σE_γ , I_γ , σI_γ - 1998 ENSDF Data



¹³⁷Cs(30 yr.) Decay Scheme

GAMMA-RAY ENERGIES AND INTENSITIES

Nuclide: ¹³⁷Cs

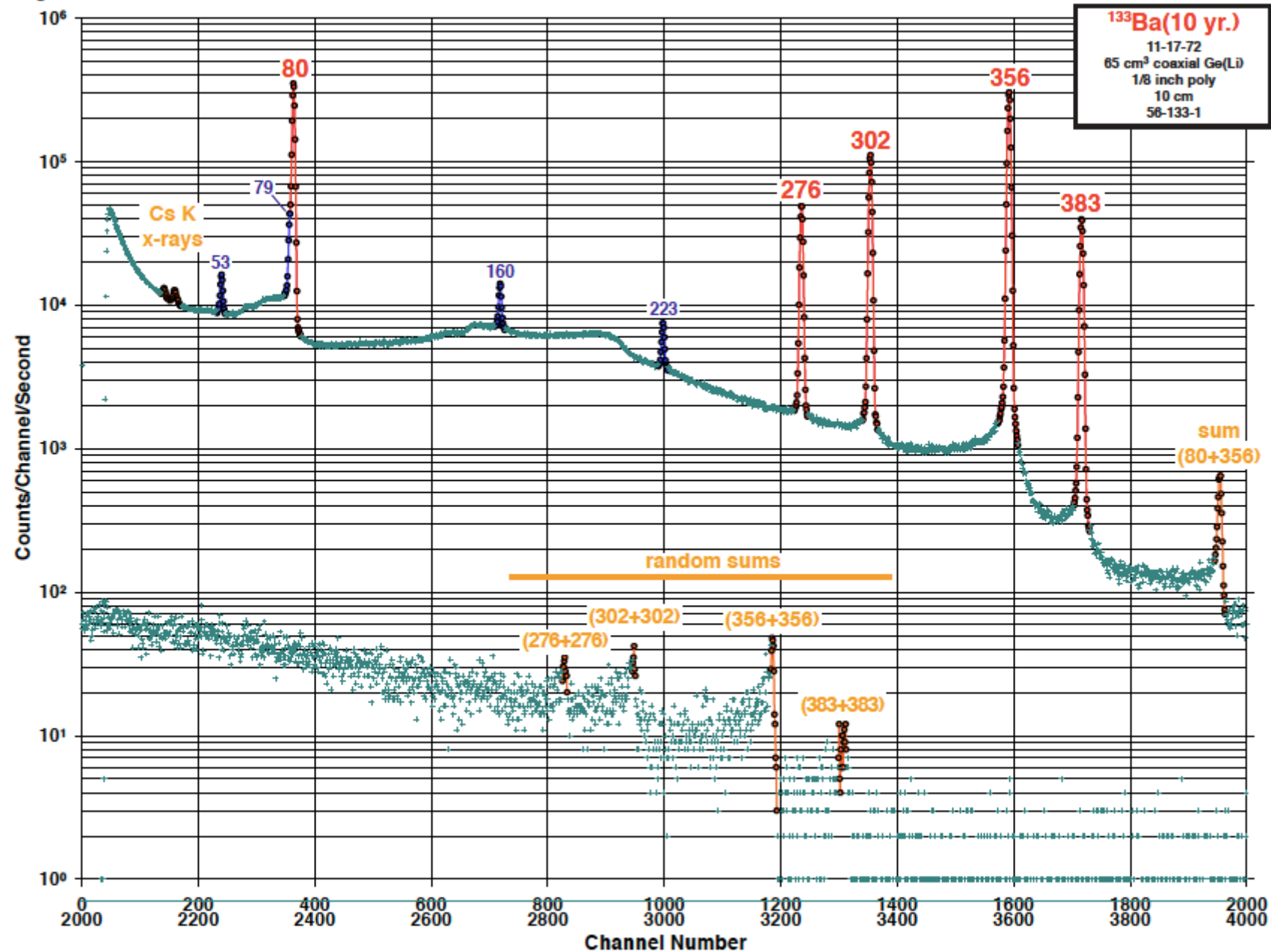
Half Life: 30.07(3) yr.

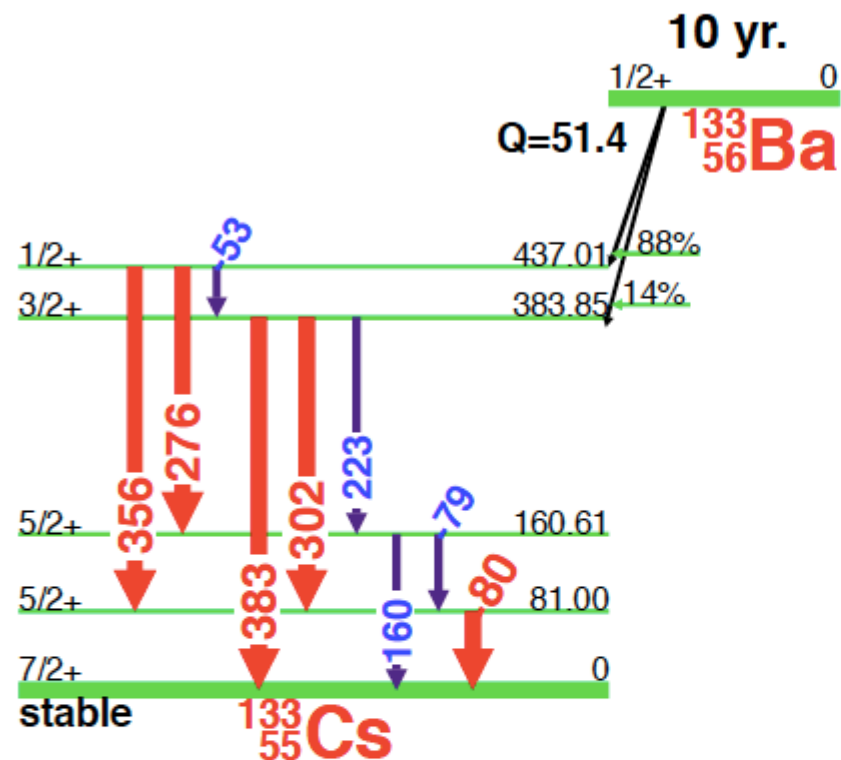
Detector: 55 cm³ coaxial Ge (Li)

Method of Production: U(n,f) chem.

| E_γ (keV) | σE_γ | I_γ (rel) | I_γ (%) | σI_γ | S |
|------------------|-------------------|------------------|----------------|-------------------|---|
| 283.5 | 0.1 | | 0.0006 | 0.0001 | 4 |
| 661.657 | 0.003 | 100 | 85.1 | 0.2 | 1 |

 E_γ , σE_γ , I_γ , σI_γ - 1998 ENSDF Data



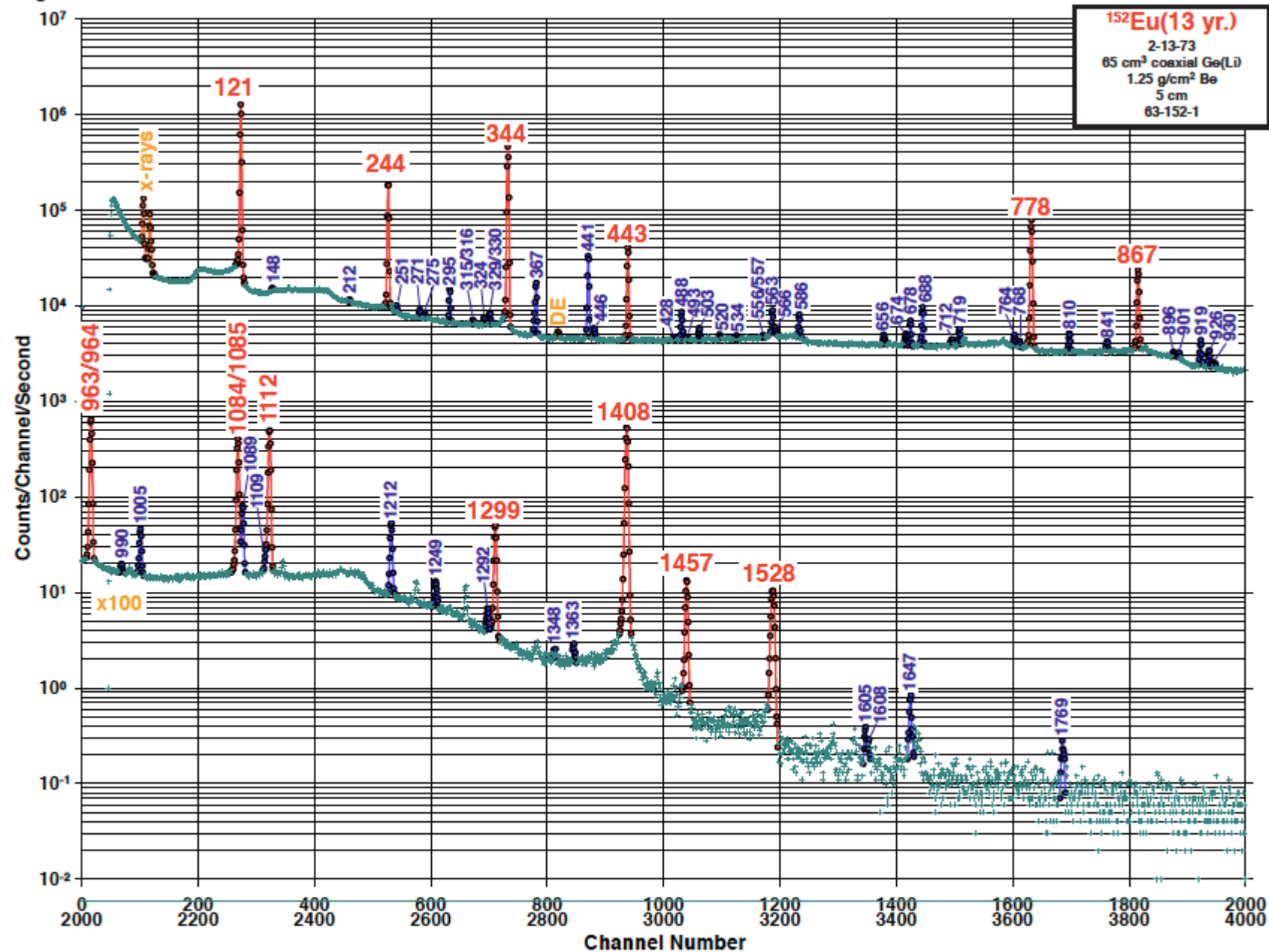
^{133}Ba (10 yr.) Decay Scheme**GAMMA-RAY ENERGIES AND INTENSITIES**Nuclide: ^{133}Ba

Half Life: 10.51(5) yr.

Detector: 65 cm³ coaxial Ge (Li)Method of Production: $^{132}\text{Ba}(n,\gamma)$

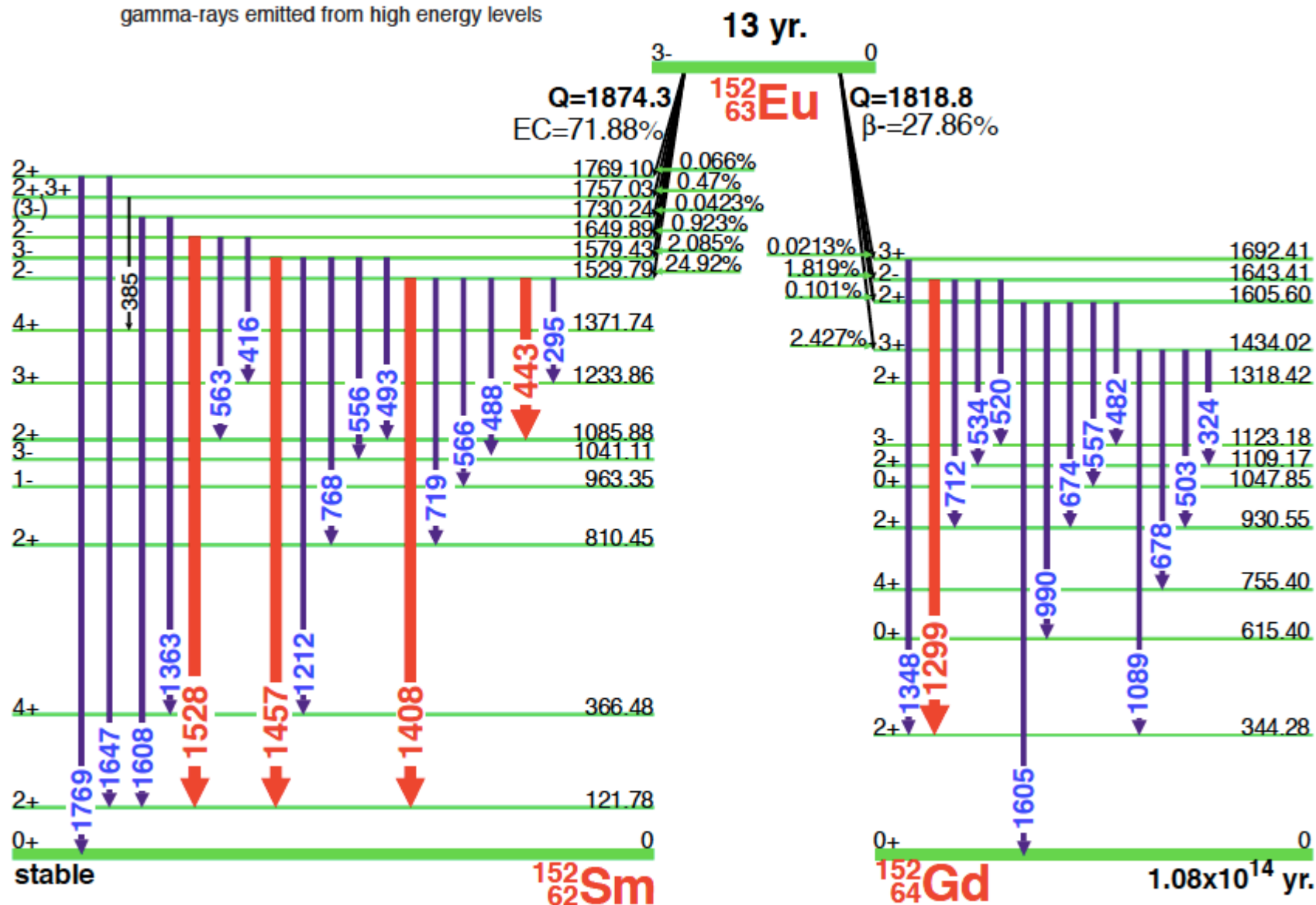
| E_γ (keV) | σE_γ | I_γ (rel) | I_γ (%) | σI_γ | S |
|------------------|-------------------|------------------|----------------|-------------------|---|
| 53.162 | 0.001 | 3.0 | 2.199 | 0.022 | 3 |
| 79.614 | 0.001 | 5.6 | 2.62 | 0.06 | 3 |
| 80.997 | 0.001 | 52.0 | 34.06 | 0.27 | 1 |
| 160.611 | 0.002 | 1.12 | 0.645 | 0.008 | 3 |
| 223.237 | 0.001 | 0.85 | 0.45 | 0.004 | 3 |
| 276.400 | 0.001 | 11.69 | 7.164 | 0.022 | 1 |
| 302.851 | 0.001 | 29.78 | 18.33 | 0.06 | 1 |
| 356.013 | 0.001 | 100. | 62.05 | 0.19 | 1 |
| 383.848 | 0.001 | 14.43 | 8.94 | 0.03 | 1 |

 E_γ , σE_γ , I_γ , σI_γ - 1998 ENSDF Data



^{152}Eu (13 yr.) Decay Scheme

gamma-rays emitted from high energy levels



^{152}Eu (13 yr.) Decay Scheme

gamma-rays emitted from low energy levels

