## Muons in aluminum (Al)

| Z | $A$ [g/mol] | $\rho$ [g/cm$^3$] | $I$ [eV] | $a$ | $k = m_s$ | $x_0$ | $x_1$ | $\overline{C}$ | $\delta_0$ |
|---|---|---|---|---|---|---|---|---|---|
| 13 (Al) | 26.9815385(7) | 2.699 | 166.0 | 0.08024 | 3.6345 | 0.1708 | 3.0127 | 4.2395 | 0.12 |

| $T$ | $p$ [MeV/$c$] | Ionization | Brems | Pair prod | Photonucl | Total | CSDA range [g/cm$^2$] |
|---|---|---|---|---|---|---|---|
| | | [MeV cm$^2$/g] | | | | | |
| 10.0 MeV | $4.704 \times 10^1$ | 6.188 | | | | 6.188 | $9.023 \times 10^{-1}$ |
| 14.0 MeV | $5.616 \times 10^1$ | 4.849 | | | | 4.849 | $1.640 \times 10^0$ |
| 20.0 MeV | $6.802 \times 10^1$ | 3.802 | | | | 3.802 | $3.053 \times 10^0$ |
| 30.0 MeV | $8.509 \times 10^1$ | 2.960 | | | | 2.961 | $6.075 \times 10^0$ |
| 40.0 MeV | $1.003 \times 10^2$ | 2.533 | | | | 2.533 | $9.750 \times 10^0$ |
| 80.0 MeV | $1.527 \times 10^2$ | 1.908 | | | | 1.908 | $2.851 \times 10^1$ |
| 100. MeV | $1.764 \times 10^2$ | 1.797 | | | | 1.798 | $3.934 \times 10^1$ |
| 140. MeV | $2.218 \times 10^2$ | 1.688 | | | | 1.688 | $6.241 \times 10^1$ |
| 200. MeV | $2.868 \times 10^2$ | 1.629 | | | | 1.630 | $9.871 \times 10^1$ |
| 277. MeV | $3.683 \times 10^2$ | 1.615 | | | 0.000 | 1.615 | *Minimum ionization* |
| 300. MeV | $3.917 \times 10^2$ | 1.616 | | | 0.000 | 1.616 | $1.605 \times 10^2$ |
| 400. MeV | $4.945 \times 10^2$ | 1.630 | | | 0.000 | 1.630 | $2.222 \times 10^2$ |
| 800. MeV | $8.995 \times 10^2$ | 1.710 | 0.000 | | 0.000 | 1.711 | $4.616 \times 10^2$ |
| 1.00 GeV | $1.101 \times 10^3$ | 1.744 | 0.000 | | 0.000 | 1.745 | $5.773 \times 10^2$ |
| 1.40 GeV | $1.502 \times 10^3$ | 1.797 | 0.001 | 0.000 | 0.001 | 1.799 | $8.029 \times 10^2$ |
| 2.00 GeV | $2.103 \times 10^3$ | 1.855 | 0.001 | 0.000 | 0.001 | 1.858 | $1.131 \times 10^3$ |
| 3.00 GeV | $3.104 \times 10^3$ | 1.920 | 0.002 | 0.001 | 0.001 | 1.925 | $1.659 \times 10^3$ |
| 4.00 GeV | $4.104 \times 10^3$ | 1.965 | 0.002 | 0.002 | 0.002 | 1.971 | $2.172 \times 10^3$ |
| 8.00 GeV | $8.105 \times 10^3$ | 2.067 | 0.006 | 0.006 | 0.004 | 2.082 | $4.140 \times 10^3$ |
| 10.0 GeV | $1.011 \times 10^4$ | 2.097 | 0.008 | 0.008 | 0.005 | 2.117 | $5.092 \times 10^3$ |
| 14.0 GeV | $1.411 \times 10^4$ | 2.141 | 0.012 | 0.013 | 0.006 | 2.172 | $6.956 \times 10^3$ |
| 20.0 GeV | $2.011 \times 10^4$ | 2.185 | 0.018 | 0.021 | 0.009 | 2.233 | $9.678 \times 10^3$ |
| 30.0 GeV | $3.011 \times 10^4$ | 2.233 | 0.030 | 0.036 | 0.013 | 2.312 | $1.408 \times 10^4$ |
| 40.0 GeV | $4.011 \times 10^4$ | 2.265 | 0.042 | 0.053 | 0.017 | 2.377 | $1.834 \times 10^4$ |
| 80.0 GeV | $8.011 \times 10^4$ | 2.338 | 0.095 | 0.129 | 0.033 | 2.594 | $3.442 \times 10^4$ |
| 100. GeV | $1.001 \times 10^5$ | 2.360 | 0.123 | 0.169 | 0.040 | 2.693 | $4.199 \times 10^4$ |
| 140. GeV | $1.401 \times 10^5$ | 2.394 | 0.181 | 0.253 | 0.056 | 2.884 | $5.634 \times 10^4$ |
| 200. GeV | $2.001 \times 10^5$ | 2.429 | 0.272 | 0.385 | 0.080 | 3.166 | $7.618 \times 10^4$ |
| 300. GeV | $3.001 \times 10^5$ | 2.469 | 0.427 | 0.610 | 0.120 | 3.627 | $1.057 \times 10^5$ |
| 400. GeV | $4.001 \times 10^5$ | 2.498 | 0.588 | 0.845 | 0.160 | 4.091 | $1.316 \times 10^5$ |
| 612. GeV | $6.124 \times 10^5$ | 2.540 | 0.940 | 1.355 | 0.245 | 5.080 | *Muon critical energy* |
| 800. GeV | $8.001 \times 10^5$ | 2.567 | 1.257 | 1.813 | 0.323 | 5.960 | $2.122 \times 10^5$ |
| 1.00 TeV | $1.000 \times 10^6$ | 2.589 | 1.602 | 2.312 | 0.405 | 6.909 | $2.433 \times 10^5$ |
| 1.40 TeV | $1.400 \times 10^6$ | 2.623 | 2.295 | 3.304 | 0.575 | 8.797 | $2.945 \times 10^5$ |
| 2.00 TeV | $2.000 \times 10^6$ | 2.660 | 3.357 | 4.823 | 0.832 | 11.672 | $3.535 \times 10^5$ |
| 3.00 TeV | $3.000 \times 10^6$ | 2.702 | 5.135 | 7.347 | 1.274 | 16.458 | $4.254 \times 10^5$ |
| 4.00 TeV | $4.000 \times 10^6$ | 2.732 | 6.941 | 9.902 | 1.723 | 21.299 | $4.786 \times 10^5$ |
| 8.00 TeV | $8.000 \times 10^6$ | 2.807 | 14.238 | 20.187 | 3.590 | 40.823 | $6.120 \times 10^5$ |
| 10.0 TeV | $1.000 \times 10^7$ | 2.832 | 17.923 | 25.362 | 4.551 | 50.668 | $6.559 \times 10^5$ |
| 14.0 TeV | $1.400 \times 10^7$ | 2.869 | 25.280 | 35.679 | 6.528 | 70.356 | $7.226 \times 10^5$ |
| 20.0 TeV | $2.000 \times 10^7$ | 2.910 | 36.398 | 51.230 | 9.562 | 100.100 | $7.937 \times 10^5$ |
| 30.0 TeV | $3.000 \times 10^7$ | 2.956 | 54.885 | 77.116 | 14.821 | 149.779 | $8.749 \times 10^5$ |
| 40.0 TeV | $4.000 \times 10^7$ | 2.990 | 73.453 | 103.077 | 20.213 | 199.734 | $9.325 \times 10^5$ |
| 80.0 TeV | $8.000 \times 10^7$ | 3.073 | 147.903 | 207.008 | 42.793 | 400.778 | $1.071 \times 10^6$ |
| 100. TeV | $1.000 \times 10^8$ | 3.100 | 185.220 | 259.030 | 54.480 | 501.831 | $1.116 \times 10^6$ |