## Table 041: Muons in Niobium

| Z | $A$ [g/mol] | $\rho$ [g/cm$^3$] | $I$ [eV] | $a$ | $k = m_s$ | $x_0$ | $x_1$ | $\overline{C}$ | $\delta_0$ |
|---|---|---|---|---|---|---|---|---|---|
| 41 (Nb) | 92.90638 (2) | 8.570 | 417.0 | 0.13883 | 3.0930 | 0.1785 | 3.2201 | 5.0141 | 0.14 |

| $T$ | $p$ [MeV/$c$] | Ionization | Brems | Pair prod | Photonucl | Total | CSDA range [g/cm$^2$] |
|---|---|---|---|---|---|---|---|
| | | [MeV cm$^2$/g] | | | | | |
| 10.0 MeV | $4.704 \times 10^1$ | 4.890 | | | | 4.890 | $1.161 \times 10^0$ |
| 14.0 MeV | $5.616 \times 10^1$ | 3.861 | | | | 3.861 | $2.091 \times 10^0$ |
| 20.0 MeV | $6.802 \times 10^1$ | 3.049 | | | | 3.049 | $3.858 \times 10^0$ |
| 30.0 MeV | $8.509 \times 10^1$ | 2.390 | | | | 2.390 | $7.612 \times 10^0$ |
| 40.0 MeV | $1.003 \times 10^2$ | 2.054 | | | | 2.054 | $1.215 \times 10^1$ |
| 80.0 MeV | $1.527 \times 10^2$ | 1.561 | | | | 1.561 | $3.517 \times 10^1$ |
| 100. MeV | $1.764 \times 10^2$ | 1.474 | | | | 1.474 | $4.839 \times 10^1$ |
| 140. MeV | $2.218 \times 10^2$ | 1.390 | | | | 1.390 | $7.645 \times 10^1$ |
| 200. MeV | $2.868 \times 10^2$ | 1.349 | | | | 1.349 | $1.204 \times 10^2$ |
| 253. MeV | $3.431 \times 10^2$ | 1.343 | | | | 1.343 | *Minimum ionization* |
| 300. MeV | $3.917 \times 10^2$ | 1.346 | 0.000 | | 0.000 | 1.347 | $1.948 \times 10^2$ |
| 400. MeV | $4.945 \times 10^2$ | 1.364 | 0.000 | | 0.000 | 1.365 | $2.686 \times 10^2$ |
| 800. MeV | $8.995 \times 10^2$ | 1.449 | 0.001 | | 0.000 | 1.450 | $5.526 \times 10^2$ |
| 1.00 GeV | $1.101 \times 10^3$ | 1.482 | 0.001 | | 0.000 | 1.484 | $6.890 \times 10^2$ |
| 1.40 GeV | $1.502 \times 10^3$ | 1.536 | 0.001 | 0.000 | 0.001 | 1.539 | $9.534 \times 10^2$ |
| 2.00 GeV | $2.103 \times 10^3$ | 1.594 | 0.002 | 0.001 | 0.001 | 1.599 | $1.336 \times 10^3$ |
| 3.00 GeV | $3.104 \times 10^3$ | 1.660 | 0.004 | 0.003 | 0.001 | 1.668 | $1.947 \times 10^3$ |
| 4.00 GeV | $4.104 \times 10^3$ | 1.704 | 0.006 | 0.005 | 0.002 | 1.717 | $2.537 \times 10^3$ |
| 8.00 GeV | $8.105 \times 10^3$ | 1.806 | 0.015 | 0.015 | 0.003 | 1.839 | $4.779 \times 10^3$ |
| 10.0 GeV | $1.011 \times 10^4$ | 1.836 | 0.020 | 0.021 | 0.004 | 1.881 | $5.854 \times 10^3$ |
| 14.0 GeV | $1.411 \times 10^4$ | 1.880 | 0.030 | 0.033 | 0.006 | 1.950 | $7.941 \times 10^3$ |
| 20.0 GeV | $2.011 \times 10^4$ | 1.923 | 0.047 | 0.055 | 0.008 | 2.033 | $1.095 \times 10^4$ |
| 30.0 GeV | $3.011 \times 10^4$ | 1.969 | 0.077 | 0.095 | 0.012 | 2.153 | $1.573 \times 10^4$ |
| 40.0 GeV | $4.011 \times 10^4$ | 2.000 | 0.108 | 0.139 | 0.015 | 2.263 | $2.026 \times 10^4$ |
| 80.0 GeV | $8.011 \times 10^4$ | 2.068 | 0.245 | 0.332 | 0.030 | 2.676 | $3.648 \times 10^4$ |
| 100. GeV | $1.001 \times 10^5$ | 2.089 | 0.317 | 0.437 | 0.037 | 2.881 | $4.368 \times 10^4$ |
| 140. GeV | $1.401 \times 10^5$ | 2.120 | 0.466 | 0.652 | 0.051 | 3.291 | $5.667 \times 10^4$ |
| 200. GeV | $2.001 \times 10^5$ | 2.153 | 0.699 | 0.992 | 0.073 | 3.918 | $7.336 \times 10^4$ |
| 241. GeV | $2.410 \times 10^5$ | 2.170 | 0.859 | 1.222 | 0.088 | 4.340 | *Muon critical energy* |
| 300. GeV | $3.001 \times 10^5$ | 2.189 | 1.096 | 1.562 | 0.110 | 4.958 | $9.601 \times 10^4$ |
| 400. GeV | $4.001 \times 10^5$ | 2.215 | 1.507 | 2.153 | 0.146 | 6.022 | $1.143 \times 10^5$ |
| 800. GeV | $8.001 \times 10^5$ | 2.278 | 3.205 | 4.576 | 0.295 | 10.356 | $1.644 \times 10^5$ |
| 1.00 TeV | $1.000 \times 10^6$ | 2.299 | 4.078 | 5.816 | 0.371 | 12.565 | $1.819 \times 10^5$ |
| 1.40 TeV | $1.400 \times 10^6$ | 2.330 | 5.828 | 8.290 | 0.526 | 16.975 | $2.092 \times 10^5$ |
| 2.00 TeV | $2.000 \times 10^6$ | 2.364 | 8.507 | 12.066 | 0.761 | 23.698 | $2.390 \times 10^5$ |
| 3.00 TeV | $3.000 \times 10^6$ | 2.403 | 12.980 | 18.342 | 1.163 | 34.889 | $2.735 \times 10^5$ |
| 4.00 TeV | $4.000 \times 10^6$ | 2.430 | 17.514 | 24.686 | 1.572 | 46.204 | $2.984 \times 10^5$ |
| 8.00 TeV | $8.000 \times 10^6$ | 2.499 | 35.802 | 50.193 | 3.268 | 91.764 | $3.586 \times 10^5$ |
| 10.0 TeV | $1.000 \times 10^7$ | 2.521 | 45.021 | 63.016 | 4.140 | 114.700 | $3.781 \times 10^5$ |
| 14.0 TeV | $1.400 \times 10^7$ | 2.556 | 63.409 | 88.600 | 5.929 | 160.495 | $4.074 \times 10^5$ |
| 20.0 TeV | $2.000 \times 10^7$ | 2.593 | 91.160 | 127.144 | 8.670 | 229.568 | $4.385 \times 10^5$ |
| 30.0 TeV | $3.000 \times 10^7$ | 2.635 | 137.359 | 191.276 | 13.410 | 344.681 | $4.738 \times 10^5$ |
| 40.0 TeV | $4.000 \times 10^7$ | 2.666 | 183.730 | 255.565 | 18.263 | 460.225 | $4.988 \times 10^5$ |
| 80.0 TeV | $8.000 \times 10^7$ | 2.742 | 369.518 | 512.907 | 38.530 | 923.699 | $5.590 \times 10^5$ |
| 100. TeV | $1.000 \times 10^8$ | 2.767 | 462.580 | 641.700 | 49.000 | 1156.049 | $5.783 \times 10^5$ |