## Table 325: Muons in Water (ice) ($H_2O$)

| $\langle Z/A \rangle$ | $\rho$ [g/cm$^3$] | $I$ [eV] | $a$ | $k = m_s$ | $x_0$ | $x_1$ | $\overline{C}$ | $\delta_0$ |
|---|---|---|---|---|---|---|---|---|
| 0.55509 | 0.918 | 75.0 | 0.09116 | 3.4773 | 0.2586 | 2.8190 | 3.5873 | 0.00 |

| $T$ | $p$ [MeV/$c$] | Ionization | Brems | Pair prod | Photonucl | Total | CSDA range [g/cm$^2$] |
|---|---|---|---|---|---|---|---|
| | | [MeV cm$^2$/g] | | | | | |
| 10.0 MeV | $4.704 \times 10^1$ | 7.965 | | | | 7.965 | $6.939 \times 10^{-1}$ |
| 14.0 MeV | $5.616 \times 10^1$ | 6.213 | | | | 6.213 | $1.269 \times 10^0$ |
| 20.0 MeV | $6.802 \times 10^1$ | 4.852 | | | | 4.852 | $2.374 \times 10^0$ |
| 30.0 MeV | $8.509 \times 10^1$ | 3.764 | | | | 3.764 | $4.747 \times 10^0$ |
| 40.0 MeV | $1.003 \times 10^2$ | 3.214 | | | | 3.214 | $7.640 \times 10^0$ |
| 80.0 MeV | $1.527 \times 10^2$ | 2.413 | | | | 2.413 | $2.246 \times 10^1$ |
| 100. MeV | $1.764 \times 10^2$ | 2.270 | | | | 2.270 | $3.103 \times 10^1$ |
| 140. MeV | $2.218 \times 10^2$ | 2.119 | | | | 2.119 | $4.934 \times 10^1$ |
| 200. MeV | $2.868 \times 10^2$ | 2.030 | | | | 2.030 | $7.838 \times 10^1$ |
| 300. MeV | $3.917 \times 10^2$ | 1.996 | | | 0.000 | 1.996 | $1.282 \times 10^2$ |
| 317. MeV | $4.096 \times 10^2$ | 1.996 | | | 0.000 | 1.996 | *Minimum ionization* |
| 400. MeV | $4.945 \times 10^2$ | 2.002 | | | 0.000 | 2.003 | $1.783 \times 10^2$ |
| 800. MeV | $8.995 \times 10^2$ | 2.079 | 0.000 | | 0.000 | 2.080 | $3.743 \times 10^2$ |
| 1.00 GeV | $1.101 \times 10^3$ | 2.114 | 0.000 | | 0.000 | 2.115 | $4.697 \times 10^2$ |
| 1.40 GeV | $1.502 \times 10^3$ | 2.170 | 0.000 | | 0.001 | 2.172 | $6.562 \times 10^2$ |
| 2.00 GeV | $2.103 \times 10^3$ | 2.233 | 0.001 | 0.000 | 0.001 | 2.235 | $9.284 \times 10^2$ |
| 3.00 GeV | $3.104 \times 10^3$ | 2.303 | 0.001 | 0.001 | 0.001 | 2.307 | $1.368 \times 10^3$ |
| 4.00 GeV | $4.104 \times 10^3$ | 2.353 | 0.001 | 0.001 | 0.002 | 2.357 | $1.797 \times 10^3$ |
| 8.00 GeV | $8.105 \times 10^3$ | 2.465 | 0.004 | 0.003 | 0.004 | 2.476 | $3.447 \times 10^3$ |
| 10.0 GeV | $1.011 \times 10^4$ | 2.499 | 0.005 | 0.005 | 0.005 | 2.514 | $4.249 \times 10^3$ |
| 14.0 GeV | $1.411 \times 10^4$ | 2.549 | 0.007 | 0.008 | 0.007 | 2.571 | $5.821 \times 10^3$ |
| 20.0 GeV | $2.011 \times 10^4$ | 2.599 | 0.011 | 0.013 | 0.009 | 2.633 | $8.126 \times 10^3$ |
| 30.0 GeV | $3.011 \times 10^4$ | 2.653 | 0.019 | 0.023 | 0.013 | 2.708 | $1.187 \times 10^4$ |
| 40.0 GeV | $4.011 \times 10^4$ | 2.689 | 0.027 | 0.034 | 0.018 | 2.767 | $1.552 \times 10^4$ |
| 80.0 GeV | $8.011 \times 10^4$ | 2.773 | 0.060 | 0.081 | 0.034 | 2.949 | $2.950 \times 10^4$ |
| 100. GeV | $1.001 \times 10^5$ | 2.799 | 0.078 | 0.107 | 0.042 | 3.027 | $3.619 \times 10^4$ |
| 140. GeV | $1.401 \times 10^5$ | 2.838 | 0.116 | 0.161 | 0.059 | 3.173 | $4.909 \times 10^4$ |
| 200. GeV | $2.001 \times 10^5$ | 2.879 | 0.174 | 0.246 | 0.084 | 3.383 | $6.740 \times 10^4$ |
| 300. GeV | $3.001 \times 10^5$ | 2.925 | 0.275 | 0.391 | 0.125 | 3.716 | $9.559 \times 10^4$ |
| 400. GeV | $4.001 \times 10^5$ | 2.957 | 0.379 | 0.542 | 0.167 | 4.046 | $1.214 \times 10^5$ |
| 800. GeV | $8.001 \times 10^5$ | 3.037 | 0.814 | 1.171 | 0.337 | 5.359 | $2.070 \times 10^5$ |
| 1.00 TeV | $1.000 \times 10^6$ | 3.063 | 1.038 | 1.496 | 0.423 | 6.020 | $2.422 \times 10^5$ |
| 1.03 TeV | $1.035 \times 10^6$ | 3.067 | 1.077 | 1.551 | 0.439 | 6.134 | *Muon critical energy* |
| 1.40 TeV | $1.400 \times 10^6$ | 3.102 | 1.491 | 2.142 | 0.601 | 7.335 | $3.023 \times 10^5$ |
| 2.00 TeV | $2.000 \times 10^6$ | 3.144 | 2.186 | 3.132 | 0.870 | 9.332 | $3.747 \times 10^5$ |
| 3.00 TeV | $3.000 \times 10^6$ | 3.193 | 3.352 | 4.781 | 1.332 | 12.658 | $4.663 \times 10^5$ |
| 4.00 TeV | $4.000 \times 10^6$ | 3.228 | 4.537 | 6.452 | 1.803 | 16.021 | $5.364 \times 10^5$ |
| 8.00 TeV | $8.000 \times 10^6$ | 3.314 | 9.338 | 13.185 | 3.763 | 29.601 | $7.173 \times 10^5$ |
| 10.0 TeV | $1.000 \times 10^7$ | 3.342 | 11.766 | 16.575 | 4.773 | 36.457 | $7.781 \times 10^5$ |
| 14.0 TeV | $1.400 \times 10^7$ | 3.385 | 16.613 | 23.331 | 6.854 | 50.183 | $8.712 \times 10^5$ |
| 20.0 TeV | $2.000 \times 10^7$ | 3.432 | 23.944 | 33.521 | 10.051 | 70.948 | $9.713 \times 10^5$ |
| 30.0 TeV | $3.000 \times 10^7$ | 3.486 | 36.151 | 50.475 | 15.600 | 105.713 | $1.086 \times 10^6$ |
| 40.0 TeV | $4.000 \times 10^7$ | 3.525 | 48.424 | 67.484 | 21.296 | 140.729 | $1.168 \times 10^6$ |
| 80.0 TeV | $8.000 \times 10^7$ | 3.620 | 97.657 | 135.575 | 45.199 | 282.053 | $1.365 \times 10^6$ |
| 100. TeV | $1.000 \times 10^8$ | 3.652 | 122.347 | 169.661 | 57.590 | 353.250 | $1.428 \times 10^6$ |