

**Table 276: Muons in Water (liquid) (H<sub>2</sub>O)**

|          | $\langle Z/A \rangle$ | $\rho$ [g/cm <sup>3</sup> ] | $I$ [eV] | $a$                      | $k = m_s$ | $x_0$   | $x_1$                              | $\bar{C}$ | $\delta_0$                  |
|----------|-----------------------|-----------------------------|----------|--------------------------|-----------|---------|------------------------------------|-----------|-----------------------------|
|          | 0.55509               | 1.000                       | 75.0     | 0.09116                  | 3.4773    | 0.2400  | 2.8004                             | 3.5017    | 0.00                        |
| $T$      | $p$<br>[MeV/c]        | Ionization                  | Brems    | Pair prod                | Photonucl | Total   | CSDA range<br>[g/cm <sup>2</sup> ] |           |                             |
|          |                       |                             |          | [MeV cm <sup>2</sup> /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 | $2.218 \times 10^2$   | 2.116                       |          |                          |           | 2.116   |                                    |           | $4.936 \times 10^1$         |
| 200. MeV | $2.868 \times 10^2$   | 2.026                       |          |                          |           | 2.026   |                                    |           | $7.844 \times 10^1$         |
| 300. MeV | $3.917 \times 10^2$   | 1.992                       |          |                          | 0.000     | 1.992   |                                    |           | $1.284 \times 10^2$         |
| 318. MeV | $4.105 \times 10^2$   | 1.992                       |          |                          | 0.000     | 1.992   |                                    |           | <i>Minimum ionization</i>   |
| 400. MeV | $4.945 \times 10^2$   | 1.998                       |          |                          | 0.000     | 1.999   |                                    |           | $1.785 \times 10^2$         |
| 800. MeV | $8.995 \times 10^2$   | 2.074                       | 0.000    |                          | 0.000     | 2.075   |                                    |           | $3.750 \times 10^2$         |
| 1.00 GeV | $1.101 \times 10^3$   | 2.109                       | 0.000    |                          | 0.000     | 2.109   |                                    |           | $4.706 \times 10^2$         |
| 1.40 GeV | $1.502 \times 10^3$   | 2.165                       | 0.000    |                          | 0.001     | 2.166   |                                    |           | $6.576 \times 10^2$         |
| 2.00 GeV | $2.103 \times 10^3$   | 2.227                       | 0.001    | 0.000                    | 0.001     | 2.229   |                                    |           | $9.305 \times 10^2$         |
| 3.00 GeV | $3.104 \times 10^3$   | 2.297                       | 0.001    | 0.001                    | 0.001     | 2.300   |                                    |           | $1.372 \times 10^3$         |
| 4.00 GeV | $4.104 \times 10^3$   | 2.346                       | 0.001    | 0.001                    | 0.002     | 2.351   |                                    |           | $1.801 \times 10^3$         |
| 8.00 GeV | $8.105 \times 10^3$   | 2.458                       | 0.004    | 0.003                    | 0.004     | 2.470   |                                    |           | $3.456 \times 10^3$         |
| 10.0 GeV | $1.011 \times 10^4$   | 2.492                       | 0.005    | 0.005                    | 0.005     | 2.507   |                                    |           | $4.260 \times 10^3$         |
| 14.0 GeV | $1.411 \times 10^4$   | 2.542                       | 0.007    | 0.008                    | 0.007     | 2.564   |                                    |           | $5.837 \times 10^3$         |
| 20.0 GeV | $2.011 \times 10^4$   | 2.592                       | 0.011    | 0.013                    | 0.009     | 2.625   |                                    |           | $8.148 \times 10^3$         |
| 30.0 GeV | $3.011 \times 10^4$   | 2.645                       | 0.019    | 0.023                    | 0.013     | 2.701   |                                    |           | $1.190 \times 10^4$         |
| 40.0 GeV | $4.011 \times 10^4$   | 2.682                       | 0.027    | 0.034                    | 0.018     | 2.760   |                                    |           | $1.556 \times 10^4$         |
| 80.0 GeV | $8.011 \times 10^4$   | 2.766                       | 0.060    | 0.081                    | 0.034     | 2.942   |                                    |           | $2.958 \times 10^4$         |
| 100. GeV | $1.001 \times 10^5$   | 2.792                       | 0.078    | 0.107                    | 0.042     | 3.020   |                                    |           | $3.629 \times 10^4$         |
| 140. GeV | $1.401 \times 10^5$   | 2.831                       | 0.116    | 0.161                    | 0.059     | 3.166   |                                    |           | $4.922 \times 10^4$         |
| 200. GeV | $2.001 \times 10^5$   | 2.871                       | 0.174    | 0.246                    | 0.084     | 3.375   |                                    |           | $6.757 \times 10^4$         |
| 300. GeV | $3.001 \times 10^5$   | 2.917                       | 0.275    | 0.391                    | 0.125     | 3.709   |                                    |           | $9.581 \times 10^4$         |
| 400. GeV | $4.001 \times 10^5$   | 2.950                       | 0.379    | 0.542                    | 0.167     | 4.038   |                                    |           | $1.216 \times 10^5$         |
| 800. GeV | $8.001 \times 10^5$   | 3.030                       | 0.814    | 1.171                    | 0.337     | 5.351   |                                    |           | $2.074 \times 10^5$         |
| 1.00 TeV | $1.000 \times 10^6$   | 3.055                       | 1.038    | 1.496                    | 0.423     | 6.013   |                                    |           | $2.426 \times 10^5$         |
| 1.03 TeV | $1.032 \times 10^6$   | 3.059                       | 1.074    | 1.547                    | 0.438     | 6.118   |                                    |           | <i>Muon critical energy</i> |
| 1.40 TeV | $1.400 \times 10^6$   | 3.095                       | 1.491    | 2.142                    | 0.601     | 7.328   |                                    |           | $3.028 \times 10^5$         |
| 2.00 TeV | $2.000 \times 10^6$   | 3.137                       | 2.186    | 3.132                    | 0.870     | 9.325   |                                    |           | $3.752 \times 10^5$         |
| 3.00 TeV | $3.000 \times 10^6$   | 3.186                       | 3.352    | 4.781                    | 1.332     | 12.650  |                                    |           | $4.670 \times 10^5$         |
| 4.00 TeV | $4.000 \times 10^6$   | 3.221                       | 4.537    | 6.452                    | 1.803     | 16.013  |                                    |           | $5.371 \times 10^5$         |
| 8.00 TeV | $8.000 \times 10^6$   | 3.307                       | 9.338    | 13.185                   | 3.763     | 29.593  |                                    |           | $7.181 \times 10^5$         |
| 10.0 TeV | $1.000 \times 10^7$   | 3.335                       | 11.766   | 16.575                   | 4.773     | 36.450  |                                    |           | $7.789 \times 10^5$         |
| 14.0 TeV | $1.400 \times 10^7$   | 3.378                       | 16.613   | 23.331                   | 6.854     | 50.176  |                                    |           | $8.720 \times 10^5$         |
| 20.0 TeV | $2.000 \times 10^7$   | 3.425                       | 23.944   | 33.521                   | 10.051    | 70.941  |                                    |           | $9.721 \times 10^5$         |
| 30.0 TeV | $3.000 \times 10^7$   | 3.479                       | 36.151   | 50.475                   | 15.600    | 105.705 |                                    |           | $1.087 \times 10^6$         |
| 40.0 TeV | $4.000 \times 10^7$   | 3.517                       | 48.424   | 67.484                   | 21.296    | 140.722 |                                    |           | $1.169 \times 10^6$         |
| 80.0 TeV | $8.000 \times 10^7$   | 3.613                       | 97.657   | 135.575                  | 45.199    | 282.045 |                                    |           | $1.365 \times 10^6$         |
| 100. TeV | $1.000 \times 10^8$   | 3.645                       | 122.347  | 169.661                  | 57.590    | 353.242 |                                    |           | $1.429 \times 10^6$         |