

## Muons in deuterium gas (D<sub>2</sub>)

| Z        | A [g/mol]           | $\rho$ [g/cm <sup>3</sup> ] | I [eV] | $a$                                   | $k = m_s$ | $x_0$   | $x_1$                              | $\bar{C}$ | $\delta_0$ |
|----------|---------------------|-----------------------------|--------|---------------------------------------|-----------|---------|------------------------------------|-----------|------------|
| 1 (D)    | 2.014101764(13)     | $0.677 \times 10^{-4}$      | 19.2   | 0.14092                               | 5.7273    | 1.8793  | 3.2872                             | 9.6543    | 0.00       |
| $T$      | $p$<br>[MeV/c]      | Ionization                  | Brems  | Pair prod<br>[MeV cm <sup>2</sup> /g] | Photonucl | Total   | CSDA range<br>[g/cm <sup>2</sup> ] |           |            |
| 10.0 MeV | $4.704 \times 10^1$ | 8.379                       |        |                                       |           | 8.379   | $6.528 \times 10^{-1}$             |           |            |
| 14.0 MeV | $5.616 \times 10^1$ | 6.500                       |        |                                       |           | 6.500   | $1.201 \times 10^0$                |           |            |
| 20.0 MeV | $6.802 \times 10^1$ | 5.049                       |        |                                       |           | 5.049   | $2.261 \times 10^0$                |           |            |
| 30.0 MeV | $8.509 \times 10^1$ | 3.895                       |        |                                       |           | 3.895   | $4.548 \times 10^0$                |           |            |
| 40.0 MeV | $1.003 \times 10^2$ | 3.313                       |        |                                       |           | 3.313   | $7.350 \times 10^0$                |           |            |
| 80.0 MeV | $1.527 \times 10^2$ | 2.466                       |        |                                       |           | 2.466   | $2.180 \times 10^1$                |           |            |
| 100. MeV | $1.764 \times 10^2$ | 2.312                       |        |                                       |           | 2.312   | $3.020 \times 10^1$                |           |            |
| 140. MeV | $2.218 \times 10^2$ | 2.159                       |        |                                       |           | 2.159   | $4.819 \times 10^1$                |           |            |
| 200. MeV | $2.868 \times 10^2$ | 2.076                       |        |                                       | 0.000     | 2.076   | $7.663 \times 10^1$                |           |            |
| 284. MeV | $3.748 \times 10^2$ | 2.053                       |        |                                       | 0.000     | 2.054   | <i>Minimum ionization</i>          |           |            |
| 300. MeV | $3.917 \times 10^2$ | 2.054                       |        |                                       | 0.000     | 2.054   | $1.252 \times 10^2$                |           |            |
| 400. MeV | $4.945 \times 10^2$ | 2.072                       |        |                                       | 0.000     | 2.073   | $1.737 \times 10^2$                |           |            |
| 800. MeV | $8.995 \times 10^2$ | 2.188                       |        |                                       | 0.000     | 2.189   | $3.615 \times 10^2$                |           |            |
| 1.00 GeV | $1.101 \times 10^3$ | 2.239                       |        |                                       | 0.001     | 2.240   | $4.518 \times 10^2$                |           |            |
| 1.40 GeV | $1.502 \times 10^3$ | 2.323                       | 0.000  |                                       | 0.001     | 2.324   | $6.269 \times 10^2$                |           |            |
| 2.00 GeV | $2.103 \times 10^3$ | 2.418                       | 0.000  |                                       | 0.001     | 2.420   | $8.797 \times 10^2$                |           |            |
| 3.00 GeV | $3.104 \times 10^3$ | 2.530                       | 0.000  | 0.000                                 | 0.002     | 2.533   | $1.283 \times 10^3$                |           |            |
| 4.00 GeV | $4.104 \times 10^3$ | 2.611                       | 0.001  | 0.000                                 | 0.002     | 2.615   | $1.671 \times 10^3$                |           |            |
| 8.00 GeV | $8.105 \times 10^3$ | 2.806                       | 0.001  | 0.001                                 | 0.005     | 2.814   | $3.140 \times 10^3$                |           |            |
| 10.0 GeV | $1.011 \times 10^4$ | 2.860                       | 0.002  | 0.002                                 | 0.006     | 2.870   | $3.843 \times 10^3$                |           |            |
| 14.0 GeV | $1.411 \times 10^4$ | 2.927                       | 0.003  | 0.003                                 | 0.008     | 2.941   | $5.218 \times 10^3$                |           |            |
| 20.0 GeV | $2.011 \times 10^4$ | 2.984                       | 0.005  | 0.006                                 | 0.011     | 3.005   | $7.235 \times 10^3$                |           |            |
| 30.0 GeV | $3.011 \times 10^4$ | 3.039                       | 0.008  | 0.010                                 | 0.015     | 3.073   | $1.052 \times 10^4$                |           |            |
| 40.0 GeV | $4.011 \times 10^4$ | 3.074                       | 0.012  | 0.015                                 | 0.020     | 3.121   | $1.375 \times 10^4$                |           |            |
| 80.0 GeV | $8.011 \times 10^4$ | 3.150                       | 0.028  | 0.038                                 | 0.038     | 3.255   | $2.628 \times 10^4$                |           |            |
| 100. GeV | $1.001 \times 10^5$ | 3.174                       | 0.037  | 0.050                                 | 0.047     | 3.309   | $3.238 \times 10^4$                |           |            |
| 140. GeV | $1.401 \times 10^5$ | 3.209                       | 0.055  | 0.076                                 | 0.066     | 3.406   | $4.429 \times 10^4$                |           |            |
| 200. GeV | $2.001 \times 10^5$ | 3.245                       | 0.085  | 0.118                                 | 0.093     | 3.541   | $6.156 \times 10^4$                |           |            |
| 300. GeV | $3.001 \times 10^5$ | 3.286                       | 0.137  | 0.191                                 | 0.139     | 3.753   | $8.898 \times 10^4$                |           |            |
| 400. GeV | $4.001 \times 10^5$ | 3.315                       | 0.191  | 0.268                                 | 0.185     | 3.960   | $1.149 \times 10^5$                |           |            |
| 800. GeV | $8.001 \times 10^5$ | 3.387                       | 0.423  | 0.592                                 | 0.373     | 4.774   | $2.068 \times 10^5$                |           |            |
| 1.00 TeV | $1.000 \times 10^6$ | 3.410                       | 0.544  | 0.761                                 | 0.468     | 5.183   | $2.470 \times 10^5$                |           |            |
| 1.40 TeV | $1.400 \times 10^6$ | 3.445                       | 0.791  | 1.101                                 | 0.663     | 6.001   | $3.186 \times 10^5$                |           |            |
| 1.86 TeV | $1.858 \times 10^6$ | 3.475                       | 1.083  | 1.501                                 | 0.890     | 6.950   | <i>Muon critical energy</i>        |           |            |
| 2.00 TeV | $2.000 \times 10^6$ | 3.483                       | 1.175  | 1.627                                 | 0.961     | 7.246   | $4.095 \times 10^5$                |           |            |
| 3.00 TeV | $3.000 \times 10^6$ | 3.526                       | 1.827  | 2.504                                 | 1.474     | 9.331   | $5.309 \times 10^5$                |           |            |
| 4.00 TeV | $4.000 \times 10^6$ | 3.557                       | 2.496  | 3.399                                 | 1.996     | 11.448  | $6.275 \times 10^5$                |           |            |
| 8.00 TeV | $8.000 \times 10^6$ | 3.634                       | 5.240  | 7.012                                 | 4.180     | 20.067  | $8.882 \times 10^5$                |           |            |
| 10.0 TeV | $1.000 \times 10^7$ | 3.660                       | 6.642  | 8.837                                 | 5.308     | 24.447  | $9.783 \times 10^5$                |           |            |
| 14.0 TeV | $1.400 \times 10^7$ | 3.698                       | 9.452  | 12.466                                | 7.642     | 33.258  | $1.118 \times 10^6$                |           |            |
| 20.0 TeV | $2.000 \times 10^7$ | 3.740                       | 13.734 | 17.952                                | 11.236    | 46.662  | $1.270 \times 10^6$                |           |            |
| 30.0 TeV | $3.000 \times 10^7$ | 3.788                       | 20.884 | 27.062                                | 17.498    | 69.232  | $1.445 \times 10^6$                |           |            |
| 40.0 TeV | $4.000 \times 10^7$ | 3.823                       | 28.113 | 36.210                                | 23.940    | 92.085  | $1.570 \times 10^6$                |           |            |
| 80.0 TeV | $8.000 \times 10^7$ | 3.908                       | 57.248 | 72.833                                | 51.135    | 185.124 | $1.870 \times 10^6$                |           |            |
| 100. TeV | $1.000 \times 10^8$ | 3.937                       | 71.920 | 91.170                                | 65.290    | 232.317 | $1.966 \times 10^6$                |           |            |