

## Muons in barium (Ba)

| Z        | A [g/mol]           | $\rho$ [g/cm <sup>3</sup> ] | I [eV]  | $a$                                   | $k = m_s$ | $x_0$    | $x_1$                              | $\bar{C}$ | $\delta_0$ |
|----------|---------------------|-----------------------------|---------|---------------------------------------|-----------|----------|------------------------------------|-----------|------------|
| 56 (Ba)  | 137.327 (7)         | 3.500                       | 491.0   | 0.18268                               | 2.8906    | 0.4190   | 3.4547                             | 6.3153    | 0.14       |
| $T$      | $p$<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 | $4.704 \times 10^1$ | 4.394                       |         |                                       |           | 4.394    | $1.297 \times 10^0$                |           |            |
| 14.0 MeV | $5.616 \times 10^1$ | 3.476                       |         |                                       |           | 3.476    | $2.331 \times 10^0$                |           |            |
| 20.0 MeV | $6.802 \times 10^1$ | 2.750                       |         |                                       |           | 2.750    | $4.292 \times 10^0$                |           |            |
| 30.0 MeV | $8.509 \times 10^1$ | 2.160                       |         |                                       |           | 2.160    | $8.449 \times 10^0$                |           |            |
| 40.0 MeV | $1.003 \times 10^2$ | 1.859                       |         |                                       |           | 1.860    | $1.347 \times 10^1$                |           |            |
| 80.0 MeV | $1.527 \times 10^2$ | 1.420                       |         |                                       |           | 1.420    | $3.883 \times 10^1$                |           |            |
| 100. MeV | $1.764 \times 10^2$ | 1.342                       |         |                                       |           | 1.342    | $5.335 \times 10^1$                |           |            |
| 140. MeV | $2.218 \times 10^2$ | 1.268                       |         |                                       |           | 1.268    | $8.414 \times 10^1$                |           |            |
| 200. MeV | $2.868 \times 10^2$ | 1.234                       |         |                                       |           | 1.234    | $1.323 \times 10^2$                |           |            |
| 233. MeV | $3.220 \times 10^2$ | 1.231                       |         |                                       |           | 1.231    | <i>Minimum ionization</i>          |           |            |
| 300. MeV | $3.917 \times 10^2$ | 1.237                       | 0.000   |                                       | 0.000     | 1.237    | $2.134 \times 10^2$                |           |            |
| 400. MeV | $4.945 \times 10^2$ | 1.258                       | 0.000   |                                       | 0.000     | 1.259    | $2.936 \times 10^2$                |           |            |
| 800. MeV | $8.995 \times 10^2$ | 1.346                       | 0.001   |                                       | 0.000     | 1.347    | $6.002 \times 10^2$                |           |            |
| 1.00 GeV | $1.101 \times 10^3$ | 1.381                       | 0.001   |                                       | 0.000     | 1.382    | $7.467 \times 10^2$                |           |            |
| 1.40 GeV | $1.502 \times 10^3$ | 1.435                       | 0.002   | 0.000                                 | 0.001     | 1.438    | $1.030 \times 10^3$                |           |            |
| 2.00 GeV | $2.103 \times 10^3$ | 1.494                       | 0.003   | 0.001                                 | 0.001     | 1.500    | $1.438 \times 10^3$                |           |            |
| 3.00 GeV | $3.104 \times 10^3$ | 1.561                       | 0.005   | 0.003                                 | 0.001     | 1.570    | $2.089 \times 10^3$                |           |            |
| 4.00 GeV | $4.104 \times 10^3$ | 1.606                       | 0.007   | 0.006                                 | 0.002     | 1.621    | $2.715 \times 10^3$                |           |            |
| 8.00 GeV | $8.105 \times 10^3$ | 1.709                       | 0.018   | 0.018                                 | 0.003     | 1.749    | $5.081 \times 10^3$                |           |            |
| 10.0 GeV | $1.011 \times 10^4$ | 1.740                       | 0.024   | 0.025                                 | 0.004     | 1.793    | $6.210 \times 10^3$                |           |            |
| 14.0 GeV | $1.411 \times 10^4$ | 1.784                       | 0.037   | 0.040                                 | 0.005     | 1.867    | $8.395 \times 10^3$                |           |            |
| 20.0 GeV | $2.011 \times 10^4$ | 1.827                       | 0.057   | 0.065                                 | 0.008     | 1.958    | $1.153 \times 10^4$                |           |            |
| 30.0 GeV | $3.011 \times 10^4$ | 1.873                       | 0.094   | 0.114                                 | 0.011     | 2.093    | $1.647 \times 10^4$                |           |            |
| 40.0 GeV | $4.011 \times 10^4$ | 1.903                       | 0.133   | 0.167                                 | 0.015     | 2.219    | $2.111 \times 10^4$                |           |            |
| 80.0 GeV | $8.011 \times 10^4$ | 1.970                       | 0.300   | 0.401                                 | 0.029     | 2.702    | $3.741 \times 10^4$                |           |            |
| 100. GeV | $1.001 \times 10^5$ | 1.990                       | 0.389   | 0.528                                 | 0.036     | 2.944    | $4.450 \times 10^4$                |           |            |
| 140. GeV | $1.401 \times 10^5$ | 2.020                       | 0.571   | 0.788                                 | 0.050     | 3.429    | $5.708 \times 10^4$                |           |            |
| 194. GeV | $1.937 \times 10^5$ | 2.047                       | 0.825   | 1.154                                 | 0.068     | 4.096    | <i>Muon critical energy</i>        |           |            |
| 200. GeV | $2.001 \times 10^5$ | 2.050                       | 0.856   | 1.199                                 | 0.071     | 4.177    | $7.291 \times 10^4$                |           |            |
| 300. GeV | $3.001 \times 10^5$ | 2.084                       | 1.343   | 1.887                                 | 0.106     | 5.421    | $9.388 \times 10^4$                |           |            |
| 400. GeV | $4.001 \times 10^5$ | 2.108                       | 1.846   | 2.599                                 | 0.141     | 6.696    | $1.105 \times 10^5$                |           |            |
| 800. GeV | $8.001 \times 10^5$ | 2.166                       | 3.923   | 5.521                                 | 0.286     | 11.897   | $1.547 \times 10^5$                |           |            |
| 1.00 TeV | $1.000 \times 10^6$ | 2.185                       | 4.989   | 7.015                                 | 0.359     | 14.550   | $1.699 \times 10^5$                |           |            |
| 1.40 TeV | $1.400 \times 10^6$ | 2.214                       | 7.128   | 9.996                                 | 0.509     | 19.848   | $1.933 \times 10^5$                |           |            |
| 2.00 TeV | $2.000 \times 10^6$ | 2.245                       | 10.399  | 14.545                                | 0.736     | 27.926   | $2.187 \times 10^5$                |           |            |
| 3.00 TeV | $3.000 \times 10^6$ | 2.281                       | 15.859  | 22.104                                | 1.125     | 41.370   | $2.479 \times 10^5$                |           |            |
| 4.00 TeV | $4.000 \times 10^6$ | 2.307                       | 21.392  | 29.743                                | 1.520     | 54.963   | $2.689 \times 10^5$                |           |            |
| 8.00 TeV | $8.000 \times 10^6$ | 2.370                       | 43.697  | 60.450                                | 3.158     | 109.677  | $3.194 \times 10^5$                |           |            |
| 10.0 TeV | $1.000 \times 10^7$ | 2.391                       | 54.937  | 75.885                                | 3.999     | 137.213  | $3.356 \times 10^5$                |           |            |
| 14.0 TeV | $1.400 \times 10^7$ | 2.423                       | 77.356  | 106.683                               | 5.725     | 192.189  | $3.602 \times 10^5$                |           |            |
| 20.0 TeV | $2.000 \times 10^7$ | 2.457                       | 111.182 | 153.078                               | 8.370     | 275.088  | $3.861 \times 10^5$                |           |            |
| 30.0 TeV | $3.000 \times 10^7$ | 2.496                       | 167.494 | 230.266                               | 12.939    | 413.196  | $4.156 \times 10^5$                |           |            |
| 40.0 TeV | $4.000 \times 10^7$ | 2.525                       | 224.007 | 307.636                               | 17.614    | 551.784  | $4.364 \times 10^5$                |           |            |
| 80.0 TeV | $8.000 \times 10^7$ | 2.595                       | 450.390 | 617.341                               | 37.132    | 1107.460 | $4.866 \times 10^5$                |           |            |
| 100. TeV | $1.000 \times 10^8$ | 2.618                       | 563.770 | 772.340                               | 47.210    | 1385.940 | $5.027 \times 10^5$                |           |            |