

## Muons in heavymet as Rochester gamma stop

|          | $\langle Z/A \rangle$ | $\rho$ [g/cm <sup>3</sup> ] | $I$ [eV] | $a$                      | $k = m_s$ | $x_0$    | $x_1$                              | $\bar{C}$ | $\delta_0$                  |
|----------|-----------------------|-----------------------------|----------|--------------------------|-----------|----------|------------------------------------|-----------|-----------------------------|
|          | 0.40915               | 19.300                      | 727.0    | 0.15509                  | 2.8447    | 0.2167   | 3.4960                             | 5.4059    | 0.14                        |
| $T$      | $p$<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 | $4.704 \times 10^1$   | 4.142                       |          |                          |           | 4.142    |                                    |           | $1.377 \times 10^0$         |
| 14.0 MeV | $5.616 \times 10^1$   | 3.280                       |          |                          |           | 3.280    |                                    |           | $2.472 \times 10^0$         |
| 20.0 MeV | $6.802 \times 10^1$   | 2.598                       |          |                          |           | 2.598    |                                    |           | $4.550 \times 10^0$         |
| 30.0 MeV | $8.509 \times 10^1$   | 2.044                       |          |                          |           | 2.044    |                                    |           | $8.946 \times 10^0$         |
| 40.0 MeV | $1.003 \times 10^2$   | 1.761                       |          |                          |           | 1.761    |                                    |           | $1.425 \times 10^1$         |
| 80.0 MeV | $1.527 \times 10^2$   | 1.347                       |          |                          |           | 1.347    |                                    |           | $4.101 \times 10^1$         |
| 100. MeV | $1.764 \times 10^2$   | 1.273                       |          |                          |           | 1.273    |                                    |           | $5.632 \times 10^1$         |
| 140. MeV | $2.218 \times 10^2$   | 1.202                       |          |                          |           | 1.202    |                                    |           | $8.880 \times 10^1$         |
| 200. MeV | $2.868 \times 10^2$   | 1.168                       |          |                          |           | 1.169    |                                    |           | $1.396 \times 10^2$         |
| 242. MeV | $3.316 \times 10^2$   | 1.164                       | 0.000    |                          |           | 1.164    |                                    |           | <i>Minimum ionization</i>   |
| 300. MeV | $3.917 \times 10^2$   | 1.169                       | 0.000    |                          | 0.000     | 1.169    |                                    |           | $2.254 \times 10^2$         |
| 400. MeV | $4.945 \times 10^2$   | 1.187                       | 0.000    |                          | 0.000     | 1.188    |                                    |           | $3.103 \times 10^2$         |
| 800. MeV | $8.995 \times 10^2$   | 1.268                       | 0.001    |                          | 0.000     | 1.269    |                                    |           | $6.356 \times 10^2$         |
| 1.00 GeV | $1.101 \times 10^3$   | 1.300                       | 0.001    |                          | 0.000     | 1.302    |                                    |           | $7.912 \times 10^2$         |
| 1.40 GeV | $1.502 \times 10^3$   | 1.351                       | 0.002    |                          | 0.001     | 1.354    |                                    |           | $1.092 \times 10^3$         |
| 2.00 GeV | $2.103 \times 10^3$   | 1.407                       | 0.004    | 0.001                    | 0.001     | 1.413    |                                    |           | $1.525 \times 10^3$         |
| 3.00 GeV | $3.104 \times 10^3$   | 1.470                       | 0.006    | 0.003                    | 0.001     | 1.481    |                                    |           | $2.216 \times 10^3$         |
| 4.00 GeV | $4.104 \times 10^3$   | 1.514                       | 0.009    | 0.006                    | 0.002     | 1.531    |                                    |           | $2.879 \times 10^3$         |
| 8.00 GeV | $8.105 \times 10^3$   | 1.613                       | 0.022    | 0.020                    | 0.003     | 1.658    |                                    |           | $5.380 \times 10^3$         |
| 10.0 GeV | $1.011 \times 10^4$   | 1.642                       | 0.029    | 0.028                    | 0.004     | 1.705    |                                    |           | $6.569 \times 10^3$         |
| 14.0 GeV | $1.411 \times 10^4$   | 1.685                       | 0.045    | 0.046                    | 0.005     | 1.782    |                                    |           | $8.862 \times 10^3$         |
| 20.0 GeV | $2.011 \times 10^4$   | 1.728                       | 0.069    | 0.076                    | 0.007     | 1.882    |                                    |           | $1.214 \times 10^4$         |
| 30.0 GeV | $3.011 \times 10^4$   | 1.773                       | 0.114    | 0.133                    | 0.011     | 2.032    |                                    |           | $1.725 \times 10^4$         |
| 40.0 GeV | $4.011 \times 10^4$   | 1.803                       | 0.161    | 0.196                    | 0.014     | 2.175    |                                    |           | $2.200 \times 10^4$         |
| 80.0 GeV | $8.011 \times 10^4$   | 1.870                       | 0.363    | 0.472                    | 0.028     | 2.735    |                                    |           | $3.836 \times 10^4$         |
| 100. GeV | $1.001 \times 10^5$   | 1.890                       | 0.471    | 0.621                    | 0.035     | 3.018    |                                    |           | $4.532 \times 10^4$         |
| 140. GeV | $1.401 \times 10^5$   | 1.920                       | 0.691    | 0.928                    | 0.049     | 3.589    |                                    |           | $5.746 \times 10^4$         |
| 159. GeV | $1.590 \times 10^5$   | 1.931                       | 0.798    | 1.078                    | 0.055     | 3.863    |                                    |           | <i>Muon critical energy</i> |
| 200. GeV | $2.001 \times 10^5$   | 1.951                       | 1.036    | 1.414                    | 0.070     | 4.470    |                                    |           | $7.242 \times 10^4$         |
| 300. GeV | $3.001 \times 10^5$   | 1.985                       | 1.624    | 2.225                    | 0.104     | 5.939    |                                    |           | $9.178 \times 10^4$         |
| 400. GeV | $4.001 \times 10^5$   | 2.009                       | 2.231    | 3.066                    | 0.139     | 7.447    |                                    |           | $1.068 \times 10^5$         |
| 800. GeV | $8.001 \times 10^5$   | 2.067                       | 4.739    | 6.513                    | 0.281     | 13.602   |                                    |           | $1.460 \times 10^5$         |
| 1.00 TeV | $1.000 \times 10^6$   | 2.086                       | 6.027    | 8.276                    | 0.354     | 16.745   |                                    |           | $1.592 \times 10^5$         |
| 1.40 TeV | $1.400 \times 10^6$   | 2.115                       | 8.607    | 11.793                   | 0.501     | 23.017   |                                    |           | $1.795 \times 10^5$         |
| 2.00 TeV | $2.000 \times 10^6$   | 2.146                       | 12.552   | 17.159                   | 0.724     | 32.583   |                                    |           | $2.013 \times 10^5$         |
| 3.00 TeV | $3.000 \times 10^6$   | 2.182                       | 19.135   | 26.075                   | 1.107     | 48.501   |                                    |           | $2.263 \times 10^5$         |
| 4.00 TeV | $4.000 \times 10^6$   | 2.208                       | 25.805   | 35.085                   | 1.496     | 64.595   |                                    |           | $2.441 \times 10^5$         |
| 8.00 TeV | $8.000 \times 10^6$   | 2.272                       | 52.684   | 71.300                   | 3.106     | 129.365  |                                    |           | $2.870 \times 10^5$         |
| 10.0 TeV | $1.000 \times 10^7$   | 2.292                       | 66.226   | 89.503                   | 3.933     | 161.956  |                                    |           | $3.008 \times 10^5$         |
| 14.0 TeV | $1.400 \times 10^7$   | 2.324                       | 93.235   | 125.824                  | 5.630     | 227.014  |                                    |           | $3.216 \times 10^5$         |
| 20.0 TeV | $2.000 \times 10^7$   | 2.359                       | 133.978  | 180.536                  | 8.229     | 325.102  |                                    |           | $3.435 \times 10^5$         |
| 30.0 TeV | $3.000 \times 10^7$   | 2.398                       | 201.805  | 271.564                  | 12.718    | 488.488  |                                    |           | $3.685 \times 10^5$         |
| 40.0 TeV | $4.000 \times 10^7$   | 2.427                       | 269.867  | 362.805                  | 17.312    | 652.413  |                                    |           | $3.861 \times 10^5$         |
| 80.0 TeV | $8.000 \times 10^7$   | 2.497                       | 542.495  | 728.005                  | 36.486    | 1309.486 |                                    |           | $4.285 \times 10^5$         |
| 100. TeV | $1.000 \times 10^8$   | 2.521                       | 679.027  | 910.765                  | 46.386    | 1638.700 |                                    |           | $4.422 \times 10^5$         |