## Muons in valine ($C_5H_{11}NOi_2$)

| $\langle Z/A \rangle$ | $\rho$ [g/cm$^3$] | $I$ [eV] | $a$ | $k = m_s$ | $x_0$ | $x_1$ | $\overline{C}$ | $\delta_0$ |
|---|---|---|---|---|---|---|---|---|
| 0.54632 | 1.230 | 67.7 | 0.11386 | 3.3774 | 0.1441 | 2.6227 | 3.1059 | 0.00 |

| $T$ | $p$ [MeV/$c$] | Ionization | Brems | Pair prod | Photonucl | Total | CSDA range [g/cm$^2$] |
|---|---|---|---|---|---|---|---|
| | | [MeV cm$^2$/g] | | | | | |
| 10.0 MeV | $4.704 \times 10^1$ | 7.943 | | | | 7.943 | $6.951 \times 10^{-1}$ |
| 14.0 MeV | $5.616 \times 10^1$ | 6.193 | | | | 6.193 | $1.272 \times 10^0$ |
| 20.0 MeV | $6.802 \times 10^1$ | 4.834 | | | | 4.834 | $2.381 \times 10^0$ |
| 30.0 MeV | $8.509 \times 10^1$ | 3.748 | | | | 3.748 | $4.763 \times 10^0$ |
| 40.0 MeV | $1.003 \times 10^2$ | 3.200 | | | | 3.200 | $7.669 \times 10^0$ |
| 80.0 MeV | $1.527 \times 10^2$ | 2.398 | | | | 2.398 | $2.256 \times 10^1$ |
| 100. MeV | $1.764 \times 10^2$ | 2.245 | | | | 2.245 | $3.121 \times 10^1$ |
| 140. MeV | $2.218 \times 10^2$ | 2.088 | | | | 2.088 | $4.977 \times 10^1$ |
| 200. MeV | $2.868 \times 10^2$ | 1.997 | | | | 1.997 | $7.927 \times 10^1$ |
| 300. MeV | $3.917 \times 10^2$ | 1.961 | | | 0.000 | 1.961 | $1.300 \times 10^2$ |
| 324. MeV | $4.161 \times 10^2$ | 1.960 | | | 0.000 | 1.960 | *Minimum ionization* |
| 400. MeV | $4.945 \times 10^2$ | 1.965 | | | 0.000 | 1.965 | $1.809 \times 10^2$ |
| 800. MeV | $8.995 \times 10^2$ | 2.036 | 0.000 | | 0.000 | 2.037 | $3.810 \times 10^2$ |
| 1.00 GeV | $1.101 \times 10^3$ | 2.069 | 0.000 | | 0.000 | 2.070 | $4.783 \times 10^2$ |
| 1.40 GeV | $1.502 \times 10^3$ | 2.123 | 0.000 | | 0.001 | 2.124 | $6.690 \times 10^2$ |
| 2.00 GeV | $2.103 \times 10^3$ | 2.182 | 0.001 | 0.000 | 0.001 | 2.184 | $9.474 \times 10^2$ |
| 3.00 GeV | $3.104 \times 10^3$ | 2.250 | 0.001 | 0.001 | 0.001 | 2.253 | $1.398 \times 10^3$ |
| 4.00 GeV | $4.104 \times 10^3$ | 2.297 | 0.001 | 0.001 | 0.002 | 2.302 | $1.837 \times 10^3$ |
| 8.00 GeV | $8.105 \times 10^3$ | 2.406 | 0.003 | 0.003 | 0.004 | 2.416 | $3.528 \times 10^3$ |
| 10.0 GeV | $1.011 \times 10^4$ | 2.439 | 0.004 | 0.004 | 0.005 | 2.452 | $4.349 \times 10^3$ |
| 14.0 GeV | $1.411 \times 10^4$ | 2.487 | 0.006 | 0.007 | 0.007 | 2.507 | $5.962 \times 10^3$ |
| 20.0 GeV | $2.011 \times 10^4$ | 2.535 | 0.010 | 0.011 | 0.009 | 2.566 | $8.326 \times 10^3$ |
| 30.0 GeV | $3.011 \times 10^4$ | 2.588 | 0.016 | 0.020 | 0.014 | 2.638 | $1.217 \times 10^4$ |
| 40.0 GeV | $4.011 \times 10^4$ | 2.623 | 0.023 | 0.029 | 0.018 | 2.694 | $1.592 \times 10^4$ |
| 80.0 GeV | $8.011 \times 10^4$ | 2.706 | 0.053 | 0.071 | 0.034 | 2.865 | $3.029 \times 10^4$ |
| 100. GeV | $1.001 \times 10^5$ | 2.732 | 0.069 | 0.094 | 0.043 | 2.937 | $3.718 \times 10^4$ |
| 140. GeV | $1.401 \times 10^5$ | 2.770 | 0.102 | 0.141 | 0.059 | 3.072 | $5.050 \times 10^4$ |
| 200. GeV | $2.001 \times 10^5$ | 2.810 | 0.153 | 0.216 | 0.084 | 3.263 | $6.944 \times 10^4$ |
| 300. GeV | $3.001 \times 10^5$ | 2.855 | 0.242 | 0.344 | 0.126 | 3.567 | $9.873 \times 10^4$ |
| 400. GeV | $4.001 \times 10^5$ | 2.887 | 0.334 | 0.477 | 0.168 | 3.866 | $1.257 \times 10^5$ |
| 800. GeV | $8.001 \times 10^5$ | 2.966 | 0.717 | 1.032 | 0.339 | 5.054 | $2.159 \times 10^5$ |
| 1.00 TeV | $1.000 \times 10^6$ | 2.991 | 0.915 | 1.319 | 0.426 | 5.652 | $2.533 \times 10^5$ |
| 1.12 TeV | $1.121 \times 10^6$ | 3.004 | 1.035 | 1.490 | 0.480 | 6.009 | *Muon critical energy* |
| 1.40 TeV | $1.400 \times 10^6$ | 3.030 | 1.315 | 1.890 | 0.604 | 6.839 | $3.175 \times 10^5$ |
| 2.00 TeV | $2.000 \times 10^6$ | 3.071 | 1.929 | 2.765 | 0.875 | 8.641 | $3.954 \times 10^5$ |
| 3.00 TeV | $3.000 \times 10^6$ | 3.119 | 2.959 | 4.223 | 1.341 | 11.643 | $4.948 \times 10^5$ |
| 4.00 TeV | $4.000 \times 10^6$ | 3.154 | 4.007 | 5.702 | 1.816 | 14.679 | $5.711 \times 10^5$ |
| 8.00 TeV | $8.000 \times 10^6$ | 3.238 | 8.254 | 11.660 | 3.790 | 26.943 | $7.693 \times 10^5$ |
| 10.0 TeV | $1.000 \times 10^7$ | 3.266 | 10.403 | 14.661 | 4.808 | 33.138 | $8.361 \times 10^5$ |
| 14.0 TeV | $1.400 \times 10^7$ | 3.309 | 14.691 | 20.640 | 6.905 | 45.545 | $9.387 \times 10^5$ |
| 20.0 TeV | $2.000 \times 10^7$ | 3.355 | 21.179 | 29.659 | 10.127 | 64.320 | $1.049 \times 10^6$ |
| 30.0 TeV | $3.000 \times 10^7$ | 3.408 | 31.984 | 44.665 | 15.722 | 95.779 | $1.176 \times 10^6$ |
| 40.0 TeV | $4.000 \times 10^7$ | 3.446 | 42.848 | 59.721 | 21.465 | 127.480 | $1.266 \times 10^6$ |
| 80.0 TeV | $8.000 \times 10^7$ | 3.540 | 86.412 | 119.994 | 45.576 | 255.523 | $1.483 \times 10^6$ |
| 100. TeV | $1.000 \times 10^8$ | 3.571 | 108.253 | 150.167 | 58.078 | 320.070 | $1.553 \times 10^6$ |