

### Muons in hafnium (Hf)

Z	A [g/mol]	$\rho$ [g/cm <sup>3</sup> ]	I [eV]	$a$	$k = m_s$	$x_0$	$x_1$	$\bar{C}$	$\delta_0$
72 (Hf)	178.49(2)	13.310	705.0	0.22918	2.6155	0.1965	3.4337	5.7139	0.14

  

$T$	$p$ [MeV/c]	Ionization	Brems	Pair prod [MeV cm <sup>2</sup> /g]	Photonucl	Total	CSDA range [g/cm <sup>2</sup> ]
10.0 MeV	$4.704 \times 10^1$	4.035				4.035	$1.432 \times 10^0$
14.0 MeV	$5.616 \times 10^1$	3.212				3.212	$2.553 \times 10^0$
20.0 MeV	$6.802 \times 10^1$	2.553				2.553	$4.670 \times 10^0$
30.0 MeV	$8.509 \times 10^1$	2.014				2.014	$9.137 \times 10^0$
40.0 MeV	$1.003 \times 10^2$	1.737				1.737	$1.452 \times 10^1$
80.0 MeV	$1.527 \times 10^2$	1.330				1.331	$4.161 \times 10^1$
100. MeV	$1.764 \times 10^2$	1.258				1.258	$5.711 \times 10^1$
140. MeV	$2.218 \times 10^2$	1.188				1.188	$8.997 \times 10^1$
200. MeV	$2.868 \times 10^2$	1.155				1.156	$1.413 \times 10^2$
243. MeV	$3.325 \times 10^2$	1.152	0.000			1.152	<i>Minimum ionization</i>
300. MeV	$3.917 \times 10^2$	1.156	0.000		0.000	1.157	$2.280 \times 10^2$
400. MeV	$4.945 \times 10^2$	1.175	0.000		0.000	1.176	$3.138 \times 10^2$
800. MeV	$8.995 \times 10^2$	1.256	0.001		0.000	1.258	$6.423 \times 10^2$
1.00 GeV	$1.101 \times 10^3$	1.289	0.001		0.000	1.291	$7.992 \times 10^2$
1.40 GeV	$1.502 \times 10^3$	1.341	0.002		0.001	1.344	$1.103 \times 10^3$
2.00 GeV	$2.103 \times 10^3$	1.397	0.004	0.001	0.001	1.403	$1.539 \times 10^3$
3.00 GeV	$3.104 \times 10^3$	1.461	0.006	0.003	0.001	1.472	$2.234 \times 10^3$
4.00 GeV	$4.104 \times 10^3$	1.505	0.009	0.006	0.002	1.522	$2.901 \times 10^3$
8.00 GeV	$8.105 \times 10^3$	1.606	0.023	0.021	0.003	1.653	$5.413 \times 10^3$
10.0 GeV	$1.011 \times 10^4$	1.636	0.030	0.029	0.004	1.700	$6.606 \times 10^3$
14.0 GeV	$1.411 \times 10^4$	1.679	0.046	0.048	0.005	1.779	$8.904 \times 10^3$
20.0 GeV	$2.011 \times 10^4$	1.723	0.072	0.078	0.007	1.881	$1.218 \times 10^4$
30.0 GeV	$3.011 \times 10^4$	1.769	0.117	0.137	0.011	2.035	$1.729 \times 10^4$
40.0 GeV	$4.011 \times 10^4$	1.799	0.166	0.202	0.014	2.182	$2.204 \times 10^4$
80.0 GeV	$8.011 \times 10^4$	1.866	0.374	0.487	0.028	2.756	$3.831 \times 10^4$
100. GeV	$1.001 \times 10^5$	1.886	0.485	0.640	0.035	3.048	$4.521 \times 10^4$
140. GeV	$1.401 \times 10^5$	1.916	0.712	0.956	0.049	3.634	$5.721 \times 10^4$
154. GeV	$1.546 \times 10^5$	1.924	0.796	1.075	0.054	3.850	<i>Muon critical energy</i>
200. GeV	$2.001 \times 10^5$	1.946	1.067	1.457	0.069	4.540	$7.196 \times 10^4$
300. GeV	$3.001 \times 10^5$	1.980	1.672	2.294	0.104	6.051	$9.099 \times 10^4$
400. GeV	$4.001 \times 10^5$	2.003	2.298	3.160	0.138	7.602	$1.057 \times 10^5$
800. GeV	$8.001 \times 10^5$	2.061	4.881	6.713	0.279	13.936	$1.440 \times 10^5$
1.00 TeV	$1.000 \times 10^6$	2.080	6.207	8.529	0.351	17.169	$1.569 \times 10^5$
1.40 TeV	$1.400 \times 10^6$	2.108	8.864	12.153	0.497	23.624	$1.767 \times 10^5$
2.00 TeV	$2.000 \times 10^6$	2.139	12.927	17.681	0.719	33.468	$1.980 \times 10^5$
3.00 TeV	$3.000 \times 10^6$	2.174	19.707	26.867	1.099	49.849	$2.223 \times 10^5$
4.00 TeV	$4.000 \times 10^6$	2.200	26.574	36.150	1.485	66.411	$2.396 \times 10^5$
8.00 TeV	$8.000 \times 10^6$	2.262	54.253	73.460	3.084	133.061	$2.813 \times 10^5$
10.0 TeV	$1.000 \times 10^7$	2.283	68.197	92.211	3.904	166.597	$2.947 \times 10^5$
14.0 TeV	$1.400 \times 10^7$	2.314	96.008	129.631	5.587	233.542	$3.149 \times 10^5$
20.0 TeV	$2.000 \times 10^7$	2.348	137.960	185.998	8.166	334.474	$3.363 \times 10^5$
30.0 TeV	$3.000 \times 10^7$	2.387	207.800	279.776	12.621	502.586	$3.605 \times 10^5$
40.0 TeV	$4.000 \times 10^7$	2.415	277.881	373.772	17.179	671.249	$3.777 \times 10^5$
80.0 TeV	$8.000 \times 10^7$	2.485	558.592	750.012	36.195	1347.285	$4.189 \times 10^5$
100. TeV	$1.000 \times 10^8$	2.508	699.170	938.300	46.010	1685.990	$4.321 \times 10^5$