

**Muons in protactinium (Pa)**

Z	A [g/mol]	$\rho$ [g/cm <sup>3</sup> ]	I [eV]	a	$k = m_s$	$x_0$	$x_1$	$\bar{C}$	$\delta_0$
91 (Pa)	[231.03588(2)]	15.370	878.0	0.14770	2.9845	0.3144	3.5079	6.0327	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	$4.704 \times 10^1$	3.749				3.749	$1.558 \times 10^0$
14.0 MeV	$5.616 \times 10^1$	2.999				2.999	$2.761 \times 10^0$
20.0 MeV	$6.802 \times 10^1$	2.395				2.395	$5.023 \times 10^0$
30.0 MeV	$8.509 \times 10^1$	1.897				1.897	$9.774 \times 10^0$
40.0 MeV	$1.003 \times 10^2$	1.640				1.640	$1.548 \times 10^1$
80.0 MeV	$1.527 \times 10^2$	1.263				1.263	$4.408 \times 10^1$
100. MeV	$1.764 \times 10^2$	1.197				1.197	$6.038 \times 10^1$
140. MeV	$2.218 \times 10^2$	1.134				1.134	$9.486 \times 10^1$
200. MeV	$2.868 \times 10^2$	1.109				1.109	$1.485 \times 10^2$
226. MeV	$3.145 \times 10^2$	1.107	0.000			1.108	<i>Minimum ionization</i>
300. MeV	$3.917 \times 10^2$	1.115	0.000		0.000	1.116	$2.386 \times 10^2$
400. MeV	$4.945 \times 10^2$	1.137	0.000		0.000	1.137	$3.274 \times 10^2$
800. MeV	$8.995 \times 10^2$	1.222	0.001		0.000	1.223	$6.659 \times 10^2$
1.00 GeV	$1.101 \times 10^3$	1.255	0.002		0.000	1.257	$8.272 \times 10^2$
1.40 GeV	$1.502 \times 10^3$	1.307	0.003		0.001	1.310	$1.139 \times 10^3$
2.00 GeV	$2.103 \times 10^3$	1.363	0.004	0.001	0.001	1.369	$1.586 \times 10^3$
3.00 GeV	$3.104 \times 10^3$	1.425	0.008	0.003	0.001	1.438	$2.298 \times 10^3$
4.00 GeV	$4.104 \times 10^3$	1.468	0.011	0.006	0.002	1.488	$2.981 \times 10^3$
8.00 GeV	$8.105 \times 10^3$	1.566	0.027	0.023	0.003	1.620	$5.547 \times 10^3$
10.0 GeV	$1.011 \times 10^4$	1.595	0.036	0.033	0.004	1.669	$6.763 \times 10^3$
14.0 GeV	$1.411 \times 10^4$	1.637	0.056	0.054	0.005	1.753	$9.100 \times 10^3$
20.0 GeV	$2.011 \times 10^4$	1.679	0.086	0.089	0.007	1.862	$1.242 \times 10^4$
30.0 GeV	$3.011 \times 10^4$	1.722	0.142	0.158	0.011	2.034	$1.755 \times 10^4$
40.0 GeV	$4.011 \times 10^4$	1.751	0.200	0.233	0.014	2.200	$2.228 \times 10^4$
80.0 GeV	$8.011 \times 10^4$	1.816	0.453	0.566	0.027	2.864	$3.817 \times 10^4$
100. GeV	$1.001 \times 10^5$	1.835	0.587	0.746	0.034	3.204	$4.477 \times 10^4$
130. GeV	$1.301 \times 10^5$	1.857	0.792	1.022	0.044	3.716	<i>Muon critical energy</i>
140. GeV	$1.401 \times 10^5$	1.864	0.861	1.117	0.047	3.891	$5.609 \times 10^4$
200. GeV	$2.001 \times 10^5$	1.893	1.291	1.704	0.068	4.957	$6.973 \times 10^4$
300. GeV	$3.001 \times 10^5$	1.926	2.023	2.684	0.101	6.736	$8.698 \times 10^4$
400. GeV	$4.001 \times 10^5$	1.949	2.780	3.700	0.135	8.566	$1.001 \times 10^5$
800. GeV	$8.001 \times 10^5$	2.005	5.901	7.864	0.273	16.045	$1.337 \times 10^5$
1.00 TeV	$1.000 \times 10^6$	2.024	7.502	9.994	0.343	19.865	$1.449 \times 10^5$
1.40 TeV	$1.400 \times 10^6$	2.051	10.710	14.241	0.486	27.490	$1.620 \times 10^5$
2.00 TeV	$2.000 \times 10^6$	2.081	15.614	20.721	0.702	39.120	$1.802 \times 10^5$
3.00 TeV	$3.000 \times 10^6$	2.116	23.794	31.488	1.073	58.473	$2.009 \times 10^5$
4.00 TeV	$4.000 \times 10^6$	2.141	32.078	42.369	1.450	78.040	$2.157 \times 10^5$
8.00 TeV	$8.000 \times 10^6$	2.202	65.456	86.096	3.010	156.766	$2.511 \times 10^5$
10.0 TeV	$1.000 \times 10^7$	2.222	82.266	108.072	3.810	196.372	$2.625 \times 10^5$
14.0 TeV	$1.400 \times 10^7$	2.253	115.794	151.929	5.452	275.430	$2.796 \times 10^5$
20.0 TeV	$2.000 \times 10^7$	2.286	166.362	217.994	7.966	394.610	$2.977 \times 10^5$
30.0 TeV	$3.000 \times 10^7$	2.324	250.545	327.892	12.307	593.071	$3.183 \times 10^5$
40.0 TeV	$4.000 \times 10^7$	2.351	335.009	438.043	16.749	792.154	$3.328 \times 10^5$
80.0 TeV	$8.000 \times 10^7$	2.419	673.294	878.959	35.283	1589.958	$3.677 \times 10^5$
100. TeV	$1.000 \times 10^8$	2.442	842.690	1099.620	44.850	1989.604	$3.790 \times 10^5$