

## Muons in zirconium (Zr)

Z	A [g/mol]	$\rho$ [g/cm <sup>3</sup> ]	I [eV]	$a$	$k = m_s$	$x_0$	$x_1$	$\bar{C}$	$\delta_0$
40 (Zr)	91.224 (2)	6.506	393.0	0.07177	3.4533	0.2957	3.4890	5.1774	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	$4.704 \times 10^1$	4.913				4.913	$1.154 \times 10^0$		
14.0 MeV	$5.616 \times 10^1$	3.877				3.877	$2.080 \times 10^0$		
20.0 MeV	$6.802 \times 10^1$	3.060				3.060	$3.840 \times 10^0$		
30.0 MeV	$8.509 \times 10^1$	2.399				2.399	$7.580 \times 10^0$		
40.0 MeV	$1.003 \times 10^2$	2.061				2.061	$1.211 \times 10^1$		
80.0 MeV	$1.527 \times 10^2$	1.568				1.568	$3.503 \times 10^1$		
100. MeV	$1.764 \times 10^2$	1.480				1.480	$4.819 \times 10^1$		
140. MeV	$2.218 \times 10^2$	1.395				1.395	$7.615 \times 10^1$		
200. MeV	$2.868 \times 10^2$	1.355				1.355	$1.199 \times 10^2$		
247. MeV	$3.366 \times 10^2$	1.349				1.349	<i>Minimum ionization</i>		
300. MeV	$3.917 \times 10^2$	1.353	0.000		0.000	1.353	$1.940 \times 10^2$		
400. MeV	$4.945 \times 10^2$	1.371	0.000		0.000	1.372	$2.674 \times 10^2$		
800. MeV	$8.995 \times 10^2$	1.456	0.001		0.000	1.457	$5.500 \times 10^2$		
1.00 GeV	$1.101 \times 10^3$	1.490	0.001		0.000	1.491	$6.857 \times 10^2$		
1.40 GeV	$1.502 \times 10^3$	1.543	0.001	0.000	0.001	1.546	$9.489 \times 10^2$		
2.00 GeV	$2.103 \times 10^3$	1.601	0.002	0.001	0.001	1.606	$1.329 \times 10^3$		
3.00 GeV	$3.104 \times 10^3$	1.666	0.004	0.003	0.001	1.674	$1.938 \times 10^3$		
4.00 GeV	$4.104 \times 10^3$	1.711	0.006	0.005	0.002	1.723	$2.527 \times 10^3$		
8.00 GeV	$8.105 \times 10^3$	1.812	0.015	0.014	0.003	1.844	$4.762 \times 10^3$		
10.0 GeV	$1.011 \times 10^4$	1.842	0.019	0.020	0.004	1.886	$5.834 \times 10^3$		
14.0 GeV	$1.411 \times 10^4$	1.885	0.029	0.032	0.006	1.953	$7.917 \times 10^3$		
20.0 GeV	$2.011 \times 10^4$	1.928	0.046	0.053	0.008	2.035	$1.092 \times 10^4$		
30.0 GeV	$3.011 \times 10^4$	1.974	0.075	0.092	0.012	2.153	$1.570 \times 10^4$		
40.0 GeV	$4.011 \times 10^4$	2.005	0.105	0.135	0.015	2.261	$2.023 \times 10^4$		
80.0 GeV	$8.011 \times 10^4$	2.074	0.238	0.323	0.030	2.665	$3.649 \times 10^4$		
100. GeV	$1.001 \times 10^5$	2.095	0.308	0.425	0.037	2.865	$4.373 \times 10^4$		
140. GeV	$1.401 \times 10^5$	2.126	0.453	0.634	0.052	3.264	$5.680 \times 10^4$		
200. GeV	$2.001 \times 10^5$	2.158	0.678	0.965	0.073	3.875	$7.366 \times 10^4$		
248. GeV	$2.478 \times 10^5$	2.177	0.860	1.226	0.091	4.355	<i>Muon critical energy</i>		
300. GeV	$3.001 \times 10^5$	2.194	1.065	1.519	0.110	4.889	$9.659 \times 10^4$		
400. GeV	$4.001 \times 10^5$	2.220	1.464	2.093	0.146	5.925	$1.151 \times 10^5$		
800. GeV	$8.001 \times 10^5$	2.283	3.113	4.450	0.296	10.143	$1.662 \times 10^5$		
1.00 TeV	$1.000 \times 10^6$	2.303	3.961	5.656	0.372	12.293	$1.841 \times 10^5$		
1.40 TeV	$1.400 \times 10^6$	2.334	5.662	8.062	0.527	16.586	$2.120 \times 10^5$		
2.00 TeV	$2.000 \times 10^6$	2.368	8.264	11.736	0.762	23.130	$2.425 \times 10^5$		
3.00 TeV	$3.000 \times 10^6$	2.406	12.610	17.840	1.165	34.022	$2.779 \times 10^5$		
4.00 TeV	$4.000 \times 10^6$	2.434	17.015	24.011	1.575	45.036	$3.034 \times 10^5$		
8.00 TeV	$8.000 \times 10^6$	2.502	34.786	48.822	3.274	89.385	$3.652 \times 10^5$		
10.0 TeV	$1.000 \times 10^7$	2.524	43.744	61.296	4.146	111.711	$3.852 \times 10^5$		
14.0 TeV	$1.400 \times 10^7$	2.558	61.612	86.183	5.938	156.292	$4.153 \times 10^5$		
20.0 TeV	$2.000 \times 10^7$	2.595	88.578	123.676	8.684	223.534	$4.473 \times 10^5$		
30.0 TeV	$3.000 \times 10^7$	2.638	133.470	186.060	13.431	335.599	$4.835 \times 10^5$		
40.0 TeV	$4.000 \times 10^7$	2.668	178.530	248.596	18.291	448.086	$5.092 \times 10^5$		
80.0 TeV	$8.000 \times 10^7$	2.744	359.067	498.925	38.592	899.329	$5.710 \times 10^5$		
100. TeV	$1.000 \times 10^8$	2.769	449.500	624.210	49.080	1125.560	$5.908 \times 10^5$		