

RANGES OF PROJECTILES WITH ATOMIC NUMBERS 8 TO 20 IN Ti, Fe, Ni, Cu, Ag, AND Au AT ENERGIES OF 0.0125 TO 12.0 MEV/NUCLEON*

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Electronic stopping powers of light elements in Ti, Fe, Ni, Cu, Ag, and Au have been recently reported. Earlier measurements were made for the stopping of ^{16}O in Ni, Ag, and Au. With the aid of the Northcliffe-Schilling stopping-power tables these values were extrapolated to values of E/A equal to 0.0125 and 12.0 Mev/AMU. Range tables were calculated from these stopping-power values.

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In 1970 Northcliffe and Schilling (NS) published tables of electronic stopping powers and ranges for heavy ions.¹ Recently, a group at Chalk River (CR) measured stopping powers for beams of ^{19}F , ^{24}Mg , ^{32}S , and ^{35}Cl at energies between ~ 0.2 and ~ 3.5 Mev/nucleon in Ti, Fe, Ni, Cu, Ag, and Au.² They found discrepancies between their values and those given in the NS tables. These deviations were attributed to the presence of an appreciable structure in the variation of stopping powers with the Z of the stopping medium,³⁻⁶ whereas NS assumed a smooth dependence.

These deviations imply that the corresponding NS ranges are also incorrect. A new set of ranges have been generated, based primarily on the CR values. Tables of these ranges and the electronic stopping powers from which they are derived are given on the following pages.

ELECTRONIC STOPPING POWERS

The Chalk River group generated electronic stopping powers for projectiles with atomic numbers from 8 to 20 at energies from 0.15 to 4.0 Mev/nucleon from their measured values. The values for ^{16}O incident on Ni, Ag, and Au have been compared with reported values.⁷⁻⁹ Discrepancies were found for the CR values in these cases. As a result, they were replaced by values based on the direct measurements.

In order to generate ranges from these results, it is necessary to extrapolate the stopping powers to lower values of E/A . This was done by multiplying the NS values down to 0.0125 Mev/nucleon by a factor equal to the average ratio of the adopted and NS values at the two lowest energies of the adopted values. A similar procedure was used at the high-energy end to extrapolate to 12.0 Mev/nucleon. Since NS did not report stopping powers in Fe and Cu, these were obtained from their tables by a logarithmic interpolation of the values given for Ti and Ni and for Ni and Ge.

The adopted electronic stopping powers are given in the tables. The values for ^{16}O from ~ 0.02 to 4.0 Mev/AMU for Ni, Ag, and Au were obtained from references 7 to 9. In the other cases the values given for 0.15 to 4.0 Mev/AMU are from CR.²

RANGES

The procedure for generating range tables from electronic stopping powers was that given by NS, except for two minor changes. The integrations to get increments in the "electronic" range from one energy to the next were done analytically, based on a power-law dependence of stopping power on energy. The parameters for this integration were evaluated from each adjacent pair of energy and stopping-power values. The second change involved a different analytical expression for the quantity defined as $\Delta R(k, \infty)$ in NS, because they did not give the expression they used.

Ranges calculated this way with NS stopping powers agreed with NS ranges within a few tenths of a percent.

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ELECTRONIC STOPPING POWERS (MEV/MG CM⁻²) IN TITANIUM

MEV/AMU	O-16	F-19	NE-20	NA-23	MG-24	AL-27	SI-28	P-31	S-32	CL-35	AR-40	K-39	CA-40
0.0125	1.571	1.659	1.737	1.865	1.960	2.052	2.135	2.219	2.292	2.369	2.437	2.502	2.545
0.0160	1.777	1.876	1.966	2.109	2.219	2.322	2.416	2.510	2.594	2.680	2.756	2.831	2.884
0.0200	1.987	2.097	2.198	2.358	2.481	2.597	2.701	2.806	2.900	2.997	3.081	3.165	3.227
0.0250	2.222	2.346	2.457	2.636	2.773	2.903	3.020	3.137	3.241	3.351	3.445	3.537	3.512
0.0320	2.514	2.654	2.780	2.983	3.137	3.283	3.417	3.549	3.667	3.791	3.897	4.003	4.091
0.0400	2.818	2.975	3.116	3.345	3.518	3.682	3.831	3.980	4.113	4.251	4.371	4.488	4.594
0.0500	3.143	3.342	3.500	3.757	3.951	4.135	4.303	4.470	4.618	4.774	4.909	5.041	5.164
0.0600	3.436	3.666	3.853	4.135	4.354	4.557	4.742	4.926	5.090	5.260	5.409	5.555	5.696
0.0700	3.701	3.960	4.178	4.485	4.729	4.955	5.159	5.352	5.530	5.716	5.878	6.036	6.193
0.0800	3.950	4.241	4.487	4.816	5.086	5.334	5.558	5.770	5.965	6.156	6.329	6.500	6.674
0.0900	4.179	4.500	4.777	5.127	5.423	5.693	5.937	6.167	6.378	6.585	6.774	6.959	7.135
0.1000	4.391	4.744	5.052	5.420	5.741	6.033	6.297	6.545	6.772	6.995	7.199	7.397	7.587
0.1250	4.851	5.283	5.667	6.079	6.454	6.797	7.107	7.398	7.666	7.928	8.165	8.400	8.621
0.15	5.21	5.73	6.20	6.62	7.01	7.37	7.69	8.00	8.28	8.56	8.81	9.06	9.30
0.20	5.76	6.39	6.98	7.51	8.01	8.47	8.90	9.30	9.68	10.05	10.40	10.74	11.07
0.32	6.49	7.34	8.15	8.93	9.66	10.37	11.04	11.70	12.33	12.94	13.54	14.13	14.71
0.50	6.61	7.62	8.61	9.58	10.52	11.45	12.36	13.26	14.14	15.01	15.87	16.72	17.57
0.70	6.38	7.45	8.51	9.56	10.61	11.64	12.67	13.68	14.69	15.70	16.70	17.69	18.68
1.00	5.67	6.72	7.80	8.88	9.97	11.07	12.18	13.29	14.40	15.52	16.65	17.79	18.93
1.25	5.23	6.25	7.30	8.36	9.44	10.54	11.65	12.76	13.89	15.02	16.17	17.32	18.48
1.60	4.75	5.72	6.71	7.74	8.78	9.84	10.91	12.00	13.10	14.21	15.33	16.47	17.61
2.00	4.37	5.28	6.23	7.22	8.22	9.25	10.29	11.34	12.41	13.49	14.58	15.68	16.79
2.50	4.01	4.87	5.78	6.72	7.68	8.67	9.68	10.70	11.74	12.79	13.85	14.92	16.00
3.20	3.66	4.47	5.32	6.20	7.11	8.04	8.99	9.96	10.94	11.92	12.92	13.92	14.93
4.00	3.35	4.11	4.90	5.74	6.60	7.48	8.38	9.30	10.23	11.17	12.11	13.06	14.01
5.00	2.90	3.60	4.33	5.07	5.85	6.65	7.48	8.33	9.19	10.06	10.95	11.85	12.76
6.00	2.59	3.23	3.91	4.59	5.31	6.05	6.82	7.61	8.42	9.24	10.07	10.92	11.78
7.00	2.33	2.93	3.56	4.20	4.86	5.55	6.27	7.01	7.77	8.55	9.34	10.15	10.96
8.00	2.13	2.68	3.27	3.87	4.49	5.14	5.82	6.52	7.24	7.98	8.73	9.50	10.27
9.00	1.96	2.47	3.03	3.59	4.18	4.79	5.43	6.10	6.78	7.48	8.20	8.93	9.68
10.00	1.81	2.30	2.82	3.36	3.92	4.50	5.11	5.74	6.40	7.07	7.76	8.46	9.18
11.00	1.69	2.14	2.64	3.16	3.69	4.24	4.82	5.43	6.06	6.70	7.36	8.04	8.74
12.00	1.58	2.01	2.48	2.98	3.48	4.01	4.57	5.15	5.75	6.38	7.01	7.67	8.34

RANGES (MG/CM²) IN TITANIUM

MEV/AMU	O-16	F-19	NE-20	NA-23	MG-24	AL-27	SI-28	P-31	S-32	CL-35	AR-40	K-39	CA-40
0.0125	0.155	0.164	0.160	0.164	0.159	0.164	0.159	0.163	0.159	0.163	0.174	0.153	0.160
0.0160	0.185	0.197	0.192	0.199	0.192	0.199	0.194	0.200	0.195	0.200	0.214	0.201	0.198
0.0200	0.216	0.232	0.226	0.235	0.228	0.237	0.231	0.239	0.234	0.240	0.258	0.242	0.239
0.0250	0.251	0.271	0.266	0.276	0.269	0.280	0.274	0.284	0.278	0.287	0.309	0.290	0.287
0.0320	0.296	0.321	0.315	0.329	0.321	0.336	0.329	0.342	0.336	0.347	0.375	0.353	0.349
0.0400	0.342	0.373	0.367	0.384	0.375	0.393	0.386	0.402	0.395	0.410	0.445	0.418	0.414
0.0500	0.394	0.431	0.425	0.446	0.436	0.459	0.450	0.471	0.464	0.482	0.524	0.493	0.488
0.0600	0.442	0.484	0.477	0.502	0.491	0.518	0.509	0.533	0.526	0.547	0.596	0.561	0.556
0.0700	0.486	0.532	0.526	0.554	0.542	0.573	0.564	0.591	0.583	0.608	0.663	0.625	0.620
0.0800	0.527	0.578	0.571	0.602	0.590	0.624	0.614	0.645	0.637	0.664	0.726	0.684	0.679
0.0900	0.566	0.620	0.613	0.647	0.635	0.671	0.661	0.695	0.687	0.717	0.784	0.739	0.734
0.1000	0.603	0.661	0.653	0.690	0.677	0.716	0.706	0.742	0.734	0.767	0.840	0.792	0.786
0.1250	0.688	0.755	0.746	0.789	0.774	0.820	0.809	0.851	0.842	0.882	0.966	0.912	0.906
0.15	0.767	0.840	0.829	0.878	0.862	0.914	0.902	0.950	0.941	0.986	1.082	1.021	1.015
0.20	0.912	0.996	0.980	1.040	1.020	1.082	1.069	1.127	1.117	1.171	1.287	1.215	1.208
0.32	1.224	1.326	1.295	1.373	1.343	1.424	1.403	1.479	1.463	1.534	1.685	1.588	1.577
0.50	1.662	1.781	1.722	1.818	1.769	1.867	1.831	1.923	1.895	1.981	2.171	2.040	2.020
0.70	2.155	2.285	2.189	2.298	2.222	2.333	2.277	2.382	2.338	2.435	2.660	2.491	2.459
1.00	2.955	3.092	2.926	3.047	2.923	3.046	2.953	3.071	2.997	3.107	3.378	3.149	3.096
1.25	3.690	3.825	3.589	3.715	3.541	3.671	3.540	3.665	3.562	3.679	3.987	3.704	3.629
1.60	4.815	4.939	4.590	4.716	4.464	4.599	4.410	4.542	4.392	4.517	4.875	4.511	4.405
2.00	6.221	6.323	5.828	5.947	5.594	5.731	5.467	5.605	5.396	5.528	5.945	5.482	5.335
2.50	8.134	8.198	7.496	7.599	7.105	7.239	6.870	7.012	6.721	6.861	7.353	6.756	6.555
3.20	11.062	11.052	10.024	10.096	9.381	9.505	8.973	9.116	8.699	8.846	9.447	8.652	8.368
4.00	14.723	14.603	13.161	13.184	12.187	12.293	11.556	11.695	11.121	11.274	12.007	10.967	10.581
5.00	19.87	19.56	17.51	17.46	16.06	16.13	15.10	15.22	14.43	14.58	15.49	14.11	13.58
6.00	25.73	25.14	22.38	22.23	20.37	20.39	19.03	19.12	18.07	18.21	19.30	17.54	16.84
7.00	32.25	31.32	27.75	27.47	25.10	25.05	23.31	23.37	22.03	22.15	23.42	21.24	20.36
8.00	39.45	38.10	33.61	33.18	30.23	30.10	27.95	27.96	26.30	26.39	27.86	25.22	24.13
9.00	47.30	45.49	39.97	39.35	35.77	35.54	32.93	32.88	30.87	30.93	32.59	29.45	28.14
10.00	55.80	53.46	46.81	45.97	41.70	41.36	38.24	38.11	35.73	35.74	37.60	33.94	32.39
11.00	64.94	62.02	54.13	53.04	48.02	47.54	43.88	43.67	40.87	40.82	42.90	38.66	36.85
12.00	74.72	71.18	61.94	60.54	54.72	54.08	49.85	49.53	46.29	46.18	48.46	43.63	41.54

ELECTRONIC STOPPING POWERS (MEV/MG CM⁻²) IN IRON

MEV/AMU	O-16	F-19	NE-20	NA-23	MG-24	AL-27	SI-28	P-31	S-32	CL-35	AR-40	K-39	CA-40
0.0125	1.126	1.204	1.278	1.389	1.480	1.566	1.652	1.738	1.818	1.900	1.979	2.056	2.116
0.0160	1.275	1.363	1.447	1.572	1.674	1.773	1.870	1.966	2.057	2.149	2.238	2.327	2.397
0.0200	1.425	1.524	1.619	1.758	1.872	1.983	2.090	2.198	2.299	2.403	2.503	2.601	2.682
0.0250	1.593	1.704	1.809	1.965	2.093	2.216	2.338	2.458	2.571	2.688	2.799	2.908	3.002
0.0320	1.806	1.930	2.049	2.226	2.370	2.510	2.648	2.784	2.912	3.045	3.169	3.294	3.405
0.0400	2.028	2.167	2.301	2.501	2.662	2.820	2.974	3.127	3.271	3.420	3.560	3.700	3.829
0.0500	2.268	2.443	2.593	2.818	2.999	3.176	3.351	3.522	3.684	3.852	4.011	4.158	4.318
0.0600	2.485	2.684	2.860	3.107	3.312	3.508	3.699	3.890	4.069	4.254	4.429	4.604	4.772
0.0700	2.685	2.910	3.111	3.380	3.608	3.826	4.038	4.241	4.436	4.637	4.829	5.017	5.207
0.0800	2.869	3.119	3.344	3.634	3.885	4.123	4.354	4.576	4.790	4.999	5.205	5.410	5.616
0.0900	3.038	3.313	3.565	3.873	4.147	4.405	4.656	4.895	5.126	5.353	5.576	5.797	6.010
0.1000	3.199	3.501	3.778	4.104	4.399	4.678	4.950	5.207	5.456	5.698	5.939	6.175	6.405
0.1250	3.546	3.910	4.252	4.617	4.962	5.288	5.604	5.905	6.195	6.480	6.758	7.034	7.302
0.15	3.79	4.22	4.64	5.02	5.39	5.74	6.08	6.40	6.72	7.03	7.34	7.65	7.95
0.20	4.28	4.81	5.31	5.78	6.23	6.66	7.08	7.49	7.88	8.27	8.65	9.03	9.40
0.32	4.88	5.56	6.23	6.87	7.49	8.10	8.69	9.27	9.84	10.41	10.97	11.53	12.08
0.50	5.20	6.03	6.86	7.69	8.50	9.31	10.11	10.91	11.71	12.50	13.29	14.09	14.89
0.70	5.28	6.20	7.13	8.06	8.98	9.91	10.84	11.77	12.71	13.64	14.58	15.52	16.47
1.00	5.06	6.01	6.99	7.98	8.99	10.01	11.03	12.07	13.12	14.17	15.24	16.31	17.39
1.25	4.73	5.68	6.66	7.66	8.69	9.75	10.82	11.90	13.01	14.13	15.26	16.41	17.58
1.60	4.38	5.29	6.24	7.22	8.23	9.27	10.32	11.40	12.50	13.61	14.75	15.90	17.06
2.00	4.04	4.90	5.80	6.74	7.71	8.70	9.72	10.75	11.81	12.88	13.97	15.07	16.19
2.50	3.73	4.54	5.40	6.29	7.20	8.14	9.10	10.08	11.08	12.09	13.11	14.14	15.19
3.20	3.41	4.16	4.95	5.76	6.61	7.47	8.34	9.23	10.13	11.04	11.95	12.87	13.79
4.00	3.09	3.79	4.52	5.29	6.08	6.89	7.72	8.56	9.42	10.28	11.14	12.01	12.89
5.00	2.70	3.35	4.03	4.72	5.45	6.19	6.95	7.73	8.53	9.34	10.15	10.98	11.83
6.00	2.41	3.01	3.65	4.28	4.95	5.64	6.35	7.08	7.83	8.59	9.36	10.14	10.94
7.00	2.18	2.74	3.33	3.91	4.54	5.18	5.84	6.53	7.24	7.95	8.68	9.43	10.18
8.00	1.99	2.51	3.06	3.61	4.20	4.80	5.43	6.08	6.75	7.43	8.12	8.83	9.56
9.00	1.83	2.31	2.83	3.36	3.91	4.48	5.07	5.69	6.33	6.98	7.64	8.32	9.01
10.00	1.70	2.15	2.64	3.14	3.66	4.20	4.77	5.35	5.96	6.59	7.22	7.88	8.54
11.00	1.58	2.01	2.48	2.95	3.45	3.97	4.51	5.07	5.65	6.25	6.86	7.49	8.14
12.00	1.48	1.88	2.33	2.79	3.26	3.75	4.27	4.81	5.38	5.95	6.54	7.15	7.77

RANGES (MG/CM²) IN IRON

MEV/AMU	O-16	F-19	NE-20	NA-23	MG-24	AL-27	SI-28	P-31	S-32	CL-35	AR-40	K-39	CA-40
0.0125	0.200	0.209	0.200	0.203	0.194	0.198	0.191	0.194	0.187	0.190	0.200	0.186	0.182
0.0160	0.240	0.253	0.243	0.248	0.237	0.243	0.234	0.238	0.231	0.234	0.243	0.231	0.226
0.0200	0.283	0.299	0.288	0.295	0.282	0.290	0.280	0.286	0.277	0.282	0.299	0.279	0.273
0.0250	0.331	0.352	0.340	0.349	0.335	0.345	0.333	0.342	0.332	0.339	0.360	0.336	0.329
0.0320	0.392	0.419	0.406	0.418	0.402	0.416	0.402	0.414	0.402	0.412	0.440	0.409	0.401
0.0400	0.456	0.489	0.474	0.490	0.472	0.490	0.475	0.489	0.476	0.498	0.523	0.487	0.478
0.0500	0.527	0.567	0.552	0.571	0.552	0.574	0.556	0.575	0.560	0.576	0.618	0.576	0.566
0.0600	0.592	0.639	0.622	0.646	0.624	0.650	0.631	0.653	0.637	0.656	0.706	0.658	0.646
0.0700	0.653	0.705	0.687	0.714	0.690	0.720	0.700	0.725	0.708	0.730	0.786	0.733	0.721
0.0800	0.709	0.766	0.747	0.777	0.752	0.786	0.764	0.792	0.774	0.799	0.862	0.804	0.790
0.0900	0.762	0.824	0.803	0.837	0.810	0.847	0.824	0.855	0.836	0.853	0.933	0.870	0.855
0.1000	0.813	0.879	0.857	0.893	0.865	0.905	0.881	0.915	0.894	0.924	0.999	0.933	0.917
0.1250	0.930	1.005	0.979	1.023	0.991	1.037	1.010	1.051	1.028	1.064	1.152	1.075	1.058
0.15	1.038	1.120	1.090	1.140	1.105	1.157	1.128	1.174	1.149	1.190	1.290	1.205	1.185
0.20	1.234	1.329	1.289	1.351	1.309	1.372	1.337	1.394	1.364	1.415	1.536	1.434	1.411
0.32	1.650	1.765	1.701	1.783	1.725	1.807	1.759	1.833	1.793	1.860	2.019	1.884	1.852
0.50	2.219	2.352	2.248	2.349	2.262	2.362	2.292	2.382	2.324	2.406	2.609	2.428	2.382
0.70	2.828	2.972	2.818	2.931	2.809	2.921	2.824	2.927	2.846	2.939	3.180	2.952	2.890
1.00	3.756	3.905	3.667	3.790	3.608	3.733	3.590	3.704	3.587	3.691	3.982	3.684	3.596
1.25	4.574	4.717	4.400	4.524	4.287	4.415	4.230	4.350	4.198	4.308	4.636	4.279	4.166
1.50	5.805	5.931	5.486	5.607	5.280	5.409	5.157	5.281	5.076	5.191	5.568	5.123	4.974
2.00	7.328	7.425	6.816	6.926	6.485	6.612	6.275	6.401	6.129	6.248	6.682	6.130	5.936
2.50	9.391	9.441	8.604	8.693	8.096	8.216	7.764	7.890	7.528	7.651	8.160	7.466	7.212
3.20	12.535	12.505	11.315	11.372	10.535	10.643	10.017	10.143	9.645	9.774	10.400	9.492	9.149
4.00	16.485	16.338	14.702	14.709	13.566	13.657	12.811	12.935	12.267	12.404	13.175	12.003	11.550
5.00	22.04	21.68	19.40	19.32	17.75	17.80	16.64	16.75	15.84	15.98	16.94	15.40	14.79
6.00	29.31	27.67	24.62	24.44	22.37	22.37	20.86	20.95	19.76	19.89	21.05	19.10	18.31
7.00	35.30	34.29	30.37	30.07	27.44	27.38	25.46	25.51	24.01	24.13	25.49	23.09	22.10
8.00	42.99	41.55	36.64	36.19	32.95	32.79	30.43	30.43	28.60	28.68	30.25	27.36	26.16
9.00	51.38	49.44	43.44	42.80	38.88	38.62	35.77	35.71	33.50	33.55	35.33	31.91	30.46
10.00	60.46	57.97	50.75	49.88	45.23	44.84	41.46	41.32	38.71	38.71	40.72	36.73	35.02
11.00	70.23	67.12	58.57	57.44	51.98	51.45	47.50	47.28	44.22	44.16	46.40	41.81	39.82
12.00	80.67	76.89	66.91	65.46	59.14	58.45	53.88	53.55	50.02	49.90	52.36	47.13	44.85

ELECTRONIC STOPPING POWERS (MEV/MG CM⁻²) IN NICKEL

MEV/AMU	O-16	F-19	NE-20	NA-23	MG-24	AL-27	SI-28	P-31	S-32	CL-35	AR-40	K-39	CA-40
0.0125	0.982	0.964	1.027	1.119	1.197	1.272	1.346	1.421	1.490	1.562	1.632	1.699	1.755
0.0160	1.110	1.091	1.162	1.266	1.353	1.439	1.523	1.606	1.685	1.767	1.847	1.923	1.988
0.0200	1.240	1.220	1.299	1.416	1.513	1.609	1.703	1.797	1.884	1.976	2.065	2.149	2.225
0.0250	1.380	1.364	1.452	1.584	1.691	1.799	1.904	2.009	2.107	2.210	2.309	2.404	2.490
0.0320	1.570	1.546	1.646	1.794	1.917	2.039	2.158	2.277	2.387	2.505	2.617	2.724	2.826
0.0400	1.790	1.738	1.850	2.018	2.155	2.293	2.426	2.559	2.684	2.816	2.941	3.053	3.180
0.0500	2.070	1.961	2.088	2.277	2.432	2.586	2.737	2.888	3.029	3.177	3.319	3.456	3.592
0.0500	2.280	2.157	2.306	2.514	2.688	2.859	3.025	3.192	3.348	3.511	3.668	3.820	3.974
0.0700	2.470	2.343	2.512	2.739	2.934	3.123	3.307	3.485	3.656	3.834	4.006	4.170	4.343
0.0800	2.650	2.512	2.702	2.946	3.161	3.368	3.569	3.763	3.949	4.135	4.320	4.499	4.687
0.0900	2.820	2.670	2.881	3.142	3.375	3.600	3.818	4.028	4.228	4.430	4.631	4.823	5.018
0.1000	3.000	2.824	3.057	3.332	3.584	3.828	4.063	4.289	4.505	4.722	4.937	5.143	5.353
0.1250	3.280	3.160	3.446	3.755	4.049	4.333	4.608	4.871	5.124	5.377	5.628	5.869	6.113
0.15	3.45	3.41	3.76	4.09	4.41	4.72	5.02	5.31	5.59	5.88	6.16	6.44	6.72
0.20	3.82	3.91	4.33	4.72	5.10	5.47	5.83	6.18	6.52	6.85	7.19	7.51	7.84
0.32	4.48	4.70	5.25	5.78	6.30	6.80	7.29	7.77	8.24	8.71	9.17	9.62	10.08
0.50	4.94	5.35	6.06	6.77	7.47	8.16	8.84	9.51	10.18	10.85	11.51	12.17	12.83
0.70	5.05	5.71	6.54	7.36	8.19	9.01	9.82	10.63	11.44	12.25	13.06	13.87	14.68
1.00	4.93	5.76	6.68	7.61	8.56	9.51	10.47	11.43	12.40	13.38	14.36	15.35	16.34
1.25	4.76	5.56	6.50	7.47	8.46	9.46	10.48	11.51	12.56	13.61	14.68	15.76	16.86
1.60	4.47	5.23	6.17	7.14	8.13	9.15	10.19	11.25	12.32	13.41	14.52	15.65	16.79
2.00	4.28	4.88	5.78	6.71	7.68	8.67	9.69	10.72	11.77	12.85	13.94	15.04	16.16
2.50	3.78	4.55	5.41	6.31	7.24	8.20	9.18	10.19	11.21	12.25	13.30	14.37	15.46
3.20	3.40	4.13	4.94	5.78	6.66	7.56	8.49	9.44	10.41	11.39	12.39	13.41	14.44
4.00	3.06	3.72	4.47	5.27	6.10	6.97	7.86	8.78	9.73	10.70	11.68	12.68	13.71
5.00	2.69	3.32	4.02	4.73	5.49	6.28	7.10	7.94	8.82	9.71	10.62	11.55	12.53
6.00	2.41	2.99	3.63	4.29	4.99	5.72	6.48	7.27	8.09	8.93	9.79	10.68	11.59
7.00	2.17	2.71	3.32	3.93	4.58	5.26	5.97	6.71	7.49	8.27	9.09	9.93	10.79
8.00	1.99	2.49	3.05	3.63	4.24	4.88	5.55	6.25	6.98	7.73	8.51	9.31	10.14
9.00	1.83	2.30	2.83	3.37	3.95	4.56	5.19	5.86	6.55	7.26	8.01	8.77	9.56
10.00	1.69	2.13	2.64	3.15	3.70	4.27	4.88	5.51	6.17	6.86	7.57	8.30	9.06
11.00	1.58	1.99	2.47	2.97	3.49	4.03	4.61	5.22	5.85	6.51	7.20	7.90	8.64
12.00	1.48	1.87	2.32	2.80	3.30	3.82	4.38	4.96	5.57	6.20	6.86	7.54	8.25

RANGES (MG/CM²) IN NICKEL

MEV/AMU	O-16	F-19	NE-20	NA-23	MG-24	AL-27	SI-28	P-31	S-32	CL-35	AR-40	K-39	CA-40
0.0125	0.220	0.241	0.229	0.231	0.220	0.223	0.214	0.216	0.208	0.210	0.219	0.204	0.199
0.0160	0.265	0.293	0.280	0.284	0.270	0.275	0.264	0.267	0.258	0.261	0.274	0.255	0.248
0.0200	0.313	0.349	0.334	0.340	0.324	0.331	0.318	0.323	0.312	0.316	0.334	0.310	0.303
0.0250	0.368	0.413	0.397	0.405	0.387	0.397	0.381	0.389	0.376	0.382	0.405	0.376	0.367
0.0320	0.438	0.496	0.477	0.489	0.468	0.481	0.464	0.474	0.459	0.468	0.497	0.452	0.451
0.0400	0.509	0.581	0.561	0.577	0.553	0.570	0.550	0.564	0.547	0.559	0.595	0.554	0.541
0.0500	0.588	0.678	0.656	0.676	0.650	0.671	0.649	0.667	0.647	0.663	0.708	0.659	0.644
0.0600	0.659	0.766	0.742	0.766	0.737	0.764	0.739	0.761	0.739	0.758	0.812	0.755	0.739
0.0700	0.725	0.847	0.821	0.850	0.818	0.849	0.822	0.847	0.824	0.846	0.908	0.845	0.827
0.0800	0.786	0.923	0.895	0.927	0.894	0.928	0.899	0.928	0.904	0.929	0.998	0.929	0.909
0.0900	0.843	0.994	0.965	1.000	0.965	1.003	0.972	1.004	0.978	1.006	1.082	1.007	0.986
0.1000	0.897	1.061	1.030	1.069	1.031	1.073	1.040	1.076	1.048	1.079	1.162	1.082	1.059
0.1250	1.022	1.217	1.181	1.228	1.184	1.234	1.197	1.240	1.209	1.246	1.343	1.251	1.226
0.15	1.140	1.360	1.317	1.372	1.323	1.380	1.339	1.388	1.354	1.397	1.508	1.405	1.377
0.20	1.358	1.616	1.561	1.629	1.572	1.640	1.592	1.653	1.613	1.666	1.801	1.678	1.645
0.32	1.817	2.141	2.058	2.150	2.072	2.163	2.099	2.180	2.127	2.199	2.379	2.216	2.172
0.50	2.425	2.818	2.690	2.805	2.695	2.808	2.719	2.821	2.748	2.838	3.070	2.856	2.796
0.70	3.064	3.502	3.323	3.454	3.306	3.434	3.317	3.433	3.337	3.441	3.718	3.451	3.374
1.00	4.025	4.494	4.228	4.373	4.163	4.306	4.141	4.273	4.139	4.257	4.590	4.249	4.144
1.25	4.850	5.333	4.986	5.134	4.867	5.016	4.808	4.947	4.778	4.904	5.276	4.874	4.745
1.50	6.064	6.566	6.091	6.236	5.879	6.031	5.756	5.900	5.677	5.809	6.234	5.741	5.576
2.00	7.527	8.071	7.431	7.565	7.094	7.243	6.883	7.029	6.740	6.875	7.358	6.757	6.546
2.50	9.520	10.088	9.220	9.333	8.703	8.844	8.367	8.511	8.132	8.269	8.826	8.083	7.811
3.20	12.650	13.161	11.932	12.002	11.125	11.247	10.589	10.726	10.207	10.345	11.008	10.051	9.686
4.00	16.625	17.045	15.342	15.341	14.141	14.226	13.333	13.452	12.753	12.882	13.669	12.444	11.960
5.00	22.21	22.46	20.07	19.95	18.29	18.31	17.09	17.17	16.21	16.32	17.27	15.67	15.02
6.00	28.51	28.51	25.31	25.06	22.88	22.82	21.22	21.25	20.00	20.08	21.19	19.13	18.34
7.00	35.52	35.19	31.08	30.67	27.91	27.74	25.72	25.69	24.12	24.16	25.43	22.97	21.92
8.00	43.22	42.51	37.36	36.76	33.36	33.07	30.59	30.48	28.55	28.54	29.98	27.03	25.74
9.00	51.62	50.47	44.17	43.34	39.23	38.80	35.80	35.60	33.28	33.21	34.83	31.35	29.81
10.00	60.72	59.06	51.50	50.39	45.51	44.92	41.37	41.06	38.31	38.17	39.97	35.92	34.10
11.00	70.50	68.29	59.33	57.91	52.19	51.43	47.27	46.84	43.63	43.40	45.39	40.73	38.62
12.00	80.95	78.13	67.68	65.89	59.28	58.30	53.50	52.93	49.24	48.91	51.08	45.78	43.36

ELECTRONIC STOPPING POWERS (MEV/MG CM⁻²) IN COPPER

MEV/AMU	O-16	F-19	NE-20	NA-23	MG-24	AL-27	SI-28	P-31	S-32	CL-35	AR-40	K-39	CA-40
0.0125	0.900	0.968	1.032	1.128	1.206	1.284	1.358	1.438	1.508	1.583	1.654	1.725	1.783
0.0160	1.018	1.096	1.168	1.276	1.365	1.452	1.538	1.625	1.705	1.791	1.872	1.953	2.020
0.0200	1.139	1.225	1.306	1.427	1.526	1.624	1.719	1.818	1.907	2.003	2.092	2.183	2.261
0.0250	1.273	1.369	1.460	1.597	1.706	1.815	1.921	2.032	2.132	2.240	2.339	2.441	2.530
0.0320	1.444	1.553	1.655	1.810	1.934	2.059	2.179	2.304	2.417	2.540	2.653	2.768	2.874
0.0400	1.624	1.747	1.862	2.037	2.176	2.316	2.451	2.592	2.720	2.857	2.984	3.114	3.235
0.0500	1.820	1.972	2.100	2.298	2.455	2.612	2.766	2.924	3.068	3.223	3.365	3.513	3.654
0.0600	1.994	2.166	2.318	2.535	2.712	2.886	3.054	3.229	3.388	3.560	3.717	3.880	4.039
0.0700	2.158	2.353	2.525	2.761	2.959	3.151	3.338	3.525	3.699	3.886	4.059	4.236	4.413
0.0800	2.305	2.521	2.715	2.969	3.187	3.397	3.601	3.806	3.995	4.190	4.376	4.567	4.761
0.0900	2.444	2.682	2.897	3.169	3.404	3.634	3.856	4.094	4.281	4.492	4.694	4.900	5.100
0.1000	2.575	2.836	3.071	3.358	3.614	3.861	4.099	4.337	4.558	4.785	5.000	5.222	5.438
0.1250	2.860	3.173	3.462	3.784	4.082	4.372	4.649	4.926	5.184	5.449	5.701	5.959	6.211
0.15	3.03	3.41	3.77	4.11	4.44	4.75	5.06	5.37	5.66	5.96	6.25	6.55	6.84
0.20	3.50	3.94	4.36	4.77	5.15	5.53	5.89	6.25	6.59	6.94	7.27	7.61	7.95
0.32	4.12	4.70	5.26	5.80	6.33	6.84	7.35	7.84	8.32	8.80	9.28	9.75	10.22
0.50	4.59	5.30	6.01	6.71	7.40	8.08	8.75	9.41	10.07	10.72	11.37	12.02	12.66
0.70	4.71	5.51	6.31	7.11	7.90	8.70	9.49	10.27	11.05	11.84	12.62	13.40	14.18
1.00	4.62	5.49	6.37	7.26	8.16	9.07	9.98	10.90	11.83	12.76	13.69	14.64	15.59
1.25	4.44	5.32	6.22	7.14	8.08	9.03	10.00	10.97	11.96	12.96	13.97	14.99	16.02
1.60	4.18	5.04	5.93	6.85	7.79	8.75	9.73	10.72	11.73	12.75	13.78	14.83	15.88
2.00	3.89	4.71	5.57	6.45	7.35	8.27	9.21	10.16	11.12	12.10	13.08	14.08	15.08
2.50	3.59	4.37	5.18	6.02	6.89	7.78	8.68	9.60	10.53	11.48	12.43	13.39	14.36
3.20	3.27	3.99	4.75	5.53	6.34	7.16	8.00	8.86	9.72	10.59	11.46	12.34	13.22
4.00	2.94	3.62	4.33	5.07	5.85	6.65	7.46	8.30	9.14	10.00	10.87	11.75	12.63
5.00	2.59	3.22	3.88	4.54	5.25	5.98	6.72	7.49	8.26	9.06	9.86	10.68	11.51
6.00	2.32	2.90	3.51	4.13	4.78	5.45	6.14	6.86	7.59	8.34	9.10	9.88	10.66
7.00	2.09	2.64	3.21	3.78	4.39	5.01	5.66	6.34	7.03	7.73	8.45	9.19	9.93
8.00	1.91	2.42	2.95	3.49	4.06	4.65	5.26	5.90	6.55	7.23	7.91	8.62	9.33
9.00	1.76	2.23	2.74	3.25	3.78	4.34	4.92	5.53	6.15	6.79	7.45	8.12	8.81
10.00	1.63	2.07	2.55	3.04	3.54	4.08	4.63	5.21	5.80	6.41	7.04	7.69	8.35
11.00	1.53	1.94	2.39	2.86	3.34	3.85	4.38	4.93	5.50	6.09	6.70	7.32	7.96
12.00	1.43	1.82	2.25	2.70	3.16	3.65	4.15	4.69	5.24	5.80	6.39	6.99	7.61

RANGES (MG/CM²) IN COPPER

MEV/AMU	O-16	F-19	NE-20	NA-23	MG-24	AL-27	SI-28	P-31	S-32	CL-35	AR-40	K-39	CA-40
0.0125	0.241	0.250	0.239	0.241	0.229	0.232	0.223	0.225	0.217	0.219	0.229	0.213	0.208
0.0160	0.291	0.304	0.290	0.294	0.280	0.285	0.274	0.278	0.268	0.271	0.285	0.265	0.258
0.0200	0.343	0.360	0.345	0.351	0.335	0.342	0.329	0.334	0.323	0.327	0.345	0.321	0.313
0.0250	0.403	0.425	0.408	0.416	0.398	0.408	0.393	0.400	0.387	0.393	0.417	0.387	0.378
0.0320	0.479	0.507	0.489	0.500	0.480	0.493	0.475	0.486	0.471	0.479	0.510	0.474	0.463
0.0400	0.557	0.593	0.573	0.588	0.564	0.582	0.562	0.575	0.558	0.570	0.608	0.565	0.552
0.0500	0.646	0.690	0.668	0.687	0.661	0.683	0.660	0.678	0.658	0.673	0.720	0.659	0.655
0.0600	0.727	0.778	0.754	0.777	0.748	0.775	0.750	0.771	0.750	0.768	0.824	0.765	0.749
0.0700	0.801	0.859	0.833	0.860	0.829	0.860	0.833	0.858	0.834	0.856	0.919	0.854	0.836
0.0800	0.871	0.934	0.907	0.938	0.904	0.939	0.910	0.938	0.913	0.938	1.008	0.937	0.918
0.0900	0.937	1.006	0.976	1.010	0.974	1.013	0.982	1.013	0.987	1.015	1.092	1.015	0.994
0.1000	1.000	1.073	1.042	1.079	1.041	1.083	1.050	1.084	1.057	1.087	1.171	1.089	1.066
0.1250	1.145	1.228	1.192	1.236	1.193	1.242	1.205	1.246	1.216	1.252	1.351	1.257	1.231
0.15	1.279	1.371	1.328	1.380	1.331	1.387	1.347	1.393	1.360	1.401	1.514	1.408	1.380
0.20	1.521	1.627	1.571	1.635	1.578	1.646	1.598	1.656	1.616	1.668	1.803	1.677	1.644
0.32	2.022	2.150	2.066	2.153	2.075	2.165	2.101	2.178	2.125	2.195	2.376	2.210	2.165
0.50	2.679	2.830	2.701	2.811	2.700	2.812	2.722	2.820	2.747	2.836	3.068	2.849	2.790
0.70	3.365	3.531	3.348	3.474	3.325	3.453	3.333	3.447	3.350	3.453	3.731	3.450	3.382
1.00	4.393	4.565	4.292	4.431	4.219	4.361	4.193	4.323	4.186	4.303	4.640	4.291	4.185
1.25	5.276	5.443	5.085	5.229	4.957	5.106	4.893	5.030	4.857	4.982	5.361	4.947	4.816
1.60	6.576	6.728	6.238	6.380	6.015	6.168	5.885	6.029	5.802	5.933	6.368	5.861	5.692
2.00	8.164	8.288	7.630	7.764	7.284	7.438	7.068	7.217	6.922	7.060	7.560	6.940	6.726
2.50	10.307	10.384	9.493	9.610	8.971	9.121	8.634	8.787	8.401	8.545	9.128	8.350	8.084
3.20	13.581	13.573	12.319	12.404	11.515	11.656	10.989	11.142	10.617	10.769	11.476	10.486	10.118
4.00	17.716	17.579	15.852	15.883	14.671	14.789	13.890	14.035	13.334	13.491	14.344	13.077	12.594
5.00	23.53	23.16	20.74	20.68	19.01	19.08	17.85	17.97	17.02	17.17	18.21	16.56	15.92
6.00	30.07	29.38	26.16	26.00	23.81	23.82	22.22	22.30	21.07	21.20	22.44	20.36	19.53
7.00	37.34	36.26	32.12	31.83	29.05	28.98	26.97	27.00	25.45	25.57	27.00	24.46	23.42
8.00	45.34	43.79	38.62	38.17	34.74	34.58	32.10	32.07	30.17	30.25	31.89	28.84	27.57
9.00	54.05	51.98	45.66	45.00	40.87	40.59	37.60	37.50	35.21	35.25	37.11	33.50	31.99
10.00	63.49	60.81	53.23	52.33	47.42	47.01	43.46	43.28	40.56	40.55	42.63	38.44	36.65
11.00	73.62	70.29	61.32	60.15	54.40	53.82	49.68	49.39	46.23	46.15	48.45	43.64	41.56
12.00	84.46	80.41	69.93	68.43	61.78	61.03	56.25	55.84	52.19	52.04	54.57	49.09	46.70

ELECTRONIC STOPPING POWERS (MEV/MG CM⁻²) IN SILVER

MEV/AMU	O-16	F-19	NE-20	NA-23	MG-24	AL-27	SI-28	P-31	S-32	CL-35	AR-40	K-39	CA-40
0.0125	0.748	0.871	0.927	1.010	1.079	1.146	1.210	1.276	1.339	1.403	1.463	1.525	1.574
0.0160	0.846	0.985	1.049	1.142	1.220	1.296	1.369	1.444	1.514	1.587	1.656	1.724	1.782
0.0200	0.946	1.101	1.172	1.277	1.364	1.449	1.531	1.614	1.693	1.775	1.851	1.928	1.994
0.0250	1.100	1.232	1.310	1.428	1.526	1.619	1.711	1.805	1.893	1.985	2.070	2.156	2.232
0.0320	1.260	1.393	1.483	1.616	1.725	1.832	1.936	2.041	2.141	2.245	2.342	2.439	2.529
0.0400	1.450	1.569	1.669	1.820	1.943	2.063	2.180	2.299	2.412	2.527	2.637	2.747	2.850
0.0500	1.680	1.771	1.884	2.054	2.194	2.328	2.460	2.594	2.722	2.853	2.976	3.100	3.220
0.0600	1.850	1.949	2.081	2.268	2.425	2.575	2.720	2.869	3.009	3.154	3.291	3.427	3.564
0.0700	2.010	2.118	2.269	2.473	2.649	2.815	2.976	3.134	3.289	3.447	3.596	3.745	3.897
0.0800	2.150	2.271	2.441	2.661	2.854	3.036	3.212	3.386	3.554	3.719	3.880	4.040	4.207
0.0900	2.270	2.414	2.604	2.838	3.047	3.246	3.437	3.625	3.807	3.985	4.159	4.333	4.505
0.1000	2.390	2.556	2.764	3.012	3.240	3.454	3.660	3.862	4.058	4.250	4.438	4.625	4.810
0.1250	2.670	2.864	3.120	3.399	3.665	3.916	4.157	4.393	4.622	4.846	5.065	5.283	5.500
0.15	2.89	3.06	3.38	3.68	3.97	4.25	4.52	4.79	5.05	5.31	5.57	5.82	6.08
0.20	3.22	3.57	3.94	4.29	4.63	4.95	5.26	5.56	5.86	6.15	6.43	6.72	7.00
0.32	3.70	4.31	4.80	5.23	5.74	6.18	6.61	7.03	7.44	7.84	8.23	8.62	9.00
0.50	4.04	4.78	5.40	6.02	6.62	7.21	7.78	8.36	8.92	9.48	10.03	10.58	11.12
0.70	4.04	4.85	5.54	6.23	6.92	7.60	8.27	8.94	9.61	10.27	10.93	11.59	12.25
1.00	3.74	4.52	5.25	6.00	6.76	7.53	8.31	9.10	9.89	10.69	11.50	12.32	13.14
1.25	3.50	4.22	4.97	5.73	6.51	7.31	8.13	8.97	9.82	10.68	11.56	12.45	13.36
1.60	3.25	3.97	4.68	5.42	6.18	6.96	7.76	8.57	9.40	10.24	11.09	11.96	12.84
2.00	3.04	3.70	4.39	5.11	5.85	6.61	7.39	8.19	9.01	9.84	10.69	11.55	12.43
2.50	2.83	3.52	4.18	4.87	5.58	6.30	7.04	7.80	8.57	9.34	10.13	10.93	11.73
3.20	2.60	3.30	3.92	4.56	5.22	5.90	6.58	7.28	7.98	8.68	9.39	10.10	10.82
4.00	2.37	3.10	3.69	4.30	4.93	5.58	6.23	6.89	7.55	8.21	8.87	9.53	10.19
5.00	2.09	2.73	3.27	3.82	4.40	5.00	5.60	6.22	6.85	7.48	8.11	8.76	9.41
6.00	1.87	2.47	2.98	3.49	4.02	4.58	5.15	5.73	6.32	6.91	7.52	8.13	8.75
7.00	1.70	2.25	2.73	3.21	3.71	4.24	4.77	5.32	5.88	6.45	7.02	7.61	8.20
8.00	1.56	2.07	2.53	2.98	3.45	3.94	4.45	4.97	5.50	6.04	6.59	7.15	7.73
9.00	1.44	1.92	2.35	2.78	3.22	3.69	4.17	4.67	5.18	5.70	6.23	6.77	7.32
10.00	1.34	1.79	2.20	2.61	3.04	3.48	3.94	4.42	4.91	5.41	5.92	6.44	6.97
11.00	1.26	1.68	2.07	2.46	2.87	3.30	3.74	4.20	4.68	5.16	5.65	6.16	6.67
12.00	1.19	1.59	1.96	2.34	2.73	3.14	3.57	4.01	4.47	4.93	5.41	5.90	6.40

RANGES (MG/CM²) IN SILVER

MEV/AMU	C-16	F-19	NE-20	NA-23	MG-24	AL-27	SI-28	P-31	S-32	CL-35	AR-40	K-39	CA-40
0.0125	0.328	0.323	0.310	0.313	0.299	0.303	0.292	0.295	0.285	0.288	0.300	0.291	0.274
0.0160	0.389	0.384	0.369	0.375	0.359	0.366	0.352	0.357	0.346	0.350	0.367	0.343	0.335
0.0200	0.453	0.448	0.432	0.440	0.422	0.431	0.416	0.423	0.410	0.416	0.438	0.409	0.400
0.0250	0.524	0.522	0.504	0.515	0.495	0.507	0.490	0.500	0.484	0.492	0.520	0.486	0.475
0.0320	0.613	0.616	0.596	0.611	0.587	0.605	0.585	0.598	0.580	0.592	0.628	0.586	0.574
0.0400	0.703	0.712	0.691	0.710	0.684	0.706	0.683	0.701	0.681	0.696	0.740	0.691	0.677
0.0500	0.801	0.821	0.798	0.822	0.793	0.820	0.795	0.817	0.795	0.814	0.869	0.811	0.794
0.0600	0.889	0.919	0.894	0.924	0.891	0.924	0.897	0.923	0.899	0.922	0.986	0.920	0.902
0.0700	0.970	1.010	0.983	1.017	0.982	1.020	0.990	1.021	0.995	1.021	1.095	1.022	1.002
0.0800	1.045	1.094	1.066	1.104	1.066	1.108	1.077	1.112	1.084	1.114	1.196	1.116	1.094
0.0900	1.116	1.174	1.143	1.185	1.145	1.192	1.158	1.197	1.167	1.201	1.291	1.205	1.181
0.1000	1.184	1.249	1.216	1.262	1.219	1.270	1.235	1.277	1.246	1.282	1.330	1.238	1.263
0.1250	1.340	1.421	1.383	1.438	1.390	1.449	1.409	1.460	1.425	1.469	1.583	1.478	1.450
0.15	1.483	1.580	1.535	1.598	1.544	1.611	1.568	1.625	1.586	1.637	1.766	1.649	1.618
0.20	1.742	1.864	1.806	1.883	1.820	1.901	1.850	1.920	1.875	1.937	2.093	1.953	1.917
0.32	2.293	2.438	2.351	2.455	2.371	2.478	2.411	2.505	2.446	2.531	2.740	2.556	2.510
0.50	3.034	3.187	3.053	3.184	3.065	3.199	3.106	3.225	3.145	3.253	3.523	3.282	3.220
0.70	3.824	3.974	3.782	3.932	3.772	3.925	3.801	3.938	3.833	3.958	4.282	3.981	3.900
1.00	5.060	5.192	4.894	5.060	4.823	4.994	4.812	4.966	4.814	4.956	5.348	4.956	4.841
1.25	6.166	6.280	5.872	6.040	5.727	5.902	5.662	5.823	5.624	5.773	6.213	5.741	5.594
1.60	7.827	7.904	7.324	7.484	7.050	7.227	6.895	7.059	6.789	6.944	7.448	6.859	6.662
2.00	9.863	9.888	9.089	9.232	8.647	8.819	8.374	8.539	8.179	8.338	8.917	8.185	7.927
2.50	12.593	12.521	11.423	11.537	10.747	10.910	10.314	10.478	9.999	10.163	10.838	9.920	9.583
3.20	16.726	16.425	14.884	14.956	13.862	14.012	13.196	13.359	12.710	12.885	13.711	12.520	12.070
4.00	21.890	21.180	19.093	19.113	17.648	17.778	16.695	16.861	16.008	16.203	17.218	15.701	15.118
5.00	29.10	27.73	24.86	24.80	22.81	22.90	21.44	21.60	20.47	20.68	21.94	19.97	19.21
6.00	37.20	35.07	31.27	31.10	28.52	28.55	26.66	26.80	25.33	25.55	27.06	24.60	23.62
7.00	46.16	43.13	38.29	37.98	34.74	34.68	32.32	32.42	30.59	30.79	32.57	29.56	28.34
8.00	55.98	51.93	45.90	45.43	41.45	41.29	38.40	38.45	36.22	36.40	38.45	34.85	33.36
9.00	66.65	61.45	54.12	53.43	48.65	48.37	44.90	44.88	42.21	42.37	44.69	40.45	38.68
10.00	78.13	71.69	62.91	61.97	56.32	55.89	51.81	51.70	48.55	48.67	51.27	46.36	44.28
11.00	90.42	82.62	72.28	71.04	64.45	63.86	59.09	58.89	55.23	55.29	58.19	52.55	50.14
12.00	103.51	94.25	82.22	80.62	73.03	72.24	66.76	66.44	62.23	62.23	65.42	59.02	56.26

ELECTRONIC STOPPING POWERS (MEV/MG CM⁻²) IN GOLD

MEV/AMU	O-16	F-19	NE-20	NA-23	MG-24	AL-27	SI-28	P-31	S-32	CL-35	AR-40	K-39	CA-40
0.0125	0.387	0.479	0.507	0.547	0.579	0.611	0.641	0.672	0.700	0.729	0.756	0.732	0.801
0.0150	0.438	0.542	0.573	0.619	0.656	0.692	0.725	0.759	0.792	0.824	0.856	0.884	0.908
0.0200	0.490	0.606	0.640	0.692	0.734	0.772	0.811	0.849	0.885	0.922	0.957	0.988	1.016
0.0250	0.548	0.679	0.717	0.775	0.823	0.867	0.909	0.952	0.992	1.033	1.071	1.107	1.140
0.0320	0.653	0.769	0.814	0.880	0.933	0.982	1.031	1.079	1.125	1.171	1.215	1.256	1.295
0.0400	0.775	0.869	0.913	0.993	1.052	1.108	1.164	1.219	1.270	1.322	1.372	1.418	1.463
0.0500	0.883	0.989	1.046	1.130	1.199	1.263	1.325	1.388	1.446	1.506	1.563	1.614	1.668
0.0600	0.969	1.102	1.168	1.262	1.341	1.412	1.482	1.551	1.617	1.683	1.747	1.806	1.866
0.0700	1.060	1.212	1.290	1.395	1.483	1.564	1.642	1.718	1.790	1.864	1.934	1.999	2.068
0.0800	1.160	1.311	1.400	1.512	1.611	1.700	1.787	1.870	1.951	2.027	2.104	2.175	2.251
0.0900	1.250	1.412	1.512	1.633	1.742	1.841	1.936	2.028	2.115	2.199	2.283	2.351	2.440
0.1000	1.360	1.502	1.614	1.744	1.862	1.969	2.073	2.172	2.267	2.359	2.450	2.534	2.620
0.1250	1.570	1.725	1.867	2.017	2.160	2.289	2.414	2.533	2.648	2.757	2.867	2.967	3.071
0.15	1.70	1.92	2.10	2.26	2.42	2.57	2.71	2.85	2.98	3.11	3.24	3.36	3.49
0.20	1.92	2.20	2.42	2.62	2.81	2.98	3.15	3.31	3.47	3.62	3.77	3.91	4.05
0.32	2.26	2.67	2.96	3.23	3.49	3.73	3.96	4.19	4.40	4.61	4.81	5.01	5.20
0.50	2.53	3.02	3.40	3.77	4.13	4.48	4.82	5.15	5.48	5.79	6.11	6.41	6.72
0.70	2.61	3.17	3.60	4.03	4.45	4.86	5.27	5.67	6.06	6.44	6.82	7.20	7.57
1.00	2.52	3.13	3.60	4.06	4.53	4.99	5.45	5.90	6.35	6.79	7.23	7.66	8.10
1.25	2.38	3.05	3.53	4.00	4.48	4.95	5.42	5.89	6.35	6.81	7.26	7.71	8.15
1.60	2.25	2.91	3.39	3.87	4.35	4.83	5.31	5.79	6.26	6.73	7.20	7.65	8.11
2.00	2.14	2.76	3.23	3.70	4.19	4.67	5.16	5.64	6.12	6.60	7.08	7.55	8.02
2.50	2.02	2.60	3.06	3.53	4.01	4.50	4.99	5.48	5.98	6.47	6.96	7.43	7.94
3.20	1.88	2.42	2.87	3.34	3.82	4.30	4.80	5.30	5.80	6.30	6.80	7.31	7.81
4.00	1.73	2.25	2.69	3.15	3.62	4.11	4.60	5.11	5.62	6.13	6.65	7.17	7.70
5.00	1.55	2.04	2.45	2.87	3.30	3.75	4.21	4.68	5.16	5.64	6.12	6.62	7.12
6.00	1.41	1.86	2.25	2.64	3.05	3.48	3.91	4.36	4.81	5.27	5.74	6.21	6.69
7.00	1.29	1.72	2.08	2.45	2.84	3.24	3.65	4.08	4.51	4.95	5.40	5.85	6.32
8.00	1.19	1.59	1.94	2.29	2.66	3.04	3.43	3.84	4.26	4.68	5.11	5.56	6.01
9.00	1.11	1.48	1.81	2.15	2.50	2.86	3.24	3.63	4.03	4.44	4.85	5.28	5.72
10.00	1.04	1.39	1.71	2.03	2.37	2.72	3.08	3.46	3.84	4.24	4.64	5.06	5.48
11.00	0.98	1.31	1.62	1.93	2.25	2.59	2.94	3.31	3.68	4.07	4.46	4.87	5.28
12.00	0.92	1.24	1.53	1.84	2.14	2.47	2.81	3.16	3.52	3.90	4.28	4.67	5.07

RANGES (MG/CM²) IN GOLD

MEV/AMU	O-16	F-19	NE-20	NA-23	MG-24	AL-27	SI-28	P-31	S-32	CL-35	AR-40	K-39	CA-40
0.0125	0.647	0.610	0.587	0.594	0.570	0.578	0.557	0.562	0.544	0.547	0.567	0.534	0.521
0.0160	0.764	0.721	0.697	0.708	0.681	0.692	0.669	0.677	0.657	0.663	0.690	0.650	0.636
0.0200	0.886	0.837	0.811	0.827	0.796	0.813	0.787	0.799	0.776	0.786	0.822	0.773	0.757
0.0250	1.025	0.970	0.941	0.963	0.929	0.952	0.923	0.940	0.915	0.928	0.975	0.918	0.899
0.0320	1.197	1.138	1.107	1.137	1.099	1.131	1.097	1.122	1.093	1.113	1.175	1.105	1.084
0.0400	1.366	1.311	1.278	1.317	1.274	1.316	1.279	1.311	1.279	1.306	1.384	1.301	1.277
0.0500	1.550	1.505	1.469	1.519	1.471	1.524	1.483	1.526	1.489	1.525	1.622	1.525	1.498
0.0600	1.717	1.679	1.641	1.701	1.649	1.713	1.668	1.720	1.681	1.724	1.839	1.729	1.700
0.0700	1.869	1.838	1.798	1.866	1.811	1.884	1.837	1.897	1.855	1.906	2.038	1.916	1.884
0.0800	2.010	1.984	1.942	2.018	1.960	2.042	1.992	2.060	2.016	2.075	2.222	2.089	2.055
0.0900	2.140	2.120	2.075	2.160	2.098	2.188	2.136	2.211	2.165	2.231	2.393	2.250	2.214
0.1000	2.260	2.248	2.200	2.292	2.227	2.325	2.271	2.353	2.305	2.377	2.553	2.400	2.363
0.1250	2.530	2.537	2.482	2.591	2.518	2.633	2.573	2.672	2.619	2.706	2.914	2.739	2.698
0.15	2.771	2.795	2.730	2.856	2.775	2.906	2.841	2.952	2.896	2.996	3.231	3.037	2.992
0.20	3.209	3.251	3.168	3.321	3.228	3.384	3.310	3.446	3.382	3.504	3.787	3.550	3.508
0.32	4.121	4.180	4.053	4.256	4.133	4.340	4.245	4.426	4.345	4.511	4.889	4.593	4.529
0.50	5.317	5.375	5.178	5.431	5.260	5.516	5.385	5.613	5.503	5.713	6.198	5.812	5.727
0.70	6.558	6.599	6.317	6.606	6.374	6.667	6.490	6.753	6.606	6.851	7.427	6.951	6.839
1.00	8.428	8.406	7.980	8.308	7.973	8.306	8.051	8.354	8.147	8.431	9.127	8.518	8.363
1.25	10.061	9.941	9.381	9.732	9.302	9.662	9.336	9.666	9.403	9.715	10.504	9.783	9.590
1.60	12.481	12.173	11.403	11.777	11.203	11.592	11.161	11.521	11.177	11.521	12.436	11.556	11.308
2.00	15.397	14.854	13.820	14.207	13.450	13.864	13.298	13.688	13.242	13.618	14.673	13.603	13.288
2.50	19.245	18.401	17.001	17.388	16.377	16.807	16.055	16.474	15.884	16.293	17.519	16.200	15.791
3.20	24.997	23.708	21.728	22.078	20.670	21.104	20.059	20.499	19.686	20.128	21.585	19.896	19.343
4.00	32.102	30.226	27.489	27.753	25.834	26.242	24.826	25.263	24.168	24.631	26.341	24.202	23.465
5.00	41.88	39.11	35.29	35.41	32.78	33.13	31.20	31.61	30.12	30.59	32.61	29.87	28.87
6.00	52.71	48.88	43.81	43.77	40.35	40.61	38.10	38.47	36.54	37.01	39.36	35.95	34.67
7.00	64.58	59.52	53.05	52.81	48.50	48.66	45.51	45.83	43.41	43.87	46.55	42.41	40.82
8.00	77.47	71.02	63.00	62.50	57.24	57.27	53.42	53.66	50.71	51.14	54.16	49.25	47.31
9.00	91.39	83.40	73.65	72.86	66.55	66.42	61.82	61.96	58.43	58.82	62.19	56.45	54.13
10.00	106.30	96.62	85.01	83.85	76.42	76.10	70.69	70.71	66.56	66.89	70.61	63.99	61.28
11.00	122.14	110.66	97.02	95.45	86.81	86.28	79.99	79.87	75.06	75.32	79.40	71.85	68.71
12.00	133.95	125.54	109.71	107.66	97.72	96.95	89.73	89.46	83.94	84.11	88.56	80.03	76.44