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Energy Loss And Energy Loss Straggling In Stripper Foils

G. R. Young

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Collider Accelerator Department

Brookhaven National Laboratory

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DISCLAIMER

RHIC-PG-38

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Glenn Young

February 27, 1984

Brookhaven National Laboratory

2/27/84

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In the following tables, values for the kinetic energy loss per a.m.u. are given for stripping at the tandem (or linac) exit and at the booster exit.

For the tandem energies, tables of Northcliffe and Schilling were used:

LC Northcliffe and RF Schilling, Nuclear Data Tables A7, 233-463 (1970)

A relevant subset, for ^{12}C, ^{32}S, ^{63}Cu, ^{127}I and ^{197}Au plus some explanatory material, is attached.

For the booster energies, tables of Ziegler were used:

JF Ziegler, "The Stopping Powers & Ranges of Ions in Matter" volume 5
library # QC 794.6.S8

The Tandem Van de Graaff has a copy in the control room; the library does not have the relevant volume. Tables for all ions stopping in C, Cu and Ta foils are attached.

At the tandem exit, the effect of energy loss & energy loss straggling is very small for ^{12}C and ^{32}S. For heavier ions such as ^{127}I and ^{197}Au the straggling leads to an increase in σ_E/E to about 10^{-3}, which actually might help with RF capture at injection into the booster.

The rule of thumb I use is $FWHM_{straggling} = 25\% \, \Delta E_{loss}$, so the rms $\sigma = \frac{1}{2.35} FWHM$ becomes

$$\sigma_{straggling} = 0.106 * \Delta E_{loss}$$

2/21/84

Energy loss, Tandem Exit, Carbon foils

Ion	E/A (MeV/A)	ΔE (MeV/A) 5 μg/cm²	10 μg/cm²	20 μg/cm²	$\sigma_{straggling}$ (MeV/A) [×10⁻³] 5 μg/cm²	10 μg/cm²	20 μg/cm²
^{12}C	6.5	.000863	.00173	.00345	.091	.183	.366
(Z=6)	7	.000812	.00162	.00325	.086	.172	.344
	7.5	.000771	.00154	.00308	.082	.163	.326
	8	.00073	.00146	.00292	.077	.155	.309
	8.5	.00070	.00139	.00279	.074	.147	.296
^{32}S	3.5	.00245	.00490	.00980	.260	.519	1.04
(Z=16)	4	.00226	.00452	.00904	.240	.479	.958
	4.5	.00214	.00428	.00856	.227	.454	.907
	5	.00202	.00404	.00807	.214	.454	.855
	5.5	.00192	.00384	.00769	.204	.407	.815
^{63}Cu	2	.00306	.00612	.0122	.324	.649	1.29
	2.5	.00292	.00584	.0117	.309	.619	1.24
	3	.00278	.00556	.0111	.295	.589	1.18
	3.5	.00266	.00533	.0107	.282	.565	1.13
	4	.00255	.00509	.0102	.270	.539	1.08
^{127}I	.5	.00243	.00487	.00974	.258	.516	1.03
	1	.00289	.00578	.0116	.306	.613	1.23
	1.5	.00290	.00579	.0116	.307	.614	1.23
	2	.00286	.00572	.0114	.303	.606	1.21
^{197}Au	.5	.00206	.00412	.00823	.218	.437	.872
	1	.00262	.00523	.0105	.278	.554	1.11
	1.5	.00275	.00549	.01099	.292	.582	1.16

2/27/84

Energy Loss, Booster Exit, Copper foils

Ion	MeV/A	ΔE (MeV/A) 10 mg/cm²	40 mg/cm²	70 mg/cm²	100 mg/cm²	$\sigma_{straggle}$ (MeV/A) 10 mg/cm²	40 mg/cm²	70 mg/cm²	100 mg/cm²
^{32}S	300	.194	.775	1.356	1.938	.021	.082	.144	.205
	350	.178	.713	1.247	1.781	.019	.076	.132	.189
	400	.166	.663	1.159	1.656	.018	.070	.122	.176
	450	.159	.638	1.116	1.594	.017	.068	.118	.169
	500	.150	.600	1.050	1.500	.016	.064	.111	.159
^{63}Cu	300	.325	1.302	2.278	3.254	.034	.138	.235	.345
	350	.286	1.143	2.000	2.857	.030	.121	.212	.303
	400	.275	1.098	1.922	2.746	.029	.116	.204	.291
	450	.259	1.035	1.811	2.587	.027	.110	.192	.274
	500	.248	.990	1.733	2.476	.026	.105	.184	.262
^{127}I	300	.527	2.110	3.693	5.276	.056	.224	.391	.559
	350	.488	1.953	3.417	4.882	.052	.207	.362	.517
	400	.457	1.827	3.197	4.567	.048	.194	.339	.484
	450	.441	1.764	3.087	4.409	.047	.187	.327	.467
	500	.417	1.669	2.921	4.173	.044	.177	.310	.442
^{197}Au	300	.761	3.046	5.330	7.614	.081	.323	.565	.807
	350	.701	2.802	4.904	7.005	.074	.297	.520	.742
	400	.660	2.639	4.619	6.599	.070	.280	.490	.699
	450	.635	2.538	4.442	6.345	.067	.269	.471	.673
	500	.609	2.437	4.264 ↑	6.091	.065	.258	.452 ↑	.646

The FWHM due to energy loss straggling is ~25% of the energy loss, conservatively.
The rms is then $\sigma_{straggle} = \frac{1}{2.35} FWHM_{straggle} = 0.106\ E_{loss}$.

Considering values for gold, at the tandem exit carbon stripper foils of 20 $\mu g/cm^2$ can be used, while at the booster exit copper foils of ~60 mg/cm^2 must be used.

For the booster, values of $\sigma_{straggling}/E$ of $1-2 \times 10^{-3}$ result. Two comments apply.

1) If the bunches from the booster are manipulated to a total time length of 14 nsec, then for (e.g.) 350 MeV $^{197}Au^{36+}$ leaving the booster and hitting a stripper, a bucket area of 0.2 eV/A/sec corresponds to $\sigma_{E_{max}} = 3.87$ MeV/A. Adding the straggling due to a 70 mg/cm^2 copper foil, which is $\sigma_{straggling} = 0.520$ MeV/A, in quadrature, gives

$\sigma_{E_{total}} = \sqrt{\sigma_{E_{max}}^2 + \sigma_{straggle}^2} = 3.90$ MeV/A, or a 1% change in bucket area. If σ_E is less than $\sigma_{E_{max}}$ (~ 1.1% rms energy spread) then there should be no problem matching AGS RF buckets

2) At the expense of a few percent in stripping efficiency, a gold foil of about 30 mg/cm^2 can be substituted for the 70 mg/cm^2 of copper. As the energy loss of gold in copper at 350 MeV/A is ~ 14 MeV/mg/cm^2 while for gold in gold it is ~11 MeV/mg/cm^2, the straggling width is reduced by $\frac{30}{70}\,\frac{11}{14} = 0.34$.

Thus, straggling due to stripper foils does not appear to cause problems.

NUCLEAR DATA TABLES, A7, 233–463 (1970)

RANGE AND STOPPING - POWER TABLES FOR HEAVY IONS*

L. C. NORTHCLIFFE and R. F. SCHILLING

Cyclotron Institute, Texas A&M University, College Station, Texas 77843

The electronic stopping power and range (corrected for nuclear stopping) are tabulated for representative ions of all atomic numbers $1 \leqslant z \leqslant 103$ in 24 different material media at 38 energies distributed logarithmically throughout the region $0.0125 \leqslant E/m \leqslant 12$ MeV/amu. The media include twelve solid elements (Be, C, Al, Ti, Ni, Ge, Zr, Ag, Eu, Ta, Au, and U), nine gaseous elements (H, He, N, O, Ne, Ar, Kr, Xe, and Rn), and three compounds (polyethylene, Mylar, and water). The tables are based on an investigation of the systematic relationships between observed data, guided by simple theoretical expectations and extrapolated into regions where no measurements have been made.

*This work was supported by the U. S. Atomic Energy Commission

Similarly, most of the points plotted in Fig. 8 are taken from the smoothed curves of Fig. 6 at the six indicated energies. In addition, several values of the relative stopping power at 4.43 MeV[28] are shown to verify its Z-dependence. The smoothed, isoergic curves through the data provide an estimate of the relative stopping power of O, Ne, Xe, and Rn as well as of other gaseous media. The complete family of relative stopping-power curves for gases is shown in Fig. 10.

G. *Stopping Power of Compounds*

Although there is some evidence that the Bragg additivity rule relating the stopping power of a compound to that of its constituents does not strictly hold,[30] the deviations from the rule are not large and have been observed mainly in the stopping power of hydrocarbons for protons. These deviations are poorly understood and difficult to systematize, and they have little effect on the calculated range of a high-energy ion. For present purposes the additivity rule is assumed to hold well enough to use in the calculation of stopping powers of polyethylene, Mylar, and water.

According to this rule, the relative stopping power of a compound of molecular weight M containing N_i atoms of atomic weight A_i, etc., is given by the formula

$$\frac{(dE/dx)_{\text{compound}}}{(dE/dx)_{\text{Al}}} = \frac{1}{M} \sum_i \frac{N_i A_i (dE/dx)_i}{(dE/dx)_{\text{Al}}},$$

where $(dE/dx)_i$ is the stopping power of the pure element labeled by subscript i. In the case of Mylar ($C_{10}H_8O_4$) for example we have

$$\frac{(dE/dx)_{\text{Mylar}}}{(dE/dx)_{\text{Al}}} = \frac{1}{192}\left[120\,\frac{(dE/dx)_{\text{C}}}{(dE/dx)_{\text{Al}}} + 8\,\frac{(dE/dx)_{\text{H}}}{(dE/dx)_{\text{Al}}} + 64\,\frac{(dE/dx)_{\text{O}}}{(dE/dx)_{\text{Al}}}\right].$$

This formula for Mylar and the analogous formulas for polyethylene ($[CH_2]_n$) and water (H_2O) were used to calculate relative stopping powers for these compounds from the relative stopping-power curves for elements (Figs. 9 and 10).[31]

H. *Calculation of Stopping-Power Tables*

As described in Part D of this section, each stopping-power curve of Fig. 2 was fitted at nine points in two sections by a general second-order polynomial with five coefficients (yielding ten coefficients per curve). The nine points were approximately equispaced on the scale of $\log E/m$ in the region $0.0125 \leqslant E/m \leqslant 12$ MeV/amu. By the interpolation method described in Part E of this section the stopping power for an intermediate ion was determined at the same nine E/m values, and these nine points were fitted by the two-section polynomial (with $2 \times 5 = 10$ coefficients) which was used to calculate the stopping power for that ion in aluminum at any desired energy.

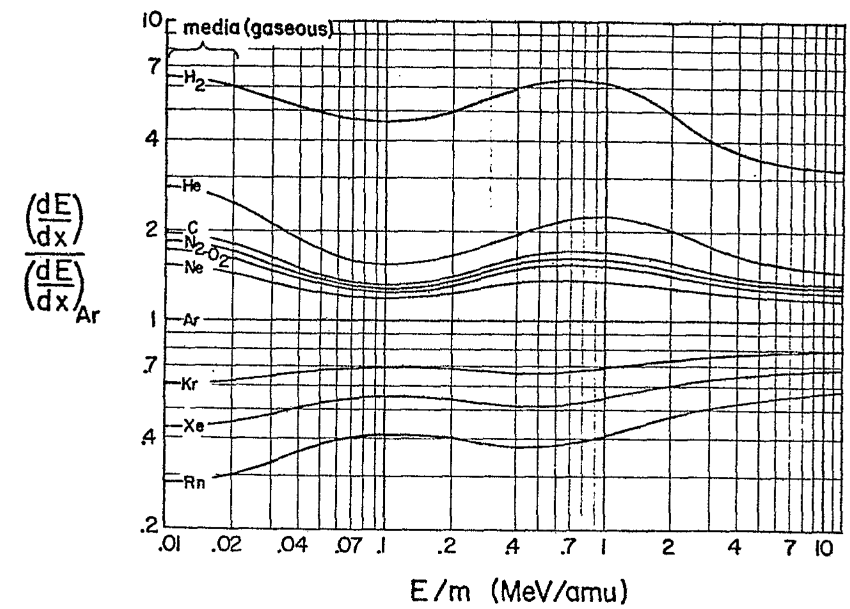


Fig. 10. Adopted curves for stopping power of various gases relative to Ar

Table II. Unit conversion factors

To convert range or stopping power values of the main tabulation into units specified at the head of a column, multiply by the column entry for the desired material medium. The formula for the conversion factor is given at the foot of each column.

The 1959 international atomic weights W are for natural isotopic abundances on the chemical scale and are taken from the "CRC Handbook of Chemistry and Physics" (Chemical Rubber Publishing Co., Cleveland, 1966) 47th edition.

The densities ρ (in units of g/cm^3 at 20° C and 760 torr) are from the same source (gas densities have been converted to these standard conditions). The density of Mylar is that specified by the manufacturer (E. I. DuPont de Nemours and Co., Wilmington, Delaware). That of polyethylene is taken from the 39th edition of the CRC Handbook.

			Range	Stopping Power	
	W	ρ	for (mm) multiply by	for (MeV/mm) multiply by	for (eV cm^2/atom)x 10^{-15} multiply by
Be	9.013	1.848	.005411	184.8	14.96
C	12.011	2.25	.004444	225	19.94
Al	26.98	2.6989	.003705	269.9	44.80
Ti	47.90	4.54	.002203	454	79.53
Ni	58.71	8.902	.001123	890.2	97.48
Ge	72.60	5.323	.001879	532.3	120.54
Zr	91.22	6.53	.001531	653	151.45
Ag	107.873	10.50	.0009524	1050	179.1
Eu	152.0	5.259	.0019015	525.9	252.4
Ta	180.95	16.6	.0006024	1660	300.4
Au	197.0	19.32	.0005176	1932	327.1
U	238.07	18.95	.0005277	1895	395.3
H	1.008	.00008375	119.4	.008375	1.674
He	4.003	.0001663	60.13	.01663	6.646
N	14.008	.0011652	8.582	.11652	23.26
O	16	.0013315	7.510	.13315	26.57
Ne	20.183	.0008388	11.92	.08388	33.51
Ar	39.944	.0016619	6.017	.1662	66.32
Kr	83.80	.003481	2.873	.3481	139.1
Xe	131.30	.005485	1.823	.5485	218.0
Rn	222	.009066	1.103	.9066	368.6
Mylar		1.395	.007168	139.5	
$(CH_2)_n$		.92	.01087	92	
Water		1.0	.01	100	
Conversion factor formula			0.01/ρ	100ρ	1.6603W

$^{12}_{6}C$ IONS

ENERGY PER MASS UNIT | ELECTRONIC STOPPING POWER IN UNITS OF MEV/(MG/SQ CM) | ENERGY FOR A=12

MEV/AMU	BE	C	AL	TI	NI	GE	ZR	AG	EU	TA	AU	U	MEV
0.0125	2.558	2.116	1.550	1.031	0.837	0.760	0.704	0.651	0.414	0.354	0.326	0.279	0.1500
0.0160	2.894	2.394	1.754	1.166	0.947	0.859	0.796	0.737	0.468	0.401	0.368	0.316	0.1920
0.0200	3.236	2.677	1.961	1.304	1.059	0.961	0.890	0.824	0.524	0.446	0.412	0.353	0.2400
0.0250	3.618	2.993	2.192	1.458	1.184	1.074	0.995	0.921	0.585	0.501	0.462	0.395	0.3000
0.0320	4.088	3.388	2.481	1.650	1.342	1.220	1.126	1.042	0.662	0.568	0.523	0.449	0.3840
0.0400	4.559	3.797	2.773	1.850	1.509	1.376	1.267	1.173	0.746	0.642	0.591	0.508	0.4800
0.0500	5.042	4.226	3.078	2.062	1.690	1.539	1.419	1.314	0.834	0.725	0.668	0.574	0.6000
0.0600	5.455	4.616	3.342	2.253	1.852	1.681	1.554	1.441	0.922	0.802	0.740	0.637	0.7200
0.0700	5.806	4.967	3.573	2.423	2.001	1.815	1.679	1.558	1.000	0.875	0.811	0.697	0.8400
0.0800	6.108	5.293	3.775	2.578	2.133	1.933	1.786	1.661	1.076	0.944	0.872	0.751	0.9600
0.0900	6.365	5.587	3.951	2.718	2.252	2.047	1.885	1.754	1.150	1.006	0.932	0.804	1.0800
0.1000	6.587	5.856	4.104	2.844	2.364	2.142	1.970	1.843	1.215	1.063	0.985	0.850	1.2000
0.1250	6.991	6.450	4.397	3.095	2.585	2.344	2.155	2.018	1.352	1.183	1.106	0.956	1.5000
0.1600	7.286	7.082	4.644	3.325	2.796	2.536	2.327	2.183	1.486	1.305	1.224	1.068	1.9200
0.2000	7.407	7.518	4.785	3.479	2.943	2.665	2.445	2.292	1.589	1.402	1.316	1.148	2.4000
0.2500	7.402	7.786	4.860	3.592	3.052	2.770	2.537	2.377	1.677	1.482	1.390	1.215	3.0000
0.3200	7.294	7.925	4.889	3.681	3.144	2.870	2.616	2.444	1.750	1.555	1.459	1.283	3.8400
0.4000	7.140	7.926	4.884	3.721	3.204	2.930	2.671	2.496	1.817	1.617	1.519	1.333	4.8000
0.5000	6.950	7.810	4.860	3.757	3.256	2.989	2.722	2.537	1.876	1.672	1.572	1.385	6.0000
0.6000	6.692	7.537	4.773	3.738	3.255	2.998	2.721	2.535	1.895	1.695	1.597	1.418	7.2000
0.7000	6.456	7.247	4.682	3.698	3.235	2.982	2.701	2.519	1.901	1.699	1.606	1.423	8.4000
0.8000	6.229	6.944	4.587	3.655	3.206	2.967	2.683	2.500	1.899	1.706	1.610	1.431	9.6000
0.9000	6.025	6.658	4.490	3.601	3.174	2.945	2.658	2.474	1.899	1.706	1.612	1.437	10.800
1.0000	5.828	6.382	4.392	3.553	3.136	2.912	2.631	2.446	1.889	1.700	1.607	1.436	12.000
1.2500	5.382	5.764	4.150	3.403	3.029	2.822	2.544	2.361	1.855	1.672	1.581	1.415	15.000
1.6000	4.844	5.077	3.826	3.195	2.854	2.667	2.403	2.219	1.779	1.611	1.523	1.366	19.200
2.0000	4.327	4.515	3.492	2.958	2.657	2.493	2.235	2.071	1.676	1.529	1.446	1.303	24.000
2.5000	3.799	3.981	3.132	2.690	2.434	2.286	2.045	1.898	1.560	1.419	1.347	1.222	30.000
3.2000	3.240	3.423	2.725	2.371	2.158	2.030	1.820	1.684	1.406	1.286	1.221	1.109	38.400
4.0000	2.770	2.950	2.368	2.081	1.906	1.795	1.617	1.492	1.262	1.156	1.101	1.002	48.000
5.0000	2.347	2.516	2.034	1.802	1.660	1.566	1.412	1.306	1.119	1.021	0.978	0.893	60.000
6.0000	2.041	2.194	1.784	1.591	1.468	1.392	1.256	1.161	0.995	0.919	0.880	0.808	72.000
7.0000	1.804	1.948	1.590	1.425	1.317	1.252	1.132	1.048	0.907	0.833	0.800	0.736	84.000
8.0000	1.619	1.752	1.436	1.293	1.196	1.137	1.034	0.955	0.830	0.766	0.735	0.678	96.000
9.0000	1.472	1.592	1.310	1.183	1.097	1.044	0.950	0.879	0.767	0.708	0.680	0.629	108.00
10.0000	1.348	1.459	1.206	1.094	1.013	0.966	0.879	0.816	0.712	0.660	0.636	0.587	120.00
11.0000	1.245	1.349	1.118	1.017	0.943	0.900	0.819	0.763	0.666	0.619	0.598	0.551	132.00
12.0000	1.158	1.254	1.042	0.950	0.883	0.843	0.768	0.717	0.626	0.584	0.563	0.519	144.00

MEV/AMU	H	HE	N	O	NE	AR	KR	XE	RN	MYLAR	$(CH_2)_n$	WATER	MEV
0.0125	5.814	2.481	1.643	1.544	1.372	0.905	0.555	0.394	0.260	2.079	2.645	2.019	0.1500
0.0160	6.455	2.722	1.829	1.721	1.529	1.033	0.640	0.456	0.303	2.338	2.975	2.247	0.1920
0.0200	7.020	2.883	1.994	1.879	1.681	1.167	0.728	0.529	0.354	2.592	3.296	2.449	0.2400
0.0250	7.630	3.028	2.175	2.050	1.855	1.331	0.851	0.620	0.449	2.872	3.655	2.670	0.3000
0.0320	8.459	3.210	2.379	2.265	2.069	1.550	1.007	0.759	0.528	3.225	4.113	2.952	0.3840
0.0400	9.291	3.378	2.587	2.490	2.294	1.792	1.187	0.910	0.646	3.591	4.582	3.245	0.4800
0.0500	10.188	3.583	2.829	2.752	2.561	2.065	1.391	1.083	0.785	3.983	5.079	3.577	0.6000
0.0600	11.163	3.820	3.098	2.995	2.831	2.330	1.584	1.247	0.916	4.348	5.551	3.904	0.7200
0.0700	12.113	4.102	3.359	3.262	3.094	2.580	1.758	1.397	1.033	4.695	5.989	4.245	0.8400
0.0800	13.100	4.398	3.628	3.526	3.356	2.820	1.933	1.540	1.144	5.028	6.406	4.591	0.9600
0.0900	14.027	4.706	3.892	3.793	3.611	3.046	2.094	1.675	1.241	5.342	6.792	4.931	1.0800
0.1000	15.021	5.040	4.178	4.047	3.850	3.263	2.253	1.793	1.330	5.635	7.166	5.265	1.2000
0.1250	17.456	5.826	4.815	4.639	4.432	3.742	2.577	2.053	1.526	6.305	8.024	6.063	1.5000
0.1600	20.573	6.859	5.628	5.424	5.146	4.286	2.940	2.341	1.737	7.091	9.009	7.105	1.9200
0.2000	23.495	7.800	6.388	6.135	5.800	4.713	3.206	2.546	1.881	7.723	9.800	8.063	2.4000
0.2500	26.341	8.719	7.071	6.809	6.357	5.025	3.397	2.663	1.959	8.233	10.434	8.981	3.0000
0.3200	29.040	9.480	7.710	7.358	6.732	5.158	3.442	2.684	1.960	8.614	10.941	9.768	3.8400
0.4000	30.475	10.061	7.990	7.594	6.876	5.133	3.394	2.642	1.924	8.757	11.150	10.139	4.8000
0.5000	31.007	10.303	8.004	7.616	6.814	5.011	3.305	2.581	1.881	8.714	11.125	10.216	6.0000
0.6000	30.311	10.167	7.695	7.313	6.535	4.778	3.170	2.473	1.809	8.411	10.793	9.867	7.2000
0.7000	28.745	9.878	7.266	6.905	6.180	4.513	3.020	2.350	1.737	8.029	10.318	9.330	8.4000
0.8000	26.923	9.448	6.829	6.513	5.820	4.256	2.880	2.247	1.669	7.632	9.797	8.779	9.6000
0.9000	25.142	8.961	6.420	6.119	5.441	4.014	2.739	2.164	1.607	7.251	9.298	8.234	10.800
1.0000	23.673	8.560	6.109	5.797	5.165	3.825	2.635	2.099	1.559	6.909	8.850	7.783	12.000
1.2500	20.623	7.722	5.498	5.249	4.664	3.498	2.457	1.984	1.498	6.212	7.888	6.959	15.000
1.6000	17.295	6.773	4.890	4.676	4.186	3.195	2.292	1.863	1.443	5.452	6.822	6.076	19.200
2.0000	14.457	5.926	4.393	4.183	3.785	2.940	2.148	1.763	1.386	4.819	5.936	5.325	24.000
2.5000	11.839	5.090	3.887	3.699	3.414	2.700	2.005	1.669	1.328	4.216	5.102	4.604	30.000
3.2000	9.538	4.238	3.360	3.208	2.979	2.412	1.834	1.526	1.224	3.605	4.298	3.911	38.400
4.0000	7.814	3.533	2.889	2.770	2.605	2.131	1.634	1.376	1.113	3.093	3.644	3.332	48.000
5.0000	6.468	2.939	2.459	2.368	2.231	1.849	1.438	1.214	0.997	2.632	3.081	2.823	60.000
6.0000	5.548	2.523	2.144	2.062	1.953	1.631	1.274	1.083	0.892	2.291	2.674	2.449	72.000
7.0000	4.883	2.217	1.905	1.837	1.737	1.460	1.148	0.980	0.810	2.034	2.368	2.176	84.000
8.0000	4.366	1.975	1.716	1.656	1.564	1.320	1.038	0.890	0.740	1.830	2.126	1.958	96.000
9.0000	3.945	1.793	1.561	1.507	1.426	1.206	0.950	0.816	0.681	1.662	1.928	1.778	108.00
10.0000	3.606	1.646	1.436	1.387	1.312	1.110	0.877	0.754	0.631	1.524	1.766	1.633	120.00
11.0000	3.320	1.522	1.331	1.285	1.216	1.028	0.815	0.701	0.587	1.409	1.631	1.511	132.00
12.0000	3.074	1.416	1.241	1.198	1.134	0.959	0.762	0.656	0.549	1.311	1.514	1.407	144.00

$^{12}_{6}C$ IONS

ENERGY PER MASS UNIT	RANGE IN UNITS OF MG/SQ CM												ENERGY FOR A=12
MEV/AMU	BE	C	AL	TI	NI	GE	ZR	AG	EU	TA	AU	U	MEV
0.0125	0.075	0.085	0.119	0.181	0.216	0.255	0.282	0.313	0.491	0.581	0.635	0.758	0.1500
0.0160	0.089	0.102	0.143	0.216	0.258	0.302	0.332	0.368	0.576	0.681	0.744	0.886	0.1920
0.0200	0.104	0.120	0.167	0.252	0.302	0.350	0.385	0.425	0.665	0.785	0.857	1.019	0.2400
0.0250	0.121	0.140	0.194	0.293	0.351	0.406	0.444	0.490	0.766	0.903	0.985	1.169	0.3000
0.0320	0.143	0.165	0.229	0.345	0.414	0.476	0.520	0.572	0.893	1.051	1.146	1.357	0.3840
0.0400	0.164	0.191	0.264	0.398	0.478	0.547	0.597	0.655	1.024	1.203	1.311	1.549	0.4800
0.0500	0.189	0.221	0.304	0.457	0.551	0.627	0.684	0.749	1.171	1.373	1.495	1.764	0.6000
0.0600	0.212	0.247	0.341	0.512	0.617	0.700	0.763	0.834	1.304	1.526	1.661	1.957	0.7200
0.0700	0.233	0.272	0.375	0.562	0.678	0.767	0.836	0.913	1.426	1.666	1.812	2.133	0.8400
0.0800	0.253	0.296	0.408	0.609	0.735	0.830	0.904	0.986	1.539	1.795	1.952	2.295	0.9600
0.0900	0.272	0.318	0.439	0.655	0.789	0.891	0.968	1.056	1.645	1.916	2.083	2.447	1.0800
0.1000	0.291	0.339	0.468	0.698	0.841	0.948	1.030	1.123	1.747	2.032	2.208	2.592	1.2000
0.1250	0.335	0.387	0.539	0.799	0.962	1.082	1.176	1.278	1.981	2.299	2.494	2.925	1.5000
0.1600	0.394	0.449	0.631	0.929	1.118	1.253	1.363	1.478	2.276	2.636	2.854	3.339	1.9200
0.2000	0.459	0.515	0.733	1.070	1.285	1.438	1.564	1.692	2.588	2.991	3.232	3.771	2.4000
0.2500	0.540	0.593	0.857	1.240	1.485	1.658	1.804	1.949	2.955	3.406	3.675	4.279	3.0000
0.3200	0.654	0.700	1.030	1.471	1.756	1.956	2.130	2.297	3.445	3.959	4.264	4.951	3.8400
0.4000	0.787	0.821	1.226	1.730	2.058	2.287	2.493	2.685	3.983	4.564	4.909	5.684	4.8000
0.5000	0.957	0.974	1.472	2.051	2.429	2.692	2.938	3.162	4.633	5.294	5.685	6.567	6.0000
0.6000	1.133	1.130	1.721	2.371	2.798	3.093	3.379	3.635	5.269	6.007	6.442	7.423	7.2000
0.7000	1.316	1.292	1.975	2.694	3.168	3.494	3.821	4.110	5.901	6.714	7.192	8.268	8.4000
0.8000	1.505	1.462	2.234	3.020	3.540	3.898	4.267	4.589	6.533	7.419	7.938	9.109	9.6000
0.9000	1.701	1.638	2.498	3.351	3.916	4.303	4.716	5.071	7.165	8.122	8.683	9.946	10.800
1.0000	1.903	1.822	2.769	3.686	4.297	4.713	5.170	5.559	7.798	8.827	9.428	10.781	12.000
1.2500	2.439	2.317	3.471	4.549	5.270	5.760	6.330	6.807	9.401	10.605	11.310	12.885	15.000
1.6000	3.262	3.094	4.526	5.823	6.698	7.291	8.029	8.642	11.713	13.164	14.016	15.905	19.200
2.0000	4.311	4.097	5.840	7.385	8.442	9.153	10.101	10.882	14.493	16.223	17.252	19.504	24.000
2.5000	5.793	5.514	7.656	9.514	10.803	11.668	12.910	13.911	18.206	20.299	21.555	24.264	30.000
3.2000	8.193	7.795	10.537	12.846	14.476	15.574	17.271	18.618	23.888	26.527	28.116	31.492	38.400
4.0000	11.405	10.823	14.325	17.178	19.219	20.614	22.878	24.688	31.108	34.416	36.411	40.617	48.000
5.0000	16.125	15.240	19.809	23.391	25.984	27.791	30.841	33.308	41.232	45.491	48.001	53.336	60.000
6.0000	21.621	20.359	26.123	30.493	33.687	35.936	39.873	43.073	52.627	57.905	60.963	67.489	72.000
7.0000	27.887	26.173	33.259	38.475	42.332	45.044	49.951	53.967	65.278	71.640	75.291	83.068	84.000
8.0000	34.921	32.678	41.210	47.329	51.905	55.114	61.055	65.977	79.129	86.683	90.956	100.073	96.000
9.0000	42.705	39.870	49.967	57.042	62.392	66.136	73.175	79.085	94.186	103.004	107.942	118.468	108.00
10.0000	51.232	47.750	59.521	67.599	73.786	78.093	86.316	93.260	110.448	120.581	126.208	138.227	120.00
11.0000	60.500	56.310	69.865	78.984	86.071	90.974	100.466	108.470	127.890	139.370	145.686	159.335	132.00
12.0000	70.501	65.543	80.991	91.197	99.229	104.760	115.603	124.700	146.479	159.344	166.385	181.788	144.00

MEV/AMU	H	HE	N	O	NE	AR	KR	XE	RN	MYLAR	$(CH_2)_n$	WATER	MEV
0.0125	0.027	0.070	0.103	0.109	0.122	0.192	0.330	0.487	0.762	0.082	0.064	0.080	0.1500
0.0160	0.033	0.085	0.125	0.133	0.148	0.231	0.392	0.574	0.894	0.100	0.078	0.097	0.1920
0.0200	0.040	0.102	0.148	0.157	0.176	0.271	0.456	0.663	1.026	0.118	0.092	0.116	0.2400
0.0250	0.048	0.121	0.175	0.186	0.207	0.315	0.526	0.760	1.166	0.139	0.108	0.138	0.3000
0.0320	0.057	0.147	0.210	0.223	0.248	0.371	0.612	0.876	1.329	0.165	0.129	0.167	0.3840
0.0400	0.068	0.175	0.248	0.262	0.290	0.426	0.696	0.987	1.486	0.192	0.151	0.197	0.4800
0.0500	0.080	0.209	0.291	0.306	0.338	0.487	0.787	1.104	1.649	0.223	0.175	0.231	0.6000
0.0600	0.091	0.241	0.330	0.347	0.382	0.541	0.866	1.205	1.788	0.252	0.197	0.262	0.7200
0.0700	0.101	0.270	0.367	0.385	0.422	0.589	0.936	1.294	1.909	0.278	0.218	0.291	0.8400
0.0800	0.110	0.298	0.401	0.420	0.458	0.633	1.000	1.376	2.019	0.302	0.237	0.318	0.9600
0.0900	0.119	0.325	0.433	0.452	0.493	0.673	1.060	1.451	2.120	0.325	0.255	0.343	1.0800
0.1000	0.127	0.349	0.463	0.483	0.525	0.711	1.115	1.520	2.213	0.347	0.273	0.367	1.2000
0.1250	0.146	0.405	0.529	0.552	0.597	0.797	1.239	1.676	2.424	0.397	0.312	0.420	1.5000
0.1600	0.168	0.471	0.610	0.636	0.685	0.902	1.392	1.867	2.681	0.460	0.361	0.483	1.9200
0.2000	0.190	0.536	0.690	0.719	0.773	1.008	1.548	2.063	2.946	0.525	0.412	0.547	2.4000
0.2500	0.214	0.609	0.779	0.811	0.871	1.131	1.729	2.293	3.258	0.600	0.471	0.617	3.0000
0.3200	0.244	0.701	0.892	0.930	1.000	1.296	1.975	2.607	3.686	0.700	0.550	0.707	3.8400
0.4000	0.276	0.799	1.015	1.058	1.141	1.483	2.256	2.968	4.181	0.810	0.637	0.803	4.8000
0.5000	0.315	0.917	1.165	1.216	1.316	1.719	2.614	3.427	4.811	0.947	0.745	0.921	6.0000
0.6000	0.354	1.035	1.318	1.377	1.496	1.965	2.984	3.902	5.462	1.088	0.854	1.041	7.2000
0.7000	0.395	1.154	1.478	1.546	1.685	2.223	3.372	4.400	6.139	1.234	0.968	1.166	8.4000
0.8000	0.438	1.278	1.648	1.725	1.885	2.497	3.779	4.922	6.843	1.387	1.087	1.298	9.6000
0.9000	0.484	1.409	1.830	1.915	2.098	2.787	4.206	5.466	7.576	1.548	1.213	1.439	10.800
1.0000	0.534	1.546	2.021	2.116	2.324	3.093	4.653	6.029	8.334	1.718	1.345	1.589	12.000
1.2500	0.669	1.915	2.539	2.660	2.936	3.913	5.832	7.499	10.297	2.176	1.704	1.997	15.000
1.6000	0.892	2.496	3.349	3.508	3.887	5.170	7.603	9.684	13.153	2.898	2.277	2.643	19.200
2.0000	1.196	3.254	4.386	4.594	5.093	6.737	9.767	12.333	16.548	3.835	3.032	3.488	24.000
2.5000	1.655	4.348	5.839	6.121	6.764	8.868	12.661	15.831	20.971	5.168	4.124	4.701	30.000
3.2000	2.448	6.162	8.169	8.565	9.404	12.166	17.048	21.102	27.570	7.327	5.922	6.685	38.400
4.0000	3.563	8.650	11.258	11.794	12.858	16.410	22.605	27.739	35.811	10.210	8.354	9.352	48.000
5.0000	5.256	12.386	15.774	16.493	17.850	22.472	30.454	37.047	47.231	14.429	11.946	13.277	60.000
6.0000	7.265	16.804	21.011	21.936	23.611	29.398	39.339	47.534	59.984	19.327	16.136	17.851	72.000
7.0000	9.574	21.888	26.959	28.113	30.138	37.189	49.278	59.203	74.127	24.896	20.914	23.058	84.000
8.0000	12.177	27.631	33.604	35.003	37.429	45.845	60.283	72.068	89.655	31.125	26.270	28.881	96.000
9.0000	15.072	34.016	40.944	42.607	45.474	55.369	72.377	86.157	106.576	38.015	32.205	35.320	108.00
10.0000	18.257	41.008	48.966	50.915	54.255	65.754	85.537	101.468	124.896	45.562	38.716	42.369	120.00
11.0000	21.728	48.594	57.651	59.910	63.763	76.997	99.745	117.991	144.635	53.755	45.793	50.014	132.00
12.0000	25.487	56.772	66.993	69.585	73.989	89.090	114.986	135.707	165.787	62.589	53.435	58.249	144.00

$^{32}_{16}S$ IONS

ENERGY PER MASS UNIT	ELECTRONIC STOPPING POWER IN UNITS OF MEV/(MG/SQ CM)												ENERGY FOR A=32
MEV/AMU	BE	C	AL	TI	NI	GE	ZR	AG	EU	TA	AU	U	MEV
0.0125	4.848	4.011	2.938	1.954	1.587	1.440	1.334	1.234	0.785	0.671	0.617	0.529	0.3996
0.0160	5.485	4.538	3.324	2.211	1.795	1.629	1.509	1.396	0.888	0.760	0.698	0.598	0.5116
0.0200	6.132	5.073	3.717	2.472	2.007	1.821	1.687	1.561	0.992	0.849	0.780	0.669	0.6394
0.0250	6.856	5.672	4.155	2.763	2.244	2.036	1.886	1.745	1.109	0.949	0.875	0.748	0.7993
0.0320	7.748	6.422	4.701	3.126	2.543	2.313	2.134	1.974	1.255	1.077	0.992	0.851	1.0231
0.0400	8.641	7.196	5.256	3.506	2.859	2.607	2.402	2.223	1.414	1.217	1.120	0.962	1.2789
0.0500	9.626	8.068	5.876	3.937	3.226	2.938	2.709	2.509	1.593	1.384	1.275	1.096	1.5986
0.0600	10.506	8.890	6.437	4.339	3.566	3.238	2.993	2.774	1.777	1.545	1.426	1.226	1.9183
0.0700	11.299	9.665	6.953	4.714	3.894	3.532	3.268	3.032	1.947	1.704	1.578	1.356	2.2380
0.0800	12.045	10.437	7.445	5.085	4.206	3.812	3.521	3.276	2.122	1.861	1.720	1.481	2.5578
0.0900	12.731	11.174	7.903	5.437	4.504	4.094	3.770	3.509	2.300	2.011	1.865	1.608	2.8775
0.1000	13.371	11.888	8.331	5.773	4.799	4.349	3.999	3.741	2.466	2.158	1.999	1.724	3.1972
0.1250	14.759	13.618	9.283	6.535	5.458	4.948	4.548	4.261	2.854	2.497	2.335	2.019	3.9965
0.1600	16.227	15.771	10.342	7.405	6.226	5.647	5.181	4.861	3.309	2.906	2.725	2.379	5.1155
0.2000	17.359	17.617	11.214	8.153	6.897	6.246	5.730	5.372	3.723	3.286	3.084	2.691	6.3944
0.2500	18.295	19.244	12.012	8.877	7.544	6.847	6.270	5.874	4.144	3.664	3.436	3.003	7.9930
0.3200	19.214	20.875	12.878	9.697	8.280	7.559	6.890	6.439	4.610	4.095	3.844	3.380	10.231
0.4000	19.999	22.202	13.679	10.424	8.974	8.208	7.483	6.990	5.089	4.528	4.254	3.734	12.789
0.5000	20.755	23.324	14.514	11.220	9.725	8.926	8.128	7.576	5.602	4.993	4.695	4.137	15.986
0.6000	21.155	23.826	15.089	11.815	10.291	9.476	8.601	8.012	5.990	5.357	5.047	4.481	19.183
0.7000	21.355	23.972	15.486	12.234	10.701	9.864	8.935	8.331	6.287	5.621	5.312	4.708	22.380
0.8000	21.384	23.841	15.747	12.550	11.007	10.188	9.212	8.582	6.519	5.858	5.527	4.913	25.578
0.9000	21.343	23.586	15.904	12.755	11.244	10.433	9.415	8.763	6.727	6.044	5.710	5.089	28.775
1.0000	21.206	23.220	15.981	12.928	11.410	10.595	9.572	8.901	6.872	6.184	5.849	5.226	31.972
1.2500	20.656	22.121	15.926	13.059	11.626	10.830	9.763	9.062	7.119	6.418	6.068	5.431	39.965
1.6000	19.640	20.586	15.513	12.954	11.573	10.813	9.742	8.998	7.214	6.531	6.174	5.538	51.155
2.0000	18.391	19.193	14.843	12.572	11.296	10.598	9.500	8.802	7.125	6.501	6.145	5.537	63.944
2.5000	16.914	17.723	13.944	11.978	10.835	10.179	9.106	8.450	6.944	6.317	5.996	5.438	79.930
3.2000	15.178	16.034	12.766	11.106	10.110	9.510	8.528	7.889	6.587	6.025	5.719	5.196	102.31
4.0000	13.586	14.468	11.612	10.207	9.347	8.802	7.931	7.315	6.189	5.667	5.399	4.912	127.89
5.0000	12.045	12.912	10.438	9.248	8.517	8.037	7.244	6.701	5.741	5.240	5.021	4.582	159.86
6.0000	10.866	11.682	9.498	8.472	7.817	7.408	6.686	6.183	5.300	4.891	4.682	4.303	191.83
7.0000	9.901	10.696	8.731	7.823	7.230	6.872	6.217	5.754	4.977	4.575	4.392	4.043	223.80
8.0000	9.123	9.876	8.095	7.286	6.743	6.411	5.828	5.383	4.679	4.315	4.145	3.821	255.78
9.0000	8.488	9.183	7.558	6.825	6.326	6.024	5.480	5.072	4.422	4.081	3.923	3.628	287.75
10.0000	7.936	8.589	7.099	6.439	5.963	5.686	5.175	4.806	4.188	3.883	3.741	3.457	319.72
11.0000	7.464	8.087	6.700	6.097	5.655	5.394	4.911	4.576	3.993	3.712	3.585	3.303	351.69
12.0000	7.057	7.641	6.352	5.793	5.380	5.138	4.681	4.370	3.817	3.557	3.430	3.163	383.66

MEV/AMU	H	HE	N	O	NE	AR	KR	XE	RN	MYLAR	$(CH_2)_n$	WATER	MEV
0.0125	11.018	4.701	3.115	2.926	2.600	1.716	1.052	0.746	0.492	3.940	5.013	3.826	0.3996
0.0160	12.233	5.159	3.467	3.261	2.899	1.958	1.213	0.864	0.574	4.431	5.638	4.258	0.5116
0.0200	13.305	5.463	3.780	3.561	3.185	2.211	1.379	1.003	0.671	4.913	6.248	4.642	0.6394
0.0250	14.460	5.738	4.122	3.885	3.515	2.522	1.612	1.176	0.852	5.443	6.927	5.061	0.7993
0.0320	16.031	6.083	4.508	4.292	3.921	2.938	1.909	1.439	1.001	6.112	7.795	5.594	1.0231
0.0400	17.608	6.402	4.904	4.720	4.347	3.395	2.250	1.724	1.225	6.807	8.683	6.150	1.2789
0.0500	19.451	6.840	5.400	5.254	4.889	3.943	2.656	2.069	1.498	7.604	9.696	6.828	1.5986
0.0600	21.501	7.358	5.967	5.768	5.452	4.487	3.051	2.401	1.764	8.375	10.692	7.519	1.9183
0.0700	23.571	7.982	6.536	6.348	6.021	5.020	3.421	2.719	2.009	9.136	11.653	8.260	2.2380
0.0800	25.833	8.673	7.154	6.953	6.618	5.561	3.812	3.037	2.256	9.916	12.634	9.053	2.5578
0.0900	28.054	9.412	7.784	7.587	7.223	6.093	4.188	3.351	2.481	10.684	13.585	9.862	2.8775
0.1000	30.491	10.230	8.481	8.214	7.814	6.623	4.574	3.641	2.699	11.438	14.546	10.688	3.1972
0.1250	36.852	12.300	10.164	9.793	9.357	7.900	5.440	4.335	3.221	13.311	16.941	12.801	3.9965
0.1600	45.815	15.275	12.534	12.079	11.459	9.546	6.546	5.212	3.868	15.792	20.063	15.823	5.1155
0.2000	55.061	18.279	14.971	14.376	13.591	11.046	7.513	5.966	4.407	18.100	22.966	18.896	6.3944
0.2500	65.107	21.550	17.478	16.829	15.712	12.421	8.397	6.583	4.841	20.349	25.790	22.199	7.9930
0.3200	76.494	24.970	20.308	19.381	17.733	13.586	9.066	7.070	5.164	22.691	28.821	25.730	10.231
0.4000	85.359	28.179	22.379	21.271	19.260	14.377	9.507	7.401	5.390	24.527	31.230	28.398	12.789
0.5000	92.601	30.770	23.905	22.744	20.349	14.964	9.870	7.707	5.617	26.024	33.223	30.509	15.986
0.6000	95.816	32.140	24.324	23.117	20.657	15.104	10.019	7.816	5.719	26.587	34.117	31.189	19.183
0.7000	95.082	32.675	24.034	22.841	20.441	14.928	9.988	7.774	5.745	26.558	34.130	30.863	22.380
0.8000	92.435	32.439	23.447	22.361	19.983	14.613	9.889	7.716	5.732	26.203	33.635	30.140	25.578
0.9000	89.063	31.745	22.743	21.677	19.276	14.218	9.702	7.666	5.694	25.685	32.937	29.168	28.775
1.0000	86.135	31.146	22.229	21.094	18.793	13.919	9.588	7.639	5.673	25.137	32.201	28.318	31.972
1.2500	79.153	29.639	21.102	20.147	17.901	13.426	9.428	7.613	5.749	23.841	30.276	26.708	39.965
1.6000	70.120	27.459	19.826	18.957	16.972	12.954	9.292	7.555	5.849	22.107	27.660	24.635	51.155
2.0000	61.452	25.189	18.673	17.782	16.090	12.498	9.129	7.496	5.893	20.484	25.234	22.636	63.944
2.5000	52.710	22.660	17.305	16.468	15.199	12.020	8.924	7.432	5.912	18.769	22.715	20.498	79.930
3.2000	44.680	19.851	15.740	15.025	13.953	11.298	8.591	7.149	5.732	16.889	20.132	18.319	102.31
4.0000	38.319	17.325	14.166	13.586	12.773	10.451	8.012	6.746	5.458	15.165	17.871	16.338	127.89
5.0000	33.193	15.083	12.620	12.150	11.450	9.488	7.380	6.231	5.115	13.507	15.814	14.488	159.86
6.0000	29.538	13.430	11.416	10.979	10.400	8.681	6.781	5.765	4.749	12.195	14.237	13.041	191.83
7.0000	26.805	12.172	10.460	10.085	9.535	8.015	6.304	5.379	4.444	11.167	13.001	11.945	223.80
8.0000	24.609	11.131	9.674	9.334	8.816	7.439	5.853	5.019	4.169	10.313	11.981	11.034	255.78
9.0000	22.750	10.340	9.002	8.692	8.223	6.954	5.480	4.709	3.930	9.584	11.118	10.257	287.75
10.0000	21.225	9.690	8.455	8.164	7.723	6.531	5.161	4.437	3.713	8.973	10.392	9.612	319.72
11.0000	19.900	9.126	7.980	7.706	7.290	6.164	4.885	4.201	3.518	8.449	9.776	9.059	351.69
12.0000	18.737	8.632	7.565	7.304	6.911	5.844	4.643	3.995	3.347	7.990	9.229	8.575	383.66

$^{32}_{16}S$ IONS

ENERGY PER MASS UNIT	RANGE IN UNITS OF MG/SQ CM												ENERGY FOR A=32
MEV/AMU	BE	C	AL	TI	NI	GE	ZR	AG	EU	TA	AU	U	MEV
0.0125	0.082	0.088	0.120	0.174	0.199	0.241	0.265	0.296	0.450	0.532	0.580	0.700	0.3996
0.0160	0.100	0.109	0.148	0.215	0.247	0.295	0.323	0.360	0.548	0.646	0.704	0.846	0.5116
0.0200	0.120	0.132	0.178	0.259	0.298	0.354	0.386	0.429	0.651	0.767	0.835	1.001	0.6394
0.0250	0.142	0.158	0.213	0.310	0.359	0.422	0.460	0.508	0.773	0.908	0.988	1.181	0.7993
0.0320	0.171	0.191	0.258	0.376	0.437	0.510	0.554	0.611	0.930	1.091	1.186	1.412	1.0231
0.0400	0.200	0.226	0.305	0.445	0.520	0.603	0.654	0.719	1.095	1.282	1.393	1.654	1.2789
0.0500	0.234	0.265	0.358	0.524	0.614	0.708	0.767	0.841	1.284	1.500	1.628	1.928	1.5986
0.0600	0.265	0.301	0.407	0.596	0.701	0.804	0.871	0.953	1.457	1.698	1.842	2.177	1.9183
0.0700	0.293	0.335	0.453	0.663	0.781	0.893	0.967	1.056	1.615	1.879	2.038	2.405	2.2380
0.0800	0.320	0.366	0.496	0.725	0.855	0.976	1.056	1.152	1.762	2.047	2.219	2.615	2.5578
0.0900	0.345	0.394	0.536	0.784	0.925	1.053	1.140	1.242	1.899	2.203	2.387	2.810	2.8775
0.1000	0.369	0.422	0.575	0.839	0.991	1.126	1.219	1.327	2.027	2.349	2.544	2.992	3.1972
0.1250	0.426	0.483	0.663	0.965	1.142	1.293	1.400	1.521	2.316	2.679	2.898	3.402	3.9965
0.1600	0.498	0.558	0.775	1.122	1.328	1.500	1.624	1.760	2.669	3.081	3.327	3.896	5.1155
0.2000	0.574	0.634	0.892	1.284	1.519	1.711	1.854	2.005	3.025	3.484	3.757	4.389	6.3944
0.2500	0.664	0.721	1.028	1.470	1.738	1.952	2.117	2.285	3.424	3.937	4.239	4.941	7.9930
0.3200	0.783	0.832	1.207	1.708	2.017	2.260	2.453	2.645	3.930	4.507	4.846	5.633	10.231
0.4000	0.913	0.951	1.399	1.961	2.311	2.582	2.806	3.023	4.452	5.094	5.472	6.346	12.789
0.5000	1.070	1.091	1.626	2.256	2.653	2.955	3.216	3.462	5.051	5.766	6.187	7.158	15.986
0.6000	1.222	1.227	1.842	2.534	2.972	3.302	3.598	3.871	5.602	6.384	6.843	7.900	19.183
0.7000	1.373	1.360	2.051	2.799	3.277	3.633	3.962	4.262	6.122	6.966	7.460	8.596	22.380
0.8000	1.522	1.494	2.255	3.057	3.571	3.951	4.314	4.640	6.621	7.523	8.050	9.260	25.578
0.9000	1.672	1.629	2.457	3.310	3.859	4.261	4.658	5.009	7.104	8.060	8.619	9.899	28.775
1.0000	1.822	1.765	2.658	3.559	4.141	4.565	4.994	5.371	7.574	8.583	9.172	10.519	31.972
1.2500	2.203	2.118	3.158	4.173	4.834	5.310	5.820	6.259	8.715	9.849	10.511	12.017	39.965
1.6000	2.758	2.641	3.869	5.032	5.797	6.343	6.966	7.497	10.274	11.575	12.336	14.054	51.155
2.0000	3.431	3.284	4.711	6.033	6.915	7.537	8.294	8.933	12.057	13.536	14.411	16.361	63.944
2.5000	4.337	4.151	5.822	7.336	8.359	9.075	10.012	10.786	14.328	16.029	17.043	19.273	79.930
3.2000	5.735	5.479	7.500	9.277	10.498	11.351	12.553	13.528	17.638	19.658	20.866	23.484	102.31
4.0000	7.518	7.161	9.604	11.682	13.132	14.149	15.666	16.898	21.647	24.038	25.472	28.551	127.89
5.0000	10.021	9.504	12.512	14.978	16.720	17.956	19.890	21.470	27.018	29.913	31.620	35.298	159.86
6.0000	12.820	12.110	15.727	18.594	20.643	22.104	24.489	26.443	32.821	36.235	38.221	42.506	191.83
7.0000	15.906	14.974	19.242	22.525	24.901	26.590	29.453	31.809	39.052	43.000	45.278	50.179	223.80
8.0000	19.273	18.087	23.048	26.764	29.484	31.410	34.769	37.558	45.682	50.202	52.777	58.320	255.78
9.0000	22.909	21.447	27.139	31.301	34.382	36.559	40.430	43.681	52.716	57.825	60.712	66.913	287.75
10.0000	26.807	25.049	31.506	36.127	39.591	42.025	46.438	50.161	60.150	65.861	69.062	75.945	319.72
11.0000	30.963	28.887	36.145	41.232	45.099	47.801	52.783	56.982	67.971	74.286	77.797	85.411	351.69
12.0000	35.370	32.956	41.046	46.614	50.898	53.876	59.453	64.134	76.163	83.088	86.918	95.306	383.66

MEV/AMU	H	HE	N	O	NE	AR	KR	XE	RN	MYLAR	$(CH_2)_n$	WATER	MEV
0.0125	0.029	0.075	0.103	0.108	0.119	0.180	0.296	0.433	0.667	0.084	0.067	0.080	0.3996
0.0160	0.037	0.093	0.129	0.136	0.149	0.224	0.366	0.530	0.813	0.105	0.084	0.101	0.5116
0.0200	0.045	0.114	0.158	0.166	0.182	0.272	0.440	0.633	0.964	0.128	0.102	0.124	0.6394
0.0250	0.054	0.139	0.192	0.202	0.222	0.327	0.525	0.749	1.129	0.155	0.123	0.152	0.7993
0.0320	0.067	0.173	0.237	0.249	0.274	0.398	0.632	0.892	1.329	0.189	0.150	0.189	1.0231
0.0400	0.081	0.210	0.286	0.300	0.329	0.470	0.740	1.034	1.528	0.226	0.179	0.228	1.2789
0.0500	0.096	0.255	0.343	0.359	0.392	0.550	0.859	1.187	1.740	0.267	0.211	0.273	1.5986
0.0600	0.111	0.298	0.396	0.414	0.450	0.621	0.963	1.320	1.920	0.305	0.241	0.315	1.9183
0.0700	0.124	0.338	0.445	0.464	0.503	0.685	1.056	1.438	2.079	0.340	0.269	0.354	2.2380
0.0800	0.137	0.375	0.489	0.510	0.551	0.743	1.140	1.543	2.222	0.373	0.294	0.389	2.5578
0.0900	0.148	0.409	0.531	0.552	0.596	0.796	1.217	1.640	2.351	0.403	0.318	0.422	2.8775
0.1000	0.159	0.441	0.569	0.591	0.637	0.845	1.288	1.728	2.470	0.431	0.340	0.452	3.1972
0.1250	0.182	0.511	0.653	0.678	0.728	0.953	1.443	1.923	2.732	0.494	0.390	0.519	3.9965
0.1600	0.209	0.591	0.750	0.779	0.834	1.079	1.627	2.154	3.042	0.570	0.450	0.596	5.1155
0.2000	0.234	0.667	0.842	0.875	0.935	1.202	1.806	2.379	3.346	0.645	0.509	0.669	6.3944
0.2500	0.260	0.747	0.941	0.977	1.043	1.338	2.007	2.634	3.688	0.728	0.574	0.747	7.9930
0.3200	0.292	0.843	1.059	1.100	1.177	1.510	2.264	2.962	4.134	0.832	0.656	0.840	10.231
0.4000	0.324	0.940	1.179	1.226	1.315	1.693	2.539	3.315	4.619	0.941	0.741	0.935	12.789
0.5000	0.359	1.048	1.317	1.371	1.477	1.911	2.868	3.738	5.199	1.067	0.840	1.043	15.986
0.6000	0.393	1.150	1.450	1.511	1.632	2.123	3.189	4.149	5.763	1.188	0.935	1.147	19.183
0.7000	0.427	1.248	1.582	1.650	1.788	2.336	3.509	4.559	6.320	1.309	1.029	1.250	22.380
0.8000	0.461	1.346	1.717	1.791	1.946	2.552	3.830	4.971	6.877	1.430	1.123	1.354	25.578
0.9000	0.496	1.446	1.855	1.936	2.109	2.774	4.156	5.387	7.436	1.553	1.219	1.462	28.775
1.0000	0.533	1.548	1.997	2.086	2.277	3.001	4.488	5.805	7.998	1.679	1.317	1.573	31.972
1.2500	0.629	1.810	2.365	2.473	2.712	3.585	5.327	6.851	9.396	2.005	1.573	1.864	39.965
1.6000	0.779	2.202	2.912	3.045	3.353	4.432	6.521	8.325	11.322	2.491	1.959	2.299	51.155
2.0000	0.974	2.688	3.576	3.741	4.126	5.437	7.908	10.022	13.499	3.092	2.443	2.840	63.944
2.5000	1.255	3.357	4.465	4.675	5.148	6.741	9.679	12.163	16.205	3.907	3.110	3.583	79.930
3.2000	1.716	4.413	5.822	6.098	6.686	8.662	12.235	15.234	20.050	5.165	4.158	4.738	102.31
4.0000	2.335	5.794	7.537	7.891	8.604	11.018	15.320	18.919	24.626	6.765	5.508	6.219	127.89
5.0000	3.234	7.776	9.932	10.383	11.252	14.233	19.484	23.857	30.684	9.003	7.413	8.300	159.86
6.0000	4.256	10.025	12.599	13.155	14.185	17.761	24.009	29.197	37.179	11.497	9.547	10.630	191.83
7.0000	5.394	12.529	15.528	16.197	17.400	21.597	28.904	34.944	44.145	14.240	11.900	13.194	223.80
8.0000	6.640	15.279	18.710	19.495	20.890	25.741	34.172	41.103	51.578	17.222	14.464	15.982	255.78
9.0000	7.992	18.261	22.138	23.047	24.648	30.190	39.821	47.684	59.482	20.440	17.236	18.989	287.75
10.0000	9.448	21.457	25.805	26.845	28.662	34.937	45.837	54.684	67.857	23.890	20.212	22.211	319.72
11.0000	11.004	24.859	29.700	30.878	32.925	39.979	52.208	62.093	76.708	27.564	23.386	25.640	351.69
12.0000	12.661	28.463	33.817	35.142	37.432	45.308	58.925	69.900	86.030	31.457	26.753	29.269	383.66

$^{63}_{29}Cu$ IONS

ENERGY PER MASS UNIT	ELECTRONIC STOPPING POWER IN UNITS OF MEV/(MG/SQ CM)												ENERGY FOR A=63
MEV/AMU	BE	C	AL	TI	NI	GE	ZR	AG	EU	TA	AU	U	MEV
0.0125	6.472	5.354	3.922	2.608	2.118	1.922	1.781	1.647	1.047	0.896	0.824	0.706	0.7866
0.0160	7.371	6.098	4.467	2.971	2.412	2.189	2.028	1.876	1.193	1.021	0.938	0.804	1.0069
0.0200	8.290	6.858	5.024	3.341	2.713	2.462	2.281	2.110	1.342	1.148	1.055	0.904	1.2586
0.0250	9.325	7.714	5.651	3.758	3.052	2.769	2.566	2.374	1.509	1.291	1.190	1.017	1.5732
0.0320	10.607	8.792	6.436	4.280	3.482	3.167	2.922	2.703	1.718	1.474	1.358	1.165	2.0138
0.0400	11.901	9.911	7.239	4.829	3.938	3.591	3.308	3.062	1.947	1.676	1.542	1.325	2.5172
0.0500	13.337	11.180	8.143	5.455	4.470	4.071	3.754	3.477	2.207	1.918	1.767	1.519	3.1465
0.0600	14.629	12.379	8.964	6.041	4.966	4.509	4.168	3.863	2.474	2.151	1.985	1.708	3.7758
0.0700	15.798	13.514	9.722	6.591	5.444	4.939	4.569	4.239	2.722	2.382	2.207	1.896	4.4051
0.0800	16.877	14.624	10.431	7.124	5.893	5.340	4.934	4.589	2.973	2.608	2.409	2.076	5.0344
0.0900	17.880	15.693	11.098	7.636	6.326	5.749	5.294	4.928	3.230	2.825	2.619	2.259	5.6637
0.1000	18.830	16.742	11.732	8.130	6.758	6.124	5.631	5.268	3.473	3.039	2.816	2.429	6.2930
0.1250	20.981	19.358	13.196	9.290	7.759	7.033	6.466	6.057	4.058	3.550	3.319	2.870	7.8662
0.1600	23.580	22.919	15.029	10.761	9.047	8.206	7.529	7.063	4.809	4.223	3.960	3.457	10.069
0.2000	25.814	26.197	16.676	12.123	10.255	9.288	8.521	7.988	5.536	4.886	4.586	4.002	12.586
0.2500	27.955	29.405	18.355	13.565	11.527	10.462	9.581	8.976	6.333	5.598	5.250	4.589	15.732
0.3200	30.290	32.909	20.302	15.287	13.054	11.917	10.861	10.151	7.268	6.456	6.060	5.329	20.138
0.4000	32.435	36.007	22.186	16.906	14.554	13.311	12.136	11.337	8.253	7.343	6.900	6.057	25.172
0.5000	34.632	38.918	24.218	18.720	16.226	14.894	13.562	12.642	9.348	8.331	7.835	6.902	31.465
0.6000	35.971	40.512	25.657	20.089	17.498	16.113	14.625	13.624	10.186	9.108	8.582	7.620	37.758
0.7000	36.954	41.482	26.797	21.170	18.517	17.070	15.462	14.417	10.880	9.727	9.192	8.146	44.051
0.8000	37.616	41.937	27.700	22.077	19.362	17.922	16.204	15.096	11.468	10.304	9.723	8.642	50.344
0.9000	38.123	42.129	28.408	22.783	20.084	18.636	16.817	15.653	12.017	10.795	10.198	9.091	56.637
1.0000	38.425	42.074	28.956	23.426	20.675	19.198	17.345	16.129	12.451	11.206	10.598	9.469	62.930
1.2500	38.645	41.386	29.795	24.432	21.751	20.261	18.265	16.954	13.319	12.008	11.352	10.160	78.662
1.6000	38.127	39.964	30.116	25.147	22.467	20.991	18.913	17.467	14.004	12.679	11.986	10.751	100.69
2.0000	36.927	38.536	29.804	25.244	22.680	21.280	19.074	17.673	14.306	13.054	12.339	11.117	125.86
2.5000	35.105	36.783	28.940	24.860	22.487	21.127	18.898	17.538	14.412	13.110	12.444	11.287	157.32
3.2000	32.636	34.475	27.448	23.880	21.739	20.449	18.336	16.963	14.163	12.956	12.297	11.171	201.38
4.0000	30.126	32.083	25.748	22.633	20.728	19.517	17.586	16.222	13.724	12.565	11.973	10.892	251.72
5.0000	27.521	29.501	23.849	21.130	19.460	18.363	16.551	15.311	13.117	11.972	11.471	10.470	314.65
6.0000	25.428	27.339	22.227	19.826	18.293	17.337	15.648	14.470	12.403	11.447	10.958	10.069	377.58
7.0000	23.641	25.538	20.847	18.679	17.262	16.407	14.843	13.738	11.883	10.924	10.486	9.652	440.51
8.0000	22.163	23.991	19.665	17.699	16.381	15.575	14.159	13.077	11.366	10.481	10.069	9.282	503.44
9.0000	20.935	22.650	18.642	16.834	15.603	14.858	13.515	12.509	10.906	10.067	9.675	8.948	566.37
10.0000	19.842	21.475	17.748	16.097	14.908	14.216	12.938	12.015	10.471	9.708	9.353	8.643	629.30
11.0000	18.893	20.470	16.959	15.433	14.314	13.652	12.431	11.583	10.108	9.396	9.073	8.361	692.23
12.0000	18.063	19.558	16.258	14.827	13.771	13.153	11.982	11.186	9.771	9.105	8.779	8.097	755.16

MEV/AMU	H	HE	N	O	NE	AR	KR	XE	RN	MYLAR	$(CH_2)_n$	WATER	MEV
0.0125	14.708	6.276	4.158	3.907	3.471	2.291	1.404	0.996	0.657	5.260	6.691	5.107	0.7866
0.0160	16.439	6.933	4.659	4.382	3.895	2.631	1.630	1.161	0.771	5.955	7.576	5.722	1.0069
0.0200	17.987	7.386	5.110	4.813	4.306	2.990	1.864	1.357	0.907	6.642	8.446	6.276	1.2586
0.0250	19.666	7.804	5.606	5.284	4.781	3.430	2.193	1.599	1.159	7.403	9.421	6.883	1.5732
0.0320	21.948	8.329	6.172	5.876	5.368	4.023	2.613	1.970	1.371	8.367	10.671	7.659	2.0138
0.0400	24.252	8.817	6.754	6.501	5.987	4.677	3.098	2.374	1.687	9.375	11.959	8.470	2.5172
0.0500	26.952	9.478	7.483	7.279	6.775	5.464	3.680	2.866	2.076	10.536	13.435	9.462	3.1465
0.0600	29.938	10.245	8.309	8.031	7.592	6.248	4.249	3.343	2.456	11.662	14.888	10.469	3.7758
0.0700	32.957	11.161	9.139	8.876	8.419	7.019	4.783	3.801	2.810	12.775	16.294	11.550	4.4051
0.0800	36.194	12.152	10.024	9.742	9.273	7.792	5.340	4.256	3.160	13.894	17.701	12.684	5.0344
0.0900	39.399	13.218	10.932	10.655	10.144	8.557	5.882	4.706	3.485	15.005	19.078	13.851	5.6637
0.1000	42.939	14.407	11.943	11.568	11.005	9.327	6.441	5.127	3.801	16.108	20.484	15.052	6.2930
0.1250	52.387	17.484	14.449	13.921	13.301	11.230	7.733	6.162	4.579	18.923	24.082	18.197	7.8662
0.1600	66.577	22.197	18.215	17.554	16.652	13.871	9.513	7.574	5.621	22.949	29.156	22.994	10.069
0.2000	81.877	27.181	22.262	21.378	20.211	16.425	11.173	8.871	6.553	26.914	34.152	28.098	12.586
0.2500	99.485	32.929	26.707	25.716	24.009	18.979	12.830	10.059	7.397	31.094	39.409	33.920	15.732
0.3200	120.591	39.365	32.015	30.554	27.955	21.418	14.292	11.146	8.141	35.771	45.435	40.562	20.138
0.4000	138.439	45.703	36.296	34.499	31.237	23.317	15.419	12.002	8.741	39.779	50.650	46.058	25.172
0.5000	154.511	51.342	39.887	37.950	33.954	24.969	16.468	12.860	9.372	43.423	55.435	50.906	31.465
0.6000	162.922	54.649	41.359	39.307	35.124	25.683	17.036	13.290	9.724	45.208	58.011	53.033	37.758
0.7000	164.536	56.542	41.590	39.526	35.373	25.833	17.284	13.452	9.942	45.958	59.061	53.407	44.051
0.8000	162.596	57.061	41.245	39.333	35.151	25.705	17.395	13.573	10.083	46.092	59.166	53.017	50.344
0.9000	159.084	56.702	40.623	38.720	34.430	25.397	17.329	13.693	10.170	45.879	58.833	52.100	56.637
1.0000	156.075	56.436	40.278	38.223	34.053	25.221	17.374	13.841	10.280	45.549	58.347	51.311	62.930
1.2500	148.083	55.449	39.479	37.691	33.490	25.118	17.639	14.242	10.756	44.604	56.641	49.967	78.662
1.6000	136.125	53.305	38.488	36.802	32.947	25.147	18.040	14.667	11.354	42.915	53.697	47.824	100.69
2.0000	123.387	50.577	37.493	35.705	32.307	25.095	18.329	15.051	11.832	41.129	50.666	45.450	125.86
2.5000	109.395	47.028	35.915	34.179	31.545	24.947	18.522	15.425	12.271	38.954	47.144	42.542	157.32
3.2000	96.069	42.682	33.844	32.307	30.001	24.292	18.473	15.371	12.324	36.314	43.286	39.388	201.38
4.0000	84.970	38.417	31.413	30.126	28.323	23.174	17.766	14.960	12.102	33.627	39.627	36.228	251.72
5.0000	75.838	34.461	28.833	27.760	26.162	21.678	16.861	14.238	11.686	30.860	36.131	33.102	314.65
6.0000	69.126	31.429	26.717	25.694	24.339	20.315	15.870	13.492	11.113	28.539	33.318	30.518	377.58
7.0000	64.001	29.061	24.975	24.079	22.765	19.138	15.052	12.842	10.611	26.664	31.042	28.519	440.51
8.0000	59.782	27.039	23.500	22.674	21.415	18.072	14.218	12.192	10.128	25.053	29.104	26.803	503.44
9.0000	56.113	25.502	22.203	21.438	20.283	17.151	13.515	11.614	9.694	23.638	27.422	25.297	566.37
10.0000	53.067	24.226	21.138	20.410	19.310	16.328	12.903	11.093	9.282	22.434	25.983	24.031	629.30
11.0000	50.370	23.099	20.199	19.503	18.452	15.603	12.363	10.634	8.904	21.386	24.744	22.929	692.23
12.0000	47.961	22.095	19.363	18.697	17.689	14.957	11.885	10.226	8.568	20.453	23.623	21.948	755.16

$^{63}_{29}Cu$ IONS

ENERGY PER MASS UNIT	RANGE IN UNITS OF MG/SQ CM												ENERGY FOR A=63
MEV/AMU	BE	C	AL	TI	NI	GE	ZR	AG	EU	TA	AU	U	MEV
0.0125	0.097	0.100	0.131	0.181	0.199	0.242	0.263	0.293	0.425	0.496	0.537	0.644	0.7866
0.0160	0.121	0.127	0.165	0.229	0.253	0.305	0.331	0.367	0.534	0.622	0.673	0.807	1.0069
0.0200	0.146	0.155	0.203	0.282	0.313	0.375	0.404	0.447	0.652	0.760	0.822	0.982	1.2586
0.0250	0.176	0.189	0.247	0.345	0.385	0.458	0.493	0.543	0.794	0.923	0.998	1.190	1.5732
0.0320	0.215	0.233	0.305	0.429	0.482	0.568	0.611	0.670	0.982	1.141	1.232	1.464	2.0138
0.0400	0.255	0.279	0.367	0.518	0.587	0.686	0.736	0.806	1.186	1.375	1.484	1.757	2.5172
0.0500	0.301	0.333	0.439	0.621	0.708	0.822	0.883	0.964	1.423	1.646	1.777	2.097	3.1465
0.0600	0.343	0.381	0.505	0.717	0.821	0.949	1.018	1.109	1.643	1.898	2.048	2.411	3.7758
0.0700	0.382	0.427	0.566	0.806	0.926	1.067	1.144	1.245	1.849	2.132	2.299	2.703	4.4051
0.0800	0.419	0.469	0.624	0.890	1.025	1.177	1.262	1.373	2.041	2.350	2.533	2.975	5.0344
0.0900	0.454	0.508	0.679	0.969	1.118	1.281	1.374	1.492	2.221	2.554	2.753	3.229	5.6637
0.1000	0.487	0.545	0.731	1.043	1.206	1.379	1.480	1.606	2.390	2.746	2.960	3.468	6.2930
0.1250	0.564	0.629	0.852	1.214	1.409	1.604	1.723	1.865	2.774	3.184	3.429	4.010	7.8662
0.1600	0.661	0.731	1.003	1.425	1.658	1.880	2.023	2.184	3.242	3.716	3.996	4.661	10.069
0.2000	0.761	0.832	1.157	1.638	1.909	2.158	2.325	2.506	3.707	4.243	4.557	5.304	12.586
0.2500	0.877	0.943	1.333	1.878	2.189	2.469	2.662	2.867	4.220	4.823	5.174	6.010	15.732
0.3200	1.026	1.083	1.558	2.178	2.540	2.855	3.085	3.318	4.852	5.535	5.933	6.875	20.138
0.4000	1.186	1.228	1.792	2.487	2.899	3.249	3.516	3.779	5.489	6.252	6.695	7.742	25.172
0.5000	1.373	1.396	2.061	2.837	3.304	3.691	4.000	4.298	6.195	7.044	7.538	8.700	31.465
0.6000	1.551	1.554	2.313	3.161	3.673	4.097	4.442	4.772	6.833	7.758	8.296	9.557	37.758
0.7000	1.724	1.708	2.553	3.466	4.023	4.476	4.860	5.221	7.430	8.426	9.003	10.355	44.051
0.8000	1.892	1.858	2.784	3.757	4.355	4.835	5.258	5.647	7.993	9.054	9.669	11.105	50.344
0.9000	2.058	2.008	3.008	4.037	4.674	5.179	5.639	6.057	8.529	9.650	10.300	11.814	56.637
1.0000	2.223	2.157	3.227	4.309	4.982	5.512	6.007	6.452	9.043	10.222	10.905	12.492	62.930
1.2500	2.630	2.534	3.762	4.966	5.723	6.308	6.889	7.402	10.263	11.576	12.337	14.093	78.662
1.6000	3.203	3.074	4.496	5.852	6.717	7.374	8.072	8.679	11.872	13.357	14.221	16.196	100.69
2.0000	3.873	3.715	5.335	6.850	7.831	8.563	9.395	10.110	13.648	15.311	16.288	18.495	125.86
2.5000	4.746	4.550	6.405	8.105	9.223	10.046	11.051	11.895	15.837	17.713	18.824	21.301	157.32
3.2000	6.047	5.786	7.967	9.912	11.214	12.164	13.416	14.448	18.918	21.091	22.383	25.221	201.38
4.0000	7.653	7.300	9.861	12.078	13.586	14.684	16.220	17.483	22.529	25.037	26.532	29.785	251.72
5.0000	9.840	9.347	12.403	14.957	16.721	18.010	19.911	21.478	27.221	30.170	31.904	35.680	314.65
6.0000	12.221	11.565	15.138	18.034	20.059	21.539	23.823	25.709	32.158	35.549	37.520	41.813	377.58
7.0000	14.789	13.948	18.063	21.306	23.602	25.273	27.955	30.175	37.345	41.180	43.394	48.199	440.51
8.0000	17.540	16.492	21.173	24.769	27.347	29.212	32.298	34.873	42.762	47.064	49.521	54.851	503.44
9.0000	20.463	19.193	24.462	28.417	31.285	33.351	36.850	39.795	48.417	53.193	55.900	61.759	566.37
10.0000	23.552	22.048	27.923	32.241	35.413	37.683	41.610	44.930	54.308	59.561	62.518	68.917	629.30
11.0000	26.804	25.050	31.551	36.235	39.722	42.201	46.574	50.266	60.427	66.152	69.351	76.322	692.23
12.0000	30.212	28.196	35.342	40.397	44.206	46.899	51.732	55.796	66.761	72.958	76.404	83.973	755.16

MEV/AMU	H	HE	N	O	NE	AR	KR	XE	RN	MYLAR	$(CH_2)_n$	WATER	MEV
0.0125	0.035	0.087	0.113	0.118	0.127	0.184	0.285	0.403	0.592	0.096	0.078	0.090	0.7866
0.0160	0.044	0.111	0.145	0.151	0.163	0.235	0.362	0.509	0.749	0.121	0.098	0.115	1.0069
0.0200	0.055	0.137	0.180	0.188	0.203	0.292	0.447	0.624	0.915	0.150	0.121	0.144	1.2586
0.0250	0.067	0.169	0.223	0.233	0.252	0.359	0.548	0.760	1.104	0.184	0.148	0.179	1.5732
0.0320	0.083	0.214	0.281	0.294	0.318	0.448	0.679	0.933	1.341	0.229	0.184	0.226	2.0138
0.0400	0.101	0.263	0.345	0.360	0.389	0.541	0.815	1.110	1.585	0.277	0.222	0.277	2.5172
0.0500	0.122	0.324	0.420	0.437	0.472	0.646	0.968	1.306	1.851	0.333	0.266	0.337	3.1465
0.0600	0.142	0.381	0.491	0.510	0.549	0.741	1.104	1.479	2.084	0.384	0.306	0.392	3.7758
0.0700	0.160	0.435	0.556	0.577	0.619	0.826	1.227	1.634	2.291	0.431	0.343	0.444	4.4051
0.0800	0.176	0.485	0.616	0.639	0.684	0.904	1.340	1.774	2.478	0.475	0.378	0.492	5.0344
0.0900	0.192	0.531	0.672	0.696	0.745	0.976	1.443	1.903	2.649	0.517	0.410	0.536	5.6637
0.1000	0.206	0.575	0.724	0.749	0.800	1.042	1.538	2.022	2.808	0.555	0.441	0.577	6.2930
0.1250	0.238	0.670	0.838	0.867	0.924	1.188	1.748	2.285	3.160	0.641	0.509	0.668	7.8662
0.1600	0.274	0.778	0.969	1.003	1.067	1.359	1.995	2.594	3.573	0.744	0.590	0.772	10.069
0.2000	0.307	0.879	1.091	1.130	1.200	1.522	2.232	2.891	3.972	0.843	0.668	0.868	12.586
0.2500	0.341	0.982	1.218	1.262	1.341	1.697	2.489	3.217	4.412	0.950	0.752	0.969	15.732
0.3200	0.381	1.103	1.367	1.417	1.508	1.912	2.809	3.625	4.967	1.081	0.855	1.086	20.138
0.4000	0.420	1.222	1.514	1.572	1.679	2.137	3.143	4.054	5.554	1.214	0.960	1.202	25.172
0.5000	0.463	1.352	1.679	1.746	1.871	2.397	3.538	4.560	6.240	1.365	1.079	1.332	31.465
0.6000	0.502	1.470	1.834	1.908	2.053	2.646	3.913	5.041	6.898	1.507	1.189	1.453	37.758
0.7000	0.541	1.584	1.986	2.068	2.232	2.890	4.279	5.511	7.538	1.645	1.297	1.571	44.051
0.8000	0.579	1.694	2.138	2.227	2.410	3.134	4.642	5.976	8.166	1.782	1.403	1.689	50.344
0.9000	0.618	1.805	2.291	2.388	2.591	3.380	5.004	6.438	8.787	1.918	1.510	1.809	56.637
1.0000	0.658	1.916	2.447	2.552	2.775	3.628	5.366	6.894	9.402	2.056	1.617	1.931	62.930
1.2500	0.761	2.197	2.840	2.966	3.239	4.252	6.263	8.013	10.896	2.404	1.890	2.241	78.662
1.6000	0.916	2.601	3.404	3.556	3.901	5.127	7.496	9.534	12.884	2.907	2.289	2.690	100.69
2.0000	1.110	3.085	4.066	4.249	4.672	6.127	8.878	11.225	15.053	3.505	2.771	3.229	125.86
2.5000	1.381	3.730	4.923	5.149	5.656	7.384	10.584	13.288	17.661	4.290	3.414	3.944	157.32
3.2000	1.810	4.712	6.186	6.474	7.087	9.172	12.963	16.146	21.240	5.461	4.389	5.020	201.38
4.0000	2.368	5.956	7.730	8.088	8.815	11.294	15.742	19.466	25.362	6.902	5.604	6.353	251.72
5.0000	3.152	7.687	9.823	10.266	11.128	14.103	19.380	23.780	30.655	8.857	7.269	8.172	314.65
6.0000	4.022	9.601	12.092	12.624	13.624	17.104	23.230	28.324	36.181	10.979	9.084	10.153	377.58
7.0000	4.969	11.685	14.530	15.156	16.299	20.298	27.304	33.108	41.979	13.262	11.042	12.288	440.51
8.0000	5.987	13.931	17.129	17.851	19.151	23.684	31.608	38.139	48.053	15.698	13.137	14.565	503.44
9.0000	7.074	16.329	19.885	20.706	22.172	27.260	36.150	43.430	54.407	18.286	15.366	16.983	566.37
10.0000	8.228	18.862	22.791	23.716	25.353	31.022	40.918	48.977	61.044	21.020	17.725	19.537	629.30
11.0000	9.446	21.523	25.838	26.871	28.689	34.966	45.902	54.773	67.968	23.894	20.207	22.219	692.23
12.0000	10.726	24.310	29.021	30.168	32.173	39.087	51.095	60.810	75.176	26.904	22.811	25.025	755.16

$^{127}_{53}I$ IONS

ELECTRONIC STOPPING POWER IN UNITS OF MEV/(MG/SQ CM)

ENERGY PER MASS UNIT MEV/AMU	BE.	C	AL	TI	NI	GE	ZR	AG	EU	TA	AU	U	ENERGY FOR A=127 MEV
0.0125	8.029	6.643	4.866	3.236	2.628	2.384	2.209	2.044	1.299	1.112	1.022	0.876	1.5862
0.0160	9.232	7.638	5.595	3.721	3.022	2.742	2.540	2.350	1.494	1.279	1.175	1.007	2.0304
0.0200	10.474	8.665	6.348	4.221	3.428	3.110	2.882	2.666	1.695	1.451	1.333	1.143	2.5380
0.0250	11.883	9.830	7.202	4.789	3.889	3.529	3.270	3.025	1.923	1.646	1.516	1.296	3.1725
0.0320	13.646	11.311	8.281	5.507	4.480	4.074	3.759	3.478	2.211	1.896	1.747	1.499	4.0608
0.0400	15.444	12.861	9.394	6.266	5.111	4.660	4.293	3.974	2.527	2.175	2.001	1.719	5.0760
0.0500	17.458	14.633	10.658	7.141	5.851	5.329	4.913	4.551	2.888	2.510	2.313	1.988	6.3450
0.0600	19.283	16.317	11.815	7.964	6.546	5.943	5.494	5.092	3.261	2.836	2.617	2.251	7.6140
0.0700	20.949	17.919	12.892	8.740	7.219	6.549	6.059	5.621	3.610	3.158	2.926	2.514	8.8830
0.0800	22.495	19.492	13.903	9.496	7.855	7.118	6.576	6.117	3.962	3.476	3.212	2.767	10.152
0.0900	23.940	21.012	14.860	10.224	8.470	7.698	7.088	6.598	4.324	3.782	3.507	3.024	11.421
0.1000	25.315	22.508	15.773	10.930	9.085	8.233	7.571	7.082	4.669	4.085	3.785	3.265	12.690
0.1250	28.451	26.251	17.894	12.597	10.522	9.538	8.768	8.213	5.502	4.813	4.500	3.892	15.862
0.1600	32.282	31.377	20.575	14.732	12.386	11.234	10.308	9.670	6.584	5.782	5.421	4.732	20.304
0.2000	36.133	36.670	23.342	16.970	14.355	13.002	11.928	11.181	7.750	6.839	6.419	5.602	25.380
0.2500	40.331	42.423	26.481	19.570	16.630	15.094	13.823	12.949	9.136	8.077	7.574	6.620	31.725
0.3200	45.430	49.357	30.449	22.928	19.579	17.873	16.290	15.224	10.901	9.683	9.089	7.993	40.608
0.4000	50.361	55.907	34.447	26.248	22.597	20.668	18.842	17.602	12.814	11.402	10.713	9.404	50.760
0.5000	55.029	61.841	38.482	29.747	25.783	23.666	21.550	20.088	14.854	13.238	12.449	10.967	63.450
0.6000	58.914	66.352	42.022	32.903	28.659	26.390	23.952	22.313	16.683	14.918	14.056	12.480	76.140
0.7000	61.869	69.451	44.865	35.444	31.002	28.579	25.887	24.138	18.215	16.286	15.389	13.639	88.830
0.8000	64.052	71.410	47.166	37.591	32.969	30.517	27.592	25.706	19.527	17.546	16.555	14.716	101.52
0.9000	65.807	72.722	49.037	39.328	34.669	32.168	29.030	27.019	20.743	18.634	17.604	15.692	114.21
1.0000	67.096	73.467	50.562	40.905	36.101	33.523	30.287	28.163	21.742	19.567	18.506	16.534	126.90
1.2500	69.075	73.974	53.257	43.671	38.878	36.215	32.647	30.303	23.806	21.463	20.291	18.161	158.62
1.6000	69.986	73.358	55.281	46.160	41.240	38.531	34.717	32.063	25.706	23.273	22.002	19.735	203.04
2.0000	69.607	72.640	56.180	47.584	42.753	40.112	35.955	33.315	26.966	24.607	23.258	20.955	253.80
2.5000	68.163	71.423	56.194	48.271	43.663	41.022	36.695	34.054	27.985	25.456	24.163	21.916	317.25
3.2000	65.688	69.390	55.247	48.065	43.755	41.159	36.905	34.142	28.507	26.076	24.750	22.485	406.08
4.0000	62.741	66.817	53.625	47.136	43.168	40.648	36.626	33.784	28.582	26.169	24.936	22.683	507.60
5.0000	59.320	63.587	51.404	45.544	41.946	39.581	35.674	33.001	28.272	25.805	24.725	22.566	634.50
6.0000	56.329	60.564	49.239	43.921	40.524	38.406	34.664	32.055	27.475	25.358	24.275	22.305	761.40
7.0000	53.549	57.846	47.221	42.310	39.099	37.163	33.622	31.119	26.916	24.744	23.752	21.863	888.30
8.0000	51.132	55.351	45.370	40.833	37.793	35.933	32.666	30.171	26.224	24.182	23.229	21.415	1015.2
9.0000	49.051	53.070	43.679	39.442	36.559	34.812	31.667	29.309	25.552	23.587	22.669	20.966	1142.1
10.0000	47.106	50.983	42.134	38.216	35.393	33.750	30.716	28.525	24.859	23.048	22.205	20.519	1269.0
11.0000	45.363	49.150	40.721	37.056	34.368	32.780	29.848	27.812	24.270	22.559	21.786	20.075	1395.9
12.0000	43.799	47.426	39.423	35.954	33.391	31.893	29.055	27.123	23.693	22.077	21.288	19.633	1522.8

MEV/AMU	H	HE	N	O	NE	AR	KR	XE	RN	MYLAR	$(CH_2)_n$	WATER	MEV
0.0125	18.249	7.786	5.158	4.847	4.307	2.842	1.742	1.236	0.816	6.526	8.302	6.336	1.5862
0.0160	20.591	8.684	5.836	5.489	4.879	3.296	2.042	1.455	0.966	7.459	9.490	7.168	2.0304
0.0200	22.726	9.331	6.456	6.081	5.440	3.777	2.355	1.714	1.146	8.392	10.671	7.929	2.5380
0.0250	25.062	9.946	7.144	6.734	6.093	4.371	2.794	2.038	1.476	9.434	12.005	8.772	3.1725
0.0320	28.237	10.715	7.941	7.560	6.906	5.175	3.362	2.534	1.764	10.765	13.729	9.854	4.0608
0.0400	31.471	11.442	8.765	8.436	7.769	6.069	4.021	3.081	2.189	12.166	15.519	10.991	5.0760
0.0500	35.278	12.406	9.795	9.528	8.867	7.151	4.817	3.752	2.718	13.791	17.585	12.384	6.3450
0.0600	39.463	13.505	10.953	10.587	10.008	8.235	5.600	4.407	3.237	15.372	19.625	13.800	7.6140
0.0700	43.702	14.800	12.118	11.770	11.164	9.308	6.343	5.041	3.726	16.940	21.606	15.315	8.8830
0.0800	48.243	16.197	13.361	12.985	12.360	10.385	7.118	5.672	4.213	18.518	23.593	16.906	10.152
0.0900	52.754	17.699	14.637	14.266	13.582	11.457	7.876	6.301	4.666	20.091	25.545	18.546	11.421
0.1000	57.728	19.369	16.057	15.552	14.795	12.539	8.659	6.893	5.110	21.656	27.539	20.236	12.690
0.1250	71.039	23.710	19.594	18.878	18.037	15.228	10.486	8.356	6.209	25.660	32.657	24.676	15.862
0.1600	91.146	30.389	24.937	24.031	22.797	18.991	13.024	10.370	7.695	31.418	39.915	31.479	20.304
0.2000	114.609	38.048	31.162	29.924	28.291	22.992	15.639	12.418	9.173	37.674	47.804	39.331	25.380
0.2500	143.530	47.508	38.531	37.101	34.638	27.382	18.511	14.512	10.672	44.860	56.856	48.938	31.725
0.3200	180.866	59.040	48.018	45.825	41.928	32.123	21.436	16.716	12.210	53.651	68.144	60.837	40.608
0.4000	214.947	70.960	56.355	53.564	48.501	36.203	23.940	18.636	13.572	61.763	78.642	71.511	50.760
0.5000	245.516	81.582	63.380	60.301	53.952	39.675	26.168	20.434	14.893	68.998	88.086	80.889	63.450
0.6000	266.837	89.506	67.739	64.377	57.527	42.064	27.902	21.767	15.926	74.042	95.011	86.858	76.140
0.7000	275.473	94.666	69.631	66.176	59.222	43.250	28.938	22.522	16.645	76.944	98.883	89.417	88.830
0.8000	276.866	97.162	70.231	66.976	59.854	43.770	29.620	23.111	17.169	78.485	100.747	90.276	101.52
0.9000	274.606	97.878	70.123	66.837	59.433	43.839	29.912	23.636	17.555	79.194	101.555	89.934	114.21
1.0000	272.529	98.545	70.332	66.742	59.461	44.039	30.337	24.169	17.950	79.534	101.882	89.596	126.90
1.2500	264.688	99.112	70.566	67.370	59.861	44.896	31.528	25.457	19.226	79.726	101.242	89.312	158.62
1.6000	249.871	97.848	70.649	67.554	60.478	46.160	33.113	26.922	20.841	78.776	98.566	87.787	203.04
2.0000	232.584	95.337	70.674	67.303	60.899	47.303	34.551	28.371	22.303	77.528	95.506	85.674	253.80
2.5000	212.414	91.315	69.737	66.365	61.252	48.439	35.964	29.951	23.826	75.637	91.540	82.605	317.25
3.2000	193.363	85.908	68.119	65.025	60.385	48.893	37.181	30.938	24.806	73.091	87.124	79.279	406.08
4.0000	176.962	80.008	65.422	62.741	58.987	48.262	37.001	31.156	25.204	70.034	82.529	75.450	507.60
5.0000	163.465	74.279	62.148	59.834	56.390	46.726	36.343	30.688	25.188	66.517	77.877	71.349	634.50
6.0000	153.133	69.624	59.185	56.920	53.917	45.004	35.157	29.888	24.620	63.223	73.809	67.605	761.40
7.0000	144.969	65.826	56.571	54.541	51.566	43.349	34.094	29.088	24.036	60.396	70.313	64.599	888.30
8.0000	137.925	62.384	54.217	52.312	49.408	41.695	32.802	28.129	23.366	57.801	67.148	61.839	1015.2
9.0000	131.474	59.753	52.022	50.231	47.523	40.185	31.667	27.212	22.713	55.385	64.252	59.272	1142.1
10.0000	125.982	57.514	50.182	48.455	45.842	38.764	30.632	26.334	22.036	53.258	61.685	57.050	1269.0
11.0000	120.941	55.462	48.498	46.829	44.304	37.463	29.685	25.532	21.378	51.349	59.412	55.054	1395.9
12.0000	116.298	53.576	46.953	45.336	42.892	36.269	28.818	24.797	20.776	49.594	57.282	53.221	1522.8

$^{127}_{53}I$ IONS

RANGE IN UNITS OF MG/SQ CM

ENERGY PER MASS UNIT MEV/AMU	BE	C	AL	TI	NI	GE	ZR	AG	EU	TA	AU	U	ENERGY FOR A=127 MEV
0.0125	0.120	0.120	0.149	0.193	0.204	0.245	0.261	0.286	0.386	0.438	0.466	0.544	1.5862
0.0160	0.152	0.153	0.190	0.248	0.263	0.315	0.335	0.367	0.500	0.570	0.609	0.715	2.0304
0.0200	0.186	0.189	0.236	0.310	0.330	0.395	0.419	0.458	0.627	0.716	0.765	0.900	2.5380
0.0250	0.227	0.233	0.293	0.386	0.414	0.493	0.522	0.569	0.783	0.894	0.955	1.123	3.1725
0.0320	0.280	0.292	0.369	0.491	0.530	0.628	0.663	0.721	0.998	1.138	1.216	1.427	4.0608
0.0400	0.337	0.356	0.451	0.606	0.659	0.776	0.820	0.890	1.238	1.411	1.507	1.764	5.0760
0.0500	0.403	0.430	0.549	0.743	0.815	0.953	1.007	1.091	1.529	1.739	1.858	2.169	6.3450
0.0600	0.463	0.498	0.640	0.872	0.963	1.121	1.184	1.281	1.806	2.053	2.194	2.556	7.6140
0.0700	0.520	0.562	0.726	0.994	1.103	1.279	1.353	1.462	2.071	2.352	2.513	2.923	8.8830
0.0800	0.573	0.622	0.807	1.109	1.237	1.430	1.513	1.633	2.323	2.635	2.816	3.273	10.152
0.0900	0.624	0.679	0.885	1.219	1.364	1.573	1.665	1.796	2.562	2.905	3.104	3.605	11.421
0.1000	0.672	0.732	0.959	1.323	1.485	1.709	1.811	1.952	2.789	3.162	3.379	3.921	12.690
0.1250	0.784	0.853	1.130	1.563	1.766	2.022	2.148	2.311	3.312	3.754	4.011	4.648	15.862
0.1600	0.924	0.999	1.345	1.862	2.114	2.411	2.567	2.757	3.957	4.485	4.787	5.538	20.304
0.2000	1.067	1.143	1.565	2.163	2.466	2.802	2.989	3.207	4.601	5.212	5.560	6.421	25.380
0.2500	1.229	1.299	1.810	2.494	2.852	3.231	3.454	3.703	5.302	6.002	6.400	7.380	31.725
0.3200	1.433	1.489	2.113	2.899	3.323	3.750	4.020	4.307	6.146	6.952	7.410	8.530	40.608
0.4000	1.642	1.679	2.419	3.302	3.790	4.263	4.581	4.906	6.972	7.879	8.396	9.651	50.760
0.5000	1.880	1.892	2.761	3.746	4.302	4.824	5.195	5.564	7.865	8.880	9.460	10.860	63.450
0.6000	2.100	2.090	3.072	4.146	4.760	5.323	5.743	6.151	8.653	9.762	10.396	11.918	76.140
0.7000	2.310	2.276	3.364	4.513	5.180	5.779	6.245	6.690	9.369	10.562	11.243	12.872	88.830
0.8000	2.512	2.456	3.640	4.860	5.576	6.208	6.719	7.199	10.041	11.312	12.038	13.767	101.52
0.9000	2.707	2.632	3.903	5.190	5.951	6.613	7.167	7.680	10.671	12.013	12.780	14.602	114.21
1.0000	2.898	2.806	4.158	5.506	6.310	6.999	7.595	8.140	11.268	12.677	13.483	15.389	126.90
1.2500	3.363	3.235	4.768	6.255	7.155	7.908	8.602	9.223	12.660	14.222	15.117	17.216	158.62
1.6000	4.000	3.836	5.585	7.242	8.261	9.094	9.918	10.645	14.451	16.205	17.214	19.556	203.04
2.0000	4.726	4.530	6.494	8.323	9.468	10.383	11.352	12.195	16.376	18.322	19.454	22.048	253.80
2.5000	5.646	5.410	7.622	9.645	10.935	11.945	13.097	14.077	18.682	20.854	22.127	25.005	317.25
3.2000	6.972	6.671	9.214	11.487	12.965	14.104	15.508	16.679	21.823	24.298	25.755	29.002	406.08
4.0000	8.553	8.161	11.078	13.619	15.299	16.585	18.268	19.666	25.378	28.182	29.839	33.494	507.60
5.0000	10.632	10.107	13.495	16.358	18.281	19.748	21.778	23.466	29.841	33.064	34.948	39.101	634.50
6.0000	12.828	12.153	16.018	19.195	21.359	23.003	25.386	27.368	34.394	38.024	40.128	44.757	761.40
7.0000	15.139	14.297	18.650	22.139	24.548	26.363	29.104	31.387	39.061	43.091	45.413	50.504	888.30
8.0000	17.565	16.540	21.392	25.193	27.850	29.836	32.934	35.529	43.838	48.280	50.816	56.370	1015.2
9.0000	20.099	18.882	24.244	28.356	31.265	33.425	36.880	39.797	48.741	53.594	56.347	62.360	1142.1
10.0000	22.740	21.322	27.202	31.625	34.793	37.128	40.950	44.187	53.777	59.038	62.004	68.479	1269.0
11.0000	25.486	23.858	30.267	34.998	38.432	40.944	45.142	48.693	58.945	64.604	67.775	74.732	1395.9
12.0000	28.333	26.487	33.434	38.475	42.179	44.869	49.452	53.314	64.238	70.291	73.668	81.125	1522.8

MEV/AMU	H	HE	N	O	NE	AR	KR	XE	RN	MYLAR	$(CH_2)_n$	WATER	MEV
0.0125	0.046	0.107	0.131	0.135	0.143	0.194	0.277	0.368	0.493	0.114	0.095	0.107	1.5862
0.0160	0.058	0.137	0.169	0.174	0.184	0.251	0.358	0.477	0.651	0.146	0.121	0.137	2.0304
0.0200	0.071	0.171	0.212	0.218	0.232	0.316	0.450	0.598	0.821	0.182	0.150	0.172	2.5380
0.0250	0.087	0.213	0.265	0.274	0.292	0.397	0.564	0.747	1.023	0.226	0.186	0.216	3.1725
0.0320	0.109	0.272	0.340	0.352	0.374	0.507	0.718	0.947	1.288	0.285	0.233	0.276	4.0608
0.0400	0.133	0.339	0.423	0.438	0.467	0.626	0.887	1.161	1.573	0.350	0.285	0.343	5.0760
0.0500	0.162	0.422	0.524	0.541	0.577	0.764	1.082	1.408	1.899	0.426	0.346	0.424	6.3450
0.0600	0.189	0.501	0.620	0.640	0.680	0.892	1.262	1.634	2.194	0.497	0.402	0.500	7.6140
0.0700	0.214	0.576	0.710	0.732	0.777	1.010	1.428	1.840	2.464	0.564	0.455	0.572	8.8830
0.0800	0.237	0.647	0.794	0.818	0.867	1.118	1.581	2.031	2.713	0.626	0.504	0.638	10.152
0.0900	0.259	0.713	0.872	0.898	0.951	1.219	1.723	2.207	2.944	0.685	0.550	0.700	11.421
0.1000	0.279	0.774	0.945	0.973	1.029	1.312	1.856	2.371	3.159	0.740	0.594	0.758	12.690
0.1250	0.324	0.910	1.107	1.141	1.204	1.520	2.151	2.739	3.644	0.863	0.691	0.887	15.862
0.1600	0.376	1.066	1.295	1.335	1.408	1.763	2.499	3.174	4.220	1.011	0.808	1.036	20.304
0.2000	0.423	1.210	1.469	1.515	1.598	1.994	2.834	3.592	4.778	1.152	0.919	1.174	25.380
0.2500	0.471	1.355	1.646	1.700	1.794	2.238	3.191	4.043	5.382	1.302	1.037	1.314	31.725
0.3200	0.525	1.519	1.848	1.910	2.021	2.530	3.622	4.593	6.127	1.479	1.177	1.473	40.608
0.4000	0.576	1.674	2.040	2.111	2.242	2.822	4.059	5.152	6.889	1.653	1.314	1.625	50.760
0.5000	0.631	1.840	2.251	2.331	2.486	3.151	4.556	5.787	7.756	1.844	1.464	1.791	63.450
0.6000	0.680	1.989	2.445	2.535	2.713	3.461	5.018	6.379	8.563	2.021	1.603	1.942	76.140
0.7000	0.727	2.126	2.629	2.729	2.930	3.758	5.464	6.951	9.329	2.189	1.733	2.086	88.830
0.8000	0.773	2.258	2.810	2.919	3.143	4.049	5.897	7.506	10.079	2.352	1.860	2.227	101.52
0.9000	0.819	2.388	2.991	3.109	3.356	4.339	6.323	8.049	10.809	2.513	1.986	2.368	114.21
1.0000	0.865	2.518	3.172	3.299	3.569	4.628	6.744	8.580	11.523	2.673	2.110	2.509	126.90
1.2500	0.983	2.838	3.621	3.770	4.099	5.339	7.767	9.856	13.227	3.070	2.422	2.863	158.62
1.6000	1.155	3.288	4.248	4.427	4.836	6.312	9.138	11.548	15.441	3.629	2.865	3.363	203.04
2.0000	1.365	3.812	4.965	5.179	5.671	7.397	10.637	13.382	17.791	4.278	3.387	3.947	253.80
2.5000	1.650	4.491	5.868	6.127	6.708	8.721	12.434	15.555	20.540	5.105	4.065	4.701	317.25
3.2000	2.088	5.493	7.155	7.478	8.167	10.544	14.860	18.470	24.189	6.299	5.059	5.797	406.08
4.0000	2.637	6.717	8.675	9.066	9.867	12.633	17.596	21.738	28.246	7.717	6.255	7.109	507.60
5.0000	3.383	8.363	10.665	11.137	12.067	15.305	21.055	25.841	33.281	9.576	7.838	8.838	634.50
6.0000	4.185	10.128	12.758	13.312	14.369	18.072	24.606	30.031	38.377	11.533	9.512	10.666	761.40
7.0000	5.037	12.003	14.952	15.590	16.776	20.946	28.272	34.335	43.594	13.587	11.274	12.587	888.30
8.0000	5.935	13.984	17.244	17.966	19.291	23.931	32.067	38.773	48.950	15.735	13.122	14.595	1015.2
9.0000	6.877	16.063	19.634	20.442	21.911	27.032	36.006	43.360	54.460	17.979	15.054	16.691	1142.1
10.0000	7.864	18.228	22.118	23.015	24.630	30.248	40.081	48.102	60.133	20.316	17.070	18.874	1269.0
11.0000	8.892	20.475	24.691	25.680	27.446	33.579	44.290	52.997	65.981	22.743	19.167	21.139	1395.9
12.0000	9.962	22.804	27.350	28.434	30.358	37.022	48.629	58.041	72.003	25.258	21.343	23.484	1522.8

$^{197}_{79}Au$ IONS

ELECTRONIC STOPPING POWER IN UNITS OF MEV/(MG/SQ CM)

ENERGY PER MASS UNIT MEV/AMU	BE	C	AL	TI	NI	GE	ZR	AG	EU	TA	AU	U	ENERGY FOR A=197 MEV
0.0125	9.346	7.732	5.664	3.767	3.059	2.776	2.572	2.379	1.512	1.294	1.190	1.020	2.4621
0.0160	10.819	8.950	6.557	4.360	3.541	3.213	2.977	2.754	1.751	1.498	1.377	1.180	3.1515
0.0200	12.350	10.217	7.485	4.977	4.042	3.667	3.398	3.144	1.998	1.710	1.572	1.347	3.9394
0.0250	14.096	11.662	8.543	5.681	4.613	4.186	3.879	3.588	2.281	1.952	1.798	1.538	4.9242
0.0320	16.298	13.510	9.890	6.577	5.350	4.866	4.490	4.154	2.641	2.265	2.087	1.790	6.3030
0.0400	18.559	15.454	11.289	7.530	6.141	5.599	5.159	4.775	3.037	2.613	2.405	2.066	7.8788
0.0500	21.107	17.692	12.886	8.633	7.074	6.443	5.940	5.502	3.492	3.035	2.796	2.403	9.8485
0.0600	23.430	19.826	14.357	9.676	7.954	7.221	6.676	6.188	3.962	3.446	3.180	2.735	11.818
0.0700	25.562	21.865	15.730	10.665	8.809	7.991	7.393	6.858	4.405	3.854	3.571	3.067	13.788
0.0800	27.549	23.871	17.026	11.629	9.620	8.718	8.054	7.492	4.853	4.257	3.933	3.388	15.758
0.0900	29.414	25.817	18.258	12.561	10.407	9.458	8.709	8.107	5.313	4.647	4.309	3.715	17.727
0.1000	31.193	27.734	19.435	13.468	11.194	10.145	9.329	8.726	5.753	5.034	4.664	4.023	19.697
0.1250	35.272	32.544	22.184	15.617	13.044	11.824	10.870	10.182	6.822	5.967	5.579	4.825	24.621
0.1600	40.293	39.163	25.680	18.387	15.460	14.021	12.866	12.070	8.218	7.216	6.767	5.906	31.515
0.2000	45.376	46.051	29.313	21.310	18.027	16.327	14.979	14.041	9.732	8.589	8.061	7.035	39.394
0.2500	50.958	53.602	33.459	24.726	21.012	19.072	17.466	16.362	11.543	10.205	9.569	8.365	49.242
0.3200	57.789	62.786	38.733	29.166	24.905	22.736	20.722	19.366	13.866	12.317	11.562	10.167	63.030
0.4000	64.637	71.755	44.212	33.689	29.003	26.527	24.184	22.592	16.447	14.634	13.750	12.070	78.788
0.5000	72.165	81.098	50.465	39.010	33.812	31.036	28.261	26.343	19.480	17.360	16.326	14.383	98.485
0.6000	78.417	88.317	55.932	43.795	38.146	35.125	31.881	29.700	22.205	19.856	18.709	16.612	118.18
0.7000	83.551	93.791	60.588	47.865	41.867	38.595	34.960	32.597	24.599	21.994	20.782	18.419	137.88
0.8000	87.694	97.768	64.576	51.467	45.139	41.781	37.777	35.194	26.734	24.022	22.666	20.148	157.58
0.9000	91.263	100.852	68.005	54.540	48.080	44.611	40.259	37.471	28.766	25.842	24.414	21.762	177.27
1.0000	94.170	103.111	70.965	57.410	50.669	47.049	42.508	39.527	30.515	27.463	25.973	23.205	196.97
1.2500	99.536	106.596	76.743	62.929	56.022	52.185	47.043	43.667	34.304	30.927	29.239	26.169	246.21
1.6000	103.903	108.910	82.072	68.530	61.226	57.204	51.541	47.602	38.164	34.552	32.665	29.300	315.15
2.0000	106.141	110.767	85.667	72.560	65.193	61.166	54.827	50.801	41.120	37.522	35.466	31.954	393.94
2.5000	106.674	111.775	87.943	75.543	68.331	64.198	57.427	53.293	43.795	39.838	37.815	34.298	492.42
3.2000	105.660	111.614	88.864	77.312	70.381	66.204	59.361	54.918	45.854	41.944	39.811	36.168	630.30
4.0000	103.323	110.035	88.310	77.625	71.090	66.939	60.316	55.636	47.069	43.096	41.064	37.355	787.88
5.0000	99.907	107.093	86.574	76.705	70.645	66.662	60.083	55.581	47.616	43.460	41.642	38.006	984.85
6.0000	96.559	103.818	84.405	75.289	69.465	65.836	59.421	54.948	47.098	43.469	41.612	38.235	1181.8
7.0000	93.139	100.613	82.133	73.591	68.006	64.639	58.479	54.126	46.816	43.038	41.313	38.028	1378.8
8.0000	90.045	97.476	79.898	71.908	66.555	63.279	57.527	53.132	46.181	42.586	40.908	37.712	1575.8
9.0000	87.322	94.476	77.758	70.215	65.083	61.973	56.374	52.175	45.488	41.989	40.356	37.324	1772.7
10.0000	84.670	91.638	75.734	68.691	63.616	60.663	55.210	51.272	44.683	41.426	39.912	36.882	1969.7
11.0000	82.248	89.114	73.831	67.186	62.314	59.434	54.118	50.427	44.003	40.902	39.500	36.399	2166.7
12.0000	80.044	86.672	72.047	65.706	61.023	58.286	53.098	49.568	43.300	40.346	38.905	35.879	2363.6

MEV/AMU	H	HE	N	O	NE	AR	KR	XE	RN	MYLAR	$(CH_2)_n$	WATER	MEV
0.0125	21.241	9.063	6.004	5.642	5.013	3.308	2.028	1.439	0.949	7.596	9.663	7.375	2.4621
0.0160	24.130	10.177	6.839	6.433	5.718	3.862	2.393	1.705	1.132	8.741	11.121	8.400	3.1515
0.0200	26.795	11.002	7.612	7.170	6.414	4.453	2.777	2.021	1.352	9.895	12.582	9.348	3.9394
0.0250	29.731	11.798	8.475	7.988	7.228	5.186	3.315	2.418	1.751	11.192	14.242	10.406	4.9242
0.0320	33.724	12.797	9.484	9.029	8.248	6.181	4.015	3.026	2.107	12.857	16.397	11.769	6.3030
0.0400	37.817	13.750	10.532	10.137	9.336	7.293	4.832	3.703	2.630	14.619	18.649	13.208	7.8788
0.0500	42.651	14.999	11.842	11.520	10.721	8.646	5.824	4.536	3.286	16.674	21.261	14.973	9.8485
0.0600	47.951	16.410	13.309	12.863	12.160	10.007	6.805	5.355	3.934	18.678	23.846	16.768	11.818
0.0700	53.326	18.059	14.787	14.362	13.623	11.357	7.739	6.151	4.546	20.670	26.364	18.688	13.788
0.0800	59.082	19.836	16.362	15.903	15.137	12.719	8.718	6.947	5.159	22.679	28.894	20.704	15.758
0.0900	64.816	21.745	17.984	17.528	16.688	14.077	9.677	7.741	5.733	24.685	31.385	22.786	17.727
0.1000	71.132	23.866	19.785	19.163	18.230	15.451	10.670	8.493	6.297	26.684	33.933	24.935	19.697
0.1250	88.070	29.394	24.291	23.404	22.361	18.879	13.000	10.360	7.698	31.812	40.486	30.592	24.621
0.1600	113.764	37.930	31.125	29.995	28.454	23.703	16.256	12.943	9.604	39.214	49.820	39.291	31.515
0.2000	143.926	47.780	39.133	37.579	35.527	28.873	19.640	15.594	11.520	47.311	60.033	49.392	39.394
0.2500	181.349	60.026	48.683	46.876	43.765	34.597	23.388	18.336	13.484	56.680	71.837	61.833	49.242
0.3200	230.073	75.103	61.082	58.293	53.335	40.863	27.268	21.264	15.532	68.247	86.684	77.388	63.030
0.4000	275.880	91.076	72.330	68.749	62.250	46.466	30.727	23.918	17.419	79.271	100.935	91.783	78.788
0.5000	321.968	106.986	83.116	79.079	70.752	52.030	34.316	26.797	19.530	90.484	115.515	106.078	98.485
0.6000	355.169	119.135	90.163	85.688	76.571	55.988	37.139	28.973	21.198	98.552	126.463	115.612	118.18
0.7000	372.013	127.842	94.033	89.368	79.977	58.407	39.080	30.415	22.478	103.909	133.537	120.753	137.88
0.8000	379.061	133.026	96.154	91.698	81.947	59.926	40.554	31.642	23.506	107.454	137.934	123.598	157.58
0.9000	380.829	135.738	97.247	92.691	82.422	60.797	41.483	32.779	24.346	109.828	140.839	124.722	177.27
1.0000	382.499	138.310	98.712	93.673	83.454	61.810	42.579	33.921	25.192	111.627	142.993	125.749	196.97
1.2500	381.413	142.819	101.684	97.080	86.259	64.694	45.432	36.683	27.704	114.884	145.888	128.698	246.21
1.6000	370.966	145.268	104.888	100.292	89.787	68.530	49.161	39.969	30.941	116.953	146.335	130.330	315.15
2.0000	354.661	145.377	107.769	102.629	92.863	72.132	52.685	43.262	34.010	118.220	145.634	130.642	393.94
2.5000	332.423	142.907	109.137	103.860	95.857	75.807	56.283	46.873	37.288	118.371	143.259	129.276	492.42
3.2000	311.025	138.184	109.570	104.593	97.129	78.645	59.806	49.764	39.900	117.568	140.139	127.520	630.30
4.0000	291.425	131.759	107.739	103.323	97.142	79.479	60.934	51.308	41.506	115.333	135.910	124.253	787.88
5.0000	275.307	125.100	104.669	100.773	94.972	78.696	61.208	51.685	42.421	112.027	131.160	120.165	984.85
6.0000	262.500	119.349	101.455	97.572	92.423	77.146	60.265	51.234	42.203	108.376	126.523	115.888	1181.8
7.0000	252.149	114.494	98.395	94.864	89.689	75.398	59.300	50.594	41.806	105.048	122.296	112.358	1378.8
8.0000	242.890	109.860	95.478	92.122	87.009	73.426	57.766	49.537	41.147	101.790	118.249	108.901	1575.8
9.0000	234.051	106.372	92.609	89.421	84.600	71.537	56.374	48.443	40.434	98.597	114.382	105.517	1772.7
10.0000	226.444	103.377	90.199	87.094	82.398	69.675	55.059	47.334	39.609	95.728	110.874	102.544	1969.7
11.0000	219.279	100.558	87.933	84.906	80.328	67.925	53.823	46.292	38.761	93.101	107.720	99.820	2166.7
12.0000	212.537	97.911	85.807	82.853	78.387	66.283	52.666	45.317	37.969	90.635	104.684	97.263	2363.6

$^{197}_{79}Au$ IONS

RANGE IN UNITS OF MG/SQ CM

ENERGY PER MASS UNIT MEV/AMU	BE	C	AL	TI	NI	GE	ZR	AG	EU	TA	AU	U	ENERGY FOR A=197 MEV
0.0125	0.136	0.133	0.159	0.199	0.205	0.244	0.254	0.273	0.353	0.390	0.407	0.458	2.4621
0.0160	0.172	0.169	0.204	0.257	0.267	0.317	0.331	0.358	0.469	0.524	0.552	0.633	3.1515
0.0200	0.212	0.210	0.255	0.322	0.336	0.399	0.417	0.451	0.595	0.667	0.706	0.815	3.9394
0.0250	0.259	0.260	0.317	0.403	0.423	0.500	0.523	0.565	0.749	0.841	0.892	1.032	4.9242
0.0320	0.321	0.327	0.402	0.516	0.544	0.642	0.671	0.724	0.963	1.083	1.148	1.329	6.3030
0.0400	0.388	0.400	0.495	0.642	0.681	0.801	0.837	0.902	1.207	1.357	1.438	1.664	7.8788
0.0500	0.466	0.486	0.606	0.794	0.850	0.995	1.040	1.119	1.509	1.695	1.798	2.076	9.8485
0.0600	0.539	0.567	0.712	0.940	1.013	1.182	1.236	1.328	1.805	2.027	2.150	2.479	11.818
0.0700	0.608	0.643	0.812	1.080	1.171	1.361	1.424	1.530	2.092	2.348	2.491	2.870	13.788
0.0800	0.672	0.714	0.908	1.213	1.322	1.533	1.606	1.724	2.369	2.658	2.821	3.248	15.758
0.0900	0.733	0.782	1.000	1.341	1.468	1.698	1.780	1.910	2.636	2.957	3.139	3.612	17.727
0.1000	0.792	0.846	1.088	1.463	1.608	1.855	1.948	2.089	2.892	3.244	3.445	3.962	19.697
0.1250	0.928	0.992	1.292	1.747	1.934	2.223	2.340	2.506	3.490	3.917	4.160	4.782	24.621
0.1600	1.098	1.169	1.551	2.102	2.345	2.683	2.833	3.030	4.239	4.762	5.055	5.805	31.515
0.2000	1.274	1.344	1.815	2.462	2.762	3.148	3.334	3.563	4.994	5.612	5.957	6.832	39.394
0.2500	1.470	1.533	2.110	2.860	3.222	3.661	3.888	4.153	5.823	6.544	6.946	7.960	49.242
0.3200	1.717	1.763	2.475	3.345	3.785	4.283	4.564	4.874	6.825	7.670	8.142	9.319	63.030
0.4000	1.969	1.992	2.842	3.828	4.342	4.896	5.233	5.589	7.807	8.771	9.311	10.647	78.788
0.5000	2.252	2.245	3.248	4.355	4.948	5.560	5.959	6.366	8.860	9.950	10.564	12.070	98.485
0.6000	2.510	2.474	3.611	4.820	5.481	6.142	6.597	7.050	9.776	10.974	11.650	13.297	118.18
0.7000	2.753	2.690	3.944	5.243	5.963	6.666	7.174	7.669	10.596	11.891	12.621	14.390	137.88
0.8000	2.983	2.896	4.259	5.639	6.408	7.149	7.706	8.239	11.348	12.729	13.508	15.389	157.58
0.9000	3.203	3.094	4.556	6.011	6.831	7.605	8.211	8.781	12.058	13.519	14.345	16.329	177.27
1.0000	3.416	3.287	4.839	6.362	7.230	8.034	8.687	9.293	12.723	14.258	15.126	17.205	196.97
1.2500	3.923	3.755	5.505	7.180	8.152	9.026	9.785	10.475	14.241	15.944	16.909	19.198	246.21
1.6000	4.599	4.393	6.371	8.227	9.325	10.284	11.181	11.983	16.141	18.047	19.134	21.681	315.15
2.0000	5.347	5.109	7.309	9.342	10.570	11.613	12.660	13.582	18.126	20.231	21.444	24.251	393.94
2.5000	6.271	5.992	8.441	10.669	12.043	13.182	14.412	15.471	20.442	22.773	24.128	27.220	492.42
3.2000	7.567	7.225	9.998	12.470	14.027	15.293	16.770	18.015	23.514	26.140	27.675	31.128	630.30
4.0000	9.074	8.645	11.775	14.502	16.253	17.658	19.400	20.863	26.902	29.842	31.568	35.410	787.88
5.0000	11.011	10.458	14.026	17.053	19.030	20.604	22.670	24.402	31.059	34.390	36.328	40.633	984.85
6.0000	13.016	12.326	16.330	19.644	21.841	23.577	25.965	27.966	35.217	38.920	41.058	45.799	1181.8
7.0000	15.093	14.253	18.695	22.290	24.707	26.596	29.307	31.577	39.411	43.474	45.808	50.964	1378.8
8.0000	17.244	16.242	21.127	24.998	27.635	29.676	32.703	35.250	43.648	48.075	50.599	56.165	1575.8
9.0000	19.466	18.295	23.626	27.770	30.628	32.821	36.162	38.991	47.945	52.733	55.447	61.415	1772.7
10.0000	21.757	20.412	26.193	30.607	33.689	36.034	39.693	42.800	52.315	57.456	60.355	66.724	1969.7
11.0000	24.117	22.592	28.827	33.507	36.818	39.315	43.296	46.674	56.757	62.241	65.317	72.101	2166.7
12.0000	26.545	24.833	31.528	36.471	40.012	42.662	46.971	50.614	61.270	67.091	70.342	77.551	2363.6

MEV/AMU	H	HE	N	O	NE	AR	KR	XE	RN	MYLAR	$(CH_2)_n$	WATER	MEV
0.0125	0.052	0.121	0.143	0.146	0.153	0.201	0.273	0.346	0.425	0.126	0.107	0.118	2.4621
0.0160	0.067	0.155	0.184	0.188	0.198	0.260	0.354	0.455	0.587	0.162	0.137	0.152	3.1515
0.0200	0.083	0.192	0.230	0.237	0.249	0.328	0.446	0.574	0.753	0.202	0.169	0.190	3.9394
0.0250	0.102	0.240	0.289	0.297	0.313	0.412	0.560	0.720	0.949	0.251	0.210	0.238	4.9242
0.0320	0.127	0.307	0.371	0.381	0.402	0.529	0.719	0.922	1.209	0.318	0.264	0.305	6.3030
0.0400	0.155	0.383	0.463	0.477	0.503	0.659	0.896	1.144	1.498	0.391	0.323	0.380	7.8788
0.0500	0.188	0.478	0.577	0.593	0.626	0.813	1.108	1.408	1.838	0.479	0.394	0.472	9.8485
0.0600	0.220	0.570	0.686	0.705	0.743	0.958	1.308	1.655	2.155	0.562	0.460	0.559	11.818
0.0700	0.249	0.658	0.790	0.812	0.855	1.093	1.495	1.887	2.451	0.641	0.522	0.642	13.788
0.0800	0.277	0.741	0.888	0.912	0.959	1.219	1.670	2.103	2.728	0.715	0.581	0.720	15.758
0.0900	0.303	0.820	0.981	1.007	1.058	1.337	1.835	2.305	2.989	0.784	0.636	0.793	17.727
0.1000	0.327	0.893	1.067	1.095	1.150	1.448	1.989	2.495	3.234	0.850	0.688	0.862	19.697
0.1250	0.382	1.056	1.260	1.295	1.358	1.695	2.336	2.925	3.794	0.999	0.806	1.016	24.621
0.1600	0.444	1.245	1.486	1.528	1.603	1.987	2.751	3.441	4.469	1.177	0.947	1.196	31.515
0.2000	0.501	1.419	1.696	1.746	1.832	2.266	3.152	3.940	5.130	1.348	1.083	1.362	39.394
0.2500	0.560	1.595	1.911	1.968	2.068	2.561	3.581	4.480	5.849	1.530	1.226	1.532	49.242
0.3200	0.625	1.794	2.155	2.223	2.343	2.913	4.099	5.139	6.737	1.744	1.395	1.725	63.030
0.4000	0.686	1.981	2.386	2.465	2.608	3.264	4.623	5.808	7.645	1.953	1.560	1.907	78.788
0.5000	0.751	2.178	2.635	2.727	2.899	3.655	5.212	6.561	8.669	2.181	1.739	2.103	98.485
0.6000	0.809	2.352	2.860	2.963	3.162	4.014	5.751	7.249	9.606	2.387	1.900	2.279	118.18
0.7000	0.863	2.511	3.073	3.188	3.413	4.358	6.258	7.899	10.484	2.581	2.051	2.445	137.88
0.8000	0.916	2.662	3.280	3.405	3.656	4.690	6.752	8.533	11.322	2.767	2.196	2.606	157.58
0.9000	0.968	2.809	3.483	3.618	3.896	5.016	7.232	9.144	12.145	2.949	2.337	2.765	177.27
1.0000	1.019	2.952	3.684	3.830	4.133	5.337	7.700	9.734	12.940	3.126	2.476	2.922	196.97
1.2500	1.148	3.302	4.174	4.344	4.712	6.114	8.817	11.127	14.799	3.560	2.816	3.308	246.21
1.6000	1.330	3.779	4.840	5.041	5.493	7.146	10.271	12.922	17.147	4.153	3.286	3.838	315.15
2.0000	1.547	4.320	5.579	5.816	6.354	8.264	11.816	14.813	19.571	4.821	3.825	4.441	393.94
2.5000	1.833	5.001	6.486	6.768	7.396	9.594	13.622	16.996	22.332	5.652	4.505	5.197	492.42
3.2000	2.261	5.981	7.744	8.088	8.822	11.376	15.994	19.846	25.900	6.819	5.476	6.269	630.30
4.0000	2.784	7.147	9.193	9.603	10.443	13.367	18.601	22.961	29.767	8.171	6.617	7.519	787.88
5.0000	3.479	8.680	11.047	11.532	12.492	15.856	21.824	26.783	34.457	9.902	8.091	9.130	984.85
6.0000	4.211	10.292	12.958	13.518	14.594	18.383	25.066	30.609	39.111	11.689	9.620	10.799	1181.8
7.0000	4.977	11.977	14.929	15.565	16.757	20.966	28.361	34.478	43.800	13.535	11.203	12.525	1378.8
8.0000	5.773	13.733	16.961	17.672	18.987	23.613	31.727	38.412	48.549	15.440	12.841	14.306	1575.8
9.0000	6.599	15.556	19.056	19.842	21.283	26.331	35.178	42.433	53.378	17.407	14.535	16.143	1772.7
10.0000	7.455	17.434	21.211	22.075	23.642	29.121	38.714	46.547	58.301	19.434	16.284	18.037	1969.7
11.0000	8.339	19.366	23.423	24.365	26.064	31.985	42.333	50.755	63.328	21.521	18.087	19.984	2166.7
12.0000	9.251	21.352	25.691	26.714	28.546	34.921	46.033	55.056	68.463	23.666	19.942	21.984	2363.6

J F Ziegler (IBM) The Stopping Powers and Ranges of Ions in Matter vol 5 library call # QC 794.6.S8

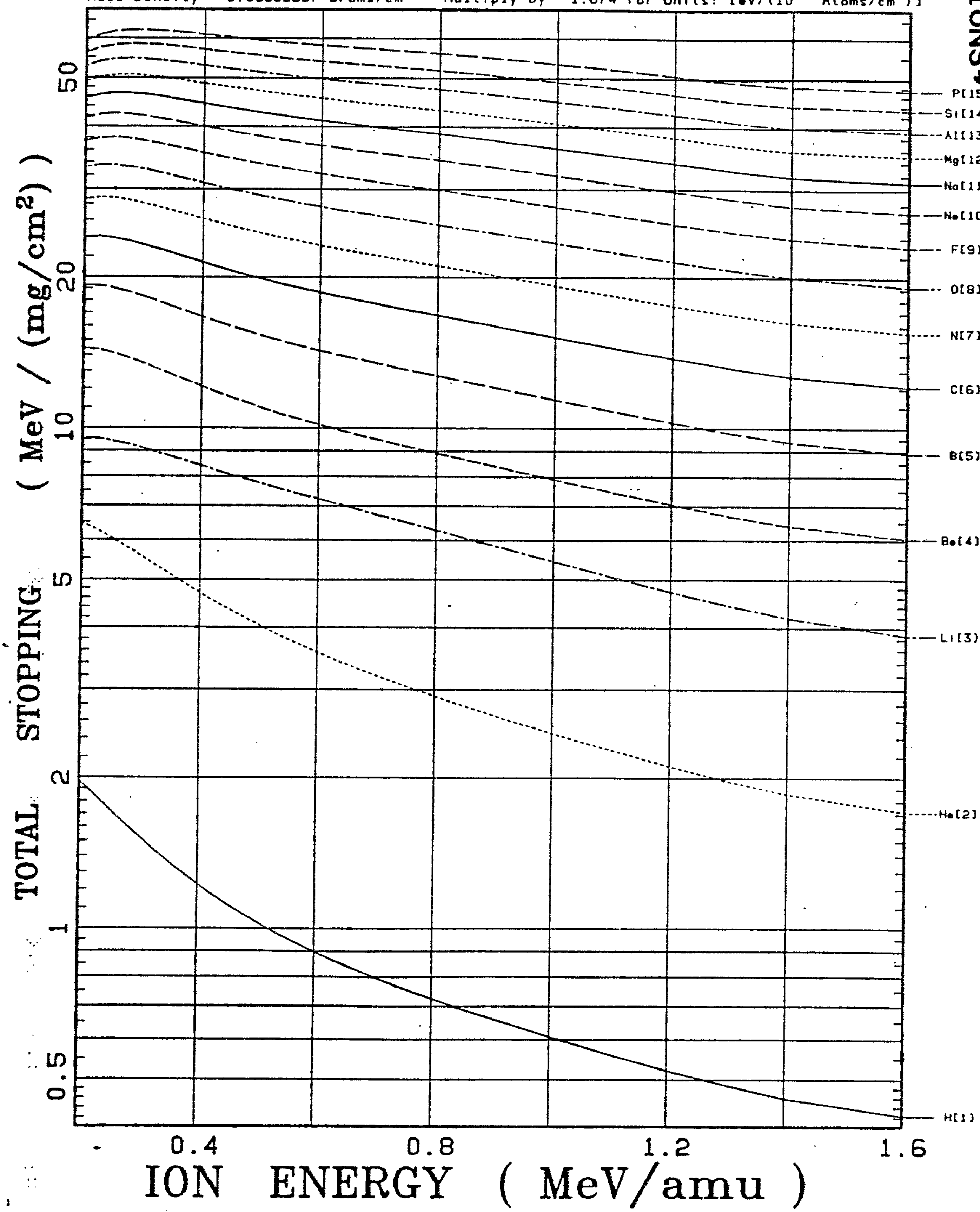
Tandem Van de Graaff has a copy

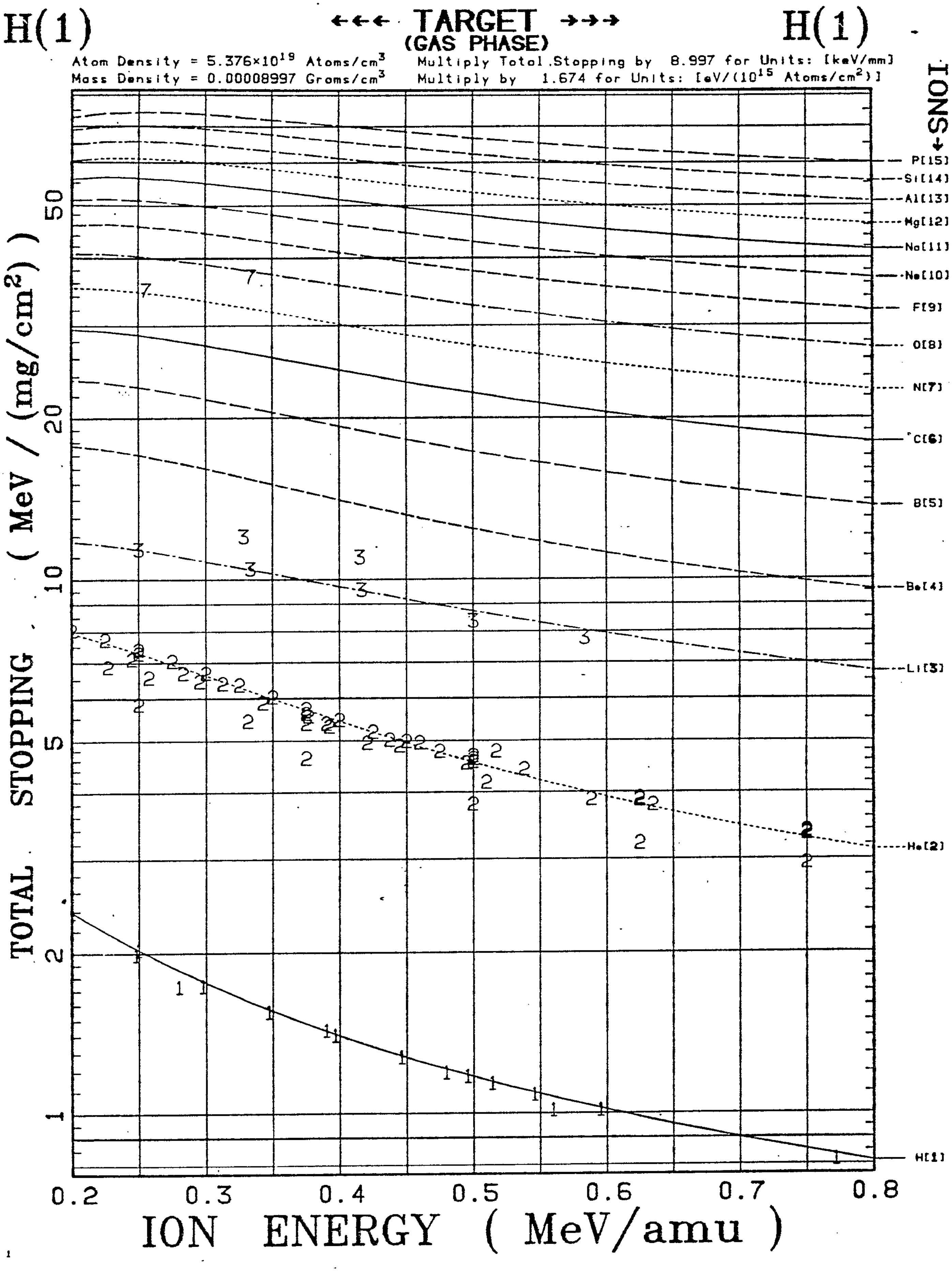
H(1) ←←← TARGET →→→ H(1)

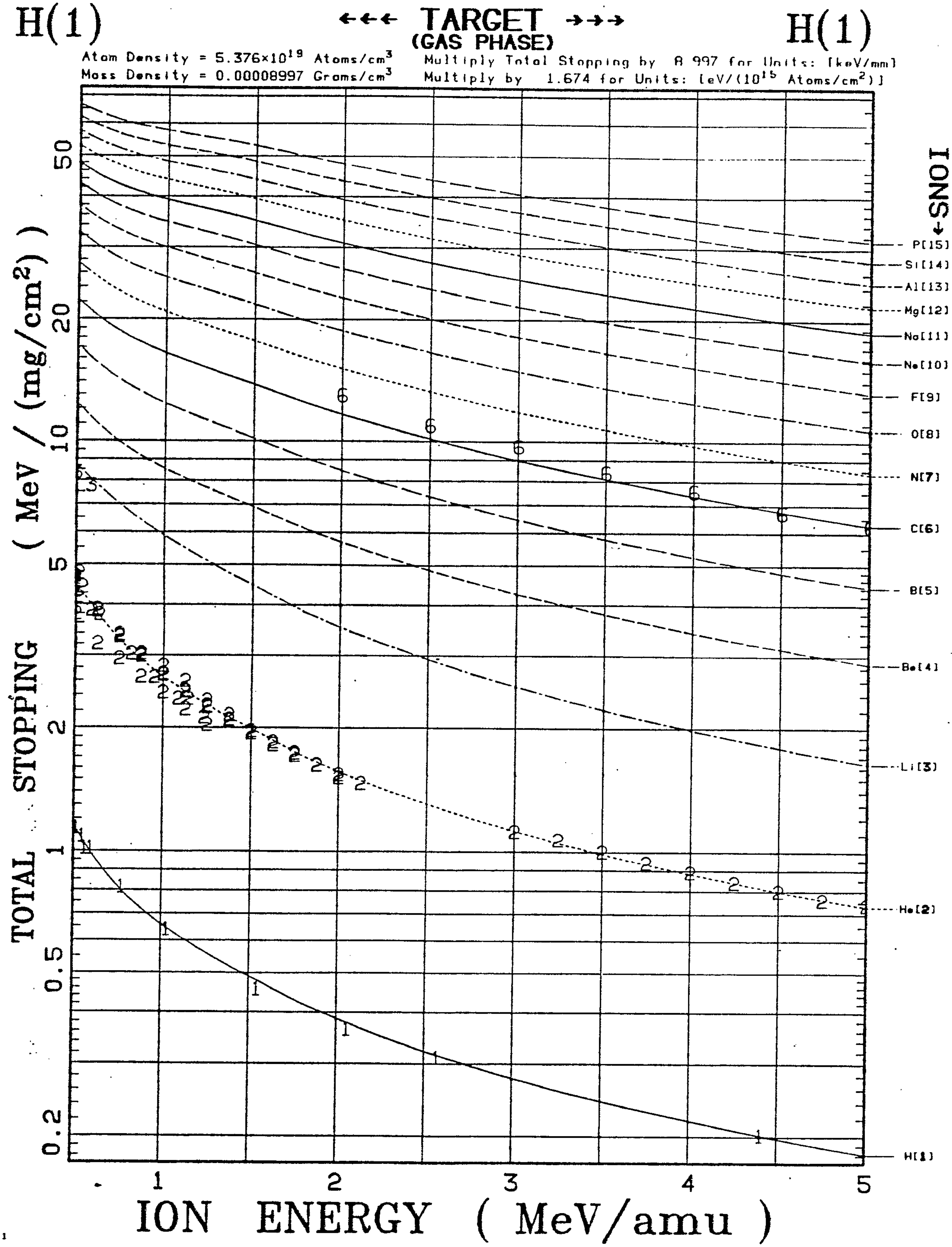
(SOLID PHASE)

Atom Density = 5.376×10^{19} Atoms/cm^3 Multiply Total Stopping by 8.997 for Units: [keV/mm]

Mass Density = 0.00008997 Grams/cm^3 Multiply by 1.674 for Units: [eV/(10^{15} Atoms/cm^2)]

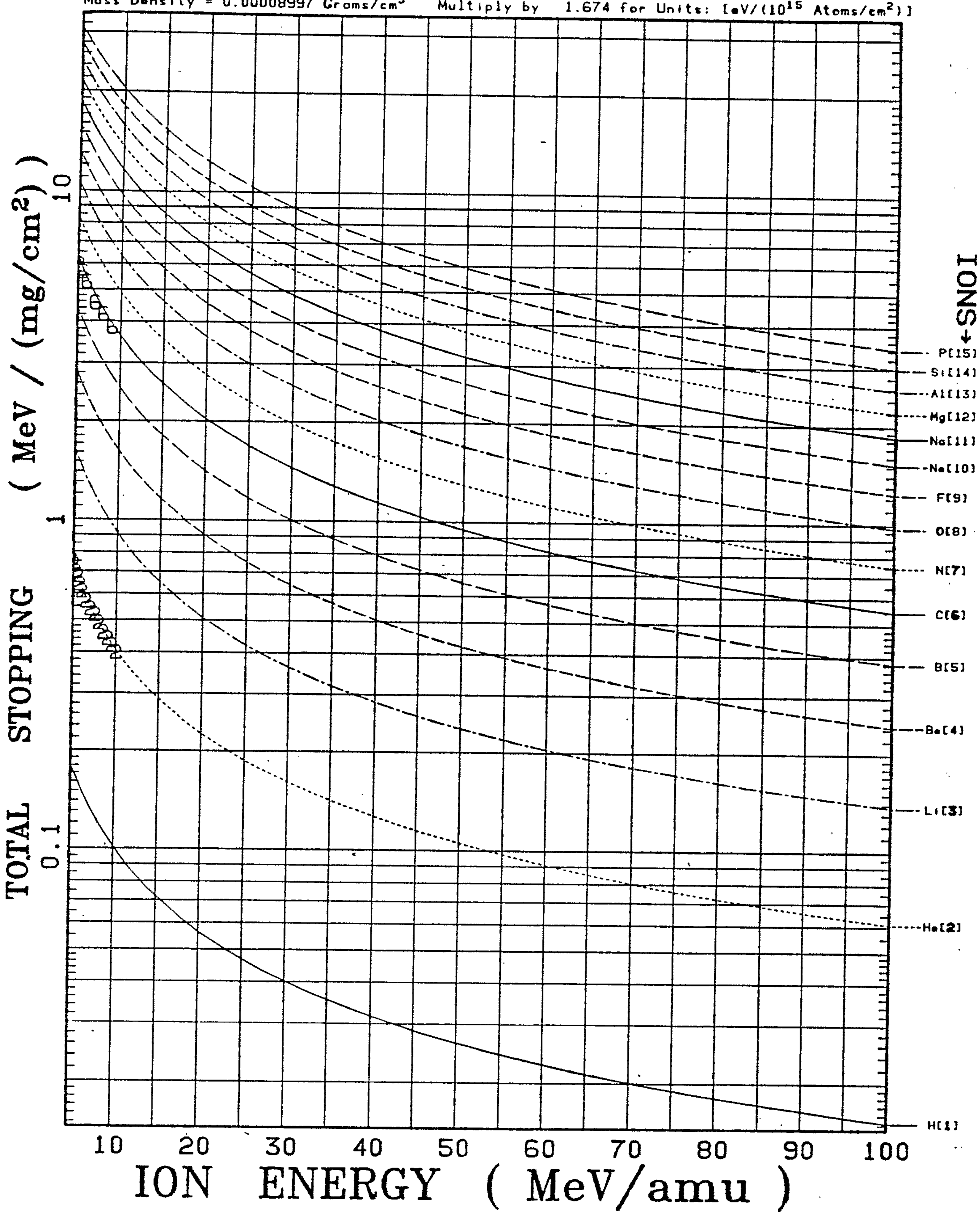



H(1)
←←← TARGET →→→
(GAS PHASE)
H(1)
Atom Density = 5.376×10^19 Atoms/cm^3
Mass Density = 0.00008997 Grams/cm^3
Multiply Total Stopping by 8.997 for Units: [keV/mm]
Multiply by 1.674 for Units: [eV/(10^15 Atoms/cm^2)]
IONS
P[15]
Si[14]
Al[13]
Mg[12]
Na[11]
Ne[10]
F[9]
O[8]
N[7]
C[6]
B[5]
Be[4]
Li[3]
He[2]
H[1]
TOTAL STOPPING (MeV / (mg/cm^2))
50
20
10
5
2
1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
ION ENERGY (MeV/amu)


H(1)
←←← TARGET →→→
(GAS PHASE)
H(1)
Atom Density = 5.376×10^19 Atoms/cm^3
Mass Density = 0.00008997 Grams/cm^3
Multiply Total Stopping by 8.997 for Units: [keV/mm]
Multiply by 1.674 for Units: [eV/(10^15 Atoms/cm^2)]
TOTAL STOPPING (MeV / (mg/cm^2))
ION ENERGY (MeV/amu)
IONS→
P[15]
Si[14]
Al[13]
Mg[12]
Na[11]
Ne[10]
F[9]
O[8]
N[7]
C[6]
B[5]
Be[4]
Li[3]
He[2]
H[1]

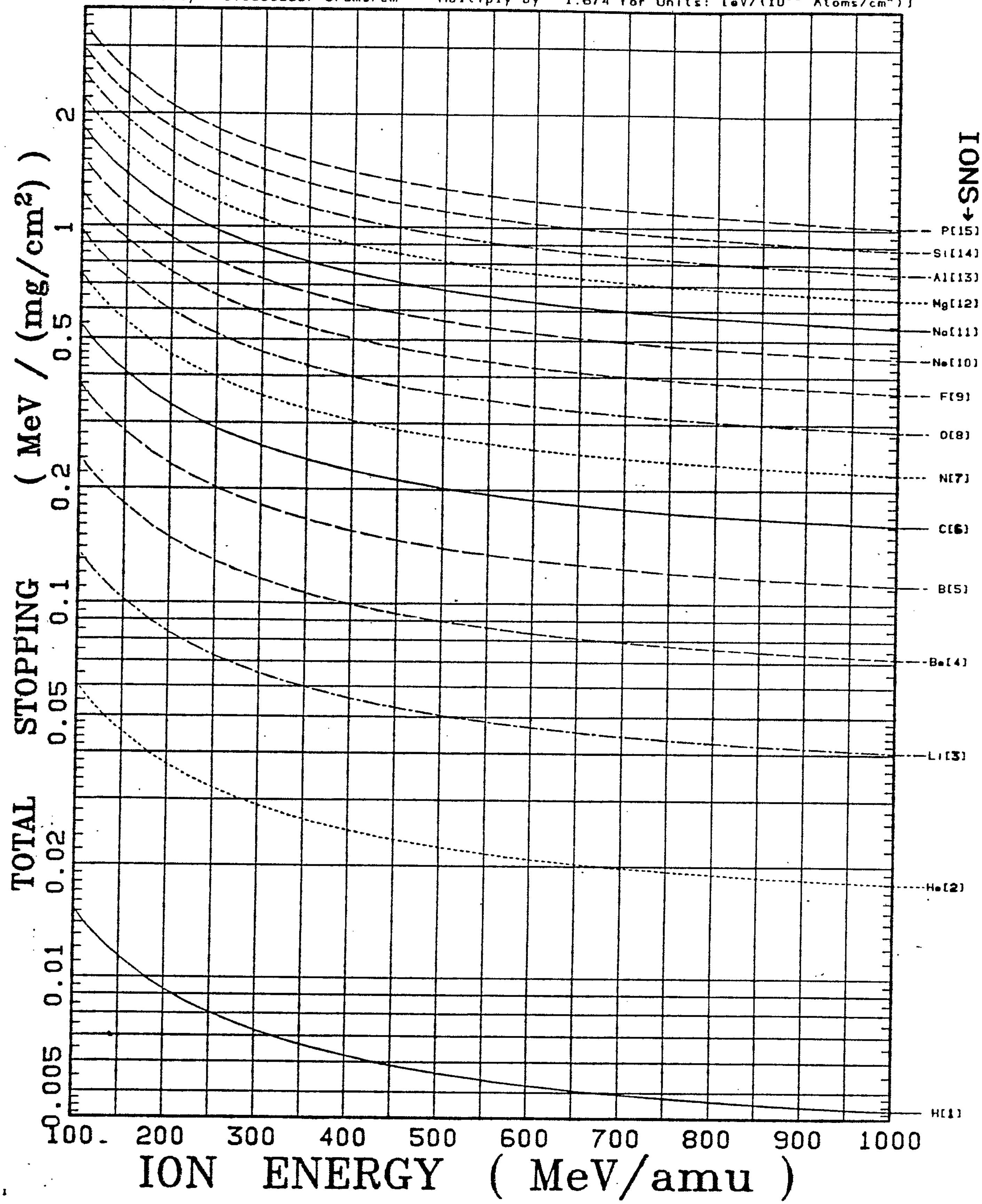
H(1) ←←← TARGET →→→ H(1)
(GAS PHASE)

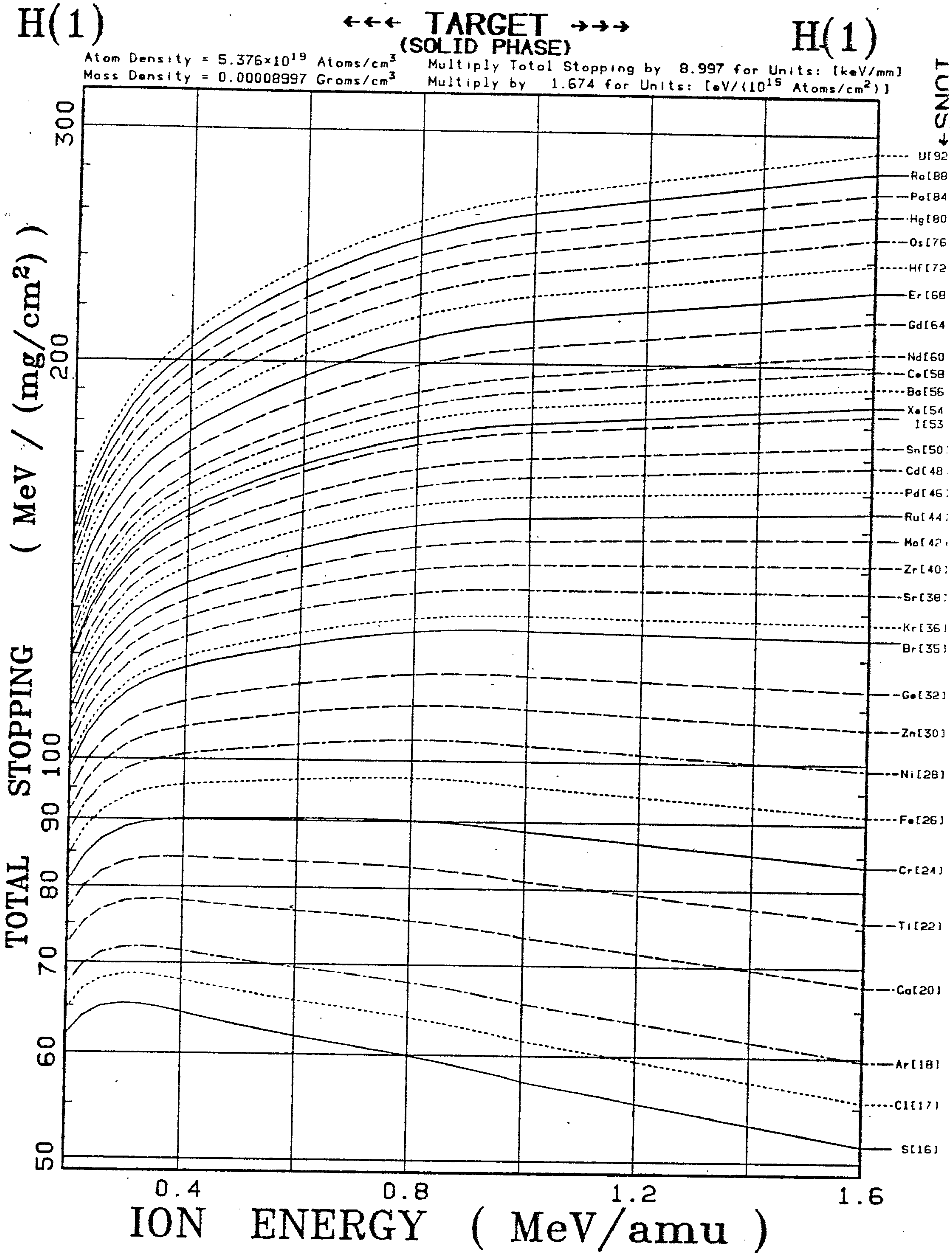
Atom Density = 5.376×10^{19} Atoms/cm^3 Multiply Total Stopping by 8.997 for Units: [keV/mm].
Mass Density = 0.00008997 Grams/cm^3 Multiply by 1.674 for Units: [eV/(10^{15} Atoms/cm^2)]

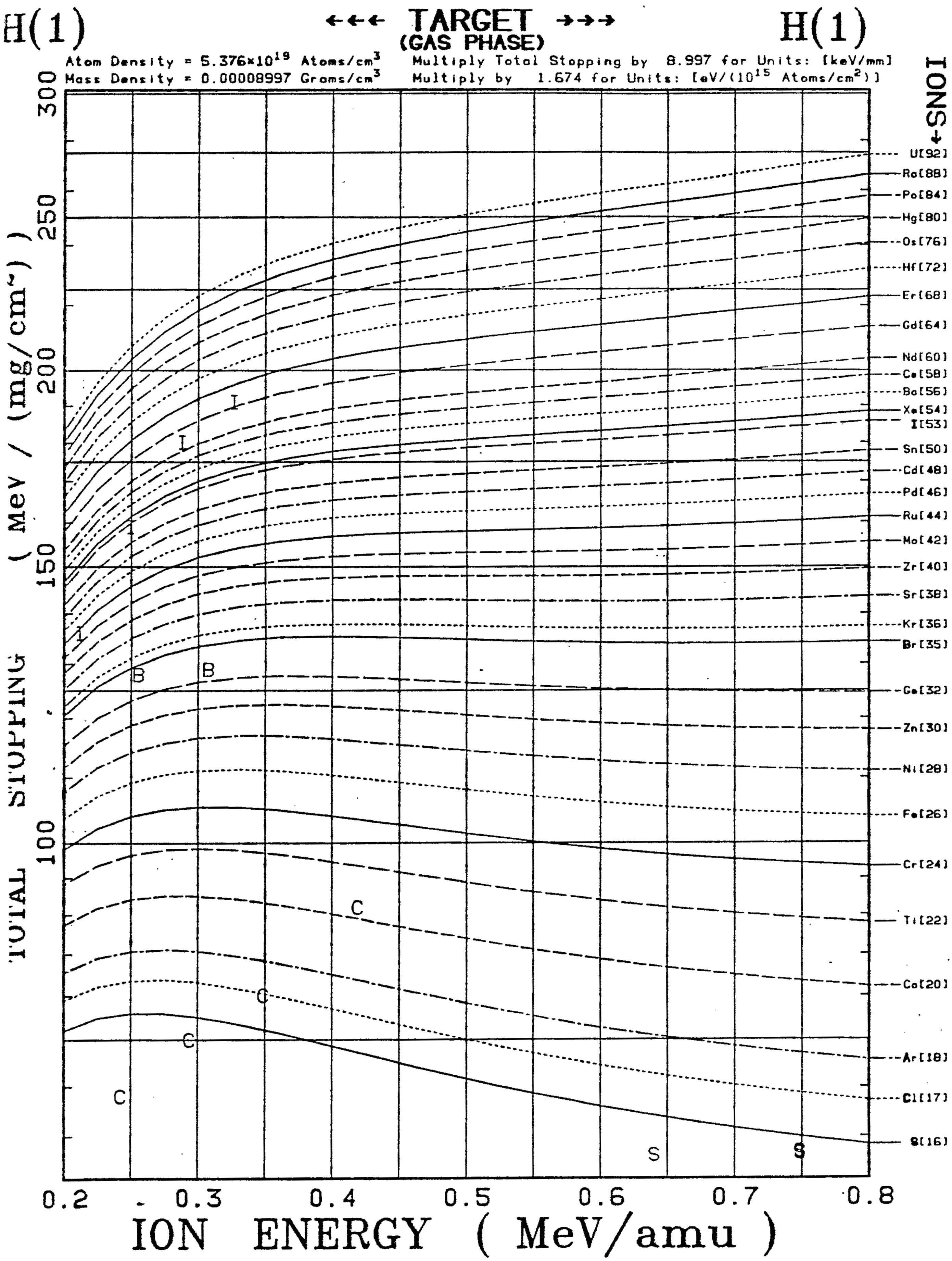


H(1) ←←← TARGET (GAS PHASE) →→→ H(1)

Atom Density = 5.376×10^{19} Atoms/cm^3 Multiply Total Stopping by 8.997 for Units: [keV/mm]
Mass Density = 0.00008997 Grams/cm^3 Multiply by 1.674 for Units: [eV/(10^{15} Atoms/cm^2)]

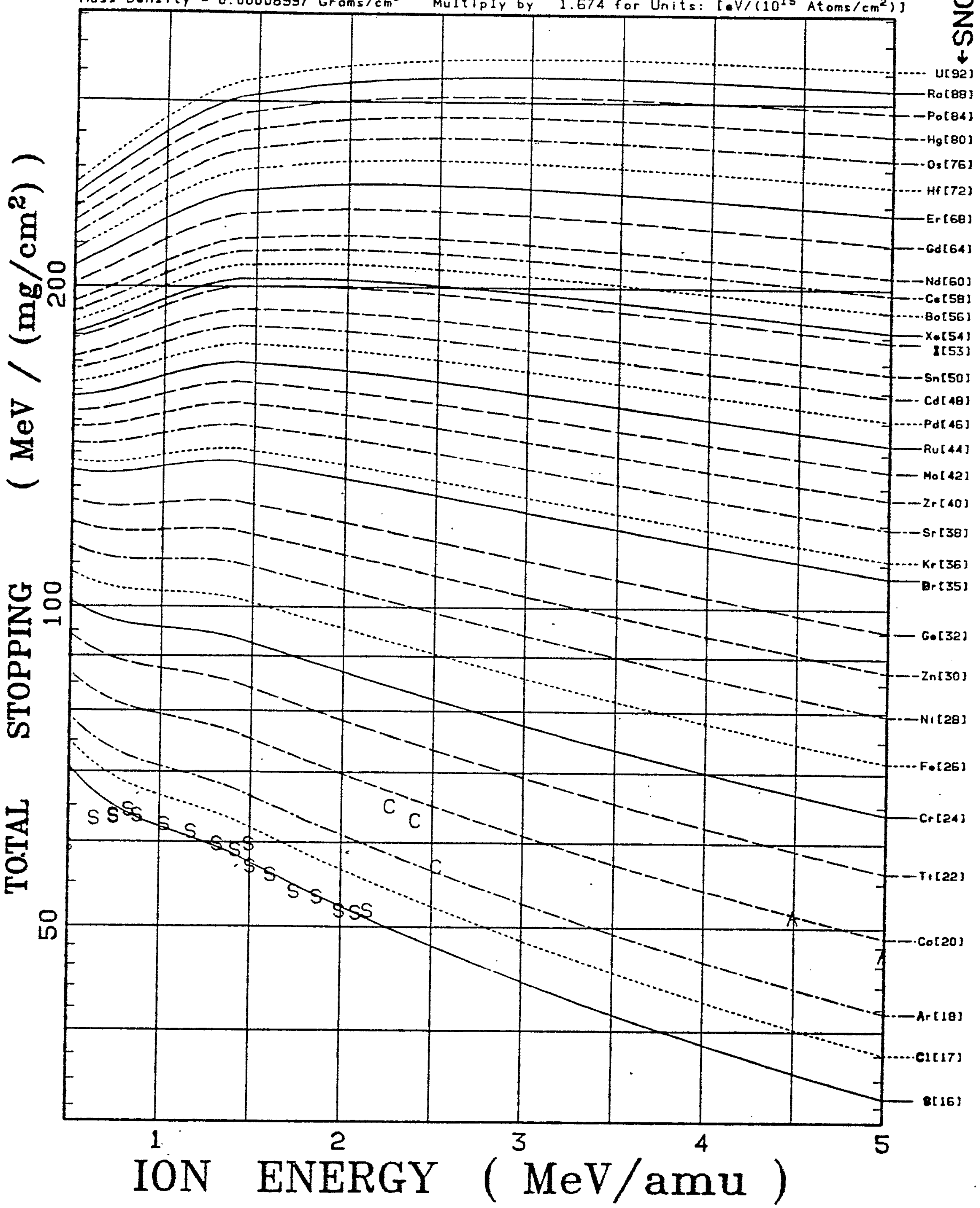



H(1)
←←← TARGET →→→
(SOLID PHASE)
H(1)
Atom Density = 5.376x10^19 Atoms/cm^3
Mass Density = 0.00008997 Grams/cm^3
Multiply Total Stopping by 8.997 for Units: [keV/mm]
Multiply by 1.674 for Units: [eV/(10^15 Atoms/cm^2)]
IONS →
U[92
Ra[88
Po[84
Hg[80
Os[76
Hf[72
Er[68
Gd[64
Nd[60
Ce[58
Ba[56
Xe[54
I[53
Sn[50]
Cd[48
Pd[46]
Ru[44]
Mo[42]
Zr[40]
Sr[38]
Kr[36]
Br[35]
Ge[32]
Zn[30]
Ni[28]
Fe[26]
Cr[24]
Ti[22]
Ca[20]
Ar[18]
Cl[17]
S[16]
TOTAL STOPPING (MeV / (mg/cm²))
300
200
100
90
80
70
60
50
0.4
0.8
1.2
1.6
ION ENERGY (MeV/amu)


H(1)
←←← TARGET →→→
(GAS PHASE)
H(1)
Atom Density = 5.376×10^19 Atoms/cm^3
Mass Density = 0.00008997 Grams/cm^3
Multiply Total Stopping by 8.997 for Units: [keV/mm]
Multiply by 1.674 for Units: [eV/(10^15 Atoms/cm^2)]
IONS→
U[92]
Ra[88]
Po[84]
Hg[80]
Os[76]
Hf[72]
Er[68]
Gd[64]
Nd[60]
Ce[58]
Ba[56]
Xe[54]
I[53]
Sn[50]
Cd[48]
Pd[46]
Ru[44]
Mo[42]
Zr[40]
Sr[38]
Kr[36]
Br[35]
Ge[32]
Zn[30]
Ni[28]
Fe[26]
Cr[24]
Ti[22]
Ca[20]
Ar[18]
Cl[17]
S[16]
TOTAL STOPPING (MeV / (mg/cm²))
300
250
200
150
100
0.2
0.3
0.4
0.5
0.6
0.7
0.8
ION ENERGY (MeV/amu)

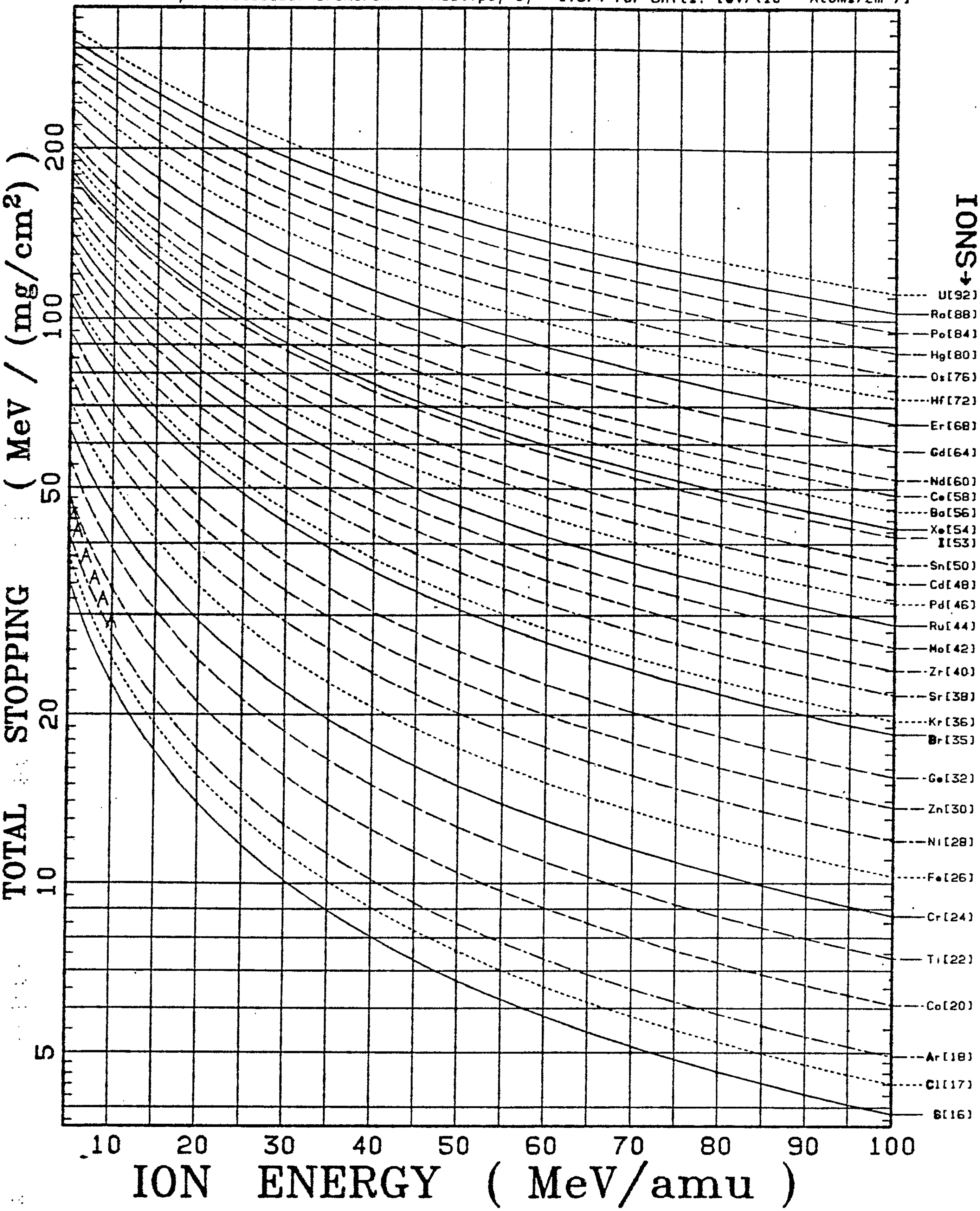
H(1) ←←← TARGET (GAS PHASE) →→→ H(1)

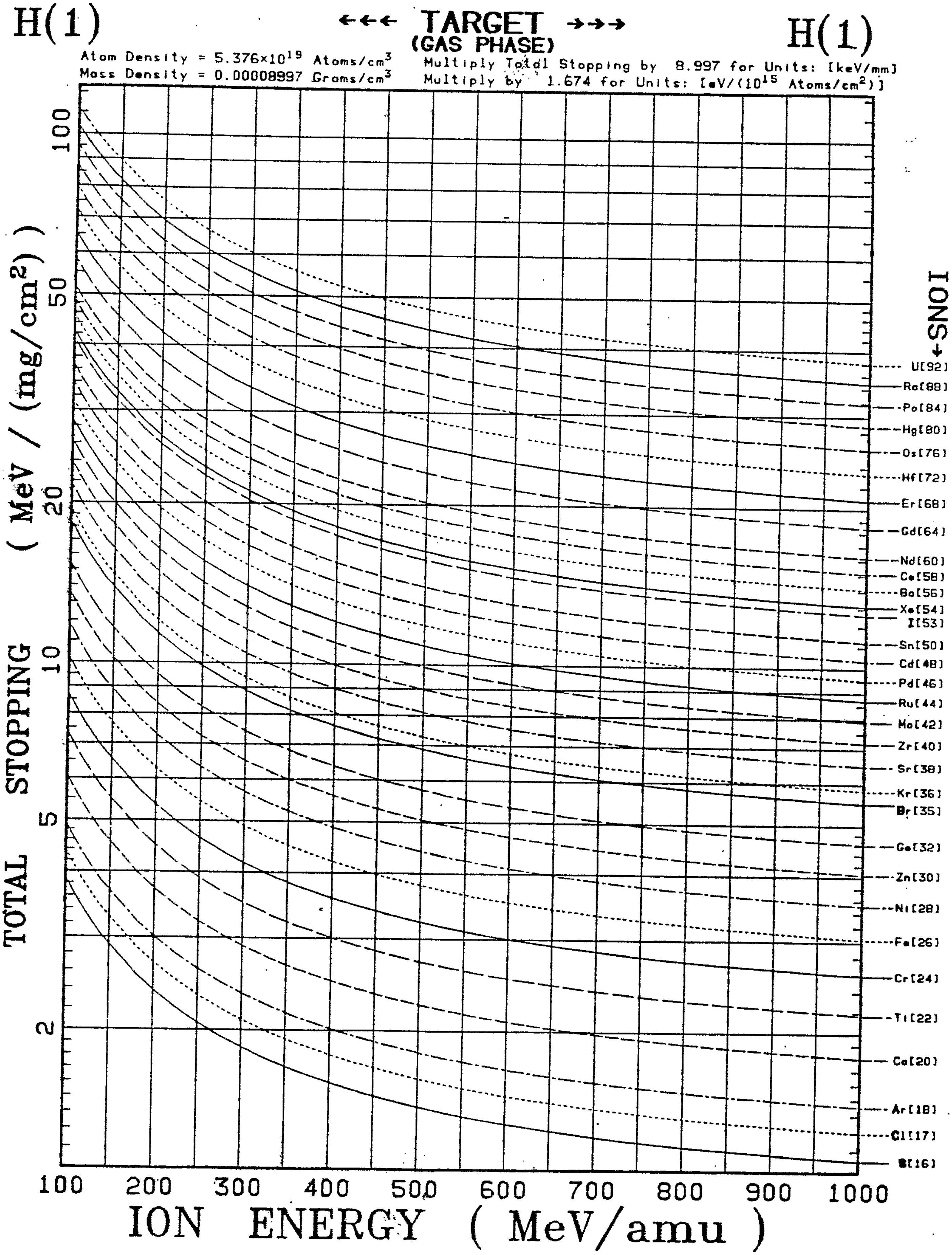
Atom Density = 5.376×10^{19} Atoms/cm^3 Multiply Total Stopping by 8.997 for Units: [keV/mm]
Mass Density = 0.00008997 Grams/cm^3 Multiply by 1.674 for Units: [eV/(10^{15} Atoms/cm^2)]

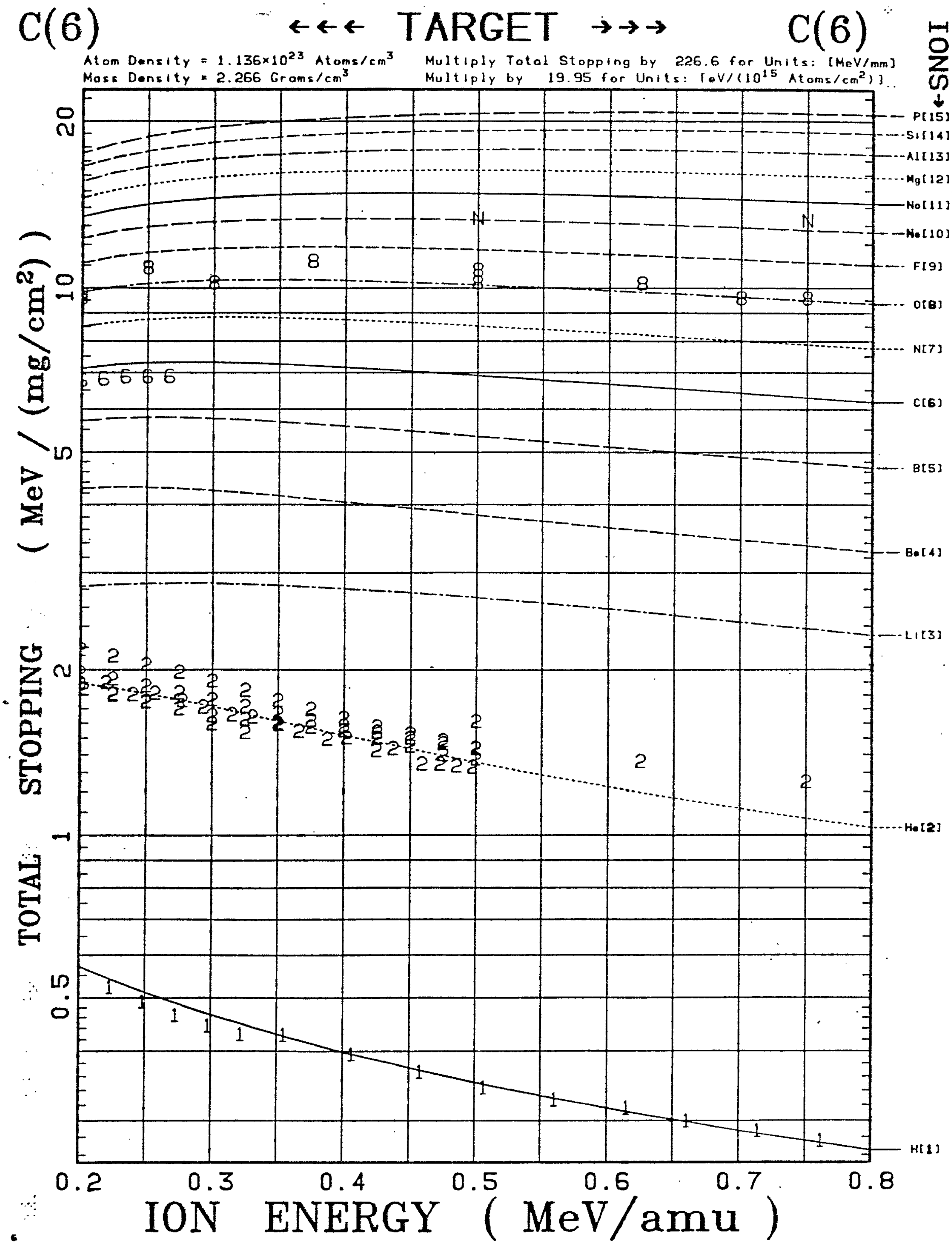


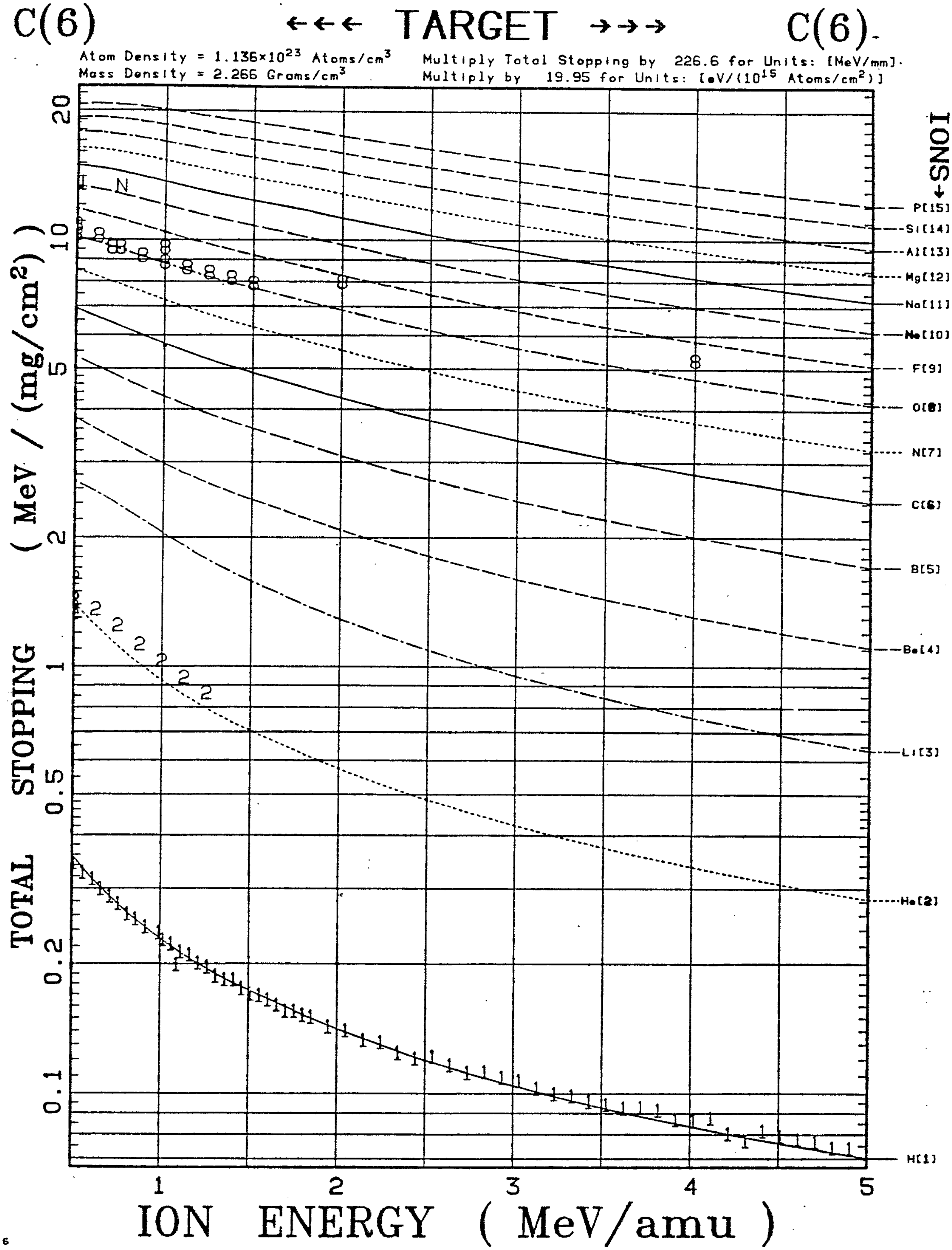
H(1) ←←← TARGET (GAS PHASE) →→→ H(1)

Atom Density = 5.376×10[19] Atoms/cm[3] Multiply Total Stopping by 8.997 for Units: [keV/mm]
Mass Density = 0.00008997 Grams/cm[3] Multiply by 1.674 for Units: [eV/(10[15] Atoms/cm[2])]




H(1)
←←← TARGET →→→
(GAS PHASE)
H(1)
Atom Density = 5.376×10^19 Atoms/cm^3
Mass Density = 0.00008997 Grams/cm^3
Multiply Total Stopping by 8.997 for Units: [keV/mm]
Multiply by 1.674 for Units: [eV/(10^15 Atoms/cm^2)]
TOTAL STOPPING (MeV / (mg/cm^2))
100
50
20
10
5
2
100
200
300
400
500
600
700
800
900
1000
ION ENERGY (MeV/amu)
IONS→
U[92]
Ra[88]
Po[84]
Hg[80]
Os[76]
Hf[72]
Er[68]
Gd[64]
Nd[60]
Ce[58]
Ba[56]
Xe[54]
I[53]
Sn[50]
Cd[48]
Pd[46]
Ru[44]
Mo[42]
Zr[40]
Sr[38]
Kr[36]
Br[35]
Ge[32]
Zn[30]
Ni[28]
Fe[26]
Cr[24]
Ti[22]
Ca[20]
Ar[18]
Cl[17]
S[16]

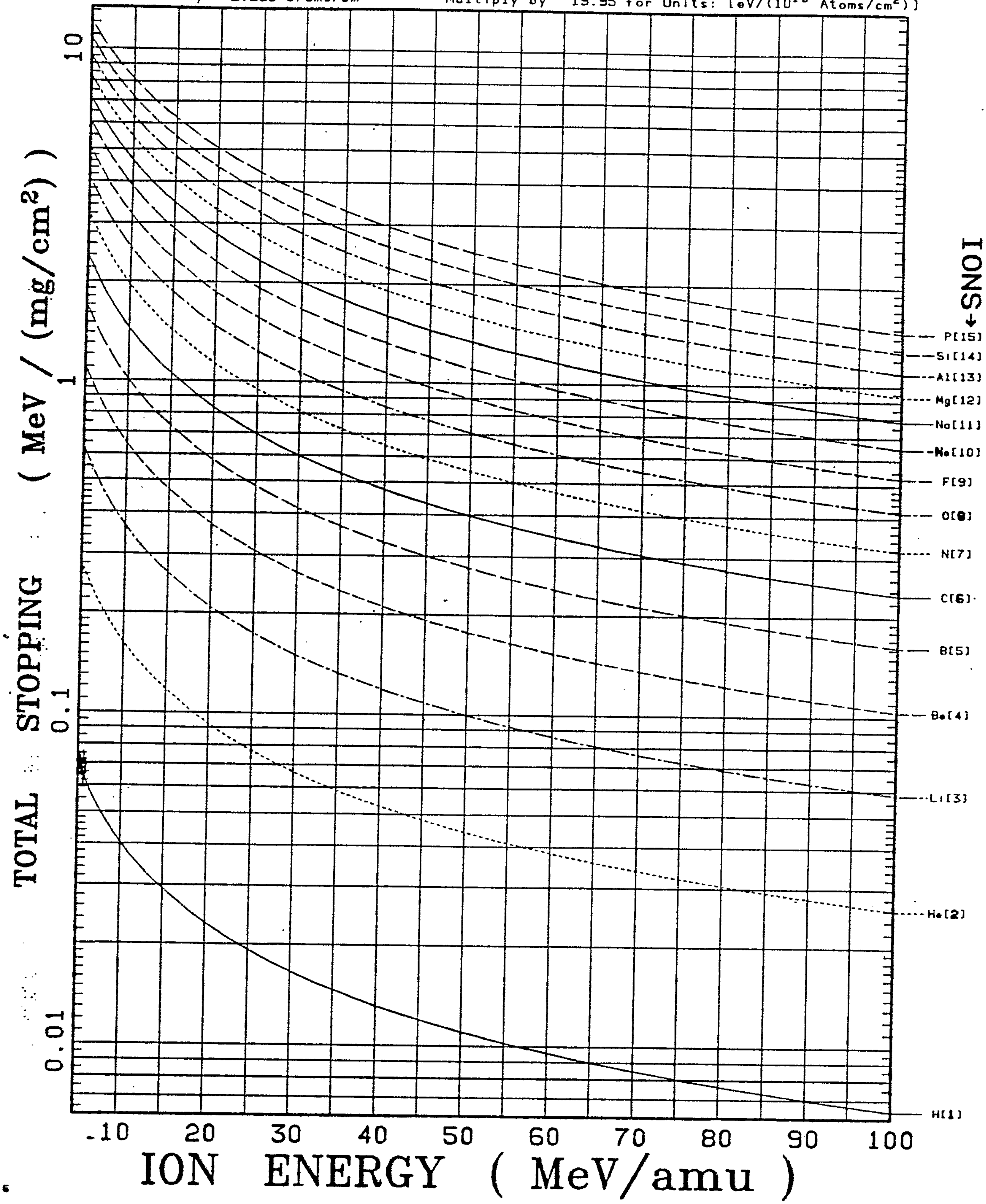

C(6)
←←← TARGET →→→
C(6)
Atom Density = 1.136×10^23 Atoms/cm^3
Mass Density = 2.266 Grams/cm^3
Multiply Total Stopping by 226.6 for Units: [MeV/mm]
Multiply by 19.95 for Units: [eV/(10^15 Atoms/cm^2)]
IONS→
P[15]
Si[14]
Al[13]
Mg[12]
Na[11]
Ne[10]
F[9]
O[8]
N[7]
C[6]
B[5]
Be[4]
Li[3]
He[2]
H[1]
TOTAL STOPPING (MeV / (mg/cm²))
20
10
5
2
1
0.5
0.2
0.3
0.4
0.5
0.6
0.7
0.8
ION ENERGY (MeV/amu)

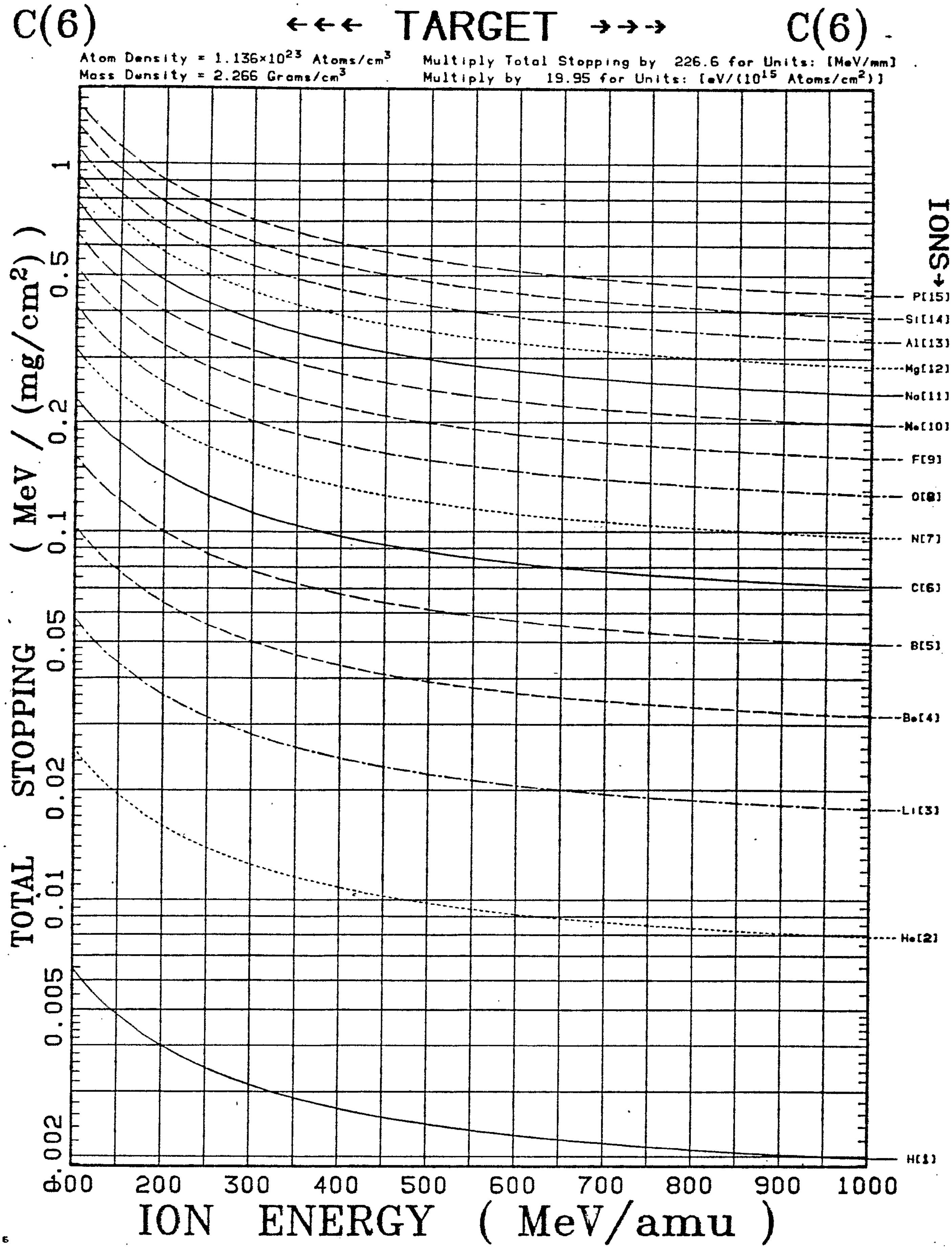

C(6)
←←← TARGET →→→
C(6)
Atom Density = 1.136×10^23 Atoms/cm^3
Mass Density = 2.266 Grams/cm^3
Multiply Total Stopping by 226.6 for Units: [MeV/mm]
Multiply by 19.95 for Units: [eV/(10^15 Atoms/cm^2)]
TOTAL STOPPING (MeV / (mg/cm^2))
ION ENERGY (MeV/amu)
IONS→
P[15]
Si[14]
Al[13]
Mg[12]
Na[11]
Ne[10]
F[9]
O[8]
N[7]
C[6]
B[5]
Be[4]
Li[3]
He[2]
H[1]

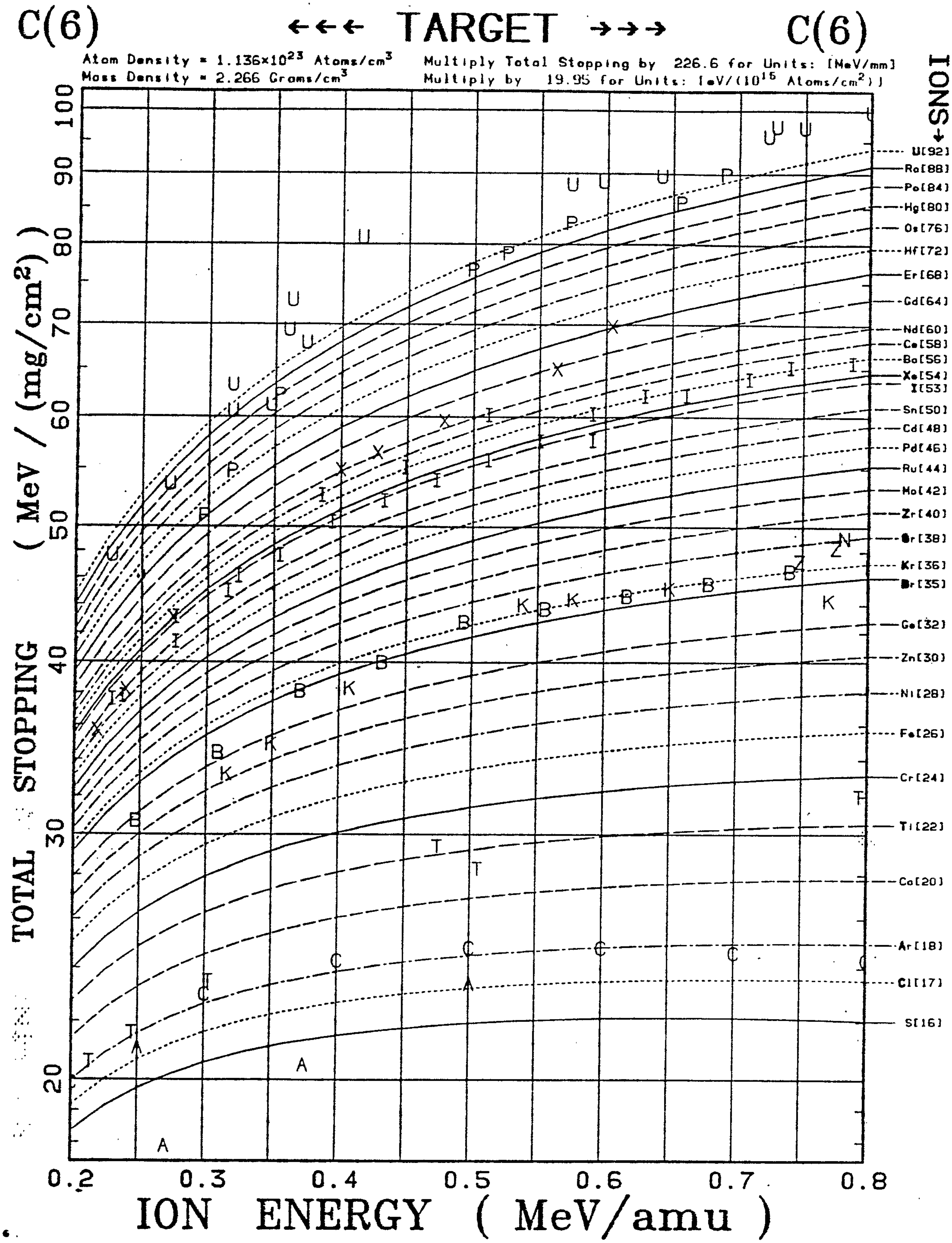
C(6) ←←← TARGET →→→ C(6)

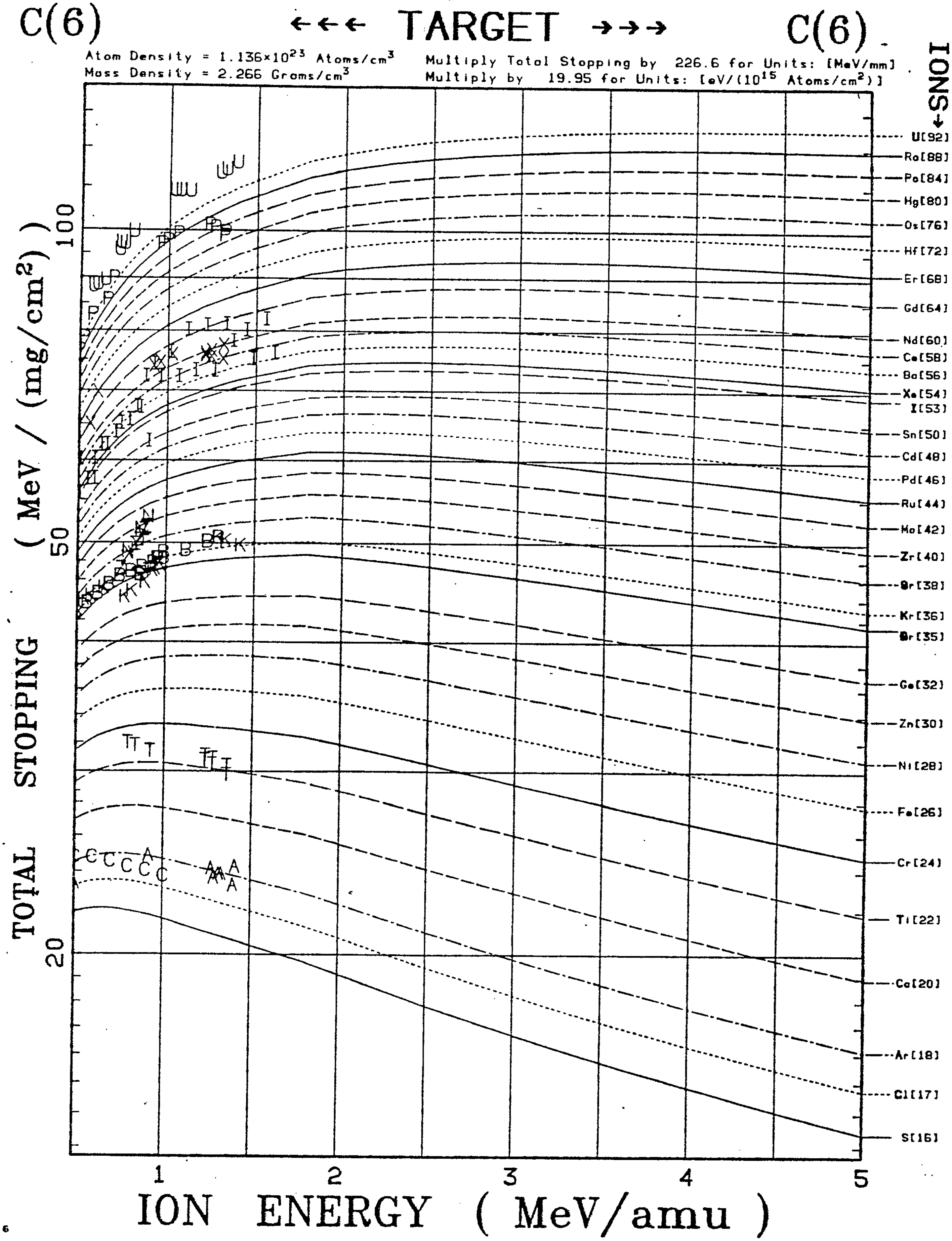
Atom Density = 1.136×10^{23} Atoms/cm^3 Multiply Total Stopping by 226.6 for Units: [MeV/mm]

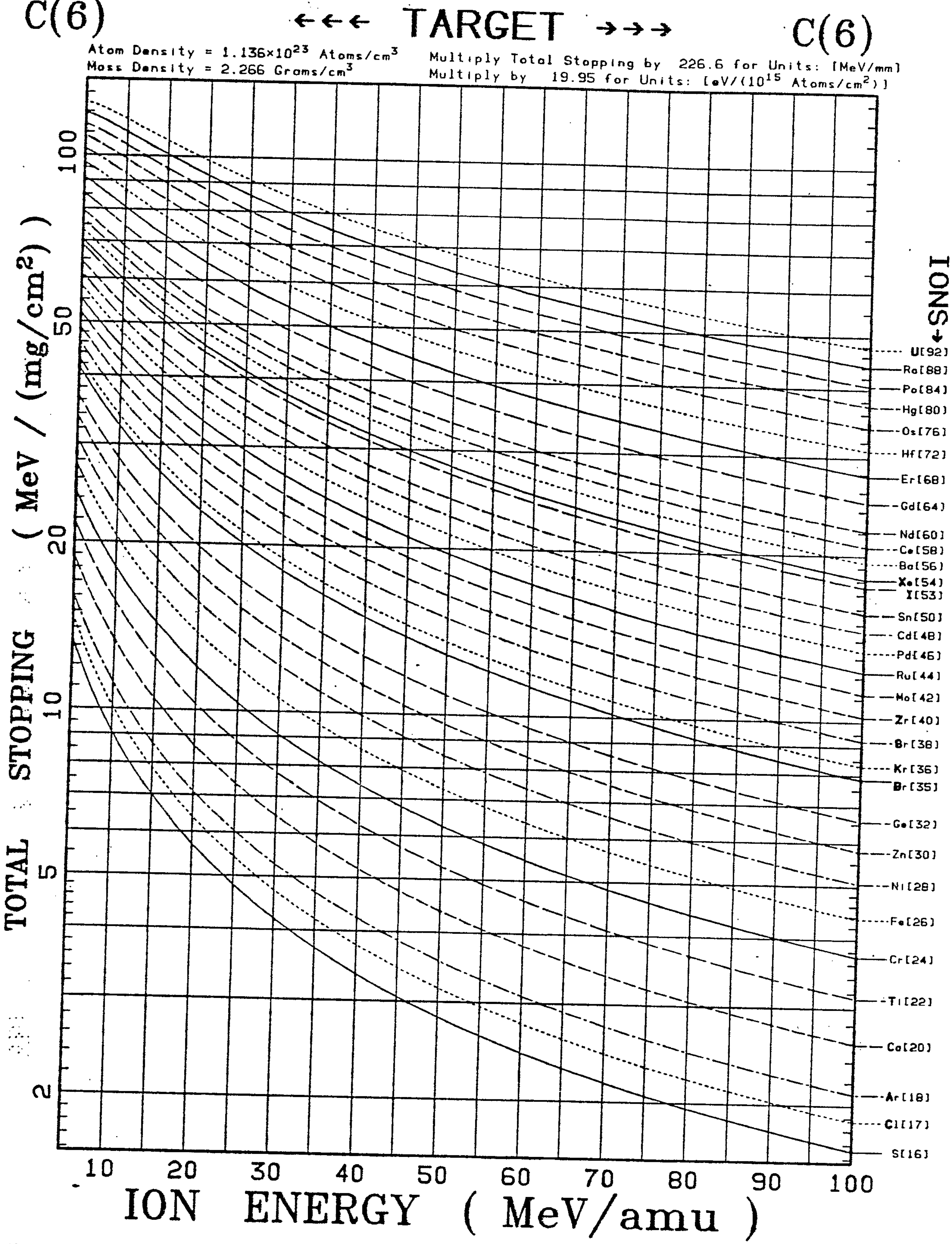
Mass Density = 2.266 Grams/cm^3 Multiply by 19.95 for Units: [eV/(10^{15} Atoms/cm^2)]

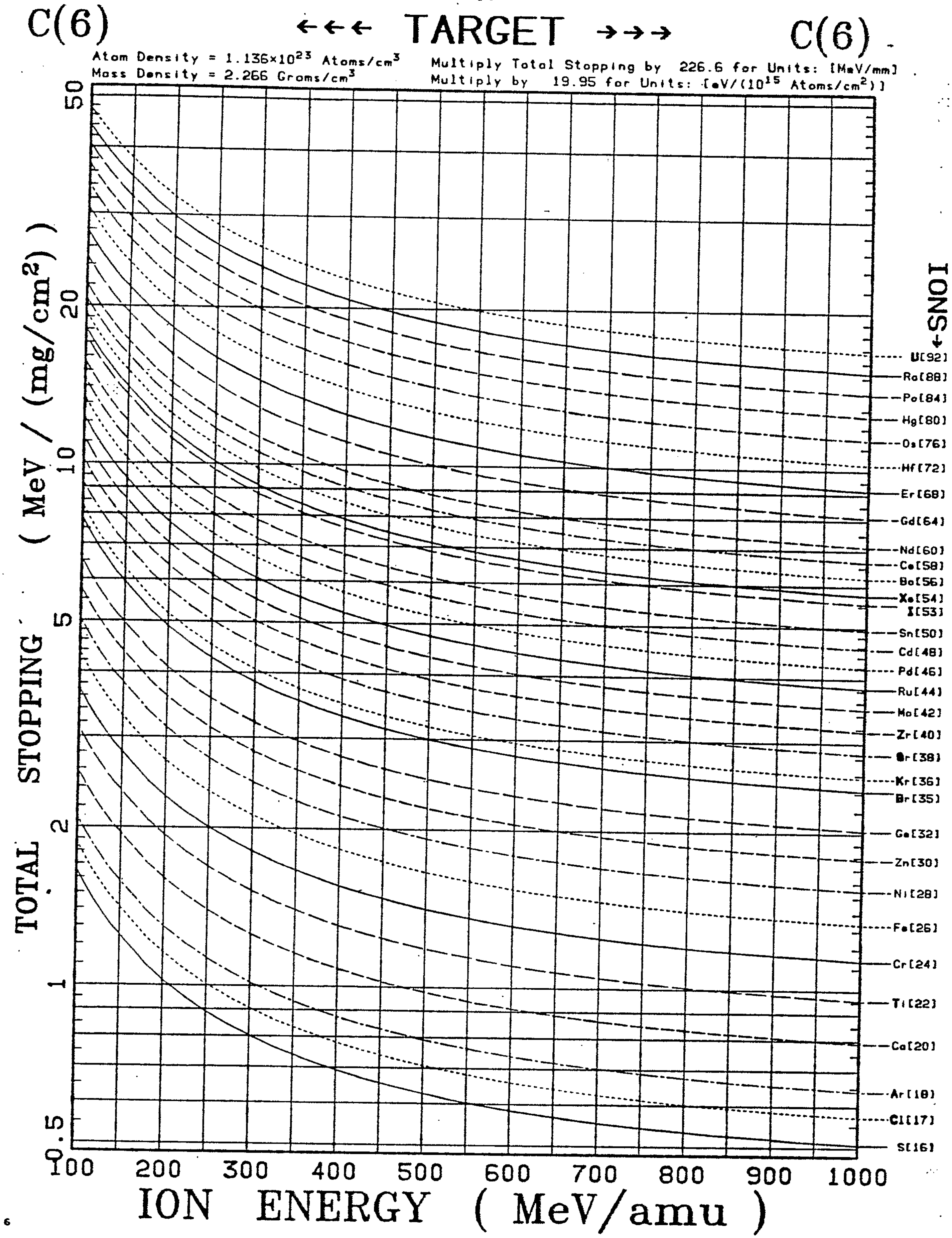


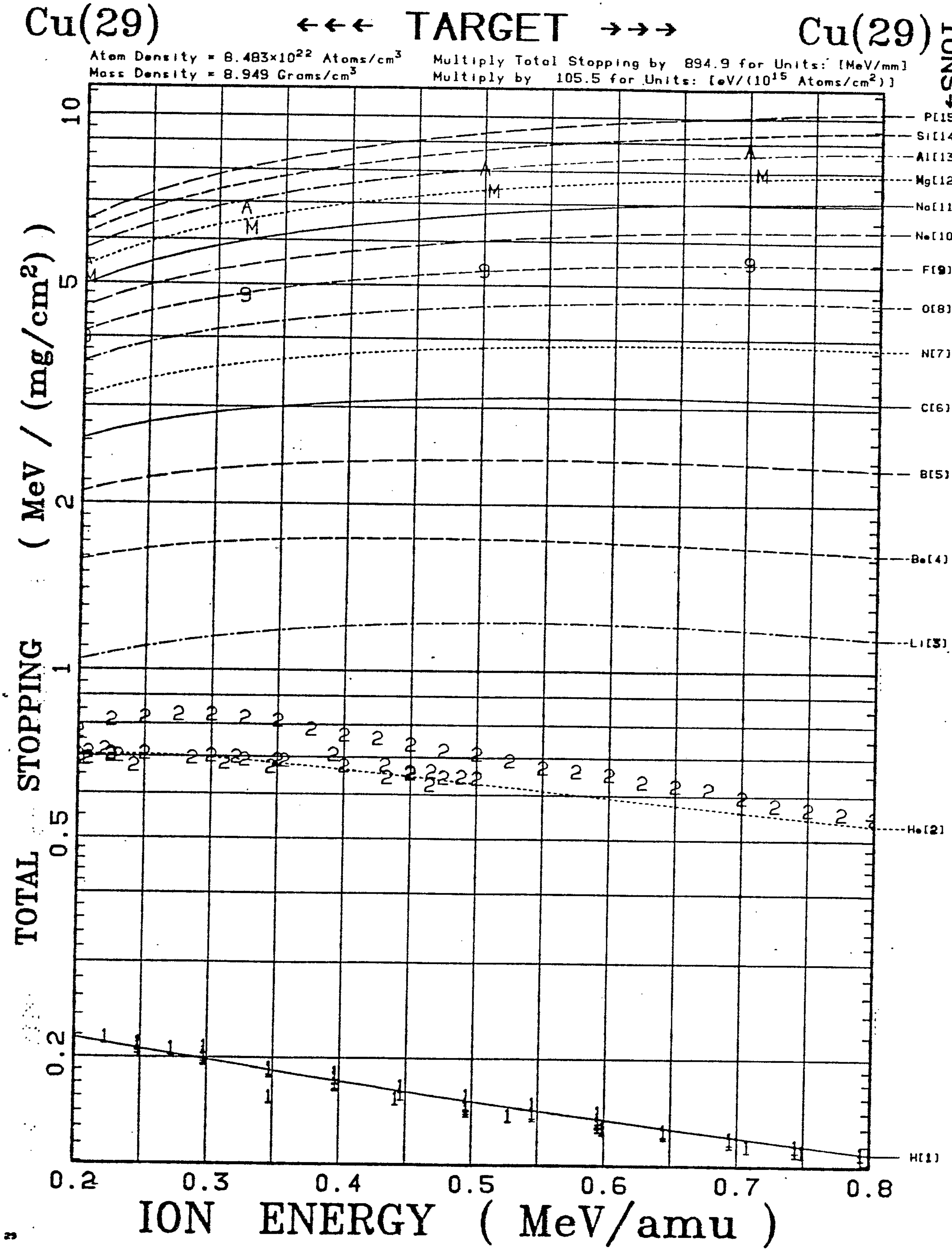

C(6)
←←← TARGET →→→
C(6)
Atom Density = 1.136×10^23 Atoms/cm^3
Mass Density = 2.266 Grams/cm^3
Multiply Total Stopping by 226.6 for Units: [MeV/mm]
Multiply by 19.95 for Units: [eV/(10^15 Atoms/cm^2)]
TOTAL STOPPING (MeV / (mg/cm^2))
1
0.5
0.2
0.1
0.05
0.02
0.01
0.005
0.002
IONS→
P[15]
Si[14]
Al[13]
Mg[12]
Na[11]
Ne[10]
F[9]
O[8]
N[7]
C[6]
B[5]
Be[4]
Li[3]
He[2]
H[1]
100
200
300
400
500
600
700
800
900
1000
ION ENERGY (MeV/amu)

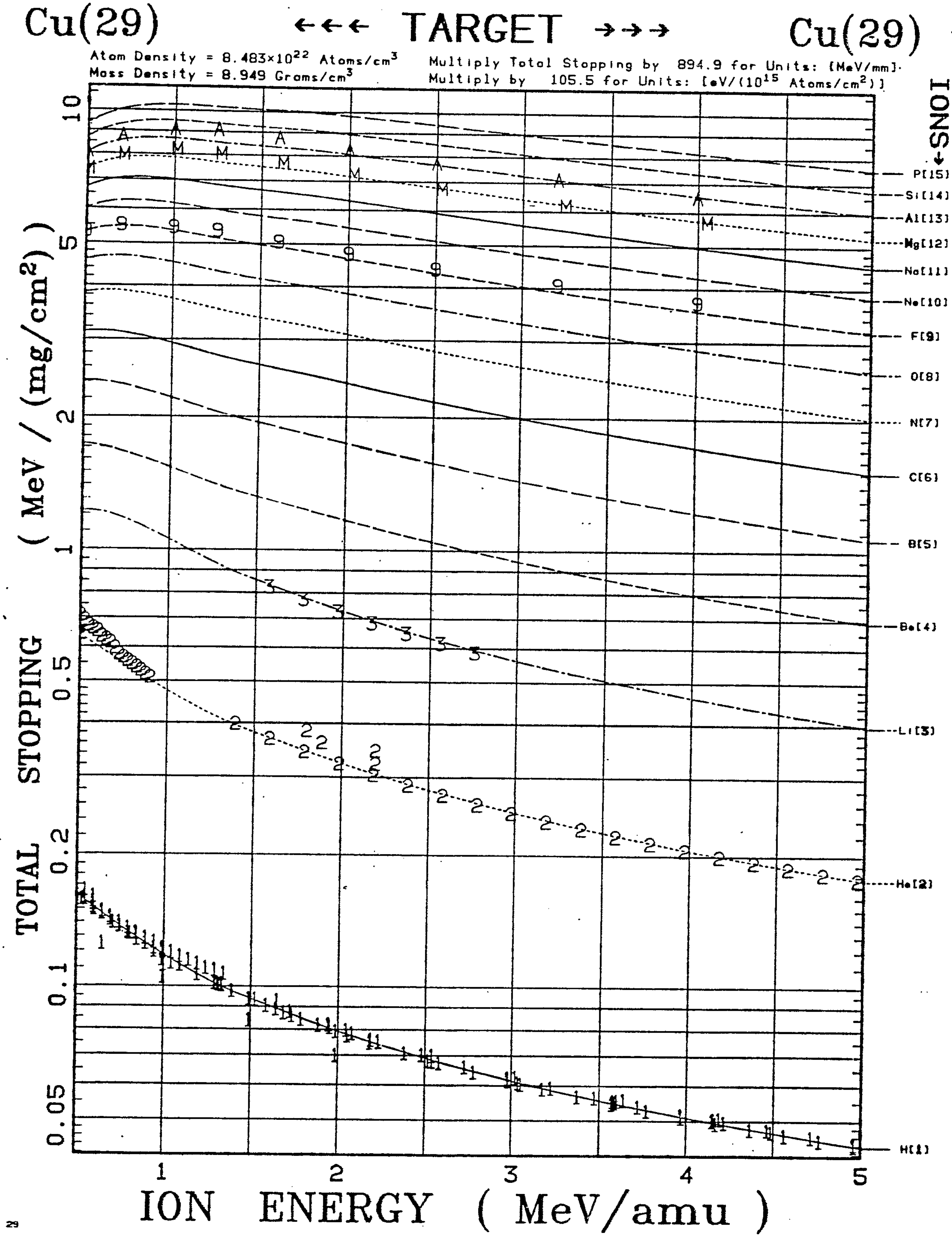

C(6)
←←← TARGET →→→
C(6)
Atom Density = 1.136×10^23 Atoms/cm^3
Mass Density = 2.266 Grams/cm^3
Multiply Total Stopping by 226.6 for Units: [MeV/mm]
Multiply by 19.95 for Units: [eV/(10^15 Atoms/cm^2)]
IONS↓
TOTAL STOPPING (MeV / (mg/cm^2))
ION ENERGY (MeV/amu)
U[92]
Ra[88]
Po[84]
Hg[80]
Os[76]
Hf[72]
Er[68]
Gd[64]
Nd[60]
Ce[58]
Ba[56]
Xe[54]
I[53]
Sn[50]
Cd[48]
Pd[46]
Ru[44]
Mo[42]
Zr[40]
Sr[38]
Kr[36]
Br[35]
Ge[32]
Zn[30]
Ni[28]
Fe[26]
Cr[24]
Ti[22]
Ca[20]
Ar[18]
Cl[17]
S[16]


C(6) ←←← TARGET →→→ C(6)
Atom Density = 1.136×10^23 Atoms/cm^3
Mass Density = 2.266 Grams/cm^3
Multiply Total Stopping by 226.6 for Units: [MeV/mm]
Multiply by 19.95 for Units: [eV/(10^15 Atoms/cm^2)]
IONS→
U[92]
Ra[88]
Po[84]
Hg[80]
Os[76]
Hf[72]
Er[68]
Gd[64]
Nd[60]
Ce[58]
Ba[56]
Xe[54]
I[53]
Sn[50]
Cd[48]
Pd[46]
Ru[44]
Mo[42]
Zr[40]
Sr[38]
Kr[36]
Br[35]
Ge[32]
Zn[30]
Ni[28]
Fe[26]
Cr[24]
Ti[22]
Ca[20]
Ar[18]
Cl[17]
S[16]
TOTAL STOPPING (MeV / (mg/cm²))
100
50
20
1
2
3
4
5
ION ENERGY (MeV/amu)


C(6)
←←← TARGET →→→
C(6)
Atom Density = 1.136×10^23 Atoms/cm^3
Mass Density = 2.266 Grams/cm^3
Multiply Total Stopping by 226.6 for Units: [MeV/mm]
Multiply by 19.95 for Units: [eV/(10^15 Atoms/cm^2)]
TOTAL STOPPING (MeV / (mg/cm²))
100
50
20
10
5
2
10
20
30
40
50
60
70
80
90
100
ION ENERGY (MeV/amu)
IONS→
U[92]
Ra[88]
Po[84]
Hg[80]
Os[76]
Hf[72]
Er[68]
Gd[64]
Nd[60]
Ce[58]
Ba[56]
Xe[54]
I[53]
Sn[50]
Cd[48]
Pd[46]
Ru[44]
Mo[42]
Zr[40]
Sr[38]
Kr[36]
Br[35]
Ge[32]
Zn[30]
Ni[28]
Fe[26]
Cr[24]
Ti[22]
Ca[20]
Ar[18]
Cl[17]
S[16]


C(6)
←←← TARGET →→→
C(6)
Atom Density = 1.136×10^23 Atoms/cm^3
Mass Density = 2.266 Grams/cm^3
Multiply Total Stopping by 226.6 for Units: [MeV/mm]
Multiply by 19.95 for Units: [eV/(10^15 Atoms/cm^2)]
TOTAL STOPPING (MeV / (mg/cm^2))
IONS↓
U[92]
Ra[88]
Po[84]
Hg[80]
Os[76]
Hf[72]
Er[68]
Gd[64]
Nd[60]
Ce[58]
Ba[56]
Xe[54]
I[53]
Sn[50]
Cd[48]
Pd[46]
Ru[44]
Mo[42]
Zr[40]
Sr[38]
Kr[36]
Br[35]
Ge[32]
Zn[30]
Ni[28]
Fe[26]
Cr[24]
Ti[22]
Ca[20]
Ar[18]
Cl[17]
S[16]
50
20
10
5
2
1
0.5
100
200
300
400
500
600
700
800
900
1000
ION ENERGY (MeV/amu)

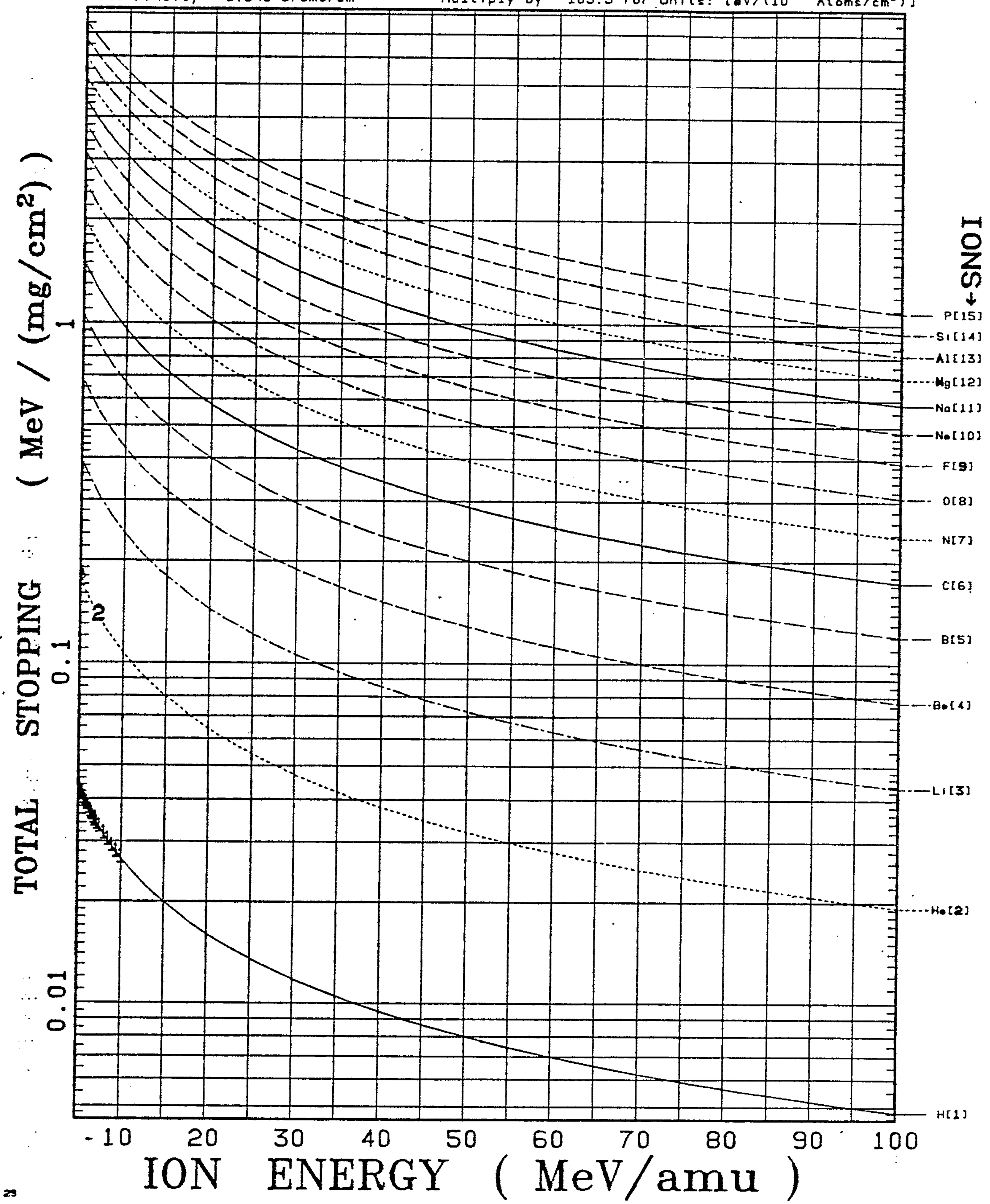

Cu(29)
←←← TARGET →→→
Cu(29)
IONS→
Atom Density = 8.483×10^22 Atoms/cm^3
Mass Density = 8.949 Grams/cm^3
Multiply Total Stopping by 894.9 for Units: [MeV/mm]
Multiply by 105.5 for Units: [eV/(10^15 Atoms/cm^2)]
TOTAL STOPPING (MeV / (mg/cm^2))
ION ENERGY (MeV/amu)
P[15]
Si[14]
Al[13]
Mg[12]
Na[11]
Ne[10]
F[9]
O[8]
N[7]
C[6]
B[5]
Be[4]
Li[3]
He[2]
H[1]
0.2
0.3
0.4
0.5
0.6
0.7
0.8
10
5
2
1
0.5
0.2

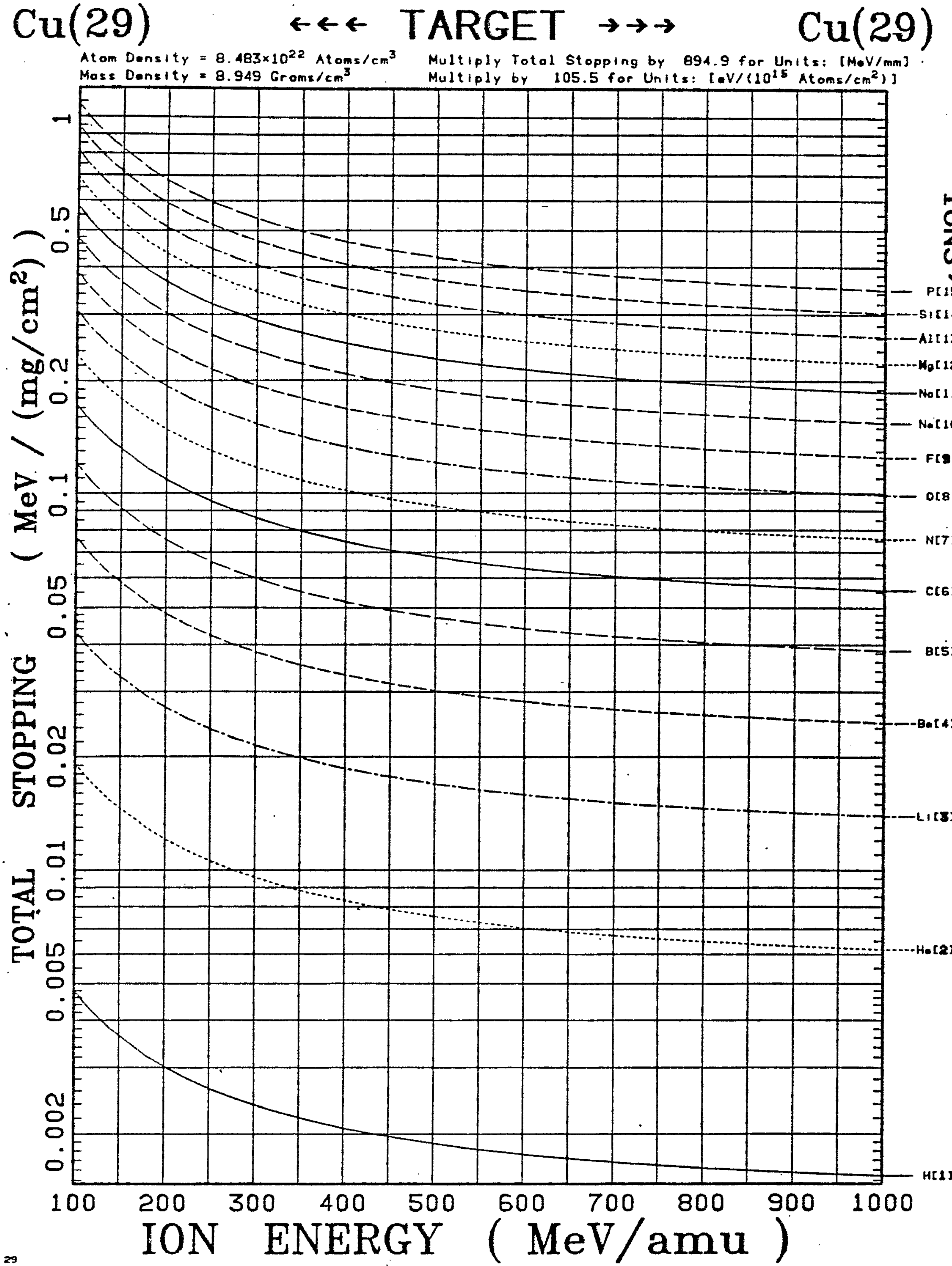

Cu(29)
←←← TARGET →→→
Cu(29)
Atom Density = 8.483×10^22 Atoms/cm^3
Mass Density = 8.949 Grams/cm^3
Multiply Total Stopping by 894.9 for Units: [MeV/mm].
Multiply by 105.5 for Units: [eV/(10^15 Atoms/cm^2)]
IONS→
P[15]
Si[14]
Al[13]
Mg[12]
Na[11]
Ne[10]
F[9]
O[8]
N[7]
C[6]
B[5]
Be[4]
Li[3]
He[2]
H[1]
TOTAL STOPPING (MeV / (mg/cm^2))
10
5
2
1
0.5
0.2
0.1
0.05
1
2
3
4
5
ION ENERGY (MeV/amu)

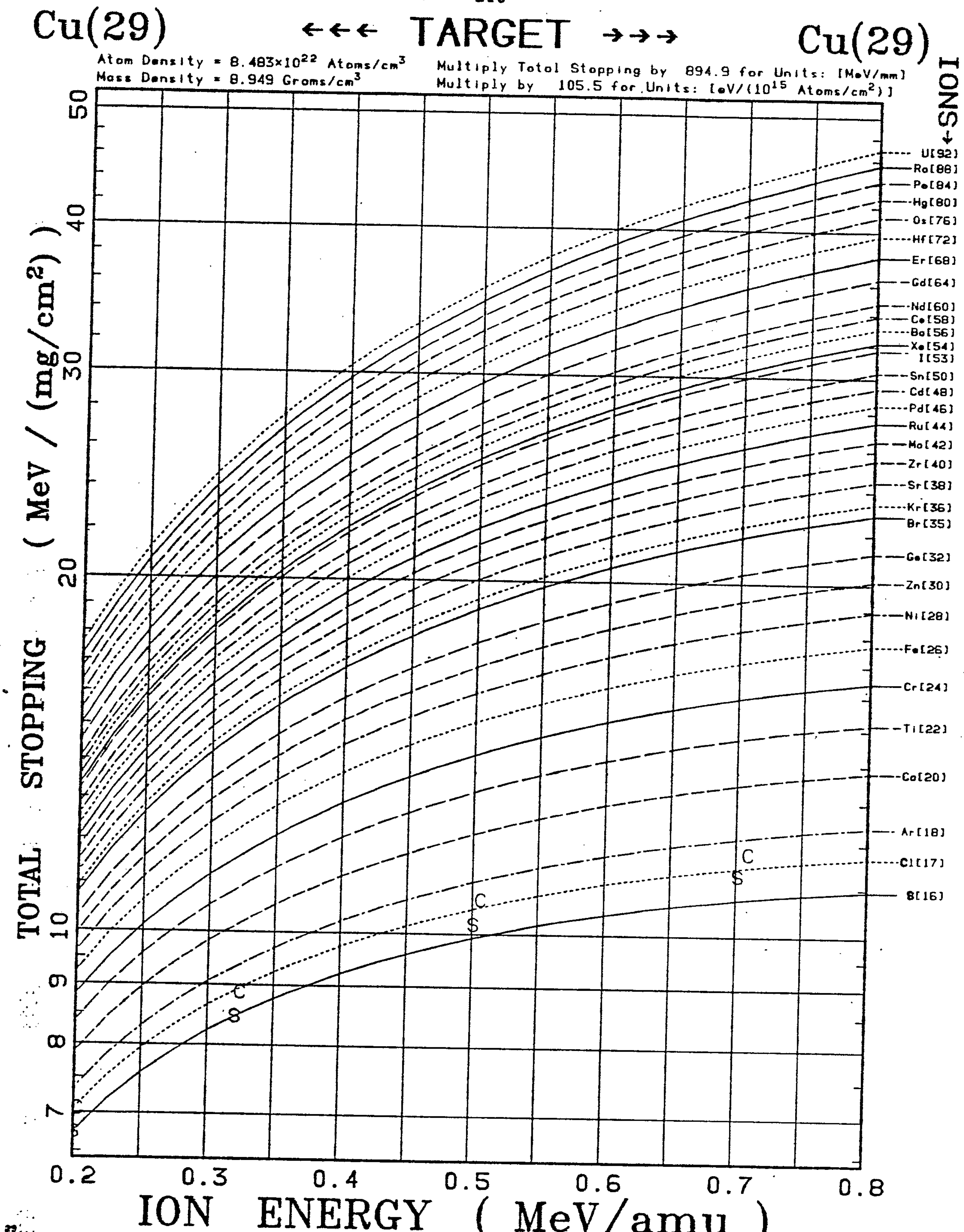
29

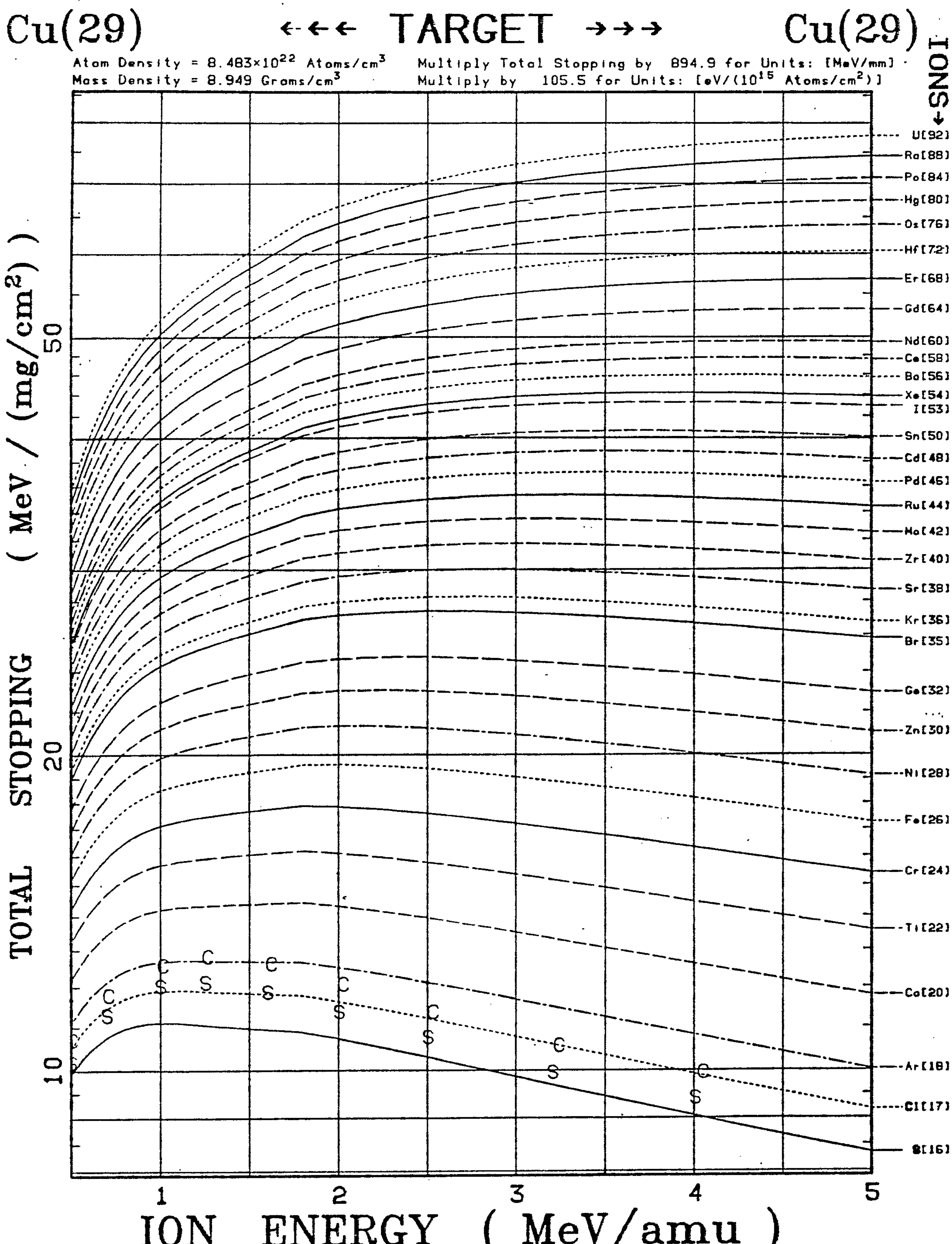
Cu(29) ←←← TARGET →→→ Cu(29)

Atom Density = 8.483×10[22] Atoms/cm[3] Multiply Total Stopping by 894.9 for Units: [MeV/mm]
Mass Density = 8.949 Grams/cm[3] Multiply by 105.5 for Units: [eV/(10[15] Atoms/cm[2])]



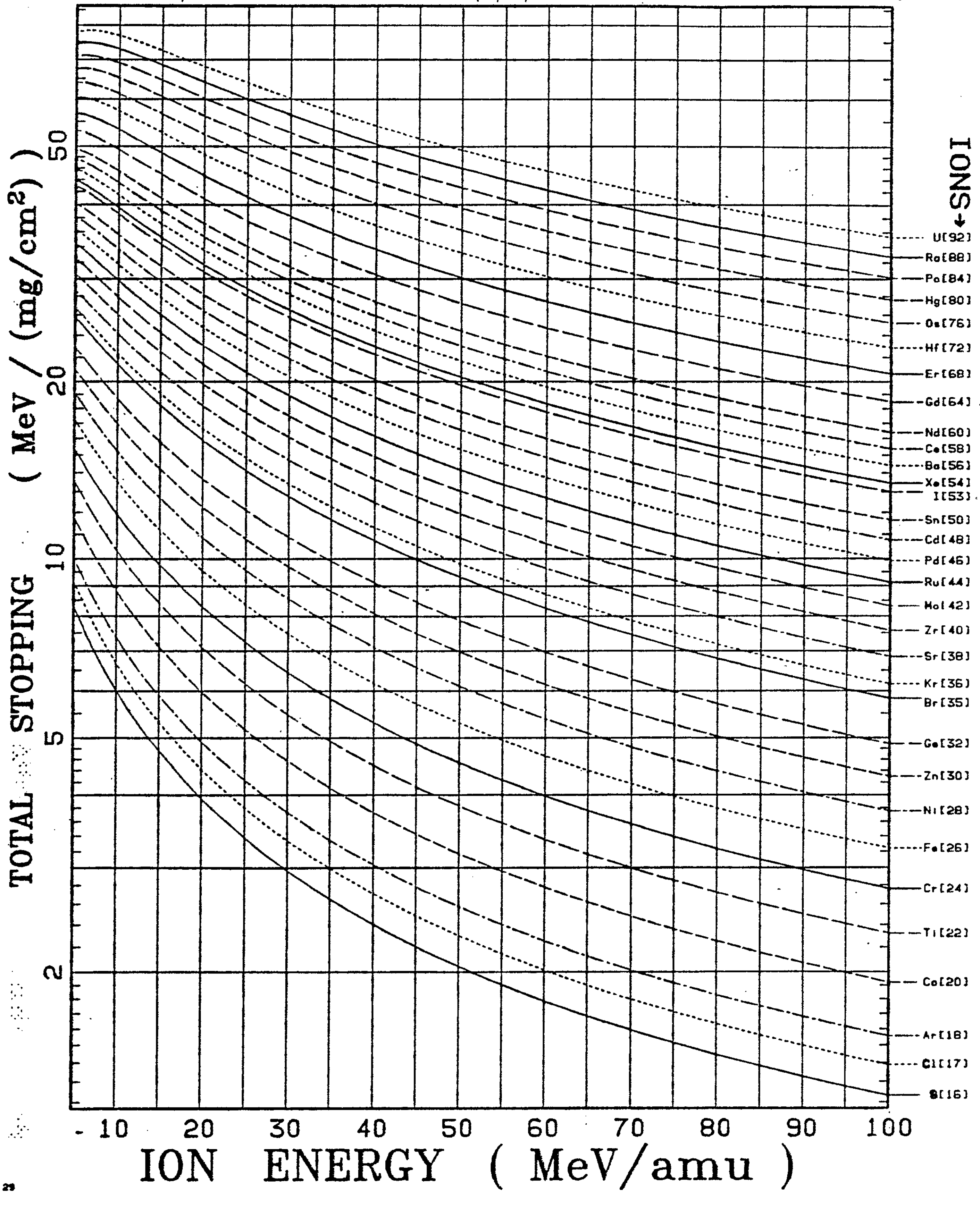

Cu(29) ←←← TARGET →→→ Cu(29)
Atom Density = 8.483×10^22 Atoms/cm^3
Mass Density = 8.949 Grams/cm^3
Multiply Total Stopping by 894.9 for Units: [MeV/mm]
Multiply by 105.5 for Units: [eV/(10^15 Atoms/cm^2)]
TOTAL STOPPING (MeV / (mg/cm^2))
1
0.5
0.2
0.1
0.05
0.02
0.01
0.005
0.002
IONS→
P[15]
Si[14]
Al[13]
Mg[12]
Na[11]
Ne[10]
F[9]
O[8]
N[7]
C[6]
B[5]
Be[4]
Li[3]
He[2]
H[1]
100
200
300
400
500
600
700
800
900
1000
ION ENERGY (MeV/amu)


Cu(29)
←←← TARGET →→→
Cu(29)
Atom Density = 8.483×10^22 Atoms/cm^3
Mass Density = 8.949 Grams/cm^3
Multiply Total Stopping by 894.9 for Units: [MeV/mm]
Multiply by 105.5 for Units: [eV/(10^15 Atoms/cm^2)]
IONS→
U[92]
Ra[88]
Po[84]
Hg[80]
Os[76]
Hf[72]
Er[68]
Gd[64]
Nd[60]
Ce[58]
Ba[56]
Xe[54]
I[53]
Sn[50]
Cd[48]
Pd[46]
Ru[44]
Mo[42]
Zr[40]
Sr[38]
Kr[36]
Br[35]
Ge[32]
Zn[30]
Ni[28]
Fe[26]
Cr[24]
Ti[22]
Ca[20]
Ar[18]
Cl[17]
S[16]
TOTAL STOPPING (MeV / (mg/cm²))
50
40
30
20
10
9
8
7
0.2
0.3
0.4
0.5
0.6
0.7
0.8
ION ENERGY (MeV/amu)


Cu(29)
←←← TARGET →→→
Cu(29)
Atom Density = 8.483×10^22 Atoms/cm^3
Multiply Total Stopping by 894.9 for Units: [MeV/mm]
Mass Density = 8.949 Grams/cm^3
Multiply by 105.5 for Units: [eV/(10^15 Atoms/cm^2)]
IONS→
U[92]
Ra[88]
Po[84]
Hg[80]
Os[76]
Hf[72]
Er[68]
Gd[64]
Nd[60]
Ce[58]
Ba[56]
Xe[54]
I[53]
Sn[50]
Cd[48]
Pd[46]
Ru[44]
Mo[42]
Zr[40]
Sr[38]
Kr[36]
Br[35]
Ge[32]
Zn[30]
Ni[28]
Fe[26]
Cr[24]
Ti[22]
Ca[20]
Ar[18]
Cl[17]
S[16]
TOTAL STOPPING (MeV / (mg/cm^2))
50
20
10
1
2
3
4
5
ION ENERGY (MeV/amu)

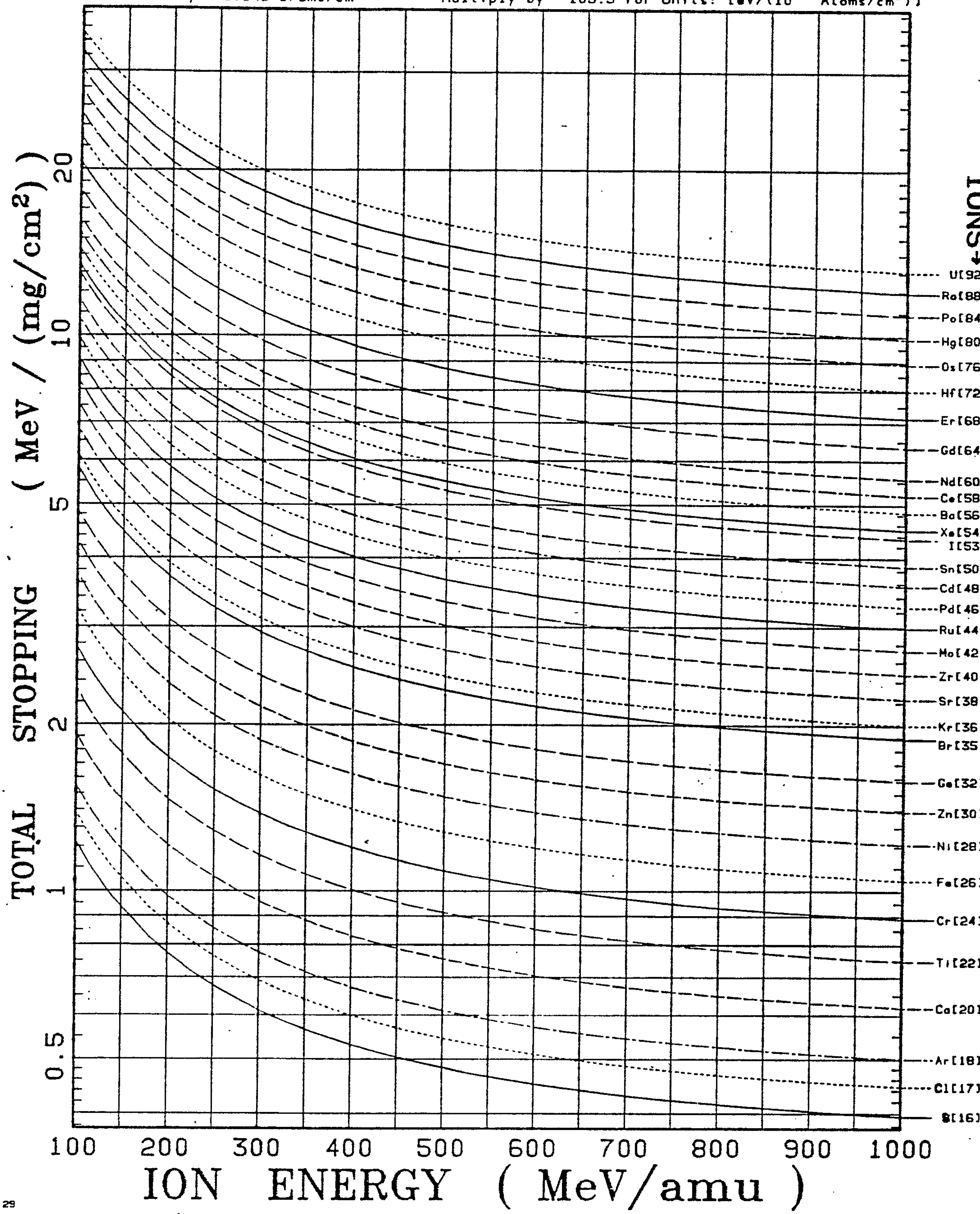
Cu(29) ←←← TARGET →→→ Cu(29)

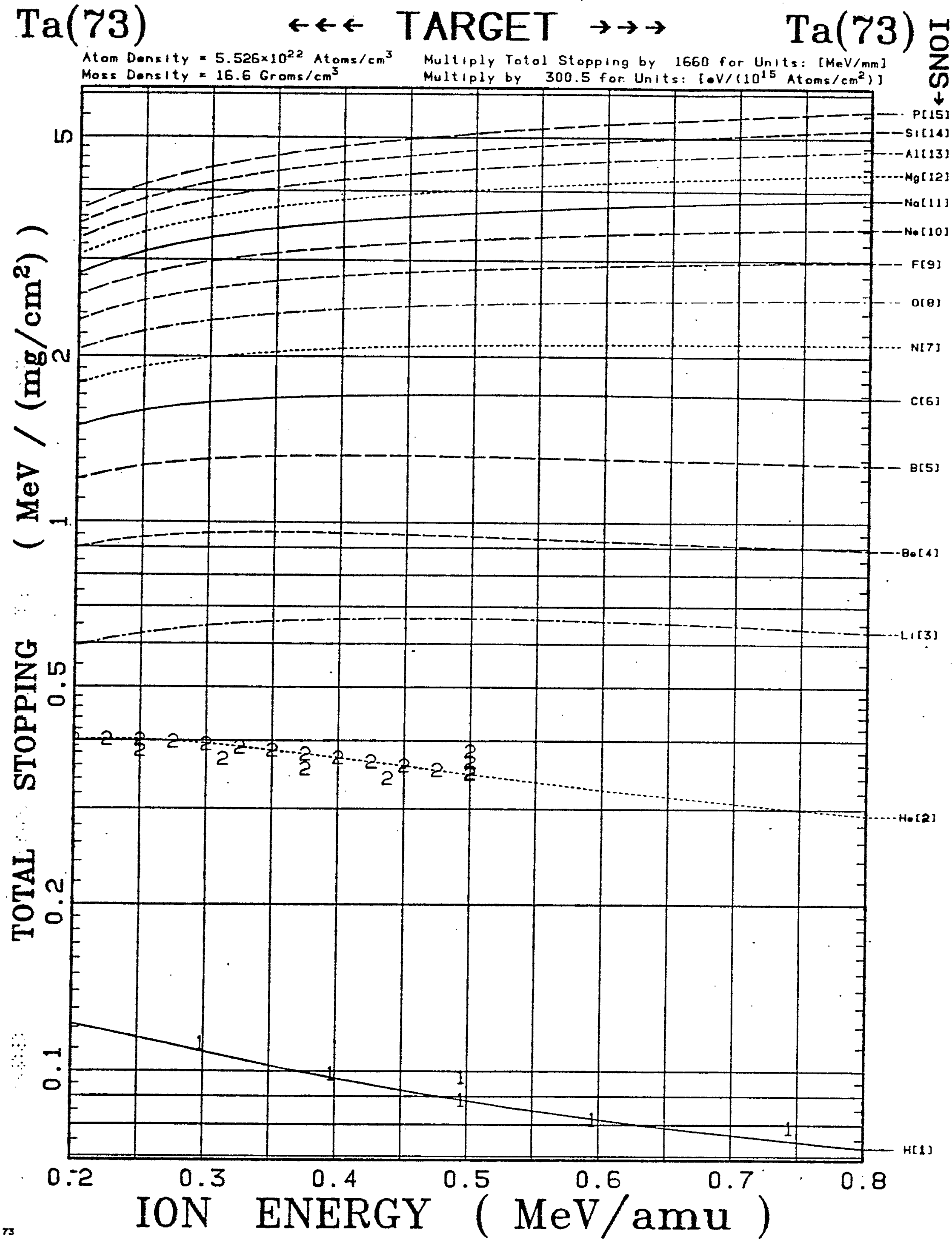
Atom Density = 8.483×10[22] Atoms/cm[3] Multiply Total Stopping by 894.9 for Units: [MeV/mm]
Mass Density = 8.949 Grams/cm[3] Multiply by 105.5 for Units: [eV/(10[15] Atoms/cm[2])]

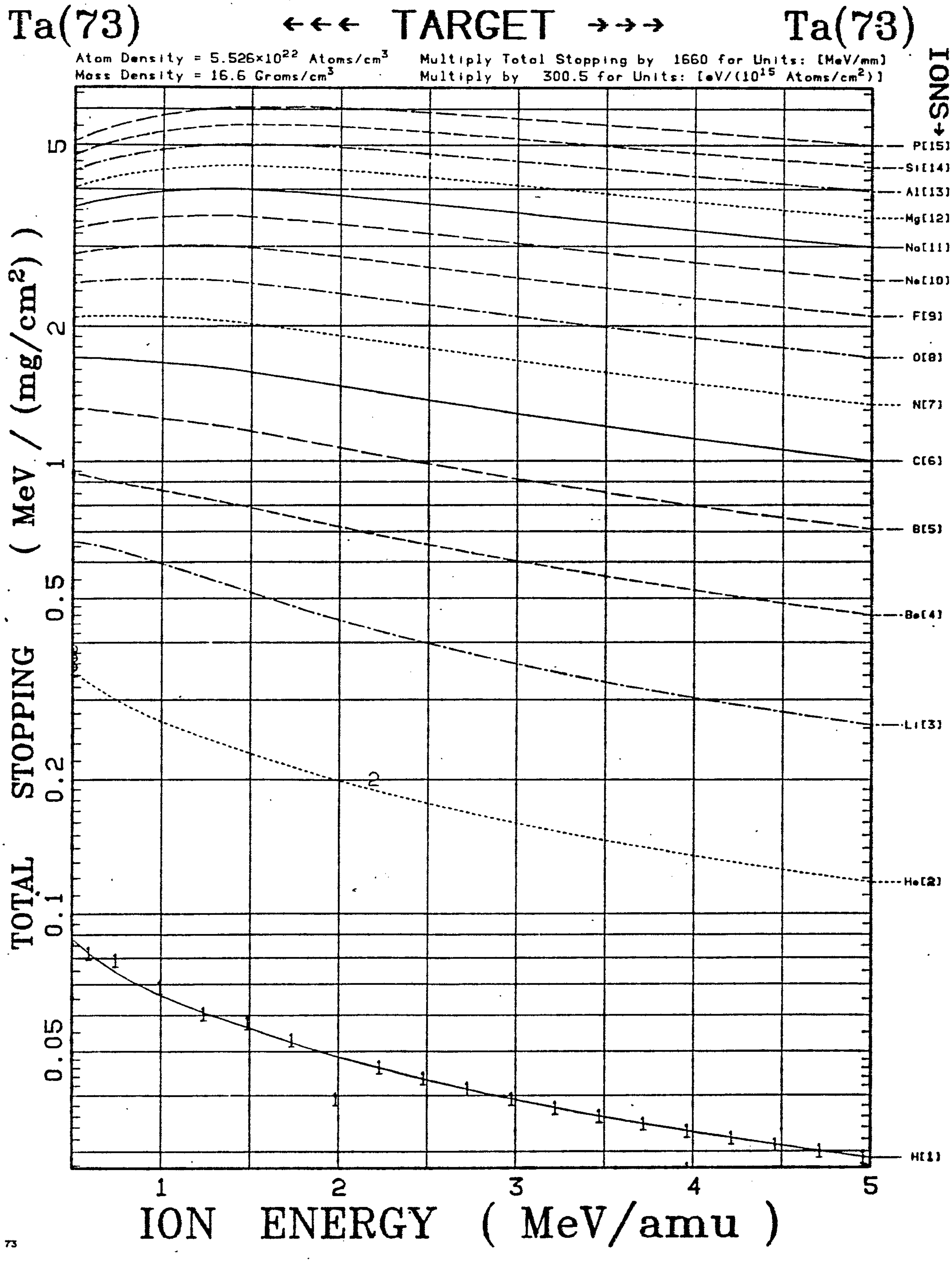


Cu(29) ←←← TARGET →→→ Cu(29)

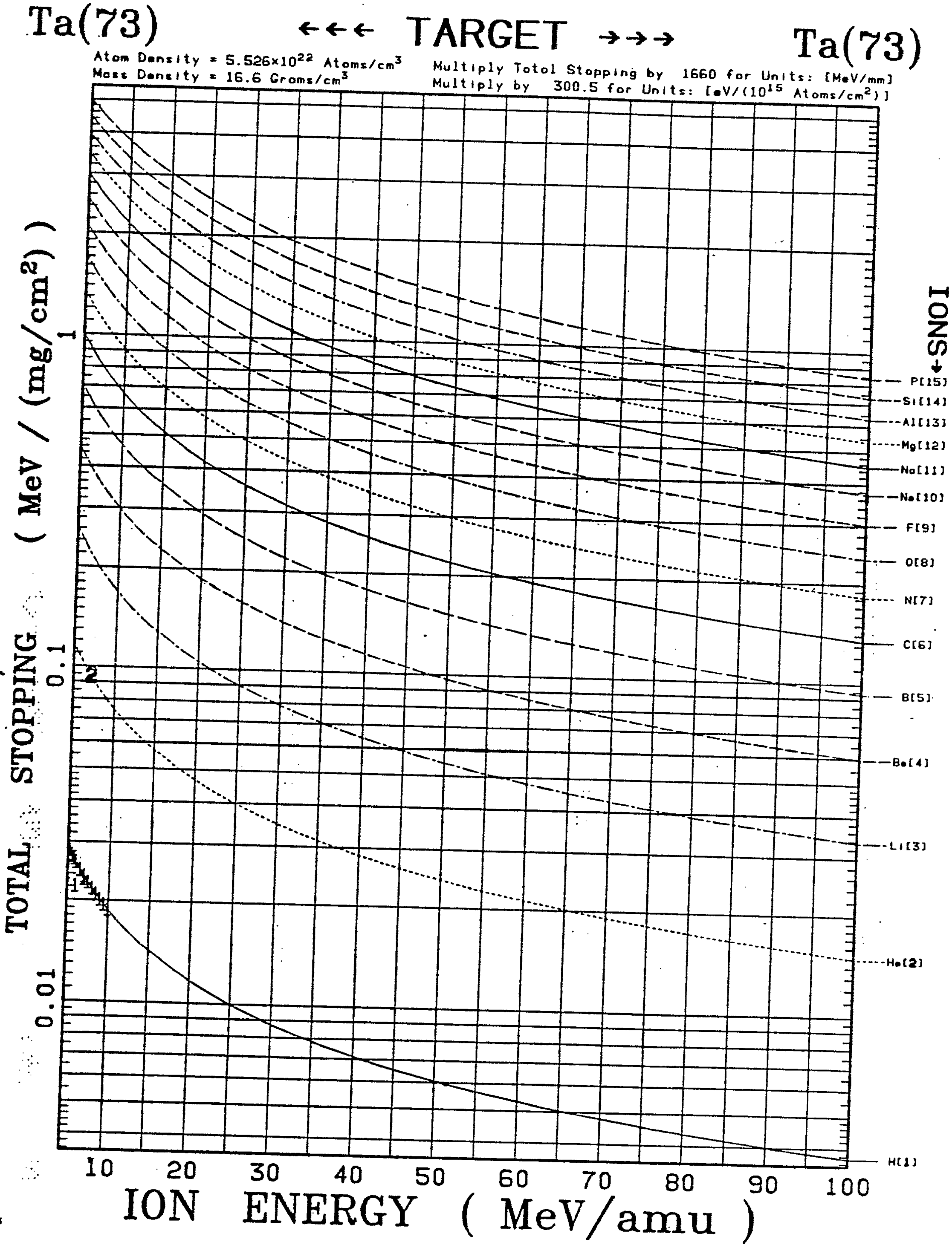
Atom Density = 8.483×10^{22} Atoms/cm^3
Mass Density = 8.949 Grams/cm^3
Multiply Total Stopping by 894.9 for Units: [MeV/mm]
Multiply by 105.5 for Units: [eV/(10^{15} Atoms/cm^2)]

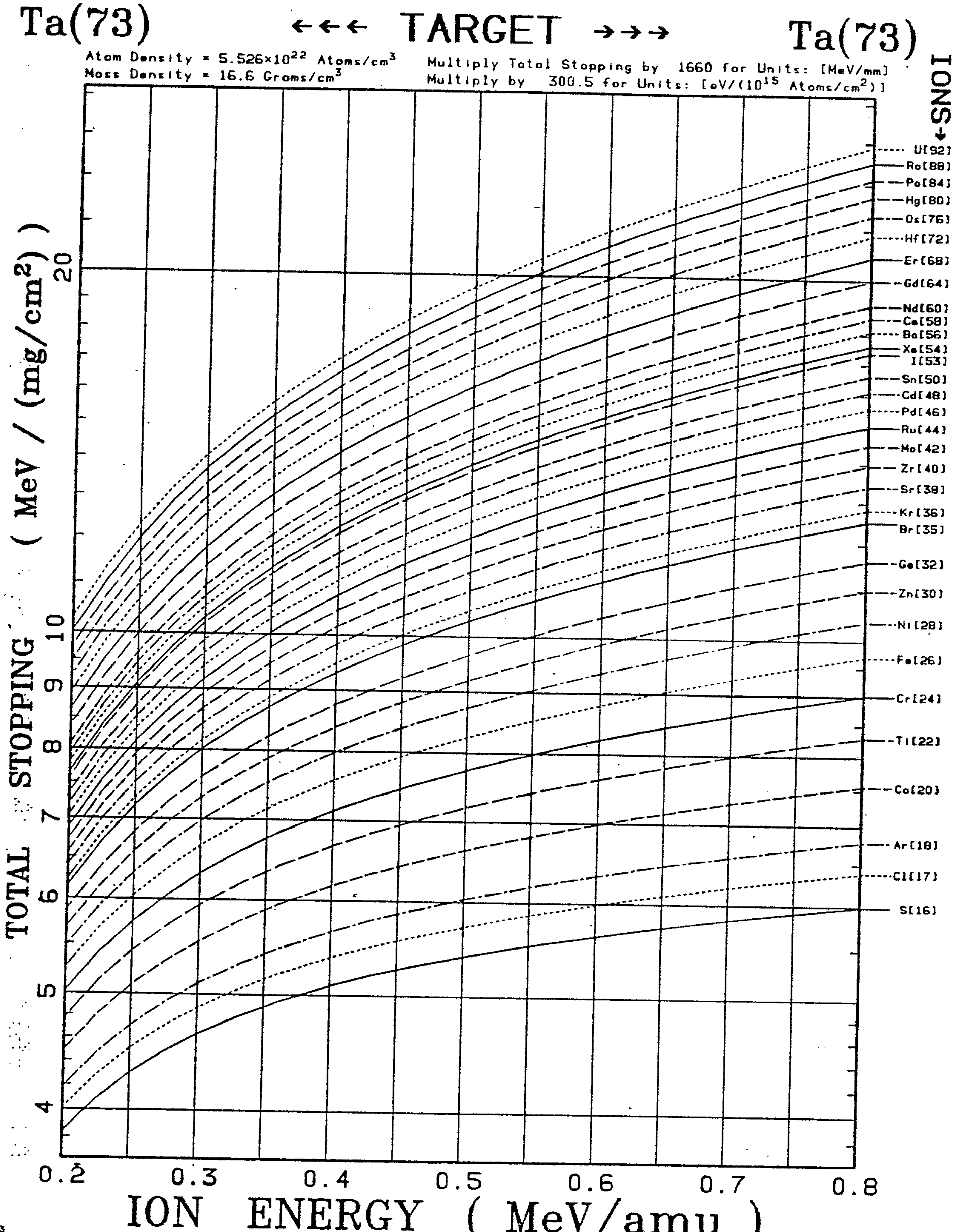


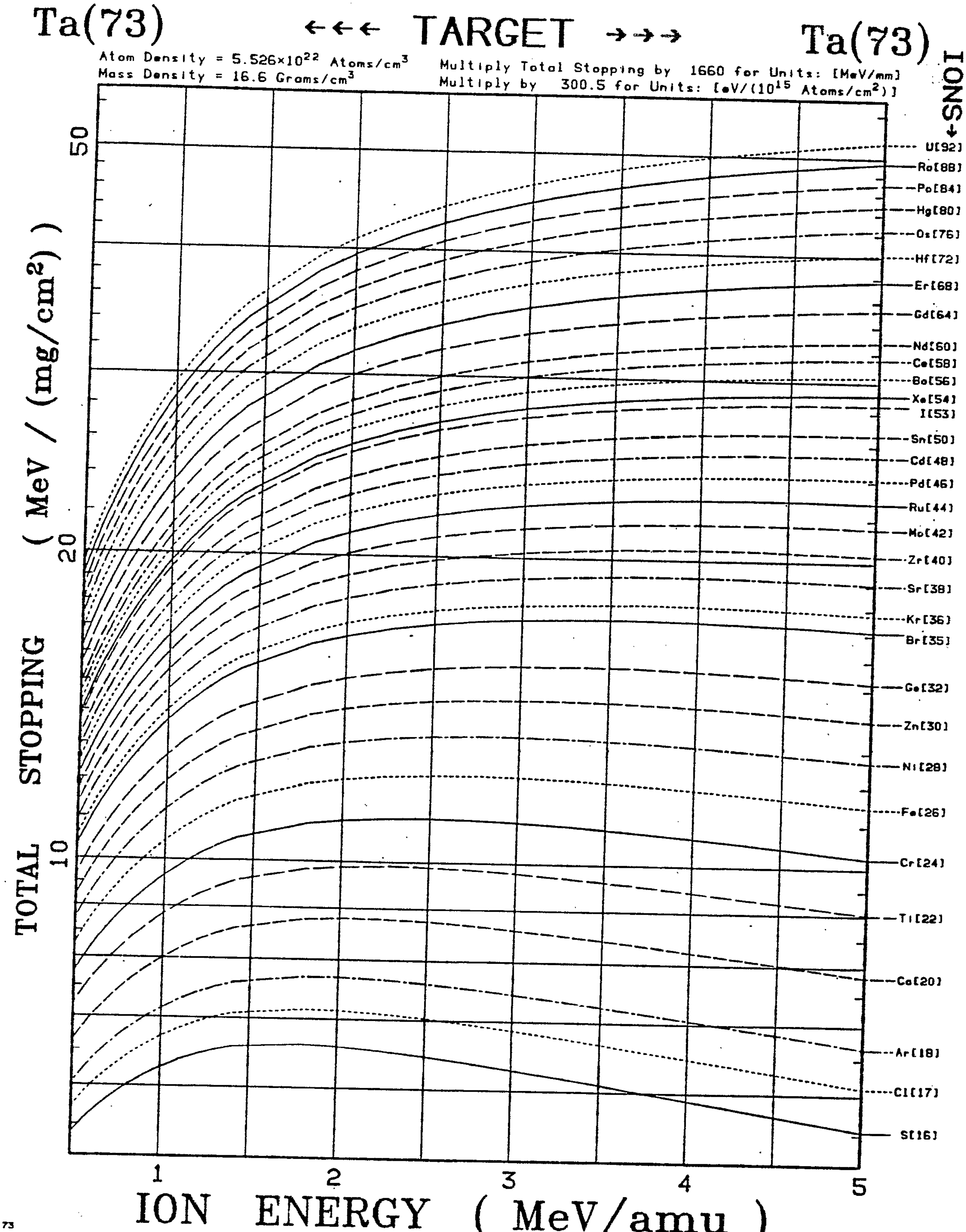

Ta(73)
←←← TARGET →→→
Ta(73)
IONS→
Atom Density = 5.526×10^22 Atoms/cm^3
Mass Density = 16.6 Grams/cm^3
Multiply Total Stopping by 1660 for Units: [MeV/mm]
Multiply by 300.5 for Units: [eV/(10^15 Atoms/cm^2)]
P[15]
Si[14]
Al[13]
Mg[12]
Na[11]
Ne[10]
F[9]
O[8]
N[7]
C[6]
B[5]
Be[4]
Li[3]
He[2]
H[1]
TOTAL STOPPING (MeV / (mg/cm^2))
ION ENERGY (MeV/amu)
0.2
0.3
0.4
0.5
0.6
0.7
0.8
5
2
1
0.5
0.2
0.1
73

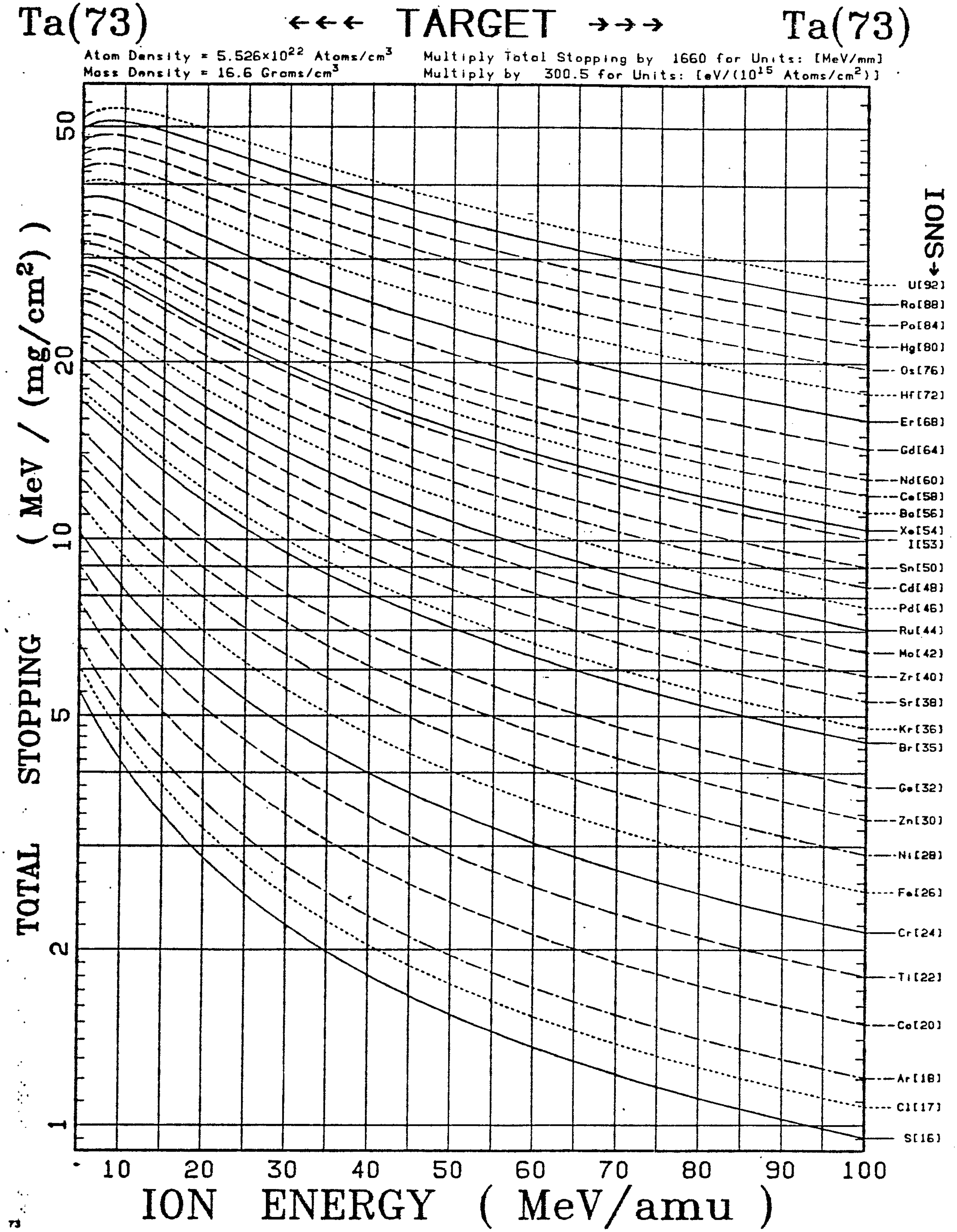

Ta(73)
←←← TARGET →→→
Ta(73)
Atom Density = 5.526×10^22 Atoms/cm^3
Mass Density = 16.6 Grams/cm^3
Multiply Total Stopping by 1660 for Units: [MeV/mm]
Multiply by 300.5 for Units: [eV/(10^15 Atoms/cm^2)]
IONS
P[15]
Si[14]
Al[13]
Mg[12]
Na[11]
Ne[10]
F[9]
O[8]
N[7]
C[6]
B[5]
Be[4]
Li[3]
He[2]
H[1]
TOTAL STOPPING (MeV / (mg/cm^2))
5
2
1
0.5
0.2
0.1
0.05
1
2
3
4
5
ION ENERGY (MeV/amu)

73


Ta(73)
←←← TARGET →→→
Ta(73)
Atom Density = 5.526x10^22 Atoms/cm^3
Mass Density = 16.6 Grams/cm^3
Multiply Total Stopping by 1660 for Units: [MeV/mm]
Multiply by 300.5 for Units: [eV/(10^15 Atoms/cm^2)]
TOTAL STOPPING (MeV / (mg/cm^2))
1
0.1
0.01
IONS→
P[15]
Si[14]
Al[13]
Mg[12]
Na[11]
Ne[10]
F[9]
O[8]
N[7]
C[6]
B[5]
Be[4]
Li[3]
He[2]
H[1]
10
20
30
40
50
60
70
80
90
100
ION ENERGY (MeV/amu)


Ta(73)
←←← TARGET →→→
Ta(73)
Atom Density = 5.526×10^22 Atoms/cm^3
Mass Density = 16.6 Grams/cm^3
Multiply Total Stopping by 1660 for Units: [MeV/mm]
Multiply by 300.5 for Units: [eV/(10^15 Atoms/cm^2)]
IONS→
U[92]
Ra[88]
Po[84]
Hg[80]
Os[76]
Hf[72]
Er[68]
Gd[64]
Nd[60]
Ce[58]
Ba[56]
Xe[54]
I[53]
Sn[50]
Cd[48]
Pd[46]
Ru[44]
Mo[42]
Zr[40]
Sr[38]
Kr[36]
Br[35]
Ge[32]
Zn[30]
Ni[28]
Fe[26]
Cr[24]
Ti[22]
Ca[20]
Ar[18]
Cl[17]
S[16]
TOTAL STOPPING (MeV / (mg/cm²))
20
10
9
8
7
6
5
4
0.2
0.3
0.4
0.5
0.6
0.7
0.8
ION ENERGY (MeV/amu)


Ta(73)
←←← TARGET →→→
Ta(73)
Atom Density = 5.526×10^22 Atoms/cm^3
Mass Density = 16.6 Grams/cm^3
Multiply Total Stopping by 1660 for Units: [MeV/mm]
Multiply by 300.5 for Units: [eV/(10^15 Atoms/cm^2)]
IONS
U[92]
Ra[88]
Po[84]
Hg[80]
Os[76]
Hf[72]
Er[68]
Gd[64]
Nd[60]
Ce[58]
Ba[56]
Xe[54]
I[53]
Sn[50]
Cd[48]
Pd[46]
Ru[44]
Mo[42]
Zr[40]
Sr[38]
Kr[36]
Br[35]
Ge[32]
Zn[30]
Ni[28]
Fe[26]
Cr[24]
Ti[22]
Ca[20]
Ar[18]
Cl[17]
S[16]
50
20
10
TOTAL STOPPING (MeV / (mg/cm^2))
1
2
3
4
5
ION ENERGY (MeV/amu)


Ta(73)
←←← TARGET →→→
Ta(73)
Atom Density = 5.526x10^22 Atoms/cm^3
Mass Density = 16.6 Grams/cm^3
Multiply Total Stopping by 1660 for Units: [MeV/mm]
Multiply by 300.5 for Units: [eV/(10^15 Atoms/cm^2)]
TOTAL STOPPING (MeV / (mg/cm^2))
50
20
10
5
2
1
10
20
30
40
50
60
70
80
90
100
ION ENERGY (MeV/amu)
IONS→
U[92]
Ra[88]
Po[84]
Hg[80]
Os[76]
Hf[72]
Er[68]
Gd[64]
Nd[60]
Ce[58]
Ba[56]
Xe[54]
I[53]
Sn[50]
Cd[48]
Pd[46]
Ru[44]
Mo[42]
Zr[40]
Sr[38]
Kr[36]
Br[35]
Ge[32]
Zn[30]
Ni[28]
Fe[26]
Cr[24]
Ti[22]
Ca[20]
Ar[18]
Cl[17]
S[16]

Ta(73) ←←← TARGET →→→ Ta(73)

Atom Density = 5.526×10^{22} Atoms/cm^3 Multiply Total Stopping by 1660 for Units: [MeV/mm]
Mass Density = 16.6 Grams/cm^3 Multiply by 300.5 for Units: [eV/(10^{15} Atoms/cm^2)]