ER 7777

DATA COMPILATION AND EVALUATION OF SPACE SHIELDING PROBLEMS

RANGE AND STOPPING POWER DATA

VOLUME I

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FOREWORD

Volumes I and II, ER 7777, Data Compilation and Evaluation of Space Shielding Problems, comprise a technical summary report of the study performed for Contract NAS 8-11164 under the direction of the George C. Marshall Space Flight Center, NASA, Huntsville, Alabama. Special acknowledgement is due the technical contract monitor, Martin O. Burrell of the Research Projects Division, who suggested the charged particle range approximation and the radiation transport method. Mr. Burrell also furnished solar flare and other data. J. C. Whiten, Vehicle Propulsion and Engineering, forwarded data on vehicle configurations and mission trajectories. Frank T. Bly, Lockheed-Georgia Company, made several important contributions to the design of the Geometry program and the approximation of range data. C. C. Douglass, Lockheed-Georgia Company, performed the initial programming of the Geometry program and the Geometry Test program. Mr. Douglass also developed DIP, the Data Input Program, which condenses and simplifies data preparation for several of the computer codes described herein.

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1.0 INTRODUCTION

This report presents tabulations of proton and alpha particle range and stopping power data for 55 materials. The present effort differs from other compilations[1, 3, 7, 8, 16, 20, 22, 24, 28, 33, 35] in that a detailed calculation is performed for both density effect corrections and K, L, and higher shell corrections. Recent experimental values of electron binding energies[13] for the L_1 subshell of elements with low atomic number, 8 through 23, are incorporated in the calculations. Because experimental data adequate to define empirical parameters exist for relatively few materials, an attempt has been made to find smooth variations of these parameters over atomic number and energy. The tabulated data generally agree with available experimental data within experimental accuracy.

The data tabulations are generated with the Lockheed Range and Stopping Power Calculator[16] (LRSPC). The LRSPC code includes a library tape with sufficient data to treat elements with atomic number one through one hundred inclusive. The code will treat elements and mixtures or compounds of two to ten elements. Stopping power is calculated from the Bethe-Bloch equation. The Bragg additivity assumption is used in the case of compounds and mixtures. Ranges are calculated by integrating the reciprocal of the stopping power from two MeV to the energy of interest, and adding the two MeV range.

The mean excitation potential, I, (sometimes called the effective excitation potential or mean ionization potential) is tabulated for elements below carbon and selected from a smooth function above carbon. The K-shell corrections are due to Brown[10] and Walske[31]. The L-shell and higher shell corrections are based on Walske's L-shell corrections[32] modified to improve agreement with experimental data. The form of the higher shell corrections is based on L-shell corrections according to an approach suggested by Bichsel[8]. The density effect corrections are computed according to Sternheimer's[28, 29, 30] method.

An approximation function to charged particle range data has been suggested by Burrell[12]. This function is used in proton and alpha particle transport computational methods described in Volume II of this report. "Best fit" values of the parameters in the Chebyshev sense are tabulated.

2.0 PROGRAM DESCRIPTION

The Lockheed Range and Stopping Power Calculator (LRSPC) is a computer code designed to estimate the energy loss, due to ionization and excitation, of charged particles passing through matter. This energy loss (i.e., stopping power) is calculated as a function of kinetic energy for charged particles penetrating materials composed of ten or fewer elements. Appropriate correction factors are introduced in the stopping power calculation to account for the density effect and the shell effect. Protons with kinetic energies ranging from 0.4 MeV to 100 GeV and alphas from 2 MeV to 100 GeV are considered in the calculations.

The range of charged particles in matter is given by:

$$R(E) = R(2\ \text{MeV}) + \int_{E(2\ \text{MeV})}^{E} \frac{dE}{SP(E)} \qquad (2\text{-}1)$$

where R(E) is the range of a particle with kinetic energy (E):

R(2 MeV) is the experimentally determined range of particles with kinetic energy of 2 MeV;

SP(E) is the calculated stopping power of particles with kinetic energy (E).

The stopping power, SP(E), is calculated from the Bethe-Bloch formula.

$$SP(E) = -\left(\frac{dE}{dx}\right)\left(\frac{1}{\rho_t}\right) = \frac{2\pi Ne^4}{mc^2\beta^2} \sum \frac{Z_k \rho_k}{A_k \rho_t}\ (\text{BRAK}) \qquad (2\text{-}2)$$

where $-(dE/dx)$ is the charged particle energy loss rate due to ionization and excitation in the material:

ρ_t is the density of the stopping material in units of gm/cm^3;

N is Avogadro's number in units of atoms/mole;

e is the electronic charge in units of $(MeV\text{-}cm)^{1/2}$;

mc^2 is the electron rest mass in units of MeV;

β is the ratio of the velocity of the incident particle to the velocity of light;

Z_k is the atomic number of the k^{th} element of the stopping material;

ρ_k is the partial density of the k^{th} element of the stopping material in units of gm/cm^3;

A_k is the atomic weight of the k^{th} element of the stopping material; and

BRAK is a term of convenience defined below:

$$BRAK = \ln \left[\frac{2mc^2 \beta^2}{I^2(1-\beta^2)} W_{max} \right] - 2\beta^2 - U - \delta \qquad (2\text{-}3)$$

where I is the mean excitation potential of the stopping material in units of MeV;

U is the shell effect correction term;

δ is the density effect correction term; and

W_{max} is maximum energy transfer from the incident particle to an atomic electron.

W_{max} is defined by:

$$W_{max} = \frac{E_t^2 - \mu^2 c^4}{\mu c^2 \left[(\mu/2m) + (m/2\mu) + (E_t/\mu c^2) \right]} \qquad (2\text{-}4)$$

where E_t is the total energy of the incident particle;

μ is the rest mass of the incident particle;

c is the speed of light; and

m is the rest mass of the electron.

The mean excitation potential, I, is given by:

$$I = \exp\left[\frac{\sum_k (Z_k \rho_k / A_k) \ln I_k}{\sum_k (Z_k \rho_k / A_k)}\right] \qquad (2\text{-}5)$$

where I_k is the mean excitation potential of the k^{th} element in the stopping material.

2.1 SHELL CORRECTION

The shell effect correction term (U) is introduced to prevent an overestimation of the stopping power of a material when the velocity of the incident charged particle is not much greater than the velocity of the inner electrons of the elements present. For one element, the shell effect correction term is:

$$U_k = 2C_K/Z + 2C_L/Z + 2C_H/Z$$

where C_K is the correction term for the ineffectiveness of the K-shell electrons;

Z is the atomic number of the stopping material,

C_L is the correction term for the L-shell electrons, and

C_H is the correction term for higher shells.

The total shell correction term for a mixture or compound is:

$$U = \frac{\sum_k (Z_k \rho_k / A_k) U_k}{\sum_k (Z_k \rho_k / A_k)} \qquad (2\text{-}6)$$

The stopping number (B_i) for any atomic shell when η_i is large is:

$$B_i(\theta_i, \eta_i) = S_i(\theta_i) \ln \eta_i + T_i(\theta_i) - C_i(\theta_i, \eta_i) \qquad (2\text{-}7)$$

where i indicates the atomic electron shell (K, L, . . . etc.);

θ_i is the ratio of the observed binding energy of the i^{th} atomic electron shell to the "ideal" ionization potential, which ignores screening by the outer electron shells;

η_i is proportional to the energy of the incident particle divided by the ideal ionization potential;

S_i is an η_i dependent term and T_i is an η_i independent term when the electrons of the i^{th} shell are considered motionless; and

C_i is the correction term for the i^{th} shell electrons in motion .

The stopping number, B, for a material is determined by the sum of the stopping numbers of each shell from all elements present.

$$B = \sum_{j=1}^{M} \sum_{i=1}^{N_j} B_{ij}(\theta_i, \eta_i) \qquad (2\text{-}8)$$

where B_{ij} is the stopping number for the i^{th} shell of the j^{th} atom;

N_j is the number of electron shells in the j^{th} atom; and

M is the number of elements in the material.

To determine the stopping number (B_K) of the K-shell electrons, the expressions for θ_K and η_K are:

$$\theta_K = \frac{I_K}{\left(\frac{mc^2}{2}\right)\left(\frac{Z - 0.3}{137.0372}\right)^2} \tag{2-9}$$

where I_K is the observed binding energy of the K-shell, and the denominator is the non-relativistic ideal ionization potential of the K-shell which ignores screening by all but the K electrons, and

$$\eta_K = \beta^2 \Big/ \left[\left(\frac{Z - 0.3}{137.0372}\right)^2 (1 - \beta^2)\right] \tag{2-10}$$

To determine the stopping number correction for the L-shell electrons, the expression for θ_L, which is the weighted average of the energy states of the L level, is

$$\theta_L = \frac{2(\theta_{L1})(HOF_{L1}) + 3(\theta_{L2} + \theta_{L3})(HOF_{L2})}{2(HOF_{L1}) + 6(HOF_{L2})} \tag{2-11}$$

where θ_{L1}, θ_{L2}, and θ_{L3} correspond to the three relativistic energy states in the L electron shell,

$$\theta_{L1} = \frac{I_{L1}}{\left(\frac{mc^2}{2}\right)\left(\frac{Z - 4.15}{137.0372}\right)^2} - \frac{5}{16}\left(\frac{Z - 4.15}{137.0372}\right)^2$$

$$\theta_{L2} = \frac{I_{L2}}{\left(\frac{mc^2}{2}\right)\left(\frac{Z - 4.15}{137.0372}\right)^2} - \frac{5}{16}\left(\frac{Z - 4.15}{137.0372}\right)^2 \tag{2-12}$$

$$\theta_{L3} = \frac{I_{L3}}{\left(\frac{mc^2}{2}\right)\left(\frac{Z - 4.15}{137.0372}\right)^2} - \frac{1}{16}\left(\frac{Z - 4.15}{137.0372}\right)^2$$

I_{L1}, I_{L2}, and I_{L3} are the observed binding energies of the L-shell electrons; HOF_{L1} is the Hönl[18] oscillator strength for the 2s electron states of the L-shell, and HOF_{L2} is the Hönl oscillator strength for the 2p electron states of the L-shell.

The value of η_L is:

$$\eta_L = \frac{\beta^2}{(1-\beta^2)\left(\frac{Z-4.15}{137.0372}\right)^2} \qquad (2\text{-}13)$$

Values of η_K are calculated using Equation 2-10, and values of θ_K are calculated using Equation 2-9. "Exact" values of the stopping number, $B_K(\theta_K, \eta_K)$, are determined from data presentations of Brown[10] and Walske[31] for η_K less than ten. These values are subtracted from approximate values of B_K(the first two terms of each of Equations 2-14) in order to obtain $C_K(\theta_K, \eta_K)$. Three point interpolation is used to obtain the proper value of C_K. For values of η_K greater than ten, the asymptotic formulas for $B_K(\theta_K, \eta_K)$ given by Walske are used;

$$B_K(0.7, \eta_K) = 1.8133 \ln \eta_K + 2.4603 - 2.0662\,\eta_K^{-1} - 7.3246\,\eta_K^{-2} + 45\,\eta_K^{-3}$$

$$B_K(0.75, \eta_K) = 1.7223 \ln \eta_K + 2.4044 - 2.0999\,\eta_K^{-1} - 7.3194\,\eta_K^{-2} + 45\,\eta_K^{-3}$$

$$B_K(0.8, \eta_K) = 1.6457 \ln \eta_K + 2.3462 - 2.1196\,\eta_K^{-1} - 7.3191\,\eta_K^{-2} + 45\,\eta_K^{-3}$$

$$B_K(0.85, \eta_K) = 1.5807 \ln \eta_K + 2.2868 - 2.1290\,\eta_K^{-1} - 7.3218\,\eta_K^{-2} + 45\,\eta_K^{-3} \qquad (2\text{-}14)$$

$$B_K(0.9, \eta_K) = 1.5250 \ln \eta_K + 2.2273 - 2.1309 \eta_K^{-1} - 7.3263 \eta_K^{-2} + 45 \eta_K^{-3} \quad (2\text{-}14)$$

where $C_K(\theta_K, \eta_K)$ to order η_K^{-3} is the negative of the last three terms of the asyptotic formulas.

Values of η_L, as a function of the kinetic energy of the incident particle, and θ_L, as a function of the stopping material, are calculated, and a table of values of C_L versus η_L for θ_L = 0.15, 0.25, 0.35, 0.45, 0.55, and 0.65 are used to determine the correction to stopping number for the ineffectiveness of L-shell electrons.

The correction to stopping number for the higher electron shells (M, N, O, P, Q) are scaled from the C_L correction term of the L-shell electrons in accordance with the approach used by Bichsel[8]. A parameter (A1) is introduced to handle the energy scaling and parameters (I_i) are introduced to handle the magnitude of the sub-shell correction scaling where the subscript (i) refers to the various sub-shells (s, p, d, f, etc.) of the electron shells. The correction term for the desired shell is determined at a particular velocity (β) by using a table of L-shell corrections at a velocity ζ, which is,

$$\zeta^2 = \frac{\beta^2 \cdot I_L}{A1 \cdot I_i} \quad (2\text{-}15)$$

where β is the velocity of incident particle,

I_L is the average ionization potential of the L-shell, and

I_i is the ionization potential of the desired sub-shell.

Thus, for the full M-shell, the correction at any particular velocity is:

$$C_M(\beta) = \sum_{i=1}^{5} C_{M_i} \quad (2\text{-}16)$$

where

$$C_{M1} = \frac{2}{8} \quad C_L(\zeta_1)\left(\frac{1-\beta^2}{1-\zeta_1^2}\right) \text{ and } \zeta_1^2 = \frac{\beta^2 I_L}{A1\, I_{M1}}$$

$$C_{M2} = \frac{2}{8} \quad C_L(\zeta_2)\left(\frac{1-\beta^2}{1-\zeta_2^2}\right) \text{ and } \zeta_2^2 = \frac{\beta^2 I_L}{A1 \cdot I_{M2}} \qquad (2\text{-}17)$$

$$C_{M3} = \frac{4}{8} \quad C_L(\zeta_3)\left(\frac{1-\beta^2}{1-\zeta_3^2}\right) \text{ and } \zeta_3^2 = \frac{\beta^2 I_L}{A1 \cdot I_{M3}}$$

• • •

The correction term for the other higher shells are similar to the M-shell term when the proper number of electrons per sub-shell and their corresponding ionization potentials are used.

2.2 DENSITY EFFECT

The density effect is the reduction in the ionization loss of a charged particle due to polarization of the stopping media. The density effect correction term to be applied to the Bethe-Bloch formula is directly dependent on the value of the mean excitation potential of the stopping media and is calculated by a method similar to that of Sternheimer.[28,29,30]. If differs chiefly in the large number of electron shells considered.[17,13]

$$\Delta\left(-\frac{dE}{dx}\right) = \frac{2\pi Ne^4}{mv^2}\left(-\delta\right) \qquad (2\text{-}18)$$

where dE/dx is the energy loss rate,

N is the number of electrons per cubic centimeter in the stopping material,

e is the electron charge,

m is the electron mass

v is the velocity of the incident particle ($v = \beta c$), and

δ is the density effect correction term.

The density effect correction term δ is given by:

$$\delta = \left\{ \sum_{i,k} f_{ik} \ln \left[(I_{ik}^2 + I^2)/I_{ik}^2 \right] - I^2(1 - \beta^2) \right\} \qquad (2\text{-}19)$$

where I is the solution of

$$\frac{1}{\beta^2} - 1 = \sum_{i,k} \frac{f_{ik}}{\bar{\nu}_{ik}^2 + I^2} \qquad (2\text{-}20)$$

and I_{ik} is given by

$$I_{ik} = (\bar{\nu}_{ik}^2 + f_{ik})^{1/2} \qquad (2\text{-}21)$$

Here, f_{ik} is the oscillator strength of the i^{th} transition in the k^{th} element. Its value is given by the ratio of the number of electrons in the i^{th} subshell to the atomic number. The term $\bar{\nu}_{ik}$ is the effective oscillator frequency of the i^{th} shell electrons of the k^{th} element in units of the plasma frequency ν_p.

$$\bar{\nu}_{ik} = \left(\frac{\nu_{ik}}{\nu_p} G_k \right) \qquad (2\text{-}22)$$

The ν_{ik} is i^{th} transition frequency for the k^{th} element. The plasma frequency of the mixture is given by :

$$h\nu_p = h(Ne^2/\pi m)^{1/2}$$

$$= 28.8203 \times 10^{-6} \left[\sum_k (Z_k \rho_k / A_k) \right]^{1/2} \quad (2\text{-}23)$$

The symbol G_k represents a correction term due to the fact that transitions are made into the continum. It is evaluated by normalizing the calculated ionization potential to the experimental effective excitation potential, I_k, for the k^{th} element. For non-conductors, the value of G_k is:

$$G_k = \exp\left[\frac{\ln I_k - \sum_{i=1}^{j} f_{ik} \ln(h\nu_{ik})}{\sum_{i=1}^{j} f_{ik}} \right] \quad i \leq j \quad (2\text{-}24)$$

For metals, the value of G_k is:

$$G_k = \exp\left\{ \frac{\ln I_k - f_{jk} \ln h\nu_p (f_{jk})^{1/2} - \sum_{i=1}^{j-1} f_{ik} \ln(h\nu_{ik})}{\sum_{i=1}^{j-1} f_{ik}} \right\} \quad (2\text{-}25)$$

where i is the number of subshells,

j is the oscillator number of the conduction electrons, and

k is the element number.

A third correction is needed if the mean excitation potential is measured for a material in a solid or liquid physical state, and the stopping power is desired for the gaseous state or vice versa.[34]

$$I_k^{gas} = I_k^{condensed} e^{D_k/2} \quad (2\text{-}26)$$

For metals the D_k term is

$$D_k = \sum_{i=1}^{j-1} f_{ik} \ln(1 + f_{ik}/\bar{\nu}_{ik}^2) + 2f_{jk} \ln\left[h \nu_p (f_{jk})^{1/2}/E_{jk}\right] \qquad (2\text{-}27)$$

where E_{jk} is the optical transition energy of electrons in a gas. For nonconductors the D_k term is

$$D_k = \sum_{i=1}^{j} f_{ik} \ln(1 + f_{ik}/\bar{\nu}_{ik}^2) \qquad (2\text{-}28)$$

3.0 DISCUSSION OF DATA

The objective of this study is to generate range and stopping power data for a variety of materials and to provide a computer code capable of calculating similar data for materials not in the present tabulation. To this purpose, a library tape has been prepared which contains atomic constants for elements with atomic numbers one through one hundred. This section discusses the choice of certain parameters and presents comparisons of experimental and calculated data.

3.1 MEAN EXCITATION POTENTIAL

The mean excitation potential is tabulated for carbon and lower atomic number elements where the value fluctuates rapidly. A linear interpolation in I/Z is used from carbon to aluminum. For aluminum and higher elements, this value is taken from Equation 3-1 , suggested by Sternheimer and recommended by the Subcommittee on the Penetration of Charged Particles of the Committee on Nuclear Sciences, National Academy of Sciences - National Research Council as the "best smooth curve".[3, 20]

$$I/Z = 9.76 + 58.8\, Z^{-1.19} \text{ eV} \qquad (3\text{-}1)$$

This choice of I appears to give satisfactory fits to available high energy range data.

3.2 SHELL CORRECTION

The most difficult energy region to treat lies below 10 MeV. Here, the shell correction terms may become quite large, especially for high Z elements. Barkas and Berger[3, 20] use an empirical formula in this energy region with constants derived from a least squares fit to range data. The approach taken in this study is also empirical, but is based on stopping power data rather than range data.

The K-shell corrections of Walske[31] are used directly as illustrated in section 2.1. The calculation starts with the L-shell corrections of Walske.[32] Values are obtained by extrapolation for θ_L equal to 0.15 and 0.25. This is equivalent to guessing an initial L-shell correction for atomic numbers less than 16. Higher shell corrections, if any, are based upon L-shell corrections as explained in Section 2.1. The resulting proton stopping power values are automatically compared to experimental values for 26 elements. The comparison is tabulated as a function of $\eta_{L'}$ the energy parameter, and $\theta_{L'}$ the element parameter.

The L-shell corrections are then manually corrected to improve the agreement with experimental data. This task does not lend itself to an automated approach because of the coupling between L-shell corrections and higher shell corrections. A number of iterations are made; each time the correction terms are estimated and smoothed before the succeeding iteration.

The final L-shell correction values are tabulated in Table 3-1. These values should not be used as L-shell corrections alone, but only in conjunction with higher shell corrections according to the procedure in Section 2.1.

The comparison of low energy experimental and calculated proton stopping power is shown in Table 3-2. Discrepancies are generally within experimental error. The fit might be improved somewhat by varying the value of I for individual elements from that specified by Equation 3-1.

The lithium data exhibits a severe disagreement over part of the energy region which cannot be reduced appreciably with other values of I. Shell correction terms are small. New experimental data in the region one to ten MeV would be useful in resolving this discrepancy. Excluding lithium, the average deviation at two MeV and above is 1.47 percent in Table 3-2. The average deviation for all data from 0.4 to 6.0 MeV is 2.76 percent.

Table 3-3 shows a comparison of experimental and calculated proton stopping power data, relative to aluminum, at 19.8, 20.6, and 28.7 MeV. In most instances, the difference between experimental values and calculated values is less than twice the probable error. The large error for calcium may be due in part to oxidation of the foil which was noticed during the experiment. It is not obvious what significance should be given to the fact that calculated values for heavy elements are generally low near 20 MeV and high near 29 MeV. At these energies, shell corrections contribute less than one percent to proton stopping power in aluminum and three to five percent in the heavy elements. It would be necessary to change the L-shell corrections by twenty to several hundred percent in order to obtain agreement, depending on the energy region where alterations might be applied.

A comparison of experimental and calculated proton range data is shown in Table 3-4. Multiple scattering corrections may not be consistently applied to different sets of experimental data. Some of the experimental emulsion ranges are derived from range measurements for particles other than protons. Calculated ranges are based on two MeV experimental ranges. Below two MeV, errors in stopping power lead to relatively large errors in range due to the computational method. Excluding two MeV and lower energy proton ranges, the average relative error in Table 3-4 is 0.97 percent.

Table 3-5 compares experimental and calculated alpha stopping power. The calculation is identical to the proton calculation except for the necessary changes in particle mass and charge. In particular, the shell corrections deduced from proton comparisons are unchanged. Comparison with data from Reference 25 shows a definite trend. Calculated values decrease relative to experimental values as energy increases. However, the data from Reference 14 shows an opposite trend in the energy region where overlap occurs, 3 to 4 MeV. If the former trend is genuine, the cause may be electron pickup; i.e., partial neutralization of the bombarding particle. This phenomonon decreases the average stopping power at low energies.

Theoretical shell corrections do not account for electron pickup. The empirical L and higher shell corrections used here do include an approximate allowance for electron pickup by protons because they are deduced from experimental stopping power data. This allowance is probably inadequate for alpha particles.

Table 3-6 compares experimental and calculated alpha ranges. It is evident that reduction of the two MeV and higher ranges in silicon by approximately 0.58 milligrams per square centimeter would greatly improve the comparison for that element. The revised value would not be consistent with the initial range for aluminum. For those elements where several experimental ranges are available, the calculated ranges decrease relative to experimental values as energy decreases. This behavior suggests that electron pickup is appreciable up to ten MeV. The predominance of positive differences near five MeV may imply that the initial ranges at two MeV are sometimes five to ten percent too large in the calculation.

TABLE 3-1 LISTING OF C_L CORRECTION TERMS

η_L	θ_L = .15	θ_L = .25	θ_L = .35	θ_L = .45	θ_L = .55	θ_L = .65
0.0005	0.1	-1.0	-19.2	-30.7	-38.9	-45.0
0.0007	0.1	-1.0	-18.8	-30.1	-38.4	-44.0
0.001	0.1	-1.0	-18.4	-29.1	-37.5	-42.5
0.003	0.48	-0.62	-16.1	-24.2	-32.6	-35.2
0.005	0.72	-0.36	-14.6	-20.8	-28.9	-29.2
0.007	0.9	-0.14	-13.5	-18.2	-23.6	-23.2
0.01	1.1	0.08	-12.1	-15.1	-18.0	-17.4
0.03	1.81	1.02	- 6.9	- 5.97	- 4.68	- 2.9
0.05	2.21	1.55	- 3.3	- 2.4	- 0.7	1.0
0.07	2.49	1.94	- 1.3	- 0.3	1.72	2.92
0.1	2.82	2.38	0.46	1.71	3.95	4.39
0.11	2.9	2.5	0.74	2.27	4.37	4.72
0.12	2.98	2.61	0.99	2.71	4.71	5.02
0.13	3.03	2.68	1.2	3.16	5.03	5.3
0.14	3.09	2.75	1.4	3.49	5.31	5.55
0.16	3.18	2.9	1.51	3.99	5.39	5.69
0.18	3.25	2.93	1.51	4.21	5.38	5.73
0.2	3.29	2.91	1.46	4.31	5.32	5.70
0.25	3.15	2.8	1.35	4.22	5.06	5.48
0.3	2.92	2.63	1.23	3.98	4.78	5.21
0.4	2.5	2.28	1.07	3.48	4.27	4.74
0.5	2.21	2.02	0.95	3.09	3.82	4.32
0.6	1.98	1.81	0.85	2.79	3.4	3.97
0.7	1.8	1.67	0.78	2.54	3.08	3.62
0.8	1.62	1.51	0.7	2.31	2.77	3.3
0.9	1.5	1.38	0.66	2.13	2.51	3.03
1.0	1.4	1.28	0.6	1.98	2.29	2.77
3.5	0.46	0.32	0.15	0.62	0.69	0.74
10.0	0.1	0.08	0.04	0.13	0.2	0.243
25.0	0.0099	0.0099	0.0099	0.085	0.0899	0.0947
100.0	0.0055	0.0055	0.0055	0.015	0.022	0.0232
1000.0	0.00055	0.00055	0.00055	0.002	0.0021	0.00231
10000.0	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001
100000.0	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001
10000000.0	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001

TABLE 3-2 COMPARISON OF CALCULATED PROTON STOPPING POWER WITH EXPERIMENTAL DATA

E (MeV)	Hydrogen[7]			Helium[7]			Lithium[7]			Beryllium[7]		
	EXP	LRSPC	%	EXP	LRSPC	%	EXP	LRSPC	%	EXP	LRSPC	%
0.4	1410.	1395.	-1.1	554.	545.9	-1.4	418.	418.9	0.2	390.	391.8	0.5
0.5	1180.	1180.	0.0	478.	469.0	-1.9	363.	366.6	1.0	345.	342.6	-0.7
0.6	1020.	1027.	0.7	422.	412.7	-2.2	321.	327.1	1.9	305.	305.8	0.3
0.7	910.	911.9	0.2	375.	369.7	-1.4	288.	296.1	2.8	276.	277.2	0.4
0.8	814.	821.9	1.0	341.	335.6	-1.6	262.	271.0	3.4	255.	254.5	-0.2
0.9	736.	749.4	1.8	312.	307.7	-1.4	243.	250.2	3.0	236.	235.4	-0.2
1.0	676.	689.6	2.0	290.	284.6	-1.9	230.	232.1	0.9	220.	219.3	-0.3
2.0	393.	395.0	0.5	168.	167.5	-0.3	164.	140.0	-14.6	137.	134.2	-2.0
3.0	282.	283.1	0.4	121.	121.6	0.5				101.	98.9	-2.1
4.0	222.	222.9	0.4	95.	96.5	1.6				81.	79.2	-2.2
5.0	184.	185.0	0.6	80.	80.6	0.7				67.	66.5	-0.8
6.0	158.	158.8	0.5	68.	69.4	2.1				58.	57.5	-0.9

E (MeV)	Carbon[7]			Nitrogen[7]			Oxygen[7]			Neon[7]		
	EXP	LRSPC	%	EXP	LRSPC	%	EXP	LRSPC	%	EXP	LRSPC	%
0.4	426.	410.6	-3.6	400.	388.9	-2.8	382.	366.4	-4.1	319.	319.1	0.0
0.5	368.	357.6	-2.8	345.	340.0	-1.4	336.	322.7	-4.0	285.	285.9	0.3
0.6	327.	318.0	-2.8	307.	303.4	-1.2	301.	289.3	-3.9	256.	259.0	1.2
0.7	294.	288.0	-2.0	278.	275.1	-1.0	272.	262.9	-3.3	233.	237.5	1.9
0.8	268.	263.9	-1.5	254.	252.0	-0.8	252.	241.7	-4.1	214.	219.5	2.6
0.9	246.	243.9	-0.8	235.	233.1	-0.8	233.	224.0	-3.8	198.	204.3	3.2
1.0	230.	227.3	-1.2	220.	217.5	-1.1	219.	209.0	-4.5	185.	191.4	3.5
2.0	143.	140.2	-2.0	137.	134.7	-1.6	134.	130.1	-2.9	119.	121.1	1.7
3.0	106.	104.0	-1.9	102.	100.4	-1.6	100.	97.2	-2.8	90.	90.9	1.0
4.0	85.	83.7	-1.5	82.	81.0	-1.3	80.	78.6	-1.8	73.	73.7	1.0
5.0	71.	70.5	-0.8	69.	68.3	-1.0	68.	66.4	-2.3	62.	62.5	0.7
6.0	62.	61.1	-1.4	60.	59.3	-1.1	59.	57.8	-2.1	54.	54.5	0.9

TABLE 3-2 COMPARISON OF CALCULATED PROTON STOPPING POWER WITH EXPERIMENTAL DATA
(Continued)

E (MeV)	Aluminum[2,7]			Argon[7]			Calcium[2]			Vanadium[2]		
	EXP	LRSPC	%	EXP	LRSPC	%	EXP	LRSPC	%	EXP	LRSPC	%
0.4	279.	284.0	1.8	251.	243.5	-3.0	265.	258.4	-2.5	253.	218.6	-13.6
0.5	252.	255.9	1.6	220.	214.4	-2.5	230.	229.4	-0.3	219.	196.6	-10.2
0.6	230.	233.2	1.4	200.	192.4	-3.8	215.	206.7	-3.9	196.	178.8	- 8.8
0.7	212.	214.4	1.1	184.	175.4	-4.7						
0.8	197.	198.6	0.8	171.	162.4	-5.0						
0.9	185.	185.2	0.1	160.	151.9	-5.0						
1.0	173.	173.7	0.4	150.	143.1	-4.6						
2.0	110.7	110.3	-0.4	95.	94.0	-1.0						
3.0	83.2	83.1	-0.1	72.	71.7	-0.4						
4.0	67.6	67.5	-0.1	59.	58.6	-0.7						
5.0	57.3	57.3	0.0	50.	49.9	-0.2						
6.0	50.0	50.0	0.1	44.	43.7	-0.7						

E (MeV)	Chromium[2]			Manganese[2,15]			Iron[2]			Cobalt[2]		
	EXP	LRSPC	%	EXP	LRSPC	%	EXP	LRSPC	%	EXP	LRSPC	%
0.4	248.	220.0	-11.3	218.	210.2	-3.6	228.	211.3	-7.3	201.	202.6	0.8
0.5	213.	198.4	- 6.8	196.	190.6	-2.8	195.	192.2	-1.4	176.	185.2	5.2
0.6	198.	180.9	- 8.6	177.	174.4	-1.5	181.	176.2	-2.7	171.	170.3	-0.4
0.7				162.	160.9	-0.7						
0.8				151.	149.5	-1.0						
0.9				143.	139.8	-2.3						
1.0				136.	131.3	-3.5						
2.0												
3.0												
4.0												
5.0												
6.0												

TABLE 3-2 COMPARISON OF CALCULATED PROTON STOPPING POWER WITH EXPERIMENTAL DATA
(Continued)

E (MeV)	Nickel[2,7]			Copper[2,7]			Zinc[2]			Germanium[15]		
	EXP	LRSPC	%	EXP	LRSPC	%	EXP	LRSPC	%	EXP	LRSPC	%
0.4	206.	205.9	0.0	183.	192.5	5.2	188.	188.3	0.1	177.	176.4	-0.3
0.5	182.	189.1	3.9	168.	177.4	5.6	171.	174.0	1.8	159.	162.7	2.3
0.6	165.	174.4	5.7	155.	164.1	5.9	162.	161.5	-0.3	147.	151.2	2.8
0.7	151.	161.7	7.1	144.	152.5	5.9				138.	141.2	2.3
0.8	141.	150.9	7.0	135.	142.5	5.5				130.	132.4	1.8
0.9	133.	141.5	6.4	128.	133.8	4.5				123.	124.6	1.3
1.0	128.	133.4	4.2	121.	126.2	4.3				116.	117.8	1.6
2.0	85.	86.5	1.7	80.	82.2	2.7						
3.0	66.	66.5	0.7	62.	63.0	1.6						
4.0	54.	55.0	1.8	51.	52.1	2.2						
5.0	47.	47.3	0.6	44.	44.8	1.9						
6.0	41.	41.6	1.6	39.	39.5	1.3						

E (MeV)	Selenium[15]			Krypton[7]			Silver[7]			Tin[7]		
	EXP	LRSPC	%	EXP	LRSPC	%	EXP	LRSPC	%	EXP	LRSPC	%
0.4	168.	158.5	-5.7	159.	152.0	-4.1	151.	145.4	-3.7	142.	148.7	4.7
0.5	154.	147.3	-4.4	143.	140.3	-1.9	134.	128.0	-4.4	127.	129.4	1.9
0.6	143.	137.9	-3.6	132.	131.0	-0.8	122.	115.9	-5.0	115.	116.3	1.2
0.7	134.	129.7	-3.2	123.	123.2	0.2	113.	106.5	-5.8	107.	106.3	-0.7
0.8	126.	122.4	-2.9	116.	116.5	0.4	105.	99.9	-4.8	100.	98.3	-1.7
0.9	120.	115.7	-3.6	109.	110.6	1.4	99.	94.5	-4.5	94.	92.1	-2.0
1.0	115.	109.8	-4.5	104.	105.2	1.2	94.	89.9	-4.4	89.	87.4	-1.8
2.0				72.	71.6	-0.6	64.	63.7	-0.4	61.	60.8	-0.3
3.0				56.	55.4	-1.1	51.	50.5	-1.0	48.	48.1	0.3
4.0				46.	45.8	-0.4	42.	42.3	0.7	40.	40.2	0.6
5.0				40.	39.5	-1.2	37.	36.6	-1.0	35.	34.8	-0.4
6.0				35.	35.0	-0.0	32.	32.5	1.5	31.	30.9	-0.3

TABLE 3-2 COMPARISON OF CALCULATED PROTON STOPPING POWER WITH EXPERIMENTAL DATA
(Continued)

E (MeV)	Antimony[15]			Xenon[7]			Tatalum[2]			Gold[2,7]		
	EXP	LRSPC	%	EXP	LRSPC	%	EXP	LRSPC	%	EXP	LRSPC	%
0.4	146.	139.9	-4.2	143.	133.2	-6.6	99.2	111.2	12.1	98.	98.6	0.6
0.5	132.	123.2	-6.7	127.	117.9	-7.2	88.9	101.9	14.6	88.	90.9	3.3
0.6	119.	111.0	-6.8	115.	106.7	-7.2	81.9	93.7	14.4	81.	85.1	5.1
0.7	108.	101.9	-5.7	106.	97.9	-7.6				75.	80.0	6.7
0.8	101.	94.6	-6.3	98.	91.1	-7.0				70.	76.0	8.6
0.9	96.	88.6	-7.7	92.	85.5	-7.1				66.	71.9	8.9
1.0	91.	84.0	-7.7	87.	80.7	-7.2				63.	68.3	8.5
2.0				59.	56.3	-4.6				44.	47.6	8.2
3.0				47.	45.1	-4.0				36.4	38.1	4.7
4.0				39.	37.9	-2.7				31.6	32.3	2.3
5.0				34.	32.9	-3.1				27.7	28.3	2.1
6.0				30.	29.2	-2.6				24.8	25.3	2.0

E (MeV)	Lead[2,7]			Bismuth[15]								
	EXP	LRSPC	%	EXP	LRSPC	%						
0.4	100.	94.6	-5.4	104.	94.2	-9.4						
0.5	90.	86.5	-3.9	94.	86.0	-8.5						
0.6	83.	80.1	-3.5	86.	79.6	-7.4						
0.7	77.	75.1	-2.5	79.	74.5	-5.7						
0.8	71.	71.5	0.7	73.	71.0	-2.7						
0.9	67.	67.6	0.9	69.	67.0	-2.8						
1.0	63.	64.4	2.2	66.	63.8	-3.3						
2.0	44.5	45.9	3.2									
3.0	36.5	36.8	0.9									
4.0	31.8	31.2	-1.9									
5.0	27.9	27.5	-1.4									
6.0	25.0	24.6	-1.6									

TABLE 3-2 COMPARISON OF CALCULATED PROTON STOPPING POWER WITH EXPERIMENTAL DATA
(Continued)

E (MeV)	Aluminum[21]			Nickel[21]			Silver[21]			Gold[21]		
	EXP	LRSPC	%	EXP	LRSPC	%	EXP	LRSPC	%	EXP	LRSPC	%
1.0	172.4	173.7	0.8	126.8	133.4	5.2	93.7	89.9	-4.1			
1.5	133.3	134.0	0.5	100.8	104.2	3.4	74.8	74.0	-1.1			
2.0	109.9	110.3	0.4	84.6	86.5	2.2	64.0	63.7	-0.4	44.0	47.6	8.3
2.5	94.2	94.6	0.4	73.5	74.8	1.8	56.4	56.2	-0.3	40.0	42.3	5.6
3.0	82.8	83.1	0.4	65.4	66.5	1.7	50.7	50.5	-0.4	36.5	38.1	4.4
3.5	74.2	74.4	0.3	59.3	60.1	1.3	46.4	46.0	-0.9	34.0	35.0	2.9
4.0	67.4	67.5	0.2	54.4	55.0	1.1	42.9	42.3	-1.4	32.0	32.3	0.9
4.5	62.0	62.0	-0.1	50.5	50.8	0.6	40.0	39.2	-2.0	29.5	30.1	2.0
5.0	57.4	57.3	-0.1	47.4	47.3	-0.2	37.5	36.6	-2.4			

Units are MeV - cm^2 - gm^{-1}

$$\% = \frac{\text{LRSPC} - \text{EXP}}{\text{EXP}} \times 100$$

References	Probable Error
7	1 - 10%
2	3%
15	2 1/2 - 5%
21	3%

TABLE 3-3 COMPARISON OF EXPERIMENTAL AND CALCULATED PROTON MASS STOPPING POWER RELATIVE TO ALUMINUM

Element	E = 19.8 MeV			E = 20.6 MeV			E = 28.7 MeV		
	Experiment[11]	LRSPC	%	Experiment[27]	LRSPC	%	Experiment[19]	LRSPC	%
Be	1.073 ±.005	1.093	1.9				1.0890 ±.0029	1.0809	-0.7
Ca	1.008 ±.020	.965	-4.3						
Ti	.888 ±.006	.873	-1.7				.8969 ±.0022	.8797	-1.9
V	.860 ±.002	.850	-1.2				.8605 ±.0022	.8579	-0.3
Fe	.856 ±.002	.858	0.2						
Co							.8501 ±.0021	.8466	-0.4
Ni	.863 ±.002	.867	0.5	.859 ±.004	.868	1.0	.8691 ±.0022	.8761	0.8
Cu	.821 ±.002	.824	0.4	.836 ±.006	.825	-1.3	.8233 ±.0020	.8330	1.2
Zn	.819 ±.002	.823	0.5						
Ag	.715 ±.003	.709	-0.8	.717 ±.006	.711	-0.8	.7164 ±.0021	.7231	0.9
Sn	.680 ±.002	.676	-0.6						
Ta	.597 ±.005	.589	-1.3	.607 ±.006	.591	-2.6	.5981 ±.0036	.6067	1.4
W	.590 ±.002	.585	-0.8				.5866 ±.0017	.6035	2.9
Pt	.576 ±.002	.574	-0.3	.590 ±.012	.576	-2.4			
Au	.576 ±.003	.572	-0.7	.588 ±.006	.575	-2.2	.5838 ±.0020	.5916	1.3
Pb	.556 ±.003	.560	0.7						

$$\% = \frac{EXP - LRSPC}{EXP} \times 100$$

References	Probable Error
11	0.3 - 2%
27	0.5 - 2%
19	0.2 - 1 %

TABLE 3-4 COMPARISON OF CALCULATED PROTON RANGE WITH EXPERIMENTAL DATA

E (MeV)	Hydrogen[26]			Beryllium[26]			Aluminum[26]			Iron[26]		
	EXP	LRSPC	%	EXP	LRSPC	%	EXP	LRSPC	%	EXP	LRSPC	%
1.0	0.837	0.863	3.1	2.907	2.804	-3.5	3.881	3.759	-3.1	5.800	5.061	-12.7
2.0	2.863	2.863	0.0	8.833	8.833	0.0	11.21	11.21	0.0	14.70	14.70	0.0
3.0	5.947	5.900	-0.8	17.53	17.627	0.6	21.71	21.77	-0.3	28.51	28.11	-1.4
4.0	10.01	9.913	-1.0	28.82	29.00	0.6	34.87	35.20	1.0	45.00	44.80	-0.4
5.0	15.02	14.86	-1.1	42.59	42.84	0.6	51.05	51.34	0.6	63.99	64.57	0.9
6.0	20.94	20.71	-1.1	57.91	59.07	2.0	70.00	70.06	0.1	87.00	87.30	0.3
7.0	27.75	27.45	-1.1	76.14	77.61	1.9	91.50	91.28	0.2	112.0	112.9	0.8
8.0	35.44	35.05	-1.1	96.62	98.41	1.8	115.0	114.9	0.1	142.0	141.3	-0.5
9.0	43.73	43.50	-0.5	119.7	121.4	1.4	141.1	141.0	0.1	173.1	172.3	-0.4

E (MeV)	Copper[26]			Tin[26]			Lead[26]					
	EXP	LRSPC	%	EXP	LRSPC	%	EXP	LRSPC	%			
1.0	6.119	5.618	-8.2	9.000	6.934	-23.0	12.00	12.26	2.2			
2.0	15.70	15.70	0.0	21.00	21.00	0.0	31.01	31.01	0.0			
3.0	30.30	29.76	-1.8	39.00	39.64	1.6	56.50	55.77	-1.3			
4.0	48.00	47.32	-1.4	62.01	62.47	0.7	87.00	85.45	-1.8			
5.0	70.00	68.07	-2.8	89.00	89.26	0.3	122.0	120.3	-1.4			
6.0	95.00	91.89	-3.3	120.0	119.8	-0.2	160.0	158.9	-0.7			
7.0	122.0	118.7	-2.7	155.0	153.9	-0.7	202.0	201.6	-0.2			
8.0	152.0	148.3	-2.4	193.0	191.6	-0.8	248.0	248.3	0.1			
9.0	184.6	180.8	-2.0	236.3	232.4	-1.6	299.2	298.9	-0.1			

Units are mgm - cm^{-2}

$$\% = \frac{LRSPC - EXP}{EXP} \times 100$$

TABLE 3-4 COMPARISON OF CALCULATED PROTON RANGE WITH EXPERIMENTAL DATA
(Continued)

E (MeV)	Ilford G5 Emulsion[5]			%
	EXPERIMENT		LRSPC	
1.295	.007897	±.000076	.0073115	-7.41
2.421	.02056	±.00023	.020373	-0.91
2.45	.02124	±.00013	.020772	-2.20
5.000	.06680	±.00076	.067199	+0.60
5.477	.07805	±.00024	.078214	+0.21
5.477	.07840	±.00042	.078214	-0.24
10.00	.2147	±.00099	.21552	+0.38
13.96	.3770	±.0028	.38104	+1.07
21.21	.7844	±.0019	.78468	+0.04
36.55	2.039	±.0084	2.0274	-0.57
200.	39.33	±.027	38.807	-1.33
340.	94.38	±.038	93.215	-1.23
540.	195.1	±.17	192.48	-1.34
700.	286.0	±.14	283.36	-0.92

Units are gm - cm^{-2}

$$\% = \frac{LRSPC - EXP}{EXP} \times 100$$

E (MeV)*	Copper[4]		
	EXP	LRSPC	%
751.07	314.91	313.81	-0.35

E (MeV)*	Lead[4]		
	EXP	LRSPC	%
751.07	415.62	415.964	+0.08

E (MeV)*	Uranium[4]		
	EXP	LRSPC	%
751.07	432.50	435.407	+0.67

* Aluminum standard determines energy

TABLE 3-5 COMPARISON OF CALCULATED ALPHA PARTICLE STOPPING POWER WITH EXPERIMENTAL DATA

E (MeV)	Lithium[25]			Aluminum[25]			Iron[25]			Nickel[25]		
	EXP	LRSPC	%	EXP	LRSPC	%	EXP	LRSPC	%	EXP	LRSPC	%
3.0	1050.	1126.9	+ 7.3	730.2	821.6	+ 12.5	576.1	625.5	+ 8.6	554.1	622.3	+ 12.3
4.0	920.2	924.0	+ 0.4	649.8	692.1	+ 6.5	507.0	530.9	+ 4.7	486.4	531.5	+ 9.3
5.0	834.3	788.2	- 5.5	587.3	600.9	+ 2.3	457.4	462.7	+ 1.2	440.2	465.6	+ 5.8
6.0	763.1	690.1	- 9.6	535.9	533.4	- 0.5	418.6	411.9	- 1.6	402.3	415.1	+ 3.2
7.0	709.3	615.7	-13.2	500.2	481.0	- 3.8	389.4	372.7	- 4.3	373.5	375.8	+ 0.6
8.0	662.4	557.2	-15.9	466.7	439.2	- 5.9	363.5	342.1	- 5.9	348.9	344.4	- 1.3
9.0	624.2	509.2	-18.4	439.9	405.1	- 7.9				328.4	319.0	- 2.9
10.0	592.1	469.5	-20.7							313.0	298.0	- 4.8

E (MeV)	Copper[25]			Zinc[25]			Silver[25]			Tin[25]		
	EXP	LRSPC	%	EXP	LRSPC	%	EXP	LRSPC	%	EXP	LRSPC	%
3.0	533.8	587.3	+ 10.0	526.2	580.3	+ 10.3	413.8	410.9	-0.7	398.9	406.8	+ 2.0
4.0	469.4	502.8	+ 7.1	463.5	498.3	+ 7.5	364.1	358.6	-1.5	351.2	348.4	- 0.8
5.0	423.8	441.5	+ 4.2	418.4	438.4	+ 4.8	328.9	322.4	-2.0	317.2	310.1	- 2.2
6.0	387.8	394.3	+ 1.7	383.3	392.3	+ 2.3	301.0	295.1	-2.0	290.3	282.0	- 2.9
7.0	360.3	357.3	- 0.8	356.6	355.6	- 0.3	279.8	272.9	-2.5	269.5	260.5	- 3.3
8.0	335.7	327.2	- 2.5	332.7	326.2	- 2.0	260.8	254.1	-2.6	251.8	242.4	- 3.7
9.0	316.7	302.9	- 4.4	313.3	301.7	- 3.7	246.3	238.0	-3.4	237.0	227.0	- 4.2
10.0	301.5	282.7	- 6.2	297.6	281.5	- 5.4	234.0	224.0	-4.3	224.9	213.6	- 5.0

TABLE 3-5 COMPARISON OF CALCULATED ALPHA PARTICLE STOPPING POWER WITH EXPERIMENTAL DATA
(Continued)

E (MeV)	Platinum[25]			Gold[25]			Lead[25]		
	EXP	LRSPC	%	EXP	LRSPC	%	EXP	LRSPC	%
3.0	294.3	317.9	+8.0	297.0	310.3	+4.5	296.6	294.3	-0.8
4.0	258.5	277.1	+7.2	261.5	272.6	+4.2	259.9	256.7	-1.2
5.0	233.2	247.5	+6.1	235.8	244.3	+3.6	234.6	231.7	-1.2
6.0	213.7	224.7	+5.1	215.9	222.4	+3.0	214.6	212.4	-1.0
7.0	198.6	207.2	+4.3	200.6	204.7	+2.0	199.5	196.3	-1.6
8.0	185.6	192.2	+3.6	187.2	190.2	+1.6	186.4	183.0	-1.8
9.0	174.8	180.4	+3.2	176.5	178.8	+1.3	175.6	171.7	-2.2
10.0	166.1	170.4	+2.6	167.6	168.4	+0.5	166.9	162.1	-2.9

E (MeV)	Aluminum[14]			Silicon[14]			Copper[14]			Germanium		
	EXP	LRSPC	%	EXP	LRSPC	%	EXP	LRSPC	%	EXP	LRSPC	%
1	1340	1367.6	2.1	1240	1453.0	17.2	692	867.8	25.4	747	807.9	8.2
2	1050	1020.5	-2.8	1050	1051.0	0.1	692	707.9	2.3	647	649.5	0.4
3	782	821.6	5.1	826	845.0	2.3	569	587.3	3.2	523	544.9	4.2
4	592	692.1	6.9	686	710.4	3.6	484	502.8	3.9	440	469.6	6.7

E (MeV)	Silver[14]			Gold[14]		
	EXP	LRSPC	%	EXP	LRSPC	%
1	642	760.0	18.4	379	469.4	23.6
2	553	510.5	-7.7	370	363.0	-1.9
3	436	410.9	-5.9	300	310.3	3.4
4	357	358.6	0.4	251	272.6	8.6

References	Probable Error
Reference 25	8%
Reference 14	10%

Units are MeV - cm^2 - gm^{-1}

$$\% = \frac{LRSPC - EXP}{EXP} \times 100$$

TABLE 3-6 COMPARISON OF CALCULATED ALPHA PARTICLE RANGE WITH EXPERIMENTAL DATA

E	Hydrogen[9]			Helium[9]			Lithium[25]			Nitrogen[9]		
(MeV)	EXP	LRSPC	%	EXP	LRSPC	%	EXP	LRSPC	%	EXP	LRSPC	%
5.298	1.547	1.5293	-1.1	3.801	3.6909	-2.9				4.839	5.0139	3.6
6.054	1.951	1.8936	-2.9	4.687	4.5032	-3.9				5.952	6.1213	2.8
7.680	2.926	2.8074	-4.1	6.898	6.5317	-5.3	8.5	8.3097	-2.2	8.703	8.8406	1.6
8.776	3.672	3.5209	-4.1	8.656	8.1095	-6.3				10.83	10.925	0.9
E	Oxygen[9]			Neon[9]			Aluminum[25]			Argon[9]		
(MeV)	EXP	LRSPC	%	EXP	LRSPC	%	EXP	LRSPC	%	EXP	LRSPC	%
5.298	5.187	5.4064	4.2	6.065	6.1961	2.2				7.402	7.7631	4.7
6.054	6.402	6.5555	2.4	7.379	7.4384	0.8				8.954	9.3904	4.9
7.680	9.345	9.3756	0.3	10.60	10.475	-1.2	11.8	11.834	0.3	12.93	13.327	3.1
8.776	11.56	11.5338	-0.2	13.04	12.793	-1.9				16.00	16.306	1.9
E	Nickel[25]			Copper[25]			Krypton[9,6]			Silver[25]		
(MeV)	EXP	LRSPC	%	EXP	LRSPC	%	EXP	LRSPC	%	EXP	LRSPC	%
5.298							11.34	11.162				
6.054												
7.680	15.8	15.344	-2.9	16.3	16.195	-0.6	19.35	18.525	-4.3	21.1	20.990	-0.5
8.776												
E	Xenon[9,6]			Gold[25]			Lead[25]			Water[23]		
(MeV)	EXP	LRSPC	%	EXP	LRSPC	%	EXP	LRSPC	%	EXP	LRSPC	%
5.298	12.79	14.166	10.8									
6.054												
7.680	22.46	23.689	5.5	29.4	29.088	-1.1	29.6	30.355	2.6	7.18	7.6113	6.0
8.776												
E	Carbon Dioxide[9]			Air[9]								
(MeV)	EXP	LRSPC	%	EXP	LRSPC	%						
5.298	5.100	5.1422	0.8	4.874	5.1062	4.8						
6.054				6.128	6.2254	1.6						
7.680				8.934	8.9732	0.4						
8.776				11.08	11.078	0.0						
E	Silicon[14]			Germanium[14]								
(MeV)	EXP	LRSPC	%	EXP	LRSPC	%						
2	1.925	2.531	31.5	3.561	3.623	1.7						
3	3.053	3.599	17.9	5.467	5.310	-2.9						
4	4.344	4.895	12.7	7.606	7.293	-4.1						
5	5.802	6.411	10.5	9.936	9.567	-3.7						

$$\% = \frac{\text{LRSPC} - \text{EXP}}{\text{EXP}} \times 100$$

Units are mgm - cm^{-2}

References	Probable Error
14	10%

4.0 LOCKHEED RANGE & STOPPING POWER CALCULATOR - DATA PREPARATION

4.1 GLOSSARY OF INPUT DATA TERMS

IN	name of tape unit on which library tape is mounted
NTB	name of tape unit on which working tape is mounted
BIN	physical storage location of library tape
BIN1	physical storage location of working tape
NS	number of subshells per element
HNU	observed binding energy of the atomic electrons in each subshell in units of MeV
EJ	principal quantum number of the outer shell electrons for the j^{th} element
II	number of electrons in the i^{th} subshell of the j^{th} element
NBK	number of enteries in the K-shell electron stopping number table per θ_K.
EBK	energy dependent variable, η_K
BK	stopping number of K-shell electrons for $\eta_K \leq 10$. BK(1) - value of stopping number when θ_K is 0.7; BK(2) - value of stopping number when θ_K is 0.8; BK(3) - value of stopping number when θ_K is 0.9. Where θ_K is the energy difference between a K electron in the ground state and the lowest unoccupied state in units of $Z^2_{Keff} R_H$; R_H is the ionization potential of hydrogen.
NCL	number of entries in the L-shell correction term table per θ_L
ECL	energy dependent variable, η_L
CL	L-shell correction term as a function of $\eta_L(I)$ CL(1, I) - value of C_L correction term when $\theta_L = 0.15$ CL(2, I) - value of C_L correction term when $\theta_L = 0.25$

CL	(continued)
	CL(3, I) - value of C_L correction term when $\theta_L = 0.35$
	CL(4, I) - value of C_L correction term when $\theta_L = 0.45$
	CL(5, I) - value of C_L correction term when $\theta_L = 0.55$
	CL(6, I) - value of C_L correction term when $\theta_L = 0.65$
NZZ	number of elements in the Hönl weighting function table for L-shell electrons
ZZ	atomic number of the elements in the Hönl weighting function table for L-shell electrons
OZ1	Hönl weighting function to correct for relativistic effects in the 2s electron energy states
OZ2	Hönl weighting function to correct for relativistic effects in the 2p electron energy states
NTPR	number of elements in the initializing 2 MeV range table
ZR	atomic numbers of the elements in the initializing 2 MeV range table
TPOR	values of range for charged particles at 2 MeV in the elements, ZR
NFIZ	number of elements in the table of ionization potentials
FIZ	atomic numbers of elements in the table of ionization potential
FIZP	values of the experimentally determined ionization potential in units of eV
NEB	number of fine mesh energy points
EMIN	minimum energy of mesh
EBR	major energy break points in fine mesh
DE	step size of fine mesh between major energy break points
HD	heading information to identify each case (i.e. name of element or material)
KMAX	number of elements present in material $1 \leq$ KMAX ≤ 10
I 2	physical state of material; if
	I 2 = 1 material is a metal
	I 2 = 2 material is a condensed non conductor

I 2 (continued)

I 2 = 3 material is a gas

I1K state of element when I/Z measurement was performed; if

I1K = 1 element was a metal

I1K = 2 element was a condensed non conductor

I1K = 3 element was a gas

Z atomic number of the element

AW atomic weight of the element

FIP ionization potential of element in units of eV. If FIP is zero, the code will interpolate in the FIZP table

RHO density of element, or partial density in the case of a material, in units of gm/cm^3

ACK energy scaling, factor for electron shells above L-shell

BCK magnitude scaling factor for

BCK = 1 K shell electrons

BCK = 2 L shell electrons

BCK = 3 M shell electrons

BCK = 4 N shell electrons

BCK = 5 O shell electrons

BCK = 6 P shell electrons

BCK = 7 Q shell electrons

4.2 INPUT DATA PREPARATION

NOTE: The following cards follow the asterisk data card which is directly behind the binary program cards.

CARD TYPE 1 Columns 1-5 contain the name of tape unit (IN) on which library tape is mounted. Columns 6-10 contain the name of tape unit (NTB) on which working tape is mounted. Columns 11-16

contain the physical storage location (BIN) of the library tape. Columns 17-22 contain the physical storage location (BIN1) of the working tape.
FORMAT (2I5, 2A6)

CARD TYPE 2 Columns 1-5 contain the number of fine energy mesh points (NEB). Columns 6-15 contain the minimum energy of mesh (EMIN).

CARD TYPE 2A Continuation card - contains eight fields of nine columns per field. Columns 1-9, 19-27, 37-45, and 55-63 contain the major energy break point (EBR) while columns 10-18, 28-36, 46-54, and 64-72 contain the step size of the fine mesh between major energy break points (DE).
FORMAT (I5, E10./(8E9.))

NOTE: The total number of EBR and DE entries on card type 2A must equal the number in columns 1-5 of card type 2.

CARD TYPE 3 Columns 1-72 contain alphameric information to identify the case (HD) such as element or material name.
FORMAT (12A6)

CARD TYPE 4 Three fields of five columns per field followed by four fields of ten columns per field. Columns 1-5 contain the number of elements present in a material (KMAX), columns 6-10 contain the physical state of element or material (I2), and columns 11-15, the state of the element at the time its ionization potential was measured (I1k). Columns 16-25 contain the atomic number of the element (Z), columns 26-35 contain the atomic weight of the element (AW), columns 36-45 contain the

CARD TYPE 4 (continued)

ionization potential of the element (FIP), and columns 46-55 contain the density or partial density of the element (RHO).

CARD TYPE 4A Continuation card for card type 4. Columns 1-10 are left intentionally blank and columns 11-15 contain the state of the element at the time its ionization potential was measured (IIk). Columns 16-25 contain the atomic number of the element(Z), columns 26-35 contain the atomic weight of the element (AW), columns 36-45 contain the ionization potential of the element (FIP) and columns 46-55 contain the density or partial density of the element (RHO).

CARD TYPE 5 Continuation card for both card type 4 and card type 4A. Eight fields of eight columns per field. Columns 1-8 contains the energy scaling factor for higher than L-shell electrons (ACK), columns 9-16, 17-24, 25-32, 33-40, 41-48, 49-56, and 57-64 contain the magnitude scaling factors for the electron shells (BCK)

FORMAT (3I5, 4E10./8E8)

NOTE: Case input data cards are read in order of one card type 4 followed immediately by a card type 5 and then by zero to nine cards type 4A with a card type 5 for each card type 4A until the number of card type 4 and card type 4A is equal to the number of elements composing the material, KMAX, columns 1-5 on card type 4.

NOTE: The ionization potential, FIP, in cards type 4 and 4A may be left blank. In this circumstance, a value for FIP will be determined by interpolation in the FIZP table of the library tape.

4.3 OUTPUT FORMAT

The typical printed output from the Lockheed Range & Stopping Power Calculator consists of two sections, the heading and the calculated values.

The heading consists of an identification of the element or material being evaluated. A listing of the atomic number, atomic weight, excitation potential divided by the atomic number, the density or partial density, the total ionization potential, and the total density of the element or elements forms one of two subheadings. The second subheading consists of the atomic number, the energy scaling factor for higher shell electrons, and seven magnitude scaling factors for the shell electrons of the element or elements being evaluated.

The main body of the printed output consists of the calculated values as a function of energy of the particle and is listed in nine columns. The first column lists the kinetic energy of the incident charged particle. The second column lists the energy dependent variable η_L. The third column lists the shell correction due to the K-shell electrons. The fourth column lists the shell correction due to L-shell electrons. The fifth column lists the shell correction due to the electron shells higher than the L-shell. The sixth column lists (BRAK) from equation 2-3. The seventh column lists the density effect correction terms. The eighth column lists the stopping power and the ninth column lists the range. The stopping power values have units of MeV - cm^2 - gm^{-1} and the range values have units of gms - cm^{-2}.

5.0 RANGE FUNCTION

It is sometimes convenient to treat charged particle range as an analytic function. The function given by Equation 5-1 is often used and is generally accurate to $\pm$ 5 percent in the energy range 10 to 250 MeV for protons in low-Z materials if the value of a and r are properly chosen.

$$R(E) = a E^{-r} \tag{5-1}$$

Burrell[12] has suggested an alternate function, Equation 5-2, which is equally good from 10 to 1200 MeV.

$$R(E) = \frac{a}{2b} \ln (1 + 2b E^{r}) \tag{5-2}$$

The values of a and b are dependent on material; the value of r is slightly material dependent. The expression for stopping power in terms of these parameters is:

$$S(E) = \frac{E}{a \cdot r} (E^{-r} + 2b).$$

A parametric search was conducted on the range data to find suitable values of a and b for several values of r. Those values of a and b which minimized the maximum relative difference between Equation 5-2 and the LRSPC results from 10 to 1200 MeV were chosen. Typical error curves for proton range data are shown in Figure 5-1. Typical error curves for alpha range data are shown in Figure 5-2. Relative errors in the alpha data are about twice those in the proton data, reflecting the more rapidly changing shape of the alpha range data at low energies. The same parameter values give fairly good results for stopping power. Figures 5-3 and 5-4 show relative differences between Equation 5-2 and LRSPC results for typical proton and alpha stopping power data.

Tabulations of the best values of a and b for several choices of r are shown in the Appendix . The maximum error is also given. These tables include data for 55 materials for both protons and alphas. The best value of r for one or more materials may be chosen by examining the error columns. Figures 5-5 and 5-6 show the general trends of the error band magnitude for proton and alpha range data.

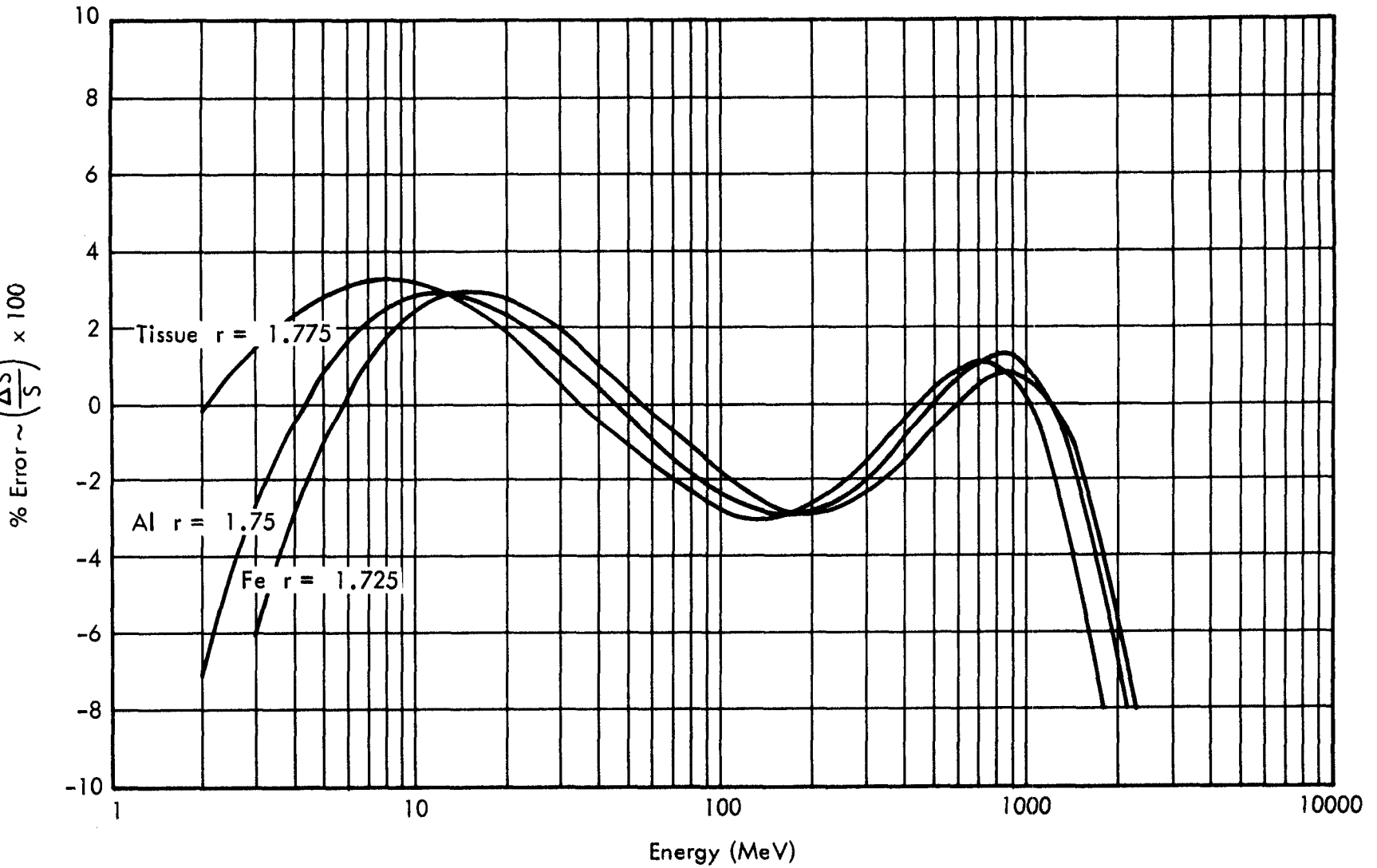

FIGURE 5-1 PROTON RANGE ERROR CURVE $\Delta R = \frac{a}{2b} \ln (1 + 2bE^r) - R$

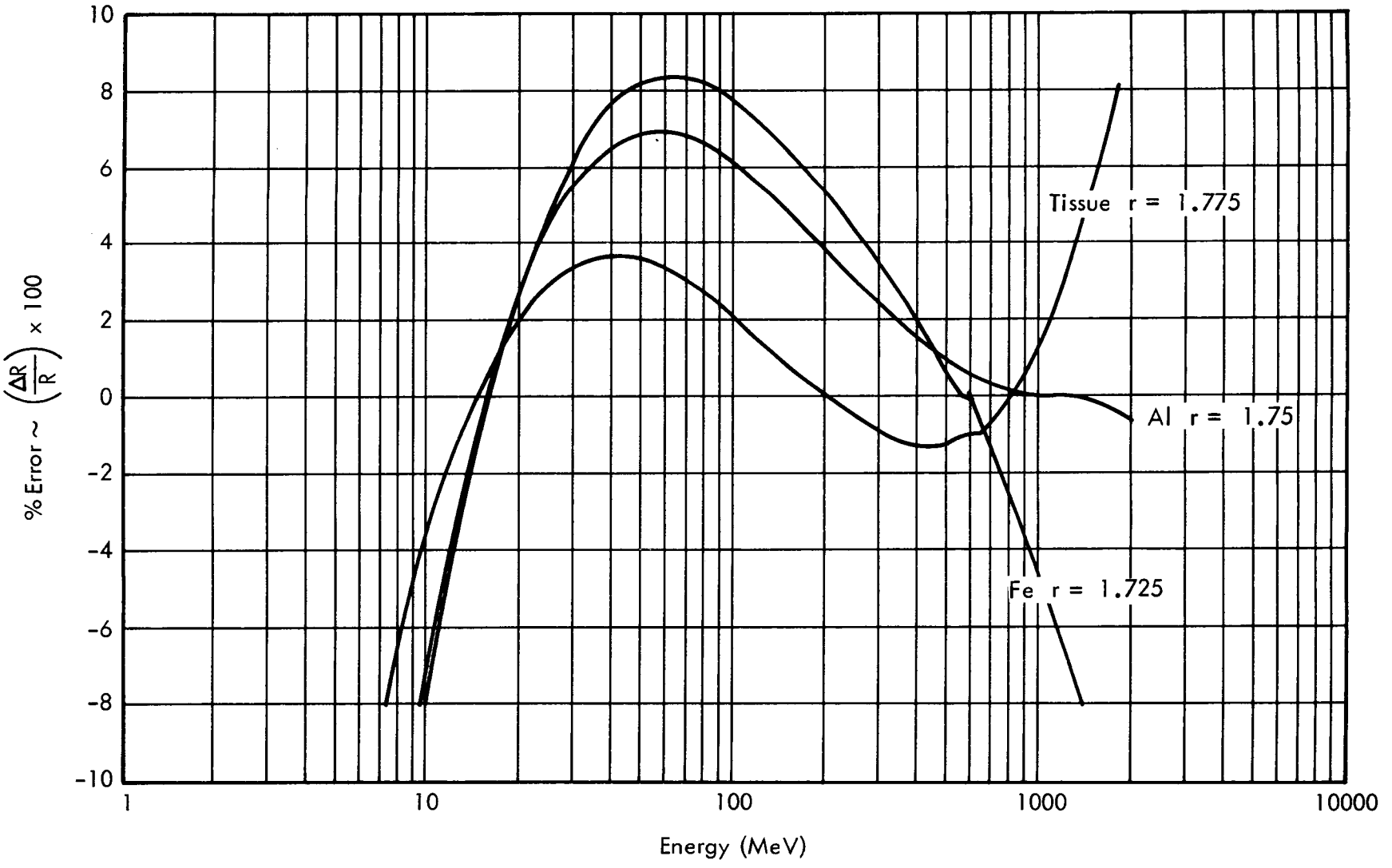

FIGURE 5-2 ALPHA RANGE ERROR CURVE $\Delta R = \frac{a}{2b} \ln (1 + 2bE^r) - R$

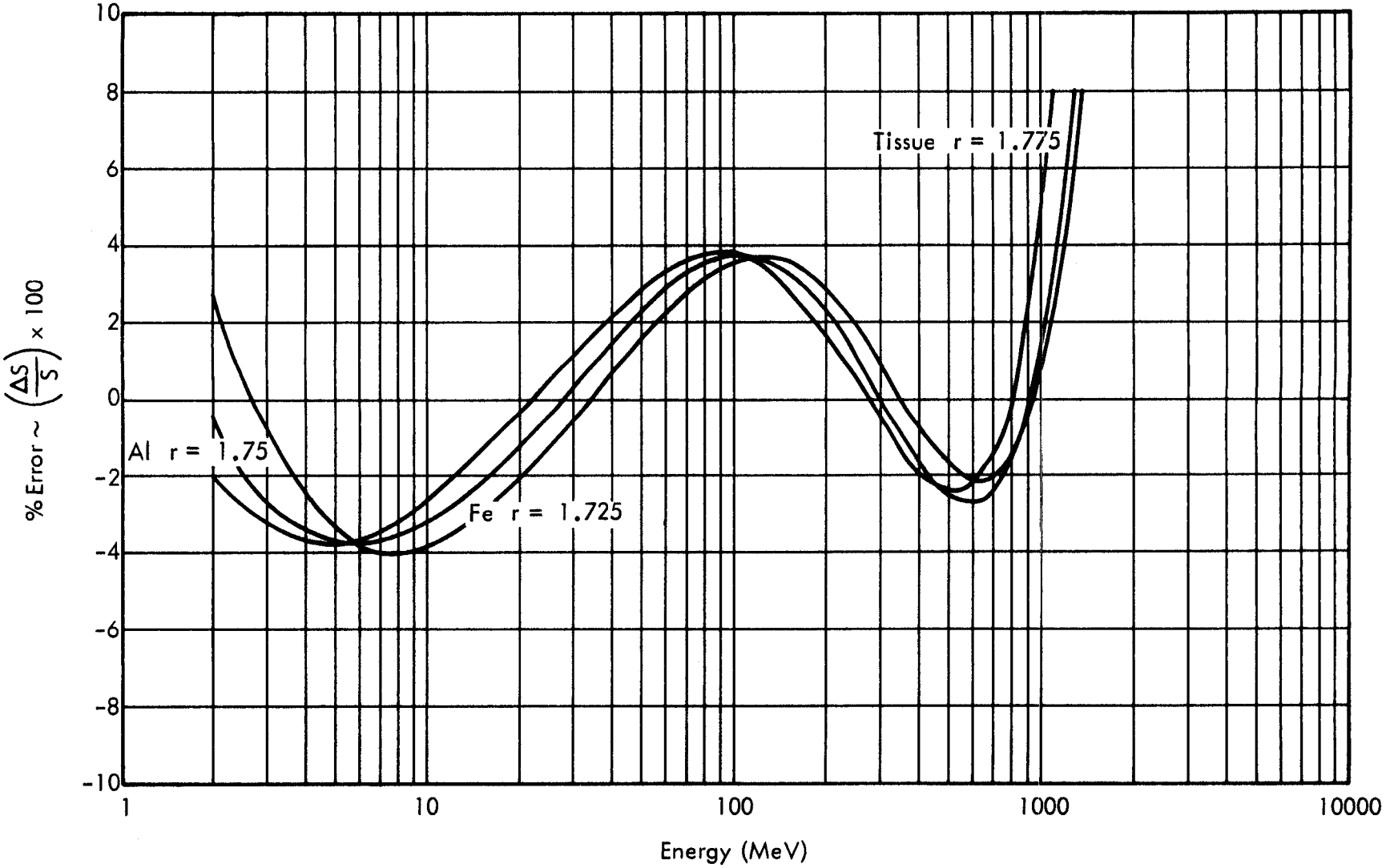

FIGURE 5-3 PROTON STOPPING POWER ERROR CURVE $\Delta S = \frac{E^{1-r} + 2bE}{ar} - S$

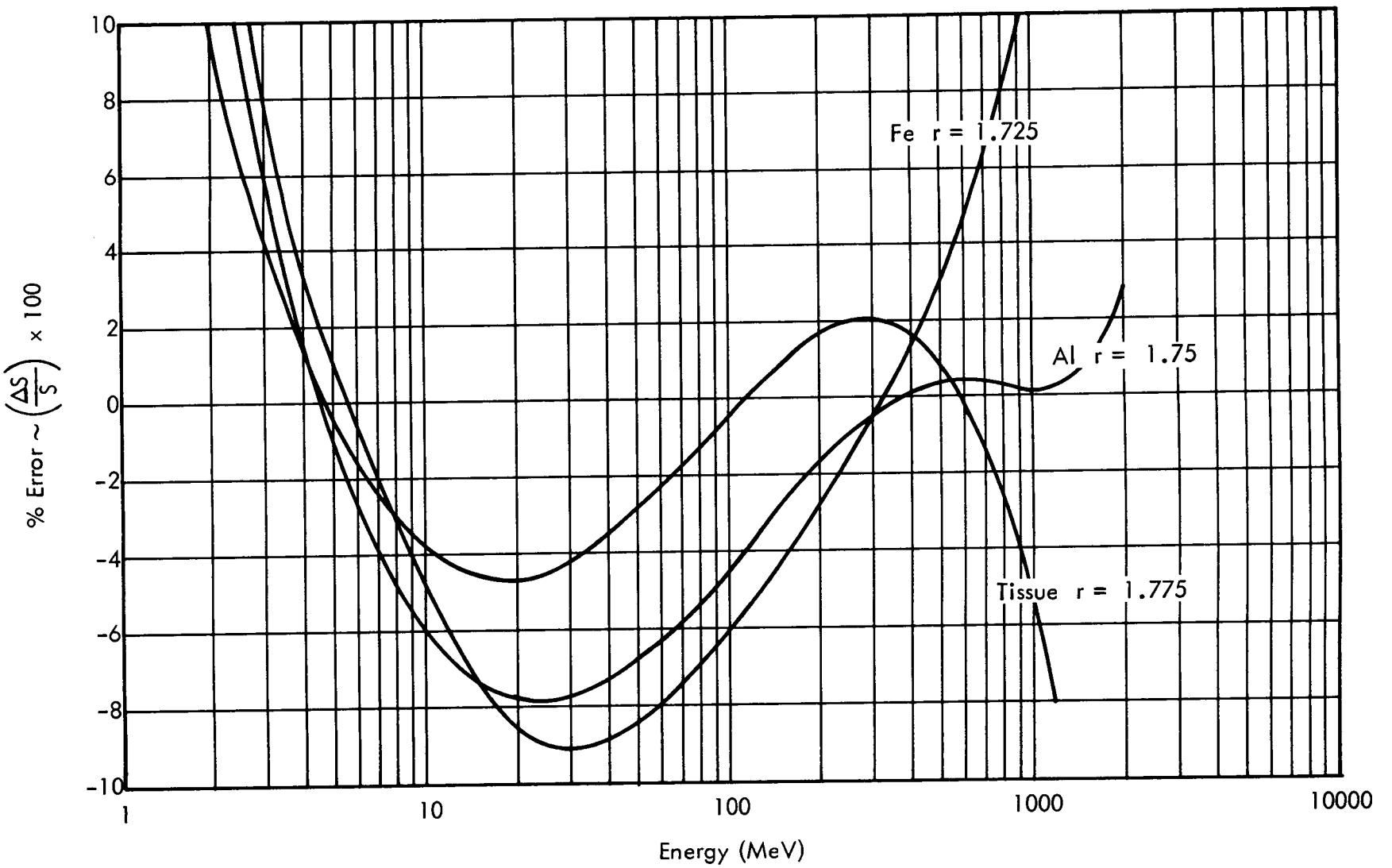

FIGURE 5-4 ALPHA STOPPING POWER ERROR CURVE $\Delta S = \frac{E^{1-r} + 2bE}{ar} - S$

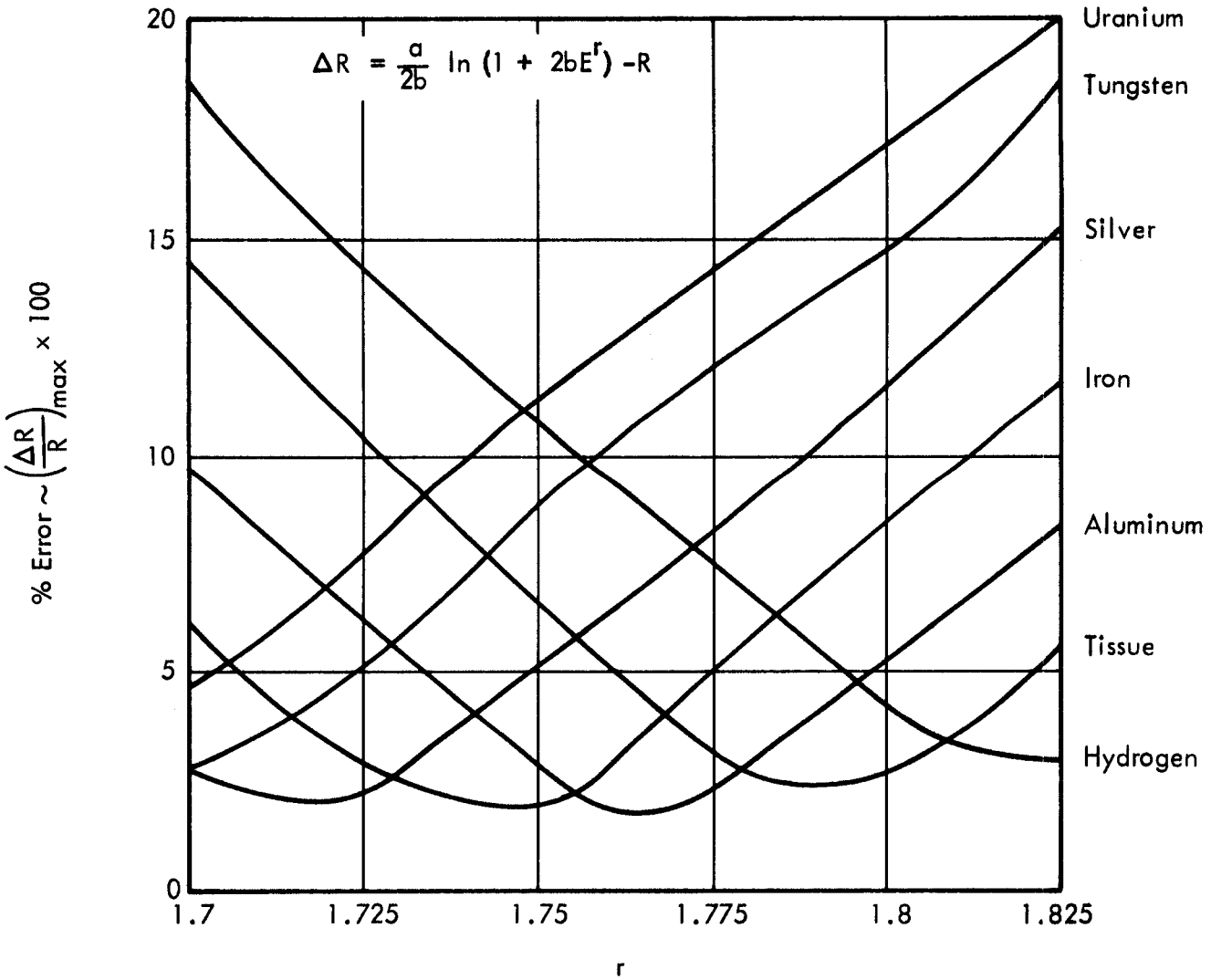

FIGURE 5-5 MAXIMUM ERROR IN PROTON RANGE FUNCTION VERSUS r

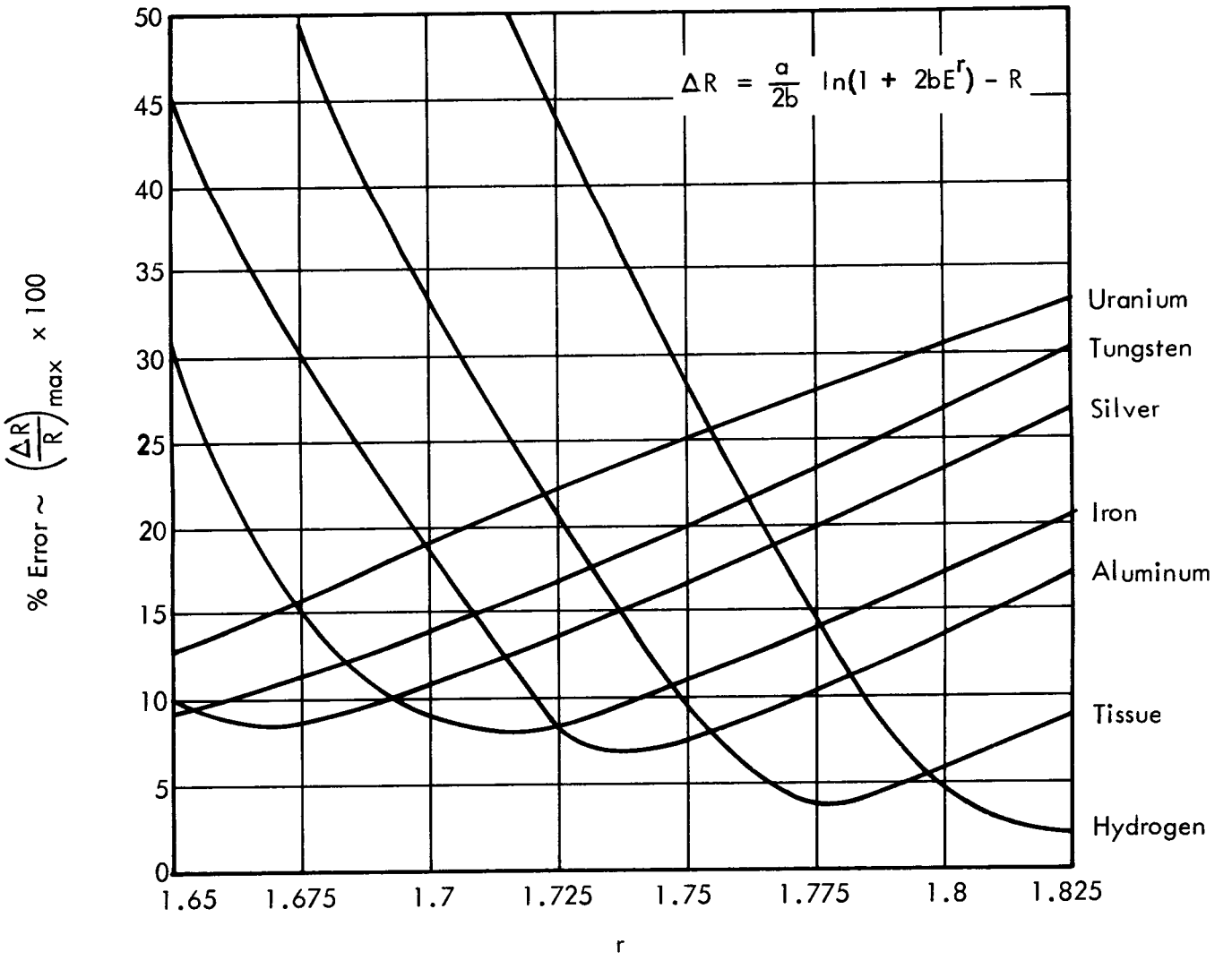

FIGURE 5-6 MAXIMUM ERROR IN ALPHA RANGE FUNCTION VERSUS r

APPENDIX A

PROTON AND ALPHA
PARTICLE RANGE AND STOPPING POWER DATA

TABLE A0 DATA FOR STOPPING MATERIALS

Material or Element	KMAX	I2	IIK	Z	AW	FIP	RHO	θ_K	θ_L
Hydrogen	1	3	3	1	1.008	17.6	.000089888*	2.0393	0.0
Helium	1	3	3	2	4.003	21.0	.000178467*	1.0044	0.0
Lithium	1	1	1	3	6.94	15.333	.534	0.55143	0.0
Beryllium	1	1	1	4	9.0122	15.0	1.83	0.60116	0.0
Boron	1	1	1	5	10.82	13.4	2.535	0.62194	0.0
Carbon	1	2	2	6	12.011	13.167	2.25	0.64207	0.15000
Nitrogen	1	3	3	7	14.008	13.0	.00125036*	0.65437	0.16750
Oxygen	1	3	3	8	16.0	12.875	.00142896*	0.65874	0.18500
Neon	1	3	3	10	20.183	12.7	.0008999*	0.68152	0.22000
Magnesium	1	1	1	12	24.312	12.583	1.71	0.69782	0.26133
Aluminum	1	1	1	13	26.9815	12.538	2.692	0.70832	0.28200
Silicon	1	2	2	14	28.086	12.406	2.32	0.71730	0.33059
Argon	1	3	3	18	39.944	11.6667	.00178364*	0.74660	0.39798
Calcium	1	1	1	20	40.08	11.424	1.54	0.75962	0.42437
Titanium	1	1	1	22	47.9	11.2455	4.58	0.76890	0.43783
Vanadium	1	1	1	23	50.95	11.169	5.98	0.77298	0.44283
Chromium	1	1	1	24	52.01	11.0994	7.22	0.77612	0.44467
Manganese	1	1	1	25	54.94	11.0359	7.21	0.78005	0.45208
Iron	1	1	1	26	55.85	10.9777	7.86	0.78278	0.45416
Cobalt	1	1	1	27	58.94	10.9243	8.67	0.78577	0.45723
Nickel	1	1	1	28	58.71	10.8571	9.04	0.78844	0.45959
Copper	1	1	1	29	63.54	10.8276	8.95	0.79056	0.45987
Zinc	1	1	1	30	65.38	10.7871	7.04	0.79338	0.46486
Germanium	1	1	1	32	72.6	10.7111	5.38	0.79854	0.47369
Selenium	1	1	1	34	78.96	10.6494	4.86	0.80380	0.48497
Krypton	1	3	3	36	83.8	10.5833	.003743*	0.80891	0.49616
Silver	1	1	1	47	107.88	10.3617	10.49	0.83158	0.54743
Tin	1	1	1	50	118.7	10.32	7.3	0.83549	0.55326
Antimony	1	1	1	51	121.76	10.3062	6.73	0.83784	0.56066
Xenon	1	3	3	54	131.3	10.2703	.005896*	0.84227	0.57097
Cesium	1	1	1	55	132.91	10.2592	1.873	0.84390	0.57483
Tantalum	1	1	1	73	180.95	10.1165	17.1	0.86781	0.61598

TABLE A0 DATA FOR STOPPING MATERIALS
(Continued)

Material or Element	KMAX	I2	I1K	Z	AW	FIP	RHO	θ_K	θ_L
Tungsten	1	1	1	74	183.85	10.1081	19.3	0.86832	0.61763
Platinum	1	1	1	78	195.09	10.0897	21.5	0.87388	0.62613
Gold	1	1	1	79	197.0	10.0886	19.4	0.87540	0.62897
Mercury	1	1	1	80	200.61	10.0796	14.193	0.87710	0.63150
Lead	1	1	1	82	207.21	10.0732	11.48	0.88020	0.63673
Bismuth	1	1	1	83	209.0	10.066	9.86	0.88180	0.63919
Uranium	1	1	1	92	238.07	10.0326	18.7	0.89845	0.66348
CO_2	2	3	2	6	12.011	13.167	.0005395		
			3	8	16.0	12.875	.0014374		
H_2O_2	2	2	3	1	1.008	17.6	.08681		
			3	8	16.0	12.875	1.37809		
Air	3	3	3	7	14.008	13.0	.00101		
			3	8	16.0	12.875	.000271		
			3	18	39.944	11.6667	.000012		
H_2O	2	2	3	1	1.008	17.6	.1119		
			3	8	16.0	12.875	.8881		
Tissue	4	2	2	6	12.011	13.167	.1872		
			3	1	1.008	17.6	.10474		
			3	8	16.0	12.875	.67687		
			3	7	14.008	13.0	.03119		
Polyethylene	2	2	3	1	1.008	17.6	.137974		
			2	6	12.011	13.167	.822026		
Glass	5	2	1	5	10.82	13.0	.0871		
			3	8	16.0	12.875	.11632		
			1	11	22.991	12.636	.17783		
			2	14	28.086	12.406	.76463		
			1	19	39.10	11.529	1.75875		
Emulsion	8	2	1	47	107.88	10.3617	1.8088		
			2	35	79.916	10.615	1.3319		
			2	53	126.91	10.282	.0119		
			2	6	12.011	13.167	.2757		
			3	7	14.008	13.0	.0737		

TABLE A0 DATA FOR STOPPING MATERIALS
(Continued)

Material or Element	KMAX	I2	IIK	Z	AW	FIP	RHO		
Emulsion (Continued)			2	16	32.066	11.93	.0072		
			3	1	1.008	17.6	.0538		
			3	8	16.0	12.875	.2522		
NaI	2	1	1	11	22.991	12.636	.563		
			2	53	126.91	10.282	3.104		
Bone	8	2	3	1	1.008	17.6	.0768		
			2	6	12.011	13.167	.3336		
			3	7	14.008	13.0	.0324		
			3	8	16.0	12.875	.492		
			1	12	24.312	12.583	.0024		
			1	15	30.975	12.117	.084		
			2	16	32.064	11.93	.0024		
			1	20	40.08	11.424	.1764		
Anthracene	2	2	2	6	12.011	13.167	1.1793		
			3	1	1.008	17.6	.0707		
Stilbene	2	2	2	6	12.011	13.167	1.0859		
			3	1	1.008	17.6	.0781		
Mylar	3	2	2	6	12.011	13.167	.86875		
			3	1	1.008	17.6	.05838		
			3	8	16.0	12.875	.46287		
Lucite	3	2	2	6	12.011	13.167	.71081		
			3	1	1.008	17.6	.09544		
			3	8	16.0	12.875	.37875		
Polystyrene	2	2	2	6	12.011	13.167	.97331		
			3	1	1.008	17.6	.08169		
Teflon	2	2	2	6	12.011	13.167	.8521		
			3	9	19.0	11.529	1.3479		

* 0°C and 760 mm Hg

TABLE AI COMPUTED PROTON RANGE DATA, IN UNITS OF GMS/CM**2, AS A FUNCTION OF ENERGY IN MEV.

ENERGY	H	HE	LI	BE	B	C	N	O
1.0	8.6275-04	1.7788-03	2.3884-03	2.8040-03	2.4820-03	2.5997-03	2.7966-03	2.9962-03
1.5	1.7279-03	3.8549-03	4.9117-03	5.4584-03	5.1207-03	5.1582-03	5.4670-03	5.7698-03
2.0	2.8630-03	6.5440-03	8.1422-03	8.8330-03	8.4700-03	8.4000-03	8.8407-03	9.2682-03
2.5	4.2566-03	9.8172-03	1.2049-02	1.2898-02	1.2493-02	1.2286-02	1.2877-02	1.3446-02
3.0	5.9002-03	1.3654-02	1.6611-02	1.7627-02	1.7164-02	1.6791-02	1.7546-02	1.8275-02
3.5	7.7873-03	1.8037-02	2.1810-02	2.3000-02	2.2467-02	2.1895-02	2.2830-02	2.3730-02
4.0	9.9126-03	2.2955-02	2.7633-02	2.9000-02	2.8386-02	2.7581-02	2.8712-02	2.9794-02
4.5	1.2272-02	2.8395-02	3.4165-02	3.5618-02	3.4907-02	3.3839-02	3.5177-02	3.6453-02
5.0	1.4860-02	3.4349-02	4.1097-02	4.2842-02	4.2020-02	4.0659-02	4.2214-02	4.3695-02
6.0	2.0714-02	4.7763-02	5.6925-02	5.9067-02	5.7974-02	5.5942-02	5.7966-02	5.9886-02
7.0	2.7450-02	6.3141-02	7.5038-02	7.7609-02	7.6187-02	7.3365-02	7.5904-02	7.8299-02
8.0	3.5049-02	8.0436-02	9.5394-02	9.8412-02	9.6604-02	9.2875-02	9.5971-02	9.8876-02
9.0	4.3495-02	9.9608-02	1.1794-01	1.2143-01	1.1918-01	1.1442-01	1.1812-01	1.2157-01
10.0	5.2774-02	1.2062-01	1.4265-01	1.4662-01	1.4387-01	1.3797-01	1.4232-01	1.4635-01
11.0	6.2872-02	1.4345-01	1.6947-01	1.7394-01	1.7064-01	1.6349-01	1.6852-01	1.7317-01
12.0	7.3778-02	1.6806-01	1.9837-01	2.0336-01	1.9946-01	1.9095-01	1.9669-01	2.0199-01
14.0	9.7972-02	2.2254-01	2.6233-01	2.6840-01	2.6313-01	2.5155-01	2.5883-01	2.6555-01
16.0	1.2528-01	2.8388-01	3.3435-01	3.4152-01	3.3467-01	3.1960-01	3.2855-01	3.3679-01
18.0	1.5564-01	3.5193-01	4.1411-01	4.2252-01	4.1390-01	3.9490-01	4.0567-01	4.1555-01
20.0	1.8890-01	4.2655-01	5.0160-01	5.1126-01	5.0065-01	4.7732-01	4.9002-01	5.0166-01
22.0	2.2529-01	5.0762-01	5.9662-01	6.0758-01	5.9478-01	5.6670-01	5.8147-01	5.9498-01
24.0	2.6448-01	5.9504-01	6.9905-01	7.1134-01	6.9617-01	6.6293-01	6.7989-01	6.9538-01
26.0	3.0651-01	6.8869-01	8.0877-01	8.2244-01	8.0470-01	7.6590-01	7.8516-01	8.0273-01
28.0	3.5136-01	7.8848-01	9.2567-01	9.4075-01	9.2025-01	8.7549-01	8.9717-01	9.1693-01
30.0	3.9897-01	8.9433-01	1.0496+00	1.0662+00	1.0427+00	9.9161-01	1.0158+00	1.0379+00
35.0	5.2987-01	1.1849+00	1.3899+00	1.4102+00	1.3785+00	1.3099+00	1.3409+00	1.3691+00
40.0	6.7734-01	1.5116+00	1.7723+00	1.7965+00	1.7556+00	1.6670+00	1.7055+00	1.7404+00
45.0	8.4090-01	1.8734+00	2.1956+00	2.2240+00	2.1726+00	2.0618+00	2.1084+00	2.1506+00
50.0	1.0201+00	2.2692+00	2.6588+00	2.6915+00	2.6286+00	2.4933+00	2.5486+00	2.5986+00
55.0	1.2149+00	2.6989+00	3.1615+00	3.1986+00	3.1231+00	2.9612+00	3.0257+00	3.0841+00
60.0	1.4240+00	3.1597+00	3.7005+00	3.7421+00	3.6531+00	3.4623+00	3.5368+00	3.6039+00
65.0	1.6482+00	3.6534+00	4.2779+00	4.3242+00	4.2205+00	3.9988+00	4.0836+00	4.1601+00
70.0	1.8861+00	4.1768+00	4.8900+00	4.9410+00	4.8217+00	4.5670+00	4.6627+00	4.7490+00
75.0	2.1385+00	4.7315+00	5.5387+00	5.5945+00	5.4586+00	5.1689+00	5.2760+00	5.3725+00
80.0	2.4040+00	5.3146+00	6.2205+00	6.2812+00	6.1278+00	5.8011+00	5.9202+00	6.0273+00
90.0	2.9752+00	6.5682+00	7.6862+00	7.7570+00	7.5657+00	7.1591+00	7.3034+00	7.4331+00
100.0	3.5978+00	7.9327+00	9.2815+00	9.3627+00	9.1298+00	8.6358+00	8.8072+00	8.9610+00
110.0	4.2706+00	9.4060+00	1.1004+01	1.1096+01	1.0818+01	1.0229+01	1.0429+01	1.0608+01
120.0	4.9891+00	1.0978+01	1.2841+01	1.2944+01	1.2618+01	1.1927+01	1.2157+01	1.2364+01
130.0	5.7552+00	1.2653+01	1.4739+01	1.4913+01	1.4534+01	1.3735+01	1.3997+01	1.4233+01
140.0	6.5687+00	1.4419+01	1.6864+01	1.6989+01	1.6555+01	1.5640+01	1.5936+01	1.6202+01
150.0	7.4166+00	1.6281+01	1.9043+01	1.9176+01	1.8685+01	1.7648+01	1.7979+01	1.8275+01
160.0	8.3091+00	1.8228+01	2.1316+01	2.1464+01	2.0912+01	1.9746+01	2.0114+01	2.0442+01
180.0	1.0214+01	2.2380+01	2.6171+01	2.6342+01	2.5659+01	2.4218+01	2.4662+01	2.5059+01

TABLE A1 COMPUTED PROTON RANGE DATA, IN UNITS OF GMS/CM**2, AS A FUNCTION OF ENERGY IN MEV.

ENERGY	H	HE	LI	BE	B	C	N	O
200.0	1.2268+01	2.6854+01	3.1401+01	3.1597+01	3.0772+01	2.9032+01	2.9557+01	3.0027+01
225.0	1.5032+01	3.2867+01	3.8432+01	3.8659+01	3.7641+01	3.5497+01	3.6130+01	3.6695+01
250.0	1.7997+01	3.9315+01	4.5972+01	4.6231+01	4.5005+01	4.2423+01	4.3171+01	4.3838+01
275.0	2.1161+01	4.6186+01	5.4010+01	5.4301+01	5.2852+01	4.9803+01	5.0668+01	5.1441+01
300.0	2.4477+01	5.3385+01	6.2432+01	6.2757+01	6.1072+01	5.7523+01	5.8516+01	5.9401+01
325.0	2.7975+01	6.0972+01	7.1310+01	7.1670+01	6.9735+01	6.5658+01	6.6782+01	6.7782+01
350.0	3.1617+01	6.8868+01	8.0651+01	8.0948+01	7.8750+01	7.4120+01	7.5378+01	7.6497+01
375.0	3.5394+01	7.7052+01	9.0133+01	9.0566+01	8.8095+01	8.2886+01	8.4283+01	8.5525+01
400.0	3.9298+01	8.5506+01	1.0003+02	1.0050+02	9.7749+01	9.1939+01	9.3478+01	9.4846+01
450.0	4.7493+01	1.0324+02	1.2080+02	1.2136+02	1.1830+02	1.1091+02	1.1274+02	1.1437+02
500.0	5.6097+01	1.2185+02	1.4262+02	1.4326+02	1.3926+02	1.3081+02	1.3295+02	1.3485+02
550.0	6.5109+01	1.4132+02	1.6546+02	1.6619+02	1.6151+02	1.5162+02	1.5407+02	1.5625+02
600.0	7.4441+01	1.6147+02	1.8910+02	1.8993+02	1.8455+02	1.7314+02	1.7592+02	1.7838+02
700.0	9.3929+01	2.0351+02	2.3848+02	2.3953+02	2.3265+02	2.1805+02	2.2145+02	2.2450+02
800.0	1.1438+02	2.4758+02	2.9031+02	2.9160+02	2.8313+02	2.6515+02	2.6912+02	2.7278+02
900.0	1.3553+02	2.9322+02	3.4405+02	3.4561+02	3.3547+02	3.1397+02	3.1844+02	3.2272+02
1000.0	1.5739+02	3.4011+02	3.9933+02	4.0118+02	3.8931+02	3.6419+02	3.6907+02	3.7398+02
1250.0	2.1386+02	4.6143+02	5.4261+02	5.4534+02	5.2889+02	4.9435+02	4.9983+02	5.0631+02
1500.0	2.7207+02	5.8622+02	6.9043+02	6.9420+02	6.7298+02	6.2870+02	6.3416+02	6.4224+02
1750.0	3.3134+02	7.1315+02	8.4110+02	8.4605+02	8.1994+02	7.6574+02	7.7058+02	7.8024+02
2000.0	3.9125+02	8.4128+02	9.9354+02	9.9981+02	9.6873+02	9.0450+02	9.0812+02	9.1934+02
2250.0	4.5155+02	9.7005+02	1.1472+03	1.1550+03	1.1189+03	1.0446+03	1.0461+03	1.0589+03
2500.0	5.1186+02	1.0988+03	1.3009+03	1.3102+03	1.2691+03	1.1847+03	1.1841+03	1.1984+03
2750.0	5.7222+02	1.2275+03	1.4551+03	1.4661+03	1.4203+03	1.3255+03	1.3218+03	1.3375+03
3000.0	6.3259+02	1.3562+03	1.6093+03	1.6220+03	1.5710+03	1.4663+03	1.4595+03	1.4767+03
3500.0	7.5282+02	1.6121+03	1.9169+03	1.9335+03	1.8726+03	1.7477+03	1.7328+03	1.7529+03
4000.0	8.7228+02	1.8661+03	2.2231+03	2.2439+03	2.1732+03	2.0281+03	2.0038+03	2.0267+03
4500.0	9.9083+02	2.1179+03	2.5276+03	2.5528+03	2.4726+03	2.3073+03	2.2721+03	2.2977+03
5000.0	1.1085+03	2.3674+03	2.8304+03	2.8601+03	2.7704+03	2.5851+03	2.5378+03	2.5660+03
6000.0	1.3409+03	2.8600+03	3.4301+03	3.4697+03	3.3615+03	3.1360+03	3.0616+03	3.0949+03
7000.0	1.5699+03	3.3446+03	4.0230+03	4.0731+03	3.9467+03	3.6811+03	3.5762+03	3.6143+03
8000.0	1.7957+03	3.8218+03	4.6098+03	4.6706+03	4.5265+03	4.2206+03	4.0823+03	4.1252+03
9000.0	2.0185+03	4.2924+03	5.1911+03	5.2630+03	5.1013+03	4.7551+03	4.5810+03	4.6284+03
10000.0	2.2387+03	4.7571+03	5.7677+03	5.8507+03	5.6716+03	5.2850+03	5.0729+03	5.1247+03
15000.0	3.3072+03	7.0068+03	8.5927+03	8.7316+03	8.4679+03	7.8774+03	7.4498+03	7.5220+03
20000.0	4.3368+03	9.1697+03	1.1351+04	1.1545+04	1.1198+04	1.0403+04	9.7296+03	9.8206+03
30000.0	6.3144+03	1.3314+04	1.6732+04	1.7029+04	1.6521+04	1.5315+04	1.4088+04	1.4213+04
40000.0	8.2177+03	1.7294+04	2.1988+04	2.2382+04	2.1715+04	2.0104+04	1.8265+04	1.8421+04
50000.0	1.0069+04	2.1160+04	2.7157+04	2.7642+04	2.6818+04	2.4806+04	2.2316+04	2.2501+04
60000.0	1.1880+04	2.4939+04	3.2257+04	3.2831+04	3.1851+04	2.9443+04	2.6272+04	2.6484+04
70000.0	1.3661+04	2.8648+04	3.7303+04	3.7961+04	3.6824+04	3.4027+04	3.0155+04	3.0390+04
80000.0	1.5419+04	3.2299+04	4.2303+04	4.3043+04	4.1757+04	3.8567+04	3.3984+04	3.4236+04
90000.0	1.7159+04	3.5902+04	4.7264+04	4.8084+04	4.6645+04	4.3069+04	3.7769+04	3.8035+04
100000.0	1.8884+04	3.9462+04	5.2190+04	5.3088+04	5.1498+04	4.7539+04	4.1517+04	4.1795+04

TABLE A1 COMPUTED PROTON RANGE DATA, IN UNITS OF GMS/CM**2, AS A FUNCTION OF ENERGY IN MEV.

ENERGY	NE	MG	AL	SI	A	CA	TI	V
1.0	3.3080-03	3.6932-03	3.7591-03	4.1588-03	3.5352-03	4.5490-03	4.0898-03	4.1002-03
1.5	6.3166-03	6.8753-03	7.0699-03	7.3869-03	7.5070-03	8.3124-03	8.3007-03	8.4291-03
2.0	1.0083-02	1.0846-02	1.1207-02	1.1427-02	1.2387-02	1.2916-02	1.3477-02	1.3771-02
2.5	1.4565-02	1.5558-02	1.6120-02	1.6232-02	1.8128-02	1.8302-02	1.9524-02	2.0015-02
3.0	1.9730-02	2.0982-02	2.1774-02	2.1765-02	2.4697-02	2.4443-02	2.6399-02	2.7109-02
3.5	2.5556-02	2.7090-02	2.8143-02	2.8000-02	3.2069-02	3.1314-02	3.4076-02	3.5023-02
4.0	3.2023-02	3.3865-02	3.5205-02	3.4916-02	4.0218-02	3.8897-02	4.2533-02	4.3736-02
4.5	3.9117-02	4.1288-02	4.2942-02	4.2494-02	4.9126-02	4.7175-02	5.1753-02	5.3228-02
5.0	4.6822-02	4.9346-02	5.1340-02	5.0718-02	5.8776-02	5.6131-02	6.1721-02	6.3484-02
6.0	6.4013-02	6.7314-02	7.0062-02	6.9059-02	8.0243-02	7.6027-02	8.3840-02	8.6233-02
7.0	8.3523-02	8.7695-02	9.1281-02	8.9848-02	1.0452-01	9.8497-02	1.0879-01	1.1188-01
8.0	1.0529-01	1.1041-01	1.1494-01	1.1301-01	1.3151-01	1.2346-01	1.3649-01	1.4033-01
9.0	1.2925-01	1.3541-01	1.4097-01	1.3849-01	1.6114-01	1.5086-01	1.6686-01	1.7153-01
10.0	1.5537-01	1.6263-01	1.6932-01	1.6624-01	1.9337-01	1.8063-01	1.9986-01	2.0541-01
11.0	1.8361-01	1.9204-01	1.9994-01	1.9621-01	2.2812-01	2.1272-01	2.3541-01	2.4191-01
12.0	2.1392-01	2.2360-01	2.3279-01	2.2836-01	2.6535-01	2.4707-01	2.7347-01	2.8099-01
14.0	2.8068-01	2.9302-01	3.0503-01	2.9905-01	3.4710-01	3.2246-01	3.5694-01	3.6667-01
16.0	3.5543-01	3.7065-01	3.8578-01	3.7807-01	4.3832-01	4.0651-01	4.4997-01	4.6215-01
18.0	4.3798-01	4.5628-01	4.7484-01	4.6521-01	5.3875-01	4.9899-01	5.5228-01	5.6713-01
20.0	5.2817-01	5.4974-01	5.7199-01	5.6026-01	6.4813-01	5.9970-01	6.6364-01	6.8137-01
22.0	6.2583-01	6.5088-01	6.7708-01	6.6307-01	7.6631-01	7.0847-01	7.8386-01	8.0468-01
24.0	7.3083-01	7.5956-01	7.8996-01	7.7348-01	8.9312-01	8.2511-01	9.1277-01	9.3688-01
26.0	8.4304-01	8.7565-01	9.1051-01	8.9136-01	1.0284+00	9.4947-01	1.0502+00	1.0778+00
28.0	9.6235-01	9.9903-01	1.0386+00	1.0166+00	1.1720+00	1.0814+00	1.1960+00	1.2273+00
30.0	1.0886+00	1.1296+00	1.1741+00	1.1490+00	1.3239+00	1.2209+00	1.3500+00	1.3852+00
35.0	1.4343+00	1.4867+00	1.5447+00	1.5112+00	1.7386+00	1.6016+00	1.7702+00	1.8160+00
40.0	1.8215+00	1.8864+00	1.9593+00	1.9163+00	2.2020+00	2.0267+00	2.2390+00	2.2965+00
45.0	2.2490+00	2.3275+00	2.4168+00	2.3631+00	2.7127+00	2.4949+00	2.7552+00	2.8254+00
50.0	2.7156+00	2.8087+00	2.9157+00	2.8503+00	3.2692+00	3.0049+00	3.3172+00	3.4011+00
55.0	3.2210+00	3.3296+00	3.4558+00	3.3775+00	3.8711+00	3.5563+00	3.9247+00	4.0233+00
60.0	3.7619+00	3.8871+00	4.0336+00	3.9415+00	4.5146+00	4.1457+00	4.5739+00	4.6881+00
65.0	4.3405+00	4.4830+00	4.6513+00	4.5443+00	5.2021+00	4.7752+00	5.2670+00	5.3979+00
70.0	4.9528+00	5.1137+00	5.3048+00	5.1820+00	5.9292+00	5.4409+00	5.9997+00	6.1481+00
75.0	5.6010+00	5.7811+00	5.9963+00	5.8567+00	6.6981+00	6.1447+00	6.7744+00	6.9412+00
80.0	6.2815+00	6.4816+00	6.7220+00	6.5648+00	7.5047+00	6.8831+00	7.5869+00	7.7729+00
90.0	7.7420+00	7.9846+00	8.2789+00	8.0834+00	9.2341+00	8.4659+00	9.3282+00	9.5552+00
100.0	9.3287+00	9.6170+00	9.9694+00	9.7322+00	1.1111+01	1.0183+01	1.1217+01	1.1488+01
110.0	1.1039+01	1.1376+01	1.1791+01	1.1508+01	1.3131+01	1.2032+01	1.3250+01	1.3569+01
120.0	1.2861+01	1.3249+01	1.3730+01	1.3399+01	1.5282+01	1.3999+01	1.5414+01	1.5783+01
130.0	1.4799+01	1.5242+01	1.5793+01	1.5411+01	1.7568+01	1.6091+01	1.7714+01	1.8136+01
140.0	1.6841+01	1.7341+01	1.7966+01	1.7528+01	1.9975+01	1.8292+01	2.0134+01	2.0613+01
150.0	1.8992+01	1.9551+01	2.0253+01	1.9758+01	2.2508+01	2.0608+01	2.2681+01	2.3218+01
160.0	2.1239+01	2.1860+01	2.2643+01	2.2086+01	2.5153+01	2.3027+01	2.5339+01	2.5938+01
180.0	2.6023+01	2.6776+01	2.7729+01	2.7042+01	3.0780+01	2.8173+01	3.0996+01	3.1725+01

TABLE A1 COMPUTED PROTON RANGE DATA, IN UNITS OF GMS/CM**2, AS A FUNCTION OF ENERGY IN MEV.

ENERGY	NE	MG	AL	SI	A	CA	TI	V
200.0	3.1170+01	3.2063+01	3.3199+01	3.2371+01	3.6828+01	3.3702+01	3.7073+01	3.7942+01
225.0	3.8077+01	3.9158+01	4.0538+01	3.9518+01	4.4938+01	4.1116+01	4.5220+01	4.6276+01
250.0	4.5473+01	4.6753+01	4.8392+01	4.7167+01	5.3613+01	4.9047+01	5.3934+01	5.5189+01
275.0	5.3343+01	5.4836+01	5.6750+01	5.5303+01	6.2838+01	5.7480+01	6.3199+01	6.4666+01
300.0	6.1581+01	6.3295+01	6.5495+01	6.3816+01	7.2487+01	6.6301+01	7.2890+01	7.4578+01
325.0	7.0252+01	7.2200+01	7.4700+01	7.2774+01	8.2639+01	7.5582+01	8.3084+01	8.5004+01
350.0	7.9268+01	8.1458+01	8.4269+01	8.2084+01	9.3188+01	8.5225+01	9.3677+01	9.5838+01
375.0	8.8605+01	9.1047+01	9.4179+01	9.1724+01	1.0411+02	9.5209+01	1.0464+02	1.0705+02
400.0	9.8243+01	1.0095+02	1.0441+02	1.0167+02	1.1537+02	1.0551+02	1.1596+02	1.1862+02
450.0	1.1843+02	1.2168+02	1.2583+02	1.2250+02	1.3896+02	1.2708+02	1.3964+02	1.4285+02
500.0	1.3960+02	1.4342+02	1.4828+02	1.4433+02	1.6366+02	1.4967+02	1.6446+02	1.6823+02
550.0	1.6171+02	1.6614+02	1.7174+02	1.6712+02	1.8946+02	1.7327+02	1.9038+02	1.9473+02
600.0	1.8457+02	1.8964+02	1.9600+02	1.9068+02	2.1612+02	1.9765+02	2.1716+02	2.2212+02
700.0	2.3220+02	2.3860+02	2.4653+02	2.3974+02	2.7161+02	2.4843+02	2.7294+02	2.7917+02
800.0	2.8204+02	2.8987+02	2.9942+02	2.9105+02	3.2962+02	3.0154+02	3.3129+02	3.3885+02
900.0	3.3359+02	3.4291+02	3.5412+02	3.4408+02	3.8956+02	3.5645+02	3.9162+02	4.0056+02
1000.0	3.8647+02	3.9736+02	4.1026+02	3.9848+02	4.5101+02	4.1276+02	4.5352+02	4.6388+02
1250.0	5.2295+02	5.3802+02	5.5522+02	5.3891+02	6.0941+02	5.5805+02	6.1331+02	6.2738+02
1500.0	6.6305+02	6.8260+02	7.0417+02	6.8315+02	7.7182+02	7.0719+02	7.7747+02	7.9538+02
1750.0	8.0524+02	8.2950+02	8.5547+02	8.2967+02	9.3644+02	8.5855+02	9.4423+02	9.6608+02
2000.0	9.4851+02	9.7770+02	1.0081+03	9.7746+02	1.1022+03	1.0111+03	1.1125+03	1.1383+03
2250.0	1.0921+03	1.1266+03	1.1614+03	1.1259+03	1.2681+03	1.1642+03	1.2815+03	1.3114+03
2500.0	1.2358+03	1.2754+03	1.3147+03	1.2744+03	1.4340+03	1.3173+03	1.4506+03	1.4845+03
2750.0	1.3789+03	1.4241+03	1.4680+03	1.4228+03	1.5992+03	1.4700+03	1.6196+03	1.6576+03
3000.0	1.5221+03	1.5729+03	1.6212+03	1.5711+03	1.7643+03	1.6228+03	1.7885+03	1.8307+03
3500.0	1.8062+03	1.8687+03	1.9261+03	1.8663+03	2.0917+03	1.9265+03	2.1249+03	2.1752+03
4000.0	2.0876+03	2.1624+03	2.2290+03	2.1595+03	2.4156+03	2.2278+03	2.4589+03	2.5175+03
4500.0	2.3661+03	2.4539+03	2.5298+03	2.4505+03	2.7360+03	2.5266+03	2.7905+03	2.8572+03
5000.0	2.6418+03	2.7431+03	2.8283+03	2.7392+03	3.0528+03	2.8228+03	3.1195+03	3.1944+03
6000.0	3.1850+03	3.3152+03	3.4194+03	3.3103+03	3.6766+03	3.4082+03	3.7699+03	3.8611+03
7000.0	3.7182+03	3.8796+03	4.0028+03	3.8736+03	4.2883+03	3.9847+03	4.4111+03	4.5183+03
8000.0	4.2425+03	4.4372+03	4.5796+03	4.4301+03	4.8891+03	4.5533+03	5.0438+03	5.1669+03
9000.0	4.7587+03	4.9890+03	5.1505+03	4.9805+03	5.4803+03	5.1147+03	5.6689+03	5.8078+03
10000.0	5.2677+03	5.5354+03	5.7161+03	5.5256+03	6.0629+03	5.6697+03	6.2871+03	6.4417+03
15000.0	7.7251+03	8.2037+03	8.4794+03	8.1868+03	8.8710+03	8.3672+03	9.2946+03	9.5260+03
20000.0	1.0080+04	1.0797+04	1.1167+04	1.0774+04	1.1557+04	1.0974+04	1.2205+04	1.2511+04
30000.0	1.4576+04	1.5830+04	1.6383+04	1.5793+04	1.6677+04	1.6003+04	1.7827+04	1.8279+04
40000.0	1.8881+04	2.0722+04	2.1453+04	2.0673+04	2.1572+04	2.0871+04	2.3278+04	2.3870+04
50000.0	2.3053+04	2.5514+04	2.6422+04	2.5455+04	2.6310+04	2.5631+04	2.8611+04	2.9341+04
60000.0	2.7125+04	3.0231+04	3.1314+04	3.0163+04	3.0933+04	3.0311+04	3.3857+04	3.4723+04
70000.0	3.1116+04	3.4887+04	3.6143+04	3.4811+04	3.5466+04	3.4929+04	3.9033+04	4.0033+04
80000.0	3.5042+04	3.9494+04	4.0921+04	3.9410+04	3.9927+04	3.9495+04	4.4153+04	4.5284+04
90000.0	3.8911+04	4.4058+04	4.5656+04	4.3966+04	4.4329+04	4.4018+04	4.9224+04	5.0485+04
100000.0	4.2732+04	4.8586+04	5.0353+04	4.8487+04	4.8681+04	4.8504+04	5.4253+04	5.5644+04

TABLE A1 COMPUTED PROTON RANGE DATA, IN UNITS OF GMS/CM**2, AS A FUNCTION OF ENERGY IN MEV.

ENERGY	CR	MN	FE	CO	NI	CU	ZN	GE
1.0	4.5364-03	4.5876-03	5.0612-03	5.1545-03	5.8014-03	5.6178-03	5.7921-03	5.6769-03
1.5	8.7957-03	8.9599-03	9.3610-03	9.5675-03	1.0078-02	1.0128-02	1.0334-02	1.0488-02
2.0	1.4072-02	1.4381-02	1.4699-02	1.5040-02	1.5374-02	1.5701-02	1.5931-02	1.6397-02
2.5	2.0250-02	2.0738-02	2.0972-02	2.1480-02	2.1613-02	2.2272-02	2.2527-02	2.3357-02
3.0	2.7270-02	2.7961-02	2.8107-02	2.8810-02	2.8721-02	2.9764-02	3.0054-02	3.1317-02
3.5	3.5100-02	3.6010-02	3.6058-02	3.6980-02	3.6646-02	3.8124-02	3.8454-02	4.0213-02
4.0	4.3718-02	4.4860-02	4.4800-02	4.5959-02	4.5356-02	4.7313-02	4.7687-02	5.0000-02
4.5	5.3103-02	5.4492-02	5.4310-02	5.5724-02	5.4825-02	5.7302-02	5.7725-02	6.0640-02
5.0	6.3239-02	6.4889-02	6.4573-02	6.6257-02	6.5035-02	6.8071-02	6.8546-02	7.2107-02
6.0	8.5712-02	8.7924-02	8.7299-02	8.9572-02	8.7627-02	9.1889-02	9.2466-02	9.7446-02
7.0	1.1104-01	1.1387-01	1.1288-01	1.1581-01	1.1303-01	1.1866-01	1.1934-01	1.2589-01
8.0	1.3913-01	1.4264-01	1.4124-01	1.4487-01	1.4117-01	1.4831-01	1.4908-01	1.5735-01
9.0	1.6992-01	1.7415-01	1.7230-01	1.7670-01	1.7198-01	1.8077-01	1.8162-01	1.9175-01
10.0	2.0335-01	2.0835-01	2.0601-01	2.1123-01	2.0539-01	2.1596-01	2.1689-01	2.2899-01
11.0	2.3936-01	2.4518-01	2.4229-01	2.4839-01	2.4135-01	2.5382-01	2.5483-01	2.6904-01
12.0	2.7790-01	2.8460-01	2.8112-01	2.8815-01	2.7981-01	2.9431-01	2.9540-01	3.1185-01
14.0	3.6242-01	3.7102-01	3.6623-01	3.7528-01	3.6407-01	3.8301-01	3.8426-01	4.0559-01
16.0	4.5657-01	4.6729-01	4.6103-01	4.7233-01	4.5790-01	4.8174-01	4.8313-01	5.0985-01
18.0	5.6007-01	5.7310-01	5.6520-01	5.7897-01	5.6102-01	5.9024-01	5.9176-01	6.2435-01
20.0	6.7271-01	6.8823-01	6.7855-01	6.9496-01	6.7316-01	7.0824-01	7.0989-01	7.4884-01
22.0	7.9427-01	8.1245-01	8.0085-01	8.2012-01	7.9414-01	8.3550-01	8.3730-01	8.8310-01
24.0	9.2457-01	9.4560-01	9.3192-01	9.5423-01	9.2378-01	9.7186-01	9.7379-01	1.0269+00
26.0	1.0635+00	1.0875+00	1.0716+00	1.0971+00	1.0619+00	1.1171+00	1.1192+00	1.1801+00
28.0	1.2108+00	1.2380+00	1.2197+00	1.2487+00	1.2084+00	1.2712+00	1.2734+00	1.3425+00
30.0	1.3664+00	1.3969+00	1.3761+00	1.4087+00	1.3630+00	1.4338+00	1.4361+00	1.5140+00
35.0	1.7908+00	1.8305+00	1.8027+00	1.8450+00	1.7846+00	1.8771+00	1.8798+00	1.9811+00
40.0	2.2642+00	2.3140+00	2.2785+00	2.3316+00	2.2548+00	2.3714+00	2.3743+00	2.5017+00
45.0	2.7851+00	2.8457+00	2.8017+00	2.8667+00	2.7717+00	2.9148+00	2.9180+00	3.0741+00
50.0	3.3520+00	3.4245+00	3.3709+00	3.4488+00	3.3340+00	3.5058+00	3.5093+00	3.6964+00
55.0	3.9646+00	4.0497+00	3.9858+00	4.0775+00	3.9413+00	4.1441+00	4.1477+00	4.3681+00
60.0	4.6190+00	4.7175+00	4.6426+00	4.7488+00	4.5897+00	4.8256+00	4.8293+00	5.0851+00
65.0	5.3176+00	5.4304+00	5.3435+00	5.4653+00	5.2815+00	5.5526+00	5.5565+00	5.8500+00
70.0	6.0560+00	6.1837+00	6.0842+00	6.2223+00	6.0125+00	6.3206+00	6.3245+00	6.6579+00
75.0	6.8364+00	6.9799+00	6.8670+00	7.0222+00	6.7848+00	7.1319+00	7.1359+00	7.5112+00
80.0	7.6548+00	7.8148+00	7.6877+00	7.8608+00	7.5945+00	7.9825+00	7.9863+00	8.4054+00
90.0	9.4083+00	9.6034+00	9.4458+00	9.6572+00	9.3286+00	9.8039+00	9.8074+00	1.0320+01
100.0	1.1310+01	1.1543+01	1.1352+01	1.1605+01	1.1208+01	1.1778+01	1.1781+01	1.2394+01
110.0	1.3356+01	1.3630+01	1.3403+01	1.3699+01	1.3230+01	1.3901+01	1.3903+01	1.4624+01
120.0	1.5534+01	1.5850+01	1.5585+01	1.5928+01	1.5381+01	1.6159+01	1.6160+01	1.6995+01
130.0	1.7848+01	1.8210+01	1.7903+01	1.8296+01	1.7666+01	1.8558+01	1.8558+01	1.9514+01
140.0	2.0283+01	2.0693+01	2.0343+01	2.0787+01	2.0070+01	2.1081+01	2.1080+01	2.2163+01
150.0	2.2845+01	2.3305+01	2.2909+01	2.3408+01	2.2599+01	2.3735+01	2.3732+01	2.4948+01
160.0	2.5520+01	2.6032+01	2.5588+01	2.6144+01	2.5238+01	2.6505+01	2.6500+01	2.7854+01
180.0	3.1209+01	3.1833+01	3.1286+01	3.1963+01	3.0851+01	3.2396+01	3.2386+01	3.4034+01

TABLE A1 COMPUTED PROTON RANGE DATA, IN UNITS OF GMS/CM**2, AS A FUNCTION OF ENERGY IN MEV.

ENERGY	CR	MN	FE	CO	NI	CU	ZN	GE
200.0	3.7321+01	3.8064+01	3.7407+01	3.8212+01	3.6881+01	3.8721+01	3.8707+01	4.0669+01
225.0	4.5512+01	4.6416+01	4.5611+01	4.6588+01	4.4960+01	4.7197+01	4.7176+01	4.9558+01
250.0	5.4272+01	5.5347+01	5.4384+01	5.5544+01	5.3599+01	5.6258+01	5.6230+01	5.9059+01
275.0	6.3586+01	6.4842+01	6.3710+01	6.5064+01	6.2782+01	6.5887+01	6.5851+01	6.9154+01
300.0	7.3325+01	7.4771+01	7.3462+01	7.5020+01	7.2384+01	7.5955+01	7.5911+01	7.9708+01
325.0	8.3569+01	8.5215+01	8.3720+01	8.5490+01	8.2482+01	8.6542+01	8.6488+01	9.0804+01
350.0	9.4212+01	9.6066+01	9.4378+01	9.6369+01	9.2974+01	9.7538+01	9.7476+01	1.0233+02
375.0	1.0523+02	1.0730+02	1.0541+02	1.0763+02	1.0383+02	1.0892+02	1.0885+02	1.1426+02
400.0	1.1660+02	1.1889+02	1.1679+02	1.1924+02	1.1503+02	1.2066+02	1.2057+02	1.2656+02
450.0	1.4039+02	1.4314+02	1.4061+02	1.4356+02	1.3848+02	1.4522+02	1.4511+02	1.5229+02
500.0	1.6531+02	1.6856+02	1.6557+02	1.6903+02	1.6304+02	1.7094+02	1.7081+02	1.7923+02
550.0	1.9134+02	1.9509+02	1.9164+02	1.9563+02	1.8869+02	1.9779+02	1.9764+02	2.0735+02
600.0	2.1824+02	2.2252+02	2.1857+02	2.2311+02	2.1518+02	2.2552+02	2.2534+02	2.3639+02
700.0	2.7426+02	2.7963+02	2.7466+02	2.8034+02	2.7036+02	2.8326+02	2.8302+02	2.9683+02
800.0	3.3286+02	3.3937+02	3.3334+02	3.4021+02	3.2808+02	3.4362+02	3.4331+02	3.5999+02
900.0	3.9346+02	4.0113+02	3.9402+02	4.0211+02	3.8775+02	4.0601+02	4.0561+02	4.2523+02
1000.0	4.5565+02	4.6451+02	4.5628+02	4.6563+02	4.4898+02	4.7000+02	4.6949+02	4.9213+02
1250.0	6.1626+02	6.2814+02	6.1705+02	6.2962+02	6.0704+02	6.3511+02	6.3428+02	6.6460+02
1500.0	7.8134+02	7.9628+02	7.8226+02	7.9812+02	7.6944+02	8.0467+02	8.0343+02	8.4157+02
1750.0	9.4911+02	9.6709+02	9.5013+02	9.6930+02	9.3442+02	9.7688+02	9.7513+02	1.0211+03
2000.0	1.1184+03	1.1395+03	1.1195+03	1.1420+03	1.1009+03	1.1506+03	1.1482+03	1.2022+03
2250.0	1.2887+03	1.3127+03	1.2897+03	1.3156+03	1.2681+03	1.3251+03	1.3220+03	1.3838+03
2500.0	1.4589+03	1.4859+03	1.4600+03	1.4892+03	1.4354+03	1.4996+03	1.4958+03	1.5655+03
2750.0	1.6292+03	1.6591+03	1.6302+03	1.6627+03	1.6026+03	1.6740+03	1.6694+03	1.7468+03
3000.0	1.7994+03	1.8322+03	1.8004+03	1.8362+03	1.7698+03	1.8484+03	1.8429+03	1.9282+03
3500.0	2.1385+03	2.1770+03	2.1392+03	2.1817+03	2.1026+03	2.1955+03	2.1881+03	2.2888+03
4000.0	2.4753+03	2.5194+03	2.4758+03	2.5248+03	2.4331+03	2.5402+03	2.5308+03	2.6466+03
4500.0	2.8097+03	2.8594+03	2.8099+03	2.8654+03	2.7613+03	2.8824+03	2.8708+03	3.0014+03
5000.0	3.1416+03	3.1967+03	3.1415+03	3.2034+03	3.0869+03	3.2220+03	3.2081+03	3.3533+03
6000.0	3.7981+03	3.8639+03	3.7972+03	3.8719+03	3.7309+03	3.8936+03	3.8748+03	4.0485+03
7000.0	4.4453+03	4.5216+03	4.4437+03	4.5309+03	4.3658+03	4.5557+03	4.5319+03	4.7331+03
8000.0	5.0841+03	5.1708+03	5.0817+03	5.1814+03	4.9925+03	5.2094+03	5.1803+03	5.4083+03
9000.0	5.7153+03	5.8122+03	5.7122+03	5.8243+03	5.6118+03	5.8553+03	5.8209+03	6.0751+03
10000.0	6.3397+03	6.4468+03	6.3359+03	6.4601+03	6.2244+03	6.4943+03	6.4546+03	6.7343+03
15000.0	9.3782+03	9.5343+03	9.3705+03	9.5542+03	9.2056+03	9.6042+03	9.5376+03	9.9390+03
20000.0	1.2319+04	1.2522+04	1.2307+04	1.2548+04	1.2090+04	1.2614+04	1.2520+04	1.3037+04
30000.0	1.8001+04	1.8294+04	1.7977+04	1.8330+04	1.7661+04	1.8426+04	1.8279+04	1.9014+04
40000.0	2.3509+04	2.3886+04	2.3470+04	2.3930+04	2.3057+04	2.4053+04	2.3851+04	2.4795+04
50000.0	2.8899+04	2.9356+04	2.8841+04	2.9405+04	2.8332+04	2.9555+04	2.9297+04	3.0439+04
60000.0	3.4199+04	3.4735+04	3.4122+04	3.4788+04	3.3517+04	3.4962+04	3.4648+04	3.5982+04
70000.0	3.9429+04	4.0043+04	3.9332+04	4.0098+04	3.8632+04	4.0296+04	3.9924+04	4.1444+04
80000.0	4.4600+04	4.5291+04	4.4483+04	4.5348+04	4.3689+04	4.5569+04	4.5139+04	4.6840+04
90000.0	4.9723+04	5.0488+04	4.9584+04	5.0548+04	4.8697+04	5.0791+04	5.0303+04	5.2181+04
100000.0	5.4803+04	5.5643+04	5.4643+04	5.5703+04	5.3662+04	5.5968+04	5.5422+04	5.7475+04

TABLE A1 COMPUTED PROTON RANGE DATA, IN UNITS OF GMS/CM**2, AS A FUNCTION OF ENERGY IN MEV.

ENERGY	SE	KR	AG	SN	SB	XE	CS	TA
1.0	5.5022-03	5.5951-03	6.7061-03	6.9344-03	6.8078-03	7.0383-03	7.3523-03	1.1263-02
1.5	1.0629-02	1.0917-02	1.2883-02	1.3352-02	1.3450-02	1.4004-02	1.4311-02	1.8993-02
2.0	1.6873-02	1.7358-02	2.0185-02	2.1004-02	2.1328-02	2.2296-02	2.2617-02	2.8269-02
2.5	2.4184-02	2.4873-02	2.8557-02	2.9782-02	3.0330-02	3.1736-02	3.2088-02	3.8963-02
3.0	3.2509-02	3.3405-02	3.7959-02	3.9642-02	4.0419-02	4.2278-02	4.2654-02	5.0989-02
3.5	4.1806-02	4.2923-02	4.8359-02	5.0547-02	5.1560-02	5.3896-02	5.4289-02	6.4236-02
4.0	5.2023-02	5.3385-02	5.9713-02	6.2472-02	6.3713-02	6.6563-02	6.6968-02	7.8629-02
4.5	6.3127-02	6.4741-02	7.1997-02	7.5388-02	7.6856-02	8.0250-02	8.0663-02	9.4119-02
5.0	7.5088-02	7.6964-02	8.5195-02	8.9266-02	9.0956-02	9.4939-02	9.5354-02	1.1067-01
6.0	1.0151-01	1.0393-01	1.1425-01	1.1981-01	1.2196-01	1.2722-01	1.2764-01	1.4687-01
7.0	1.3115-01	1.3414-01	1.4674-01	1.5394-01	1.5657-01	1.6314-01	1.6363-01	1.8708-01
8.0	1.6392-01	1.6751-01	1.8249-01	1.9155-01	1.9469-01	2.0264-01	2.0312-01	2.3118-01
9.0	1.9972-01	2.0395-01	2.2139-01	2.3245-01	2.3617-01	2.4564-01	2.4609-01	2.7905-01
10.0	2.3848-01	2.4339-01	2.6338-01	2.7655-01	2.8089-01	2.9199-01	2.9243-01	3.3062-01
11.0	2.8014-01	2.8576-01	3.0838-01	3.2381-01	3.2879-01	3.4162-01	3.4203-01	3.8572-01
12.0	3.2464-01	3.3101-01	3.5629-01	3.7416-01	3.7981-01	3.9444-01	3.9481-01	4.4423-01
14.0	4.2199-01	4.2997-01	4.6079-01	4.8392-01	4.9086-01	5.0946-01	5.0972-01	5.7149-01
16.0	5.3023-01	5.3987-01	5.7653-01	6.0540-01	6.1376-01	6.3655-01	6.3665-01	7.1204-01
18.0	6.4897-01	6.6044-01	7.0315-01	7.3829-01	7.4818-01	7.7544-01	7.7535-01	8.6541-01
20.0	7.7796-01	7.9139-01	8.4044-01	8.8232-01	8.9379-01	9.2588-01	9.2556-01	1.0310+00
22.0	9.1703-01	9.3250-01	9.8814-01	1.0372+00	1.0503+00	1.0875+00	1.0870+00	1.2086+00
24.0	1.0660+00	1.0836+00	1.1460+00	1.2028+00	1.2177+00	1.2602+00	1.2594+00	1.3979+00
26.0	1.2246+00	1.2444+00	1.3139+00	1.3788+00	1.3955+00	1.4437+00	1.4425+00	1.5988+00
28.0	1.3927+00	1.4147+00	1.4915+00	1.5650+00	1.5836+00	1.6378+00	1.6362+00	1.8108+00
30.0	1.5702+00	1.5945+00	1.6788+00	1.7613+00	1.7819+00	1.8423+00	1.8403+00	2.0340+00
35.0	2.0537+00	2.0842+00	2.1883+00	2.2950+00	2.3209+00	2.3980+00	2.3949+00	2.6394+00
40.0	2.5924+00	2.6296+00	2.7547+00	2.8883+00	2.9199+00	3.0152+00	3.0108+00	3.3105+00
45.0	3.1845+00	3.2290+00	3.3762+00	3.5390+00	3.5769+00	3.6920+00	3.6860+00	4.0450+00
50.0	3.8282+00	3.8804+00	4.0510+00	4.2455+00	4.2899+00	4.4263+00	4.4186+00	4.8409+00
55.0	4.5230+00	4.5835+00	4.7786+00	5.0069+00	5.0583+00	5.2175+00	5.2078+00	5.6974+00
60.0	5.2644+00	5.3339+00	5.5541+00	5.8187+00	5.8775+00	6.0608+00	6.0489+00	6.6094+00
65.0	6.0550+00	6.1339+00	6.3800+00	6.6829+00	6.7501+00	6.9589+00	6.9447+00	7.5798+00
70.0	6.8901+00	6.9785+00	7.2518+00	7.5949+00	7.6700+00	7.9064+00	7.8898+00	8.6027+00
75.0	7.7722+00	7.8705+00	8.1719+00	8.5575+00	8.6407+00	8.9051+00	8.8862+00	9.6811+00
80.0	8.6965+00	8.8051+00	9.1356+00	9.5655+00	9.6572+00	9.9506+00	9.9287+00	1.0809+01
90.0	1.0675+01	1.0806+01	1.1197+01	1.1722+01	1.1831+01	1.2186+01	1.2158+01	1.3219+01
100.0	1.2817+01	1.2972+01	1.3426+01	1.4054+01	1.4182+01	1.4604+01	1.4569+01	1.5819+01
110.0	1.5121+01	1.5300+01	1.5821+01	1.6559+01	1.6707+01	1.7199+01	1.7156+01	1.8608+01
120.0	1.7570+01	1.7775+01	1.8365+01	1.9220+01	1.9388+01	1.9954+01	1.9904+01	2.1567+01
130.0	2.0170+01	2.0402+01	2.1065+01	2.2043+01	2.2232+01	2.2877+01	2.2818+01	2.4703+01
140.0	2.2905+01	2.3165+01	2.3902+01	2.5012+01	2.5222+01	2.5948+01	2.5880+01	2.7995+01
150.0	2.5780+01	2.6069+01	2.6883+01	2.8130+01	2.8362+01	2.9174+01	2.9096+01	3.1451+01
160.0	2.8780+01	2.9099+01	2.9992+01	3.1384+01	3.1637+01	3.2538+01	3.2450+01	3.5053+01
180.0	3.5158+01	3.5539+01	3.6597+01	3.8296+01	3.8592+01	3.9680+01	3.9571+01	4.2695+01

TABLE A1 COMPUTED PROTON RANGE DATA, IN UNITS OF GMS/CM**2, AS A FUNCTION OF ENERGY IN MEV.

ENERGY	SE	KR	AG	SN	SB	XE	CS	TA
200.0	4.2004+01	4.2451+01	4.3680+01	4.5710+01	4.6050+01	4.7338+01	4.7205+01	5.0884+01
225.0	5.1174+01	5.1706+01	5.3159+01	5.5636+01	5.6029+01	5.7582+01	5.7419+01	6.1830+01
250.0	6.0973+01	6.1595+01	6.3280+01	6.6239+01	6.6682+01	6.8515+01	6.8320+01	7.3507+01
275.0	7.1385+01	7.2099+01	7.4026+01	7.7501+01	7.7990+01	8.0119+01	7.9889+01	8.5893+01
300.0	8.2269+01	8.3078+01	8.5252+01	8.9269+01	8.9802+01	9.2238+01	9.1972+01	9.8823+01
325.0	9.3710+01	9.4617+01	9.7047+01	1.0164+02	1.0221+02	1.0496+02	1.0466+02	1.1240+02
350.0	1.0559+02	1.0660+02	1.0929+02	1.1448+02	1.1509+02	1.1817+02	1.1783+02	1.2648+02
375.0	1.1789+02	1.1899+02	1.2196+02	1.2777+02	1.2841+02	1.3183+02	1.3145+02	1.4104+02
400.0	1.3056+02	1.3177+02	1.3501+02	1.4148+02	1.4214+02	1.4590+02	1.4549+02	1.5604+02
450.0	1.5708+02	1.5850+02	1.6230+02	1.7014+02	1.7084+02	1.7531+02	1.7482+02	1.8737+02
500.0	1.8485+02	1.8647+02	1.9086+02	2.0016+02	2.0086+02	2.0607+02	2.0550+02	2.2013+02
550.0	2.1382+02	2.1565+02	2.2065+02	2.3148+02	2.3218+02	2.3813+02	2.3749+02	2.5427+02
600.0	2.4373+02	2.4577+02	2.5139+02	2.6382+02	2.6449+02	2.7121+02	2.7050+02	2.8949+02
700.0	3.0597+02	3.0841+02	3.1533+02	3.3112+02	3.3168+02	3.3994+02	3.3910+02	3.6268+02
800.0	3.7098+02	3.7380+02	3.8209+02	4.0145+02	4.0181+02	4.1164+02	4.1069+02	4.3905+02
900.0	4.3812+02	4.4129+02	4.5101+02	4.7409+02	4.7419+02	4.8556+02	4.8454+02	5.1784+02
1000.0	5.0693+02	5.1042+02	5.2163+02	5.4856+02	5.4832+02	5.6123+02	5.6016+02	5.9854+02
1250.0	6.8418+02	6.8831+02	7.0353+02	7.4049+02	7.3916+02	7.5571+02	7.5468+02	8.0624+02
1500.0	8.6584+02	8.7038+02	8.8996+02	9.3728+02	9.3460+02	9.5451+02	9.5372+02	1.0189+03
1750.0	1.0500+03	1.0547+03	1.0789+03	1.1368+03	1.1326+03	1.1555+03	1.1552+03	1.2344+03
2000.0	1.2354+03	1.2399+03	1.2692+03	1.3377+03	1.3318+03	1.3574+03	1.3577+03	1.4512+03
2250.0	1.4212+03	1.4251+03	1.4593+03	1.5391+03	1.5313+03	1.5590+03	1.5602+03	1.6684+03
2500.0	1.6069+03	1.6103+03	1.6506+03	1.7404+03	1.7307+03	1.7605+03	1.7627+03	1.8855+03
2750.0	1.7921+03	1.7943+03	1.8406+03	1.9409+03	1.9293+03	1.9605+03	1.9640+03	2.1016+03
3000.0	1.9772+03	1.9783+03	2.0306+03	2.1415+03	2.1279+03	2.1605+03	2.1653+03	2.3178+03
3500.0	2.3449+03	2.3424+03	2.4079+03	2.5393+03	2.5218+03	2.5559+03	2.5638+03	2.7465+03
4000.0	2.7094+03	2.7022+03	2.7815+03	2.9334+03	2.9120+03	2.9463+03	2.9580+03	3.1711+03
4500.0	3.0707+03	3.0577+03	3.1518+03	3.3235+03	3.2982+03	3.3316+03	3.3476+03	3.5913+03
5000.0	3.4287+03	3.4089+03	3.5184+03	3.7097+03	3.6806+03	3.7121+03	3.7328+03	4.0072+03
6000.0	4.1358+03	4.0996+03	4.2419+03	4.4710+03	4.4345+03	4.4597+03	4.4911+03	4.8272+03
7000.0	4.8319+03	4.7759+03	4.9532+03	5.2187+03	5.1754+03	5.1910+03	5.2346+03	5.6325+03
8000.0	5.5182+03	5.4394+03	5.6538+03	5.9543+03	5.9045+03	5.9080+03	5.9652+03	6.4249+03
9000.0	6.1959+03	6.0917+03	6.3448+03	6.6793+03	6.6233+03	6.6123+03	6.6844+03	7.2059+03
10000.0	6.8659+03	6.7339+03	7.0273+03	7.3948+03	7.3330+03	7.3054+03	7.3936+03	7.9767+03
15000.0	1.0123+04	9.8234+03	1.0339+04	1.0857+04	1.0771+04	1.0635+04	1.0820+04	1.1708+04
20000.0	1.3273+04	1.2772+04	1.3535+04	1.4186+04	1.4081+04	1.3808+04	1.4109+04	1.5299+04
30000.0	1.9353+04	1.8380+04	1.9697+04	2.0576+04	2.0448+04	1.9833+04	2.0416+04	2.2195+04
40000.0	2.5235+04	2.3730+04	2.5658+04	2.6733+04	2.6593+04	2.5576+04	2.6485+04	2.8841+04
50000.0	3.0981+04	2.8904+04	3.1480+04	3.2733+04	3.2590+04	3.1127+04	3.2392+04	3.5315+04
60000.0	3.6625+04	3.3946+04	3.7199+04	3.8617+04	3.8476+04	3.6536+04	3.8179+04	4.1663+04
70000.0	4.2188+04	3.8887+04	4.2836+04	4.4410+04	4.4275+04	4.1834+04	4.3873+04	4.7912+04
80000.0	4.7685+04	4.3745+04	4.8406+04	5.0130+04	5.0003+04	4.7041+04	4.9492+04	5.4079+04
90000.0	5.3126+04	4.8534+04	5.3920+04	5.5787+04	5.5672+04	5.2173+04	5.5047+04	6.0178+04
100000.0	5.8520+04	5.3265+04	5.9385+04	6.1392+04	6.1289+04	5.7240+04	6.0549+04	6.6219+04

TABLE A1 COMPUTED PROTON RANGE DATA, IN UNITS OF GMS/CM**2, AS A FUNCTION OF ENERGY IN MEV.

ENERGY	W	PT	AU	HG	PB	BI	U	CO2
1.0	1.1536-02	1.2123-02	1.2215-02	1.2241-02	1.2259-02	1.2427-02	1.2707-02	2.8781-03
1.5	1.9274-02	2.0171-02	2.0369-02	2.0535-02	2.0857-02	2.1099-02	2.2503-02	5.5895-03
2.0	2.8576-02	2.9797-02	3.0100-02	3.0403-02	3.1006-02	3.1306-02	3.3977-02	9.0139-03
2.5	3.9321-02	4.0831-02	4.1245-02	4.1699-02	4.2609-02	4.2955-02	4.6896-02	1.3108-02
3.0	5.1410-02	5.3193-02	5.3729-02	5.4340-02	5.5560-02	5.5954-02	6.1121-02	1.7844-02
3.5	6.4729-02	6.6839-02	6.7421-02	6.8256-02	6.9776-02	7.0217-02	7.6643-02	2.3199-02
4.0	7.9212-02	8.1685-02	8.2315-02	8.3304-02	8.5229-02	8.5709-02	9.3430-02	2.9154-02
4.5	9.4801-02	9.7681-02	9.8353-02	9.9507-02	1.0186-01	1.0237-01	1.1145-01	3.5699-02
5.0	1.1146-01	1.1478-01	1.1549-01	1.1683-01	1.1952-01	1.2015-01	1.3065-01	4.2820-02
6.0	1.4789-01	1.5214-01	1.5295-01	1.5467-01	1.5803-01	1.5872-01	1.7250-01	5.8753-02
7.0	1.8834-01	1.9358-01	1.9449-01	1.9663-01	2.0073-01	2.0145-01	2.1869-01	7.6885-02
8.0	2.3270-01	2.3899-01	2.3998-01	2.4257-01	2.4745-01	2.4820-01	2.6907-01	9.7160-02
9.0	2.8086-01	2.8824-01	2.8932-01	2.9238-01	2.9808-01	2.9886-01	3.2346-01	1.1953-01
10.0	3.3272-01	3.4125-01	3.4240-01	3.4597-01	3.5252-01	3.5332-01	3.8154-01	1.4396-01
11.0	3.8813-01	3.9793-01	3.9915-01	4.0325-01	4.1069-01	4.1150-01	4.4340-01	1.7041-01
12.0	4.4697-01	4.5815-01	4.5949-01	4.6414-01	4.7252-01	4.7333-01	5.0905-01	1.9885-01
14.0	5.7495-01	5.8882-01	5.9035-01	5.9628-01	6.0687-01	6.0766-01	6.5146-01	2.6157-01
16.0	7.1628-01	7.3305-01	7.3467-01	7.4188-01	7.5466-01	7.5547-01	8.0825-01	3.3191-01
18.0	8.7053-01	8.9043-01	8.9214-01	9.0073-01	9.1579-01	9.1652-01	9.7902-01	4.0970-01
20.0	1.0371+00	1.0605+00	1.0624+00	1.0725+00	1.0900+00	1.0906+00	1.1630+00	4.9477-01
22.0	1.2157+00	1.2428+00	1.2449+00	1.2565+00	1.2768+00	1.2774+00	1.3601+00	5.8698-01
24.0	1.4060+00	1.4371+00	1.4392+00	1.4527+00	1.4757+00	1.4764+00	1.5701+00	6.8620-01
26.0	1.6080+00	1.6431+00	1.6453+00	1.6606+00	1.6867+00	1.6872+00	1.7929+00	7.9232-01
28.0	1.8212+00	1.8606+00	1.8629+00	1.8801+00	1.9092+00	1.9097+00	2.0279+00	9.0522-01
30.0	2.0455+00	2.0893+00	2.0918+00	2.1110+00	2.1434+00	2.1437+00	2.2749+00	1.0248+00
35.0	2.6541+00	2.7095+00	2.7121+00	2.7365+00	2.7777+00	2.7776+00	2.9438+00	1.3524+00
40.0	3.3288+00	3.3966+00	3.3992+00	3.4295+00	3.4800+00	3.4794+00	3.6832+00	1.7197+00
45.0	4.0671+00	4.1484+00	4.1509+00	4.1874+00	4.2481+00	4.2467+00	4.4909+00	2.1256+00
50.0	4.8670+00	4.9626+00	4.9650+00	5.0083+00	5.0797+00	5.0775+00	5.3648+00	2.5690+00
55.0	5.7278+00	5.8386+00	5.8408+00	5.8912+00	5.9742+00	5.9711+00	6.3041+00	3.0495+00
60.0	6.6443+00	6.7711+00	6.7730+00	6.8311+00	6.9262+00	6.9220+00	7.3033+00	3.5641+00
65.0	7.6195+00	7.7631+00	7.7647+00	7.8308+00	7.9388+00	7.9334+00	8.3656+00	4.1148+00
70.0	8.6474+00	8.8087+00	8.8098+00	8.8844+00	9.0059+00	8.9991+00	9.4846+00	4.6979+00
75.0	9.7310+00	9.9107+00	9.9114+00	9.9948+00	1.0130+01	1.0122+01	1.0663+01	5.3153+00
80.0	1.0865+01	1.1064+01	1.1064+01	1.1156+01	1.1307+01	1.1297+01	1.1896+01	5.9638+00
90.0	1.3286+01	1.3525+01	1.3525+01	1.3637+01	1.3818+01	1.3805+01	1.4527+01	7.3562+00
100.0	1.5898+01	1.6181+01	1.6179+01	1.6313+01	1.6528+01	1.6512+01	1.7368+01	8.8698+00
110.0	1.8701+01	1.9028+01	1.9025+01	1.9181+01	1.9432+01	1.9411+01	2.0409+01	1.0502+01
120.0	2.1674+01	2.2050+01	2.2045+01	2.2224+01	2.2512+01	2.2487+01	2.3633+01	1.2242+01
130.0	2.4824+01	2.5250+01	2.5243+01	2.5447+01	2.5775+01	2.5744+01	2.7049+01	1.4093+01
140.0	2.8132+01	2.8610+01	2.8601+01	2.8831+01	2.9200+01	2.9164+01	3.0633+01	1.6044+01
150.0	3.1604+01	3.2137+01	3.2124+01	3.2383+01	3.2795+01	3.2754+01	3.4394+01	1.8100+01
160.0	3.5222+01	3.5811+01	3.5796+01	3.6083+01	3.6540+01	3.6492+01	3.8314+01	2.0248+01
180.0	4.2899+01	4.3606+01	4.3584+01	4.3932+01	4.4483+01	4.4421+01	4.6625+01	2.4824+01

TABLE A1 COMPUTED PROTON RANGE DATA, IN UNITS OF GMS/CM**2, AS A FUNCTION OF ENERGY IN MEV.

ENERGY	W	PT	AU	HG	PB	BI	U	CO2
200.0	5.1125+01	5.1955+01	5.1926+01	5.2338+01	5.2989+01	5.2912+01	5.5522+01	2.9748+01
225.0	6.2120+01	6.3114+01	6.3074+01	6.3573+01	6.4357+01	6.4258+01	6.7412+01	3.6360+01
250.0	7.3850+01	7.5015+01	7.4964+01	7.5554+01	7.6479+01	7.6355+01	8.0091+01	4.3442+01
275.0	8.6291+01	8.7635+01	8.7572+01	8.8259+01	8.9333+01	8.9182+01	9.3535+01	5.0983+01
300.0	9.9279+01	1.0081+02	1.0073+02	1.0152+02	1.0275+02	1.0257+02	1.0757+02	5.8876+01
325.0	1.1291+02	1.1464+02	1.1454+02	1.1544+02	1.1683+02	1.1662+02	1.2230+02	6.7189+01
350.0	1.2706+02	1.2898+02	1.2887+02	1.2987+02	1.3143+02	1.3119+02	1.3757+02	7.5833+01
375.0	1.4168+02	1.4380+02	1.4368+02	1.4479+02	1.4653+02	1.4624+02	1.5336+02	8.4788+01
400.0	1.5675+02	1.5907+02	1.5893+02	1.6017+02	1.6207+02	1.6175+02	1.6963+02	9.4034+01
450.0	1.8823+02	1.9097+02	1.9079+02	1.9227+02	1.9454+02	1.9414+02	2.0361+02	1.1341+02
500.0	2.2113+02	2.2431+02	2.2409+02	2.2581+02	2.2848+02	2.2797+02	2.3912+02	1.3372+02
550.0	2.5544+02	2.5906+02	2.5878+02	2.6076+02	2.6383+02	2.6322+02	2.7613+02	1.5496+02
600.0	2.9082+02	2.9489+02	2.9455+02	2.9680+02	3.0028+02	2.9956+02	3.1429+02	1.7692+02
700.0	3.6438+02	3.6934+02	3.6888+02	3.7166+02	3.7599+02	3.7502+02	3.9356+02	2.2269+02
800.0	4.4115+02	4.4699+02	4.4638+02	4.4971+02	4.5492+02	4.5366+02	4.7620+02	2.7061+02
900.0	5.2036+02	5.2709+02	5.2629+02	5.3016+02	5.3629+02	5.3471+02	5.6139+02	3.2018+02
1000.0	6.0150+02	6.0910+02	6.0810+02	6.1250+02	6.1956+02	6.1763+02	6.4857+02	3.7107+02
1250.0	8.1039+02	8.2011+02	8.1847+02	8.2416+02	8.3356+02	8.3070+02	8.7262+02	5.0246+02
1500.0	1.0244+03	1.0361+03	1.0337+03	1.0406+03	1.0524+03	1.0485+03	1.1016+03	6.3744+02
1750.0	1.2412+03	1.2549+03	1.2516+03	1.2595+03	1.2737+03	1.2687+03	1.3332+03	7.7450+02
2000.0	1.4594+03	1.4750+03	1.4707+03	1.4797+03	1.4960+03	1.4900+03	1.5659+03	9.1268+02
2250.0	1.6779+03	1.6954+03	1.6899+03	1.6997+03	1.7183+03	1.7112+03	1.7983+03	1.0513+03
2500.0	1.8964+03	1.9157+03	1.9092+03	1.9198+03	1.9405+03	1.9323+03	2.0308+03	1.1899+03
2750.0	2.1140+03	2.1351+03	2.1273+03	2.1386+03	2.1613+03	2.1519+03	2.2616+03	1.3282+03
3000.0	2.3316+03	2.3545+03	2.3454+03	2.3573+03	2.3821+03	2.3716+03	2.4924+03	1.4664+03
3500.0	2.7633+03	2.7897+03	2.7779+03	2.7908+03	2.8193+03	2.8064+03	2.9491+03	1.7410+03
4000.0	3.1907+03	3.2206+03	3.2061+03	3.2197+03	3.2516+03	3.2363+03	3.4006+03	2.0131+03
4500.0	3.6138+03	3.6472+03	3.6299+03	3.6441+03	3.6790+03	3.6612+03	3.8467+03	2.2825+03
5000.0	4.0327+03	4.0694+03	4.0494+03	4.0639+03	4.1017+03	4.0814+03	4.2877+03	2.5492+03
6000.0	4.8584+03	4.9020+03	4.8762+03	4.8912+03	4.9340+03	4.9086+03	5.1556+03	3.0751+03
7000.0	5.6693+03	5.7198+03	5.6884+03	5.7035+03	5.7506+03	5.7200+03	6.0065+03	3.5916+03
8000.0	6.4673+03	6.5247+03	6.4876+03	6.5025+03	6.5535+03	6.5176+03	6.8425+03	4.0997+03
9000.0	7.2538+03	7.3180+03	7.2753+03	7.2899+03	7.3444+03	7.3031+03	7.6655+03	4.6002+03
10000.0	8.0300+03	8.1010+03	8.0528+03	8.0669+03	8.1246+03	8.0779+03	8.4770+03	5.0939+03
15000.0	1.1788+04	1.1893+04	1.1818+04	1.1827+04	1.1898+04	1.1825+04	1.2399+04	7.4790+03
20000.0	1.5404+04	1.5542+04	1.5441+04	1.5445+04	1.5527+04	1.5426+04	1.6166+04	9.7664+03
30000.0	2.2348+04	2.2553+04	2.2403+04	2.2393+04	2.2491+04	2.2338+04	2.3395+04	1.4139+04
40000.0	2.9039+04	2.9309+04	2.9113+04	2.9087+04	2.9200+04	2.8995+04	3.0357+04	1.8328+04
50000.0	3.5558+04	3.5893+04	3.5652+04	3.5609+04	3.5734+04	3.5479+04	3.7138+04	2.2391+04
60000.0	4.1949+04	4.2347+04	4.2063+04	4.2001+04	4.2139+04	4.1834+04	4.3786+04	2.6357+04
70000.0	4.8239+04	4.8700+04	4.8373+04	4.8293+04	4.8441+04	4.8087+04	5.0328+04	3.0247+04
80000.0	5.4447+04	5.4971+04	5.4602+04	5.4502+04	5.4661+04	5.4258+04	5.6784+04	3.4073+04
90000.0	6.0586+04	6.1172+04	6.0762+04	6.0642+04	6.0810+04	6.0359+04	6.3168+04	3.7846+04
100000.0	6.6667+04	6.7315+04	6.6864+04	6.6724+04	6.6900+04	6.6401+04	6.9490+04	4.1573+04

TABLE A1 COMPUTED PROTON RANGE DATA, IN UNITS OF GMS/CM**2, AS A FUNCTION OF ENERGY IN MEV.

ENERGY	H2O2	AIR	H2O	TISSUE	(CH2)N	GLASS	EMULSION	NAI
1.0	2.4753-03	2.8424-03	2.1994-03	2.1889-03	1.8842-03	4.0241-03	4.7304-03	6.0014-03
1.5	4.9938-03	5.5421-03	4.4939-03	4.4751-03	3.9422-03	7.5061-03	9.3195-03	1.1810-02
2.0	8.1833-03	8.9510-03	7.4125-03	7.3839-03	6.5730-03	1.1817-02	1.4918-02	1.8803-02
2.5	1.2003-02	1.3028-02	1.0919-02	1.0879-02	9.7457-03	1.6910-02	2.1468-02	2.6856-02
3.0	1.6427-02	1.7742-02	1.4988-02	1.4937-02	1.3439-02	2.2752-02	2.8927-02	3.5927-02
3.5	2.1433-02	2.3075-02	1.9600-02	1.9539-02	1.7638-02	2.9318-02	3.7262-02	4.5988-02
4.0	2.7005-02	2.9009-02	2.4741-02	2.4669-02	2.2328-02	3.6587-02	4.6434-02	5.7007-02
4.5	3.3130-02	3.5531-02	3.0399-02	3.0316-02	2.7499-02	4.4539-02	5.6419-02	6.8959-02
5.0	3.9797-02	4.2628-02	3.6563-02	3.6470-02	3.3145-02	5.3161-02	6.7199-02	8.1825-02
6.0	5.4720-02	5.8509-02	5.0376-02	5.0265-02	4.5822-02	7.2362-02	9.1073-02	1.1016-01
7.0	7.1710-02	7.6589-02	6.6120-02	6.5994-02	6.0307-02	9.4096-02	1.1794-01	1.4189-01
8.0	9.0713-02	9.6810-02	8.3748-02	8.3609-02	7.6555-02	1.1829-01	1.4769-01	1.7690-01
9.0	1.1169-01	1.1913-01	1.0322-01	1.0307-01	9.4524-02	1.4488-01	1.8023-01	2.1512-01
10.0	1.3460-01	1.4350-01	1.2450-01	1.2434-01	1.1419-01	1.7381-01	2.1552-01	2.5641-01
11.0	1.5941-01	1.6988-01	1.4756-01	1.4739-01	1.3551-01	2.0503-01	2.5348-01	3.0072-01
12.0	1.8609-01	1.9825-01	1.7236-01	1.7220-01	1.5848-01	2.3850-01	2.9405-01	3.4798-01
14.0	2.4494-01	2.6083-01	2.2712-01	2.2695-01	2.0923-01	3.1205-01	3.8291-01	4.5115-01
16.0	3.1095-01	3.3102-01	2.8858-01	2.8842-01	2.6628-01	3.9419-01	4.8178-01	5.6550-01
18.0	3.8396-01	4.0864-01	3.5659-01	3.5646-01	3.2947-01	4.8470-01	5.9038-01	6.9075-01
20.0	4.6382-01	4.9354-01	4.3102-01	4.3092-01	3.9869-01	5.8339-01	7.0850-01	8.2665-01
22.0	5.5040-01	5.8557-01	5.1174-01	5.1169-01	4.7382-01	6.9005-01	8.3591-01	9.7295-01
24.0	6.4357-01	6.8460-01	5.9863-01	5.9864-01	5.5474-01	8.0454-01	9.7241-01	1.1294+00
26.0	7.4322-01	7.9052-01	6.9159-01	6.9168-01	6.4138-01	9.2673-01	1.1178+00	1.2960+00
28.0	8.4924-01	9.0321-01	7.9054-01	7.9070-01	7.3364-01	1.0565+00	1.2721+00	1.4723+00
30.0	9.6155-01	1.0226+00	8.9536-01	8.9563-01	8.3144-01	1.1937+00	1.4349+00	1.6583+00
35.0	1.2692+00	1.3496+00	1.1827+00	1.1832+00	1.0997+00	1.5686+00	1.8790+00	2.1644+00
40.0	1.6143+00	1.7163+00	1.5050+00	1.5059+00	1.4009+00	1.9879+00	2.3742+00	2.7277+00
45.0	1.9957+00	2.1215+00	1.8614+00	1.8628+00	1.7341+00	2.4500+00	2.9188+00	3.3462+00
50.0	2.4122+00	2.5642+00	2.2508+00	2.2527+00	2.0985+00	2.9538+00	3.5114+00	4.0181+00
55.0	2.8637+00	3.0440+00	2.6730+00	2.6755+00	2.4938+00	3.4989+00	4.1514+00	4.7429+00
60.0	3.3473+00	3.5578+00	3.1253+00	3.1284+00	2.9174+00	4.0818+00	4.8347+00	5.5161+00
65.0	3.8648+00	4.1076+00	3.6094+00	3.6133+00	3.3711+00	4.7048+00	5.5636+00	6.3404+00
70.0	4.4128+00	4.6899+00	4.1221+00	4.1268+00	3.8517+00	5.3637+00	6.3337+00	7.2103+00
75.0	4.9931+00	5.3064+00	4.6652+00	4.6708+00	4.3610+00	6.0607+00	7.1474+00	8.1282+00
80.0	5.6026+00	5.9540+00	5.2357+00	5.2422+00	4.8961+00	6.7920+00	8.0004+00	9.0899+00
90.0	6.9114+00	7.3445+00	6.4609+00	6.4696+00	6.0459+00	8.3603+00	9.8272+00	1.1147+01
100.0	8.3342+00	8.8561+00	7.7932+00	7.8043+00	7.2968+00	1.0063+01	1.1806+01	1.3375+01
110.0	9.8686+00	1.0486+01	9.2303+00	9.2440+00	8.6466+00	1.1896+01	1.3935+01	1.5768+01
120.0	1.1504+01	1.2223+01	1.0762+01	1.0779+01	1.0086+01	1.3848+01	1.6199+01	1.8311+01
130.0	1.3245+01	1.4073+01	1.2393+01	1.2413+01	1.1619+01	1.5923+01	1.8603+01	2.1010+01
140.0	1.5079+01	1.6021+01	1.4112+01	1.4136+01	1.3235+01	1.8108+01	2.1133+01	2.3847+01
150.0	1.7012+01	1.8074+01	1.5923+01	1.5950+01	1.4939+01	2.0408+01	2.3793+01	2.6829+01
160.0	1.9031+01	2.0219+01	1.7816+01	1.7847+01	1.6719+01	2.2810+01	2.6568+01	2.9939+01
180.0	2.3334+01	2.4790+01	2.1850+01	2.1890+01	2.0515+01	2.7922+01	3.2470+01	3.6548+01

TABLE A1 COMPUTED PROTON RANGE DATA, IN UNITS OF GMS/CM**2, AS A FUNCTION OF ENERGY IN MEV.

ENERGY	H2O2	AIR	H2O	TISSUE	(CH2)N	GLASS	EMULSION	NAI
200.0	2.7965+01	2.9709+01	2.6193+01	2.6241+01	2.4603+01	3.3417+01	3.8807+01	4.3639+01
225.0	3.4183+01	3.6313+01	3.2024+01	3.2085+01	3.0095+01	4.0786+01	4.7297+01	5.3130+01
250.0	4.0844+01	4.3388+01	3.8272+01	3.8347+01	3.5980+01	4.8670+01	5.6370+01	6.3267+01
275.0	4.7935+01	5.0920+01	4.4925+01	4.5015+01	4.2250+01	5.7056+01	6.6013+01	7.4031+01
300.0	5.5360+01	5.8805+01	5.1891+01	5.1998+01	4.8817+01	6.5829+01	7.6092+01	8.5277+01
325.0	6.3178+01	6.7109+01	5.9228+01	5.9352+01	5.5736+01	7.5060+01	8.6690+01	9.7094+01
350.0	7.1309+01	7.5745+01	6.6860+01	6.7002+01	6.2933+01	8.4653+01	9.7697+01	1.0936+02
375.0	7.9733+01	8.4691+01	7.4766+01	7.4928+01	7.0392+01	9.4585+01	1.0909+02	1.2205+02
400.0	8.8430+01	9.3927+01	8.2931+01	8.3113+01	7.8095+01	1.0483+02	1.2083+02	1.3513+02
450.0	1.0665+02	1.1328+02	1.0004+02	1.0026+02	9.4243+01	1.2629+02	1.4540+02	1.6248+02
500.0	1.2577+02	1.3358+02	1.1799+02	1.1826+02	1.1119+02	1.4877+02	1.7113+02	1.9110+02
550.0	1.4575+02	1.5479+02	1.3675+02	1.3707+02	1.2891+02	1.7226+02	1.9797+02	2.2094+02
600.0	1.6640+02	1.7673+02	1.5616+02	1.5653+02	1.4724+02	1.9653+02	2.2569+02	2.5174+02
700.0	2.0947+02	2.2246+02	1.9662+02	1.9709+02	1.8547+02	2.4710+02	2.8336+02	3.1579+02
800.0	2.5456+02	2.7034+02	2.3898+02	2.3958+02	2.2554+02	3.0000+02	3.4361+02	3.8266+02
900.0	3.0120+02	3.1987+02	2.8283+02	2.8354+02	2.6704+02	3.5472+02	4.0583+02	4.5166+02
1000.0	3.4909+02	3.7072+02	3.2784+02	3.2868+02	3.0971+02	4.1089+02	4.6961+02	5.2235+02
1250.0	4.7289+02	5.0201+02	4.4418+02	4.4540+02	4.2027+02	5.5596+02	6.3401+02	7.0430+02
1500.0	6.0037+02	6.3690+02	5.6395+02	5.6561+02	5.3436+02	7.0510+02	8.0265+02	8.9064+02
1750.0	7.3018+02	7.7386+02	6.8589+02	6.8804+02	6.5074+02	8.5668+02	9.7375+02	1.0794+03
2000.0	8.6148+02	9.1194+02	8.0920+02	8.1187+02	7.6860+02	1.0097+03	1.1462+03	1.2693+03
2250.0	9.9393+02	1.0505+03	9.3357+02	9.3680+02	8.8766+02	1.1635+03	1.3192+03	1.4595+03
2500.0	1.1264+03	1.1890+03	1.0579+03	1.0617+03	1.0067+03	1.3173+03	1.4922+03	1.6496+03
2750.0	1.2594+03	1.3272+03	1.1828+03	1.1872+03	1.1265+03	1.4712+03	1.6649+03	1.8390+03
3000.0	1.3924+03	1.4654+03	1.3077+03	1.3127+03	1.2462+03	1.6250+03	1.8376+03	2.0283+03
3500.0	1.6582+03	1.7398+03	1.5573+03	1.5634+03	1.4857+03	1.9314+03	2.1809+03	2.4039+03
4000.0	1.9242+03	2.0117+03	1.8061+03	1.8134+03	1.7246+03	2.2358+03	2.5215+03	2.7760+03
4500.0	2.1870+03	2.2810+03	2.0539+03	2.0624+03	1.9625+03	2.5380+03	2.8593+03	3.1444+03
5000.0	2.4495+03	2.5476+03	2.3005+03	2.3101+03	2.1994+03	2.8379+03	3.1941+03	3.5093+03
6000.0	2.9704+03	3.0733+03	2.7899+03	2.8018+03	2.6697+03	3.4313+03	3.8557+03	4.2292+03
7000.0	3.4860+03	3.5896+03	3.2744+03	3.2885+03	3.1353+03	4.0165+03	4.5072+03	4.9370+03
8000.0	3.9965+03	4.0975+03	3.7543+03	3.7706+03	3.5966+03	4.5944+03	5.1496+03	5.6341+03
9000.0	4.5024+03	4.5978+03	4.2300+03	4.2485+03	4.0539+03	5.1657+03	5.7839+03	6.3217+03
10000.0	5.0040+03	5.0914+03	4.7018+03	4.7223+03	4.5074+03	5.7311+03	6.4111+03	7.0009+03
15000.0	7.4580+03	7.4759+03	7.0112+03	7.0418+03	6.7283+03	8.4860+03	9.4599+03	1.0295+04
20000.0	9.8468+03	9.7629+03	9.2608+03	9.3011+03	8.8931+03	1.1157+04	1.2408+04	1.3472+04
30000.0	1.4486+04	1.4134+04	1.3632+04	1.3692+04	1.3105+04	1.6331+04	1.8099+04	1.9586+04
40000.0	1.8999+04	1.8324+04	1.7886+04	1.7966+04	1.7212+04	2.1353+04	2.3610+04	2.5491+04
50000.0	2.3425+04	2.2386+04	2.2058+04	2.2160+04	2.1245+04	2.6273+04	2.8998+04	3.1253+04
60000.0	2.7785+04	2.6353+04	2.6169+04	2.6292+04	2.5222+04	3.1114+04	3.4293+04	3.6910+04
70000.0	3.2093+04	3.0246+04	3.0230+04	3.0375+04	2.9154+04	3.5893+04	3.9514+04	4.2485+04
80000.0	3.6358+04	3.4083+04	3.4251+04	3.4417+04	3.3049+04	4.0621+04	4.4675+04	4.7992+04
90000.0	4.0586+04	3.7876+04	3.8238+04	3.8426+04	3.6912+04	4.5306+04	4.9786+04	5.3443+04
100000.0	4.4783+04	4.1632+04	4.2195+04	4.2405+04	4.0747+04	4.9953+04	5.4853+04	5.8845+04

TABLE A1 COMPUTED PROTON RANGE DATA, IN UNITS OF GMS/CM**2, AS A FUNCTION OF ENERGY IN MEV.

ENERGY	BONE	ANTHRACENE	STILBENE	MYLAR	LUCITE	POLYSTYRENE	TEFLON
1.0	2.5386-03	2.2577-03	2.2062-03	2.4215-03	2.2105-03	2.1605-03	2.5972-03
1.5	5.0825-03	4.5967-03	4.5069-03	4.8803-03	4.5214-03	4.4235-03	5.4954-03
2.0	8.3000-03	7.5718-03	7.4352-03	7.9997-03	7.4612-03	7.3059-03	9.1419-03
2.5	1.2151-02	1.1147-02	1.0956-02	1.1742-02	1.0994-02	1.0773-02	1.3494-02
3.0	1.6610-02	1.5300-02	1.5046-02	1.6081-02	1.5096-02	1.4803-02	1.8522-02
3.5	2.1656-02	2.0010-02	1.9688-02	2.0998-02	1.9749-02	1.9377-02	2.4202-02
4.0	2.7272-02	2.5265-02	2.4867-02	2.6477-02	2.4938-02	2.4481-02	3.0516-02
4.5	3.3447-02	3.1053-02	3.0572-02	3.2506-02	3.0652-02	3.0105-02	3.7449-02
5.0	4.0169-02	3.7364-02	3.6793-02	3.9076-02	3.6880-02	3.6239-02	4.4987-02
6.0	5.5215-02	5.1520-02	5.0751-02	5.3797-02	5.0847-02	5.0002-02	6.1842-02
7.0	7.2345-02	6.7674-02	6.6682-02	7.0577-02	6.6779-02	6.5714-02	8.1003-02
8.0	9.1505-02	8.5776-02	8.4535-02	8.9366-02	8.4627-02	8.3324-02	1.0241-01
9.0	1.1265-01	1.0578-01	1.0427-01	1.1012-01	1.0435-01	1.0279-01	1.2602-01
10.0	1.3574-01	1.2765-01	1.2585-01	1.3279-01	1.2591-01	1.2408-01	1.5178-01
11.0	1.6074-01	1.5137-01	1.4924-01	1.5737-01	1.4928-01	1.4716-01	1.7966-01
12.0	1.8761-01	1.7689-01	1.7442-01	1.8380-01	1.7442-01	1.7200-01	2.0962-01
14.0	2.4689-01	2.3325-01	2.3003-01	2.4216-01	2.2995-01	2.2689-01	2.7568-01
16.0	3.1337-01	2.9656-01	2.9250-01	3.0766-01	2.9231-01	2.8854-01	3.4973-01
18.0	3.8687-01	3.6665-01	3.6168-01	3.8016-01	3.6134-01	3.5682-01	4.3158-01
20.0	4.6725-01	4.4339-01	4.3741-01	4.5949-01	4.3690-01	4.3157-01	5.2107-01
22.0	5.5437-01	5.2664-01	5.1958-01	5.4552-01	5.1886-01	5.1268-01	6.1803-01
24.0	6.4811-01	6.1629-01	6.0807-01	6.3815-01	6.0712-01	6.0004-01	7.2235-01
26.0	7.4834-01	7.1223-01	7.0278-01	7.3724-01	7.0156-01	6.9354-01	8.3389-01
28.0	8.5498-01	8.1437-01	8.0361-01	8.4272-01	8.0209-01	7.9308-01	9.5253-01
30.0	9.6792-01	9.2262-01	9.1046-01	9.5446-01	9.0862-01	8.9857-01	1.0782+00
35.0	1.2773+00	1.2194+00	1.2034+00	1.2607+00	1.2006+00	1.1878+00	1.4222+00
40.0	1.6241+00	1.5525+00	1.5323+00	1.6044+00	1.5284+00	1.5126+00	1.8079+00
45.0	2.0074+00	1.9209+00	1.8960+00	1.9843+00	1.8908+00	1.8717+00	2.2340+00
50.0	2.4260+00	2.3235+00	2.2936+00	2.3995+00	2.2869+00	2.2644+00	2.6992+00
55.0	2.8796+00	2.7602+00	2.7248+00	2.8496+00	2.7164+00	2.6902+00	3.2034+00
60.0	3.3654+00	3.2281+00	3.1868+00	3.3318+00	3.1766+00	3.1465+00	3.7432+00
65.0	3.8852+00	3.7290+00	3.6814+00	3.8479+00	3.6693+00	3.6350+00	4.3207+00
70.0	4.4356+00	4.2597+00	4.2055+00	4.3946+00	4.1911+00	4.1525+00	4.9322+00
75.0	5.0185+00	4.8218+00	4.7606+00	4.9736+00	4.7439+00	4.7008+00	5.5796+00
80.0	5.6306+00	5.4123+00	5.3438+00	5.5818+00	5.3246+00	5.2768+00	6.2594+00
90.0	6.9449+00	6.6810+00	6.5967+00	6.8882+00	6.5720+00	6.5144+00	7.7189+00
100.0	8.3736+00	8.0608+00	7.9594+00	8.3087+00	7.9286+00	7.8604+00	9.3051+00
110.0	9.9142+00	9.5494+00	9.4297+00	9.8410+00	9.3921+00	9.3127+00	1.1015+01
120.0	1.1556+01	1.1137+01	1.0997+01	1.1474+01	1.0952+01	1.0861+01	1.2838+01
130.0	1.3304+01	1.2827+01	1.2667+01	1.3213+01	1.2614+01	1.2510+01	1.4777+01
140.0	1.5145+01	1.4608+01	1.4426+01	1.5046+01	1.4365+01	1.4248+01	1.6821+01
150.0	1.7085+01	1.6485+01	1.6280+01	1.6977+01	1.6210+01	1.6080+01	1.8973+01
160.0	1.9112+01	1.8447+01	1.8218+01	1.8996+01	1.8139+01	1.7995+01	2.1223+01
180.0	2.3431+01	2.2630+01	2.2350+01	2.3297+01	2.2249+01	2.2076+01	2.6014+01

TABLE A1 COMPUTED PROTON RANGE DATA, IN UNITS OF GMS/CM**2, AS A FUNCTION OF ENERGY IN MEV.

ENERGY	BONE	ANTHRACENE	STILBENE	MYLAR	LUCITE	POLYSTYRENE	TEFLON
200.0	2.8078+01	2.7132+01	2.6797+01	2.7927+01	2.6674+01	2.6470+01	3.1169+01
225.0	3.4318+01	3.3180+01	3.2771+01	3.4145+01	3.2617+01	3.2373+01	3.8090+01
250.0	4.1001+01	3.9660+01	3.9173+01	4.0806+01	3.8985+01	3.8698+01	4.5502+01
275.0	4.8117+01	4.6562+01	4.5992+01	4.7900+01	4.5767+01	4.5435+01	5.3392+01
300.0	5.5566+01	5.3790+01	5.3132+01	5.5328+01	5.2869+01	5.2490+01	6.1651+01
325.0	6.3410+01	6.1404+01	6.0654+01	6.3152+01	6.0350+01	5.9923+01	7.0347+01
350.0	7.1567+01	6.9324+01	6.8478+01	7.1289+01	6.8131+01	6.7654+01	7.9390+01
375.0	8.0017+01	7.7530+01	7.6586+01	7.9720+01	7.6193+01	7.5665+01	8.8757+01
400.0	8.8742+01	8.6005+01	8.4959+01	8.8426+01	8.4519+01	8.3938+01	9.8428+01
450.0	1.0702+02	1.0377+02	1.0251+02	1.0667+02	1.0197+02	1.0128+02	1.1869+02
500.0	1.2619+02	1.2240+02	1.2092+02	1.2581+02	1.2027+02	1.1947+02	1.3993+02
550.0	1.4623+02	1.4189+02	1.4017+02	1.4582+02	1.3941+02	1.3850+02	1.6213+02
600.0	1.6695+02	1.6204+02	1.6008+02	1.6651+02	1.5921+02	1.5818+02	1.8509+02
700.0	2.1014+02	2.0406+02	2.0161+02	2.0965+02	2.0049+02	1.9921+02	2.3293+02
800.0	2.5535+02	2.4809+02	2.4511+02	2.5483+02	2.4372+02	2.4220+02	2.8301+02
900.0	3.0213+02	2.9369+02	2.9016+02	3.0160+02	2.8847+02	2.8671+02	3.3481+02
1000.0	3.5015+02	3.4056+02	3.3646+02	3.4964+02	3.3445+02	3.3245+02	3.8798+02
1250.0	4.7427+02	4.6193+02	4.5636+02	4.7400+02	4.5349+02	4.5089+02	5.2543+02
1500.0	6.0202+02	5.8713+02	5.8003+02	6.0219+02	5.7620+02	5.7303+02	6.6692+02
1750.0	7.3206+02	7.1478+02	7.0612+02	7.3282+02	7.0128+02	6.9756+02	8.1095+02
2000.0	8.6352+02	8.4403+02	8.3377+02	8.6502+02	8.2787+02	8.2361+02	9.5656+02
2250.0	9.9602+02	9.7447+02	9.6264+02	9.9843+02	9.5565+02	9.5087+02	1.1033+03
2500.0	1.1285+03	1.1049+03	1.0915+03	1.1318+03	1.0834+03	1.0781+03	1.2501+03
2750.0	1.2614+03	1.2360+03	1.2210+03	1.2659+03	1.2118+03	1.2060+03	1.3974+03
3000.0	1.3944+03	1.3672+03	1.3505+03	1.3999+03	1.3402+03	1.3339+03	1.5447+03
3500.0	1.6598+03	1.6292+03	1.6095+03	1.6677+03	1.5969+03	1.5896+03	1.8388+03
4000.0	1.9242+03	1.8905+03	1.8676+03	1.9347+03	1.8528+03	1.8445+03	2.1318+03
4500.0	2.1872+03	2.1507+03	2.1246+03	2.2005+03	2.1076+03	2.0983+03	2.4234+03
5000.0	2.4488+03	2.4095+03	2.3804+03	2.4649+03	2.3611+03	2.3509+03	2.7134+03
6000.0	2.9676+03	2.9232+03	2.8879+03	2.9896+03	2.8643+03	2.8521+03	3.2886+03
7000.0	3.4806+03	3.4315+03	3.3901+03	3.5088+03	3.3624+03	3.3482+03	3.8575+03
8000.0	3.9883+03	3.9347+03	3.8875+03	4.0228+03	3.8557+03	3.8395+03	4.4207+03
9000.0	4.4911+03	4.4334+03	4.3803+03	4.5321+03	4.3444+03	4.3262+03	4.9785+03
10000.0	4.9894+03	4.9278+03	4.8689+03	5.0370+03	4.8291+03	4.8089+03	5.5315+03
15000.0	7.4254+03	7.3469+03	7.2599+03	7.5072+03	7.2012+03	7.1709+03	8.2358+03
20000.0	9.7953+03	9.7032+03	9.5889+03	9.9124+03	9.5116+03	9.4718+03	1.0868+04
30000.0	1.4396+04	1.4286+04	1.4118+04	1.4587+04	1.4004+04	1.3946+04	1.5980+04
40000.0	1.8871+04	1.8752+04	1.8533+04	1.9141+04	1.8379+04	1.8307+04	2.0956+04
50000.0	2.3260+04	2.3137+04	2.2867+04	2.3609+04	2.2674+04	2.2589+04	2.5837+04
60000.0	2.7585+04	2.7461+04	2.7142+04	2.8014+04	2.6908+04	2.6812+04	3.0646+04
70000.0	3.1857+04	3.1736+04	3.1367+04	3.2368+04	3.1092+04	3.0986+04	3.5397+04
80000.0	3.6086+04	3.5971+04	3.5553+04	3.6680+04	3.5237+04	3.5121+04	4.0101+04
90000.0	4.0279+04	4.0171+04	3.9704+04	4.0955+04	3.9346+04	3.9222+04	4.4765+04
100000.0	4.4441+04	4.4340+04	4.3826+04	4.5200+04	4.3426+04	4.3294+04	4.9394+04

TABLE A2 COMPUTED PROTON ENERGY LOSSES IN UNITS OF (MEV-CM**2)/GM.

ENERGY	H	HE	LI	BE	B	C	N	O
0.5	1.1801+03	4.6895+02	3.6658+02	3.4259+02	3.4797+02	3.5762+02	3.4004+02	3.4273+02
0.6	1.0270+03	4.1274+02	3.2709+02	3.0580+02	3.0929+02	3.1799+02	3.0344+02	2.8934+02
0.7	9.1190+02	3.6968+02	2.9613+02	2.7718+02	2.7989+02	2.8796+02	2.7513+02	2.6294+02
0.8	8.2192+02	3.3555+02	2.7105+02	2.5446+02	2.5636+02	2.6391+02	2.5204+02	2.4167+02
0.9	7.4942+02	3.0774+02	2.5018+02	2.3545+02	2.3694+02	2.4393+02	2.3313+02	2.2404+02
1.0	6.8965+02	2.8459+02	2.3211+02	2.1929+02	2.2060+02	2.2734+02	2.1750+02	2.0905+02
2.0	3.9496+02	1.6752+02	1.4001+02	1.3422+02	1.3548+02	1.4015+02	1.3474+02	1.3006+02
3.0	2.8307+02	1.2158+02	1.0238+02	9.8909+01	1.0019+02	1.0401+02	1.0041+02	9.7160+01
4.0	2.2293+02	9.6514+01	8.1574+01	7.9223+01	8.0356+01	8.3704+01	8.0970+01	7.8574+01
5.0	1.8501+02	8.0550+01	6.8231+01	6.6462+01	6.7521+01	7.0459+01	6.8309+01	6.6408+01
6.0	1.5877+02	6.9421+01	5.8891+01	5.7490+01	5.8504+01	6.1110+01	5.9329+01	5.7758+01
7.0	1.3946+02	6.1185+01	5.1960+01	5.0810+01	5.1750+01	5.4124+01	5.2599+01	5.1274+01
8.0	1.2461+02	5.4825+01	4.6596+01	4.5627+01	4.6504+01	4.8702+01	4.7353+01	4.6198+01
9.0	1.1281+02	4.9754+01	4.2313+01	4.1479+01	4.2302+01	4.4336+01	4.3142+01	4.2117+01
10.0	1.0320+02	4.5608+01	3.8808+01	3.8079+01	3.8854+01	4.0750+01	3.9676+01	3.8757+01
12.0	8.8446+01	3.9223+01	3.3402+01	3.2824+01	3.3518+01	3.5194+01	3.4310+01	3.3537+01
14.0	7.7627+01	3.4521+01	2.9414+01	2.8940+01	2.9570+01	3.1077+01	3.0319+01	2.9659+01
16.0	6.9334+01	3.0903+01	2.6344+01	2.5944+01	2.6522+01	2.7893+01	2.7231+01	2.6656+01
18.0	6.2761+01	2.8028+01	2.3902+01	2.3558+01	2.4092+01	2.5354+01	2.4765+01	2.4254+01
20.0	5.7417+01	2.5684+01	2.1910+01	2.1610+01	2.2107+01	2.3277+01	2.2746+01	2.2286+01
22.0	5.2982+01	2.3735+01	2.0253+01	1.9987+01	2.0453+01	2.1545+01	2.1062+01	2.0644+01
24.0	4.9239+01	2.2087+01	1.8851+01	1.8613+01	1.9051+01	2.0077+01	1.9634+01	1.9250+01
26.0	4.6034+01	2.0674+01	1.7648+01	1.7433+01	1.7848+01	1.8815+01	1.8406+01	1.8051+01
28.0	4.3258+01	1.9448+01	1.6605+01	1.6409+01	1.6803+01	1.7719+01	1.7339+01	1.7009+01
30.0	4.0829+01	1.8374+01	1.5690+01	1.5511+01	1.5886+01	1.6757+01	1.6402+01	1.6093+01
35.0	3.5901+01	1.6190+01	1.3830+01	1.3683+01	1.4019+01	1.4797+01	1.4491+01	1.4225+01
40.0	3.2136+01	1.4518+01	1.2404+01	1.2281+01	1.2586+01	1.3291+01	1.3022+01	1.2789+01
45.0	2.9162+01	1.3194+01	1.1275+01	1.1169+01	1.1450+01	1.2097+01	1.1856+01	1.1647+01
50.0	2.6749+01	1.2118+01	1.0358+01	1.0265+01	1.0525+01	1.1124+01	1.0906+01	1.0717+01
55.0	2.4759+01	1.1229+01	9.5988+00	9.5171+00	9.7602+00	1.0319+01	1.0119+01	9.9464+00
60.0	2.3070+01	1.0474+01	8.9544+00	8.8814+00	9.1098+00	9.6342+00	9.4500+00	9.2908+00
65.0	2.1637+01	9.8319+00	8.4067+00	8.3409+00	8.5566+00	9.0517+00	8.8805+00	8.7325+00
70.0	2.0392+01	9.2735+00	7.9233+00	7.8701+00	8.0748+00	8.5441+00	8.3841+00	8.2459+00
75.0	1.9309+01	8.7879+00	7.5152+00	7.4605+00	7.6554+00	8.1024+00	7.9526+00	7.8221+00
80.0	1.8351+01	8.3575+00	7.1476+00	7.0972+00	7.2835+00	7.7104+00	7.5685+00	7.4460+00
90.0	1.6743+01	7.6346+00	6.5300+00	6.4867+00	6.6583+00	7.0514+00	6.9236+00	6.8132+00
100.0	1.5443+01	7.0421+00	6.0296+00	5.9917+00	6.1513+00	6.5169+00	6.4003+00	6.2996+00
110.0	1.4372+01	6.5664+00	5.6170+00	5.5834+00	5.7331+00	6.0758+00	5.9683+00	5.8756+00
120.0	1.3466+01	6.1576+00	5.2675+00	5.2374+00	5.3786+00	5.7019+00	5.6020+00	5.5159+00
130.0	1.2689+01	5.8112+00	4.9713+00	4.9439+00	5.0779+00	5.3847+00	5.2913+00	5.2108+00
140.0	1.2034+01	5.5105+00	4.7140+00	4.6890+00	4.8167+00	5.1092+00	5.0213+00	4.9455+00
150.0	1.1457+01	5.2497+00	4.4908+00	4.4678+00	4.5900+00	4.8700+00	4.7869+00	4.7152+00
160.0	1.0947+01	5.0190+00	4.2934+00	4.2721+00	4.3895+00	4.6584+00	4.5795+00	4.5114+00
180.0	1.0075+01	4.6330+00	3.9630+00	3.9444+00	4.0536+00	4.3041+00	4.2321+00	4.1700+00

TABLE A2 COMPUTED PROTON ENERGY LOSSES IN UNITS OF (MEV-CM**2)/GM.

ENERGY	H	HE	LI	BE	B	C	N	O
200.0	9.4089+00	4.3220+00	3.6966+00	3.6799+00	3.7826+00	4.0182+00	3.9517+00	3.8945+00
225.0	8.7189+00	4.0089+00	3.4283+00	3.4136+00	3.5096+00	3.7303+00	3.6694+00	3.6169+00
250.0	8.1646+00	3.7572+00	3.2126+00	3.1992+00	3.2900+00	3.4987+00	3.4422+00	3.3936+00
275.0	7.7145+00	3.5528+00	3.0371+00	3.0249+00	3.1113+00	3.3105+00	3.2575+00	3.2119+00
300.0	7.3309+00	3.3783+00	2.8873+00	2.8759+00	2.9587+00	3.1498+00	3.0998+00	3.0569+00
325.0	7.0122+00	3.2339+00	2.7630+00	2.7522+00	2.8320+00	3.0164+00	2.9690+00	2.9282+00
350.0	6.7376+00	3.1087+00	2.6556+00	2.6454+00	2.7226+00	2.9014+00	2.8561+00	2.8172+00
375.0	6.4988+00	3.0001+00	2.5622+00	2.5523+00	2.6273+00	2.8013+00	2.7579+00	2.7205+00
400.0	6.2895+00	2.9049+00	2.4803+00	2.4707+00	2.5437+00	2.7136+00	2.6718+00	2.6359+00
450.0	5.9471+00	2.7492+00	2.3463+00	2.3369+00	2.4068+00	2.5701+00	2.5310+00	2.4974+00
500.0	5.6733+00	2.6247+00	2.2385+00	2.2297+00	2.2971+00	2.4554+00	2.4184+00	2.3867+00
550.0	5.4553+00	2.5257+00	2.1528+00	2.1441+00	2.2095+00	2.3641+00	2.3290+00	2.2987+00
600.0	5.2765+00	2.4436+00	2.0816+00	2.0729+00	2.1368+00	2.2878+00	2.2548+00	2.2258+00
700.0	4.9945+00	2.3166+00	1.9711+00	1.9622+00	2.0237+00	2.1682+00	2.1404+00	2.1133+00
800.0	4.7942+00	2.2260+00	1.8917+00	1.8826+00	1.9424+00	2.0820+00	2.0589+00	2.0332+00
900.0	4.6452+00	2.1589+00	1.8325+00	1.8230+00	1.8816+00	2.0173+00	1.9987+00	1.9741+00
1000.0	4.5319+00	2.1080+00	1.7872+00	1.7773+00	1.8349+00	1.9677+00	1.9533+00	1.9296+00
1250.0	4.3015+00	2.0277+00	1.7145+00	1.7034+00	1.7595+00	1.8871+00	1.8824+00	1.8602+00
1500.0	4.1483+00	1.9825+00	1.6729+00	1.6597+00	1.7148+00	1.8391+00	1.8434+00	1.8221+00
1750.0	4.1884+00	1.9572+00	1.6468+00	1.6332+00	1.6877+00	1.8098+00	1.8223+00	1.8017+00
2000.0	4.1554+00	1.9440+00	1.6321+00	1.6173+00	1.6713+00	1.7920+00	1.8122+00	1.7921+00
2250.0	4.1458+00	1.9414+00	1.6266+00	1.6108+00	1.6644+00	1.7844+00	1.8116+00	1.7917+00
2500.0	4.1362+00	1.9388+00	1.6212+00	1.6042+00	1.6575+00	1.7768+00	1.8109+00	1.7914+00
2750.0	4.1414+00	1.9428+00	1.6216+00	1.6036+00	1.6566+00	1.7758+00	1.8161+00	1.7967+00
3000.0	4.1466+00	1.9467+00	1.6221+00	1.6030+00	1.6557+00	1.7747+00	1.8212+00	1.8021+00
3500.0	4.1706+00	1.9606+00	1.6284+00	1.6074+00	1.6597+00	1.7790+00	1.8367+00	1.8178+00
4000.0	4.2007+00	1.9771+00	1.6371+00	1.6144+00	1.6664+00	1.7864+00	1.8544+00	1.8357+00
4500.0	4.2341+00	1.9947+00	1.6470+00	1.6227+00	1.6745+00	1.7954+00	1.8728+00	1.8542+00
5000.0	4.2682+00	2.0126+00	1.6573+00	1.6315+00	1.6831+00	1.8051+00	1.8912+00	1.8728+00
6000.0	4.3356+00	2.0475+00	1.6773+00	1.6492+00	1.7005+00	1.8251+00	1.9269+00	1.9087+00
7000.0	4.3997+00	2.0803+00	1.6958+00	1.6658+00	1.7172+00	1.8444+00	1.9604+00	1.9422+00
8000.0	4.4595+00	2.1109+00	1.7126+00	1.6812+00	1.7326+00	1.8625+00	1.9913+00	1.9732+00
9000.0	4.5151+00	2.1392+00	1.7277+00	1.6952+00	1.7468+00	1.8794+00	2.0198+00	2.0017+00
10000.0	4.5667+00	2.1654+00	1.7414+00	1.7081+00	1.7599+00	1.8950+00	2.0462+00	2.0282+00
15000.0	4.7773+00	2.2719+00	1.7938+00	1.7588+00	1.8120+00	1.9574+00	2.1532+00	2.1353+00
20000.0	4.9371+00	2.3526+00	1.8313+00	1.7961+00	1.8505+00	2.0028+00	2.2341+00	2.2163+00
30000.0	5.1682+00	2.4691+00	1.8835+00	1.8487+00	1.9051+00	2.0656+00	2.3508+00	2.3331+00
40000.0	5.3352+00	2.5533+00	1.9203+00	1.8862+00	1.9440+00	2.1094+00	2.4350+00	2.4174+00
50000.0	5.4658+00	2.6191+00	1.9488+00	1.9153+00	1.9743+00	2.1429+00	2.5008+00	2.4832+00
60000.0	5.5728+00	2.6730+00	1.9719+00	1.9390+00	1.9989+00	2.1700+00	2.5539+00	2.5372+00
70000.0	5.6568+00	2.7187+00	1.9914+00	1.9589+00	2.0197+00	2.1928+00	2.5950+00	2.5820+00
80000.0	5.7209+00	2.7582+00	2.0083+00	1.9762+00	2.0377+00	2.2124+00	2.6280+00	2.6177+00
90000.0	5.7725+00	2.7931+00	2.0231+00	1.9914+00	2.0535+00	2.2295+00	2.6557+00	2.6469+00
100000.0	5.8154+00	2.8243+00	2.0363+00	2.0049+00	2.0675+00	2.2448+00	2.6794+00	2.6716+00

TABLE A2 COMPUTED PROTON ENERGY LOSSES IN UNITS OF (MEV-CM**2)/GM.

ENERGY	NE	MG	AL	SI	A	CA	TI	V
0.5	2.8592+02	2.6634+02	2.5592+02	2.6358+02	2.1441+02	2.2935+02	2.0372+02	1.9657+02
0.6	2.5896+02	2.4269+02	2.3322+02	2.3998+02	1.9241+02	2.0671+02	1.8483+02	1.7879+02
0.7	2.3748+02	2.2307+02	2.1441+02	2.2057+02	1.7543+02	1.8843+02	1.6940+02	1.6435+02
0.8	2.1948+02	2.0672+02	1.9862+02	2.0420+02	1.6240+02	1.7355+02	1.5647+02	1.5214+02
0.9	2.0430+02	1.9279+02	1.8522+02	1.9029+02	1.5103+02	1.6139+02	1.4555+02	1.4169+02
1.0	1.9145+02	1.8068+02	1.7372+02	1.7834+02	1.4311+02	1.5131+02	1.3624+02	1.3274+02
2.0	1.2106+02	1.1503+02	1.1030+02	1.1289+02	9.4035+01	9.9991+01	8.8934+01	8.6133+01
3.0	9.0928+01	8.6658+01	8.3115+01	8.4920+01	7.1679+01	7.6818+01	6.8682+01	6.6594+01
4.0	7.3718+01	7.0407+01	6.7550+01	6.8971+01	5.8609+01	6.3022+01	5.6555+01	5.4917+01
5.0	6.2435+01	5.9738+01	5.7320+01	5.8519+01	4.9921+01	5.3821+01	4.8371+01	4.7020+01
6.0	5.4464+01	5.2118+01	5.0039+01	5.1074+01	4.3694+01	4.7176+01	4.2466+01	4.1299+01
7.0	4.8429+01	4.6378+01	4.4550+01	4.5480+01	3.8993+01	4.2139+01	3.7971+01	3.6951+01
8.0	4.3719+01	4.1904+01	4.0231+01	4.1101+01	3.5304+01	3.8177+01	3.4426+01	3.3512+01
9.0	3.9920+01	3.8289+01	3.6767+01	3.7558+01	3.2321+01	3.4975+01	3.1550+01	3.0724+01
10.0	3.6788+01	3.5304+01	3.3912+01	3.4642+01	2.9854+01	3.2326+01	2.9170+01	2.8411+01
12.0	3.1903+01	3.0658+01	2.9452+01	3.0099+01	2.6001+01	2.8183+01	2.5446+01	2.4785+01
14.0	2.8253+01	2.7187+01	2.6132+01	2.6702+01	2.3114+01	2.5076+01	2.2651+01	2.2068+01
16.0	2.5419+01	2.4492+01	2.3546+01	2.4065+01	2.0861+01	2.2651+01	2.0469+01	1.9945+01
18.0	2.3149+01	2.2328+01	2.1474+01	2.1948+01	1.9059+01	2.0697+01	1.8713+01	1.8241+01
20.0	2.1288+01	2.0549+01	1.9773+01	2.0210+01	1.7573+01	1.9089+01	1.7268+01	1.6833+01
22.0	1.9733+01	1.9060+01	1.8347+01	1.8756+01	1.6323+01	1.7741+01	1.6052+01	1.5651+01
24.0	1.8412+01	1.7792+01	1.7132+01	1.7518+01	1.5257+01	1.6595+01	1.5015+01	1.4642+01
26.0	1.7274+01	1.6700+01	1.6085+01	1.6451+01	1.4338+01	1.5602+01	1.4120+01	1.3770+01
28.0	1.6284+01	1.5750+01	1.5172+01	1.5520+01	1.3536+01	1.4734+01	1.3339+01	1.3009+01
30.0	1.5413+01	1.4913+01	1.4369+01	1.4701+01	1.2828+01	1.3970+01	1.2652+01	1.2338+01
35.0	1.3636+01	1.3205+01	1.2726+01	1.3025+01	1.1390+01	1.2403+01	1.1242+01	1.0966+01
40.0	1.2268+01	1.1887+01	1.1460+01	1.1732+01	1.0261+01	1.1188+01	1.0147+01	9.9025+00
45.0	1.1180+01	1.0838+01	1.0452+01	1.0703+01	9.3670+00	1.0219+01	9.2708+00	9.0496+00
50.0	1.0292+01	9.9823+00	9.6281+00	9.8612+00	8.6361+00	9.4249+00	8.5536+00	8.3506+00
55.0	9.5564+00	9.2721+00	8.9447+00	9.1629+00	8.0284+00	8.7648+00	7.9569+00	7.7690+00
60.0	8.9300+00	8.6672+00	8.3625+00	8.5678+00	7.5106+00	8.2014+00	7.4475+00	7.2727+00
65.0	8.3964+00	8.1516+00	7.8661+00	8.0604+00	7.0689+00	7.7203+00	7.0127+00	6.8489+00
70.0	7.9310+00	7.7017+00	7.4330+00	7.6175+00	6.6829+00	7.2998+00	6.6323+00	6.4780+00
75.0	7.5255+00	7.3097+00	7.0554+00	7.2314+00	6.3465+00	6.9330+00	6.3002+00	6.1541+00
80.0	7.1655+00	6.9615+00	6.7200+00	6.8884+00	6.0473+00	6.6069+00	6.0045+00	5.8660+00
90.0	6.5596+00	6.3750+00	6.1551+00	6.3105+00	5.5430+00	6.0572+00	5.5059+00	5.3796+00
100.0	6.0675+00	5.8986+00	5.6960+00	5.8408+00	5.1328+00	5.6098+00	5.1001+00	4.9836+00
110.0	5.6610+00	5.5047+00	5.3165+00	5.4525+00	4.7935+00	5.2397+00	4.7643+00	4.6557+00
120.0	5.3161+00	5.1705+00	4.9943+00	5.1228+00	4.5054+00	4.9253+00	4.4789+00	4.3772+00
130.0	5.0233+00	4.8866+00	4.7207+00	4.8428+00	4.2606+00	4.6580+00	4.2364+00	4.1403+00
140.0	4.7688+00	4.6397+00	4.4827+00	4.5992+00	4.0479+00	4.4254+00	4.0252+00	3.9341+00
150.0	4.5477+00	4.4253+00	4.2760+00	4.3876+00	3.8623+00	4.2233+00	3.8416+00	3.7548+00
160.0	4.3521+00	4.2354+00	4.0929+00	4.2001+00	3.6982+00	4.0442+00	3.6790+00	3.5960+00
180.0	4.0241+00	3.9170+00	3.7859+00	3.8859+00	3.4230+00	3.7437+00	3.4060+00	3.3294+00

TABLE A2 COMPUTED PROTON ENERGY LOSSES IN UNITS OF (MEV-CM**2)/GM.

ENERGY	NE	MG	AL	SI	A	CA	TI	V
200.0	3.7594+00	3.6599+00	3.5379+00	3.6321+00	3.2006+00	3.5007+00	3.1854+00	3.1139+00
225.0	3.4927+00	3.4006+00	3.2879+00	3.3762+00	2.9762+00	3.2555+00	2.9628+00	2.8964+00
250.0	3.2779+00	3.1918+00	3.0866+00	3.1701+00	2.7955+00	3.0579+00	2.7832+00	2.7210+00
275.0	3.1033+00	3.0219+00	2.9227+00	3.0024+00	2.6484+00	2.8971+00	2.6370+00	2.5782+00
300.0	2.9541+00	2.8767+00	2.7828+00	2.8592+00	2.5227+00	2.7595+00	2.5120+00	2.4561+00
325.0	2.8304+00	2.7562+00	2.6665+00	2.7403+00	2.4183+00	2.6453+00	2.4082+00	2.3546+00
350.0	2.7236+00	2.6521+00	2.5662+00	2.6377+00	2.3283+00	2.5467+00	2.3185+00	2.2670+00
375.0	2.6306+00	2.5615+00	2.4789+00	2.5484+00	2.2499+00	2.4609+00	2.2404+00	2.1907+00
400.0	2.5492+00	2.4821+00	2.4023+00	2.4702+00	2.1812+00	2.3856+00	2.1720+00	2.1238+00
450.0	2.4160+00	2.3520+00	2.2770+00	2.3422+00	2.0688+00	2.2624+00	2.0598+00	2.0142+00
500.0	2.3095+00	2.2480+00	2.1768+00	2.2399+00	1.9790+00	2.1638+00	1.9701+00	1.9264+00
550.0	2.2249+00	2.1652+00	2.0971+00	2.1587+00	1.9077+00	2.0854+00	1.8987+00	1.8566+00
600.0	2.1548+00	2.0965+00	2.0310+00	2.0914+00	1.8487+00	2.0205+00	1.8395+00	1.7987+00
700.0	2.0466+00	1.9904+00	1.9289+00	1.9876+00	1.7577+00	1.9202+00	1.7480+00	1.7091+00
800.0	1.9698+00	1.9147+00	1.8562+00	1.9140+00	1.6931+00	1.8489+00	1.6824+00	1.6452+00
900.0	1.9131+00	1.8586+00	1.8024+00	1.8596+00	1.6457+00	1.7963+00	1.6345+00	1.5979+00
1000.0	1.8704+00	1.8162+00	1.7617+00	1.8182+00	1.6101+00	1.7566+00	1.5980+00	1.5620+00
1250.0	1.8042+00	1.7495+00	1.6980+00	1.7532+00	1.5554+00	1.6949+00	1.5406+00	1.5055+00
1500.0	1.7681+00	1.7123+00	1.6624+00	1.7167+00	1.5262+00	1.6610+00	1.5083+00	1.4737+00
1750.0	1.7490+00	1.6918+00	1.6427+00	1.6964+00	1.5114+00	1.6428+00	1.4903+00	1.4558+00
2000.0	1.7403+00	1.6812+00	1.6325+00	1.6859+00	1.5053+00	1.6340+00	1.4809+00	1.4463+00
2250.0	1.7405+00	1.6794+00	1.6306+00	1.6839+00	1.5066+00	1.6332+00	1.4788+00	1.4442+00
2500.0	1.7407+00	1.6776+00	1.6287+00	1.6819+00	1.5079+00	1.6324+00	1.4768+00	1.4420+00
2750.0	1.7463+00	1.6810+00	1.6317+00	1.6851+00	1.5138+00	1.6364+00	1.4794+00	1.4444+00
3000.0	1.7520+00	1.6845+00	1.6346+00	1.6883+00	1.5196+00	1.6405+00	1.4820+00	1.4468+00
3500.0	1.7680+00	1.6958+00	1.6448+00	1.6991+00	1.5351+00	1.6526+00	1.4912+00	1.4556+00
4000.0	1.7860+00	1.7088+00	1.6565+00	1.7119+00	1.5521+00	1.6663+00	1.5023+00	1.4661+00
4500.0	1.8045+00	1.7223+00	1.6686+00	1.7252+00	1.5695+00	1.6806+00	1.5140+00	1.4774+00
5000.0	1.8231+00	1.7356+00	1.6807+00	1.7385+00	1.5867+00	1.6948+00	1.5258+00	1.4889+00
6000.0	1.8589+00	1.7605+00	1.7035+00	1.7637+00	1.6198+00	1.7221+00	1.5490+00	1.5112+00
7000.0	1.8922+00	1.7831+00	1.7243+00	1.7867+00	1.6504+00	1.7473+00	1.5706+00	1.5321+00
8000.0	1.9230+00	1.8034+00	1.7432+00	1.8074+00	1.6786+00	1.7706+00	1.5906+00	1.5515+00
9000.0	1.9514+00	1.8218+00	1.7603+00	1.8261+00	1.7046+00	1.7919+00	1.6090+00	1.5693+00
10000.0	1.9777+00	1.8384+00	1.7760+00	1.8430+00	1.7286+00	1.8115+00	1.6260+00	1.5857+00
15000.0	2.0840+00	1.9039+00	1.8378+00	1.9091+00	1.8255+00	1.8896+00	1.6937+00	1.6513+00
20000.0	2.1643+00	1.9518+00	1.8836+00	1.9571+00	1.8987+00	1.9471+00	1.7431+00	1.6993+00
30000.0	2.2800+00	2.0195+00	1.9483+00	2.0246+00	2.0040+00	2.0263+00	1.8108+00	1.7651+00
40000.0	2.3635+00	2.0676+00	1.9944+00	2.0723+00	2.0800+00	2.0801+00	1.8571+00	1.8103+00
50000.0	2.4288+00	2.1047+00	2.0298+00	2.1090+00	2.1393+00	2.1203+00	1.8920+00	1.8444+00
60000.0	2.4823+00	2.1347+00	2.0585+00	2.1388+00	2.1865+00	2.1522+00	1.9200+00	1.8717+00
70000.0	2.5276+00	2.1599+00	2.0824+00	2.1637+00	2.2250+00	2.1786+00	1.9432+00	1.8944+00
80000.0	2.5668+00	2.1814+00	2.1029+00	2.1850+00	2.2575+00	2.2010+00	1.9632+00	1.9139+00
90000.0	2.6014+00	2.2001+00	2.1208+00	2.2036+00	2.2855+00	2.2205+00	1.9805+00	1.9309+00
100000.0	2.6323+00	2.2167+00	2.1366+00	2.2201+00	2.3102+00	2.2377+00	1.9959+00	1.9460+00

TABLE A2 COMPUTED PROTON ENERGY LOSSES IN UNITS OF (MEV-CM**2)/GM.

ENERGY	CR	MN	FE	CO	NI	CU	ZN	GE
0.5	1.9844+02	1.9060+02	1.9221+02	1.8523+02	1.8909+02	1.7741+02	1.7403+02	1.6275+02
0.6	1.8087+02	1.7436+02	1.7618+02	1.7030+02	1.7437+02	1.6411+02	1.6151+02	1.5116+02
0.7	1.6634+02	1.6089+02	1.6283+02	1.5765+02	1.6174+02	1.5251+02	1.5049+02	1.4117+02
0.8	1.5426+02	1.4950+02	1.5144+02	1.4689+02	1.5089+02	1.4246+02	1.4088+02	1.3238+02
0.9	1.4393+02	1.3975+02	1.4172+02	1.3760+02	1.4153+02	1.3377+02	1.3244+02	1.2464+02
1.0	1.3492+02	1.3126+02	1.3325+02	1.2957+02	1.3338+02	1.2616+02	1.2502+02	1.1782+02
2.0	8.7091+01	8.4692+01	8.5890+01	8.3708+01	8.6471+01	8.2165+01	8.1901+01	7.7590+01
3.0	6.7298+01	6.5441+01	6.6230+01	6.4461+01	6.6464+01	6.3019+01	6.2727+01	5.9254+01
4.0	5.5527+01	5.4089+01	5.4771+01	5.3333+01	5.4990+01	5.2123+01	5.1867+01	4.8928+01
5.0	4.7584+01	4.6405+01	4.7018+01	4.5818+01	4.7274+01	4.4828+01	4.4620+01	4.2110+01
6.0	4.1813+01	4.0807+01	4.1372+01	4.0339+01	4.1642+01	3.9505+01	3.9357+01	3.7161+01
7.0	3.7422+01	3.6536+01	3.7057+01	3.6149+01	3.7338+01	3.5430+01	3.5313+01	3.3373+01
8.0	3.3955+01	3.3169+01	3.3647+01	3.2831+01	3.3914+01	3.2190+01	3.2099+01	3.0354+01
9.0	3.1136+01	3.0426+01	3.0872+01	3.0128+01	3.1131+01	2.9552+01	2.9477+01	2.7923+01
10.0	2.8796+01	2.8148+01	2.8568+01	2.7893+01	2.8827+01	2.7375+01	2.7316+01	2.5870+01
12.0	2.5125+01	2.4572+01	2.4949+01	2.4365+01	2.5190+01	2.3928+01	2.3883+01	2.2635+01
14.0	2.2375+01	2.1883+01	2.2219+01	2.1707+01	2.2451+01	2.1331+01	2.1297+01	2.0191+01
16.0	2.0230+01	1.9784+01	2.0097+01	1.9628+01	2.0301+01	1.9295+01	1.9269+01	1.8277+01
18.0	1.8500+01	1.8100+01	1.8383+01	1.7962+01	1.8573+01	1.7652+01	1.7631+01	1.6732+01
20.0	1.7075+01	1.6707+01	1.6970+01	1.6583+01	1.7154+01	1.6306+01	1.6287+01	1.5455+01
22.0	1.5878+01	1.5538+01	1.5783+01	1.5424+01	1.5957+01	1.5169+01	1.5153+01	1.4380+01
24.0	1.4856+01	1.4540+01	1.4771+01	1.4436+01	1.4935+01	1.4199+01	1.4186+01	1.3464+01
26.0	1.3972+01	1.3678+01	1.3897+01	1.3583+01	1.4053+01	1.3361+01	1.3349+01	1.2672+01
28.0	1.3200+01	1.2924+01	1.3132+01	1.2837+01	1.3283+01	1.2630+01	1.2619+01	1.1980+01
30.0	1.2521+01	1.2259+01	1.2457+01	1.2179+01	1.2603+01	1.1984+01	1.1975+01	1.1370+01
35.0	1.1132+01	1.0896+01	1.1074+01	1.0826+01	1.1206+01	1.0658+01	1.0652+01	1.0117+01
40.0	1.0053+01	9.8450+00	1.0006+01	9.7841+00	1.0127+01	9.6331+00	9.6248+00	9.1444+00
45.0	9.1894+00	9.0013+00	9.1497+00	8.9470+00	9.2620+00	8.8111+00	8.8076+00	8.3658+00
50.0	8.4814+00	8.3094+00	8.4478+00	8.2621+00	8.5528+00	8.1375+00	8.1351+00	7.7313+00
55.0	7.8916+00	7.7327+00	7.8630+00	7.6912+00	7.9629+00	7.5763+00	7.5745+00	7.2001+00
60.0	7.3882+00	7.2402+00	7.3629+00	7.2033+00	7.4587+00	7.0975+00	7.0959+00	6.7459+00
65.0	6.9587+00	6.8199+00	6.9361+00	6.7864+00	7.0281+00	6.6886+00	6.6875+00	6.3571+00
70.0	6.5826+00	6.4519+00	6.5624+00	6.4213+00	6.6504+00	6.3302+00	6.3300+00	6.0180+00
75.0	6.2541+00	6.1305+00	6.2360+00	6.1023+00	6.3205+00	6.0167+00	6.0171+00	5.7221+00
80.0	5.9619+00	5.8445+00	5.9455+00	5.8185+00	6.0269+00	5.7376+00	5.7384+00	5.4581+00
90.0	5.4686+00	5.3615+00	5.4550+00	5.3392+00	5.5312+00	5.2665+00	5.2676+00	5.0115+00
100.0	5.0665+00	4.9681+00	5.0552+00	4.9485+00	5.1270+00	4.8824+00	4.8839+00	4.6473+00
110.0	4.7337+00	4.6419+00	4.7240+00	4.6247+00	4.7920+00	4.5640+00	4.5658+00	4.3454+00
120.0	4.4507+00	4.3648+00	4.4421+00	4.3493+00	4.5070+00	4.2930+00	4.2951+00	4.0885+00
130.0	4.2103+00	4.1290+00	4.2025+00	4.1149+00	4.2644+00	4.0625+00	4.0647+00	3.8697+00
140.0	4.0008+00	3.9239+00	3.9937+00	3.9108+00	4.0531+00	3.8615+00	3.8639+00	3.6791+00
150.0	3.8188+00	3.7453+00	3.8123+00	3.7332+00	3.8693+00	3.6867+00	3.6891+00	3.5131+00
160.0	3.6574+00	3.5872+00	3.6514+00	3.5759+00	3.7063+00	3.5318+00	3.5342+00	3.3659+00
180.0	3.3867+00	3.3217+00	3.3814+00	3.3116+00	3.4327+00	3.2716+00	3.2740+00	3.1187+00

TABLE A2 COMPUTED PROTON ENERGY LOSSES IN UNITS OF (MEV-CM**2)/GM.

ENERGY	CR	MN	FE	CO	NI	CU	ZN	GE
200.0	3.1678+00	3.1071+00	3.1630+00	3.0980+00	3.2114+00	3.0611+00	3.0634+00	2.9186+00
225.0	2.9468+00	2.8904+00	2.9426+00	2.8823+00	2.9880+00	2.8486+00	2.8509+00	2.7165+00
250.0	2.7687+00	2.7157+00	2.7648+00	2.7083+00	2.8078+00	2.6773+00	2.6795+00	2.5535+00
275.0	2.6237+00	2.5735+00	2.6201+00	2.5666+00	2.6610+00	2.5377+00	2.5399+00	2.4207+00
300.0	2.4997+00	2.4518+00	2.4963+00	2.4455+00	2.5355+00	2.4184+00	2.4205+00	2.3072+00
325.0	2.3966+00	2.3507+00	2.3935+00	2.3448+00	2.4313+00	2.3193+00	2.3213+00	2.2129+00
350.0	2.3076+00	2.2634+00	2.3046+00	2.2579+00	2.3412+00	2.2338+00	2.2357+00	2.1315+00
375.0	2.2301+00	2.1874+00	2.2272+00	2.1822+00	2.2628+00	2.1593+00	2.1611+00	2.0606+00
400.0	2.1621+00	2.1207+00	2.1593+00	2.1157+00	2.1939+00	2.0939+00	2.0956+00	1.9984+00
450.0	2.0508+00	2.0114+00	2.0481+00	2.0068+00	2.0812+00	1.9869+00	1.9887+00	1.8966+00
500.0	1.9616+00	1.9240+00	1.9590+00	1.9197+00	1.9909+00	1.9013+00	1.9030+00	1.8153+00
550.0	1.8906+00	1.8544+00	1.8881+00	1.8503+00	1.9190+00	1.8331+00	1.8349+00	1.7505+00
600.0	1.8317+00	1.7967+00	1.8293+00	1.7927+00	1.8594+00	1.7767+00	1.7784+00	1.6969+00
700.0	1.7406+00	1.7074+00	1.7382+00	1.7037+00	1.7671+00	1.6893+00	1.6912+00	1.6142+00
800.0	1.6754+00	1.6436+00	1.6732+00	1.6401+00	1.7013+00	1.6270+00	1.6291+00	1.5553+00
900.0	1.6270+00	1.5964+00	1.6250+00	1.5929+00	1.6525+00	1.5809+00	1.5832+00	1.5119+00
1000.0	1.5904+00	1.5606+00	1.5885+00	1.5573+00	1.6155+00	1.5460+00	1.5486+00	1.4792+00
1250.0	1.5324+00	1.5043+00	1.5310+00	1.5010+00	1.5573+00	1.4912+00	1.4945+00	1.4282+00
1500.0	1.4996+00	1.4726+00	1.4986+00	1.4694+00	1.5247+00	1.4605+00	1.4644+00	1.4000+00
1750.0	1.4810+00	1.4548+00	1.4804+00	1.4517+00	1.5064+00	1.4434+00	1.4480+00	1.3846+00
2000.0	1.4710+00	1.4454+00	1.4707+00	1.4423+00	1.4968+00	1.4345+00	1.4398+00	1.3771+00
2250.0	1.4686+00	1.4433+00	1.4686+00	1.4403+00	1.4947+00	1.4327+00	1.4385+00	1.3762+00
2500.0	1.4661+00	1.4412+00	1.4664+00	1.4382+00	1.4927+00	1.4309+00	1.4374+00	1.3753+00
2750.0	1.4683+00	1.4436+00	1.4688+00	1.4407+00	1.4953+00	1.4335+00	1.4404+00	1.3785+00
3000.0	1.4705+00	1.4460+00	1.4712+00	1.4431+00	1.4978+00	1.4360+00	1.4435+00	1.3817+00
3500.0	1.4791+00	1.4548+00	1.4801+00	1.4519+00	1.5070+00	1.4450+00	1.4533+00	1.3917+00
4000.0	1.4896+00	1.4653+00	1.4909+00	1.4624+00	1.5180+00	1.4556+00	1.4647+00	1.4031+00
4500.0	1.5008+00	1.4765+00	1.5023+00	1.4736+00	1.5297+00	1.4668+00	1.4766+00	1.4151+00
5000.0	1.5123+00	1.4879+00	1.5138+00	1.4850+00	1.5414+00	1.4781+00	1.4885+00	1.4270+00
6000.0	1.5347+00	1.5101+00	1.5364+00	1.5071+00	1.5644+00	1.5000+00	1.5114+00	1.4501+00
7000.0	1.5557+00	1.5309+00	1.5575+00	1.5278+00	1.5858+00	1.5206+00	1.5326+00	1.4714+00
8000.0	1.5752+00	1.5501+00	1.5771+00	1.5469+00	1.6056+00	1.5395+00	1.5521+00	1.4909+00
9000.0	1.5932+00	1.5678+00	1.5951+00	1.5645+00	1.6239+00	1.5569+00	1.5699+00	1.5088+00
10000.0	1.6098+00	1.5841+00	1.6117+00	1.5808+00	1.6407+00	1.5730+00	1.5864+00	1.5251+00
15000.0	1.6761+00	1.6496+00	1.6784+00	1.6461+00	1.7084+00	1.6376+00	1.6521+00	1.5901+00
20000.0	1.7248+00	1.6978+00	1.7278+00	1.6944+00	1.7585+00	1.6856+00	1.7009+00	1.6380+00
30000.0	1.7918+00	1.7645+00	1.7963+00	1.7618+00	1.8285+00	1.7528+00	1.7696+00	1.7055+00
40000.0	1.8377+00	1.8103+00	1.8436+00	1.8083+00	1.8770+00	1.7996+00	1.8177+00	1.7530+00
50000.0	1.8725+00	1.8449+00	1.8791+00	1.8434+00	1.9135+00	1.8348+00	1.8541+00	1.7893+00
60000.0	1.9003+00	1.8725+00	1.9075+00	1.8714+00	1.9427+00	1.8630+00	1.8831+00	1.8185+00
70000.0	1.9235+00	1.8955+00	1.9311+00	1.8947+00	1.9670+00	1.8864+00	1.9071+00	1.8427+00
80000.0	1.9434+00	1.9152+00	1.9513+00	1.9145+00	1.9877+00	1.9063+00	1.9276+00	1.8633+00
90000.0	1.9607+00	1.9323+00	1.9689+00	1.9318+00	2.0057+00	1.9236+00	1.9453+00	1.8811+00
100000.0	1.9761+00	1.9475+00	1.9845+00	1.9472+00	2.0217+00	1.9390+00	1.9610+00	1.8968+00

TABLE A2 COMPUTED PROTON ENERGY LOSSES IN UNITS OF (MEV-CM**2)/GM.

ENERGY	SE	KR	AG	SN	SB	XE	CS	TA
0.5	1.4730+02	1.4032+02	1.2805+02	1.2940+02	1.2318+02	1.1789+02	1.1871+02	1.0187+02
0.6	1.3791+02	1.3096+02	1.1592+02	1.1633+02	1.1096+02	1.0666+02	1.0751+02	9.3674+01
0.7	1.2967+02	1.2324+02	1.0653+02	1.0628+02	1.0186+02	9.7862+01	9.8508+01	8.6675+01
0.8	1.2236+02	1.1650+02	9.9929+01	9.8263+01	9.4627+01	9.1148+01	9.1426+01	8.1076+01
0.9	1.1575+02	1.1055+02	9.4536+01	9.2129+01	8.8589+01	8.5457+01	8.5781+01	7.6566+01
1.0	1.0983+02	1.0523+02	8.9902+01	8.7392+01	8.3956+01	8.0688+01	8.0969+01	7.2526+01
2.0	7.3684+01	7.1563+01	6.3746+01	6.0808+01	5.9199+01	5.6300+01	5.6116+01	5.0034+01
3.0	5.6684+01	5.5379+01	5.0484+01	4.8131+01	4.7073+01	4.5109+01	4.5025+01	3.9526+01
4.0	4.6881+01	4.5807+01	4.2302+01	4.0236+01	3.9541+01	3.7931+01	3.7903+01	3.3447+01
5.0	4.0382+01	3.9529+01	3.6639+01	3.4845+01	3.4310+01	3.2936+01	3.2933+01	2.9280+01
6.0	3.5644+01	3.4960+01	3.2467+01	3.0903+01	3.0461+01	2.9250+01	2.9268+01	2.6160+01
7.0	3.2028+01	3.1439+01	2.9292+01	2.7854+01	2.7482+01	2.6511+01	2.6485+01	2.3713+01
8.0	2.9158+01	2.8637+01	2.6779+01	2.5448+01	2.5111+01	2.4235+01	2.4249+01	2.1738+01
9.0	2.6814+01	2.6352+01	2.4716+01	2.3528+01	2.3195+01	2.2372+01	2.2378+01	2.0106+01
10.0	2.4864+01	2.4441+01	2.2983+01	2.1885+01	2.1587+01	2.0833+01	2.0842+01	1.8735+01
12.0	2.1782+01	2.1422+01	2.0253+01	1.9277+01	1.9049+01	1.8381+01	1.8395+01	1.6602+01
14.0	1.9449+01	1.9142+01	1.8153+01	1.7292+01	1.7089+01	1.6502+01	1.6536+01	1.4929+01
16.0	1.7608+01	1.7349+01	1.6500+01	1.5718+01	1.5538+01	1.5035+01	1.5054+01	1.3600+01
18.0	1.6144+01	1.5898+01	1.5152+01	1.4440+01	1.4282+01	1.3821+01	1.3841+01	1.2528+01
20.0	1.4918+01	1.4699+01	1.4032+01	1.3378+01	1.3234+01	1.2815+01	1.2831+01	1.1652+01
22.0	1.3886+01	1.3686+01	1.3086+01	1.2479+01	1.2348+01	1.1962+01	1.1981+01	1.0902+01
24.0	1.3002+01	1.2817+01	1.2277+01	1.1708+01	1.1587+01	1.1229+01	1.1249+01	1.0251+01
26.0	1.2239+01	1.2081+01	1.1575+01	1.1041+01	1.0927+01	1.0592+01	1.0612+01	9.6830+00
28.0	1.1572+01	1.1424+01	1.0958+01	1.0456+01	1.0349+01	1.0033+01	1.0053+01	9.1892+00
30.0	1.0984+01	1.0844+01	1.0412+01	9.9377+00	9.8382+00	9.5392+00	9.5581+00	8.7463+00
35.0	9.7758+00	9.6539+00	9.2884+00	8.8669+00	8.7814+00	8.5201+00	8.5382+00	7.8290+00
40.0	8.8388+00	8.7303+00	8.4136+00	8.0339+00	7.9576+00	7.7235+00	7.7413+00	7.1104+00
45.0	8.0887+00	7.9913+00	7.7113+00	7.3651+00	7.2964+00	7.0836+00	7.1002+00	6.5314+00
50.0	7.4725+00	7.3854+00	7.1336+00	6.8150+00	6.7527+00	6.5574+00	6.5733+00	6.0537+00
55.0	6.9632+00	6.8794+00	6.6495+00	6.3539+00	6.2982+00	6.1176+00	6.1329+00	5.6539+00
60.0	6.5250+00	6.4468+00	6.2439+00	5.9675+00	5.9075+00	5.7408+00	5.7555+00	5.3108+00
65.0	6.1503+00	6.0803+00	5.8895+00	5.6294+00	5.5797+00	5.4174+00	5.4321+00	5.0162+00
70.0	5.8222+00	5.7569+00	5.5793+00	5.3332+00	5.2880+00	5.1373+00	5.1464+00	4.7577+00
75.0	5.5353+00	5.4741+00	5.3081+00	5.0741+00	5.0316+00	4.8919+00	4.9055+00	4.5311+00
80.0	5.2812+00	5.2221+00	5.0664+00	4.8432+00	4.8032+00	4.6704+00	4.6836+00	4.3291+00
90.0	4.8506+00	4.7975+00	4.6588+00	4.4525+00	4.4166+00	4.2957+00	4.3079+00	3.9902+00
100.0	4.4990+00	4.4509+00	4.3257+00	4.1359+00	4.1026+00	3.9895+00	4.0005+00	3.7117+00
110.0	4.2074+00	4.1632+00	4.0482+00	3.8704+00	3.8412+00	3.7372+00	3.7480+00	3.4777+00
120.0	3.9592+00	3.9182+00	3.8129+00	3.6451+00	3.6174+00	3.5205+00	3.5311+00	3.2806+00
130.0	3.7479+00	3.7096+00	3.6116+00	3.4525+00	3.4278+00	3.3362+00	3.3459+00	3.1107+00
140.0	3.5638+00	3.5278+00	3.4361+00	3.2846+00	3.2618+00	3.1750+00	3.1845+00	2.9626+00
150.0	3.4035+00	3.3696+00	3.2832+00	3.1381+00	3.1172+00	3.0346+00	3.0437+00	2.8336+00
160.0	3.2613+00	3.2293+00	3.1478+00	3.0081+00	2.9887+00	2.9100+00	2.9187+00	2.7184+00
180.0	3.0223+00	2.9934+00	2.9200+00	2.7897+00	2.7728+00	2.7003+00	2.7085+00	2.5246+00

TABLE A2 COMPUTED PROTON ENERGY LOSSES IN UNITS OF (MEV-CM**2)/GM.

ENERGY	SE	KR	AG	SN	SB	XE	CS	TA
200.0	2.8289+00	2.8024+00	2.7353+00	2.6126+00	2.5991+00	2.5305+00	2.5381+00	2.3673+00
225.0	2.6334+00	2.6094+00	2.5486+00	2.4334+00	2.4212+00	2.3589+00	2.3659+00	2.2081+00
250.0	2.4758+00	2.4536+00	2.3979+00	2.2886+00	2.2784+00	2.2202+00	2.2268+00	2.0794+00
275.0	2.3473+00	2.3268+00	2.2750+00	2.1705+00	2.1620+00	2.1072+00	2.1133+00	1.9745+00
300.0	2.2375+00	2.2184+00	2.1698+00	2.0694+00	2.0624+00	2.0105+00	2.0163+00	1.8847+00
325.0	2.1463+00	2.1283+00	2.0824+00	1.9853+00	1.9795+00	1.9301+00	1.9356+00	1.8099+00
350.0	2.0676+00	2.0505+00	2.0068+00	1.9126+00	1.9079+00	1.8607+00	1.8659+00	1.7453+00
375.0	1.9990+00	1.9829+00	1.9410+00	1.8493+00	1.8455+00	1.8002+00	1.8052+00	1.6891+00
400.0	1.9388+00	1.9235+00	1.8833+00	1.7937+00	1.7908+00	1.7472+00	1.7519+00	1.6397+00
450.0	1.8404+00	1.8265+00	1.7888+00	1.7026+00	1.7012+00	1.6604+00	1.6646+00	1.5588+00
500.0	1.7618+00	1.7489+00	1.7132+00	1.6297+00	1.6296+00	1.5911+00	1.5949+00	1.4941+00
550.0	1.6993+00	1.6874+00	1.6531+00	1.5717+00	1.5726+00	1.5361+00	1.5395+00	1.4426+00
600.0	1.6475+00	1.6365+00	1.6033+00	1.5237+00	1.5255+00	1.4906+00	1.4937+00	1.3999+00
700.0	1.5678+00	1.5582+00	1.5265+00	1.4495+00	1.4529+00	1.4207+00	1.4231+00	1.3340+00
800.0	1.5112+00	1.5028+00	1.4719+00	1.3968+00	1.4014+00	1.3715+00	1.3732+00	1.2872+00
900.0	1.4696+00	1.4623+00	1.4317+00	1.3580+00	1.3636+00	1.3355+00	1.3366+00	1.2527+00
1000.0	1.4384+00	1.4321+00	1.4015+00	1.3289+00	1.3353+00	1.3088+00	1.3094+00	1.2268+00
1250.0	1.3904+00	1.3862+00	1.3549+00	1.2837+00	1.2919+00	1.2687+00	1.2679+00	1.1870+00
1500.0	1.3645+00	1.3625+00	1.3296+00	1.2594+00	1.2688+00	1.2485+00	1.2464+00	1.1658+00
1750.0	1.3512+00	1.3512+00	1.3165+00	1.2468+00	1.2571+00	1.2394+00	1.2360+00	1.1550+00
2000.0	1.3453+00	1.3474+00	1.3107+00	1.2413+00	1.2523+00	1.2370+00	1.2324+00	1.1506+00
2250.0	1.3457+00	1.3500+00	1.3111+00	1.2418+00	1.2533+00	1.2403+00	1.2345+00	1.1515+00
2500.0	1.3461+00	1.3525+00	1.3115+00	1.2424+00	1.2544+00	1.2436+00	1.2366+00	1.1524+00
2750.0	1.3502+00	1.3589+00	1.3157+00	1.2466+00	1.2589+00	1.2502+00	1.2421+00	1.1566+00
3000.0	1.3544+00	1.3653+00	1.3199+00	1.2509+00	1.2634+00	1.2567+00	1.2476+00	1.1607+00
3500.0	1.3656+00	1.3811+00	1.3314+00	1.2625+00	1.2752+00	1.2725+00	1.2614+00	1.1717+00
4000.0	1.3779+00	1.3981+00	1.3441+00	1.2752+00	1.2881+00	1.2892+00	1.2760+00	1.1838+00
4500.0	1.3904+00	1.4152+00	1.3571+00	1.2883+00	1.3012+00	1.3059+00	1.2908+00	1.1961+00
5000.0	1.4027+00	1.4320+00	1.3700+00	1.3013+00	1.3141+00	1.3223+00	1.3052+00	1.2082+00
6000.0	1.4260+00	1.4641+00	1.3946+00	1.3261+00	1.3387+00	1.3533+00	1.3326+00	1.2312+00
7000.0	1.4474+00	1.4936+00	1.4172+00	1.3489+00	1.3612+00	1.3818+00	1.3575+00	1.2524+00
8000.0	1.4668+00	1.5208+00	1.4378+00	1.3698+00	1.3818+00	1.4079+00	1.3802+00	1.2717+00
9000.0	1.4845+00	1.5457+00	1.4566+00	1.3890+00	1.4006+00	1.4319+00	1.4008+00	1.2894+00
10000.0	1.5006+00	1.5687+00	1.4737+00	1.4065+00	1.4178+00	1.4540+00	1.4196+00	1.3055+00
15000.0	1.5642+00	1.6614+00	1.5405+00	1.4764+00	1.4858+00	1.5430+00	1.4933+00	1.3693+00
20000.0	1.6109+00	1.7313+00	1.5885+00	1.5278+00	1.5353+00	1.6099+00	1.5469+00	1.4161+00
30000.0	1.6763+00	1.8318+00	1.6543+00	1.5993+00	1.6032+00	1.7062+00	1.6212+00	1.4813+00
40000.0	1.7223+00	1.9043+00	1.6998+00	1.6479+00	1.6497+00	1.7747+00	1.6729+00	1.5268+00
50000.0	1.7574+00	1.9603+00	1.7344+00	1.6846+00	1.6847+00	1.8272+00	1.7120+00	1.5613+00
60000.0	1.7856+00	2.0051+00	1.7622+00	1.7138+00	1.7126+00	1.8695+00	1.7431+00	1.5888+00
70000.0	1.8091+00	2.0423+00	1.7853+00	1.7380+00	1.7357+00	1.9049+00	1.7688+00	1.6116+00
80000.0	1.8290+00	2.0741+00	1.8049+00	1.7585+00	1.7555+00	1.9352+00	1.7905+00	1.6310+00
90000.0	1.8463+00	2.1017+00	1.8221+00	1.7763+00	1.7726+00	1.9616+00	1.8093+00	1.6478+00
100000.0	1.8615+00	2.1262+00	1.8372+00	1.7920+00	1.7878+00	1.9850+00	1.8258+00	1.6626+00

TABLE A2 COMPUTED PROTON ENERGY LOSSES IN UNITS OF (MEV-CM**2)/GM.

ENERGY	W	PT	AU	HG	PB	BI	U	CO2
0.5	1.0149+02	9.3800+01	9.0926+01	8.9057+01	8.6467+01	8.5967+01	7.7260+01	3.3225+02
0.6	9.3471+01	8.7700+01	8.5129+01	8.3194+01	8.0110+01	7.9617+01	7.0938+01	2.9716+02
0.7	8.6474+01	8.1972+01	7.9976+01	7.8172+01	7.5076+01	7.4528+01	6.6421+01	2.6977+02
0.8	8.0827+01	7.7206+01	7.5985+01	7.4332+01	7.1496+01	7.0994+01	6.2780+01	2.4774+02
0.9	7.6103+01	7.3227+01	7.1871+01	7.0401+01	6.7596+01	6.7044+01	5.9541+01	2.2947+02
1.0	7.2319+01	6.9481+01	6.8348+01	6.7036+01	6.4369+01	6.3821+01	5.6634+01	2.1404+02
2.0	4.9796+01	4.8227+01	4.7648+01	4.7108+01	4.5903+01	4.5692+01	4.0878+01	1.3281+02
3.0	3.9305+01	3.8391+01	3.8125+01	3.7599+01	3.6837+01	3.6702+01	3.3605+01	9.9029+01
4.0	3.3237+01	3.2402+01	3.2319+01	3.1955+01	3.1158+01	3.1100+01	2.8723+01	7.9974+01
5.0	2.9095+01	2.8356+01	2.8279+01	2.7989+01	2.7501+01	2.7370+01	2.5276+01	6.7513+01
6.0	2.5999+01	2.5361+01	2.5300+01	2.5043+01	2.4609+01	2.4586+01	2.2680+01	5.8673+01
7.0	2.3571+01	2.3018+01	2.2970+01	2.2742+01	2.2357+01	2.2340+01	2.0696+01	5.2052+01
8.0	2.1611+01	2.1121+01	2.1084+01	2.0880+01	2.0537+01	2.0525+01	1.9089+01	4.6881+01
9.0	1.9990+01	1.9552+01	1.9523+01	1.9338+01	1.9029+01	1.9021+01	1.7737+01	4.2722+01
10.0	1.8623+01	1.8228+01	1.8205+01	1.8036+01	1.7755+01	1.7751+01	1.6685+01	3.9301+01
12.0	1.6507+01	1.6143+01	1.6090+01	1.5955+01	1.5715+01	1.5716+01	1.4809+01	3.3989+01
14.0	1.4845+01	1.4543+01	1.4533+01	1.4405+01	1.4178+01	1.4145+01	1.3362+01	3.0046+01
16.0	1.3525+01	1.3256+01	1.3249+01	1.3133+01	1.2946+01	1.2951+01	1.2207+01	2.6994+01
18.0	1.2455+01	1.2206+01	1.2201+01	1.2095+01	1.1925+01	1.1931+01	1.1257+01	2.4554+01
20.0	1.1587+01	1.1352+01	1.1328+01	1.1231+01	1.1074+01	1.1081+01	1.0502+01	2.2557+01
22.0	1.0841+01	1.0619+01	1.0613+01	1.0520+01	1.0370+01	1.0357+01	9.8239+00	2.0890+01
24.0	1.0194+01	9.9927+00	9.9873+00	9.8946+00	9.7564+00	9.7610+00	9.2396+00	1.9476+01
26.0	9.6353+00	9.4429+00	9.4394+00	9.3577+00	9.2268+00	9.2256+00	8.7266+00	1.8260+01
28.0	9.1396+00	8.9639+00	8.9551+00	8.8795+00	8.7563+00	8.7614+00	8.2985+00	1.7203+01
30.0	8.6994+00	8.5344+00	8.5324+00	8.4595+00	8.3376+00	8.3439+00	7.9057+00	1.6274+01
35.0	7.7880+00	7.6443+00	7.6436+00	7.5793+00	7.4770+00	7.4827+00	7.0962+00	1.4381+01
40.0	7.0737+00	6.9463+00	6.9465+00	6.8888+00	6.7974+00	6.8033+00	6.4606+00	1.2926+01
45.0	6.4982+00	6.3829+00	6.3837+00	6.3312+00	6.2484+00	6.2545+00	5.9440+00	1.1770+01
50.0	6.0234+00	5.9182+00	5.9194+00	5.8710+00	5.7950+00	5.8010+00	5.5168+00	1.0828+01
55.0	5.6258+00	5.5287+00	5.5302+00	5.4853+00	5.4149+00	5.4209+00	5.1580+00	1.0048+01
60.0	5.2846+00	5.1944+00	5.1960+00	5.1541+00	5.0885+00	5.0944+00	4.8494+00	9.3845+00
65.0	4.9917+00	4.9074+00	4.9091+00	4.8697+00	4.8081+00	4.8139+00	4.5840+00	8.8196+00
70.0	4.7346+00	4.6553+00	4.6572+00	4.6199+00	4.5618+00	4.5676+00	4.3507+00	8.3273+00
75.0	4.5092+00	4.4344+00	4.4363+00	4.4009+00	4.3459+00	4.3515+00	4.1460+00	7.8986+00
80.0	4.3082+00	4.2372+00	4.2392+00	4.2055+00	4.1531+00	4.1586+00	3.9632+00	7.5182+00
90.0	3.9705+00	3.9070+00	3.9033+00	3.8726+00	3.8264+00	3.8317+00	3.6529+00	6.8782+00
100.0	3.6943+00	3.6353+00	3.6374+00	3.6089+00	3.5648+00	3.5701+00	3.4025+00	6.3589+00
110.0	3.4614+00	3.4068+00	3.4091+00	3.3824+00	3.3413+00	3.3464+00	3.1923+00	5.9302+00
120.0	3.2653+00	3.2141+00	3.2163+00	3.1912+00	3.1527+00	3.1555+00	3.0106+00	5.5667+00
130.0	3.0959+00	3.0478+00	3.0499+00	3.0262+00	2.9898+00	2.9946+00	2.8575+00	5.2582+00
140.0	2.9490+00	2.9035+00	2.9056+00	2.8822+00	2.8474+00	2.8523+00	2.7218+00	4.9902+00
150.0	2.8205+00	2.7768+00	2.7789+00	2.7574+00	2.7245+00	2.7291+00	2.6034+00	4.7575+00
160.0	2.7061+00	2.6651+00	2.6673+00	2.6467+00	2.6152+00	2.6197+00	2.4991+00	4.5516+00
180.0	2.5131+00	2.4756+00	2.4777+00	2.4587+00	2.4297+00	2.4341+00	2.3227+00	4.2066+00

TABLE A2 COMPUTED PROTON ENERGY LOSSES IN UNITS OF (MEV-CM**2)/GM.

ENERGY	W	PT	AU	HG	PB	BI	U	CO2
200.0	2.1567+00	2.3219+00	2.3240+00	2.3061+00	2.2791+00	2.2834+00	2.1790+00	3.9283+00
225.0	2.1982+00	2.1663+00	2.1683+00	2.1517+00	2.1266+00	2.1308+00	2.0333+00	3.6479+00
250.0	2.0701+00	2.0405+00	2.0425+00	2.0269+00	2.0034+00	2.0075+00	1.9154+00	3.4223+00
275.0	1.9657+00	1.9378+00	1.9398+00	1.9250+00	1.9028+00	1.9069+00	1.8192+00	3.2388+00
300.0	1.8763+00	1.8500+00	1.8520+00	1.8379+00	1.8167+00	1.8207+00	1.7368+00	3.0822+00
325.0	1.8018+00	1.7770+00	1.7789+00	1.7654+00	1.7451+00	1.7491+00	1.6682+00	2.9523+00
350.0	1.7375+00	1.7138+00	1.7157+00	1.7027+00	1.6832+00	1.6872+00	1.6089+00	2.8401+00
375.0	1.6815+00	1.6587+00	1.6607+00	1.6481+00	1.6293+00	1.6333+00	1.5572+00	2.7426+00
400.0	1.6323+00	1.6105+00	1.6124+00	1.6002+00	1.5820+00	1.5860+00	1.5119+00	2.6571+00
450.0	1.5517+00	1.5314+00	1.5334+00	1.5218+00	1.5045+00	1.5086+00	1.4377+00	2.5172+00
500.0	1.4871+00	1.4681+00	1.4701+00	1.4592+00	1.4426+00	1.4468+00	1.3783+00	2.4054+00
550.0	1.4358+00	1.4178+00	1.4199+00	1.4094+00	1.3934+00	1.3977+00	1.3312+00	2.3166+00
600.0	1.3931+00	1.3761+00	1.3783+00	1.3682+00	1.3528+00	1.3571+00	1.2922+00	2.2430+00
700.0	1.3273+00	1.3117+00	1.3141+00	1.3049+00	1.2902+00	1.2947+00	1.2322+00	2.1293+00
800.0	1.2804+00	1.2660+00	1.2687+00	1.2600+00	1.2459+00	1.2507+00	1.1899+00	2.0484+00
900.0	1.2459+00	1.2324+00	1.2354+00	1.2272+00	1.2135+00	1.2184+00	1.1590+00	1.9886+00
1000.0	1.2200+00	1.2073+00	1.2105+00	1.2028+00	1.1894+00	1.1944+00	1.1360+00	1.9436+00
1250.0	1.1801+00	1.1687+00	1.1725+00	1.1657+00	1.1530+00	1.1582+00	1.1014+00	1.8733+00
1500.0	1.1587+00	1.1481+00	1.1526+00	1.1465+00	1.1342+00	1.1396+00	1.0837+00	1.8347+00
1750.0	1.1479+00	1.1378+00	1.1427+00	1.1373+00	1.1255+00	1.1310+00	1.0756+00	1.8139+00
2000.0	1.1432+00	1.1335+00	1.1390+00	1.1342+00	1.1227+00	1.1283+00	1.0732+00	1.8040+00
2250.0	1.1440+00	1.1345+00	1.1403+00	1.1360+00	1.1249+00	1.1306+00	1.0756+00	1.8035+00
2500.0	1.1488+00	1.1354+00	1.1417+00	1.1379+00	1.1271+00	1.1330+00	1.0780+00	1.8029+00
2750.0	1.1439+00	1.1396+00	1.1461+00	1.1427+00	1.1323+00	1.1383+00	1.0832+00	1.8082+00
3000.0	1.1530+00	1.1437+00	1.1505+00	1.1475+00	1.1375+00	1.1435+00	1.0884+00	1.8134+00
3500.0	1.1638+00	1.1544+00	1.1617+00	1.1594+00	1.1500+00	1.1564+00	1.1010+00	1.8290+00
4000.0	1.1757+00	1.1662+00	1.1738+00	1.1721+00	1.1633+00	1.1699+00	1.1142+00	1.8467+00
4500.0	1.1878+00	1.1782+00	1.1860+00	1.1848+00	1.1765+00	1.1834+00	1.1274+00	1.8652+00
5000.0	1.1998+00	1.1900+00	1.1981+00	1.1971+00	1.1894+00	1.1966+00	1.1403+00	1.8837+00
6000.0	1.2226+00	1.2125+00	1.2209+00	1.2205+00	1.2137+00	1.2213+00	1.1644+00	1.9195+00
7000.0	1.2436+00	1.2331+00	1.2418+00	1.2419+00	1.2356+00	1.2437+00	1.1863+00	1.9530+00
8000.0	1.2628+00	1.2520+00	1.2609+00	1.2613+00	1.2555+00	1.2640+00	1.2061+00	1.9839+00
9000.0	1.2803+00	1.2692+00	1.2782+00	1.2790+00	1.2736+00	1.2824+00	1.2241+00	2.0125+00
10000.0	1.2963+00	1.2850+00	1.2942+00	1.2951+00	1.2900+00	1.2991+00	1.2405+00	2.0389+00
15000.0	1.3598+00	1.3474+00	1.3570+00	1.3590+00	1.3547+00	1.3647+00	1.3043+00	2.1460+00
20000.0	1.4063+00	1.3932+00	1.4030+00	1.4056+00	1.4018+00	1.4124+00	1.3504+00	2.2269+00
30000.0	1.4712+00	1.4571+00	1.4672+00	1.4705+00	1.4672+00	1.4785+00	1.4137+00	2.3436+00
40000.0	1.5164+00	1.5016+00	1.5120+00	1.5158+00	1.5127+00	1.5244+00	1.4576+00	2.4279+00
50000.0	1.5508+00	1.5355+00	1.5460+00	1.5502+00	1.5472+00	1.5593+00	1.4908+00	2.4937+00
60000.0	1.5783+00	1.5626+00	1.5732+00	1.5778+00	1.5750+00	1.5873+00	1.5174+00	2.5477+00
70000.0	1.6010+00	1.5850+00	1.5957+00	1.6006+00	1.5979+00	1.6105+00	1.5394+00	2.5934+00
80000.0	1.6203+00	1.6041+00	1.6149+00	1.6201+00	1.6175+00	1.6303+00	1.5582+00	2.6329+00
90000.0	1.6371+00	1.6207+00	1.6315+00	1.6369+00	1.6345+00	1.6474+00	1.5744+00	2.6678+00
100000.0	1.6518+00	1.6353+00	1.6461+00	1.6518+00	1.6494+00	1.6625+00	1.5888+00	2.6990+00

TABLE A2 COMPUTED PROTON ENERGY LOSSES IN UNITS OF (MEV-CM**2)/GM.

ENERGY	H2O2	AIR	H2O	TISSUE	(CH2)N	GLASS	EMULSION	NAI
0.5	3.6029+02	3.3524+02	4.0153+02	4.0394+02	4.5724+02	2.4762+02	1.7847+02	1.4273+02
0.6	3.2201+02	2.9946+02	3.5760+02	3.5935+02	4.0440+02	2.2320+02	1.6219+02	1.2918+02
0.7	2.9193+02	2.7165+02	3.2332+02	3.2479+02	3.6436+02	2.0377+02	1.4927+02	1.1855+02
0.8	2.6777+02	2.4903+02	2.9588+02	2.9714+02	3.3249+02	1.8797+02	1.3919+02	1.1003+02
0.9	2.4781+02	2.3047+02	2.7331+02	2.7437+02	3.0625+02	1.7504+02	1.3070+02	1.0302+02
1.0	2.3090+02	2.1504+02	2.5425+02	2.5524+02	2.8449+02	1.6430+02	1.2339+02	9.7170+01
2.0	1.4244+02	1.3338+02	1.5541+02	1.5592+02	1.7211+02	1.0619+02	8.2210+01	6.6375+01
3.0	1.0596+02	9.9463+01	1.1510+02	1.1540+02	1.2663+02	8.0547+01	6.3272+01	5.2243+01
4.0	8.5464+01	8.0260+01	9.2574+01	9.2760+01	1.0138+02	6.5673+01	5.2186+01	4.3522+01
5.0	7.2102+01	6.7740+01	7.7954+01	7.8071+01	8.5051+01	5.5851+01	4.4760+01	3.7540+01
6.0	6.2631+01	5.8854+01	6.7621+01	6.7698+01	7.3583+01	4.8823+01	3.9384+01	3.3282+01
7.0	5.5544+01	5.2195+01	5.9905+01	5.9955+01	6.5046+01	4.3526+01	3.5309+01	2.9955+01
8.0	5.0007+01	4.6999+01	5.3888+01	5.3925+01	5.8436+01	3.9370+01	3.2091+01	2.7294+01
9.0	4.5560+01	4.2827+01	4.9062+01	4.9086+01	5.3130+01	3.6013+01	2.9477+01	2.5145+01
10.0	4.1904+01	3.9392+01	4.5038+01	4.5113+01	4.8782+01	3.3241+01	2.7298+01	2.3358+01
12.0	3.6229+01	3.4071+01	3.8954+01	3.8958+01	4.2059+01	2.8915+01	2.3881+01	2.0526+01
14.0	3.2018+01	3.0114+01	3.4401+01	3.4398+01	3.7089+01	2.5679+01	2.1297+01	1.8373+01
16.0	2.8761+01	2.7051+01	3.0883+01	3.0874+01	3.3254+01	2.3158+01	1.9273+01	1.6691+01
18.0	2.6157+01	2.4605+01	2.8073+01	2.8062+01	3.0199+01	2.1134+01	1.7638+01	1.5310+01
20.0	2.4027+01	2.2602+01	2.5776+01	2.5762+01	2.7704+01	1.9474+01	1.6285+01	1.4171+01
22.0	2.2249+01	2.0931+01	2.3860+01	2.3844+01	2.5626+01	1.8083+01	1.5154+01	1.3207+01
24.0	2.0741+01	1.9513+01	2.2235+01	2.2219+01	2.3866+01	1.6897+01	1.4185+01	1.2381+01
26.0	1.9444+01	1.8294+01	2.0840+01	2.0823+01	2.2355+01	1.5873+01	1.3346+01	1.1665+01
28.0	1.8317+01	1.7234+01	1.9627+01	1.9609+01	2.1043+01	1.4980+01	1.2613+01	1.1038+01
30.0	1.7328+01	1.6304+01	1.8562+01	1.8545+01	1.9893+01	1.4194+01	1.1966+01	1.0485+01
35.0	1.5310+01	1.4406+01	1.6392+01	1.6375+01	1.7550+01	1.2583+01	1.0640+01	9.3451+00
40.0	1.3759+01	1.2947+01	1.4726+01	1.4708+01	1.5753+01	1.1340+01	9.6117+00	8.4570+00
45.0	1.2527+01	1.1789+01	1.3403+01	1.3386+01	1.4328+01	1.0348+01	8.7899+00	7.7459+00
50.0	1.1524+01	1.0845+01	1.2326+01	1.2309+01	1.3169+01	9.5378+00	8.1163+00	7.1620+00
55.0	1.0693+01	1.0064+01	1.1434+01	1.1418+01	1.2210+01	8.8644+00	7.5543+00	6.6750+00
60.0	9.9864+00	9.3986+00	1.0676+01	1.0660+01	1.1396+01	8.2902+00	7.0799+00	6.2582+00
65.0	9.3847+00	8.8327+00	1.0031+01	1.0015+01	1.0703+01	7.8007+00	6.6702+00	5.8999+00
70.0	8.8604+00	8.3394+00	9.4688+00	9.4537+00	1.0099+01	7.3733+00	6.3121+00	5.5937+00
75.0	8.4039+00	7.9099+00	8.9795+00	8.9648+00	9.5742+00	7.0005+00	5.9992+00	5.3200+00
80.0	7.9988+00	7.5287+00	8.5454+00	8.5310+00	9.1086+00	6.6694+00	5.7208+00	5.0763+00
90.0	7.3174+00	6.8876+00	7.8153+00	7.8016+00	8.3261+00	6.1113+00	5.2520+00	4.6644+00
100.0	6.7645+00	6.3674+00	7.2232+00	7.2101+00	7.6918+00	5.6576+00	4.8695+00	4.3296+00
110.0	6.3081+00	5.9380+00	6.7345+00	6.7219+00	7.1686+00	5.2824+00	4.5520+00	4.0514+00
120.0	5.9211+00	5.5738+00	6.3202+00	6.3081+00	6.7252+00	4.9638+00	4.2825+00	3.8136+00
130.0	5.5928+00	5.2649+00	5.9688+00	5.9572+00	6.3493+00	4.6932+00	4.0529+00	3.6120+00
140.0	5.3074+00	4.9964+00	5.6635+00	5.6522+00	6.0228+00	4.4578+00	3.8528+00	3.4357+00
150.0	5.0598+00	4.7633+00	5.3985+00	5.3876+00	5.7396+00	4.2532+00	3.6788+00	3.2822+00
160.0	4.8406+00	4.5570+00	5.1641+00	5.1534+00	5.4890+00	4.0720+00	3.5245+00	3.1462+00
180.0	4.4735+00	4.2116+00	4.7714+00	4.7613+00	5.0695+00	3.7681+00	3.2655+00	2.9173+00

TABLE A2 COMPUTED PROTON ENERGY LOSSES IN UNITS OF (MEV-CM**2)/GM.

ENERGY	F2C2	AIR	H2L	TISSUE	(CH2)N	GLASS	EMULSION	NAI
200.0	4.1773+00	3.9328+00	4.4546+00	4.4450+00	4.7312+00	3.5225+00	3.0559+00	2.7322+00
225.0	3.8789+00	3.6520+00	4.1356+00	4.1264+00	4.3906+00	3.2749+00	2.8443+00	2.5451+00
250.0	3.6388+00	3.4260+00	3.8790+00	3.8702+00	4.1167+00	3.0754+00	2.6736+00	2.3941+00
275.0	3.4437+00	3.2423+00	3.6704+00	3.6619+00	3.8942+00	2.9131+00	2.5346+00	2.2711+00
300.0	3.2770+00	3.0855+00	3.4922+00	3.4840+00	3.7041+00	2.7745+00	2.4158+00	2.1658+00
325.0	3.1387+00	2.9553+00	3.3445+00	3.3365+00	3.5465+00	2.6594+00	2.3171+00	2.0784+00
350.0	3.0194+00	2.8430+00	3.2170+00	3.2092+00	3.4106+00	2.5601+00	2.2318+00	2.0029+00
375.0	2.9156+00	2.7453+00	3.1060+00	3.0985+00	3.2923+00	2.4736+00	2.1577+00	1.9371+00
400.0	2.8246+00	2.6597+00	3.0088+00	3.0014+00	3.1886+00	2.3978+00	2.0926+00	1.8795+00
450.0	2.6758+00	2.5197+00	2.8498+00	2.8426+00	3.0190+00	2.2738+00	1.9863+00	1.7851+00
500.0	2.5569+00	2.4077+00	2.7227+00	2.7157+00	2.8834+00	2.1744+00	1.9013+00	1.7098+00
550.0	2.4623+00	2.3187+00	2.6216+00	2.6148+00	2.7756+00	2.0952+00	1.8338+00	1.6499+00
600.0	2.3840+00	2.2450+00	2.5379+00	2.5312+00	2.6862+00	2.0296+00	1.7780+00	1.6003+00
700.0	2.2630+00	2.1311+00	2.4085+00	2.4021+00	2.5480+00	1.9281+00	1.6919+00	1.5239+00
800.0	2.1769+00	2.0501+00	2.3164+00	2.3101+00	2.4484+00	1.8555+00	1.6308+00	1.4699+00
900.0	2.1133+00	1.9903+00	2.2483+00	2.2421+00	2.3735+00	1.8017+00	1.5856+00	1.4302+00
1000.0	2.0650+00	1.9452+00	2.1969+00	2.1906+00	2.3160+00	1.7609+00	1.5516+00	1.4005+00
1250.0	1.9866+00	1.8747+00	2.1142+00	2.1068+00	2.2221+00	1.6963+00	1.4985+00	1.3550+00
1500.0	1.9401+00	1.8359+00	2.0652+00	2.0572+00	2.1657+00	1.6598+00	1.4692+00	1.3308+00
1750.0	1.9119+00	1.8151+00	2.0356+00	2.0272+00	2.1310+00	1.6391+00	1.4534+00	1.3186+00
2000.0	1.8948+00	1.8051+00	2.0177+00	2.0089+00	2.1094+00	1.6280+00	1.4456+00	1.3136+00
2250.0	1.8876+00	1.8046+00	2.0101+00	2.0012+00	2.0997+00	1.6252+00	1.4449+00	1.3147+00
2500.0	1.8804+00	1.8040+00	2.0026+00	1.9935+00	2.0900+00	1.6225+00	1.4441+00	1.3158+00
2750.0	1.8795+00	1.8092+00	2.0018+00	1.9925+00	2.0880+00	1.6249+00	1.4476+00	1.3204+00
3000.0	1.8787+00	1.8144+00	2.0009+00	1.9916+00	2.0860+00	1.6274+00	1.4512+00	1.3251+00
3500.0	1.8832+00	1.8300+00	2.0056+00	1.9961+00	2.0894+00	1.6369+00	1.4619+00	1.3373+00
4000.0	1.8908+00	1.8476+00	2.0134+00	2.0039+00	2.0967+00	1.6484+00	1.4741+00	1.3504+00
4500.0	1.8999+00	1.8661+00	2.0228+00	2.0133+00	2.1058+00	1.6607+00	1.4868+00	1.3637+00
5000.0	1.9097+00	1.8845+00	2.0329+00	2.0234+00	2.1159+00	1.6732+00	1.4995+00	1.3768+00
6000.0	1.9298+00	1.9203+00	2.0537+00	2.0443+00	2.1371+00	1.6975+00	1.5239+00	1.4016+00
7000.0	1.9495+00	1.9537+00	2.0740+00	2.0646+00	2.1579+00	1.7201+00	1.5464+00	1.4243+00
8000.0	1.9681+00	1.9846+00	2.0933+00	2.0839+00	2.1777+00	1.7409+00	1.5670+00	1.4449+00
9000.0	1.9855+00	2.0131+00	2.1113+00	2.1019+00	2.1962+00	1.7600+00	1.5859+00	1.4638+00
10000.0	2.0017+00	2.0395+00	2.1280+00	2.1187+00	2.2135+00	1.7775+00	1.6031+00	1.4810+00
15000.0	2.0682+00	2.1464+00	2.1969+00	2.1874+00	2.2837+00	1.8467+00	1.6714+00	1.5493+00
20000.0	2.1184+00	2.2272+00	2.2490+00	2.2392+00	2.3360+00	1.8969+00	1.7211+00	1.5993+00
30000.0	2.1897+00	2.3438+00	2.3235+00	2.3127+00	2.4089+00	1.9662+00	1.7899+00	1.6688+00
40000.0	2.2398+00	2.4280+00	2.3761+00	2.3645+00	2.4597+00	2.0141+00	1.8376+00	1.7168+00
50000.0	2.2779+00	2.4938+00	2.4163+00	2.4040+00	2.4985+00	2.0506+00	1.8738+00	1.7529+00
60000.0	2.3084+00	2.5472+00	2.4485+00	2.4357+00	2.5298+00	2.0799+00	1.9029+00	1.7817+00
70000.0	2.3338+00	2.5889+00	2.4754+00	2.4621+00	2.5560+00	2.1044+00	1.9270+00	1.8055+00
80000.0	2.3554+00	2.6223+00	2.4983+00	2.4847+00	2.5786+00	2.1254+00	1.9477+00	1.8258+00
90000.0	2.3743+00	2.6503+00	2.5182+00	2.5043+00	2.5983+00	2.1437+00	1.9656+00	1.8433+00
100000.0	2.3910+00	2.6742+00	2.5358+00	2.5218+00	2.6158+00	2.1599+00	1.9815+00	1.8588+00

TABLE A2 COMPUTED PROTON ENERGY LOSSES IN UNITS OF (MEV-CM**2)/GM.

ENERGY	ICNE	ANTHRACENE	STILBENE	MYLAR	LUCITE	POLYSTYRENE	TEFLON
0.5	3.5802+02	3.9590+02	4.0340+02	3.7283+02	4.0015+02	4.1106+02	3.0558+02
0.6	3.1935+02	3.5122+02	3.5772+02	3.3180+02	3.5547+02	3.6434+02	2.7441+02
0.7	2.8929+02	3.1736+02	3.2311+02	3.0033+02	3.2125+02	3.2895+02	2.5007+02
0.8	2.6514+02	2.9032+02	2.9547+02	2.7512+02	2.9389+02	3.0071+02	2.3024+02
0.9	2.4520+02	2.6794+02	2.7262+02	2.5425+02	2.7131+02	2.7738+02	2.1362+02
1.0	2.2847+02	2.4937+02	2.5366+02	2.3681+02	2.5245+02	2.5801+02	1.9964+02
2.0	1.4127+02	1.5249+02	1.5489+02	1.4556+02	1.5430+02	1.5731+02	1.2487+02
3.0	1.0514+02	1.1276+02	1.1445+02	1.0796+02	1.1414+02	1.1616+02	9.3329+01
4.0	8.4783+01	9.0543+01	9.1863+01	8.6874+01	9.1699+01	9.3196+01	7.5467+01
5.0	7.1514+01	7.6108+01	7.7198+01	7.3145+01	7.7126+01	7.8297+01	6.3790+01
6.0	6.2117+01	6.5941+01	6.6872+01	6.3447+01	6.6849+01	6.7810+01	5.5493+01
7.0	5.5086+01	5.8355+01	5.9170+01	5.6202+01	5.9179+01	5.9991+01	4.9273+01
8.0	4.9606+01	5.2474+01	5.3200+01	5.0569+01	5.3221+01	5.3931+01	4.4417+01
9.0	4.5202+01	4.7745+01	4.8401+01	4.6039+01	4.8434+01	4.9061+01	4.0504+01
10.0	4.1581+01	4.3864+01	4.4463+01	4.2318+01	4.4505+01	4.5065+01	3.7277+01
12.0	3.5963+01	3.7857+01	3.8368+01	3.6552+01	3.8421+01	3.8883+01	3.2264+01
14.0	3.1792+01	3.3409+01	3.3857+01	3.2278+01	3.3915+01	3.4307+01	2.8535+01
16.0	2.8565+01	2.9973+01	3.0373+01	2.8975+01	3.0433+01	3.0774+01	2.5647+01
18.0	2.5985+01	2.7234+01	2.7595+01	2.6338+01	2.7656+01	2.7957+01	2.3338+01
20.0	2.3874+01	2.4995+01	2.5325+01	2.4182+01	2.5386+01	2.5656+01	2.1448+01
22.0	2.2112+01	2.3129+01	2.3433+01	2.2384+01	2.3493+01	2.3738+01	1.9868+01
24.0	2.0617+01	2.1548+01	2.1830+01	2.0859+01	2.1890+01	2.2113+01	1.8527+01
26.0	1.9332+01	2.0190+01	2.0453+01	1.9550+01	2.0512+01	2.0718+01	1.7375+01
28.0	1.8214+01	1.9010+01	1.9257+01	1.8411+01	1.9315+01	1.9506+01	1.6372+01
30.0	1.7232+01	1.7975+01	1.8208+01	1.7413+01	1.8265+01	1.8442+01	1.5491+01
35.0	1.5230+01	1.5866+01	1.6071+01	1.5377+01	1.6125+01	1.6277+01	1.3695+01
40.0	1.3689+01	1.4248+01	1.4431+01	1.3813+01	1.4482+01	1.4614+01	1.2313+01
45.0	1.2466+01	1.2964+01	1.3130+01	1.2572+01	1.3178+01	1.3296+01	1.1214+01
50.0	1.1469+01	1.1919+01	1.2071+01	1.1562+01	1.2117+01	1.2223+01	1.0320+01
55.0	1.0644+01	1.1054+01	1.1195+01	1.0725+01	1.1239+01	1.1336+01	9.5781+00
60.0	9.9411+00	1.0319+01	1.0450+01	1.0014+01	1.0492+01	1.0581+01	8.9472+00
65.0	9.3430+00	9.6935+00	9.8163+00	9.4085+00	9.8567+00	9.9392+00	8.4100+00
70.0	8.8216+00	9.1487+00	9.2643+00	8.8811+00	9.3032+00	9.3801+00	7.9416+00
75.0	8.3676+00	8.6747+00	8.7840+00	8.4221+00	8.8216+00	8.8936+00	7.5338+00
80.0	7.9648+00	8.2541+00	8.3580+00	8.0149+00	8.3943+00	8.4621+00	7.1718+00
90.0	7.2871+00	7.5471+00	7.6419+00	7.3301+00	7.6760+00	7.7367+00	6.5627+00
100.0	6.7371+00	6.9739+00	7.0612+00	6.7747+00	7.0934+00	7.1485+00	6.0683+00
110.0	6.2830+00	6.5009+00	6.5821+00	6.3163+00	6.6127+00	6.6633+00	5.6601+00
120.0	5.9080+00	6.1000+00	6.1760+00	5.9277+00	6.2053+00	6.2520+00	5.3139+00
130.0	5.5713+00	5.7600+00	5.8317+00	5.5981+00	5.8597+00	5.9033+00	5.0201+00
140.0	5.2874+00	5.4646+00	5.5325+00	5.3117+00	5.5595+00	5.6004+00	4.7647+00
150.0	5.0409+00	5.2084+00	5.2729+00	5.0631+00	5.2989+00	5.3375+00	4.5430+00
160.0	4.8228+00	4.9816+00	5.0433+00	4.8432+00	5.0684+00	5.1050+00	4.3467+00
180.0	4.4574+00	4.6019+00	4.6588+00	4.4749+00	4.6825+00	4.7156+00	4.0180+00

TABLE A2 COMPUTED PROTON ENERGY LOSSES IN UNITS OF (MEV-CM**2)/GM.

ENERGY	ECNE	ANTHRACENE	STILBENE	MYLAR	LUCITE	POLYSTYRENE	TEFLON
200.0	4.1625+00	4.2957+00	4.3486+00	4.1778+00	4.3711+00	4.4015+00	3.7527+00
225.0	3.8655+00	3.9874+00	4.0364+00	3.8786+00	4.0576+00	4.0854+00	3.4854+00
250.0	3.6265+00	3.7393+00	3.7852+00	3.6379+00	3.8054+00	3.8310+00	3.2703+00
275.0	3.4322+00	3.5377+00	3.5810+00	3.4422+00	3.6004+00	3.6243+00	3.0954+00
300.0	3.2662+00	3.3656+00	3.4067+00	3.2751+00	3.4254+00	3.4478+00	2.9460+00
325.0	3.1286+00	3.2228+00	3.2622+00	3.1365+00	3.2802+00	3.3015+00	2.8221+00
350.0	3.0098+00	3.0997+00	3.1374+00	3.0170+00	3.1549+00	3.1752+00	2.7152+00
375.0	2.9064+00	2.9925+00	3.0289+00	2.9129+00	3.0460+00	3.0653+00	2.6221+00
400.0	2.8158+00	2.8986+00	2.9338+00	2.8217+00	2.9504+00	2.9690+00	2.5406+00
450.0	2.6676+00	2.7449+00	2.7782+00	2.6726+00	2.7942+00	2.8115+00	2.4072+00
500.0	2.5492+00	2.6221+00	2.6539+00	2.5534+00	2.6693+00	2.6856+00	2.3006+00
550.0	2.4551+00	2.5245+00	2.5550+00	2.4586+00	2.5700+00	2.5854+00	2.2158+00
600.0	2.3771+00	2.4435+00	2.4730+00	2.3800+00	2.4877+00	2.5025+00	2.1456+00
700.0	2.2566+00	2.3184+00	2.3464+00	2.2587+00	2.3606+00	2.3742+00	2.0373+00
800.0	2.1709+00	2.2284+00	2.2554+00	2.1721+00	2.2699+00	2.2825+00	1.9602+00
900.0	2.1076+00	2.1608+00	2.1871+00	2.1072+00	2.2018+00	2.2137+00	1.9033+00
1000.0	2.0594+00	2.1089+00	2.1347+00	2.0574+00	2.1496+00	2.1608+00	1.8597+00
1250.0	1.9817+00	2.0244+00	2.0494+00	1.9766+00	2.0649+00	2.0748+00	1.7895+00
1500.0	1.9363+00	1.9740+00	1.9984+00	1.9285+00	2.0144+00	2.0235+00	1.7483+00
1750.0	1.9091+00	1.9432+00	1.9673+00	1.8992+00	1.9835+00	1.9921+00	1.7236+00
2000.0	1.8930+00	1.9244+00	1.9482+00	1.8815+00	1.9646+00	1.9729+00	1.7090+00
2250.0	1.8868+00	1.9162+00	1.9399+00	1.8739+00	1.9565+00	1.9645+00	1.7032+00
2500.0	1.8806+00	1.9081+00	1.9316+00	1.8664+00	1.9484+00	1.9561+00	1.6975+00
2750.0	1.8807+00	1.9068+00	1.9303+00	1.8655+00	1.9472+00	1.9508+00	1.6970+00
3000.0	1.8807+00	1.9056+00	1.9291+00	1.8645+00	1.9459+00	1.9535+00	1.6974+00
3500.0	1.8868+00	1.9098+00	1.9332+00	1.8690+00	1.9502+00	1.9577+00	1.7025+00
4000.0	1.8957+00	1.9174+00	1.9408+00	1.8766+00	1.9577+00	1.9653+00	1.7103+00
4500.0	1.9059+00	1.9266+00	1.9500+00	1.8859+00	1.9669+00	1.9706+00	1.7194+00
5000.0	1.9168+00	1.9366+00	1.9601+00	1.8958+00	1.9770+00	1.9847+00	1.7289+00
6000.0	1.9388+00	1.9573+00	1.9809+00	1.9162+00	1.9977+00	2.0056+00	1.7483+00
7000.0	1.9599+00	1.9775+00	2.0012+00	1.9361+00	2.0179+00	2.0260+00	1.7670+00
8000.0	1.9797+00	1.9966+00	2.0204+00	1.9549+00	2.0370+00	2.0454+00	1.7845+00
9000.0	1.9981+00	2.0144+00	2.0383+00	1.9724+00	2.0549+00	2.0634+00	1.8008+00
10000.0	2.0153+00	2.0309+00	2.0549+00	1.9886+00	2.0715+00	2.0802+00	1.8160+00
15000.0	2.0844+00	2.0975+00	2.1221+00	2.0545+00	2.1390+00	2.1481+00	1.8771+00
20000.0	2.1360+00	2.1467+00	2.1718+00	2.1034+00	2.1894+00	2.1984+00	1.9226+00
30000.0	2.2083+00	2.2147+00	2.2407+00	2.1717+00	2.2599+00	2.2681+00	1.9866+00
40000.0	2.2586+00	2.2619+00	2.2884+00	2.2192+00	2.3092+00	2.3165+00	2.0314+00
50000.0	2.2965+00	2.2978+00	2.3247+00	2.2554+00	2.3466+00	2.3532+00	2.0695+00
60000.0	2.3277+00	2.3268+00	2.3540+00	2.2845+00	2.3768+00	2.3829+00	2.0930+00
70000.0	2.3533+00	2.3510+00	2.3785+00	2.3088+00	2.4020+00	2.4076+00	2.1159+00
80000.0	2.3752+00	2.3718+00	2.3995+00	2.3296+00	2.4236+00	2.4289+00	2.1354+00
90000.0	2.3943+00	2.3901+00	2.4180+00	2.3478+00	2.4425+00	2.4476+00	2.1525+00
100000.0	2.4112+00	2.4063+00	2.4344+00	2.3640+00	2.4593+00	2.4641+00	2.1677+00

TABLE A3 COMPUTED ALPHA RANGE DATA, IN UNITS OF GMS/CM**2, AS A FUNCTION OF ENERGY IN MEV.

ENERGY	H	HE	LI	BE	B	C	N	O
2.0	4.1600-04	1.1800-03	1.3200-03	1.5200-03	1.1200-03	1.1900-03	1.4510-03	1.6940-03
2.5	5.3241-04	1.4707-03	1.6884-03	1.9140-03	1.5090-03	1.5684-03	1.8481-03	2.1110-03
3.0	6.6827-04	1.8060-03	2.1073-03	2.3616-03	1.9521-03	1.9993-03	2.2991-03	2.5829-03
3.5	8.2300-04	2.1846-03	2.5753-03	2.8599-03	2.4469-03	2.4800-03	2.8022-03	3.1074-03
4.0	9.9615-04	2.6053-03	3.0920-03	3.4080-03	2.9916-03	3.0088-03	3.3553-03	3.6829-03
4.5	1.1873-03	3.0671-03	3.6569-03	4.0046-03	3.5849-03	3.5842-03	3.9564-03	4.3081-03
5.0	1.3962-03	3.5693-03	4.2682-03	4.6484-03	4.2251-03	4.2049-03	4.6047-03	4.9817-03
6.0	1.8660-03	4.6921-03	5.6276-03	6.0747-03	5.6426-03	5.5791-03	6.0379-03	6.4690-03
7.0	2.4035-03	5.9686-03	7.1651-03	7.6815-03	7.2388-03	7.1251-03	7.6473-03	8.1385-03
8.0	3.0073-03	7.3952-03	8.8741-03	9.4659-03	9.0080-03	8.8364-03	9.4275-03	9.9837-03
9.0	3.6761-03	8.9685-03	1.0754-02	1.1424-02	1.0946-02	1.0710-02	1.1374-02	1.2000-02
10.0	4.4086-03	1.0686-02	1.2801-02	1.3551-02	1.3051-02	1.2742-02	1.3484-02	1.4182-02
11.0	5.2040-03	1.2545-02	1.5013-02	1.5845-02	1.5317-02	1.4929-02	1.5751-02	1.6528-02
12.0	6.0614-03	1.4543-02	1.7387-02	1.8304-02	1.7745-02	1.7269-02	1.8176-02	1.9034-02
13.0	6.9801-03	1.6679-02	1.9921-02	2.0926-02	2.0333-02	1.9760-02	2.0755-02	2.1698-02
14.0	7.9592-03	1.8950-02	2.2614-02	2.3705-02	2.3076-02	2.2399-02	2.3486-02	2.4517-02
15.0	8.9982-03	2.1356-02	2.5464-02	2.6643-02	2.5974-02	2.5184-02	2.6368-02	2.7488-02
16.0	1.0097-02	2.3895-02	2.8468-02	2.9738-02	2.9026-02	2.8115-02	2.9398-02	3.0610-02
18.0	1.2469-02	2.9365-02	3.4935-02	3.6391-02	3.5581-02	3.4405-02	3.5896-02	3.7303-02
20.0	1.5072-02	3.5351-02	4.2005-02	4.3653-02	4.2732-02	4.1260-02	4.2970-02	4.4582-02
22.0	1.7904-02	4.1845-02	4.9668-02	5.1514-02	5.0465-02	4.8669-02	5.0608-02	5.2436-02
24.0	2.0959-02	4.8839-02	5.7915-02	5.9966-02	5.8772-02	5.6624-02	5.8803-02	6.0857-02
26.0	2.4237-02	5.6327-02	6.6739-02	6.8999-02	6.7647-02	6.5117-02	6.7549-02	6.9836-02
28.0	2.7734-02	6.4303-02	7.6132-02	7.8608-02	7.7082-02	7.4140-02	7.6836-02	7.9366-02
30.0	3.1448-02	7.2760-02	8.6089-02	8.8786-02	8.7072-02	8.3689-02	8.6659-02	8.9440-02
35.0	4.1669-02	9.5979-02	1.1340-01	1.1668-01	1.1443-01	1.0981-01	1.1352-01	1.1697-01
40.0	5.3203-02	1.2211-01	1.4412-01	1.4799-01	1.4513-01	1.3910-01	1.4361-01	1.4778-01
45.0	6.6025-02	1.5108-01	1.7816-01	1.8267-01	1.7911-01	1.7147-01	1.7684-01	1.8180-01
50.0	8.0113-02	1.8285-01	2.1547-01	2.2063-01	2.1629-01	2.0688-01	2.1316-01	2.1896-01
55.0	9.5471-02	2.1742-01	2.5605-01	2.6189-01	2.5668-01	2.4533-01	2.5258-01	2.5926-01
60.0	1.1201-01	2.5458-01	2.9966-01	3.0621-01	3.0004-01	2.8658-01	2.9486-01	3.0248-01
65.0	1.2980-01	2.9452-01	3.4651-01	3.5379-01	3.4658-01	3.3084-01	3.4020-01	3.4879-01
70.0	1.4875-01	3.3698-01	3.9630-01	4.0433-01	3.9602-01	3.7783-01	3.8832-01	3.9794-01
75.0	1.6892-01	3.8214-01	4.4925-01	4.5805-01	4.4854-01	4.2773-01	4.3941-01	4.5010-01
80.0	1.9021-01	4.2976-01	5.0508-01	5.1466-01	5.0388-01	4.8030-01	4.9321-01	5.0501-01
90.0	2.3630-01	5.3267-01	6.2570-01	6.3690-01	6.2335-01	5.9373-01	6.0925-01	6.2342-01
100.0	2.8691-01	6.4550-01	7.5790-01	7.7080-01	7.5417-01	7.1787-01	7.3619-01	7.5289-01
110.0	3.4205-01	7.6825-01	9.0169-01	9.1635-01	8.9632-01	8.5271-01	8.7401-01	8.9341-01
120.0	4.0138-01	9.0017-01	1.0562+00	1.0726+00	1.0490+00	9.9742-01	1.0219+00	1.0441+00
130.0	4.6518-01	1.0418+00	1.2221+00	1.2404+00	1.2127+00	1.1527+00	1.1805+00	1.2057+00
140.0	5.3303-01	1.1924+00	1.3983+00	1.4185+00	1.3866+00	1.3174+00	1.3487+00	1.3771+00
150.0	6.0521-01	1.3523+00	1.5856+00	1.6078+00	1.5713+00	1.4923+00	1.5273+00	1.5590+00
160.0	6.8133-01	1.5209+00	1.7828+00	1.8070+00	1.7657+00	1.6765+00	1.7153+00	1.7505+00
180.0	8.4581-01	1.8846+00	2.2085+00	2.2369+00	2.1851+00	2.0735+00	2.1204+00	2.1629+00

TABLE A3 COMPUTED ALPHA RANGE DATA, IN UNITS OF GMS/CM**2, AS A FUNCTION OF ENERGY IN MEV.

ENERGY	H	HE	LI	BE	B	C	N	O
200.0	1.0260+00	2.2827+00	2.6742+00	2.7069+00	2.6435+00	2.5073+00	2.5630+00	2.6133+00
225.0	1.2728+00	2.8270+00	3.3111+00	3.3492+00	3.2699+00	3.0999+00	3.1673+00	3.2281+00
250.0	1.5429+00	3.4220+00	4.0069+00	4.0508+00	3.9539+00	3.7466+00	3.8267+00	3.8988+00
275.0	1.8369+00	4.0688+00	4.7634+00	4.8132+00	4.6970+00	4.4490+00	4.5426+00	4.6268+00
300.0	2.1502+00	4.7575+00	5.5688+00	5.6246+00	5.4878+00	5.1963+00	5.3041+00	5.4011+00
325.0	2.4875+00	5.4982+00	6.4349+00	6.4969+00	6.3378+00	5.9993+00	6.1221+00	6.2325+00
350.0	2.8448+00	6.2821+00	7.3515+00	7.4198+00	7.2370+00	6.8485+00	6.9871+00	7.1117+00
375.0	3.2215+00	7.1083+00	8.3174+00	8.3921+00	8.1842+00	7.7429+00	7.8980+00	8.0373+00
400.0	3.6174+00	7.9758+00	9.3315+00	9.4127+00	9.1784+00	8.6814+00	8.8537+00	9.0083+00
450.0	4.4705+00	9.8435+00	1.1515+01	1.1610+01	1.1318+01	1.0700+01	1.0909+01	1.1096+01
500.0	5.3946+00	1.1864+01	1.3877+01	1.3986+01	1.3632+01	1.2883+01	1.3131+01	1.3353+01
550.0	6.3946+00	1.4049+01	1.6431+01	1.6554+01	1.6132+01	1.5240+01	1.5530+01	1.5788+01
600.0	7.4693+00	1.6373+01	1.9144+01	1.9285+01	1.8790+01	1.7746+01	1.8079+01	1.8377+01
700.0	9.7723+00	2.1418+01	2.5045+01	2.5211+01	2.4558+01	2.3180+01	2.3607+01	2.3988+01
800.0	1.2328+01	2.6985+01	3.1554+01	3.1749+01	3.0920+01	2.9171+01	2.9698+01	3.0169+01
900.0	1.5104+01	3.3023+01	3.8614+01	3.8841+01	3.7818+01	3.5662+01	3.6299+01	3.6866+01
1000.0	1.8082+01	3.9497+01	4.6185+01	4.6444+01	4.5212+01	4.2617+01	4.3367+01	4.4037+01
1250.0	2.6367+01	5.7482+01	6.7226+01	6.7570+01	6.5748+01	6.1912+01	6.2975+01	6.3921+01
1500.0	3.5586+01	7.7463+01	9.0616+01	9.1050+01	8.8563+01	8.3321+01	8.4724+01	8.5971+01
1750.0	4.5597+01	9.9135+01	1.1600+02	1.1653+02	1.1331+02	1.0652+02	1.0828+02	1.0985+02
2000.0	5.6285+01	1.2225+02	1.4309+02	1.4373+02	1.3972+02	1.3124+02	1.3338+02	1.3529+02
2250.0	6.7841+01	1.4720+02	1.7238+02	1.7314+02	1.6825+02	1.5790+02	1.6044+02	1.6270+02
2500.0	7.9997+01	1.7216+02	2.0166+02	2.0254+02	1.9678+02	1.8456+02	1.8749+02	1.9011+02
2750.0	9.1837+01	1.9898+02	2.3318+02	2.3421+02	2.2748+02	2.1322+02	2.1653+02	2.1951+02
3000.0	1.0428+02	2.2580+02	2.6470+02	2.6587+02	2.5819+02	2.4188+02	2.4556+02	2.4892+02
3500.0	1.3047+02	2.8221+02	3.3110+02	3.3259+02	3.2285+02	3.0221+02	3.0654+02	3.1067+02
4000.0	1.5767+02	3.4070+02	4.0004+02	4.0190+02	3.8999+02	3.6483+02	3.6969+02	3.7460+02
4500.0	1.8561+02	4.0075+02	4.7093+02	4.7320+02	4.5905+02	4.2922+02	4.3446+02	4.4016+02
5000.0	2.1415+02	4.6200+02	5.4332+02	5.4606+02	5.2958+02	4.9499+02	5.0046+02	5.0696+02
6000.0	2.7240+02	5.8690+02	6.9125+02	6.9502+02	6.7377+02	6.2943+02	6.3488+02	6.4297+02
7000.0	3.3173+02	7.1395+02	8.4209+02	8.4706+02	8.2090+02	7.6663+02	7.7142+02	7.8108+02
8000.0	3.9169+02	8.4217+02	9.9467+02	1.0010+03	9.6984+02	9.0553+02	9.0903+02	9.2025+02
9000.0	4.5196+02	9.7094+02	1.1482+03	1.1560+03	1.1199+03	1.0455+03	1.0471+03	1.0598+03
10000.0	5.1237+02	1.0999+03	1.3023+03	1.3116+03	1.2705+03	1.1860+03	1.1852+03	1.1994+03
15000.0	8.1296+02	1.7399+03	2.0712+03	2.0899+03	2.0241+03	1.8890+03	1.8690+03	1.8905+03
20000.0	1.1087+03	2.3677+03	2.8310+03	2.8609+03	2.7712+03	2.5858+03	2.5379+03	2.5662+03
30000.0	1.6829+03	3.5834+03	4.3169+03	4.3724+03	4.2371+03	3.9513+03	3.8292+03	3.8697+03
40000.0	2.2380+03	4.7552+03	5.7663+03	5.8493+03	5.6703+03	5.2837+03	5.0705+03	5.1223+03
50000.0	2.7780+03	5.8929+03	7.1885+03	7.2996+03	7.0779+03	6.5897+03	6.2734+03	6.3357+03
60000.0	3.3058+03	7.0035+03	8.5896+03	8.7286+03	8.4650+03	7.8745+03	7.4459+03	7.5181+03
70000.0	3.8238+03	8.0919+03	9.9738+03	1.0140+04	9.8351+03	9.1421+03	8.5936+03	8.6752+03
80000.0	4.3313+03	9.1615+03	1.1344+04	1.1537+04	1.1191+04	1.0395+04	9.7204+03	9.8111+03
90000.0	4.8355+03	1.0215+04	1.2702+04	1.2921+04	1.2535+04	1.1636+04	1.0829+04	1.0929+04
100000.0	5.3315+03	1.1255+04	1.4049+04	1.4295+04	1.3867+04	1.2866+04	1.1923+04	1.2031+04

TABLE A3 COMPUTED ALPHA RANGE DATA. IN UNITS OF GMS/CM**2. AS A FUNCTION OF ENERGY IN MEV.

ENERGY	NE	MG	AL	SI	A	CA	TI	V
2.0	2.1262-03	2.4867-03	2.6400-03	2.5310-03	2.3227-03	2.3553-03	2.4790-03	2.5751-03
2.5	2.5936-03	2.9863-03	3.1599-03	3.0361-03	2.9499-03	2.9398-03	3.1343-03	3.2528-03
3.0	3.1165-03	3.5430-03	3.7391-03	3.5991-03	3.6572-03	3.5984-03	3.8672-03	4.0084-03
3.5	3.6936-03	4.1555-03	4.3766-03	4.2192-03	4.4363-03	4.3282-03	4.6769-03	4.8408-03
4.0	4.3234-03	4.8228-03	5.0710-03	4.8954-03	5.2813-03	5.1254-03	5.5612-03	5.7491-03
4.5	5.0045-03	5.5442-03	5.8211-03	5.6264-03	6.1889-03	5.9849-03	6.5182-03	6.7312-03
5.0	5.7359-03	6.3178-03	6.6260-03	6.4112-03	7.1570-03	6.9027-03	7.5444-03	7.7850-03
6.0	7.3450-03	8.0185-03	8.3960-03	8.1374-03	9.2686-03	8.9035-03	9.7893-03	1.0096-02
7.0	9.1447-03	9.9172-03	1.0373-02	1.0068-02	1.1608-02	1.1114-02	1.2275-02	1.2659-02
8.0	1.1129-02	1.2007-02	1.2552-02	1.2195-02	1.4169-02	1.3525-02	1.4987-02	1.5459-02
9.0	1.3292-02	1.4283-02	1.4925-02	1.4516-02	1.6946-02	1.6134-02	1.7917-02	1.8485-02
10.0	1.5631-02	1.6741-02	1.7488-02	1.7023-02	1.9935-02	1.8935-02	2.1059-02	2.1730-02
11.0	1.8142-02	1.9378-02	2.0237-02	1.9713-02	2.3132-02	2.1926-02	2.4409-02	2.5187-02
12.0	2.0821-02	2.2190-02	2.3169-02	2.2583-02	2.6534-02	2.5103-02	2.7963-02	2.8854-02
13.0	2.3667-02	2.5174-02	2.6280-02	2.5629-02	3.0139-02	2.8463-02	3.1720-02	3.2727-02
14.0	2.6676-02	2.8328-02	2.9568-02	2.8848-02	3.3941-02	3.2005-02	3.5674-02	3.6804-02
15.0	2.9846-02	3.1650-02	3.3030-02	3.2238-02	3.7938-02	3.5726-02	3.9825-02	4.1081-02
16.0	3.3175-02	3.5136-02	3.6664-02	3.5797-02	4.2128-02	3.9624-02	4.4170-02	4.5556-02
18.0	4.0304-02	4.2596-02	4.4440-02	4.3412-02	5.1079-02	4.7941-02	5.3433-02	5.5091-02
20.0	4.8048-02	5.0694-02	5.2879-02	5.1678-02	6.0775-02	5.6939-02	6.3448-02	6.5396-02
22.0	5.6392-02	5.9416-02	6.1968-02	6.0582-02	7.1203-02	6.6607-02	7.4200-02	7.6454-02
24.0	6.5326-02	6.8753-02	7.1695-02	7.0111-02	8.2348-02	7.6932-02	8.5674-02	8.8254-02
26.0	7.4844-02	7.8697-02	8.2050-02	8.0256-02	9.4198-02	8.7904-02	9.7858-02	1.0078-01
28.0	8.4937-02	8.9238-02	9.3023-02	9.1005-02	1.0674-01	9.9513-02	1.1074-01	1.1402-01
30.0	9.5596-02	1.0037-01	1.0461-01	1.0235-01	1.1997-01	1.1175-01	1.2432-01	1.2797-01
35.0	1.2468-01	1.3070-01	1.3621-01	1.3328-01	1.5596-01	1.4503-01	1.6123-01	1.6588-01
40.0	1.5716-01	1.6456-01	1.7146-01	1.6779-01	1.9604-01	1.8206-01	2.0227-01	2.0802-01
45.0	1.9297-01	2.0186-01	2.1029-01	2.0579-01	2.4009-01	2.2273-01	2.4733-01	2.5428-01
50.0	2.3203-01	2.4251-01	2.5260-01	2.4720-01	2.8803-01	2.6695-01	2.9631-01	3.0457-01
55.0	2.7436-01	2.8652-01	2.9840-01	2.9202-01	3.3984-01	3.1472-01	3.4920-01	3.5887-01
60.0	3.1972-01	3.3364-01	3.4742-01	3.3999-01	3.9524-01	3.6578-01	4.0572-01	4.1687-01
65.0	3.6829-01	3.8406-01	3.9987-01	3.9131-01	4.5445-01	4.2031-01	4.6607-01	4.7881-01
70.0	4.1981-01	4.3749-01	4.5544-01	4.4568-01	5.1711-01	4.7802-01	5.2992-01	5.4432-01
75.0	4.7445-01	4.9414-01	5.1433-01	5.0330-01	5.8346-01	5.3912-01	5.9748-01	6.1363-01
80.0	5.3195-01	5.5372-01	5.7626-01	5.6389-01	6.5316-01	6.0329-01	6.6842-01	6.8641-01
90.0	6.5585-01	6.8202-01	7.0955-01	6.9428-01	8.0302-01	7.4120-01	8.2085-01	8.4275-01
100.0	7.9122-01	8.2210-01	8.5503-01	8.3656-01	9.6639-01	8.9141-01	9.8687-01	1.0130+00
110.0	9.3805-01	9.7396-01	1.0127+00	9.9071-01	1.1432+00	1.0539+00	1.1664+00	1.1971+00
120.0	1.0955+00	1.1367+00	1.1816+00	1.1558+00	1.3325+00	1.2277+00	1.3584+00	1.3939+00
130.0	1.2641+00	1.3109+00	1.3624+00	1.3325+00	1.5349+00	1.4136+00	1.5635+00	1.6043+00
140.0	1.4430+00	1.4957+00	1.5541+00	1.5198+00	1.7494+00	1.6104+00	1.7807+00	1.8269+00
150.0	1.6327+00	1.6915+00	1.7573+00	1.7184+00	1.9765+00	1.8188+00	2.0106+00	2.0625+00
160.0	1.8323+00	1.8975+00	1.9710+00	1.9271+00	2.2152+00	2.0377+00	2.2520+00	2.3099+00
180.0	2.2621+00	2.3409+00	2.4309+00	2.3763+00	2.7286+00	2.5083+00	2.7708+00	2.8415+00

TABLE A3 COMPUTED ALPHA RANGE DATA, IN UNITS OF GMS/CM**2, AS A FUNCTION OF ENERGY IN MEV.

ENERGY	NE	MG	AL	SI	A	CA	TI	V
200.0	2.7311+00	2.8247+00	2.9325+00	2.8660+00	3.2880+00	3.0210+00	3.3358+00	3.4202+00
225.0	3.3711+00	3.4844+00	3.6163+00	3.5336+00	4.0500+00	3.7191+00	4.1048+00	4.2079+00
250.0	4.0690+00	4.2033+00	4.3615+00	4.2610+00	4.8798+00	4.4789+00	4.9416+00	5.0648+00
275.0	4.8260+00	4.9831+00	5.1695+00	5.0495+00	5.7787+00	5.3020+00	5.8477+00	5.9925+00
300.0	5.6309+00	5.8118+00	6.0282+00	5.8873+00	6.7336+00	6.1761+00	6.8097+00	6.9774+00
325.0	6.4949+00	6.7013+00	6.9496+00	6.7862+00	7.7576+00	7.1134+00	7.8410+00	8.0331+00
350.0	7.4083+00	7.6412+00	7.9232+00	7.7359+00	8.8390+00	8.1032+00	8.9300+00	9.1477+00
375.0	8.3697+00	8.6303+00	8.9477+00	8.7351+00	9.9766+00	9.1441+00	1.0075+01	1.0320+01
400.0	9.3779+00	9.6676+00	1.0022+01	9.7827+00	1.1169+01	1.0235+01	1.1275+01	1.1548+01
450.0	1.1545+01	1.1897+01	1.2330+01	1.2033+01	1.3729+01	1.2577+01	1.3851+01	1.4184+01
500.0	1.3886+01	1.4304+01	1.4822+01	1.4463+01	1.6491+01	1.5104+01	1.6630+01	1.7027+01
550.0	1.6413+01	1.6901+01	1.7510+01	1.7083+01	1.9470+01	1.7828+01	1.9625+01	2.0092+01
600.0	1.9097+01	1.9659+01	2.0365+01	1.9866+01	2.2631+01	2.0720+01	2.2804+01	2.3344+01
700.0	2.4913+01	2.5635+01	2.6549+01	2.5891+01	2.9474+01	2.6977+01	2.9682+01	3.0381+01
800.0	3.1318+01	3.2215+01	3.3356+01	3.2523+01	3.7001+01	3.3859+01	3.7246+01	3.8119+01
900.0	3.8254+01	3.9339+01	4.0724+01	3.9699+01	4.5143+01	4.1303+01	4.5426+01	4.6486+01
1000.0	4.5678+01	4.6964+01	4.8610+01	4.7378+01	5.3852+01	4.9264+01	5.4173+01	5.5434+01
1250.0	6.6257+01	6.8096+01	7.0458+01	6.8644+01	7.7958+01	7.1301+01	7.8382+01	8.0195+01
1500.0	8.9064+01	9.1519+01	9.4665+01	9.2194+01	1.0464+02	9.5694+01	1.0518+02	1.0760+02
1750.0	1.1376+02	1.1688+02	1.2086+02	1.1767+02	1.3349+02	1.2208+02	1.3415+02	1.3723+02
2000.0	1.4005+02	1.4388+02	1.4876+02	1.4479+02	1.6418+02	1.5014+02	1.6498+02	1.6876+02
2250.0	1.6836+02	1.7299+02	1.7880+02	1.7397+02	1.9720+02	1.8035+02	1.9816+02	2.0269+02
2500.0	1.9668+02	2.0209+02	2.0885+02	2.0315+02	2.3023+02	2.1056+02	2.3134+02	2.3663+02
2750.0	2.2705+02	2.3331+02	2.4106+02	2.3442+02	2.6558+02	2.4293+02	2.6689+02	2.7299+02
3000.0	2.5741+02	2.6453+02	2.7328+02	2.6569+02	3.0094+02	2.7529+02	3.0245+02	3.0935+02
3500.0	3.2114+02	3.3011+02	3.4092+02	3.3127+02	3.7508+02	3.4319+02	3.7705+02	3.8566+02
4000.0	3.8711+02	3.9802+02	4.1094+02	3.9913+02	4.5173+02	4.1343+02	4.5425+02	4.6464+02
4500.0	4.5473+02	4.6769+02	4.8275+02	4.6870+02	5.3026+02	4.8543+02	5.3342+02	5.4563+02
5000.0	5.2360+02	5.3869+02	5.5592+02	5.3957+02	6.1017+02	5.5874+02	6.1406+02	6.2815+02
6000.0	6.6380+02	6.8337+02	7.0496+02	6.8391+02	7.7266+02	7.0797+02	7.7832+02	7.9626+02
7000.0	8.0609+02	8.3040+02	8.5639+02	8.3055+02	9.3741+02	8.5945+02	9.4523+02	9.6711+02
8000.0	9.4943+02	9.7869+02	1.0091+03	9.7843+02	1.1032+03	1.0121+03	1.1136+03	1.1395+03
9000.0	1.0931+03	1.1276+03	1.1624+03	1.1269+03	1.2693+03	1.1652+03	1.2826+03	1.3125+03
10000.0	1.2368+03	1.2766+03	1.3159+03	1.2755+03	1.4352+03	1.3184+03	1.4519+03	1.4858+03
15000.0	1.9476+03	2.0164+03	2.0784+03	2.0137+03	2.2544+03	2.0779+03	2.2928+03	2.3473+03
20000.0	2.6419+03	2.7434+03	2.8287+03	2.7395+03	3.0528+03	2.8231+03	3.1198+03	3.1948+03
30000.0	3.9803+03	4.1585+03	4.2913+03	4.1519+03	4.5885+03	4.2689+03	4.7275+03	4.8426+03
40000.0	5.2652+03	5.5335+03	5.7142+03	5.5236+03	6.0597+03	5.6674+03	6.2846+03	6.4392+03
50000.0	6.5092+03	6.8785+03	7.1069+03	6.8652+03	7.4820+03	7.0295+03	7.8027+03	7.9960+03
60000.0	7.7210+03	8.2001+03	8.4758+03	8.1832+03	8.8658+03	8.3630+03	9.2901+03	9.5214+03
70000.0	8.9064+03	9.5026+03	9.8252+03	9.4821+03	1.0218+04	9.6733+03	1.0752+04	1.1021+04
80000.0	1.0070+04	1.0789+04	1.1158+04	1.0765+04	1.1545+04	1.0964+04	1.2194+04	1.2500+04
90000.0	1.1214+04	1.2062+04	1.2477+04	1.2034+04	1.2849+04	1.2239+04	1.3618+04	1.3961+04
100000.0	1.2342+04	1.3322+04	1.3784+04	1.3292+04	1.4134+04	1.3499+04	1.5027+04	1.5406+04

TABLE A3 COMPUTED ALPHA RANGE DATA, IN UNITS OF GMS/CM**2, AS A FUNCTION OF ENERGY IN MEV.

ENERGY	CR	MN	FE	CO	NI	CU	ZN	GE
2.0	2.6939-03	2.8356-03	3.0000-03	3.2260-03	3.4360-03	3.6300-03	3.6250-03	3.6228-03
2.5	3.3643-03	3.5318-03	3.6894-03	3.9399-03	4.1339-03	4.3722-03	4.3803-03	4.4298-03
3.0	4.1108-03	4.3039-03	4.4523-03	4.7280-03	4.9022-03	5.1871-03	5.2063-03	5.3104-03
3.5	4.9315-03	5.1503-03	5.2878-03	5.5892-03	5.7403-03	6.0746-03	6.1036-03	6.2651-03
4.0	5.8254-03	6.0701-03	6.1943-03	6.5222-03	6.6471-03	7.0337-03	7.0719-03	7.2932-03
4.5	6.7915-03	7.0623-03	7.1710-03	7.5259-03	7.6213-03	8.0629-03	8.1100-03	8.3943-03
5.0	7.8273-03	8.1260-03	8.2170-03	8.5996-03	8.6621-03	9.1612-03	9.2165-03	9.5668-03
6.0	1.0103-02	1.0460-02	1.0512-02	1.0953-02	1.0941-02	1.1562-02	1.1632-02	1.2122-02
7.0	1.2633-02	1.3059-02	1.3068-02	1.3573-02	1.3476-02	1.4231-02	1.4313-02	1.4954-02
8.0	1.5401-02	1.5905-02	1.5872-02	1.6449-02	1.6259-02	1.7159-02	1.7252-02	1.8057-02
9.0	1.8394-02	1.8984-02	1.8910-02	1.9567-02	1.9280-02	2.0338-02	2.0443-02	2.1423-02
10.0	2.1605-02	2.2288-02	2.2172-02	2.2916-02	2.2526-02	2.3758-02	2.3877-02	2.5047-02
11.0	2.5026-02	2.5809-02	2.5650-02	2.6489-02	2.5989-02	2.7409-02	2.7544-02	2.8923-02
12.0	2.8654-02	2.9542-02	2.9338-02	3.0278-02	2.9664-02	3.1283-02	3.1437-02	3.3042-02
13.0	3.2487-02	3.3481-02	3.3230-02	3.4278-02	3.3543-02	3.5375-02	3.5548-02	3.7396-02
14.0	3.6519-02	3.7625-02	3.7324-02	3.8484-02	3.7624-02	3.9680-02	3.9873-02	4.1978-02
15.0	4.0750-02	4.1971-02	4.1616-02	4.2893-02	4.1901-02	4.4192-02	4.4407-02	4.6784-02
16.0	4.5176-02	4.6515-02	4.6104-02	4.7502-02	4.6372-02	4.8909-02	4.9147-02	5.1808-02
18.0	5.4604-02	5.6191-02	5.5658-02	5.7311-02	5.5883-02	5.8943-02	5.9231-02	6.2496-02
20.0	6.4788-02	6.6637-02	6.5968-02	6.7893-02	6.6141-02	6.9761-02	7.0101-02	7.4014-02
22.0	7.5714-02	7.7837-02	7.7020-02	7.9233-02	7.7130-02	8.1348-02	8.1739-02	8.6345-02
24.0	8.7368-02	8.9780-02	8.8801-02	9.1318-02	8.8838-02	9.3690-02	9.4131-02	9.9471-02
26.0	9.9740-02	1.0246-01	1.0130-01	1.0414-01	1.0125-01	1.0677-01	1.0726-01	1.1338-01
28.0	1.1282-01	1.1585-01	1.1451-01	1.1768-01	1.1436-01	1.2059-01	1.2113-01	1.2805-01
30.0	1.2659-01	1.2995-01	1.2841-01	1.3193-01	1.2816-01	1.3513-01	1.3571-01	1.4348-01
35.0	1.6400-01	1.6825-01	1.6616-01	1.7062-01	1.6561-01	1.7459-01	1.7528-01	1.8531-01
40.0	2.0558-01	2.1080-01	2.0809-01	2.1357-01	2.0717-01	2.1836-01	2.1916-01	2.3164-01
45.0	2.5122-01	2.5748-01	2.5407-01	2.6066-01	2.5274-01	2.6634-01	2.6723-01	2.8239-01
50.0	3.0083-01	3.0820-01	3.0403-01	3.1182-01	3.0222-01	3.1843-01	3.1942-01	3.3745-01
55.0	3.5438-01	3.6296-01	3.5797-01	3.6703-01	3.5561-01	3.7463-01	3.7571-01	3.9684-01
60.0	4.1159-01	4.2145-01	4.1557-01	4.2599-01	4.1261-01	4.3462-01	4.3580-01	4.6021-01
65.0	4.7266-01	4.8390-01	4.7705-01	4.8893-01	4.7347-01	4.9865-01	4.9992-01	5.2781-01
70.0	5.3724-01	5.4993-01	5.4206-01	5.5548-01	5.3783-01	5.6635-01	5.6771-01	5.9926-01
75.0	6.0558-01	6.1978-01	6.1083-01	6.2587-01	6.0589-01	6.3797-01	6.3940-01	6.7482-01
80.0	6.7734-01	6.9311-01	6.8303-01	6.9975-01	6.7732-01	7.1312-01	7.1464-01	7.5410-01
90.0	8.3145-01	8.5061-01	8.3808-01	8.5842-01	8.3068-01	8.7446-01	8.7615-01	9.2430-01
100.0	9.9924-01	1.0220+00	1.0068+00	1.0311+00	9.9759-01	1.0500+00	1.0519+00	1.1094+00
110.0	1.1807+00	1.2074+00	1.1892+00	1.2177+00	1.1779+00	1.2397+00	1.2417+00	1.3094+00
120.0	1.3747+00	1.4055+00	1.3842+00	1.4172+00	1.3707+00	1.4424+00	1.4446+00	1.5231+00
130.0	1.5820+00	1.6172+00	1.5926+00	1.6303+00	1.5766+00	1.6590+00	1.6613+00	1.7513+00
140.0	1.8013+00	1.8413+00	1.8130+00	1.8558+00	1.7945+00	1.8880+00	1.8905+00	1.9927+00
150.0	2.0334+00	2.0783+00	2.0463+00	2.0944+00	2.0250+00	2.1304+00	2.1330+00	2.2480+00
160.0	2.2771+00	2.3272+00	2.2912+00	2.3448+00	2.2671+00	2.3848+00	2.3876+00	2.5160+00
180.0	2.8006+00	2.8618+00	2.8171+00	2.8826+00	2.7866+00	2.9310+00	2.9341+00	3.0913+00

TABLE A3 COMPUTED ALPHA RANGE DATA, IN UNITS OF GMS/CM**2, AS A FUNCTION OF ENERGY IN MEV.

ENERGY	CR	MN	FE	CO	NI	CU	ZN	GE
200.0	3.3704+00	3.4434+00	3.3893+00	3.4677+00	3.3518+00	3.5251+00	3.5284+00	3.7167+00
225.0	4.1459+00	4.2349+00	4.1676+00	4.2635+00	4.1205+00	4.3330+00	4.3365+00	4.5668+00
250.0	4.9894+00	5.0956+00	5.0140+00	5.1286+00	4.9560+00	5.2110+00	5.2147+00	5.4907+00
275.0	5.9025+00	6.0272+00	5.9300+00	6.0648+00	5.8599+00	6.1608+00	6.1646+00	6.4899+00
300.0	6.8717+00	7.0160+00	6.9021+00	7.0583+00	6.8191+00	7.1685+00	7.1723+00	7.5497+00
325.0	7.9104+00	8.0756+00	7.9438+00	8.1226+00	7.8467+00	8.2479+00	8.2516+00	8.6844+00
350.0	9.0070+00	9.1942+00	9.0432+00	9.2460+00	8.9311+00	9.3869+00	9.3904+00	9.8815+00
375.0	1.0160+01	1.0370+01	1.0199+01	1.0427+01	1.0071+01	1.0584+01	1.0587+01	1.1139+01
400.0	1.1368+01	1.1602+01	1.1410+01	1.1664+01	1.1265+01	1.1838+01	1.1841+01	1.2457+01
450.0	1.3961+01	1.4246+01	1.4008+01	1.4318+01	1.3826+01	1.4527+01	1.4529+01	1.5282+01
500.0	1.6757+01	1.7098+01	1.6810+01	1.7180+01	1.6588+01	1.7427+01	1.7427+01	1.8326+01
550.0	1.9771+01	2.0171+01	1.9829+01	2.0263+01	1.9563+01	2.0550+01	2.0548+01	2.1604+01
600.0	2.2969+01	2.3431+01	2.3033+01	2.3534+01	2.2720+01	2.3862+01	2.3859+01	2.5081+01
700.0	2.9887+01	3.0485+01	2.9962+01	3.0611+01	2.9547+01	3.1027+01	3.1018+01	3.2598+01
800.0	3.7494+01	3.8240+01	3.7580+01	3.8389+01	3.7050+01	3.8899+01	3.8885+01	4.0856+01
900.0	4.5718+01	4.6626+01	4.5817+01	4.6798+01	4.5162+01	4.7409+01	4.7388+01	4.9780+01
1000.0	5.4513+01	5.5592+01	5.4624+01	5.5789+01	5.3835+01	5.6505+01	5.6477+01	5.9318+01
1250.0	7.8843+01	8.0397+01	7.8987+01	8.0659+01	7.7822+01	8.1656+01	8.1606+01	8.5683+01
1500.0	1.0576+02	1.0784+02	1.0594+02	1.0817+02	1.0436+02	1.0947+02	1.0939+02	1.1483+02
1750.0	1.3487+02	1.3752+02	1.3509+02	1.3792+02	1.3304+02	1.3952+02	1.3942+02	1.4632+02
2000.0	1.6584+02	1.6909+02	1.6609+02	1.6956+02	1.6355+02	1.7148+02	1.7135+02	1.7979+02
2250.0	1.9916+02	2.0306+02	1.9946+02	2.0361+02	1.9638+02	2.0584+02	2.0568+02	2.1577+02
2500.0	2.3248+02	2.3703+02	2.3283+02	2.3766+02	2.2921+02	2.4020+02	2.4000+02	2.5175+02
2750.0	2.6819+02	2.7344+02	2.6858+02	2.7414+02	2.6438+02	2.7699+02	2.7675+02	2.9026+02
3000.0	3.0389+02	3.0984+02	3.0434+02	3.1062+02	2.9955+02	3.1378+02	3.1350+02	3.2876+02
3500.0	3.7883+02	3.8622+02	3.7936+02	3.8716+02	3.7334+02	3.9094+02	3.9056+02	4.0947+02
4000.0	4.5639+02	4.6527+02	4.5702+02	4.6638+02	4.4971+02	4.7075+02	4.7024+02	4.9291+02
4500.0	5.3595+02	5.4633+02	5.3667+02	5.4762+02	5.2802+02	5.5256+02	5.5191+02	5.7839+02
5000.0	6.1701+02	6.2892+02	6.1781+02	6.3039+02	6.0779+02	6.3588+02	6.3506+02	6.6541+02
6000.0	7.8220+02	7.9715+02	7.8312+02	7.9899+02	7.7029+02	8.0555+02	8.0430+02	8.4247+02
7000.0	9.5012+02	9.6812+02	9.5114+02	9.7033+02	9.3541+02	9.7790+02	9.7614+02	1.0222+03
8000.0	1.1196+03	1.1406+03	1.1206+03	1.1432+03	1.1020+03	1.1517+03	1.1493+03	1.2033+03
9000.0	1.2898+03	1.3138+03	1.2908+03	1.3167+03	1.2692+03	1.3262+03	1.3231+03	1.3850+03
10000.0	1.4602+03	1.4872+03	1.4613+03	1.4905+03	1.4366+03	1.5009+03	1.4971+03	1.5668+03
15000.0	2.3079+03	2.3492+03	2.3085+03	2.3542+03	2.2688+03	2.3688+03	2.3604+03	2.4686+03
20000.0	3.1420+03	3.1971+03	3.1418+03	3.2038+03	3.0872+03	3.2223+03	3.2084+03	3.3535+03
30000.0	4.7647+03	4.8462+03	4.7627+03	4.8562+03	4.6792+03	4.8826+03	4.8560+03	5.0706+03
40000.0	6.3373+03	6.4443+03	6.3334+03	6.4576+03	6.2220+03	6.4917+03	6.4519+03	6.7314+03
50000.0	7.8709+03	8.0027+03	7.8651+03	8.0193+03	7.7267+03	8.0613+03	8.0081+03	8.3494+03
60000.0	9.3736+03	9.5297+03	9.3659+03	9.5496+03	9.2011+03	9.5995+03	9.5329+03	9.9339+03
70000.0	1.0851+04	1.1031+04	1.0841+04	1.1054+04	1.0651+04	1.1112+04	1.1032+04	1.1491+04
80000.0	1.2308+04	1.2511+04	1.2296+04	1.2537+04	1.2080+04	1.2603+04	1.2509+04	1.3025+04
90000.0	1.3747+04	1.3973+04	1.3732+04	1.4002+04	1.3491+04	1.4075+04	1.3968+04	1.4540+04
100000.0	1.5171+04	1.5419+04	1.5153+04	1.5050+04	1.4887+04	1.5531+04	1.5411+04	1.6038+04

TABLE A3 COMPUTED ALPHA RANGE DATA, IN UNITS OF GMS/CM**2, AS A FUNCTION OF ENERGY IN MEV.

ENERGY	SE	KR	AG	SN	SB	XE	CS	TA
2.0	3.6291-03	3.6443-03	3.8871-03	4.0000-03	4.1301-03	4.4997-03	4.6160-03	6.1186-03
2.5	4.5159-03	4.5772-03	4.9310-03	5.0391-03	5.2192-03	5.6340-03	5.7416-03	7.4161-03
3.0	5.4751-03	5.5866-03	6.0955-03	6.2069-03	6.4380-03	6.9026-03	7.0014-03	8.8490-03
3.5	6.5070-03	6.6697-03	7.3589-03	7.4938-03	7.7748-03	8.2906-03	8.3849-03	1.0407-02
4.0	7.6123-03	7.8252-03	8.7110-03	8.8819-03	9.2199-03	9.7909-03	9.8802-03	1.2079-02
4.5	8.7906-03	9.0527-03	1.0146-02	1.0363-02	1.0757-02	1.1399-02	1.1482-02	1.3864-02
5.0	1.0041-02	1.0352-02	1.1659-02	1.1934-02	1.2382-02	1.3105-02	1.3186-02	1.5758-02
6.0	1.2757-02	1.3166-02	1.4906-02	1.5321-02	1.5883-02	1.6780-02	1.6863-02	1.9833-02
7.0	1.5755-02	1.6260-02	1.8433-02	1.9016-02	1.9692-02	2.0787-02	2.0874-02	2.4302-02
8.0	1.9027-02	1.9631-02	2.2234-02	2.2999-02	2.3787-02	2.5098-02	2.5196-02	2.9144-02
9.0	2.2567-02	2.3273-02	2.6303-02	2.7265-02	2.8165-02	2.9696-02	2.9809-02	3.4337-02
10.0	2.6368-02	2.7177-02	3.0637-02	3.1809-02	3.2821-02	3.4572-02	3.4699-02	3.9877-02
11.0	3.0423-02	3.1336-02	3.5229-02	3.6625-02	3.7751-02	3.9725-02	3.9866-02	4.5754-02
12.0	3.4729-02	3.5746-02	4.0074-02	4.1708-02	4.2949-02	4.5153-02	4.5304-02	5.1948-02
13.0	3.9280-02	4.0404-02	4.5171-02	4.7053-02	4.8412-02	5.0851-02	5.1011-02	5.8450-02
14.0	4.4067-02	4.5306-02	5.0516-02	5.2657-02	5.4135-02	5.6816-02	5.6984-02	6.5246-02
15.0	4.9086-02	5.0445-02	5.6099-02	5.8518-02	6.0114-02	6.3045-02	6.3220-02	7.2329-02
16.0	5.4330-02	5.5814-02	6.1917-02	6.4632-02	6.6337-02	6.9535-02	6.9714-02	7.9694-02
18.0	6.5483-02	6.7220-02	7.4253-02	7.7603-02	7.9536-02	8.3279-02	8.3466-02	9.5245-02
20.0	7.7498-02	7.9496-02	8.7507-02	9.1540-02	9.3694-02	9.8029-02	9.8219-02	1.1186-01
22.0	9.0354-02	9.2623-02	1.0166-01	1.0642-01	1.0880-01	1.1376-01	1.1395-01	1.2953-01
24.0	1.0404-01	1.0658-01	1.1669-01	1.2222-01	1.2483-01	1.3045-01	1.3064-01	1.4821-01
26.0	1.1853-01	1.2136-01	1.3259-01	1.3892-01	1.4177-01	1.4804-01	1.4826-01	1.6791-01
28.0	1.3382-01	1.3693-01	1.4932-01	1.5651-01	1.5960-01	1.6653-01	1.6679-01	1.8859-01
30.0	1.4990-01	1.5331-01	1.6688-01	1.7497-01	1.7831-01	1.8592-01	1.8618-01	2.1025-01
35.0	1.9344-01	1.9763-01	2.1425-01	2.2478-01	2.2883-01	2.3828-01	2.3850-01	2.6859-01
40.0	2.4166-01	2.4670-01	2.6650-01	2.7966-01	2.8448-01	2.9596-01	2.9617-01	3.3276-01
45.0	2.9444-01	3.0038-01	3.2346-01	3.3950-01	3.4513-01	3.5878-01	3.5895-01	4.0248-01
50.0	3.5166-01	3.5856-01	3.8501-01	4.0417-01	4.1061-01	4.2660-01	4.2672-01	4.7757-01
55.0	4.1333-01	4.2124-01	4.5118-01	4.7366-01	4.8092-01	4.9942-01	4.9946-01	5.5812-01
60.0	4.7912-01	4.8806-01	5.2159-01	5.4758-01	5.5571-01	5.7680-01	5.7674-01	6.4369-01
65.0	5.4929-01	5.5929-01	5.9653-01	6.2623-01	6.3527-01	6.5903-01	6.5887-01	7.3460-01
70.0	6.2338-01	6.3453-01	6.7554-01	7.0916-01	7.1916-01	7.4571-01	7.4543-01	8.3032-01
75.0	7.0168-01	7.1403-01	7.5894-01	7.9667-01	8.0763-01	8.3712-01	8.3671-01	9.3109-01
80.0	7.8383-01	7.9742-01	8.4633-01	8.8833-01	9.0030-01	9.3286-01	9.3230-01	1.0364+00
90.0	9.6011-01	9.7627-01	1.0335+00	1.0846+00	1.0987+00	1.1376+00	1.1368+00	1.2613+00
100.0	1.1518+00	1.1707+00	1.2365+00	1.2975+00	1.3138+00	1.3597+00	1.3584+00	1.5045+00
110.0	1.3589+00	1.3805+00	1.4554+00	1.5270+00	1.5456+00	1.5988+00	1.5971+00	1.7659+00
120.0	1.5801+00	1.6046+00	1.6889+00	1.7716+00	1.7928+00	1.8538+00	1.8516+00	2.0441+00
130.0	1.8163+00	1.8438+00	1.9379+00	2.0325+00	2.0563+00	2.1254+00	2.1227+00	2.3402+00
140.0	2.0661+00	2.0968+00	2.2009+00	2.3080+00	2.3345+00	2.4122+00	2.4089+00	2.6524+00
150.0	2.3303+00	2.3643+00	2.4788+00	2.5991+00	2.6284+00	2.7151+00	2.7111+00	2.9818+00
160.0	2.6076+00	2.6450+00	2.7702+00	2.9043+00	2.9365+00	3.0325+00	3.0278+00	3.3268+00
180.0	3.2026+00	3.2474+00	3.3948+00	3.5583+00	3.5967+00	3.7127+00	3.7064+00	4.0649+00

TABLE A3 COMPUTED ALPHA RANGE DATA, IN UNITS OF GMS/CM**2, AS A FUNCTION OF ENERGY IN MEV.

ENERGY	SE	KR	AG	SN	SB	XE	CS	TA
200.0	3.8497+00	3.9021+00	4.0729+00	4.2682+00	4.3132+00	4.4506+00	4.4425+00	4.8646+00
225.0	4.7289+00	4.7920+00	4.9937+00	5.2318+00	5.2855+00	5.4517+00	5.4412+00	5.9482+00
250.0	5.6840+00	5.7586+00	5.9919+00	6.2767+00	6.3404+00	6.5373+00	6.5240+00	7.1217+00
275.0	6.7168+00	6.8032+00	7.0702+00	7.4048+00	7.4785+00	7.7092+00	7.6931+00	8.3873+00
300.0	7.8123+00	7.9111+00	8.2130+00	8.6004+00	8.6842+00	8.9499+00	8.9311+00	9.7269+00
325.0	8.9851+00	9.0971+00	9.4356+00	9.8793+00	9.9738+00	1.0276+01	1.0254+01	1.1158+01
350.0	1.0222+01	1.0348+01	1.0724+01	1.1228+01	1.1333+01	1.1674+01	1.1648+01	1.2665+01
375.0	1.1522+01	1.1662+01	1.2077+01	1.2643+01	1.2760+01	1.3141+01	1.3111+01	1.4244+01
400.0	1.2883+01	1.3038+01	1.3493+01	1.4124+01	1.4253+01	1.4676+01	1.4641+01	1.5894+01
450.0	1.5800+01	1.5987+01	1.6526+01	1.7296+01	1.7450+01	1.7962+01	1.7918+01	1.9426+01
500.0	1.8944+01	1.9163+01	1.9791+01	2.0711+01	2.0891+01	2.1498+01	2.1444+01	2.3220+01
550.0	2.2329+01	2.2583+01	2.3303+01	2.4385+01	2.4591+01	2.5300+01	2.5234+01	2.7296+01
600.0	2.5918+01	2.6208+01	2.7024+01	2.8278+01	2.8511+01	2.9327+01	2.9249+01	3.1611+01
700.0	3.3676+01	3.4043+01	3.5061+01	3.6688+01	3.6975+01	3.8019+01	3.7915+01	4.0915+01
800.0	4.2197+01	4.2645+01	4.3877+01	4.5917+01	4.6257+01	4.7551+01	4.7418+01	5.1107+01
900.0	5.1403+01	5.1937+01	5.3393+01	5.5882+01	5.6275+01	5.7835+01	5.7671+01	6.2096+01
1000.0	6.1240+01	6.1864+01	6.3553+01	6.6526+01	6.6969+01	6.8809+01	6.8613+01	7.3817+01
1250.0	8.8428+01	8.9289+01	9.1598+01	9.5926+01	9.6477+01	9.9082+01	9.8798+01	1.0612+02
1500.0	1.1848+02	1.1959+02	1.2256+02	1.2841+02	1.2904+02	1.3247+02	1.3210+02	1.4172+02
1750.0	1.5093+02	1.5230+02	1.5597+02	1.6349+02	1.6417+02	1.6848+02	1.6801+02	1.8008+02
2000.0	1.8542+02	1.8705+02	1.9145+02	2.0078+02	2.0148+02	2.0670+02	2.0613+02	2.2079+02
2250.0	2.2249+02	2.2437+02	2.2955+02	2.4085+02	2.4152+02	2.4769+02	2.4703+02	2.6444+02
2500.0	2.5955+02	2.6169+02	2.6764+02	2.8092+02	2.8157+02	2.8868+02	2.8794+02	3.0809+02
2750.0	2.9920+02	3.0158+02	3.0836+02	3.2380+02	3.2435+02	3.3243+02	3.3161+02	3.5469+02
3000.0	3.3884+02	3.4147+02	3.4908+02	3.6668+02	3.6713+02	3.7619+02	3.7529+02	4.0129+02
3500.0	4.2190+02	4.2498+02	4.3435+02	4.5654+02	4.5668+02	4.6768+02	4.6668+02	4.9878+02
4000.0	5.0772+02	5.1121+02	5.2244+02	5.4942+02	5.4916+02	5.6207+02	5.6101+02	5.9944+02
4500.0	5.9560+02	5.9944+02	6.1262+02	6.4456+02	6.4380+02	6.5857+02	6.5750+02	7.0245+02
5000.0	6.8501+02	6.8914+02	7.0437+02	7.4138+02	7.4003+02	7.5660+02	7.5557+02	8.0718+02
6000.0	8.6677+02	8.7130+02	8.9090+02	9.3829+02	9.3558+02	9.5550+02	9.5471+02	1.0200+03
7000.0	1.0510+03	1.0557+03	1.0800+03	1.1380+03	1.1337+03	1.1566+03	1.1563+03	1.2356+03
8000.0	1.2365+03	1.2410+03	1.2704+03	1.3390+03	1.3330+03	1.3585+03	1.3589+03	1.4525+03
9000.0	1.4224+03	1.4264+03	1.4612+03	1.5404+03	1.5326+03	1.5604+03	1.5616+03	1.6698+03
10000.0	1.6082+03	1.6115+03	1.6519+03	1.7417+03	1.7320+03	1.7617+03	1.7640+03	1.8869+03
15000.0	2.5279+03	2.5229+03	2.5954+03	2.7372+03	2.7177+03	2.7516+03	2.7615+03	2.9596+03
20000.0	3.4288+03	3.4087+03	3.5185+03	3.7097+03	3.6805+03	3.7117+03	3.7325+03	4.0071+03
30000.0	5.1748+03	5.1071+03	5.3032+03	5.5861+03	5.5395+03	5.5488+03	5.5993+03	6.0282+03
40000.0	6.8628+03	6.7299+03	7.0239+03	7.3910+03	7.3292+03	7.3008+03	7.3894+03	7.9724+03
50000.0	8.5074+03	8.2958+03	8.6969+03	9.1419+03	9.0670+03	8.9891+03	9.1229+03	9.8591+03
60000.0	1.0118+04	9.8171+03	1.0333+04	1.0851+04	1.0764+04	1.0628+04	1.0813+04	1.1701+04
70000.0	1.1701+04	1.1302+04	1.1940+04	1.2525+04	1.2429+04	1.2227+04	1.2468+04	1.3507+04
80000.0	1.3261+04	1.2758+04	1.3522+04	1.4172+04	1.4067+04	1.3792+04	1.4095+04	1.5283+04
90000.0	1.4802+04	1.4187+04	1.5084+04	1.5794+04	1.5682+04	1.5329+04	1.5697+04	1.7034+04
100000.0	1.6325+04	1.5594+04	1.6628+04	1.7396+04	1.7278+04	1.6841+04	1.7278+04	1.8763+04

TABLE A3 COMPUTED ALPHA RANGE DATA, IN UNITS OF GMS/CM**2, AS A FUNCTION OF ENERGY IN MEV.

ENERGY	W	PT	AU	HG	PB	BI	U	CO2
2.0	6.1692-03	6.3372-03	6.3706-03	6.4005-03	6.4500-03	6.4695-03	6.4900-03	1.5185-03
2.5	7.4704-03	7.7304-03	7.8066-03	7.8698-03	7.9710-03	7.9996-03	8.2039-03	1.9242-03
3.0	8.9067-03	9.2467-03	9.3618-03	9.4613-03	9.6218-03	9.6685-03	1.0075-02	2.3841-03
3.5	1.0470-02	1.0878-02	1.1027-02	1.1162-02	1.1388-02	1.1450-02	1.2085-02	2.8959-03
4.0	1.2150-02	1.2625-02	1.2805-02	1.2976-02	1.3277-02	1.3356-02	1.4231-02	3.4578-03
4.5	1.3941-02	1.4486-02	1.4694-02	1.4900-02	1.5280-02	1.5376-02	1.6510-02	4.0687-03
5.0	1.5830-02	1.6453-02	1.6689-02	1.6931-02	1.7387-02	1.7503-02	1.8912-02	4.7270-03
6.0	1.9912-02	2.0699-02	2.0986-02	2.1296-02	2.1900-02	2.2053-02	2.4055-02	6.1816-03
7.0	2.4395-02	2.5342-02	2.5678-02	2.6056-02	2.6802-02	2.6987-02	2.9615-02	7.8155-03
8.0	2.9249-02	3.0358-02	3.0750-02	3.1197-02	3.2083-02	3.2294-02	3.5562-02	9.6221-03
9.0	3.4467-02	3.5736-02	3.6168-02	3.6696-02	3.7728-02	3.7963-02	4.1880-02	1.1597-02
10.0	4.0034-02	4.1432-02	4.1935-02	4.2531-02	4.3726-02	4.3982-02	4.8512-02	1.3736-02
11.0	4.5941-02	4.7469-02	4.8042-02	4.8709-02	5.0065-02	5.0342-02	5.5482-02	1.6036-02
12.0	5.2169-02	5.3841-02	5.4467-02	5.5220-02	5.6724-02	5.7028-02	6.2783-02	1.8495-02
13.0	5.8704-02	6.0539-02	6.1184-02	6.2056-02	6.3699-02	6.4026-02	7.0410-02	2.1109-02
14.0	6.5539-02	6.7539-02	6.8210-02	6.9192-02	7.0994-02	7.1344-02	7.8359-02	2.3877-02
15.0	7.2666-02	7.4843-02	7.5539-02	7.6595-02	7.8600-02	7.8974-02	8.6627-02	2.6795-02
16.0	8.0077-02	8.2443-02	8.3162-02	8.4298-02	8.6506-02	8.6897-02	9.5207-02	2.9862-02
18.0	9.5727-02	9.8501-02	9.9262-02	1.0056-01	1.0319-01	1.0362-01	1.1330-01	3.6440-02
20.0	1.1245-01	1.1566-01	1.1647-01	1.1795-01	1.2092-01	1.2147-01	1.3257-01	4.3598-02
22.0	1.3023-01	1.3390-01	1.3475-01	1.3642-01	1.3972-01	1.4030-01	1.5301-01	5.1326-02
24.0	1.4903-01	1.5318-01	1.5408-01	1.5595-01	1.5959-01	1.6019-01	1.7458-01	5.9614-02
26.0	1.6884-01	1.7348-01	1.7443-01	1.7651-01	1.8051-01	1.8113-01	1.9723-01	6.8455-02
28.0	1.8965-01	1.9480-01	1.9580-01	1.9809-01	2.0246-01	2.0310-01	2.2095-01	7.7841-02
30.0	2.1144-01	2.1711-01	2.1815-01	2.2066-01	2.2542-01	2.2608-01	2.4573-01	8.7766-02
35.0	2.7013-01	2.7714-01	2.7828-01	2.8138-01	2.8715-01	2.8784-01	3.1213-01	1.1490-01
40.0	3.3467-01	3.4311-01	3.4434-01	3.4807-01	3.5491-01	3.5562-01	3.8448-01	1.4527-01
45.0	4.0475-01	4.1485-01	4.1617-01	4.2056-01	4.2853-01	4.2924-01	4.6274-01	1.7883-01
50.0	4.8027-01	4.9204-01	4.9357-01	4.9870-01	5.0786-01	5.0857-01	5.4693-01	2.1549-01
55.0	5.6127-01	5.7473-01	5.7634-01	5.8232-01	5.9287-01	5.9358-01	6.3703-01	2.5527-01
60.0	6.4732-01	6.6256-01	6.6423-01	6.7098-01	6.8292-01	6.8370-01	7.3256-01	2.9793-01
65.0	7.3874-01	7.5583-01	7.5756-01	7.6514-01	7.7844-01	7.7918-01	8.3389-01	3.4367-01
70.0	8.3501-01	8.5405-01	8.5583-01	8.6428-01	8.7900-01	8.7969-01	9.4046-01	3.9221-01
75.0	9.3636-01	9.5754-01	9.5936-01	9.6871-01	9.8492-01	9.8556-01	1.0526+00	4.4373-01
80.0	1.0423+00	1.0657+00	1.0677+00	1.0780+00	1.0957+00	1.0963+00	1.1695+00	4.9799-01
90.0	1.2684+00	1.2965+00	1.2986+00	1.3110+00	1.3323+00	1.3328+00	1.4190+00	6.1499-01
100.0	1.5130+00	1.5461+00	1.5483+00	1.5629+00	1.5878+00	1.5882+00	1.6888+00	7.4296-01
110.0	1.7758+00	1.8142+00	1.8166+00	1.8335+00	1.8623+00	1.8626+00	1.9786+00	8.8189-01
120.0	2.0555+00	2.0994+00	2.1019+00	2.1213+00	2.1542+00	2.1543+00	2.2866+00	1.0309+00
130.0	2.3532+00	2.4028+00	2.4053+00	2.4273+00	2.4645+00	2.4644+00	2.6139+00	1.1907+00
140.0	2.6671+00	2.7226+00	2.7252+00	2.7498+00	2.7915+00	2.7912+00	2.9586+00	1.3603+00
150.0	2.9982+00	3.0599+00	3.0625+00	3.0900+00	3.1363+00	3.1357+00	3.3217+00	1.5402+00
160.0	3.3450+00	3.4130+00	3.4156+00	3.4461+00	3.4972+00	3.4963+00	3.7015+00	1.7296+00
180.0	4.0868+00	4.1684+00	4.1709+00	4.2077+00	4.2690+00	4.2673+00	4.5131+00	2.1377+00

TABLE A3 COMPUTED ALPHA RANGE DATA, IN UNITS OF GMS/CM**2, AS A FUNCTION OF ENERGY IN MEV.

ENERGY	W	PT	AU	HG	PB	BI	U	CO2
200.0	4.8907+00	4.9866+00	4.9890+00	5.0325+00	5.1046+00	5.1022+00	5.3911+00	2.5835+00
225.0	5.9796+00	6.0947+00	6.0968+00	6.1495+00	6.2361+00	6.2324+00	6.5792+00	3.1920+00
250.0	7.1590+00	7.2946+00	7.2963+00	7.3587+00	7.4610+00	7.4559+00	7.8645+00	3.8560+00
275.0	8.4308+00	8.5882+00	8.5894+00	8.6623+00	8.7812+00	8.7745+00	9.2491+00	4.5769+00
300.0	9.7769+00	9.9572+00	9.9579+00	1.0042+01	1.0178+01	1.0170+01	1.0714+01	5.3435+00
325.0	1.1215+01	1.1419+01	1.1419+01	1.1515+01	1.1670+01	1.1659+01	1.2277+01	6.1670+00
350.0	1.2729+01	1.2958+01	1.2958+01	1.3066+01	1.3240+01	1.3228+01	1.3922+01	7.0378+00
375.0	1.4316+01	1.4571+01	1.4571+01	1.4692+01	1.4887+01	1.4872+01	1.5647+01	7.9547+00
400.0	1.5974+01	1.6257+01	1.6255+01	1.6390+01	1.6607+01	1.6589+01	1.7449+01	8.9166+00
450.0	1.9522+01	1.9862+01	1.9859+01	2.0022+01	2.0283+01	2.0260+01	2.1298+01	1.0985+01
500.0	2.3335+01	2.3736+01	2.3730+01	2.3924+01	2.4233+01	2.4203+01	2.5432+01	1.3221+01
550.0	2.7430+01	2.7897+01	2.7888+01	2.8114+01	2.8473+01	2.8437+01	2.9869+01	1.5635+01
600.0	3.1764+01	3.2299+01	3.2287+01	3.2547+01	3.2961+01	3.2916+01	3.4565+01	1.8200+01
700.0	4.1111+01	4.1789+01	4.1769+01	4.2103+01	4.2632+01	4.2571+01	4.4686+01	2.3762+01
800.0	5.1349+01	5.2181+01	5.2152+01	5.2567+01	5.3221+01	5.3140+01	5.5761+01	2.9890+01
900.0	6.2387+01	6.3383+01	6.3344+01	6.3845+01	6.4632+01	6.4530+01	6.7697+01	3.6529+01
1000.0	7.4160+01	7.5328+01	7.5277+01	7.5870+01	7.6800+01	7.6672+01	8.0422+01	4.3640+01
1250.0	1.0661+02	1.0824+02	1.0815+02	1.0900+02	1.1031+02	1.1011+02	1.1548+02	6.3360+01
1500.0	1.4236+02	1.4449+02	1.4436+02	1.4549+02	1.4723+02	1.4694+02	1.5410+02	8.5231+01
1750.0	1.8091+02	1.8355+02	1.8338+02	1.8480+02	1.8699+02	1.8660+02	1.9570+02	1.0892+02
2000.0	2.2180+02	2.2498+02	2.2475+02	2.2649+02	2.2916+02	2.2865+02	2.3984+02	1.3416+02
2250.0	2.6566+02	2.6940+02	2.6910+02	2.7116+02	2.7434+02	2.7369+02	2.8713+02	1.6136+02
2500.0	3.0952+02	3.1381+02	3.1344+02	3.1583+02	3.1952+02	3.1873+02	3.3443+02	1.8856+02
2750.0	3.5635+02	3.6120+02	3.6074+02	3.6347+02	3.6770+02	3.6675+02	3.8487+02	2.1774+02
3000.0	4.0319+02	4.0859+02	4.0805+02	4.1111+02	4.1589+02	4.1476+02	4.3532+02	2.4693+02
3500.0	5.0120+02	5.0771+02	5.0695+02	5.1069+02	5.1660+02	5.1508+02	5.4077+02	3.0822+02
4000.0	6.0241+02	6.1002+02	6.0900+02	6.1341+02	6.2047+02	6.1853+02	6.4953+02	3.7168+02
4500.0	7.0600+02	7.1467+02	7.1336+02	7.1842+02	7.2665+02	7.2426+02	7.6070+02	4.3678+02
5000.0	8.1134+02	8.2106+02	8.1942+02	8.2511+02	8.3452+02	8.3165+02	8.7363+02	5.0310+02
6000.0	1.0254+03	1.0372+03	1.0348+03	1.0416+03	1.0534+03	1.0495+03	1.1028+03	6.3817+02
7000.0	1.2424+03	1.2561+03	1.2528+03	1.2607+03	1.2748+03	1.2699+03	1.3345+03	7.7534+02
8000.0	1.4607+03	1.4763+03	1.4719+03	1.4809+03	1.4973+03	1.4913+03	1.5672+03	9.1359+02
9000.0	1.6793+03	1.6968+03	1.6914+03	1.7012+03	1.7198+03	1.7127+03	1.7999+03	1.0523+03
10000.0	1.8978+03	1.9171+03	1.9105+03	1.9211+03	1.9418+03	1.9336+03	2.0321+03	1.1910+03
15000.0	2.9778+03	3.0059+03	2.9928+03	3.0059+03	3.0361+03	3.0219+03	3.1754+03	1.8777+03
20000.0	4.0326+03	4.0693+03	4.0492+03	4.0636+03	4.1013+03	4.0810+03	4.2872+03	2.5494+03
30000.0	6.0678+03	6.1217+03	6.0874+03	6.1023+03	6.1513+03	6.1180+03	6.4236+03	3.8457+03
40000.0	8.0258+03	8.0967+03	8.0485+03	8.0624+03	8.1199+03	8.0732+03	8.4720+03	5.0915+03
50000.0	9.9258+03	1.0014+04	9.9519+03	9.9640+03	1.0029+04	9.9683+03	1.0456+04	6.2986+03
60000.0	1.1781+04	1.1886+04	1.1810+04	1.1820+04	1.1891+04	1.1817+04	1.2391+04	7.4751+03
70000.0	1.3599+04	1.3721+04	1.3633+04	1.3640+04	1.3716+04	1.3629+04	1.4286+04	8.6266+03
80000.0	1.5388+04	1.5526+04	1.5425+04	1.5429+04	1.5510+04	1.5410+04	1.6149+04	9.7571+03
90000.0	1.7151+04	1.7306+04	1.7193+04	1.7193+04	1.7279+04	1.7165+04	1.7984+04	1.0870+04
100000.0	1.8892+04	1.9063+04	1.8938+04	1.8935+04	1.9024+04	1.8897+04	1.9796+04	1.1966+04

TABLE A3 COMPUTED ALPHA RANGE DATA, IN UNITS OF GMS/CM**2, AS A FUNCTION OF ENERGY IN MEV.

ENERGY	H2O2	AIR	H2O	TISSUE	(CH2)N	GLASS	EMULSION	NAI
2.0	1.4331-03	1.5014-03	1.2606-03	1.2046-03	9.3892-04	2.2676-03	2.7288-03	3.8526-03
2.5	1.8074-03	1.9039-03	1.5973-03	1.5395-03	1.2360-03	2.8089-03	3.4759-03	4.7891-03
3.0	2.2324-03	2.3606-03	1.9810-03	1.9214-03	1.5764-03	3.4179-03	4.3076-03	5.8363-03
3.5	2.7059-03	2.8698-03	2.4097-03	2.3484-03	1.9582-03	4.0917-03	5.2160-03	6.9860-03
4.0	3.2265-03	3.4292-03	2.8821-03	2.8189-03	2.3800-03	4.8264-03	6.1972-03	8.2313-03
4.5	3.7931-03	4.0372-03	3.3971-03	3.3320-03	2.8408-03	5.6186-03	7.2487-03	9.5672-03
5.0	4.4044-03	4.6926-03	3.9537-03	3.8865-03	3.3395-03	6.4663-03	8.3681-03	1.0987-02
6.0	5.7566-03	6.1412-03	5.1874-03	5.1159-03	4.4479-03	8.3226-03	1.0803-02	1.4061-02
7.0	7.2775-03	7.7676-03	6.5780-03	6.5018-03	5.7003-03	1.0387-02	1.3491-02	1.7431-02
8.0	8.9613-03	9.5662-03	8.1201-03	8.0389-03	7.0917-03	1.2652-02	1.6424-02	2.1078-02
9.0	1.0803-02	1.1533-02	9.8097-03	9.7232-03	8.6193-03	1.5114-02	1.9597-02	2.4990-02
10.0	1.2800-02	1.3663-02	1.1643-02	1.1552-02	1.0281-02	1.7768-02	2.3002-02	2.9162-02
11.0	1.4948-02	1.5952-02	1.3619-02	1.3521-02	1.2073-02	2.0610-02	2.6636-02	3.3590-02
12.0	1.7246-02	1.8400-02	1.5733-02	1.5630-02	1.3993-02	2.3637-02	3.0494-02	3.8270-02
13.0	1.9689-02	2.1003-02	1.7984-02	1.7876-02	1.6041-02	2.6846-02	3.4572-02	4.3199-02
14.0	2.2277-02	2.3760-02	2.0369-02	2.0255-02	1.8213-02	3.0234-02	3.8865-02	4.8372-02
15.0	2.5007-02	2.6667-02	2.2887-02	2.2768-02	2.0510-02	3.3799-02	4.3369-02	5.3787-02
16.0	2.7877-02	2.9724-02	2.5536-02	2.5412-02	2.2928-02	3.7538-02	4.8079-02	5.9439-02
18.0	3.4034-02	3.6279-02	3.1224-02	3.1088-02	2.8127-02	4.5529-02	5.8110-02	7.1443-02
20.0	4.0735-02	4.3413-02	3.7420-02	3.7275-02	3.3803-02	5.4193-02	6.8939-02	8.4366-02
22.0	4.7972-02	5.1115-02	4.4116-02	4.3962-02	3.9945-02	6.3517-02	8.0549-02	9.8169-02
24.0	5.5736-02	5.9377-02	5.1306-02	5.1142-02	4.6549-02	7.3489-02	9.2925-02	1.1283-01
26.0	6.4019-02	6.8192-02	5.8980-02	5.8809-02	5.3606-02	8.4097-02	1.0605-01	1.2835-01
28.0	7.2815-02	7.7551-02	6.7134-02	6.6955-02	6.1112-02	9.5332-02	1.1992-01	1.4470-01
30.0	8.2116-02	8.7449-02	7.5761-02	7.5576-02	6.9061-02	1.0718-01	1.3451-01	1.6188-01
35.0	1.0755-01	1.1451-01	9.9368-02	9.9168-02	9.0838-02	1.3947-01	1.7408-01	2.0838-01
40.0	1.3604-01	1.4482-01	1.2583-01	1.2562-01	1.1529-01	1.7545-01	2.1797-01	2.5976-01
45.0	1.6751-01	1.7829-01	1.5508-01	1.5487-01	1.4235-01	2.1503-01	2.6607-01	3.1588-01
50.0	2.0191-01	2.1487-01	1.8708-01	1.8685-01	1.7198-01	2.5814-01	3.1826-01	3.7661-01
55.0	2.3924-01	2.5456-01	2.2181-01	2.2159-01	2.0418-01	3.0476-01	3.7455-01	4.4194-01
60.0	2.7927-01	2.9712-01	2.5907-01	2.5886-01	2.3875-01	3.5463-01	4.3464-01	5.1152-01
65.0	3.2220-01	3.4276-01	2.9905-01	2.9884-01	2.7587-01	4.0796-01	4.9875-01	5.8557-01
70.0	3.6776-01	3.9120-01	3.4148-01	3.4130-01	3.1530-01	4.6444-01	5.6652-01	6.6373-01
75.0	4.1612-01	4.4262-01	3.8656-01	3.8639-01	3.5721-01	5.2428-01	6.3820-01	7.4628-01
80.0	4.6706-01	4.9676-01	4.3403-01	4.3388-01	4.0137-01	5.8717-01	7.1343-01	8.3279-01
90.0	5.7691-01	6.1353-01	5.3645-01	5.3637-01	4.9671-01	7.2244-01	8.7495-01	1.0182+00
100.0	6.9708-01	7.4126-01	6.4854-01	6.4854-01	6.0114-01	8.6995-01	1.0507+00	1.2195+00
110.0	8.2754-01	8.7993-01	7.7028-01	7.7038-01	7.1464-01	1.0297+00	1.2406+00	1.4368+00
120.0	9.6751-01	1.0287+00	9.0093-01	9.0115-01	8.3652-01	1.2007+00	1.4436+00	1.6686+00
130.0	1.1176+00	1.1882+00	1.0411+00	1.0414+00	9.6732-01	1.3837+00	1.6605+00	1.9159+00
140.0	1.2769+00	1.3575+00	1.1898+00	1.1903+00	1.1062+00	1.5776+00	1.8899+00	2.1773+00
150.0	1.4459+00	1.5371+00	1.3477+00	1.3484+00	1.2537+00	1.7831+00	2.1328+00	2.4536+00
160.0	1.6238+00	1.7262+00	1.5139+00	1.5148+00	1.4091+00	1.9991+00	2.3877+00	2.7434+00
180.0	2.0072+00	2.1336+00	1.8722+00	1.8736+00	1.7442+00	2.4637+00	2.9351+00	3.3650+00

TABLE A3 COMPUTED ALPHA RANGE DATA, IN UNITS OF GMS/CM**2, AS A FUNCTION OF ENERGY IN MEV.

ENERGY	H2O2	AIR	H2O	TISSUE	(CH2)N	GLASS	EMULSION	NAI
200.0	2.4260+00	2.5786+00	2.2637+00	2.2656+00	2.1106+00	2.9701+00	3.5307+00	4.0403+00
225.0	2.9979+00	3.1863+00	2.7985+00	2.8011+00	2.6113+00	3.6603+00	4.3409+00	4.9576+00
250.0	3.6219+00	3.8493+00	3.3821+00	3.3856+00	3.1581+00	4.4119+00	5.2211+00	5.9534+00
275.0	4.2993+00	4.5691+00	4.0160+00	4.0204+00	3.7522+00	5.2266+00	6.1736+00	7.0296+00
300.0	5.0199+00	5.3346+00	4.6903+00	4.6958+00	4.3845+00	6.0922+00	7.1842+00	8.1698+00
325.0	5.7939+00	6.1570+00	5.4148+00	5.4215+00	5.0641+00	7.0206+00	8.2667+00	9.3900+00
350.0	6.6124+00	7.0265+00	6.1810+00	6.1891+00	5.7832+00	8.0014+00	9.4090+00	1.0677+01
375.0	7.4742+00	7.9422+00	6.9880+00	6.9975+00	6.5407+00	9.0331+00	1.0609+01	1.2028+01
400.0	8.3785+00	8.9028+00	7.8347+00	7.8458+00	7.3358+00	1.0115+01	1.1866+01	1.3443+01
450.0	1.0323+01	1.0969+01	9.6563+00	9.6707+00	9.0469+00	1.2438+01	1.4563+01	1.6474+01
500.0	1.2425+01	1.3202+01	1.1625+01	1.1644+01	1.0897+01	1.4945+01	1.7470+01	1.9737+01
550.0	1.4695+01	1.5613+01	1.3752+01	1.3774+01	1.2897+01	1.7649+01	2.0600+01	2.3249+01
600.0	1.7107+01	1.8175+01	1.6013+01	1.6040+01	1.5023+01	2.0520+01	2.3920+01	2.6971+01
700.0	2.2336+01	2.3729+01	2.0915+01	2.0952+01	1.9635+01	2.6735+01	3.1099+01	3.5012+01
800.0	2.8099+01	2.9851+01	2.6318+01	2.6367+01	2.4722+01	3.3573+01	3.8986+01	4.3837+01
900.0	3.4343+01	3.6482+01	3.2174+01	3.2235+01	3.0236+01	4.0972+01	4.7509+01	5.3366+01
1000.0	4.1030+01	4.3585+01	3.8446+01	3.8522+01	3.6146+01	4.8887+01	5.6618+01	6.3541+01
1250.0	5.9577+01	6.3284+01	5.5850+01	5.5966+01	5.2551+01	7.0804+01	8.1798+01	9.1635+01
1500.0	8.0150+01	8.5133+01	7.5159+01	7.5322+01	7.0764+01	9.5069+01	1.0963+02	1.2265+02
1750.0	1.0243+02	1.0880+02	9.6080+01	9.6294+01	9.0506+01	1.2132+02	1.3970+02	1.5613+02
2000.0	1.2617+02	1.3401+02	1.1837+02	1.1864+02	1.1155+02	1.4925+02	1.7166+02	1.9168+02
2250.0	1.5176+02	1.6119+02	1.4241+02	1.4274+02	1.3426+02	1.7932+02	2.0601+02	2.2985+02
2500.0	1.7736+02	1.8836+02	1.6645+02	1.6684+02	1.5696+02	2.0939+02	2.4035+02	2.6802+02
2750.0	2.0481+02	2.1752+02	1.9225+02	1.9271+02	1.8135+02	2.4162+02	2.7709+02	3.0881+02
3000.0	2.3227+02	2.4668+02	2.1805+02	2.1858+02	2.0574+02	2.7385+02	3.1383+02	3.4960+02
3500.0	2.8995+02	3.0792+02	2.7225+02	2.7293+02	2.5704+02	3.4151+02	3.9079+02	4.3498+02
4000.0	3.4968+02	3.7133+02	3.2839+02	3.2923+02	3.1025+02	4.1156+02	4.7035+02	5.2315+02
4500.0	4.1097+02	4.3638+02	3.8600+02	3.8702+02	3.6495+02	4.8342+02	5.5184+02	6.1339+02
5000.0	4.7348+02	5.0265+02	4.4473+02	4.4596+02	4.2081+02	5.5665+02	6.3477+02	7.0514+02
6000.0	6.0104+02	6.3762+02	5.6458+02	5.6625+02	5.3498+02	7.0588+02	8.0351+02	8.9158+02
7000.0	7.3099+02	7.7470+02	6.8664+02	6.8880+02	6.5149+02	8.5760+02	9.7474+02	1.0805+03
8000.0	8.6241+02	9.1286+02	8.1007+02	8.1275+02	7.6947+02	1.0107+03	1.1473+03	1.2704+03
9000.0	9.9470+02	1.0514+03	9.3430+02	9.3753+02	8.8837+02	1.1645+03	1.3203+03	1.4607+03
10000.0	1.1275+03	1.1901+03	1.0590+03	1.0628+03	1.0078+03	1.3185+03	1.4935+03	1.6509+03
15000.0	1.7917+03	1.8765+03	1.6826+03	1.6893+03	1.6061+03	2.0845+03	2.3521+03	2.5907+03
20000.0	2.4501+03	2.5478+03	2.3011+03	2.3107+03	2.2001+03	2.8383+03	3.1944+03	3.5093+03
30000.0	3.7416+03	3.8436+03	3.5147+03	3.5300+03	3.3664+03	4.3056+03	4.8283+03	5.2852+03
40000.0	5.0027+03	5.0890+03	4.7007+03	4.7212+03	4.5064+03	5.7290+03	6.4084+03	6.9975+03
50000.0	6.2391+03	6.2958+03	5.8640+03	5.8896+03	5.6250+03	7.1188+03	7.9477+03	8.6620+03
60000.0	7.4553+03	7.4721+03	7.0088+03	7.0393+03	6.7261+03	8.4822+03	9.4550+03	1.0289+04
70000.0	8.6547+03	8.6233+03	8.1381+03	8.1736+03	7.8127+03	9.8241+03	1.0937+04	1.1887+04
80000.0	9.8398+03	9.7536+03	9.2543+03	9.2947+03	8.8872+03	1.1148+04	1.2397+04	1.3459+04
90000.0	1.1013+04	1.0866+04	1.0359+04	1.0404+04	9.9512+03	1.2457+04	1.3839+04	1.5010+04
100000.0	1.2175+04	1.1963+04	1.1454+04	1.1504+04	1.1006+04	1.3753+04	1.5265+04	1.6542+04

TABLE A3 COMPUTED ALPHA RANGE DATA, IN UNITS OF GMS/CM**2, AS A FUNCTION OF ENERGY IN MEV.

ENERGY	BONE	ANTHRACENE	STILBENE	MYLAR	LUCITE	POLYSTYRENE	TEFLON
2.0	1.3499-03	1.0767-03	1.0579-03	1.2154-03	1.1282-03	1.0401-03	1.5510-03
2.5	1.7271-03	1.4191-03	1.3941-03	1.5782-03	1.4667-03	1.3701-03	1.9909-03
3.0	2.1559-03	1.8100-03	1.7780-03	1.9913-03	1.8528-03	1.7472-03	2.4872-03
3.5	2.6343-03	2.2470-03	2.2074-03	2.4524-03	2.2845-03	2.1692-03	3.0377-03
4.0	3.1604-03	2.7288-03	2.6810-03	2.9599-03	2.7603-03	2.6347-03	3.6408-03
4.5	3.7329-03	3.2538-03	3.1972-03	3.5125-03	3.2790-03	3.1423-03	4.2949-03
5.0	4.3504-03	3.8210-03	3.7551-03	4.1090-03	3.8394-03	3.6910-03	4.9987-03
6.0	5.7160-03	5.0788-03	4.9925-03	5.4300-03	5.0821-03	4.9084-03	6.5519-03
7.0	7.2507-03	6.4965-03	6.3877-03	6.9172-03	6.4829-03	6.2816-03	8.2930-03
8.0	8.9488-03	8.0683-03	7.9350-03	8.5645-03	8.0362-03	7.8049-03	1.0215-02
9.0	1.0806-02	9.7909-03	9.6312-03	1.0368-02	9.7384-03	9.4752-03	1.2315-02
10.0	1.2819-02	1.1662-02	1.1474-02	1.2325-02	1.1587-02	1.1290-02	1.4588-02
11.0	1.4984-02	1.3677-02	1.3459-02	1.4432-02	1.3578-02	1.3245-02	1.7031-02
12.0	1.7300-02	1.5835-02	1.5585-02	1.6686-02	1.5710-02	1.5340-02	1.9641-02
13.0	1.9763-02	1.8133-02	1.7849-02	1.9086-02	1.7980-02	1.7571-02	2.2414-02
14.0	2.2371-02	2.0570-02	2.0250-02	2.1628-02	2.0387-02	1.9937-02	2.5349-02
15.0	2.5122-02	2.3143-02	2.2786-02	2.4312-02	2.2928-02	2.2437-02	2.8444-02
16.0	2.8016-02	2.5852-02	2.5456-02	2.7135-02	2.5602-02	2.5068-02	3.1695-02
18.0	3.4222-02	3.1670-02	3.1191-02	3.3196-02	3.1346-02	3.0721-02	3.8663-02
20.0	4.0979-02	3.8014-02	3.7445-02	3.9799-02	3.7607-02	3.6888-02	4.6239-02
22.0	4.8275-02	4.4875-02	4.4210-02	4.6936-02	4.4377-02	4.3558-02	5.4416-02
24.0	5.6103-02	5.2246-02	5.1478-02	5.4598-02	5.1648-02	5.0725-02	6.3181-02
26.0	6.4455-02	6.0119-02	5.9241-02	6.2778-02	5.9413-02	5.8382-02	7.2526-02
28.0	7.3324-02	6.8487-02	6.7494-02	7.1468-02	6.7665-02	6.6521-02	8.2442-02
30.0	8.2702-02	7.7345-02	7.6230-02	8.0663-02	7.6399-02	7.5138-02	9.2924-02
35.0	1.0834-01	1.0159-01	1.0015-01	1.0582-01	1.0031-01	9.8731-02	1.2156-01
40.0	1.3705-01	1.2879-01	1.2698-01	1.3402-01	1.2711-01	1.2520-01	1.5359-01
45.0	1.6877-01	1.5888-01	1.5666-01	1.6520-01	1.5676-01	1.5449-01	1.8896-01
50.0	2.0342-01	1.9180-01	1.8914-01	1.9929-01	1.8920-01	1.8654-01	2.2758-01
55.0	2.4102-01	2.2755-01	2.2442-01	2.3631-01	2.2442-01	2.2135-01	2.6948-01
60.0	2.8133-01	2.6593-01	2.6229-01	2.7603-01	2.6223-01	2.5873-01	3.1439-01
65.0	3.2455-01	3.0712-01	3.0294-01	3.1863-01	3.0279-01	2.9884-01	3.6253-01
70.0	3.7042-01	3.5085-01	3.4610-01	3.6386-01	3.4586-01	3.4144-01	4.1361-01
75.0	4.1911-01	3.9731-01	3.9195-01	4.1190-01	3.9161-01	3.8671-01	4.6782-01
80.0	4.7037-01	4.4626-01	4.4026-01	4.6250-01	4.3981-01	4.3439-01	5.2488-01
90.0	5.8091-01	5.5191-01	5.4454-01	5.7168-01	5.4383-01	5.3733-01	6.4791-01
100.0	7.0180-01	6.6758-01	6.5871-01	6.9116-01	6.5768-01	6.5004-01	7.8243-01
110.0	8.3302-01	7.9324-01	7.8276-01	8.2093-01	7.8137-01	7.7250-01	9.2843-01
120.0	9.7378-01	9.2814-01	9.1593-01	9.6021-01	9.1414-01	9.0398-01	1.0850+00
130.0	1.1247+00	1.0729+00	1.0588+00	1.1096+00	1.0566+00	1.0450+00	1.2529+00
140.0	1.2848+00	1.2265+00	1.2105+00	1.2681+00	1.2078+00	1.1948+00	1.4309+00
150.0	1.4547+00	1.3897+00	1.3716+00	1.4365+00	1.3683+00	1.3539+00	1.6199+00
160.0	1.6335+00	1.5615+00	1.5412+00	1.6137+00	1.5373+00	1.5213+00	1.8187+00
180.0	2.0189+00	1.9319+00	1.9069+00	1.9957+00	1.9017+00	1.8825+00	2.2471+00

TABLE A3 COMPUTED ALPHA RANGE DATA, IN UNITS OF GMS/CM**2, AS A FUNCTION OF ENERGY IN MEV.

ENERGY	BONE	ANTHRACENE	STILBENE	MYLAR	LUCITE	POLYSTYRENE	TEFLON
200.0	2.4397+00	2.3367+00	2.3066+00	2.4131+00	2.3000+00	2.2772+00	2.7148+00
225.0	3.0142+00	2.8898+00	2.8528+00	2.9832+00	2.8440+00	2.8166+00	3.3533+00
250.0	3.6410+00	3.4937+00	3.4491+00	3.6055+00	3.4379+00	3.4055+00	4.0498+00
275.0	4.3215+00	4.1496+00	4.0968+00	4.2812+00	4.0830+00	4.0452+00	4.8057+00
300.0	5.0452+00	4.8476+00	4.7861+00	5.0001+00	4.7693+00	4.7260+00	5.6095+00
325.0	5.8225+00	5.5976+00	5.5267+00	5.7726+00	5.5068+00	5.4575+00	6.4728+00
350.0	6.6444+00	6.3910+00	6.3103+00	6.5895+00	6.2869+00	6.2315+00	7.3855+00
375.0	7.5099+00	7.2266+00	7.1356+00	7.4499+00	7.1085+00	7.0467+00	8.3465+00
400.0	8.4178+00	8.1036+00	8.0017+00	8.3528+00	7.9707+00	7.9022+00	9.3545+00
450.0	1.0370+01	9.9905+00	9.8654+00	1.0295+01	9.8258+00	9.7431+00	1.1522+01
500.0	1.2480+01	1.2031+01	1.1880+01	1.2394+01	1.1831+01	1.1734+01	1.3864+01
550.0	1.4759+01	1.4235+01	1.4057+01	1.4662+01	1.3998+01	1.3884+01	1.6392+01
600.0	1.7180+01	1.6578+01	1.6372+01	1.7072+01	1.6301+01	1.6170+01	1.9079+01
700.0	2.2428+01	2.1659+01	2.1391+01	2.2299+01	2.1295+01	2.1129+01	2.4902+01
800.0	2.8212+01	2.7262+01	2.6926+01	2.8061+01	2.6802+01	2.6597+01	3.1318+01
900.0	3.4478+01	3.3335+01	3.2925+01	3.4304+01	3.2770+01	3.2524+01	3.8267+01
1000.0	4.1187+01	3.9842+01	3.9352+01	4.0993+01	3.9163+01	3.8875+01	4.5709+01
1250.0	5.9797+01	5.7898+01	5.7191+01	5.9549+01	5.6905+01	5.6501+01	6.6342+01
1500.0	8.0435+01	7.7938+01	7.6989+01	8.0138+01	7.6594+01	7.6064+01	8.9220+01
1750.0	1.0279+02	9.9655+01	9.8446+01	1.0245+02	9.7929+01	9.7266+01	1.1400+02
2000.0	1.2660+02	1.2280+02	1.2131+02	1.2622+02	1.2067+02	1.1986+02	1.4038+02
2250.0	1.5227+02	1.4776+02	1.4598+02	1.5185+02	1.4519+02	1.4424+02	1.6882+02
2500.0	1.7793+02	1.7273+02	1.7064+02	1.7748+02	1.6971+02	1.6861+02	1.9725+02
2750.0	2.0547+02	1.9953+02	1.9713+02	2.0499+02	1.9603+02	1.9479+02	2.2776+02
3000.0	2.3301+02	2.2634+02	2.2361+02	2.3250+02	2.2235+02	2.2096+02	2.5826+02
3500.0	2.9084+02	2.8269+02	2.7929+02	2.9031+02	2.7768+02	2.7598+02	3.2231+02
4000.0	3.5073+02	3.4114+02	3.3704+02	3.5024+02	3.3502+02	3.3302+02	3.8863+02
4500.0	4.1219+02	4.0120+02	3.9637+02	4.1179+02	3.9393+02	3.9163+02	4.5669+02
5000.0	4.7486+02	4.6252+02	4.5694+02	4.7460+02	4.5406+02	4.5146+02	5.2608+02
6000.0	6.0270+02	5.8780+02	5.8069+02	6.0287+02	5.7685+02	5.7369+02	6.6766+02
7000.0	7.3287+02	7.1560+02	7.0693+02	7.3365+02	7.0207+02	6.9835+02	8.1184+02
8000.0	8.6444+02	8.4495+02	8.3470+02	8.6597+02	8.2878+02	8.2453+02	9.5757+02
9000.0	9.9681+02	9.7525+02	9.6341+02	9.9922+02	9.5640+02	9.5163+02	1.1042+03
10000.0	1.1296+03	1.1061+03	1.0927+03	1.1330+03	1.0845+03	1.0792+03	1.2513+03
15000.0	1.7929+03	1.7609+03	1.7395+03	1.8022+03	1.7258+03	1.7180+03	1.9863+03
20000.0	2.4494+03	2.4102+03	2.3810+03	2.4656+03	2.3618+03	2.3516+03	2.7140+03
30000.0	3.7347+03	3.6835+03	3.6392+03	3.7662+03	3.6095+03	3.5943+03	4.1395+03
40000.0	4.9880+03	4.9266+03	4.8677+03	5.0357+03	4.8280+03	4.8078+03	5.5300+03
50000.0	6.2156+03	6.1453+03	6.0722+03	6.2802+03	6.0229+03	5.9976+03	6.8926+03
60000.0	7.4226+03	7.3443+03	7.2573+03	7.5045+03	7.1986+03	7.1684+03	8.2327+03
70000.0	8.6124+03	8.5272+03	8.4265+03	8.7120+03	8.3585+03	8.3235+03	9.5541+03
80000.0	9.7879+03	9.6965+03	9.5822+03	9.9054+03	9.5050+03	9.4652+03	1.0860+04
90000.0	1.0951+04	1.0854+04	1.0727+04	1.1087+04	1.0640+04	1.0596+04	1.2152+04
100000.0	1.2103+04	1.2002+04	1.1861+04	1.2258+04	1.1765+04	1.1716+04	1.3433+04

TABLE A4 COMPUTED ALPHA ENERGY LOSSES IN UNITS OF (MEV-CM**2)/GM.

ENERGY	H	HE	LI	BE	B	C	N	O
2.0	4.6963+03	1.8672+03	1.4603+03	1.3648+03	1.3861+03	1.4245+03	1.3546+03	1.2860+03
2.5	3.9606+03	1.5962+03	1.2696+03	1.1868+03	1.2002+03	1.2334+03	1.1782+03	1.1243+03
3.0	3.4392+03	1.3999+03	1.1269+03	1.0565+03	1.0654+03	1.0967+03	1.0474+03	1.0027+03
3.5	3.0486+03	1.2506+03	1.0156+03	9.5550+02	9.6156+02	9.8976+02	9.4585+02	9.0882+02
4.0	2.7439+03	1.1327+03	9.2403+02	8.7320+02	8.7836+02	9.0528+02	8.6615+02	8.3252+02
4.5	2.4990+03	1.0370+03	8.5001+02	8.0601+02	8.1033+02	8.3578+02	8.001d+02	7.6954+02
5.0	2.2974+03	9.5757+02	7.8820+02	7.4939+02	7.5377+02	7.7740+02	7.4468+02	7.1719+02
6.0	1.9843+03	8.3307+02	6.9009+02	6.5904+02	6.6319+02	6.8436+02	6.5687+02	6.3310+02
7.0	1.7516+03	7.3955+02	6.1565+02	5.8960+02	5.9397+02	6.1367+02	5.8976+02	5.6876+02
8.0	1.5712+03	6.6646+02	5.5718+02	5.3422+02	5.3925+02	5.5790+02	5.3637+02	5.1780+02
9.0	1.4269+03	6.0762+02	5.0922+02	4.8951+02	4.9458+02	5.1195+02	4.9291+02	4.7626+02
10.0	1.3086+03	5.5914+02	4.6951+02	4.5217+02	4.5748+02	4.7386+02	4.5684+02	4.4160+02
11.0	1.2098+03	5.1843+02	4.3602+02	4.2070+02	4.2598+02	4.4169+02	4.2623+02	4.1208+02
12.0	1.1259+03	4.8371+02	4.0737+02	3.9360+02	3.9872+02	4.1395+02	3.9965+02	3.8674+02
13.0	1.0537+03	4.5373+02	3.8255+02	3.7023+02	3.7512+02	3.8982+02	3.7654+02	3.6475+02
14.0	9.9090+02	4.2755+02	3.6082+02	3.4980+02	3.5446+02	3.6865+02	3.5627+02	3.4540+02
15.0	9.3566+02	4.0447+02	3.4163+02	3.3152+02	3.3613+02	3.4988+02	3.3831+02	3.2818+02
16.0	8.8670+02	3.8395+02	3.2454+02	3.1522+02	3.1975+02	3.3310+02	3.2223+02	3.1272+02
18.0	8.0368+02	3.4906+02	2.9540+02	2.8738+02	2.9179+02	3.0419+02	2.9463+02	2.8621+02
20.0	7.3586+02	3.2043+02	2.7144+02	2.6443+02	2.6866+02	2.8036+02	2.7183+02	2.6428+02
22.0	6.7935+02	2.9649+02	2.5137+02	2.4516+02	2.4937+02	2.6031+02	2.5260+02	2.4572+02
24.0	6.3147+02	2.7615+02	2.3428+02	2.2872+02	2.3276+02	2.4315+02	2.3607+02	2.2984+02
26.0	5.9036+02	2.5864+02	2.1954+02	2.1453+02	2.1842+02	2.2833+02	2.2178+02	2.1608+02
28.0	5.5465+02	2.4339+02	2.0670+02	2.0214+02	2.0589+02	2.1534+02	2.0929+02	2.0403+02
30.0	5.2331+02	2.2997+02	1.9539+02	1.9122+02	1.9483+02	2.0390+02	1.9825+02	1.9335+02
35.0	4.5947+02	2.0256+02	1.7225+02	1.6882+02	1.7215+02	1.8040+02	1.7552+02	1.7133+02
40.0	4.1043+02	1.8142+02	1.5437+02	1.5148+02	1.5457+02	1.6212+02	1.5785+02	1.5420+02
45.0	3.7150+02	1.6458+02	1.4012+02	1.3763+02	1.4051+02	1.4748+02	1.4373+02	1.4045+02
50.0	3.3981+02	1.5083+02	1.2847+02	1.2629+02	1.2899+02	1.3548+02	1.3210+02	1.2916+02
55.0	3.1356+02	1.3941+02	1.1878+02	1.1686+02	1.1940+02	1.2547+02	1.2241+02	1.1973+02
60.0	2.9122+02	1.2968+02	1.1052+02	1.0880+02	1.1120+02	1.1692+02	1.1411+02	1.1167+02
65.0	2.7220+02	1.2137+02	1.0347+02	1.0192+02	1.0420+02	1.0960+02	1.0700+02	1.0476+02
70.0	2.5562+02	1.1412+02	9.7312+01	9.5898+01	9.8066+01	1.0319+02	1.0078+02	9.8696+01
75.0	2.4118+02	1.0779+02	9.1935+01	9.0639+01	9.2709+01	9.7587+01	9.5340+01	9.3391+01
80.0	2.2836+02	1.0216+02	8.7152+01	8.5960+01	8.7941+01	9.2597+01	9.0490+01	8.8663+01
90.0	2.0677+02	9.2670+01	7.9080+01	7.8055+01	7.9882+01	8.4158+01	8.2284+01	8.0658+01
100.0	1.8922+02	8.4941+01	7.2503+01	7.1608+01	7.3306+01	7.7266+01	7.5577+01	7.4112+01
110.0	1.7471+02	7.8536+01	6.7052+01	6.6259+01	6.7847+01	7.1542+01	7.0003+01	6.8669+01
120.0	1.6239+02	7.3087+01	6.2412+01	6.1704+01	6.3197+01	6.6663+01	6.5250+01	6.4025+01
130.0	1.5192+02	6.8448+01	5.8460+01	5.7821+01	5.9232+01	6.2501+01	6.1193+01	6.0059+01
140.0	1.4280+02	6.4403+01	5.5013+01	5.4433+01	5.5771+01	5.8866+01	5.7649+01	5.6594+01
150.0	1.3486+02	6.0879+01	5.2011+01	5.1479+01	5.2753+01	5.5696+01	5.4556+01	5.3569+01
160.0	1.2783+02	5.7751+01	4.9344+01	4.8856+01	5.0071+01	5.2878+01	5.1807+01	5.0879+01
180.0	1.1600+02	5.2486+01	4.4854+01	4.4434+01	4.5552+01	4.8126+01	4.7168+01	4.6339+01

TABLE A4 COMPUTED ALPHA ENERGY LOSSES IN UNITS OF (MEV-CM**2)/GM.

ENERGY	H	HE	LI	BE	B	C	N	O
200.0	1.0641+02	4.8208+01	4.1205+01	4.0839+01	4.1875+01	4.4258+01	4.3391+01	4.2640+01
225.0	9.6688+01	4.3866+01	3.7500+01	3.7186+01	3.8138+01	4.0326+01	3.9548+01	3.8876+01
250.0	8.8814+01	4.0342+01	3.4493+01	3.4218+01	3.5101+01	3.7128+01	3.6423+01	3.5813+01
275.0	8.2362+01	3.7451+01	3.2024+01	3.1781+01	3.2607+01	3.4501+01	3.3854+01	3.3295+01
300.0	7.6815+01	3.4962+01	2.9899+01	2.9682+01	3.0458+01	3.2237+01	3.1639+01	3.1123+01
325.0	7.2171+01	3.2876+01	2.8117+01	2.7921+01	2.8655+01	3.0337+01	2.9780+01	2.9300+01
350.0	6.8131+01	3.1060+01	2.6565+01	2.6387+01	2.7084+01	2.8681+01	2.8160+01	2.7710+01
375.0	6.4587+01	2.9464+01	2.5202+01	2.5039+01	2.5704+01	2.7226+01	2.6735+01	2.6311+01
400.0	6.1452+01	2.8053+01	2.3996+01	2.3846+01	2.4481+01	2.5937+01	2.5473+01	2.5073+01
450.0	5.6248+01	2.5706+01	2.1990+01	2.1860+01	2.2448+01	2.3792+01	2.3372+01	2.3011+01
500.0	5.2007+01	2.3792+01	2.0353+01	2.0239+01	2.0787+01	2.2040+01	2.1656+01	2.1325+01
550.0	4.8557+01	2.2233+01	1.9020+01	1.8918+01	1.9433+01	2.0612+01	2.0257+01	1.9951+01
600.0	4.5637+01	2.0913+01	1.7890+01	1.7798+01	1.8285+01	1.9401+01	1.9070+01	1.8785+01
700.0	4.0972+01	1.8800+01	1.6082+01	1.6005+01	1.6448+01	1.7463+01	1.7170+01	1.6918+01
800.0	3.7468+01	1.7212+01	1.4721+01	1.4655+01	1.5064+01	1.6003+01	1.5739+01	1.5511+01
900.0	3.4726+01	1.5968+01	1.3655+01	1.3597+01	1.3979+01	1.4859+01	1.4617+01	1.4408+01
1000.0	3.2524+01	1.4968+01	1.2798+01	1.2745+01	1.3106+01	1.3939+01	1.3714+01	1.3520+01
1250.0	2.8618+01	1.3193+01	1.1274+01	1.1230+01	1.1554+01	1.2304+01	1.2110+01	1.1943+01
1500.0	2.5959+01	1.1984+01	1.0234+01	1.0195+01	1.0495+01	1.1190+01	1.1017+01	1.0867+01
1750.0	2.4051+01	1.1116+01	9.4870+00	9.4502+00	9.7322+00	1.0390+01	1.0232+01	1.0096+01
2000.0	2.2628+01	1.0469+01	8.9285+00	8.8931+00	9.1622+00	9.7944+00	9.6471+00	9.5205+00
2250.0	2.1676+01	1.0037+01	8.5537+00	8.5185+00	8.7792+00	9.3931+00	9.2567+00	9.1366+00
2500.0	2.0724+01	9.6046+00	8.1789+00	8.1439+00	8.3963+00	8.9919+00	8.8662+00	8.7526+00
2750.0	2.0115+01	9.3291+00	7.9384+00	7.9030+00	8.1501+00	8.7311+00	8.6180+00	8.5087+00
3000.0	1.9507+01	9.0535+00	7.6979+00	7.6620+00	7.9040+00	8.4704+00	8.3698+00	8.2647+00
3500.0	1.8683+01	8.6814+00	7.3706+00	7.3329+00	7.5680+00	8.1137+00	8.0360+00	7.9369+00
4000.0	1.8102+01	8.4205+00	7.1387+00	7.0989+00	7.3292+00	7.8595+00	7.8031+00	7.7084+00
4500.0	1.7682+01	8.2328+00	6.9697+00	6.9276+00	7.1545+00	7.6729+00	7.6367+00	7.5453+00
5000.0	1.7372+01	8.0954+00	6.8442+00	6.7997+00	7.0239+00	7.5332+00	7.5161+00	7.4273+00
6000.0	1.6967+01	7.9190+00	6.6780+00	6.6285+00	6.8490+00	7.3452+00	7.3639+00	7.2789+00
7000.0	1.6741+01	7.8234+00	6.5817+00	6.5273+00	6.7452+00	7.2331+00	7.2848+00	7.2024+00
8000.0	1.6618+01	7.7752+00	6.5268+00	6.4676+00	6.6836+00	7.1661+00	7.2485+00	7.1680+00
9000.0	1.6562+01	7.7565+00	6.4977+00	6.4339+00	6.6482+00	7.1274+00	7.2385+00	7.1594+00
10000.0	1.6547+01	7.7566+00	6.4852+00	6.4170+00	6.6300+00	7.1072+00	7.2454+00	7.1674+00
15000.0	1.6752+01	7.8801+00	6.5339+00	6.4462+00	6.6548+00	7.1337+00	7.3870+00	7.3120+00
20000.0	1.7085+01	8.0568+00	6.6332+00	6.5300+00	6.7362+00	7.2249+00	7.5715+00	7.4978+00
30000.0	1.7737+01	8.3922+00	6.8232+00	6.6998+00	6.9055+00	7.4205+00	7.9131+00	7.8405+00
40000.0	1.8286+01	8.6713+00	6.9716+00	6.8383+00	7.0459+00	7.5872+00	8.1946+00	8.1227+00
50000.0	1.8745+01	8.9038+00	7.0883+00	6.9504+00	7.1606+00	7.7246+00	8.4283+00	8.3567+00
60000.0	1.9136+01	9.1014+00	7.1836+00	7.0437+00	7.2566+00	7.8393+00	8.6267+00	8.5552+00
70000.0	1.9476+01	9.2727+00	7.2640+00	7.1234+00	7.3389+00	7.9368+00	8.7984+00	8.7272+00
80000.0	1.9775+01	9.4236+00	7.3336+00	7.1928+00	7.4108+00	8.0212+00	8.9496+00	8.8785+00
90000.0	2.0042+01	9.5584+00	7.3948+00	7.2544+00	7.4746+00	8.0953+00	9.0846+00	9.0136+00
100000.0	2.0283+01	9.6800+00	7.4496+00	7.3096+00	7.5319+00	8.1613+00	9.2064+00	9.1354+00

TABLE A4 COMPUTED ALPHA ENERGY LOSSES IN UNITS OF (MEV-CM**2)/GM.

ENERGY	NE	MG	AL	SI	A	CA	TI	V
2.0	1.1399+03	1.0620+03	1.0205+03	1.0510+03	8.5441+02	9.1414+02	8.1217+02	7.8382+02
2.5	1.0092+03	9.4644+02	9.0957+02	9.3590+02	7.4788+02	8.0399+02	7.2023+02	6.9723+02
3.0	9.0893+02	8.5492+02	8.2164+02	8.4496+02	6.7139+02	7.2002+02	6.4815+02	6.2961+02
3.5	8.2802+02	7.8124+02	7.5053+02	7.7119+02	6.1520+02	6.5427+02	5.8988+02	5.7437+02
4.0	7.6263+02	7.1975+02	6.9207+02	7.1043+02	5.7032+02	6.0287+02	5.4268+02	5.2885+02
4.5	7.0779+02	6.6874+02	6.4306+02	6.5956+02	5.3298+02	5.6236+02	5.0399+02	4.9088+02
5.0	6.6134+02	6.2537+02	6.0093+02	6.1641+02	5.0114+02	5.2847+02	4.7188+02	4.5931+02
6.0	5.8637+02	5.5517+02	5.3345+02	5.4664+02	4.4914+02	4.7447+02	4.2233+02	4.0978+02
7.0	5.2824+02	5.0126+02	4.8101+02	4.9262+02	4.0801+02	4.3257+02	3.8455+02	3.7257+02
8.0	4.8202+02	4.5802+02	4.3921+02	4.4946+02	3.7453+02	3.9831+02	3.5430+02	3.4312+02
9.0	4.4413+02	4.2234+02	4.0509+02	4.1411+02	3.4677+02	3.6962+02	3.2931+02	3.1881+02
10.0	4.1229+02	3.9241+02	3.7643+02	3.8469+02	3.2324+02	3.4522+02	3.0802+02	2.9837+02
11.0	3.8529+02	3.6693+02	3.5198+02	3.5968+02	3.0300+02	3.2422+02	2.8962+02	2.8069+02
12.0	3.6195+02	3.4499+02	3.3088+02	3.3806+02	2.8540+02	3.0590+02	2.7352+02	2.6522+02
13.0	3.4157+02	3.2580+02	3.1246+02	3.1918+02	2.6999+02	2.8973+02	2.5933+02	2.5156+02
14.0	3.2361+02	3.0884+02	2.9624+02	3.0254+02	2.5640+02	2.7535+02	2.4671+02	2.3940+02
15.0	3.0768+02	2.9374+02	2.8182+02	2.8776+02	2.4427+02	2.6249+02	2.3540+02	2.2850+02
16.0	2.9341+02	2.8025+02	2.6888+02	2.7453+02	2.3332+02	2.5091+02	2.2518+02	2.1866+02
18.0	2.6886+02	2.5703+02	2.4661+02	2.5180+02	2.1445+02	2.3094+02	2.0743+02	2.0156+02
20.0	2.4857+02	2.3776+02	2.2814+02	2.3291+02	1.9871+02	2.1425+02	1.9256+02	1.8719+02
22.0	2.3145+02	2.2145+02	2.1254+02	2.1695+02	1.8537+02	2.0003+02	1.7993+02	1.7495+02
24.0	2.1674+02	2.0742+02	1.9915+02	2.0327+02	1.7392+02	1.8779+02	1.6905+02	1.6440+02
26.0	2.0394+02	1.9523+02	1.8753+02	1.9141+02	1.6395+02	1.7711+02	1.5953+02	1.5521+02
28.0	1.9272+02	1.8457+02	1.7729+02	1.8100+02	1.5520+02	1.6772+02	1.5114+02	1.4708+02
30.0	1.8281+02	1.7515+02	1.6819+02	1.7179+02	1.4744+02	1.5939+02	1.4369+02	1.3986+02
35.0	1.6235+02	1.5570+02	1.4950+02	1.5272+02	1.3138+02	1.4215+02	1.2823+02	1.2486+02
40.0	1.4638+02	1.4048+02	1.3495+02	1.3785+02	1.1881+02	1.2865+02	1.1610+02	1.1307+02
45.0	1.3353+02	1.2825+02	1.2320+02	1.2590+02	1.0867+02	1.1776+02	1.0630+02	1.0354+02
50.0	1.2292+02	1.1817+02	1.1355+02	1.1603+02	1.0031+02	1.0875+02	9.8203+01	9.5661+01
55.0	1.1405+02	1.0973+02	1.0547+02	1.0777+02	9.3279+01	1.0119+02	9.1400+01	8.9047+01
60.0	1.0644+02	1.0250+02	9.8532+01	1.0069+02	8.7234+01	9.4687+01	8.5547+01	8.3355+01
65.0	9.9912+01	9.6290+01	9.2577+01	9.4619+01	8.2044+01	8.9090+01	8.0515+01	7.8458+01
70.0	9.4185+01	9.0830+01	8.7350+01	8.9276+01	7.7499+01	8.4160+01	7.6085+01	7.4162+01
75.0	8.9171+01	8.6038+01	8.2766+01	8.4594+01	7.3508+01	7.9829+01	7.2196+01	7.0375+01
80.0	8.4695+01	8.1760+01	7.8675+01	8.0415+01	6.9927+01	7.5960+01	6.8718+01	6.6988+01
90.0	7.7118+01	7.4498+01	7.1719+01	7.3323+01	6.3828+01	6.9391+01	6.2783+01	6.1220+01
100.0	7.0906+01	6.8539+01	6.6008+01	6.7501+01	5.8817+01	6.3989+01	5.7905+01	5.6468+01
110.0	6.5737+01	6.3579+01	6.1244+01	6.2647+01	5.4631+01	5.9464+01	5.3832+01	5.2499+01
120.0	6.1322+01	5.9336+01	5.7170+01	5.8494+01	5.1044+01	5.5588+01	5.0348+01	4.9099+01
130.0	5.7551+01	5.5714+01	5.3687+01	5.4938+01	4.7973+01	5.2268+01	4.7355+01	4.6190+01
140.0	5.4253+01	5.2540+01	5.0636+01	5.1826+01	4.5283+01	4.9355+01	4.4736+01	4.3637+01
150.0	5.1373+01	4.9766+01	4.7972+01	4.9106+01	4.2928+01	4.6800+01	4.2435+01	4.1406+01
160.0	4.8810+01	4.7297+01	4.5599+01	4.6681+01	4.0828+01	4.4521+01	4.0380+01	3.9406+01
180.0	4.4481+01	4.3124+01	4.1586+01	4.2587+01	3.7273+01	4.0663+01	3.6892+01	3.6012+01

TABLE A4 COMPUTED ALPHA ENERGY LOSSES IN UNITS OF (MEV-CM**2)/GM.

ENERGY	NE	MG	AL	SI	A	CA	TI	V
200.0	4.0952+01	3.9720+01	3.8311+01	3.9239+01	3.4365+01	3.7505+01	3.4038+01	3.3231+01
225.0	3.7357+01	3.6250+01	3.4972+01	3.5827+01	3.1396+01	3.4279+01	3.1122+01	3.0389+01
250.0	3.4430+01	3.3423+01	3.2250+01	3.3045+01	2.8975+01	3.1644+01	2.8740+01	2.8068+01
275.0	3.2021+01	3.1095+01	3.0009+01	3.0753+01	2.6979+01	2.9468+01	2.6773+01	2.6149+01
300.0	2.9944+01	2.9086+01	2.8074+01	2.8775+01	2.5255+01	2.7589+01	2.5071+01	2.4490+01
325.0	2.8198+01	2.7397+01	2.6448+01	2.7111+01	2.3803+01	2.6007+01	2.3637+01	2.3092+01
350.0	2.6676+01	2.5924+01	2.5028+01	2.5659+01	2.2536+01	2.4626+01	2.2384+01	2.1870+01
375.0	2.5336+01	2.4627+01	2.3779+01	2.4382+01	2.1421+01	2.3409+01	2.1280+01	2.0793+01
400.0	2.4150+01	2.3478+01	2.2672+01	2.3248+01	2.0431+01	2.2330+01	2.0301+01	1.9837+01
450.0	2.2173+01	2.1562+01	2.0826+01	2.1360+01	1.8781+01	2.0529+01	1.8668+01	1.8242+01
500.0	2.0556+01	1.9995+01	1.9316+01	1.9814+01	1.7430+01	1.9055+01	1.7329+01	1.6936+01
550.0	1.9237+01	1.8716+01	1.8082+01	1.8552+01	1.6326+01	1.7850+01	1.6235+01	1.5868+01
600.0	1.8118+01	1.7630+01	1.7036+01	1.7480+01	1.5388+01	1.6826+01	1.5306+01	1.4960+01
700.0	1.6325+01	1.5890+01	1.5357+01	1.5762+01	1.3884+01	1.5184+01	1.3814+01	1.3503+01
800.0	1.4973+01	1.4577+01	1.4091+01	1.4467+01	1.2748+01	1.3944+01	1.2688+01	1.2403+01
900.0	1.3913+01	1.3546+01	1.3098+01	1.3449+01	1.1856+01	1.2969+01	1.1803+01	1.1539+01
1000.0	1.3060+01	1.2717+01	1.2297+01	1.2630+01	1.1138+01	1.2184+01	1.1089+01	1.0842+01
1250.0	1.1543+01	1.1240+01	1.0874+01	1.1174+01	9.8600+00	1.0786+01	9.8185+00	9.6000+00
1500.0	1.0508+01	1.0232+01	9.9023+00	1.0180+01	8.9878+00	9.8304+00	8.9499+00	8.7512+00
1750.0	9.7660+00	9.5079+00	9.2042+00	9.4669+00	8.3615+00	9.1440+00	8.3254+00	8.1407+00
2000.0	9.2128+00	8.9673+00	8.6836+00	8.9355+00	7.8949+00	8.6320+00	7.8593+00	7.6850+00
2250.0	8.8436+00	8.6058+00	8.3356+00	8.5811+00	7.5839+00	8.2899+00	7.5476+00	7.3801+00
2500.0	8.4744+00	8.2442+00	7.9876+00	8.2267+00	7.2728+00	7.9479+00	7.2359+00	7.0751+00
2750.0	8.2401+00	8.0139+00	7.7662+00	8.0020+00	7.0758+00	7.7306+00	7.0373+00	6.8807+00
3000.0	8.0057+00	7.7835+00	7.5447+00	7.7773+00	6.8788+00	7.5132+00	6.8388+00	6.6863+00
3500.0	7.6911+00	7.4728+00	7.2464+00	7.4758+00	6.6153+00	7.2212+00	6.5712+00	6.4240+00
4000.0	7.4723+00	7.2553+00	7.0380+00	7.2638+00	6.4328+00	7.0178+00	6.3839+00	6.2401+00
4500.0	7.3164+00	7.0993+00	6.8885+00	7.1115+00	6.3036+00	6.8728+00	6.2495+00	6.1080+00
5000.0	7.2040+00	6.9855+00	6.7797+00	7.0003+00	6.2112+00	6.7678+00	6.1514+00	6.0113+00
6000.0	7.0634+00	6.8403+00	6.6409+00	6.8579+00	6.0976+00	6.6358+00	6.0256+00	5.8871+00
7000.0	6.9921+00	6.7626+00	6.5666+00	6.7813+00	6.0425+00	6.5673+00	5.9574+00	5.8195+00
8000.0	6.9611+00	6.7244+00	6.5297+00	6.7430+00	6.0213+00	6.5357+00	5.9229+00	5.7849+00
9000.0	6.9550+00	6.7104+00	6.5156+00	6.7284+00	6.0210+00	6.5264+00	5.9091+00	5.7706+00
10000.0	6.9647+00	6.7117+00	6.5159+00	6.7288+00	6.0338+00	6.5313+00	5.9085+00	5.7693+00
15000.0	7.1129+00	6.8132+00	6.6062+00	6.8260+00	6.1791+00	6.6420+00	5.9904+00	5.8468+00
20000.0	7.2990+00	6.9474+00	6.7275+00	6.9591+00	6.3530+00	6.7846+00	6.1081+00	5.9600+00
30000.0	7.6403+00	7.1805+00	6.9420+00	7.1959+00	6.6670+00	7.0438+00	6.3295+00	6.1740+00
40000.0	7.9206+00	7.3610+00	7.1107+00	7.3795+00	6.9233+00	7.2539+00	6.5112+00	6.3499+00
50000.0	8.1528+00	7.5055+00	7.2471+00	7.5257+00	7.1352+00	7.4259+00	6.6602+00	6.4943+00
60000.0	8.3497+00	7.6255+00	7.3610+00	7.6465+00	7.3147+00	7.5698+00	6.7846+00	6.6149+00
70000.0	8.5202+00	7.7280+00	7.4587+00	7.7493+00	7.4700+00	7.6927+00	6.8905+00	6.7177+00
80000.0	8.6702+00	7.8173+00	7.5440+00	7.8386+00	7.6066+00	7.7993+00	6.9821+00	6.8066+00
90000.0	8.8041+00	7.8965+00	7.6196+00	7.9176+00	7.7285+00	7.8930+00	7.0624+00	6.8846+00
100000.0	8.9249+00	7.9675+00	7.6876+00	7.9883+00	7.8385+00	7.9763+00	7.1336+00	6.9539+00

TABLE A4 COMPUTED ALPHA ENERGY LOSSES IN UNITS OF (MEV-CM**2)/GM.

ENERGY	CR	MN	FE	CO	NI	CU	ZN	GE
2.0	7.9135+02	7.6015+02	7.6667+02	7.3892+02	7.5441+02	7.0791+02	6.9450+02	6.4947+02
2.5	7.0547+02	6.8090+02	6.8830+02	6.6560+02	6.8201+02	6.4235+02	6.3267+02	5.9258+02
3.0	6.3790+02	6.1752+02	6.2547+02	6.0623+02	6.2233+02	5.8729+02	5.8028+02	5.4486+02
3.5	5.8310+02	5.6612+02	5.7397+02	5.5716+02	5.7294+02	5.4143+02	5.3591+02	5.0426+02
4.0	5.3750+02	5.2296+02	5.3094+02	5.1630+02	5.3155+02	5.0278+02	4.9829+02	4.6962+02
4.5	4.9950+02	4.8625+02	4.9433+02	4.8130+02	4.9624+02	4.7000+02	4.6624+02	4.3968+02
5.0	4.6696+02	4.5518+02	4.6272+02	4.5111+02	4.6555+02	4.4146+02	4.3844+02	4.1397+02
6.0	4.1555+02	4.0498+02	4.1191+02	4.0192+02	4.1514+02	3.9434+02	3.9229+02	3.7111+02
7.0	3.7719+02	3.6696+02	3.7273+02	3.6361+02	3.7582+02	3.5725+02	3.5565+02	3.3689+02
8.0	3.4693+02	3.3736+02	3.4212+02	3.3340+02	3.4440+02	3.2724+02	3.2617+02	3.0903+02
9.0	3.2222+02	3.1320+02	3.1733+02	3.0910+02	3.1895+02	3.0292+02	3.0174+02	2.8607+02
10.0	3.0150+02	2.9296+02	2.9667+02	2.8883+02	2.9797+02	2.8273+02	2.8153+02	2.6658+02
11.0	2.8365+02	2.7563+02	2.7904+02	2.7163+02	2.8009+02	2.6570+02	2.6447+02	2.5006+02
12.0	2.6803+02	2.6064+02	2.6379+02	2.5673+02	2.6471+02	2.5098+02	2.4982+02	2.3597+02
13.0	2.5426+02	2.4737+02	2.5041+02	2.4365+02	2.5122+02	2.3815+02	2.3700+02	2.2377+02
14.0	2.4201+02	2.3557+02	2.3846+02	2.3212+02	2.3925+02	2.2679+02	2.2572+02	2.1302+02
15.0	2.3102+02	2.2496+02	2.2776+02	2.2175+02	2.2859+02	2.1666+02	2.1563+02	2.0343+02
16.0	2.2110+02	2.1538+02	2.1810+02	2.1238+02	2.1898+02	2.0757+02	2.0655+02	1.9485+02
18.0	2.0390+02	1.9874+02	2.0132+02	1.9611+02	2.0229+02	1.9177+02	1.9083+02	1.8008+02
20.0	1.8944+02	1.8476+02	1.8720+02	1.8243+02	1.8823+02	1.7849+02	1.7767+02	1.6768+02
22.0	1.7711+02	1.7280+02	1.7515+02	1.7073+02	1.7620+02	1.6713+02	1.6641+02	1.5709+02
24.0	1.6645+02	1.6245+02	1.6470+02	1.6060+02	1.6578+02	1.5728+02	1.5670+02	1.4796+02
26.0	1.5715+02	1.5341+02	1.5557+02	1.5172+02	1.5667+02	1.4867+02	1.4814+02	1.3995+02
28.0	1.4896+02	1.4544+02	1.4751+02	1.4391+02	1.4864+02	1.4105+02	1.4058+02	1.3286+02
30.0	1.4168+02	1.3835+02	1.4036+02	1.3694+02	1.4144+02	1.3425+02	1.3384+02	1.2655+02
35.0	1.2653+02	1.2364+02	1.2545+02	1.2242+02	1.2649+02	1.2007+02	1.1976+02	1.1337+02
40.0	1.1461+02	1.1203+02	1.1371+02	1.1102+02	1.1474+02	1.0896+02	1.0873+02	1.0297+02
45.0	1.0495+02	1.0264+02	1.0420+02	1.0175+02	1.0518+02	9.9901+01	9.9703+01	9.4475+01
50.0	9.6977+01	9.4843+01	9.6298+01	9.4064+01	9.7254+01	9.2389+01	9.2224+01	8.7413+01
55.0	9.0284+01	8.8297+01	8.9656+01	8.7589+01	9.0584+01	8.6066+01	8.5927+01	8.1463+01
60.0	8.4528+01	8.2671+01	8.3951+01	8.2012+01	8.4825+01	8.0616+01	8.0496+01	7.6335+01
65.0	7.9583+01	7.7830+01	7.9061+01	7.7218+01	7.9862+01	7.5907+01	7.5808+01	7.1912+01
70.0	7.5216+01	7.3585+01	7.4737+01	7.3017+01	7.5503+01	7.1762+01	7.1675+01	6.8014+01
75.0	7.1381+01	6.9838+01	7.0935+01	6.9312+01	7.1693+01	6.8127+01	6.8062+01	6.4582+01
80.0	6.7949+01	6.6486+01	6.7532+01	6.5992+01	6.8265+01	6.4890+01	6.4816+01	6.1505+01
90.0	6.2110+01	6.0782+01	6.1744+01	6.0340+01	6.2425+01	5.9347+01	5.9285+01	5.6262+01
100.0	5.7297+01	5.6088+01	5.6981+01	5.5691+01	5.7619+01	5.4781+01	5.4731+01	5.1951+01
110.0	5.3272+01	5.2155+01	5.2995+01	5.1803+01	5.3600+01	5.0965+01	5.0921+01	4.8343+01
120.0	4.9826+01	4.8783+01	4.9572+01	4.8465+01	5.0155+01	4.7691+01	4.7655+01	4.5248+01
130.0	4.6878+01	4.5894+01	4.6637+01	4.5597+01	4.7193+01	4.4880+01	4.4852+01	4.2592+01
140.0	4.4300+01	4.3362+01	4.4068+01	4.3084+01	4.4592+01	4.2412+01	4.2390+01	4.0261+01
150.0	4.2031+01	4.1154+01	4.1828+01	4.0893+01	4.2316+01	4.0255+01	4.0230+01	3.8218+01
160.0	4.0006+01	3.9178+01	3.9818+01	3.8936+01	4.0301+01	3.8335+01	3.8303+01	3.6391+01
180.0	3.6569+01	3.5821+01	3.6412+01	3.5606+01	3.6859+01	3.5065+01	3.5051+01	3.3294+01

TABLE A4 COMPUTED ALPHA ENERGY LOSSES IN UNITS OF (MEV-CM**2)/GM.

ENERGY	CR	MN	FE	CO	NI	CU	ZN	GE
200.0	3.3752+01	3.3068+01	3.3619+01	3.2880+01	3.4038+01	3.2385+01	3.2376+01	3.0769+01
225.0	3.0869+01	3.0249+01	3.0760+01	3.0089+01	3.1154+01	2.9643+01	2.9634+01	2.8172+01
250.0	2.8515+01	2.7946+01	2.8420+01	2.7806+01	2.8796+01	2.7404+01	2.7397+01	2.6045+01
275.0	2.6571+01	2.6043+01	2.6489+01	2.5919+01	2.6843+01	2.5550+01	2.5549+01	2.4290+01
300.0	2.4888+01	2.4397+01	2.4817+01	2.4285+01	2.5153+01	2.3944+01	2.3946+01	2.2773+01
325.0	2.3470+01	2.3009+01	2.3407+01	2.2908+01	2.3729+01	2.2591+01	2.2594+01	2.1491+01
350.0	2.2231+01	2.1795+01	2.2175+01	2.1704+01	2.2483+01	2.1407+01	2.1411+01	2.0369+01
375.0	2.1138+01	2.0726+01	2.1088+01	2.0642+01	2.1385+01	2.0363+01	2.0368+01	1.9379+01
400.0	2.0168+01	1.9776+01	2.0123+01	1.9699+01	2.0409+01	1.9436+01	1.9442+01	1.8500+01
450.0	1.8548+01	1.8189+01	1.8511+01	1.8123+01	1.8779+01	1.7886+01	1.7894+01	1.7031+01
500.0	1.7222+01	1.6889+01	1.7189+01	1.6831+01	1.7442+01	1.6615+01	1.6623+01	1.5825+01
550.0	1.6137+01	1.5826+01	1.6108+01	1.5773+01	1.6347+01	1.5574+01	1.5583+01	1.4838+01
600.0	1.5215+01	1.4922+01	1.5189+01	1.4874+01	1.5416+01	1.4689+01	1.4699+01	1.3998+01
700.0	1.3735+01	1.3472+01	1.3714+01	1.3431+01	1.3921+01	1.3267+01	1.3277+01	1.2647+01
800.0	1.2618+01	1.2376+01	1.2599+01	1.2340+01	1.2792+01	1.2193+01	1.2203+01	1.1626+01
900.0	1.1740+01	1.1515+01	1.1723+01	1.1482+01	1.1904+01	1.1349+01	1.1358+01	1.0822+01
1000.0	1.1032+01	1.0820+01	1.1016+01	1.0791+01	1.1188+01	1.0668+01	1.0676+01	1.0174+01
1250.0	9.7708+00	9.5838+00	9.7578+00	9.5594+00	9.9116+00	9.4547+00	9.4627+00	9.0204+00
1500.0	8.9087+00	8.7380+00	8.8970+00	8.7171+00	9.0391+00	8.6258+00	8.6332+00	8.2316+00
1750.0	8.2886+00	8.1296+00	8.2777+00	8.1109+00	8.4112+00	8.0298+00	8.0369+00	7.6647+00
2000.0	7.8255+00	7.6754+00	7.8151+00	7.6582+00	7.9423+00	7.5849+00	7.5919+00	7.2418+00
2250.0	7.5154+00	7.3714+00	7.5053+00	7.3551+00	7.6283+00	7.2874+00	7.2945+00	6.9594+00
2500.0	7.2052+00	7.0673+00	7.1955+00	7.0519+00	7.3143+00	6.9899+00	6.9971+00	6.6770+00
2750.0	7.0072+00	6.8735+00	6.9979+00	6.8586+00	7.1140+00	6.8004+00	6.8080+00	6.4977+00
3000.0	6.8091+00	6.6797+00	6.8002+00	6.6652+00	6.9137+00	6.6108+00	6.6189+00	6.3183+00
3500.0	6.5413+00	6.4180+00	6.5333+00	6.4042+00	6.6434+00	6.3553+00	6.3645+00	6.0774+00
4000.0	6.3533+00	6.2346+00	6.3461+00	6.2211+00	6.4540+00	6.1765+00	6.1869+00	5.9096+00
4500.0	6.2179+00	6.1029+00	6.2115+00	6.0896+00	6.3178+00	6.0481+00	6.0599+00	5.7898+00
5000.0	6.1186+00	6.0065+00	6.1131+00	5.9935+00	6.2184+00	5.9545+00	5.9676+00	5.7030+00
6000.0	5.9905+00	5.8828+00	5.9866+00	5.8700+00	6.0909+00	5.8346+00	5.8505+00	5.5931+00
7000.0	5.9201+00	5.8155+00	5.9177+00	5.8030+00	6.0218+00	5.7700+00	5.7886+00	5.5354+00
8000.0	5.8835+00	5.7812+00	5.8825+00	5.7689+00	5.9868+00	5.7376+00	5.7587+00	5.5081+00
9000.0	5.8678+00	5.7671+00	5.8680+00	5.7550+00	5.9727+00	5.7249+00	5.7485+00	5.4994+00
10000.0	5.8654+00	5.7660+00	5.8667+00	5.7541+00	5.9719+00	5.7249+00	5.7507+00	5.5025+00
15000.0	5.9407+00	5.8435+00	5.9454+00	5.8320+00	6.0536+00	5.8045+00	5.8397+00	5.5931+00
20000.0	6.0537+00	5.9561+00	6.0600+00	5.9445+00	6.1706+00	5.9169+00	5.9587+00	5.7128+00
30000.0	6.2688+00	6.1687+00	6.2761+00	6.1561+00	6.3900+00	6.1268+00	6.1762+00	5.9315+00
40000.0	6.4463+00	6.3435+00	6.4540+00	6.3302+00	6.5702+00	6.2989+00	6.3524+00	6.1074+00
50000.0	6.5922+00	6.4874+00	6.6006+00	6.4736+00	6.7187+00	6.4407+00	6.4968+00	6.2505+00
60000.0	6.7144+00	6.6081+00	6.7238+00	6.5942+00	6.8436+00	6.5600+00	6.6181+00	6.3701+00
70000.0	6.8185+00	6.7113+00	6.8292+00	6.6975+00	6.9507+00	6.6625+00	6.7223+00	6.4723+00
80000.0	6.9088+00	6.8008+00	6.9209+00	6.7875+00	7.0440+00	6.7519+00	6.8133+00	6.5615+00
90000.0	6.9880+00	6.8796+00	7.0017+00	6.8668+00	7.1265+00	6.8309+00	6.8938+00	6.6405+00
100000.0	7.0585+00	6.9497+00	7.0737+00	6.9376+00	7.2000+00	6.9016+00	6.9660+00	6.7112+00

TABLE A4 COMPUTED ALPHA ENERGY LOSSES IN UNITS OF (MEV-CM**2)/GM.

ENERGY	SE	KR	AG	SN	SB	XE	CS	TA
2.0	5.8801+02	5.6009+02	5.1046+02	5.1566+02	4.9097+02	4.6999+02	4.7316+02	4.0647+02
2.5	5.4168+02	5.1444+02	4.5179+02	4.5263+02	4.3225+02	4.1552+02	4.1889+02	3.6590+02
3.0	5.0240+02	4.7774+02	4.1089+02	4.0681+02	3.9090+02	3.7519+02	3.7771+02	3.3397+02
3.5	4.6790+02	4.4662+02	3.8208+02	3.7272+02	3.5873+02	3.4592+02	3.4683+02	3.0970+02
4.0	4.3787+02	4.1964+02	3.5858+02	3.4842+02	3.3479+02	3.2163+02	3.2276+02	2.8916+02
4.5	4.1164+02	3.9575+02	3.3900+02	3.2753+02	3.1612+02	3.0126+02	3.0238+02	2.7182+02
5.0	3.8856+02	3.7446+02	3.2240+02	3.1007+02	2.9972+02	2.8550+02	2.8545+02	2.5619+02
6.0	3.4992+02	3.3835+02	2.9512+02	2.8205+02	2.7336+02	2.6001+02	2.5993+02	2.3410+02
7.0	3.1890+02	3.0930+02	2.7290+02	2.6047+02	2.5300+02	2.4018+02	2.3976+02	2.1446+02
8.0	2.9352+02	2.8510+02	2.5408+02	2.4237+02	2.3598+02	2.2446+02	2.2372+02	1.9939+02
9.0	2.7233+02	2.6497+02	2.3796+02	2.2695+02	2.2134+02	2.1117+02	2.1028+02	1.8626+02
10.0	2.5451+02	2.4788+02	2.2403+02	2.1365+02	2.0862+02	1.9938+02	1.9886+02	1.7507+02
11.0	2.3916+02	2.3335+02	2.1189+02	2.0201+02	1.9745+02	1.8898+02	1.8857+02	1.6562+02
12.0	2.2574+02	2.2056+02	2.0114+02	1.9177+02	1.8756+02	1.7975+02	1.7942+02	1.5751+02
13.0	2.1413+02	2.0917+02	1.9144+02	1.8264+02	1.7878+02	1.7146+02	1.7122+02	1.5025+02
14.0	2.0393+02	1.9911+02	1.8313+02	1.7444+02	1.7090+02	1.6399+02	1.6381+02	1.4408+02
15.0	1.9486+02	1.9031+02	1.7531+02	1.6700+02	1.6393+02	1.5724+02	1.5710+02	1.3840+02
16.0	1.8670+02	1.8243+02	1.6850+02	1.6027+02	1.5750+02	1.5111+02	1.5100+02	1.3327+02
18.0	1.7257+02	1.6885+02	1.5626+02	1.4860+02	1.4614+02	1.4034+02	1.4031+02	1.2430+02
20.0	1.6080+02	1.5741+02	1.4592+02	1.3878+02	1.3665+02	1.3118+02	1.3117+02	1.1665+02
22.0	1.5069+02	1.4764+02	1.3705+02	1.3037+02	1.2845+02	1.2337+02	1.2334+02	1.1002+02
24.0	1.4192+02	1.3921+02	1.2929+02	1.2306+02	1.2131+02	1.1652+02	1.1657+02	1.0420+02
26.0	1.3427+02	1.3177+02	1.2253+02	1.1664+02	1.1503+02	1.1089+02	1.1061+02	9.9048+01
28.0	1.2751+02	1.2517+02	1.1665+02	1.1091+02	1.0943+02	1.0557+02	1.0551+02	9.4447+01
30.0	1.2150+02	1.1928+02	1.1138+02	1.0587+02	1.0442+02	1.0081+02	1.0085+02	9.0312+01
35.0	1.0891+02	1.0703+02	1.0033+02	9.5503+01	9.4142+01	9.0790+01	9.0834+01	8.1584+01
40.0	9.8975+01	9.7296+01	9.1502+01	8.7137+01	8.5954+01	8.2953+01	8.2990+01	7.4599+01
45.0	9.0878+01	8.9366+01	8.4377+01	8.0295+01	7.9225+01	7.6523+01	7.6574+01	6.9085+01
50.0	8.4149+01	8.2772+01	7.8333+01	7.4573+01	7.3698+01	7.1139+01	7.1200+01	6.4279+01
55.0	7.8463+01	7.7220+01	7.3215+01	6.9726+01	6.8919+01	6.6554+01	6.6656+01	6.0197+01
60.0	7.3532+01	7.2424+01	6.8780+01	6.5531+01	6.4774+01	6.2660+01	6.2734+01	5.6650+01
65.0	6.9295+01	6.8273+01	6.4962+01	6.1887+01	6.1177+01	5.9203+01	5.9279+01	5.3572+01
70.0	6.5621+01	6.4612+01	6.1560+01	5.8662+01	5.8015+01	5.6141+01	5.6220+01	5.0879+01
75.0	6.2324+01	6.1390+01	5.8553+01	5.5812+01	5.5206+01	5.3430+01	5.3513+01	4.8544+01
80.0	5.9370+01	5.8501+01	5.5851+01	5.3249+01	5.2679+01	5.1014+01	5.1075+01	4.6392+01
90.0	5.4331+01	5.3552+01	5.1236+01	4.8860+01	4.8350+01	4.6844+01	4.6923+01	4.2717+01
100.0	5.0173+01	4.9510+01	4.7421+01	4.5229+01	4.4762+01	4.3386+01	4.3465+01	3.9642+01
110.0	4.6694+01	4.6097+01	4.4209+01	4.2180+01	4.1751+01	4.0475+01	4.0553+01	3.7063+01
120.0	4.3712+01	4.3158+01	4.1440+01	3.9554+01	3.9159+01	3.7969+01	3.8045+01	3.4817+01
130.0	4.1152+01	4.0635+01	3.9061+01	3.7286+01	3.6923+01	3.5813+01	3.5886+01	3.2877+01
140.0	3.8904+01	3.8420+01	3.6969+01	3.5291+01	3.4951+01	3.3913+01	3.3985+01	3.1164+01
150.0	3.6935+01	3.6478+01	3.5131+01	3.3541+01	3.3220+01	3.2240+01	3.2312+01	2.9655+01
160.0	3.5176+01	3.4744+01	3.3487+01	3.1976+01	3.1673+01	3.0741+01	3.0812+01	2.8304+01
180.0	3.2191+01	3.1804+01	3.0692+01	2.9314+01	2.9041+01	2.8195+01	2.8261+01	2.5999+01

TABLE A4 COMPUTED ALPHA ENERGY LOSSES IN UNITS OF (MEV-CM**2)/GM.

ENERGY	SE	KR	AG	SN	SB	XE	CS	TA
200.0	2.9739+01	2.9393+01	2.8393+01	2.7125+01	2.6877+01	2.6100+01	2.6164+01	2.4098+01
225.0	2.7246+01	2.6918+01	2.6047+01	2.4867+01	2.4655+01	2.3950+01	2.4010+01	2.2142+01
250.0	2.5195+01	2.4906+01	2.4120+01	2.3054+01	2.2836+01	2.2184+01	2.2242+01	2.0533+01
275.0	2.3499+01	2.3235+01	2.2516+01	2.1522+01	2.1340+01	2.0729+01	2.0769+01	1.9197+01
300.0	2.2030+01	2.1786+01	2.1127+01	2.0195+01	2.0027+01	1.9471+01	1.9525+01	1.8036+01
325.0	2.0796+01	2.0563+01	1.9953+01	1.9075+01	1.8918+01	1.8396+01	1.8448+01	1.7054+01
350.0	1.9714+01	1.9496+01	1.8928+01	1.8095+01	1.7947+01	1.7454+01	1.7504+01	1.6204+01
375.0	1.8759+01	1.8556+01	1.8027+01	1.7232+01	1.7089+01	1.6622+01	1.6670+01	1.5458+01
400.0	1.7910+01	1.7719+01	1.7221+01	1.6465+01	1.6333+01	1.5889+01	1.5927+01	1.4778+01
450.0	1.6491+01	1.6318+01	1.5871+01	1.5173+01	1.5060+01	1.4654+01	1.4697+01	1.3644+01
500.0	1.5326+01	1.5169+01	1.4766+01	1.4115+01	1.4013+01	1.3635+01	1.3676+01	1.2711+01
550.0	1.4372+01	1.4227+01	1.3856+01	1.3245+01	1.3153+01	1.2803+01	1.2841+01	1.1945+01
600.0	1.3561+01	1.3426+01	1.3083+01	1.2504+01	1.2421+01	1.2092+01	1.2128+01	1.1290+01
700.0	1.2256+01	1.2138+01	1.1839+01	1.1311+01	1.1242+01	1.0948+01	1.0981+01	1.0234+01
800.0	1.1268+01	1.1163+01	1.0896+01	1.0407+01	1.0350+01	1.0081+01	1.0111+01	9.4310+00
900.0	1.0491+01	1.0396+01	1.0154+01	9.6948+00	9.6467+00	9.3984+00	9.4265+00	8.7980+00
1000.0	9.8648+00	9.7769+00	9.5551+00	9.1194+00	9.0791+00	8.8472+00	8.8735+00	8.2866+00
1250.0	8.7484+00	8.6744+00	8.4859+00	8.0918+00	8.0663+00	7.8643+00	7.8868+00	7.3734+00
1500.0	7.9855+00	7.9212+00	7.7540+00	7.3875+00	7.3727+00	7.1918+00	7.2115+00	6.7477+00
1750.0	7.4373+00	7.3804+00	7.2276+00	6.8804+00	6.8737+00	6.7083+00	6.7255+00	6.2973+00
2000.0	7.0286+00	6.9775+00	6.8349+00	6.5018+00	6.5015+00	6.3481+00	6.3632+00	5.9611+00
2250.0	6.7560+00	6.7094+00	6.5727+00	6.2487+00	6.2532+00	6.1084+00	6.1217+00	5.7363+00
2500.0	6.4834+00	6.4412+00	6.3105+00	5.9957+00	6.0049+00	5.8688+00	5.8802+00	5.5115+00
2750.0	6.3107+00	6.2718+00	6.1441+00	5.8350+00	5.8476+00	5.7178+00	5.7275+00	5.3687+00
3000.0	6.1380+00	6.1025+00	5.9777+00	5.6743+00	5.6904+00	5.5668+00	5.5749+00	5.2258+00
3500.0	5.9069+00	5.8770+00	5.7546+00	5.4587+00	5.4803+00	5.3666+00	5.3715+00	5.0344+00
4000.0	5.7468+00	5.7218+00	5.5996+00	5.3091+00	5.3351+00	5.2295+00	5.2315+00	4.9017+00
4500.0	5.6335+00	5.6130+00	5.4896+00	5.2028+00	5.2325+00	5.1341+00	5.1333+00	4.8078+00
5000.0	5.5522+00	5.5361+00	5.4106+00	5.1264+00	5.1593+00	5.0672+00	5.0637+00	4.7406+00
6000.0	5.4519+00	5.4440+00	5.3125+00	5.0317+00	5.0696+00	4.9889+00	4.9802+00	4.6581+00
7000.0	5.4021+00	5.4024+00	5.2635+00	4.9846+00	5.0262+00	4.9559+00	4.9421+00	4.6180+00
8000.0	5.3814+00	5.3901+00	5.2430+00	4.9653+00	5.0096+00	4.9490+00	4.9303+00	4.6026+00
9000.0	5.3783+00	5.3957+00	5.2399+00	4.9629+00	5.0093+00	4.9578+00	4.9344+00	4.6022+00
10000.0	5.3861+00	5.4124+00	5.2478+00	4.9712+00	5.0192+00	4.9766+00	4.9486+00	4.6112+00
15000.0	5.4905+00	5.5630+00	5.3548+00	5.0791+00	5.1303+00	5.1280+00	5.0788+00	4.7146+00
20000.0	5.6154+00	5.7340+00	5.4851+00	5.2101+00	5.2613+00	5.2948+00	5.2261+00	4.8372+00
30000.0	5.8352+00	6.0375+00	5.7173+00	5.4446+00	5.4932+00	5.5879+00	5.4831+00	5.0549+00
40000.0	6.0091+00	6.2834+00	5.9017+00	5.6332+00	5.6781+00	5.8242+00	5.6857+00	5.2286+00
50000.0	6.1496+00	6.4862+00	6.0498+00	5.7870+00	5.8281+00	6.0189+00	5.8485+00	5.3694+00
60000.0	6.2663+00	6.6577+00	6.1717+00	5.9155+00	5.9528+00	6.1834+00	5.9834+00	5.4865+00
70000.0	6.3660+00	6.8060+00	6.2746+00	6.0253+00	6.0587+00	6.3256+00	6.0979+00	5.5865+00
80000.0	6.4527+00	6.9365+00	6.3633+00	6.1207+00	6.1504+00	6.4505+00	6.1971+00	5.6733+00
90000.0	6.5293+00	7.0528+00	6.4410+00	6.2046+00	6.2307+00	6.5620+00	6.2845+00	5.7499+00
100000.0	6.5979+00	7.1577+00	6.5101+00	6.2794+00	6.3021+00	6.6625+00	6.3624+00	5.8183+00

TABLE A4 COMPUTED ALPHA ENERGY LOSSES IN UNITS OF (MEV-CM**2)/GM.

ENERGY	W	PT	AU	HG	PB	BI	U	CO2
2.0	4.0497+02	3.7452+02	3.6304+02	3.5545+02	3.4511+02	3.4312+02	3.0816+02	1.3238+03
2.5	3.6517+02	3.4411+02	3.3433+02	3.2682+02	3.1432+02	3.1204+02	2.7807+02	1.1541+03
3.0	3.3297+02	3.1793+02	3.1034+02	3.0100+02	2.9429+02	2.8696+02	2.5757+02	1.0284+03
3.5	3.0785+02	2.9608+02	2.9051+02	2.8450+02	2.7322+02	2.7105+02	2.4060+02	9.3090+02
4.0	2.8833+02	2.7705+02	2.7257+02	2.6738+02	2.5675+02	2.5457+02	2.2587+02	8.5237+02
4.5	2.7023+02	2.6117+02	2.5736+02	2.5275+02	2.4322+02	2.4101+02	2.1351+02	7.8762+02
5.0	2.5740+02	2.4750+02	2.4428+02	2.4018+02	2.3169+02	2.2957+02	2.0315+02	7.3362+02
6.0	2.3318+02	2.2469+02	2.2237+02	2.1906+02	2.1238+02	2.1085+02	1.8671+02	6.4709+02
7.0	2.1435+02	2.0723+02	2.0472+02	2.0187+02	1.9633+02	1.9523+02	1.7365+02	5.8101+02
8.0	1.9845+02	1.9221+02	1.9016+02	1.8777+02	1.8299+02	1.8215+02	1.6301+02	5.2874+02
9.0	1.8537+02	1.8043+02	1.7879+02	1.7663+02	1.7171+02	1.7105+02	1.5369+02	4.8600+02
10.0	1.7426+02	1.7044+02	1.6838+02	1.6644+02	1.6206+02	1.6151+02	1.4706+02	4.5040+02
11.0	1.6472+02	1.6113+02	1.5935+02	1.5759+02	1.5370+02	1.5323+02	1.4010+02	4.2016+02
12.0	1.5661+02	1.5296+02	1.5198+02	1.4983+02	1.4680+02	1.4627+02	1.3397+02	3.9417+02
13.0	1.4960+02	1.4606+02	1.4552+02	1.4287+02	1.4013+02	1.3968+02	1.2839+02	3.7159+02
14.0	1.4323+02	1.3980+02	1.3931+02	1.3791+02	1.3417+02	1.3377+02	1.2331+02	3.5174+02
15.0	1.3754+02	1.3416+02	1.3366+02	1.3238+02	1.2891+02	1.2847+02	1.1870+02	3.3410+02
16.0	1.3244+02	1.2910+02	1.2877+02	1.2731+02	1.2415+02	1.2393+02	1.1447+02	3.1828+02
18.0	1.2351+02	1.2036+02	1.2003+02	1.1881+02	1.1627+02	1.1562+02	1.0688+02	2.9112+02
20.0	1.1592+02	1.1297+02	1.1267+02	1.1151+02	1.0957+02	1.0914+02	1.0072+02	2.6867+02
22.0	1.0934+02	1.0660+02	1.0633+02	1.0524+02	1.0340+02	1.0331+02	9.5193+01	2.4970+02
24.0	1.0357+02	1.0103+02	1.0078+02	9.9763+01	9.8036+01	9.7947+01	9.0381+01	2.3347+02
26.0	9.8449+01	9.6096+01	9.5877+01	9.4914+01	9.3292+01	9.3212+01	8.6247+01	2.1942+02
28.0	9.3883+01	9.1683+01	9.1494+01	9.0587+01	8.9057+01	8.8990+01	8.2451+01	2.0711+02
30.0	8.9778+01	8.7714+01	8.7547+01	8.6690+01	8.5249+01	8.5191+01	7.9051+01	1.9623+02
35.0	8.1114+01	7.9326+01	7.9204+01	7.8450+01	7.7191+01	7.7159+01	7.1923+01	1.7381+02
40.0	7.4141+01	7.2589+01	7.2497+01	7.1825+01	7.0707+01	7.0692+01	6.6454+01	1.5636+02
45.0	6.8694+01	6.6994+01	6.6979+01	6.6368+01	6.5362+01	6.5361+01	6.1540+01	1.4237+02
50.0	6.3914+01	6.2602+01	6.2452+01	6.1738+01	6.0871+01	6.0878+01	5.7398+01	1.3088+02
55.0	5.9860+01	5.8640+01	5.8599+01	5.8082+01	5.7089+01	5.7040+01	5.3866+01	1.2130+02
60.0	5.6336+01	5.5205+01	5.5170+01	5.4685+01	5.3899+01	5.3921+01	5.0788+01	1.1311+02
65.0	5.3274+01	5.2218+01	5.2189+01	5.1734+01	5.0998+01	5.1019+01	4.8098+01	1.0608+02
70.0	5.0587+01	4.9570+01	4.9546+01	4.9115+01	4.8423+01	4.8447+01	4.5711+01	9.9922+01
75.0	4.8268+01	4.7221+01	4.7206+01	4.6797+01	4.6141+01	4.6166+01	4.3674+01	9.4536+01
80.0	4.6129+01	4.5196+01	4.5132+01	4.4707+01	4.4088+01	4.4114+01	4.1812+01	8.9737+01
90.0	4.2479+01	4.1603+01	4.1591+01	4.1227+01	4.0642+01	4.0661+01	3.8497+01	8.1613+01
100.0	3.9422+01	3.8651+01	3.8635+01	3.8300+01	3.7741+01	3.7761+01	3.5739+01	7.4973+01
110.0	3.6862+01	3.6139+01	3.6118+01	3.5811+01	3.5313+01	3.5334+01	3.3466+01	6.9453+01
120.0	3.4631+01	3.3975+01	3.3967+01	3.3677+01	3.3189+01	3.3218+01	3.1474+01	6.4745+01
130.0	3.2703+01	3.2092+01	3.2087+01	3.1816+01	3.1383+01	3.1405+01	2.9760+01	6.0726+01
140.0	3.1002+01	3.0430+01	3.0428+01	3.0172+01	2.9765+01	2.9788+01	2.8251+01	5.7214+01
150.0	2.9502+01	2.8965+01	2.8965+01	2.8723+01	2.8339+01	2.8362+01	2.6924+01	5.4150+01
160.0	2.8158+01	2.7651+01	2.7652+01	2.7423+01	2.7059+01	2.7083+01	2.5720+01	5.1425+01
180.0	2.5867+01	2.5409+01	2.5412+01	2.5203+01	2.4874+01	2.4898+01	2.3663+01	4.6827+01

TABLE A4 COMPUTED ALPHA ENERGY LOSSES IN UNITS OF (MEV-CM**2)/GM.

ENERGY	W	PT	AU	HG	PB	BI	U	CO2
200.0	2.3977+01	2.3559+01	2.3564+01	2.3371+01	2.3069+01	2.3093+01	2.1963+01	4.3082+01
225.0	2.2032+01	2.1653+01	2.1659+01	2.1484+01	2.1209+01	2.1233+01	2.0206+01	3.9272+01
250.0	2.0432+01	2.0085+01	2.0092+01	1.9931+01	1.9678+01	1.9701+01	1.8758+01	3.6172+01
275.0	1.9103+01	1.8783+01	1.8790+01	1.8640+01	1.8405+01	1.8428+01	1.7552+01	3.3624+01
300.0	1.7949+01	1.7652+01	1.7659+01	1.7519+01	1.7299+01	1.7322+01	1.6505+01	3.1427+01
325.0	1.6972+01	1.6694+01	1.6702+01	1.6570+01	1.6363+01	1.6385+01	1.5616+01	2.9583+01
350.0	1.6123+01	1.5862+01	1.5863+01	1.5733+01	1.5542+01	1.5564+01	1.4837+01	2.7975+01
375.0	1.5382+01	1.5134+01	1.5139+01	1.5016+01	1.4825+01	1.4849+01	1.4146+01	2.6561+01
400.0	1.4709+01	1.4474+01	1.4483+01	1.4369+01	1.4194+01	1.4215+01	1.3548+01	2.5309+01
450.0	1.3580+01	1.3361+01	1.3369+01	1.3265+01	1.3105+01	1.3126+01	1.2521+01	2.3224+01
500.0	1.2652+01	1.2455+01	1.2463+01	1.2366+01	1.2217+01	1.2237+01	1.1676+01	2.1521+01
550.0	1.1890+01	1.1703+01	1.1712+01	1.1621+01	1.1482+01	1.1501+01	1.0974+01	2.0131+01
600.0	1.1238+01	1.1067+01	1.1076+01	1.0990+01	1.0857+01	1.0875+01	1.0374+01	1.8953+01
700.0	1.0187+01	1.0035+01	1.0043+01	9.9660+00	9.8483+00	9.8660+00	9.4144+00	1.7066+01
800.0	9.3887+00	9.2503+00	9.2587+00	9.1876+00	9.0798+00	9.0970+00	8.6811+00	1.5645+01
900.0	8.7587+00	8.6317+00	8.6399+00	8.5737+00	8.4737+00	8.4905+00	8.1019+00	1.4531+01
1000.0	8.2497+00	8.1315+00	8.1396+00	8.0775+00	7.9838+00	8.0003+00	7.6333+00	1.3634+01
1250.0	7.3406+00	7.2385+00	7.2464+00	7.1912+00	7.1085+00	7.1246+00	6.7955+00	1.2041+01
1500.0	6.7174+00	6.6267+00	6.6345+00	6.5842+00	6.5090+00	6.5251+00	6.2211+00	1.0956+01
1750.0	6.2687+00	6.1863+00	6.1942+00	6.1476+00	6.0776+00	6.0940+00	5.8077+00	1.0176+01
2000.0	5.9334+00	5.8575+00	5.8657+00	5.8220+00	5.7560+00	5.7727+00	5.4993+00	9.5953+00
2250.0	5.7090+00	5.6379+00	5.6465+00	5.6050+00	5.5417+00	5.5589+00	5.2939+00	9.2075+00
2500.0	5.4846+00	5.4182+00	5.4274+00	5.3881+00	5.3274+00	5.3451+00	5.0885+00	8.8197+00
2750.0	5.3417+00	5.2788+00	5.2885+00	5.2511+00	5.1920+00	5.2102+00	4.9589+00	8.5733+00
3000.0	5.1989+00	5.1393+00	5.1497+00	5.1140+00	5.0566+00	5.0753+00	4.8294+00	8.3268+00
3500.0	5.0074+00	4.9528+00	4.9644+00	4.9314+00	4.8763+00	4.8958+00	4.6572+00	7.9955+00
4000.0	4.8745+00	4.8237+00	4.8366+00	4.8058+00	4.7525+00	4.7725+00	4.5391+00	7.7644+00
4500.0	4.7804+00	4.7325+00	4.7467+00	4.7179+00	4.6659+00	4.6863+00	4.4567+00	7.5994+00
5000.0	4.7129+00	4.6673+00	4.6828+00	4.6557+00	4.6049+00	4.6257+00	4.3988+00	7.4798+00
6000.0	4.6299+00	4.5875+00	4.6054+00	4.5813+00	4.5323+00	4.5537+00	4.3305+00	7.3292+00
7000.0	4.5892+00	4.5490+00	4.5690+00	4.5476+00	4.5002+00	4.5221+00	4.3008+00	7.2512+00
8000.0	4.5733+00	4.5344+00	4.5563+00	4.5372+00	4.4914+00	4.5138+00	4.2935+00	7.2156+00
9000.0	4.5724+00	4.5343+00	4.5579+00	4.5410+00	4.4965+00	4.5194+00	4.2996+00	7.2063+00
10000.0	4.5810+00	4.5434+00	4.5684+00	4.5535+00	4.5105+00	4.5338+00	4.3140+00	7.2136+00
15000.0	4.6825+00	4.6447+00	4.6745+00	4.6666+00	4.6304+00	4.6564+00	4.4341+00	7.3564+00
20000.0	4.8037+00	4.7644+00	4.7968+00	4.7932+00	4.7625+00	4.7912+00	4.5657+00	7.5414+00
30000.0	5.0196+00	4.9768+00	5.0120+00	5.0131+00	4.9891+00	5.0224+00	4.7917+00	7.8836+00
40000.0	5.1920+00	5.1465+00	5.1832+00	5.1872+00	5.1667+00	5.2031+00	4.9684+00	8.1654+00
50000.0	5.3318+00	5.2841+00	5.3218+00	5.3279+00	5.3096+00	5.3481+00	5.1098+00	8.3992+00
60000.0	5.4482+00	5.3988+00	5.4372+00	5.4450+00	5.4281+00	5.4682+00	5.2263+00	8.5977+00
70000.0	5.5476+00	5.4965+00	5.5356+00	5.5446+00	5.5288+00	5.5702+00	5.3250+00	8.7695+00
80000.0	5.6339+00	5.5815+00	5.6210+00	5.6311+00	5.6161+00	5.6586+00	5.4101+00	8.9208+00
90000.0	5.7101+00	5.6565+00	5.6963+00	5.7074+00	5.6930+00	5.7363+00	5.4848+00	9.0558+00
100000.0	5.7782+00	5.7235+00	5.7636+00	5.7755+00	5.7615+00	5.8056+00	5.5513+00	9.1776+00

TABLE A4 COMPUTED ALPHA ENERGY LOSSES IN UNITS OF (MEV-CM**2)/GM.

ENERGY	H202	AIR	H20	TISSUE	(CH2)N	GLASS	EMULSION	NAI
2.0	1.4354+03	1.3356+03	1.5995+03	1.6090+03	1.8209+03	9.8695+02	7.1155+02	5.6902+02
2.5	1.2503+03	1.1629+03	1.3872+03	1.3937+03	1.5663+03	8.6872+02	6.3256+02	5.0334+02
3.0	1.1120+03	1.0346+03	1.2300+03	1.2354+03	1.3841+03	7.7880+02	5.7399+02	4.5467+02
3.5	1.0055+03	9.3502+02	1.1093+03	1.1137+03	1.2434+03	7.0926+02	5.2895+02	4.1719+02
4.0	9.1946+02	8.5635+02	1.0123+03	1.0163+03	1.1326+03	6.5461+02	4.9181+02	3.8724+02
4.5	8.4862+02	7.9128+02	9.3279+02	9.3636+02	1.0420+03	6.0955+02	4.6049+02	3.6266+02
5.0	7.8976+02	7.3665+02	8.6676+02	8.6991+02	9.6629+02	5.7148+02	4.3375+02	3.4263+02
6.0	6.9561+02	6.4996+02	7.6158+02	7.6419+02	8.4654+02	5.0983+02	3.9016+02	3.0991+02
7.0	6.2379+02	5.8367+02	6.8163+02	6.8390+02	7.5607+02	4.6173+02	3.5565+02	2.8472+02
8.0	5.6704+02	5.3098+02	6.1862+02	6.2062+02	6.8503+02	4.2289+02	3.2749+02	2.6452+02
9.0	5.2087+02	4.8807+02	5.6747+02	5.6917+02	6.2699+02	3.9081+02	3.0398+02	2.4740+02
10.0	4.8242+02	4.5241+02	5.2496+02	5.2644+02	5.7903+02	3.6384+02	2.8405+02	2.3252+02
11.0	4.4976+02	4.2212+02	4.8893+02	4.9027+02	5.3862+02	3.4074+02	2.6694+02	2.1956+02
12.0	4.2174+02	3.9588+02	4.5807+02	4.5925+02	5.0392+02	3.2069+02	2.5197+02	2.0812+02
13.0	3.9745+02	3.7308+02	4.3133+02	4.3236+02	4.7384+02	3.0312+02	2.3882+02	1.9794+02
14.0	3.7610+02	3.5306+02	4.0786+02	4.0877+02	4.4748+02	2.8760+02	2.2738+02	1.8886+02
15.0	3.5712+02	3.3531+02	3.8703+02	3.8785+02	4.2418+02	2.7380+02	2.1700+02	1.8071+02
16.0	3.4012+02	3.1941+02	3.6839+02	3.6913+02	4.0338+02	2.6143+02	2.0780+02	1.7334+02
18.0	3.1099+02	2.9212+02	3.3650+02	3.3708+02	3.6772+02	2.4010+02	1.9169+02	1.6041+02
20.0	2.8692+02	2.6957+02	3.1019+02	3.1065+02	3.3839+02	2.2231+02	1.7821+02	1.4948+02
22.0	2.6660+02	2.5053+02	2.8801+02	2.8838+02	3.1377+02	2.0726+02	1.6673+02	1.4055+02
24.0	2.4922+02	2.3419+02	2.6906+02	2.6936+02	2.9275+02	1.9432+02	1.5679+02	1.3253+02
26.0	2.3417+02	2.2005+02	2.5268+02	2.5292+02	2.7462+02	1.8310+02	1.4815+02	1.2549+02
28.0	2.2101+02	2.0768+02	2.3835+02	2.3854+02	2.5878+02	1.7323+02	1.4056+02	1.1927+02
30.0	2.0935+02	1.9675+02	2.2568+02	2.2584+02	2.4483+02	1.6449+02	1.3381+02	1.1369+02
35.0	1.8536+02	1.7423+02	1.9963+02	1.9974+02	2.1624+02	1.4641+02	1.1976+02	1.0209+02
40.0	1.6671+02	1.5672+02	1.7942+02	1.7948+02	1.9406+02	1.3228+02	1.0866+02	9.2991+01
45.0	1.5176+02	1.4272+02	1.6323+02	1.6326+02	1.7634+02	1.2090+02	9.9692+01	8.5556+01
50.0	1.3950+02	1.3119+02	1.4995+02	1.4996+02	1.6184+02	1.1151+02	9.2218+01	7.9363+01
55.0	1.2926+02	1.2158+02	1.3889+02	1.3888+02	1.4976+02	1.0364+02	8.5926+01	7.4115+01
60.0	1.2052+02	1.1335+02	1.2944+02	1.2942+02	1.3945+02	9.6877+01	8.0499+01	6.9635+01
65.0	1.1302+02	1.0630+02	1.2135+02	1.2131+02	1.3064+02	9.1063+01	7.5827+01	6.5697+01
70.0	1.0645+02	1.0013+02	1.1426+02	1.1421+02	1.2293+02	8.5956+01	7.1702+01	6.2216+01
75.0	1.0070+02	9.4729+01	1.0806+02	1.0801+02	1.1620+02	8.1479+01	6.8066+01	5.9151+01
80.0	9.5584+01	8.9916+01	1.0254+02	1.0248+02	1.1020+02	7.7488+01	6.4808+01	5.6404+01
90.0	8.6920+01	8.1772+01	9.3203+01	9.3141+01	1.0008+02	7.0701+01	5.9287+01	5.1696+01
100.0	7.9839+01	7.5114+01	8.5577+01	8.5511+01	9.1822+01	6.5122+01	5.4722+01	4.7802+01
110.0	7.3954+01	6.9581+01	7.9243+01	7.9174+01	8.4969+01	6.0465+01	5.0899+01	4.4535+01
120.0	6.8935+01	6.4861+01	7.3843+01	7.3773+01	7.9132+01	5.6478+01	4.7619+01	4.1729+01
130.0	6.4651+01	6.0832+01	6.9237+01	6.9166+01	7.4157+01	5.3061+01	4.4807+01	3.9315+01
140.0	6.0909+01	5.7313+01	6.5214+01	6.5143+01	6.9815+01	5.0069+01	4.2340+01	3.7192+01
150.0	5.7643+01	5.4241+01	6.1704+01	6.1633+01	6.6030+01	4.7452+01	4.0179+01	3.5326+01
160.0	5.4739+01	5.1510+01	5.8584+01	5.8514+01	6.2667+01	4.5120+01	3.8250+01	3.3658+01
180.0	4.9840+01	4.6902+01	5.3323+01	5.3254+01	5.7001+01	4.1176+01	3.4980+01	3.0828+01

TABLE A4 COMPUTED ALPHA ENERGY LOSSES IN UNITS OF (MEV-CM**2)/GM.

ENERGY	H2O2	AIR	H2O	TISSUE	(CH2)N	GLASS	EMULSION	NAI
200.0	4.5851+01	4.3150+01	4.9040+01	4.8973+01	5.2392+01	3.7952+01	3.2300+01	2.8505+01
225.0	4.1792+01	3.9332+01	4.4686+01	4.4621+01	4.7710+01	3.4662+01	2.9564+01	2.6123+01
250.0	3.8491+01	3.6226+01	4.1145+01	4.1082+01	4.3906+01	3.1978+01	2.7330+01	2.4170+01
275.0	3.5777+01	3.3673+01	3.8235+01	3.8174+01	4.0782+01	2.9767+01	2.5478+01	2.2568+01
300.0	3.3437+01	3.1472+01	3.5727+01	3.5668+01	3.8092+01	2.7857+01	2.3875+01	2.1173+01
325.0	3.1473+01	2.9624+01	3.3622+01	3.3565+01	3.5835+01	2.6251+01	2.2524+01	1.9990+01
350.0	2.9761+01	2.8013+01	3.1788+01	3.1733+01	3.3869+01	2.4848+01	2.1346+01	1.8956+01
375.0	2.8256+01	2.6597+01	3.0176+01	3.0122+01	3.2141+01	2.3614+01	2.0308+01	1.8041+01
400.0	2.6923+01	2.5342+01	2.8748+01	2.8696+01	3.0612+01	2.2520+01	1.9384+01	1.7236+01
450.0	2.4703+01	2.3254+01	2.6372+01	2.6322+01	2.8068+01	2.0695+01	1.7840+01	1.5881+01
500.0	2.2890+01	2.1548+01	2.4431+01	2.4383+01	2.5991+01	1.9201+01	1.6575+01	1.4767+01
550.0	2.1411+01	2.0156+01	2.2848+01	2.2803+01	2.4299+01	1.7981+01	1.5539+01	1.3855+01
600.0	2.0157+01	1.8976+01	2.1507+01	2.1463+01	2.2865+01	1.6945+01	1.4658+01	1.3078+01
700.0	1.8149+01	1.7086+01	1.9359+01	1.9318+01	2.0569+01	1.5284+01	1.3243+01	1.1829+01
800.0	1.6637+01	1.5663+01	1.7741+01	1.7703+01	1.8842+01	1.4030+01	1.2173+01	1.0884+01
900.0	1.5451+01	1.4547+01	1.6474+01	1.6437+01	1.7489+01	1.3046+01	1.1331+01	1.0140+01
1000.0	1.4497+01	1.3649+01	1.5454+01	1.5418+01	1.6400+01	1.2253+01	1.0653+01	9.5398+00
1250.0	1.2802+01	1.2054+01	1.3642+01	1.3610+01	1.4468+01	1.0843+01	9.4448+00	8.4701+00
1500.0	1.1647+01	1.0967+01	1.2407+01	1.2377+01	1.3151+01	9.8813+00	8.6195+00	7.7387+00
1750.0	1.0817+01	1.0186+01	1.1521+01	1.1492+01	1.2206+01	9.1902+00	8.0268+00	7.2131+00
2000.0	1.0199+01	9.6043+00	1.0861+01	1.0833+01	1.1501+01	8.6739+00	7.5852+00	6.8214+00
2250.0	9.7867+00	9.2160+00	1.0420+01	1.0392+01	1.1031+01	8.3283+00	7.2911+00	6.5602+00
2500.0	9.3741+00	8.8276+00	9.9784+00	9.9521+00	1.0560+01	7.9827+00	6.9969+00	6.2989+00
2750.0	9.1118+00	8.5808+00	9.6979+00	9.6719+00	1.0259+01	7.7623+00	6.8104+00	6.1337+00
3000.0	8.8495+00	8.3340+00	9.4174+00	9.3918+00	9.9583+00	7.5418+00	6.6239+00	5.9685+00
3500.0	8.4968+00	8.0020+00	9.0399+00	9.0148+00	9.5455+00	7.2438+00	6.3734+00	5.7479+00
4000.0	8.2489+00	7.7706+00	8.7763+00	8.7506+00	9.2507+00	7.0345+00	6.1989+00	5.5955+00
4500.0	8.0673+00	7.6052+00	8.5848+00	8.5565+00	9.0338+00	6.8837+00	6.0743+00	5.4879+00
5000.0	7.9316+00	7.4854+00	8.4412+00	8.4115+00	8.8707+00	6.7732+00	5.9840+00	5.4111+00
6000.0	7.7497+00	7.3343+00	8.2494+00	8.2175+00	8.6499+00	6.6304+00	5.8699+00	5.3173+00
7000.0	7.6416+00	7.2560+00	8.1360+00	8.1023+00	8.5165+00	6.5520+00	5.8102+00	5.2720+00
8000.0	7.5773+00	7.2202+00	8.0688+00	8.0338+00	8.4353+00	6.5112+00	5.7823+00	5.2548+00
9000.0	7.5405+00	7.2107+00	8.0304+00	7.9945+00	8.3868+00	6.4937+00	5.7740+00	5.2546+00
10000.0	7.5216+00	7.2178+00	8.0107+00	7.9741+00	8.3600+00	6.4911+00	5.7779+00	5.2649+00
15000.0	7.5509+00	7.3601+00	8.0409+00	8.0031+00	8.3752+00	6.5741+00	5.8756+00	5.3792+00
20000.0	7.6432+00	7.5447+00	8.1363+00	8.0984+00	8.4685+00	6.6978+00	6.0028+00	5.5122+00
30000.0	7.8419+00	7.8863+00	8.3417+00	8.3041+00	8.6785+00	6.9296+00	6.2340+00	5.7456+00
40000.0	8.0143+00	8.1677+00	8.5199+00	8.4825+00	8.8619+00	7.1175+00	6.4197+00	5.9311+00
50000.0	8.1595+00	8.4013+00	8.6701+00	8.6326+00	9.0158+00	7.2702+00	6.5704+00	6.0814+00
60000.0	8.2833+00	8.5995+00	8.7983+00	8.7604+00	9.1460+00	7.3971+00	6.6956+00	6.2068+00
70000.0	8.3903+00	8.7712+00	8.9094+00	8.8708+00	9.2577+00	7.5047+00	6.8021+00	6.3137+00
80000.0	8.4843+00	8.9223+00	9.0071+00	8.9678+00	9.3551+00	7.5979+00	6.8943+00	6.4066+00
90000.0	8.5678+00	9.0571+00	9.0941+00	9.0538+00	9.4410+00	7.6796+00	6.9754+00	6.4884+00
100000.0	8.6427+00	9.1788+00	9.1722+00	9.1311+00	9.5177+00	7.7524+00	7.0476+00	6.5614+00

TABLE A4 COMPUTED ALPHA ENERGY LOSSES IN UNITS OF (MEV-CM**2)/GM.

ENERGY	BONE	ANTHRACENE	STILBENE	MYLAR	LUCITE	POLYSTYRENE	TEFLON
2.0	1.4263+03	1.5768+03	1.6067+03	1.4851+03	1.5939+03	1.6371+03	1.2177+03
2.5	1.2394+03	1.3614+03	1.3865+03	1.2871+03	1.3783+03	1.4120+03	1.0669+03
3.0	1.1017+03	1.2073+03	1.2289+03	1.1434+03	1.2221+03	1.2509+03	9.5483+02
3.5	9.9497+02	1.0875+03	1.1065+03	1.0318+03	1.1012+03	1.1259+03	8.6629+02
4.0	9.0979+02	9.9289+02	1.0099+03	9.4295+02	1.0051+03	1.0273+03	7.9515+02
4.5	8.4004+02	9.1529+02	9.3076+02	8.6995+02	9.2638+02	9.4645+02	7.3629+02
5.0	7.8182+02	8.5026+02	8.6443+02	8.0893+02	8.6061+02	8.7879+02	6.8642+02
6.0	6.8905+02	7.4695+02	7.5911+02	7.1166+02	7.5602+02	7.7142+02	6.0660+02
7.0	6.1836+02	6.6865+02	6.7932+02	6.3774+02	6.7668+02	6.9012+02	5.4569+02
8.0	5.6239+02	6.0700+02	6.1652+02	5.7943+02	6.1419+02	6.2616+02	4.9712+02
9.0	5.1664+02	5.5640+02	5.6501+02	5.3167+02	5.6312+02	5.7372+02	4.5720+02
10.0	4.7855+02	5.1451+02	5.2238+02	4.9203+02	5.2078+02	5.3033+02	4.2394+02
11.0	4.4625+02	4.7916+02	4.8641+02	4.5850+02	4.8499+02	4.9374+02	3.9577+02
12.0	4.1847+02	4.4874+02	4.5547+02	4.2967+02	4.5425+02	4.6226+02	3.7149+02
13.0	3.9433+02	4.2232+02	4.2860+02	4.0463+02	4.2758+02	4.3494+02	3.5032+02
14.0	3.7311+02	3.9915+02	4.0504+02	3.8265+02	4.0418+02	4.1099+02	3.3167+02
15.0	3.5427+02	3.7863+02	3.8418+02	3.6315+02	3.8344+02	3.8978+02	3.1513+02
16.0	3.3741+02	3.6029+02	3.6555+02	3.4571+02	3.6490+02	3.7085+02	3.0036+02
18.0	3.0848+02	3.2878+02	3.3353+02	3.1576+02	3.3310+02	3.3831+02	2.7495+02
20.0	2.8458+02	3.0283+02	3.0716+02	2.9105+02	3.0689+02	3.1153+02	2.5386+02
22.0	2.6442+02	2.8101+02	2.8500+02	2.7024+02	2.8483+02	2.8903+02	2.3606+02
24.0	2.4717+02	2.6236+02	2.6606+02	2.5245+02	2.6598+02	2.6979+02	2.2083+02
26.0	2.3225+02	2.4626+02	2.4972+02	2.3707+02	2.4970+02	2.5320+02	2.0765+02
28.0	2.1918+02	2.3217+02	2.3541+02	2.2361+02	2.3545+02	2.3867+02	1.9606+02
30.0	2.0764+02	2.1976+02	2.2281+02	2.1173+02	2.2289+02	2.2589+02	1.8583+02
35.0	1.8390+02	1.9429+02	1.9696+02	1.8733+02	1.9709+02	1.9965+02	1.6476+02
40.0	1.6543+02	1.7450+02	1.7688+02	1.6836+02	1.7706+02	1.7928+02	1.4831+02
45.0	1.5063+02	1.5867+02	1.6082+02	1.5316+02	1.6102+02	1.6299+02	1.3511+02
50.0	1.3849+02	1.4570+02	1.4767+02	1.4071+02	1.4788+02	1.4964+02	1.2426+02
55.0	1.2835+02	1.3489+02	1.3670+02	1.3032+02	1.3693+02	1.3852+02	1.1520+02
60.0	1.1968+02	1.2566+02	1.2734+02	1.2145+02	1.2758+02	1.2902+02	1.0744+02
65.0	1.1225+02	1.1776+02	1.1933+02	1.1385+02	1.1957+02	1.2090+02	1.0079+02
70.0	1.0575+02	1.1085+02	1.1232+02	1.0720+02	1.1257+02	1.1380+02	9.4966+01
75.0	1.0005+02	1.0481+02	1.0620+02	1.0138+02	1.0644+02	1.0759+02	8.9874+01
80.0	9.4977+01	9.9431+01	1.0074+02	9.6199+01	1.0099+02	1.0206+02	8.5326+01
90.0	8.6391+01	9.0339+01	9.1525+01	8.7437+01	9.1767+01	9.2715+01	7.7628+01
100.0	7.9372+01	8.2918+01	8.4001+01	8.0281+01	8.4238+01	8.5089+01	7.1333+01
110.0	7.3534+01	7.6756+01	7.7756+01	7.4337+01	7.7987+01	7.8758+01	6.6098+01
120.0	6.8555+01	7.1506+01	7.2434+01	6.9270+01	7.2659+01	7.3365+01	6.1631+01
130.0	6.4304+01	6.7028+01	6.7896+01	6.4948+01	6.8115+01	6.8765+01	5.7817+01
140.0	6.0590+01	6.3119+01	6.3934+01	6.1173+01	6.4147+01	6.4751+01	5.4484+01
150.0	5.7347+01	5.9711+01	6.0479+01	5.7880+01	6.0687+01	6.1250+01	5.1574+01
160.0	5.4463+01	5.6681+01	5.7410+01	5.4953+01	5.7612+01	5.8140+01	4.8986+01
180.0	4.9597+01	5.1575+01	5.2235+01	5.0017+01	5.2427+01	5.2896+01	4.4618+01

TABLE A4 COMPUTED ALPHA ENERGY LOSSES IN UNITS OF (MEV-CM**2)/GM.

ENERGY	BONE	ANTHRACENE	STILBENE	MYLAR	LUCITE	POLYSTYRENE	TEFLON
200.0	4.5633+01	4.7419+01	4.8024+01	4.5999+01	4.8208+01	4.8630+01	4.1059+01
225.0	4.1600+01	4.3196+01	4.3745+01	4.1913+01	4.3918+01	4.4295+01	3.7437+01
250.0	3.8318+01	3.9763+01	4.0267+01	3.8591+01	4.0432+01	4.0772+01	3.4490+01
275.0	3.5620+01	3.6943+01	3.7410+01	3.5862+01	3.7567+01	3.7878+01	3.2066+01
300.0	3.3293+01	3.4514+01	3.4949+01	3.3509+01	3.5098+01	3.5384+01	2.9976+01
325.0	3.1340+01	3.2475+01	3.2884+01	3.1535+01	3.3027+01	3.3293+01	2.8221+01
350.0	2.9637+01	3.0699+01	3.1084+01	2.9814+01	3.1222+01	3.1470+01	2.6690+01
375.0	2.8140+01	2.9138+01	2.9503+01	2.8302+01	2.9636+01	2.9868+01	2.5345+01
400.0	2.6814+01	2.7755+01	2.8103+01	2.6963+01	2.8231+01	2.8450+01	2.4152+01
450.0	2.4606+01	2.5455+01	2.5773+01	2.4734+01	2.5894+01	2.6091+01	2.2167+01
500.0	2.2802+01	2.3577+01	2.3871+01	2.2913+01	2.3985+01	2.4164+01	2.0545+01
550.0	2.1330+01	2.2046+01	2.2320+01	2.1429+01	2.2429+01	2.2594+01	1.9221+01
600.0	2.0082+01	2.0749+01	2.1006+01	2.0170+01	2.1110+01	2.1263+01	1.8099+01
700.0	1.8084+01	1.8672+01	1.8902+01	1.8156+01	1.8998+01	1.9133+01	1.6301+01
800.0	1.6578+01	1.7108+01	1.7319+01	1.6639+01	1.7409+01	1.7530+01	1.4946+01
900.0	1.5398+01	1.5883+01	1.6078+01	1.5450+01	1.6163+01	1.6273+01	1.3884+01
1000.0	1.4448+01	1.4897+01	1.5080+01	1.4493+01	1.5160+01	1.5262+01	1.3029+01
1250.0	1.2761+01	1.3147+01	1.3307+01	1.2794+01	1.3380+01	1.3468+01	1.1510+01
1500.0	1.1610+01	1.1954+01	1.2099+01	1.1636+01	1.2167+01	1.2244+01	1.0474+01
1750.0	1.0784+01	1.1097+01	1.1232+01	1.0805+01	1.1297+01	1.1367+01	9.7310+00
2000.0	1.0169+01	1.0459+01	1.0586+01	1.0185+01	1.0648+01	1.0712+01	9.1771+00
2250.0	9.7579+00	1.0033+01	1.0154+01	9.7716+00	1.0214+01	1.0275+01	8.8073+00
2500.0	9.3471+00	9.6069+00	9.7227+00	9.3579+00	9.7809+00	9.8383+00	8.4376+00
2750.0	9.0859+00	9.3346+00	9.4474+00	9.0947+00	9.5052+00	9.5600+00	8.2027+00
3000.0	8.8248+00	9.0624+00	9.1720+00	8.8315+00	9.2295+00	9.2817+00	7.9678+00
3500.0	8.4738+00	8.6897+00	8.7955+00	8.4734+00	8.8541+00	8.9021+00	7.6522+00
4000.0	8.2266+00	8.4238+00	8.5269+00	8.2183+00	8.5868+00	8.6314+00	7.4292+00
4500.0	8.0464+00	8.2284+00	8.3296+00	8.0312+00	8.3906+00	8.4326+00	7.2661+00
5000.0	7.9124+00	8.0819+00	8.1815+00	7.8911+00	8.2436+00	8.2833+00	7.1448+00
6000.0	7.7345+00	7.8844+00	7.9819+00	7.7028+00	8.0457+00	8.0822+00	6.9835+00
7000.0	7.6307+00	7.7663+00	7.8624+00	7.5907+00	7.9275+00	7.9617+00	6.8892+00
8000.0	7.5706+00	7.6954+00	7.7905+00	7.5239+00	7.8565+00	7.8893+00	6.8345+00
9000.0	7.5379+00	7.6541+00	7.7487+00	7.4855+00	7.8153+00	7.8470+00	6.8044+00
10000.0	7.5229+00	7.6323+00	7.7265+00	7.4657+00	7.7935+00	7.8206+00	6.7904+00
15000.0	7.5680+00	7.6573+00	7.7509+00	7.4942+00	7.8187+00	7.8488+00	6.8286+00
20000.0	7.6720+00	7.7511+00	7.8449+00	7.5877+00	7.9124+00	7.9433+00	6.9200+00
30000.0	7.8864+00	7.9551+00	8.0500+00	7.7887+00	8.1167+00	8.1498+00	7.1095+00
40000.0	8.0686+00	8.1310+00	8.2271+00	7.9618+00	8.2935+00	8.3284+00	7.2706+00
50000.0	8.2203+00	8.2774+00	8.3748+00	8.1063+00	8.4416+00	8.4774+00	7.4048+00
60000.0	8.3485+00	8.4007+00	8.4992+00	8.2283+00	8.5668+00	8.6031+00	7.5180+00
70000.0	8.4586+00	8.5059+00	8.6055+00	8.3329+00	8.6745+00	8.7107+00	7.6153+00
80000.0	8.5547+00	8.5973+00	8.6979+00	8.4240+00	8.7684+00	8.8042+00	7.7002+00
90000.0	8.6396+00	8.6776+00	8.7792+00	8.5044+00	8.8513+00	8.8866+00	7.7753+00
100000.0	8.7156+00	8.7492+00	8.8516+00	8.5762+00	8.9255+00	8.9599+00	7.8425+00

TABLE A5 PROTON RANGE PARAMETERS

HYDROGEN H

R	A	B	ERROR
1.700	1.2298279-03	8.9715048-08	18.59
1.725	1.1295668-03	5.4259838-08	14.26
1.750	1.0377834-03	7.8588476-07	10.77
1.775	9.5335027-04	1.1277795-06	7.59
1.800	8.7169787-04	1.6501340-06	4.21
1.825	7.8971986-04	1.9074509-06	3.04

HELIUM HE

R	A	B	ERROR
1.700	2.7568688-03	1.6357191-07	16.53
1.725	2.5323770-03	4.1292034-07	12.48
1.750	2.3264704-03	9.6155457-07	8.78
1.775	2.1372757-03	1.3842444-06	5.53
1.800	1.9620810-03	2.0222198-06	2.62
1.825	1.7520224-03	2.0781079-06	3.94

LITHIUM LI

R	A	B	ERROR
1.700	3.2355933-03	1.6034314-07	16.22
1.725	2.9721319-03	4.2224968-07	12.16
1.750	2.7304791-03	9.7996535-07	8.46
1.775	2.5084646-03	1.4346471-06	4.97
1.800	2.2950566-03	1.9952696-06	2.33
1.825	2.0477587-03	2.0481700-06	4.07

BERYLLIUM BE

R	A	B	ERROR
1.700	3.2863951-03	7.6497095-09	15.24
1.725	3.0190648-03	5.4169654-07	11.42
1.750	2.7735155-03	1.0139475-06	7.63
1.775	2.5617519-03	1.7460845-06	4.06
1.800	2.3218011-03	2.0452496-06	2.65
1.825	2.0890757-03	2.1502928-06	4.85

BORON B

R	A	B	ERROR
1.700	3.2141764-03	8.0065466-08	14.91
1.725	2.9527418-03	6.1995773-07	11.11
1.750	2.7343887-03	1.5180093-06	6.98
1.775	2.5013048-03	1.8306677-06	3.72
1.800	2.2650284-03	2.0837062-06	2.76
1.825	2.0384206-03	2.3053546-06	5.32

CARBON C

R	A	B	ERROR
1.700	3.0567999-03	2.3632116-07	14.31
1.725	2.8081909-03	7.8910489-07	10.53
1.750	2.6053195-03	1.6441648-06	6.18
1.775	2.3835181-03	1.9091960-06	2.91
1.800	2.1377780-03	2.1488200-06	2.88
1.825	1.9547872-03	2.4961921-06	5.85

NITROGEN N

R	A	B	ERROR
1.700	3.2242821-03	3.7706584-07	13.52
1.725	2.9412456-03	9.3868089-07	9.71
1.750	2.6731155-03	1.7541818-06	5.60
1.775	2.4459338-03	2.0022779-06	2.36
1.800	2.1981738-03	2.2573641-06	3.32
1.825	2.0068915-03	2.5944543-06	5.93

OXYGEN O

R	A	B	ERROR
1.700	3.2904200-03	4.6066388-07	12.67
1.725	3.0016061-03	1.0312794-06	8.87
1.750	2.7363407-03	1.8328355-06	5.13
1.775	2.4983448-03	2.1856122-06	1.92
1.800	2.2336889-03	2.2787264-06	3.71
1.825	2.0592059-03	2.6962681-06	6.37

NEON NE

R	A	B	ERROR
1.700	3.4440645-03	6.1362423-07	11.07
1.725	3.1418187-03	1.2007021-06	7.34
1.750	2.8660641-03	1.6612085-06	3.99
1.775	2.5988943-03	2.2400889-06	1.97
1.800	2.3662411-03	2.4702981-06	4.58
1.825	2.1616805-03	2.8259988-06	7.18

MAGNESIUM MG

R	A	B	ERROR
1.700	3.5669085-03	7.1127456-07	9.91
1.725	3.2537129-03	1.2000128-06	6.49
1.750	2.9814069-03	2.0688796-06	3.23
1.775	2.6784006-03	2.2596612-06	2.06
1.800	2.4492142-03	2.5232068-06	5.05
1.825	2.2358832-03	2.8788287-06	8.13

ALUMINUM AL

R	A	B	ERROR
1.700	3.7050121-03	7.8273580-07	9.67
1.725	3.3797255-03	1.2831189-06	6.27
1.750	3.0971024-03	2.0380825-06	2.94
1.775	2.7938117-03	2.3455097-06	2.36
1.800	2.5521315-03	2.7379606-06	5.30
1.825	2.3212658-03	2.9244118-06	8.39

SILICON SI

R	A	B	ERROR
1.700	3.6237246-03	8.6278518-07	9.30
1.725	3.3056073-03	1.3731612-06	6.05
1.750	3.0277131-03	2.1359064-06	2.80
1.775	2.7246341-03	2.3798908-06	2.39
1.800	2.4940655-03	2.7907405-06	5.36
1.825	2.2904695-03	3.0590873-06	8.64

TABLE A5 PROTON RANGE PARAMETERS

ARGON A				CALCIUM CA			
R	A	B	ERROR	R	A	B	ERROR
1.700	4.1645390-03	1.0561294-06	8.51	1.700	3.8900162-03	1.1190680-06	7.92
1.725	3.8204296-03	1.9340480-06	5.05	1.725	3.5299160-03	1.7921324-06	4.01
1.750	3.4887131-03	2.3480265-06	1.85	1.750	3.2031291-03	2.3360910-06	1.60
1.775	3.1454228-03	2.5509132-06	3.21	1.775	2.9102278-03	2.6473709-06	4.05
1.800	2.8847643-03	2.9912887-06	6.04	1.800	2.6821677-03	3.1456476-06	7.16
1.825	2.6316423-03	3.1906689-06	9.43	1.825	2.4221578-03	3.2440246-06	10.40

TITANIUM TI				VANADIUM V			
R	A	B	ERROR	R	A	B	ERROR
1.700	4.2946396-03	1.1994346-06	7.69	1.700	4.4033868-03	1.2397935-06	7.42
1.725	3.8968059-03	1.7813057-06	3.66	1.725	3.9955322-03	1.8335055-06	3.53
1.750	3.5246030-03	2.3784908-06	1.58	1.750	3.6067601-03	2.3878429-06	1.62
1.775	3.2152757-03	2.6968661-06	4.21	1.775	3.2979182-03	2.7219206-06	4.38
1.800	2.9342511-03	3.1040777-06	7.38	1.800	3.0095552-03	3.1309139-06	7.57
1.825	2.6767265-03	3.2974682-06	10.51	1.825	2.7448634-03	3.3210465-06	10.71

CHROMIUM CR				MANGANESE MN			
R	A	B	ERROR	R	A	B	ERROR
1.700	4.3399661-03	1.2939601-06	6.96	1.700	4.4339202-03	1.3278624-06	6.65
1.725	3.9504507-03	2.1082620-06	3.37	1.725	4.0339046-03	2.2008091-06	3.23
1.750	3.5549084-03	2.4288852-06	1.76	1.750	3.6389914-03	2.4680968-06	1.83
1.775	3.2519130-03	2.8958957-06	4.76	1.775	3.3411268-03	2.9762183-06	4.91
1.800	2.9666137-03	3.1652067-06	7.97	1.800	3.0326787-03	3.1917946-06	8.18
1.825	2.7063241-03	3.3557089-06	11.07	1.825	2.7664694-03	3.6586230-06	11.28

IRON FE				COBALT CO			
R	A	B	ERROR	R	A	B	ERROR
1.700	4.3647508-03	1.3646271-06	6.18	1.700	4.4656703-03	1.4048774-06	5.95
1.725	3.9767291-03	2.1522781-06	2.99	1.725	4.0720587-03	2.2548060-06	2.93
1.750	3.5940176-03	2.5203458-06	1.94	1.750	3.6821639-03	2.5585776-06	2.08
1.775	3.2917707-03	3.0077137-06	5.00	1.775	3.3687974-03	3.0370675-06	5.07
1.800	3.0234416-03	3.3393591-06	8.42	1.800	3.0950062-03	3.3701925-06	8.59
1.825	2.7240791-03	3.6852342-06	11.65	1.825	2.7876906-03	3.7143091-06	11.82

NICKEL NI				COPPER CU			
R	A	B	ERROR	R	A	B	ERROR
1.700	4.3171914-03	1.4458837-06	5.58	1.700	4.5399383-03	1.5089631-06	5.47
1.725	3.9372057-03	2.2050562-06	2.66	1.725	4.1317101-03	2.2296185-06	2.59
1.750	3.5738146-03	2.6351823-06	2.30	1.750	3.7512870-03	2.6490541-06	2.37
1.775	3.2778821-03	3.1323680-06	5.30	1.775	3.4485760-03	3.1833481-06	5.38
1.800	2.9946730-03	3.4046275-06	8.79	1.800	3.1503032-03	3.4521199-06	8.92
1.825	2.7517115-03	3.9715910-06	11.98	1.825	2.8947234-03	4.0209618-06	12.06

ZINC ZN				GERMANIUM GE			
R	A	B	ERROR	R	A	B	ERROR
1.700	4.5445012-03	1.5406902-06	5.37	1.700	4.7870581-03	1.6185108-06	5.18
1.725	4.1422616-03	2.3043184-06	2.40	1.725	4.3586915-03	2.2971296-06	2.22
1.750	3.7636134-03	2.6919824-06	2.57	1.750	3.9610569-03	2.7322576-06	2.74
1.775	3.4542910-03	3.2118002-06	5.53	1.775	3.6426166-03	3.2749998-06	5.79
1.800	3.1554741-03	3.4790286-06	9.08	1.800	3.3265418-03	3.5361471-06	9.34
1.825	2.8994808-03	4.0499327-06	12.22	1.825	3.0566834-03	4.1110185-06	12.48

TABLE A5 PROTON RANGE PARAMETERS

SELENIUM SE				KRYPTON KR			
R	A	B	ERROR	R	A	B	ERROR
1.700	4.9577279-03	1.5905173-06	4.90	1.700	5.0479710-03	2.1047605-06	4.63
1.725	4.5209340-03	2.3604703-06	1.94	1.725	4.5851204-03	2.4290175-06	1.64
1.750	4.1151728-03	2.8179339-06	3.03	1.750	4.1862799-03	2.9223795-06	3.43
1.775	3.7805421-03	3.3549317-06	6.44	1.775	3.8425712-03	3.4552945-06	6.57
1.800	3.4502304-03	3.6052722-06	9.67	1.800	3.5037480-03	3.6912479-06	10.03
1.825	3.1703540-03	4.1848223-06	12.81	1.825	3.2195493-03	4.2757A56-06	13.16

SILVER AG				TIN SN			
R	A	B	ERROR	R	A	B	ERROR
1.700	5.3037397-03	2.3646438-06	2.77	1.700	5.5553115-03	2.3213473-06	2.63
1.725	4.8600831-03	2.9411433-06	2.23	1.725	5.1029348-03	2.9231187-06	2.39
1.750	4.4462126-03	3.5092988-06	5.12	1.750	4.6677642-03	3.4933813-06	5.40
1.775	4.0607964-03	3.8381749-06	8.70	1.775	4.2616186-03	3.8188404-06	8.98
1.800	3.6902315-03	4.3550138-06	11.62	1.800	3.8713868-03	4.3357790-06	11.70
1.825	3.3904807-03	4.6317734-06	15.16	1.825	3.5569198-03	4.6133713-06	15.45

ANTIMONY SB				XENON XE			
R	A	B	ERROR	R	A	B	ERROR
1.700	5.6162385-03	2.5208770-06	2.46	1.700	5.8029117-03	2.6160499-06	2.18
1.725	5.1762001-03	3.0917957-06	2.84	1.725	5.3319981-03	3.1662961-06	3.07
1.750	4.7285824-03	3.6518492-06	5.80	1.750	4.8985030-03	3.7985932-06	6.36
1.775	4.3139490-03	3.9607146-06	9.33	1.775	4.4639469-03	4.0864505-06	9.85
1.800	3.9169811-03	4.4746640-06	12.04	1.800	4.0498952-03	4.5946772-06	12.51
1.825	3.5988199-03	4.7462326-06	15.73	1.825	3.7209462-03	4.8610172-06	16.19

CESIUM CS				TANTALUM TA			
R	A	B	ERROR	R	A	B	ERROR
1.700	5.7792516-03	2.3817236-06	1.98	1.700	6.4374868-03	3.2039637-06	2.70
1.725	5.3328411-03	3.1905613-06	3.20	1.725	5.9172785-03	3.8376659-06	5.01
1.750	4.8968307-03	3.8211856-06	6.58	1.750	5.3621356-03	4.4354317-06	8.82
1.775	4.4611232-03	4.4261228-06	10.00	1.775	4.9488351-03	4.9585793-06	11.76
1.800	4.0456669-03	4.6111411-06	12.74	1.800	4.4723326-03	5.0626457-06	14.68
1.825	3.7170624-03	4.8767620-06	16.36	1.825	4.1091068-03	5.3083990-06	18.54

TUNGSTEN W				PLATINUM PT			
R	A	B	ERROR	R	A	B	ERROR
1.700	6.4764647-03	3.2214114-06	2.76	1.700	6.6327538-03	3.3841820-06	3.13
1.725	5.9522955-03	3.8525498-06	5.06	1.725	6.0884753-03	3.9917291-06	5.54
1.750	5.3932315-03	4.4511237-06	8.87	1.750	5.5117395-03	4.5835983-06	9.20
1.775	4.9775352-03	4.9737263-06	11.86	1.775	5.0869175-03	5.1015884-06	12.32
1.800	4.4977435-03	5.0751687-06	14.73	1.800	4.5942089-03	5.1872697-06	15.08
1.825	4.1324546-03	5.3203664-06	18.63	1.825	4.2210941-03	5.4274890-06	19.04

GOLD AU				MERCURY HG			
R	A	B	ERROR	R	A	B	ERROR
1.700	6.6500496-03	3.4459260-06	3.31	1.700	6.7169156-03	3.4862590-06	3.43
1.725	6.1001850-03	4.0412149-06	5.73	1.725	6.1590011-03	4.0740087-06	5.86
1.750	5.5197498-03	4.6278312-06	9.37	1.750	5.5711849-03	4.6566634-06	9.47
1.775	5.0943132-03	5.1442754-06	12.48	1.775	5.1417859-03	5.1720983-06	12.59
1.800	4.5996823-03	5.2233897-06	15.27	1.800	4.6419174-03	5.2474164-06	15.37
1.825	4.2261258-03	5.4620013-06	19.18	1.825	4.2649325-03	5.4849574-06	19.29

TABLE A5 PROTON RANGE PARAMETERS

LEAD PB				BISMUTH BI			
R	A	B	ERROR	R	A	B	ERROR
1.700	6.7763492-03	3.1280519-06	3.68	1.700	6.7838699-03	3.1765734-06	3.79
1.725	6.2620065-03	4.1481406-06	6.22	1.725	6.2670828-03	4.2033343-06	6.39
1.750	5.6592346-03	4.7219250-06	9.75	1.750	5.6613559-03	4.7719459-06	9.92
1.775	5.2230534-03	5.2350709-06	12.88	1.775	5.2250145-03	5.2833331-06	13.02
1.800	4.7133691-03	5.3003401-06	15.67	1.800	4.7141449-03	5.3422839-06	15.84
1.825	4.3319754-03	6.1851104-06	19.48	1.825	4.3327009-03	6.2294657-06	19.50

URANIUM U				CARBON DIOXIDE CO2			
R	A	B	ERROR	R	A	B	ERROR
1.700	7.2563732-03	3.6360623-06	4.70	1.700	3.2512393-03	4.1155604-07	13.17
1.725	6.6324174-03	4.6118901-06	7.74	1.725	2.9658479-03	9.7688959-07	9.36
1.750	6.0186613-03	4.9753497-06	11.32	1.750	2.7001458-03	1.7730373-06	5.46
1.775	5.5547953-03	5.4795491-06	14.20	1.775	2.4664422-03	2.0811061-06	2.16
1.800	5.0031007-03	5.5001065-06	17.29	1.800	2.2126294-03	2.2661895-06	3.35
1.825	4.5983598-03	6.4116309-06	19.92	1.825	2.0217777-03	2.6103088-06	6.16

HYDROGEN PEROXIDE H2O2				AIR			
R	A	B	ERROR	R	A	B	ERROR
1.700	2.9639575-03	3.5879896-08	13.53	1.700	3.2447367-03	3.9910121-07	13.31
1.725	2.7840079-03	9.4798552-07	9.79	1.725	2.9599121-03	9.6309220-07	9.50
1.750	2.5281557-03	1.7531827-06	5.61	1.750	2.6858468-03	1.7567641-06	5.59
1.775	2.3139218-03	2.0024012-06	2.38	1.775	2.4633879-03	2.0788008-06	2.28
1.800	2.0798366-03	2.2597922-06	3.33	1.800	2.2096183-03	2.2630168-06	3.34
1.825	1.8992690-03	2.5987934-06	5.96	1.825	2.0184193-03	2.6046037-06	6.01

WATER				TISSUE			
R	A	B	ERROR	R	A	B	ERROR
1.700	2.7601364-03	2.6002093-07	14.25	1.700	2.7609269-03	2.3786870-07	14.38
1.725	2.5356543-03	8.0939556-07	10.48	1.725	2.5363768-03	7.8500710-07	10.60
1.750	2.3518310-03	1.6811755-06	6.21	1.750	2.3566435-03	1.6768516-06	6.57
1.775	2.1523066-03	1.9386534-06	2.96	1.775	2.1544199-03	2.0318594-06	3.19
1.800	1.9292607-03	2.1674312-06	2.80	1.800	1.9328651-03	2.1622699-06	2.79
1.825	1.7641907-03	2.5113201-06	5.70	1.825	1.7666101-03	2.5021080-06	5.69

POLYETHYLENE (CH2)N				GLASS			
R	A	B	ERROR	R	A	B	ERROR
1.700	2.5629399-03	9.6373122-08	15.15	1.700	3.7593030-03	9.4695596-07	8.91
1.725	2.3544716-03	6.3069271-07	11.36	1.725	3.4489041-03	1.8450838-06	5.46
1.750	2.1833397-03	1.5483591-06	7.51	1.750	3.1482257-03	2.1494823-06	2.20
1.775	1.9948323-03	1.8089785-06	4.05	1.775	2.8330348-03	2.4515085-06	2.92
1.800	1.8093624-03	2.1137309-06	2.66	1.800	2.6040453-03	2.9088509-06	5.75
1.825	1.6283789-03	2.2156770-06	4.86	1.825	2.3755488-03	3.1124176-06	9.05

EMULSION				SODIUM IODIDE NAI			
R	A	B	ERROR	R	A	B	ERROR
1.700	4.5471653-03	1.5299458-06	5.73	1.700	5.2441561-03	1.9694027-06	3.47
1.725	4.1418197-03	2.2633801-06	2.64	1.725	4.7639618-03	2.7021317-06	1.51
1.750	3.7475874-03	2.6474760-06	2.23	1.750	4.3730994-03	3.2899866-06	4.45
1.775	3.4316885-03	3.1355064-06	5.17	1.775	4.0035592-03	3.6567132-06	7.63
1.800	3.1527919-03	3.4646991-06	8.79	1.800	3.6447103-03	4.1793867-06	10.81
1.825	2.8970071-03	4.0303502-06	11.92	1.825	3.3486462-03	4.4637266-06	14.15

TABLE A5 PROTON RANGE PARAMETERS

BONE

R	A	B	ERROR
1.700	2.9836335-03	7.6732370-08	13.33
1.725	2.8010078-03	9.8835825-07	9.54
1.750	2.5472808-03	1.7701185-06	5.52
1.775	2.3277338-03	2.0818101-06	2.18
1.800	2.0884668-03	2.2682686-06	3.36
1.825	1.9088496-03	2.6148390-06	6.03

ANTHRACENE C14H10

R	A	B	ERROR
1.700	2.8440733-03	1.8372990-07	14.66
1.725	2.6127529-03	7.2676094-07	10.88
1.750	2.4208371-03	1.6056302-06	6.68
1.775	2.2137927-03	1.8694935-06	3.44
1.800	1.9984556-03	2.1466565-06	2.78
1.825	1.8244968-03	2.4787526-06	5.71

STILBENE C14H12

R	A	B	ERROR
1.700	2.8065938-03	1.7224468-07	14.73
1.725	2.5783189-03	7.1385011-07	10.95
1.750	2.3919473-03	1.6064068-06	6.87
1.775	2.1868590-03	1.8687360-06	3.50
1.800	1.9738288-03	2.1444465-06	2.77
1.825	1.7770336-03	2.3662991-06	5.64

MYLAR POLYETHYLENETEREPHTHALATE C10H804

R	A	B	ERROR
1.700	2.9423210-03	2.5666950-07	14.27
1.725	2.7030219-03	8.0628266-07	10.49
1.750	2.5039129-03	1.6667866-06	6.28
1.775	2.2944465-03	1.9330048-06	2.91
1.800	2.0569485-03	2.1651922-06	2.80
1.825	1.8808646-03	2.5095851-06	5.75

LUCITE POLYMETHYL_METHACRYLATE C5H802

R	A	B	ERROR
1.700	2.8009471-03	2.0970461-07	14.53
1.725	2.5731379-03	7.5450882-07	10.75
1.750	2.3805163-03	1.6160929-06	6.67
1.775	2.1828076-03	1.9462753-06	3.26
1.800	1.9647293-03	2.1543965-06	2.78
1.825	1.7946646-03	2.4902088-06	5.71

POLYSTYRENE C8H8

R	A	B	ERROR
1.700	2.7699374-03	1.6051150-07	14.80
1.725	2.5446418-03	7.0052293-07	11.01
1.750	2.3641218-03	1.6086281-06	7.14
1.775	2.1579855-03	1.9981134-06	3.59
1.800	1.9498044-03	2.1424194-06	2.76
1.825	1.7551349-03	2.3627684-06	5.48

TEFLON POLYTETRAFLUOROETHYLENE C2F2

R	A	B	ERROR
1.700	3.4180942-03	4.7617422-07	12.87
1.725	3.1180786-03	1.0482691-06	9.05
1.750	2.8390146-03	1.8330614-06	5.18
1.775	2.5952831-03	2.1963604-06	1.93
1.800	2.3188632-03	2.2837552-06	3.62
1.825	2.1388220-03	2.7059067-06	6.41

TABLE A6 ALPHA RANGE PARAMETERS

HYDROGEN H

R	A	B	ERROR
1.650	0.	-0.	100.00
1.675	1.7116792-04	7.5079798-09	81.60
1.700	1.4397850-04	3.1307468-08	63.50
1.725	1.2115562-04	6.0169358-09	44.11
1.750	1.0122035-04	3.0806200-08	28.94
1.775	8.4509983-05	1.4816119-08	14.73
1.800	7.1396835-05	6.4668830-09	4.75
1.825	6.4755046-05	1.9438426-07	2.18

HELIUM HE

R	A	B	ERROR
1.650	0.	-0.	100.00
1.675	3.7536921-04	4.6230235-08	65.79
1.700	3.1392516-04	4.7501773-09	46.78
1.725	2.6228908-04	1.2963789-08	31.23
1.750	2.2008469-04	1.8331769-08	17.92
1.775	1.8555838-04	5.9257685-09	7.04
1.800	1.6395386-04	1.8495634-07	3.20
1.825	1.5164320-04	6.0811312-07	5.17

LITHIUM LI

R	A	B	ERROR
1.650	1.5862952-04	8.0776653-04	99.17
1.675	4.3875848-04	4.2693210-08	62.12
1.700	3.6702852-04	3.6706508-09	43.38
1.725	3.0680517-04	1.4058855-08	28.66
1.750	2.5763816-04	2.2450832-08	15.90
1.775	2.1489960-04	4.5632887-09	4.50
1.800	1.9540531-04	2.5222306-07	3.72
1.825	1.8067043-04	7.2282189-07	6.14

BERYLLIUM BE

R	A	B	ERROR
1.650	3.0349982-04	9.5129086-06	69.85
1.675	4.3875363-04	6.3669838-09	53.88
1.700	3.6883897-04	9.4830791-09	38.12
1.725	3.0942500-04	3.0385141-08	24.29
1.750	2.5773168-04	2.6543133-09	12.31
1.775	2.1901371-04	5.2410639-08	3.65
1.800	2.0226256-04	4.0555428-07	5.83
1.825	1.8628688-04	7.7834502-07	8.13

BORON B

R	A	B	ERROR
1.650	2.1782523-04	1.1390314-03	99.12
1.675	4.2752936-04	1.5539379-08	54.13
1.700	3.5797877-04	1.1277706-08	37.81
1.725	2.9992978-04	1.1051348-08	23.62
1.750	2.5161563-04	1.5862161-08	11.39
1.775	2.1320109-04	2.2379159-08	3.59
1.800	1.9742424-04	5.0801354-07	4.55
1.825	1.8048742-04	7.5216665-07	7.58

CARBON C

R	A	B	ERROR
1.650	2.0661332-04	8.8584225-04	98.92
1.675	4.0388856-04	3.6663716-08	49.85
1.700	3.5292434-04	4.5861725-08	25.71
1.725	2.8381089-04	3.3971922-08	20.70
1.750	2.3839809-04	8.1779273-09	9.55
1.775	2.0661097-04	5.1971753-08	3.62
1.800	1.9122947-04	6.2655609-07	5.90
1.825	1.7427771-04	8.7971117-07	8.59

NITROGEN N

R	A	B	ERROR
1.650	3.0195447-04	6.9859568-06	63.71
1.675	4.1141416-04	4.6164808-08	45.70
1.700	3.4401361-04	6.9342318-09	29.98
1.725	2.8758610-04	1.4806967-08	17.38
1.750	2.4099562-04	1.4491351-08	6.84
1.775	2.1554998-04	2.4275177-07	4.81
1.800	1.9752478-04	8.2947023-07	7.57
1.825	1.8151032-04	1.1504064-06	10.09

OXYGEN O

R	A	B	ERROR
1.650	3.1802358-04	3.7533203-05	83.62
1.675	4.1574385-04	1.4497000-08	41.28
1.700	3.4771532-04	3.7370774-09	26.88
1.725	2.9273060-04	2.8281947-08	15.56
1.750	2.4601832-04	3.6271677-09	5.74
1.775	2.2314335-04	4.7419993-07	6.28
1.800	2.0526356-04	7.1681710-07	8.69
1.825	1.8832706-04	1.2987456-06	11.77

NEON NE

R	A	B	ERROR
1.650	3.4281488-04	1.1947141-06	41.33
1.675	3.2091419-04	9.4161037-07	33.97
1.700	3.6293263-04	1.9002137-09	22.78
1.725	2.9444320-04	4.7945600-07	10.90
1.750	2.6180552-04	4.9877142-08	6.06
1.775	2.4185416-04	8.9135939-07	8.33
1.800	2.2179488-04	1.2008808-06	11.12
1.825	2.0298006-04	1.5749652-06	14.78

MAGNESIUM MG

R	A	B	ERROR
1.650	5.2823259-04	6.8439882-09	46.45
1.675	4.4467550-04	4.1122340-08	32.47
1.700	3.7087583-04	9.6596719-09	19.82
1.725	2.9864899-04	2.8183497-07	8.87
1.750	2.7639573-04	2.6747023-07	7.19
1.775	2.5615684-04	1.1229651-06	10.16
1.800	2.3076913-04	8.2647278-07	13.02
1.825	2.1416832-04	1.7713165-06	16.75

TABLE A6 ALPHA RANGE PARAMETERS

ALUMINUM AL				SILICON SI			
R	A	B	ERROR	R	A	B	ERROR
1.650	5.4716316-04	1.5508157-08	44.94	1.650	5.3375063-04	2.5391762-08	44.66
1.675	4.5779911-04	5.5588072-09	30.15	1.675	4.4668462-04	1.5494533-08	30.51
1.700	3.8442287-04	1.9668971-08	19.21	1.700	3.7523088-04	3.0229456-08	18.94
1.725	3.1865129-04	2.0284722-08	7.81	1.725	3.1409719-04	2.2432409-08	8.58
1.750	2.8722918-04	2.8692487-07	7.66	1.750	2.8020163-04	2.9254022-07	7.47
1.775	2.6730275-04	1.2048697-06	10.45	1.775	2.5677779-04	7.2011752-07	10.16
1.800	2.4074630-04	1.3529143-06	13.14	1.800	2.3527042-04	1.1938614-06	12.80
1.825	2.2340503-04	1.8300810-06	17.21	1.825	2.1119663-04	1.5896385-06	17.09

ARGON A				CALCIUM CA			
R	A	B	ERROR	R	A	B	ERROR
1.650	4.3361431-04	1.2691986-06	37.40	1.650	5.5617702-04	5.0352547-08	36.90
1.675	5.0863587-04	4.3886953-09	26.58	1.675	4.6568486-04	1.2172337-08	23.94
1.700	4.2607414-04	2.8305554-08	15.15	1.700	3.7781160-04	5.0420284-07	10.15
1.725	3.5650258-04	1.8696080-08	5.51	1.725	3.3367475-04	1.3409061-07	6.55
1.750	3.2916065-04	8.2134491-07	7.66	1.750	3.0480931-04	7.1123720-07	9.48
1.775	3.0214806-04	1.1930453-06	10.47	1.775	2.7938154-04	1.2872154-06	12.12
1.800	2.7671449-04	1.6507641-06	14.10	1.800	2.5925983-04	1.8578250-06	16.01
1.825	2.4799496-04	1.8358171-06	16.87	1.825	2.3156146-04	1.9993646-06	18.28

TITANIUM TI				VANADIUM V			
R	A	B	ERROR	R	A	B	ERROR
1.650	6.0802789-04	3.3928532-09	34.26	1.650	4.6763871-04	2.5808957-07	27.04
1.675	5.0943288-04	5.2308716-09	22.18	1.675	4.3818634-04	1.1984914-07	17.36
1.700	4.0924600-04	1.5237992-07	7.03	1.700	4.3358032-04	6.4012966-07	10.23
1.725	3.7048737-04	1.8507009-07	6.65	1.725	3.8147283-04	5.7032995-07	6.82
1.750	3.3974845-04	1.0717324-06	9.28	1.750	3.5028991-04	1.0653065-06	9.36
1.775	3.1132670-04	1.4065293-06	11.95	1.775	3.2088654-04	1.4728354-06	12.19
1.800	2.7939114-04	1.6769536-06	16.30	1.800	2.8777235-04	1.7325239-06	16.45
1.825	2.5783956-04	2.1004380-06	18.44	1.825	2.6557451-04	2.1542860-06	18.88

CHROMIUM CR				MANGANESE MN			
R	A	B	ERROR	R	A	B	ERROR
1.650	6.1236452-04	1.3262559-08	32.54	1.650	6.2460632-04	1.5476490-08	31.64
1.675	5.1329108-04	1.6461533-08	20.85	1.675	4.7105492-04	1.8457388-07	12.10
1.700	4.1936368-04	2.0128771-07	7.91	1.700	4.3234508-04	1.1986420-07	8.50
1.725	3.7773854-04	2.5560386-07	7.18	1.725	3.8777069-04	2.9122942-07	7.64
1.750	3.4719920-04	1.1581055-06	9.64	1.750	3.5729643-04	1.2687413-06	10.11
1.775	3.1791026-04	1.5412777-06	12.69	1.775	3.2698532-04	1.6221962-06	13.33
1.800	2.8484786-04	1.7880978-06	16.82	1.800	2.9266236-04	1.8533745-06	17.16
1.825	2.6287584-04	2.2081276-06	19.31	1.825	2.7008786-04	2.2713576-06	19.87

IRON FE				COBALT CO			
R	A	B	ERROR	R	A	B	ERROR
1.650	6.1391544-04	1.8798341-08	30.89	1.650	6.2724421-04	2.2978578-08	30.10
1.675	4.4344418-04	1.1758662-07	15.09	1.675	5.2407115-04	1.9826148-09	18.25
1.700	4.2936077-04	1.7925988-07	9.17	1.700	4.2631438-04	4.0648338-07	9.05
1.725	3.8607262-04	7.4614489-07	8.38	1.725	3.9779010-04	9.1220422-07	8.92
1.750	3.5390801-04	1.3671499-06	10.68	1.750	3.6442861-04	1.4683201-06	11.25
1.775	3.2370862-04	1.6935197-06	13.89	1.775	3.3316033-04	1.7672474-06	14.47
1.800	2.8942123-04	1.9096980-06	17.65	1.800	2.9757552-04	1.9686589-06	18.08
1.825	2.6709698-04	2.3259048-06	20.34	1.825	2.7462254-04	2.3829961-06	20.83

TABLE A6 ALPHA RANGE PARAMETERS

NICKEL NI				COPPER CU			
R	A	B	ERROR	R	A	B	ERROR
1.650	6.0548396-04	2.6911322-08	29.24	1.650	6.3598155-04	3.5163912-08	28.74
1.675	4.4604254-04	4.3601478-07	16.87	1.675	5.0212022-04	9.6683670-08	10.93
1.700	4.1615822-04	1.2079148-07	7.47	1.700	4.3893883-04	3.8383463-07	7.44
1.725	3.8832864-04	9.8996781-07	9.76	1.725	4.0957925-04	1.0648550-06	9.93
1.750	3.5535717-04	1.6005906-06	12.08	1.750	3.7481452-04	1.6589254-06	12.29
1.775	3.2456787-04	1.8605354-06	15.26	1.775	3.4233624-04	1.9068543-06	15.51
1.800	2.8951392-04	2.4339997-06	18.92	1.800	3.0521998-04	2.6804788-06	18.95
1.825	2.6709676-04	2.4513654-06	21.46	1.825	2.8167787-04	2.4912431-06	21.72

ZINC ZN				GERMANIUM GE			
R	A	B	ERROR	R	A	B	ERROR
1.650	6.3582087-04	3.7976672-08	28.22	1.650	6.6832843-04	4.6808351-08	27.48
1.675	5.0464468-04	5.1321278-07	11.21	1.675	5.2937431-04	1.5247330-07	10.25
1.700	4.4419501-04	2.2637466-09	7.31	1.700	4.6493870-04	8.1449577-08	7.08
1.725	4.0479439-04	4.6454923-07	9.99	1.725	4.2714221-04	1.0563739-06	9.47
1.750	3.7665272-04	1.7274111-06	12.62	1.750	3.9142079-04	1.5792813-06	12.13
1.775	3.4400798-04	1.9600756-06	15.89	1.775	3.6321714-04	2.0101763-06	16.06
1.800	3.0664324-04	2.1273100-06	18.98	1.800	3.2408599-04	2.1826388-06	18.37
1.825	2.8299156-04	2.5365673-06	22.10	1.825	2.9908920-04	2.5901077-06	22.41

SELENIUM SE				KRYPTON KR			
R	A	B	ERROR	R	A	B	ERROR
1.650	6.8679670-04	1.0471058-08	25.19	1.650	6.0844334-04	6.6521001-07	18.52
1.675	5.5730051-04	4.0815126-07	11.24	1.675	5.5669079-04	4.1119388-07	9.31
1.700	4.8757421-04	1.3426801-07	7.33	1.700	4.9972947-04	1.5005974-07	7.91
1.725	4.4757044-04	1.1738686-06	9.90	1.725	4.5944397-04	1.2895881-06	10.27
1.750	4.0985634-04	1.7577824-06	12.60	1.750	4.2041621-04	1.6393922-06	13.15
1.775	3.6726552-04	2.1330825-06	17.04	1.775	3.7618608-04	2.2977056-06	17.56
1.800	3.3890586-04	2.3012609-06	18.92	1.800	3.4710040-04	2.4309861-06	19.43
1.825	3.0250494-04	2.8624456-06	23.34	1.825	3.0935851-04	2.9907283-06	23.94

SILVER AG				TIN SN			
R	A	B	ERROR	R	A	B	ERROR
1.650	6.6408807-04	3.2292053-07	10.02	1.650	7.1212565-04	2.8899651-08	12.03
1.675	5.0555520-04	3.3100823-07	8.60	1.675	6.2166247-04	2.0842527-07	8.00
1.700	5.4549476-04	6.5677425-07	10.76	1.700	5.7015299-04	1.2714865-06	10.17
1.725	4.9878924-04	1.9501486-06	13.58	1.725	5.2177559-04	1.9451949-06	12.93
1.750	4.6289499-04	2.9199526-06	17.87	1.750	4.6703730-04	2.3807079-06	17.45
1.775	4.1147800-04	3.0956051-06	20.01	1.775	4.3097800-04	2.5925790-06	19.31
1.800	3.7976564-04	3.6800222-06	23.33	1.800	3.9782491-04	3.6945949-06	23.43
1.825	3.3684500-04	3.6406406-06	26.54	1.825	3.5319099-04	3.6652034-06	25.81

ANTIMONY SB				XENON XE			
R	A	B	ERROR	R	A	B	ERROR
1.650	7.1172136-04	1.5651580-07	10.18	1.650	7.4826645-04	7.0195502-07	11.47
1.675	6.3455478-04	5.7577490-08	8.70	1.675	6.6201700-04	1.8500881-07	9.45
1.700	5.8436289-04	1.4254951-06	11.33	1.700	6.1189249-04	1.7703191-06	12.54
1.725	5.3407665-04	2.1895246-06	13.87	1.725	5.5881397-04	2.4710846-06	15.15
1.750	4.7683704-04	2.5691555-06	18.31	1.750	4.9822924-04	2.8071825-06	18.97
1.775	4.4001808-04	2.7437421-06	20.16	1.775	4.5970092-04	2.9310317-06	21.16
1.800	4.0617447-04	3.8709081-06	24.00	1.800	4.2435010-04	4.0918070-06	25.20
1.825	3.5994720-04	3.1751331-06	26.72	1.825	3.7535141-04	3.9792022-06	27.46

TABLE A6 ALPHA RANGE PARAMETERS

CESIUM CS				TANTALUM TA			
R	A	B	ERROR	R	A	B	ERROR
1.650	7.3223503-04	1.8765993-07	9.08	1.650	8.0847249-04	4.3802078-07	9.44
1.675	6.6390002-04	2.3729526-07	9.66	1.675	7.5223032-04	1.6354272-06	11.53
1.700	6.0334913-04	1.7609180-06	12.86	1.700	6.8723916-04	2.3394435-06	14.07
1.725	5.5996867-04	2.5501672-06	15.51	1.725	6.1288801-04	3.0949313-06	18.42
1.750	4.9889662-04	2.8687597-06	19.16	1.750	5.6561828-04	3.0331952-06	20.25
1.775	4.6045406-04	3.5832256-06	21.41	1.775	5.2204437-04	4.3349155-06	23.90
1.800	4.2496973-04	4.1510144-06	25.52	1.800	4.6213465-04	4.2603772-06	26.90
1.825	3.7588825-04	4.0323195-06	27.62	1.825	4.2461572-04	4.6372919-06	28.90

TUNGSTEN W				PLATINUM PT			
R	A	B	ERROR	R	A	B	ERROR
1.650	8.1256357-04	4.3683371-07	9.37	1.650	8.4183151-04	1.4394438-08	9.24
1.675	7.5603735-04	1.6406565-06	11.47	1.675	7.7797813-04	1.9404827-06	12.17
1.700	6.9085196-04	2.3480849-06	14.03	1.700	7.1067635-04	2.5699324-06	14.77
1.725	6.1626357-04	3.1080812-06	18.29	1.725	6.3330988-04	2.9852391-06	18.86
1.750	5.6875948-04	3.6584571-06	20.13	1.750	5.8451992-04	3.8398210-06	20.68
1.775	5.2493760-04	4.3468278-06	23.91	1.775	5.3948499-04	4.5220698-06	24.65
1.800	4.6475286-04	4.2729153-06	26.77	1.800	4.7722863-04	4.4192265-06	27.34
1.825	4.2702146-04	4.6492904-06	28.92	1.825	4.3848558-04	4.7892885-06	29.58

GOLD AU				MERCURY HG			
R	A	B	ERROR	R	A	B	ERROR
1.650	8.4785188-04	4.2930673-08	9.77	1.650	8.5814279-04	9.0717272-08	9.95
1.675	7.8398070-04	1.8741554-06	12.88	1.675	7.8091089-04	1.8419371-06	13.14
1.700	7.1558453-04	2.7089227-06	15.39	1.700	7.2469072-04	2.7980952-06	15.77
1.725	6.3692761-04	3.0920779-06	19.38	1.725	6.4458947-04	3.1615865-06	19.56
1.750	5.8785975-04	3.9432668-06	21.19	1.750	5.9493187-04	4.0105585-06	21.36
1.775	5.4256824-04	4.6220019-06	25.16	1.775	5.4909597-04	4.6869996-06	25.48
1.800	4.7953705-04	4.4967381-06	27.87	1.800	4.8507428-04	4.5483511-06	28.06
1.825	4.4060722-04	4.8634436-06	30.00	1.825	4.4569535-04	4.9128167-06	30.28

LEAD PB				BISMUTH BI			
R	A	B	ERROR	R	A	B	ERROR
1.650	8.7685887-04	1.9846846-07	10.48	1.650	8.7962178-04	1.1429869-06	10.67
1.675	8.0049207-04	1.1586708-06	13.38	1.675	8.0421041-04	1.7896616-06	13.49
1.700	7.4296789-04	3.0377059-06	16.80	1.700	7.4636212-04	3.1551877-06	17.29
1.725	6.5946192-04	2.7763906-06	19.95	1.725	6.6184216-04	2.8499505-06	20.13
1.750	6.0865321-04	4.1863308-06	21.74	1.750	6.1084924-04	4.2732884-06	21.94
1.775	5.6176142-04	4.8567485-06	26.32	1.775	5.6378890-04	4.9407101-06	26.72
1.800	4.9557162-04	4.6805947-06	28.51	1.800	4.9702055-04	4.7458739-06	28.72
1.825	4.5534162-04	5.0393054-06	30.98	1.825	4.5667347-04	5.1017350-06	31.32

URANIUM U				CARBON DIOXIDE CO2			
R	A	B	ERROR	R	A	B	ERROR
1.650	9.4589928-04	1.6236683-06	12.91	1.650	3.0847104-04	6.9961441-05	89.25
1.675	8.7783427-04	2.9303801-06	15.61	1.675	4.1174699-04	8.9347883-09	42.83
1.700	7.8133861-04	3.1024769-06	19.29	1.700	3.4584564-04	2.4089139-08	29.10
1.725	7.2108896-04	4.1207517-06	21.10	1.725	2.8968028-04	2.0359078-08	16.66
1.750	6.6554587-04	4.9384078-06	24.91	1.750	2.4294233-04	2.2395103-08	6.40
1.775	5.8809972-04	4.8364219-06	27.81	1.775	2.1866525-04	2.8278944-07	5.21
1.800	5.4036833-04	5.2886868-06	29.74	1.800	2.0051305-04	6.4368412-07	7.90
1.825	4.9665871-04	6.2380764-06	33.06	1.825	1.8416815-04	1.2067010-06	10.72

TABLE A6 ALPHA RANGE PARAMETERS

HYDROGEN PEROXIDE H2O2

R	A	B	ERROR
1.650	2.8696138-04	3.1920574-05	82.52
1.675	3.8700557-04	6.1735518-09	44.58
1.700	3.2501987-04	2.0984623-08	29.85
1.725	2.7216410-04	1.6453666-08	17.33
1.750	2.2761777-04	7.6760994-09	6.67
1.775	2.0436384-04	2.5607078-07	4.91
1.800	1.8727697-04	8.4784953-07	7.69
1.825	1.7207191-04	1.1639784-06	10.23

AIR

R	A	B	ERROR
1.650	3.0662308-04	5.5492275-05	87.53
1.675	4.1116642-04	7.5391145-09	44.03
1.700	3.4587083-04	9.8411528-09	29.61
1.725	2.8921400-04	1.8173020-08	16.93
1.750	2.4248244-04	1.9566286-08	6.56
1.775	2.1779404-04	2.6935374-07	5.06
1.800	1.9963066-04	7.6809918-07	7.82
1.825	1.8338375-04	1.1861196-06	10.49

WATER

R	A	B	ERROR
1.650	2.2152152-04	1.2854304-03	99.05
1.675	3.6442156-04	3.8145379-08	48.60
1.700	3.0408346-04	9.9073309-09	32.75
1.725	2.5439209-04	2.5908937-09	19.25
1.750	2.1521715-04	1.1610066-08	9.24
1.775	1.8763828-04	6.0295499-08	4.03
1.800	1.7369493-04	6.7382820-07	6.43
1.825	1.5805167-04	7.4104238-07	9.28

TISSUE

R	A	B	ERROR
1.650	1.8715217-04	1.1380397-03	99.12
1.675	3.6504671-04	3.5721000-08	49.69
1.700	3.0455545-04	6.9402984-09	33.14
1.725	2.5648746-04	3.2738317-08	20.77
1.750	2.1542266-04	6.5164801-09	9.56
1.775	1.8668739-04	4.9534441-08	3.68
1.800	1.7284493-04	6.2641855-07	5.96
1.825	1.5744799-04	9.9299356-07	8.92

POLYETHYLENE (CH2)N

R	A	B	ERROR
1.650	2.4479408-04	5.6318573-05	88.12
1.675	3.4196944-04	2.0288311-08	56.64
1.700	2.8626810-04	1.3814511-08	39.19
1.725	2.4161725-04	9.0784292-10	24.02
1.750	2.0096030-04	1.2502988-08	12.34
1.775	1.6996862-04	1.1338430-08	3.79
1.800	1.5594513-04	3.4233760-07	4.28
1.825	1.4398543-04	7.4053385-07	6.79

GLASS

R	A	B	ERROR
1.650	3.9171609-04	6.4752318-07	33.68
1.675	3.6370673-04	1.8738257-07	22.95
1.700	3.8588409-04	1.2291827-08	16.77
1.725	3.2509129-04	4.8338133-09	7.39
1.750	2.9327811-04	3.5987687-07	7.19
1.775	2.6931143-04	1.0352253-06	9.72
1.800	2.4673718-04	1.5025032-06	12.91
1.825	2.2134875-04	1.7062362-06	16.75

EMULSION

R	A	B	ERROR
1.650	6.3761467-04	4.1596443-08	29.94
1.675	5.3309280-04	2.2316769-08	17.99
1.700	4.4627343-04	1.9694604-08	8.38
1.725	4.0261461-04	8.2247667-07	8.06
1.750	3.6950554-04	1.4426708-06	10.71
1.775	3.3829530-04	1.7659199-06	14.14
1.800	3.0294617-04	1.9911097-06	16.91
1.825	2.7957904-04	2.4047325-06	20.78

SODIUM IODIDE NAI

R	A	B	ERROR
1.650	7.1491514-04	4.5944643-08	21.05
1.675	5.8189475-04	2.9687041-07	8.30
1.700	5.2487332-04	1.0114863-06	9.80
1.725	4.8833458-04	1.6469221-06	12.34
1.750	4.4620100-04	1.9992675-06	15.46
1.775	3.9804268-04	2.6645415-06	18.71
1.800	3.6729812-04	2.7225596-06	21.49
1.825	3.2670447-04	3.2929123-06	25.14

BONE

R	A	B	ERROR
1.650	2.8783988-04	6.7461065-05	89.11
1.675	3.9866027-04	1.0114042-08	44.15
1.700	3.2647627-04	2.5469412-08	29.89
1.725	2.7349090-04	2.2139549-08	17.07
1.750	2.2942896-04	2.5045141-08	6.63
1.775	2.0528922-04	2.5716918-07	4.60
1.800	1.8830727-04	6.1875970-07	7.31
1.825	1.7310122-04	1.1774707-06	10.25

ANTHRACENE C14H10

R	A	B	ERROR
1.650	2.0677276-04	1.1977841-03	99.09
1.675	3.7731930-04	2.9923825-08	53.00
1.700	3.1602098-04	2.4885178-08	36.47
1.725	2.6488774-04	2.4523972-08	22.45
1.750	2.2237957-04	3.0171439-08	10.66
1.775	1.9004733-04	9.6242135-08	3.02
1.800	1.7583709-04	5.6627506-07	4.88
1.825	1.6055926-04	6.6174346-07	7.98

TABLE A6 ALPHA RANGE PARAMETERS

STILBENE C14H12

R	A	B	ERROR
1.650	1.8525077-04	9.4182184-04	99.00
1.675	3.7263479-04	2.8617800-08	53.26
1.700	3.1207640-04	2.3383840-08	36.65
1.725	2.1327761-04	7.3875170-08	19.95
1.750	2.1953248-04	2.7772068-08	10.88
1.775	1.8709288-04	2.2824770-08	2.97
1.800	1.7314319-04	5.4100524-07	4.80
1.825	1.5815545-04	6.5104821-07	7.87

MYLAR POLYETHYLENETEREPHTHALATE C10H804

R	A	B	ERROR
1.650	1.8211262-04	9.2809615-04	99.04
1.675	3.8854300-04	3.7811019-08	49.18
1.700	3.2419871-04	9.4379575-09	33.04
1.725	2.7120842-04	1.9379325-09	19.75
1.750	2.2942348-04	1.0605165-08	9.35
1.775	1.9911415-04	1.6325202-07	3.79
1.800	1.8456882-04	6.5000474-07	6.13
1.825	1.6811280-04	1.0148839-06	8.85

LUCITE POLYMETHYLMETHACRYLATE C5H802

R	A	B	ERROR
1.650	1.9722516-04	1.0632674-03	99.03
1.675	3.7100360-04	3.2692159-08	51.28
1.700	3.1115554-04	1.7344529-09	31.95
1.725	2.6055819-04	2.8441117-08	21.50
1.750	2.1884660-04	3.5391539-08	10.22
1.775	1.8835282-04	1.0447931-07	3.37
1.800	1.7414029-04	6.2828842-07	5.31
1.825	1.5884582-04	8.3543172-07	8.38

POLYSTYRENE C8H8

R	A	B	ERROR
1.650	1.8471414-04	1.0005187-03	99.04
1.675	3.6806194-04	2.7253621-08	54.13
1.700	3.0822395-04	2.1816419-08	37.46
1.725	2.5829130-04	2.0799957-08	22.92
1.750	2.1674924-04	2.5270027-08	11.20
1.775	1.8420257-04	4.2717127-08	3.34
1.800	1.7050349-04	4.4234852-07	4.71
1.825	1.5580579-04	7.7200733-07	7.77

TEFLON POLYTETRAFLUOROETHYLENE C2F2

R	A	B	ERROR
1.650	3.2777555-04	8.0990007-05	90.13
1.675	4.3163573-04	1.6770239-08	41.75
1.700	3.6105195-04	6.3980637-09	26.84
1.725	3.0400944-04	3.1335545-08	15.61
1.750	2.5386064-04	1.3799328-08	5.12
1.775	2.3104583-04	3.3953002-07	5.67
1.800	2.1274611-04	7.8385508-07	7.99
1.825	1.9532856-04	1.2925972-06	11.60

APPENDIX B

SAMPLE PROGRAM
INPUT AND OUTPUT

LRSPC

INPUT DATA

```
*       DATA
     9    10 4-018 X-XXX
    17 .4
.7          .02         3.          .05         5.          .1          20.         .25
50.         1.          100.        2.          160.        4.          260.        5.
500.        20.         700.        40.         1000.       50.         2000.       200.
5000.       500.        10000.      1000.       20000.      2000.       50000.      5000.
100000.     5000.
     ALUMINUM AL
     1      1      1      13.    26.9815            2.692
1.          1.          1.          1.          1.          1.          1.          1.
```

LRSPC

OUTPUT DATA

AT. NO.	AT. WT.	I//(EV)	DENSITY	ITOTAL(EV)	TOT. DEN.
1.3000+01	2.6981+01	1.2538+01	2.6920+00	1.6299+02	2.6920+00

Z	A	B1	B2	B3	B4	B5	B6	B7
13.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000

E	ETAL	UK	UL	UH	HRAK	DEL	SP	RANGE
4.00000-01	2.04487-01	-2.64532-01	3.03077-01	4.17186-02	3.27012+00	8.17173-06	2.83983+02	9.65616-04
4.20000-01	2.14716-01	-2.51600-01	2.99943-01	4.02093-02	3.15938+00	8.57333-06	2.77847+02	1.03682-03
4.40000-01	2.24937-01	-2.39328-01	2.96494-01	3.87260-02	3.44496+00	8.98941-06	2.71992+02	1.10958-03
4.60000-01	2.35172-01	-2.27615-01	2.92788-01	3.73088-02	3.52726+00	9.39338-06	2.66381+02	1.18388-03
4.80000-01	2.45392-01	-2.16441-01	2.88886-01	3.58416-02	3.60648+00	9.81194-06	2.61031+02	1.25973-03
5.00000-01	2.55625-01	-2.05738-01	2.84630-01	3.43386-02	3.68313+00	1.02218-05	2.55918+02	1.33712-03
5.20000-01	2.65847-01	-1.95491-01	2.80250-01	3.30207-02	3.75694+00	1.06303-05	2.51020+02	1.41603-03
5.40000-01	2.76080-01	-1.85644-01	2.75949-01	3.17953-02	3.82805+00	1.10410-05	2.46302+02	1.49647-03
5.60000-01	2.86308-01	-1.76184-01	2.71734-01	3.06465-02	3.89663+00	1.14551-05	2.41768+02	1.57843-03
5.80000-01	2.96533-01	-1.67081-01	2.67607-01	2.95666-02	3.96284+00	1.18710-05	2.37408+02	1.66192-03
6.00000-01	3.06766-01	-1.58303-01	2.63408-01	2.85479-02	4.02704+00	1.22755-05	2.33216+02	1.74692-03
6.20000-01	3.16991-01	-1.49726-01	2.59278-01	2.75863-02	4.08905+00	1.26875-05	2.29179+02	1.83343-03
6.40000-01	3.27225-01	-1.41430-01	2.55295-01	2.66755-02	4.14910+00	1.31004-05	2.25281+02	1.92145-03
6.60000-01	3.37450-01	-1.33444-01	2.51456-01	2.58126-02	4.20728+00	1.35166-05	2.21528+02	2.01098-03
6.80000-01	3.47683-01	-1.25740-01	2.47747-01	2.49926-02	4.26375+00	1.39228-05	2.17903+02	2.10201-03
7.00000-01	3.57915-01	-1.18308-01	2.44164-01	2.42131-02	4.31860+00	1.43380-05	2.14406+02	2.19455-03
7.50000-01	3.83486-01	-1.00843-01	2.35714-01	2.24227-02	4.44919+00	1.53724-05	2.06182+02	2.43240-03
8.00000-01	4.09061-01	-8.48152-02	2.28015-01	2.08288-02	4.57137+00	1.64056-05	1.98620+02	2.67952-03
8.50000-01	4.34644-01	-7.01856-02	2.20936-01	1.94021-02	4.68635+00	1.74441-05	1.91652+02	2.93583-03
9.00000-01	4.60219-01	-5.66641-02	2.14201-01	1.81206-02	4.79499+00	1.84696-05	1.85217+02	3.20126-03
9.50000-01	4.85804-01	-4.41179-02	2.07787-01	1.69642-02	4.89800+00	1.95069-05	1.79251+02	3.47570-03
1.00000+00	5.11385-01	-3.24676-02	2.01328-01	1.59182-02	4.99627+00	2.05467-05	1.73720+02	3.75908-03
1.05000+00	5.36974-01	-2.17533-02	1.95109-01	1.49688-02	5.09016+00	2.15787-05	1.68568+02	4.05130-03
1.10000+00	5.62554-01	-1.17324-02	1.89615-01	1.41055-02	5.17937+00	2.26213-05	1.63740+02	4.35229-03
1.15000+00	5.88136-01	-2.31945-03	1.84737-01	1.33182-02	5.26436+00	2.36605-05	1.59205+02	4.66200-03
1.20000+00	6.13728-01	6.53650-03	1.81058-01	1.25985-02	5.34487+00	2.46991-05	1.54916+02	4.98041-03
1.25000+00	6.39317-01	1.48257-02	1.77766-01	1.19395-02	5.42201+00	2.57413-05	1.50878+02	5.30748-03
1.30000+00	6.64909-01	2.26600-02	1.74140-01	1.13345-02	5.49669+00	2.67885-05	1.47084+02	5.64315-03
1.35000+00	6.90498-01	3.00839-02	1.70250-01	1.07801-02	5.56903+00	2.78278-05	1.43513+02	5.98732-03
1.40000+00	7.16097-01	3.71301-02	1.65585-01	1.02038-02	5.63981+00	2.88672-05	1.40156+02	6.33990-03
1.45000+00	7.41688-01	4.39478-02	1.60948-01	9.65805-03	5.70819+00	2.99192-05	1.36976+02	6.70078-03
1.50000+00	7.67280-01	5.03763-02	1.56746-01	9.17418-03	5.77408+00	3.09603-05	1.33950+02	7.06993-03
1.55000+00	7.92884-01	5.64030-02	1.52924-01	8.74142-03	5.83774+00	3.20136-05	1.31067+02	7.44731-03
1.60000+00	8.18480-01	6.20423-02	1.49739-01	8.32109-03	5.89904+00	3.30627-05	1.28315+02	7.83289-03
1.65000+00	8.44082-01	6.72108-02	1.46722-01	8.07607-03	5.95852+00	3.41096-05	1.25691+02	8.22662-03
1.70000+00	8.69681-01	7.20734-02	1.43723-01	7.97677-03	6.01630+00	3.51599-05	1.23188+02	8.62846-03
1.75000+00	8.95287-01	7.66825-02	1.40748-01	7.92780-03	6.07253+00	3.62114-05	1.20796+02	9.03837-03
1.80000+00	9.20890-01	8.10495-02	1.37746-01	7.87079-03	6.12741+00	3.72628-05	1.18511+02	9.45628-03
1.85000+00	9.46489-01	8.51967-02	1.34815-01	7.80537-03	6.18089+00	3.83190-05	1.16325+02	9.88219-03
1.90000+00	9.72103-01	8.91245-02	1.31969-01	7.73170-03	6.23306+00	3.93679-05	1.14228+02	1.03159-02
1.95000+00	9.97706-01	9.28357-02	1.29208-01	7.65032-03	6.28398+00	4.04240-05	1.12218+02	1.07576-02
2.00000+00	1.02332+00	9.63432-02	1.25692-01	7.56166-03	6.33376+00	4.14802-05	1.10301+02	1.12070-02
2.05000+00	1.04893+00	9.96301-02	1.22270-01	7.46626-03	6.38401+00	4.25367-05	1.08460+02	1.16642-02
2.10000+00	1.07455+00	1.02739-01	1.19014-01	7.36462-03	6.43230+00	4.35951-05	1.06686+02	1.21290-02
2.15000+00	1.10016+00	1.05686-01	1.15914-01	7.25750-03	6.47946+00	4.46525-05	1.04978+02	1.26015-02
2.20000+00	1.12577+00	1.08480-01	1.12960-01	7.14553-03	6.52555+00	4.57087-05	1.03330+02	1.30815-02
2.25000+00	1.15139+00	1.11093-01	1.10139-01	7.02925-03	6.57066+00	4.67817-05	1.01740+02	1.35692-02
2.30000+00	1.17700+00	1.13578-01	1.07445-01	6.90932-03	6.61479+00	4.78350-05	1.00205+02	1.40644-02
2.35000+00	1.20263+00	1.15958-01	1.04869-01	6.78627-03	6.65797+00	4.88980-05	9.87206+01	1.45672-02
2.40000+00	1.22824+00	1.18236-01	1.02404-01	6.66071-03	6.70022+00	4.99591-05	9.72855+01	1.50774-02
2.45000+00	1.25387+00	1.20489-01	1.00042-01	6.53300-03	6.74154+00	5.10276-05	9.58952+01	1.55950-02
2.50000+00	1.27949+00	1.22656-01	9.77784-02	6.40372-03	6.78201+00	5.20890-05	9.45491+01	1.61202-02
2.55000+00	1.30511+00	1.24711-01	9.56065-02	6.27331-03	6.82170+00	5.31602-05	9.32455+01	1.66527-02

2.60000+00	1.33074+00	1.26659-01	9.35201-02	6.14209-03	6.86065+00	5.42260-05	9.19814+01	1.71326-02	
2.65000+00	1.35637+00	1.28504-01	9.15160-02	6.01055-03	6.89887+00	5.52938-05	9.07562+01	1.77398-02	
2.70000+00	1.38200+00	1.30249-01	8.95881-02	5.87891-03	6.93642+00	5.63590-05	8.95672+01	1.82944-02	
2.75000+00	1.40763+00	1.31898-01	8.77333-02	5.74750-03	6.97329+00	5.74285-05	8.84133+01	1.88563-02	
2.80000+00	1.43326+00	1.33455-01	8.59468-02	5.61661-03	7.00953+00	5.85076-05	8.72925+01	1.94255-02	
2.85000+00	1.45889+00	1.34935-01	8.42257-02	5.48652-03	7.04514+00	5.95690-05	8.62038+01	2.00019-02	
2.90000+00	1.48452+00	1.36332-01	8.25662-02	5.35742-03	7.08016+00	6.06477-05	8.51454+01	2.05855-02	
2.95000+00	1.51016+00	1.37639-01	8.09649-02	5.22950-03	7.11461+00	6.17176-05	8.41162+01	2.11763-02	
3.00000+00	1.53580+00	1.38861-01	7.94192-02	5.10297-03	7.14852+00	6.27985-05	8.31151+01	2.17743-02	
3.10000+00	1.58707+00	1.41057-01	7.64834-02	4.85458-03	7.21477+00	6.49483-05	8.11923+01	2.29917-02	
3.20000+00	1.63836+00	1.42940-01	7.37385-02	4.61328-03	7.27905+00	6.71030-05	7.93685+01	2.42375-02	
3.30000+00	1.68965+00	1.44389-01	7.11668-02	4.38218-03	7.34163+00	6.92608-05	7.76373+01	2.55115-02	
3.40000+00	1.74094+00	1.45624-01	6.87531-02	4.16098-03	7.40242+00	7.14205-05	7.59899+01	2.68135-02	
3.50000+00	1.79224+00	1.46699-01	6.64834-02	3.94806-03	7.46148+00	7.35974-05	7.44196+01	2.81434-02	
3.60000+00	1.84355+00	1.47628-01	6.43454-02	3.74394-03	7.51892+00	7.57654-05	7.29209+01	2.95009-02	
3.70000+00	1.89485+00	1.48352-01	6.23288-02	3.54871-03	7.57489+00	7.79390-05	7.14898+01	3.08860-02	
3.80000+00	1.94617+00	1.48986-01	6.04231-02	3.36229-03	7.62936+00	8.01173-05	7.01202+01	3.22984-02	
3.90000+00	1.99749+00	1.49563-01	5.86199-02	3.18465-03	7.68240+00	8.23005-05	6.88081+01	3.37381-02	
4.00000+00	2.04882+00	1.50094-01	5.69113-02	3.01564-03	7.73407+00	8.44897-05	6.75498+01	3.52050-02	
4.10000+00	2.10015+00	1.50744-01	5.52903-02	2.85507-03	7.78427+00	8.66769-05	6.63405+01	3.66989-02	
4.20000+00	2.15149+00	1.51294-01	5.37504-02	2.70270-03	7.83329+00	8.88657-05	6.51792+01	3.82197-02	
4.30000+00	2.20284+00	1.51698-01	5.22859-02	2.55827-03	7.88124+00	9.10625-05	6.40632+01	3.97673-02	
4.40000+00	2.25418+00	1.51964-01	5.08919-02	2.42151-03	7.92816+00	9.32691-05	6.29902+01	4.13415-02	
4.50000+00	2.30554+00	1.52001-01	4.95629-02	2.29209-03	7.97422+00	9.54724-05	6.19580+01	4.29423-02	
4.60000+00	2.35690+00	1.51953-01	4.82948-02	2.15677-03	8.01931+00	9.76753-05	6.09634+01	4.45695-02	
4.70000+00	2.40826+00	1.51863-01	4.70838-02	1.93653-03	8.06353+00	9.99000-05	6.00048+01	4.62229-02	
4.80000+00	2.45963+00	1.51735-01	4.59262-02	1.73408-03	8.10681+00	1.02107-04	5.90795+01	4.79025-02	
4.90000+00	2.51101+00	1.51685-01	4.48185-02	1.55837-03	8.14906+00	1.04323-04	5.81847+01	4.96081-02	
5.00000+00	2.56239+00	1.51560-01	4.37578-02	1.40524-03	8.19049+00	1.06552-04	5.73200+01	5.13398-02	
5.25000+00	2.69087+00	1.50720-01	4.12931-02	1.10780-03	8.29089+00	1.12122-04	5.52815+01	5.57817-02	
5.50000+00	2.81938+00	1.49173-01	3.90658-02	8.94704-04	8.38713+00	1.17721-04	5.34025+01	6.03835-02	
5.75000+00	2.94792+00	1.47847-01	3.70441-02	7.38837-04	8.47875+00	1.23340-04	5.16592+01	6.51439-02	
6.00000+00	3.07650+00	1.46412-01	3.52015-02	6.22705-04	8.56647+00	1.28989-04	5.00388+01	7.00617-02	
6.25000+00	3.20512+00	1.44534-01	3.35159-02	5.34747-04	8.65098+00	1.34656-04	4.85304+01	7.51355-02	
6.50000+00	3.33377+00	1.42733-01	3.19685-02	4.67141-04	8.73206+00	1.40350-04	4.71197+01	8.03640-02	
6.75000+00	3.46245+00	1.41048-01	3.05436-02	4.14499-04	8.80991+00	1.46064-04	4.57973+01	8.57462-02	
7.00000+00	3.59116+00	1.39409-01	3.01903-02	3.73017-04	8.88390+00	1.51801-04	4.45502+01	9.12815-02	
7.25000+00	3.71991+00	1.38259-01	3.01650-02	3.39982-04	8.95451+00	1.57557-04	4.33731+01	9.69693-02	
7.50000+00	3.84869+00	1.36967-01	3.00506-02	3.13426-04	9.02296+00	1.63339-04	4.22646+01	1.02809-01	
7.75000+00	3.97751+00	1.35493-01	2.98569-02	2.91901-04	9.08945+00	1.69144-04	4.12189+01	1.08799-01	
8.00000+00	4.10636+00	1.33859-01	2.95929-02	2.74291-04	9.15408+00	1.74968-04	4.02307+01	1.14939-01	
8.25000+00	4.23525+00	1.31794-01	2.92671-02	2.59779-04	9.21725+00	1.80824-04	3.92963+01	1.21227-01	
8.50000+00	4.36417+00	1.29656-01	2.88875-02	2.47741-04	9.27871+00	1.86699-04	3.84100+01	1.27662-01	
8.75000+00	4.49313+00	1.27496-01	2.84614-02	2.37692-04	9.33850+00	1.92595-04	3.75679+01	1.34244-01	
9.00000+00	4.62211+00	1.25327-01	2.79956-02	2.29252-04	9.39671+00	1.98514-04	3.67665+01	1.40971-01	
9.25000+00	4.75113+00	1.23161-01	2.74961-02	2.22125-04	9.45340+00	2.04457-04	3.60029+01	1.47843-01	
9.50000+00	4.88019+00	1.21011-01	2.69687-02	2.16072-04	9.50865+00	2.10424-04	3.52743+01	1.54858-01	
9.75000+00	5.00928+00	1.18886-01	2.64183-02	2.10907-04	9.56251+00	2.16414-04	3.45781+01	1.62017-01	
1.00000+01	5.13841+00	1.16796-01	2.58496-02	2.06545-04	9.61503+00	2.22425-04	3.39122+01	1.69318-01	
1.02500+01	5.26756+00	1.15555-01	2.52667-02	2.02051-04	9.66547+00	2.28454-04	3.32718+01	1.76761-01	
1.05000+01	5.39676+00	1.14323-01	2.46732-02	1.95656-04	9.71473+00	2.34519-04	3.26580+01	1.84345-01	
1.07500+01	5.52598+00	1.13035-01	2.40724-02	1.89531-04	9.76291+00	2.40597-04	3.20694+01	1.92071-01	
1.10000+01	5.65524+00	1.11701-01	2.34673-02	1.85310-04	9.81006+00	2.46694-04	3.15043+01	1.99936-01	
1.12500+01	5.78453+00	1.10326-01	2.28605-02	1.85630-04	9.85622+00	2.52823-04	3.09614+01	2.07941-01	
1.15000+01	5.91387+00	1.08916-01	2.22542-02	1.86317-04	9.90142+00	2.58970-04	3.04392+01	2.16085-01	
1.17500+01	6.04323+00	1.07479-01	2.16505-02	1.87045-04	9.94571+00	2.65133-04	2.99366+01	2.24367-01	
1.20000+01	6.17262+00	1.06019-01	2.10510-02	1.87812-04	9.98910+00	2.71328-04	2.94524+01	2.32787-01	
1.22500+01	6.30205+00	1.04542-01	2.04574-02	1.88612-04	1.00316+01	2.77545-04	2.89856+01	2.41343-01	
1.25000+01	6.43152+00	1.03052-01	1.98708-02	1.89445-04	1.00734+01	2.83778-04	2.85353+01	2.50036-01	
1.27500+01	6.56101+00	1.01554-01	1.92925-02	1.90306-04	1.01143+01	2.90042-04	2.81004+01	2.58865-01	
1.30000+01	6.69055+00	1.00053-01	1.87233-02	1.91193-04	1.01544+01	2.96325-04	2.76803+01	2.67829-01	
1.32500+01	6.82012+00	9.85528-02	1.81642-02	1.92103-04	1.01938+01	3.02624-04	2.72741+01	2.76928-01	

1.35000+01	6.94972+00	9.70572-02	1.76157-02	1.93034-04	1.02325+01	3.08953-04	2.68811+01	2.86161-01
1.37500+01	7.07935+00	9.55699-02	1.70783-02	1.93984-04	1.02704+01	3.15301-04	2.65007+01	2.95528-01
1.40000+01	7.20902+00	9.40991-02	1.65526-02	1.94948-04	1.03077+01	3.21675-04	2.61322+01	3.05029-01
1.42500+01	7.33872+00	9.30308-02	1.60388-02	1.95928-04	1.03439+01	3.28074-04	2.57741+01	3.14662-01
1.45000+01	7.46846+00	9.19465-02	1.55373-02	1.96919-04	1.03795+01	3.34486-04	2.54269+01	3.24428-01
1.47500+01	7.59823+00	9.08491-02	1.50480-02	1.97921-04	1.04145+01	3.40922-04	2.50900+01	3.34326-01
1.50000+01	7.72804+00	8.97416-02	1.45713-02	1.98931-04	1.04490+01	3.47383-04	2.47632+01	3.44356-01
1.52500+01	7.85788+00	8.86265-02	1.41072-02	1.99949-04	1.04829+01	3.53862-04	2.44458+01	3.54517-01
1.55000+01	7.98775+00	8.75065-02	1.36556-02	2.00971-04	1.05162+01	3.60375-04	2.41375+01	3.64809-01
1.57500+01	8.11766+00	8.63840-02	1.32164-02	2.01998-04	1.05490+01	3.66897-04	2.38378+01	3.75231-01
1.60000+01	8.24760+00	8.52612-02	1.27897-02	2.03027-04	1.05813+01	3.73445-04	2.35466+01	3.85784-01
1.62500+01	8.37758+00	8.41404-02	1.23753-02	2.04057-04	1.06131+01	3.80021-04	2.32629+01	3.96466-01
1.65000+01	8.50759+00	8.30237-02	1.19730-02	2.05087-04	1.06444+01	3.86616-04	2.29869+01	4.07277-01
1.67500+01	8.63763+00	8.19132-02	1.15827-02	2.06116-04	1.06752+01	3.93228-04	2.27183+01	4.18217-01
1.70000+01	8.76771+00	8.08108-02	1.12042-02	2.07144-04	1.07055+01	3.99864-04	2.24567+01	4.29286-01
1.72500+01	8.89781+00	7.97183-02	1.08372-02	2.08167-04	1.07355+01	4.06522-04	2.22017+01	4.40482-01
1.75000+01	9.02796+00	7.86375-02	1.04817-02	2.09187-04	1.07649+01	4.13206-04	2.19532+01	4.51806-01
1.77500+01	9.15814+00	7.75701-02	1.01372-02	2.10200-04	1.07939+01	4.19912-04	2.17109+01	4.63258-01
1.80000+01	9.28836+00	7.65177-02	9.80357-03	2.11209-04	1.08225+01	4.26642-04	2.14744+01	4.74836-01
1.82500+01	9.41860+00	7.54820-02	9.48059-03	2.12210-04	1.08507+01	4.33380-04	2.12438+01	4.86541-01
1.85000+01	9.54888+00	7.44645-02	9.16798-03	2.13203-04	1.08785+01	4.40152-04	2.10186+01	4.98372-01
1.87500+01	9.67920+00	7.34665-02	8.86547-03	2.14188-04	1.09059+01	4.46937-04	2.07987+01	5.10329-01
1.90000+01	9.80955+00	7.24894-02	8.57280-03	2.15163-04	1.09329+01	4.53749-04	2.05839+01	5.22412-01
1.92500+01	9.93993+00	7.15347-02	8.28971-03	2.16129-04	1.09596+01	4.60590-04	2.03740+01	5.34620-01
1.95000+01	1.00704+01	7.06035-02	8.01597-03	2.17084-04	1.09860+01	4.67445-04	2.01692+01	5.46951-01
1.97500+01	1.02008+01	6.96973-02	7.75132-03	2.18028-04	1.10122+01	4.74321-04	1.99691+01	5.59410-01
2.00000+01	1.03313+01	6.88165-02	6.83779-03	2.18960-04	1.10379+01	4.81219-04	1.97733+01	5.71991-01
2.10000+01	1.08536+01	6.61239-02	5.27125-03	2.22561-04	1.11368+01	5.09028-04	1.90301+01	6.23552-01
2.20000+01	1.13764+01	6.34203-02	4.14853-03	2.25934-04	1.12307+01	5.37190-04	1.83468+01	6.77079-01
2.30000+01	1.18998+01	6.08139-02	3.32582-03	2.29050-04	1.13201+01	5.65699-04	1.77163+01	7.32554-01
2.40000+01	1.24237+01	5.84893-02	2.71086-03	2.31886-04	1.14052+01	5.94541-04	1.71324+01	7.89962-01
2.50000+01	1.29482+01	5.62764-02	2.24289-03	2.34420-04	1.14866+01	6.23730-04	1.65902+01	8.49284-01
2.60000+01	1.34732+01	5.41681-02	1.88098-03	2.36631-04	1.15646+01	6.53251-04	1.60853+01	9.10507-01
2.70000+01	1.39987+01	5.23856-02	1.59697-03	2.38497-04	1.16393+01	6.83110-04	1.56137+01	9.73614-01
2.80000+01	1.45248+01	5.09162-02	1.37111-03	2.40737-04	1.17108+01	7.13308-04	1.51720+01	1.03859+00
2.90000+01	1.50515+01	4.94110-02	1.18930-03	2.39995-04	1.17798+01	7.43842-04	1.47579+01	1.10543+00
3.00000+01	1.55787+01	4.78949-02	1.04133-03	2.35579-04	1.18464+01	7.74700-04	1.43688+01	1.17411+00
3.10000+01	1.61064+01	4.63904-02	9.19662-04	2.32848-04	1.19107+01	8.05893-04	1.40024+01	1.24461+00
3.20000+01	1.66347+01	4.48855-02	8.18694-04	2.31350-04	1.19730+01	8.37422-04	1.36567+01	1.31693+00
3.30000+01	1.71635+01	4.34760-02	7.34180-04	2.30782-04	1.20332+01	8.69274-04	1.33299+01	1.39105+00
3.40000+01	1.76929+01	4.24500-02	6.62881-04	2.30947-04	1.20912+01	9.01448-04	1.30202+01	1.46697+00
3.50000+01	1.82228+01	4.14945-02	6.02291-04	2.32258-04	1.21474+01	9.33953-04	1.27264+01	1.54466+00
3.60000+01	1.87532+01	4.03737-02	5.50455-04	2.32160-04	1.22020+01	9.66778-04	1.24476+01	1.62411+00
3.70000+01	1.92842+01	3.91004-02	5.05834-04	2.19248-04	1.22554+01	9.99924-04	1.21828+01	1.70532+00
3.80000+01	1.98158+01	3.76961-02	4.67202-04	2.14888-04	1.23074+01	1.03339-03	1.19307+01	1.78827+00
3.90000+01	2.03479+01	3.61415-02	4.33578-04	2.10673-04	1.23582+01	1.06718-03	1.16906+01	1.87295+00
4.00000+01	2.08805+01	3.57676-02	4.04169-04	2.06594-04	1.24065+01	1.10129-03	1.14603+01	1.95935+00
4.10000+01	2.14137+01	3.49294-02	3.78329-04	2.02644-04	1.24540+01	1.13570-03	1.12407+01	2.04746+00
4.20000+01	2.19474+01	3.41214-02	3.55531-04	1.98817-04	1.25003+01	1.17044-03	1.10306+01	2.13727+00
4.30000+01	2.24817+01	3.33426-02	3.35339-04	1.95106-04	1.25454+01	1.20548-03	1.08294+01	2.22877+00
4.40000+01	2.30165+01	3.25920-02	3.17390-04	1.91505-04	1.25894+01	1.24085-03	1.06366+01	2.32195+00
4.50000+01	2.35518+01	3.18686-02	3.01384-04	1.88008-04	1.26324+01	1.27651-03	1.04515+01	2.41679+00
4.60000+01	2.40878+01	3.11713-02	2.87067-04	1.84611-04	1.26744+01	1.31250-03	1.02738+01	2.51330+00
4.70000+01	2.46242+01	3.04991-02	2.74226-04	1.81308-04	1.27154+01	1.34878-03	1.01030+01	2.61146+00
4.80000+01	2.51612+01	2.98509-02	2.62812-04	1.78096-04	1.27555+01	1.38537-03	9.93872+00	2.71126+00
4.90000+01	2.56987+01	2.92258-02	2.52920-04	1.74969-04	1.27947+01	1.42226-03	9.78053+00	2.81269+00
5.00000+01	2.62368+01	2.86227-02	2.43472-04	1.71923-04	1.28331+01	1.45946-03	9.62814+00	2.91574+00
5.20000+01	2.73146+01	2.74790-02	2.98393-04	1.66063-04	1.29074+01	1.53477-03	9.33946+00	3.12667+00
5.40000+01	2.83946+01	2.64125-02	3.13054-04	1.60486-04	1.29787+01	1.61126-03	9.07039+00	3.34460+00
5.60000+01	2.94768+01	2.54166-02	3.27436-04	1.55170-04	1.30472+01	1.68895-03	8.81898+00	3.56764+00
5.80000+01	3.05611+01	2.44853-02	3.41527-04	1.50091-04	1.31131+01	1.76780-03	8.58349+00	3.79753+00
6.00000+01	3.16476+01	2.36131-02	3.55313-04	1.45231-04	1.31767+01	1.84782-03	8.36245+00	4.03362+00

6.20000+01	3.27363+01	2.27951-02	3.68784-04	1.42571-04	1.32380+01	1.92900-03	8.15454+00	4.27583+00
6.40000+01	3.38272+01	2.20267-02	3.81934-04	1.36095-04	1.32972+01	2.01132-03	7.95861+00	4.52411+00
6.60000+01	3.49202+01	2.13038-02	3.94757-04	1.31789-04	1.33545+01	2.09477-03	7.77362+00	4.77849+00
6.80000+01	3.60155+01	2.06229-02	4.07248-04	1.27640-04	1.34099+01	2.17934-03	7.59868+00	5.03864+00
7.00000+01	3.71129+01	1.99806-02	4.19406-04	1.23634-04	1.34636+01	2.26502-03	7.43297+00	5.30478+00
7.20000+01	3.82125+01	1.93738-02	4.31228-04	1.19761-04	1.35156+01	2.35181-03	7.27577+00	5.57676+00
7.40000+01	3.93143+01	1.87999-02	4.42716-04	1.16011-04	1.35661+01	2.43969-03	7.12644+00	5.85452+00
7.60000+01	4.04182+01	1.82565-02	4.53869-04	1.12372-04	1.36152+01	2.52864-03	6.98438+00	6.13802+00
7.80000+01	4.15243+01	1.77412-02	4.64689-04	1.08837-04	1.36629+01	2.61868-03	6.84907+00	6.42720+00
8.00000+01	4.26326+01	1.72520-02	4.75178-04	1.05397-04	1.37093+01	2.70978-03	6.72003+00	6.72202+00
8.20000+01	4.37431+01	1.67871-02	4.85339-04	1.02043-04	1.37544+01	2.80193-03	6.59684+00	7.02241+00
8.40000+01	4.48558+01	1.63448-02	4.95177-04	9.87694-05	1.37984+01	2.89513-03	6.47909+00	7.32835+00
8.60000+01	4.59707+01	1.59236-02	5.04694-04	9.55671-05	1.38412+01	2.98936-03	6.36644+00	7.63976+00
8.80000+01	4.70877+01	1.55219-02	5.13894-04	9.24296-05	1.38830+01	3.08463-03	6.25854+00	7.95662+00
9.00000+01	4.82069+01	1.51387-02	5.22784-04	8.93502-05	1.39238+01	3.18090-03	6.15511+00	8.27886+00
9.20000+01	4.93283+01	1.47725-02	5.31367-04	8.63222-05	1.39636+01	3.27819-03	6.05587+00	8.60646+00
9.40000+01	5.04518+01	1.44225-02	5.39648-04	8.33389-05	1.40024+01	3.37648-03	5.96056+00	8.93936+00
9.60000+01	5.15776+01	1.40875-02	5.47634-04	8.03938-05	1.40404+01	3.47576-03	5.86896+00	9.27752+00
9.80000+01	5.27055+01	1.37667-02	5.55329-04	7.74804-05	1.40775+01	3.57601-03	5.78084+00	9.62089+00
1.00000+02	5.38356+01	1.34591-02	5.62738-04	7.45924-05	1.41138+01	3.67725-03	5.69602+00	9.96944+00
1.04000+02	5.61023+01	1.28809-02	5.76726-04	7.00059-05	1.41842+01	3.88259-03	5.53552+00	1.06819+01
1.08000+02	5.83778+01	1.23471-02	5.89642-04	6.32035-05	1.42516+01	4.09175-03	5.38617+00	1.14145+01
1.12000+02	6.06619+01	1.18530-02	6.01533-04	4.92643-05	1.43165+01	4.30462-03	5.24682+00	1.21670+01
1.16000+02	6.29548+01	1.13944-02	6.12445-04	3.77574-05	1.43788+01	4.52116-03	5.11650+00	1.29391+01
1.20000+02	6.52564+01	1.09677-02	6.22425-04	2.83045-05	1.44389+01	4.74131-03	4.99434+00	1.37304+01
1.24000+02	6.75668+01	1.05697-02	6.31515-04	2.22031-05	1.44968+01	4.96500-03	4.87960+00	1.45407+01
1.28000+02	6.98858+01	1.01978-02	6.39761-04	1.70959-05	1.45527+01	5.19216-03	4.77162+00	1.53697+01
1.32000+02	7.22136+01	9.84941-03	6.47204-04	1.35725-05	1.46068+01	5.42275-03	4.66982+00	1.62172+01
1.36000+02	7.45500+01	9.52250-03	6.53885-04	1.23374-05	1.46592+01	5.65671-03	4.57367+00	1.70827+01
1.40000+02	7.68952+01	9.21515-03	6.59844-04	1.32821-04	1.47098+01	5.89397-03	4.48268+00	1.79662+01
1.44000+02	7.92491+01	8.92570-03	6.65118-04	0.	1.47591+01	6.13449-03	4.39655+00	1.88673+01
1.48000+02	8.16117+01	8.65265-03	6.69744-04	0.	1.48068+01	6.37821-03	4.31480+00	1.97857+01
1.52000+02	8.39831+01	8.39467-03	6.73757-04	0.	1.48531+01	6.62507-03	4.23713+00	2.07212+01
1.56000+02	8.63631+01	8.15057-03	6.77190-04	0.	1.48982+01	6.87502-03	4.16324+00	2.16736+01
1.60000+02	8.87519+01	7.91927-03	6.80075-04	0.	1.49421+01	7.12803-03	4.09287+00	2.26427+01
1.64000+02	9.11501+01	7.69668-03	6.82956-04	0.	1.49952+01	7.38409-03	4.00948+00	2.38770+01
1.70000+02	9.47619+01	7.39092-03	6.85083-04	0.	1.50467+01	7.77352-03	3.93077+00	2.51365+01
1.75000+02	9.77874+01	7.15050-03	6.86511-04	0.	1.50967+01	8.10306-03	3.85635+00	2.64208+01
1.80000+02	1.00826+02	6.92408-03	6.82692-04	0.	1.51451+01	8.43699-03	3.78589+00	2.77295+01
1.85000+02	1.03879+02	6.71052-03	6.66729-04	0.	1.51921+01	8.77523-03	3.71909+00	2.90620+01
1.90000+02	1.06945+02	6.50874-03	6.51390-04	0.	1.52378+01	9.11771-03	3.65565+00	3.04181+01
1.95000+02	1.10025+02	6.31783-03	6.36638-04	0.	1.52823+01	9.46432-03	3.59535+00	3.17973+01
2.00000+02	1.13119+02	6.13694-03	6.22440-04	0.	1.53256+01	9.81500-03	3.53794+00	3.31993+01
2.05000+02	1.16226+02	5.96530-03	6.08766-04	0.	1.53677+01	1.01697-02	3.48323+00	3.46236+01
2.10000+02	1.19347+02	5.80224-03	5.95587-04	0.	1.54088+01	1.05282-02	3.43104+00	3.60700+01
2.15000+02	1.22481+02	5.64714-03	5.82877-04	0.	1.54489+01	1.08906-02	3.38119+00	3.75380+01
2.20000+02	1.25629+02	5.49944-03	5.70611-04	0.	1.54881+01	1.12568-02	3.33353+00	3.90274+01
2.25000+02	1.28791+02	5.35863-03	5.58766-04	0.	1.55263+01	1.16266-02	3.28793+00	4.05377+01
2.30000+02	1.31966+02	5.22425-03	5.47321-04	0.	1.55636+01	1.20000-02	3.24425+00	4.20686+01
2.35000+02	1.35155+02	5.09586-03	5.36257-04	0.	1.56002+01	1.23770-02	3.20238+00	4.36199+01
2.40000+02	1.38358+02	4.97309-03	5.25554-04	0.	1.56359+01	1.27575-02	3.16221+00	4.51911+01
2.45000+02	1.41574+02	4.85558-03	5.15196-04	0.	1.56709+01	1.31414-02	3.12364+00	4.67821+01
2.50000+02	1.44804+02	4.74300-03	5.05166-04	0.	1.57052+01	1.35286-02	3.08657+00	4.83924+01
2.55000+02	1.48047+02	4.63505-03	4.95450-04	0.	1.57388+01	1.39191-02	3.05092+00	5.00218+01
2.60000+02	1.51304+02	4.53146-03	4.86032-04	0.	1.57718+01	1.43128-02	3.01662+00	5.16699+01
2.80000+02	1.64468+02	4.15586-03	4.51095-04	0.	1.58975+01	1.59189-02	2.89145+00	5.84434+01
3.00000+02	1.77850+02	3.83269-03	4.20001-04	0.	1.60146+01	1.75722-02	2.78275+00	6.54954+01
3.20000+02	1.91450+02	3.55183-03	3.92162-04	0.	1.61243+01	1.92693-02	2.68755+00	7.28198+01
3.40000+02	2.05268+02	3.30559-03	3.67104-04	0.	1.62277+01	2.10076-02	2.60354+00	8.03716+01
3.60000+02	2.19304+02	3.08805-03	3.44444-04	0.	1.63255+01	2.27841-02	2.52891+00	8.81668+01
3.80000+02	2.33557+02	2.89453-03	3.23864-04	0.	1.64183+01	2.45966-02	2.46223+00	9.61825+01
4.00000+02	2.48029+02	2.72134-03	3.05101-04	0.	1.65068+01	2.64429-02	2.40234+00	1.04406+02

4.20000+02	2.62719+02	2.56549-03	2.87935-04	0.	1.65914+01	2.83210-02	2.34829+00	1.12827+02
4.40000+02	2.77626+02	2.42454-03	2.72179-04	0.	1.66725+01	3.02290-02	2.29931+00	1.21439+02
4.60000+02	2.92751+02	2.29651-03	2.57676-04	0.	1.67505+01	3.21654-02	2.25475+00	1.30212+02
4.80000+02	3.08095+02	2.17972-03	2.44289-04	0.	1.68256+01	3.41286-02	2.21407+00	1.39171+02
5.00000+02	3.23656+02	2.07281-03	2.31902-04	0.	1.68981+01	3.61171-02	2.17682+00	1.48281+02
5.40000+02	3.55432+02	1.88406-03	2.09736-04	0.	1.70360+01	4.01662-02	2.11110+00	1.66943+02
5.80000+02	3.88080+02	1.72284-03	1.90514-04	0.	1.71659+01	4.43036-02	2.05511+00	1.86168+02
6.20000+02	4.21599+02	1.58369-03	1.73720-04	0.	1.72888+01	4.85225-02	2.00697+00	2.05845+02
6.60000+02	4.55990+02	1.46248-03	1.58956-04	0.	1.74056+01	5.28168-02	1.96528+00	2.25987+02
7.00000+02	4.91253+02	1.35606-03	1.45902-04	0.	1.75170+01	5.71819-02	1.92894+00	2.46532+02
7.50000+02	5.36557+02	1.24010-03	1.31600-04	0.	1.76497+01	6.27317-02	1.88972+00	2.72722+02
8.00000+02	5.83223+02	1.13971-03	1.19173-04	0.	1.77758+01	6.81796-02	1.85620+00	2.99420+02
8.50000+02	6.31251+02	1.05205-03	1.08304-04	0.	1.78963+01	7.41206-02	1.82735+00	3.26563+02
9.00000+02	6.80641+02	9.74934-04	9.87464-05	0.	1.80116+01	7.99508-02	1.80239+00	3.54121+02
9.50000+02	7.31392+02	9.06640-04	9.02983-05	0.	1.81223+01	8.58671-02	1.78069+00	3.82031+02
1.00000+03	7.83506+02	8.45801-04	8.27970-05	0.	1.82288+01	9.18668-02	1.76174+00	4.10261+02
1.20000+03	1.00558+03	6.57711-04	5.95478-05	0.	1.86195+01	1.16660-01	1.70639+00	5.25626+02
1.40000+03	1.24945+03	5.28615-04	3.60499-05	0.	1.89647+01	1.42641-01	1.67271+00	6.44013+02
1.60000+03	1.51510+03	4.35493-04	2.37282-05	0.	1.92743+01	1.69704-01	1.65202+00	7.64324+02
1.80000+03	1.80255+03	3.65772-04	1.66400-05	0.	1.95551+01	1.97737-01	1.63957+00	8.85852+02
2.00000+03	2.11179+03	3.12029-04	1.22630-05	0.	1.98118+01	2.26630-01	1.63254+00	1.00613+03
2.50000+03	2.98023+03	2.20885-04	6.70243-06	0.	2.03699+01	3.02007-01	1.62866+00	1.31473+03
3.00000+03	3.98485+03	1.65097-04	4.27230-06	0.	2.08360+01	3.80975-01	1.63465+00	1.62117+03
3.50000+03	5.12568+03	1.28299-04	3.05825-06	0.	2.12332+01	4.62650-01	1.64477+00	1.92611+03
4.00000+03	6.40270+03	1.02681-04	2.35077-06	0.	2.15768+01	5.46202-01	1.65649+00	2.22903+03
4.50000+03	7.81591+03	8.40978-05	1.91198-06	0.	2.18779+01	6.30761-01	1.66864+00	2.52977+03
5.00000+03	9.36531+03	7.01738-05	1.62339-06	0.	2.21447+01	7.15479-01	1.68067+00	2.82833+03
6.00000+03	1.28727+04	5.10430-05	1.51846-06	0.	2.25993+01	8.82596-01	1.70351+00	3.41936+03
7.00000+03	1.69249+04	3.88170-05	1.51846-06	0.	2.29760+01	1.04350+00	1.72432+00	4.00284+03
8.00000+03	2.15218+04	3.05231-05	1.51846-06	0.	2.32967+01	1.19627+00	1.74318+00	4.57964+03
9.00000+03	2.66636+04	2.46355-05	1.51846-06	0.	2.35758+01	1.34035+00	1.76031+00	5.15051+03
1.00000+04	3.23500+04	2.03041-05	1.51846-06	0.	2.38226+01	1.47588+00	1.77595+00	5.71609+03
1.20000+04	4.53573+04	1.44805-05	1.51846-06	0.	2.42446+01	1.72336+00	1.80359+00	6.83362+03
1.40000+04	6.05438+04	1.08478-05	1.51846-06	0.	2.45971+01	1.94347+00	1.82741+00	7.93529+03
1.60000+04	7.79090+04	8.42973-06	1.51846-06	0.	2.49001+01	2.14084+00	1.84829+00	9.02156+03
1.80000+04	9.74538+04	6.73898-06	1.51846-06	0.	2.51658+01	2.31935+00	1.86686+00	1.01003+04
2.00000+04	1.19177+05	5.51054-06	1.46604-06	0.	2.54023+01	2.48207+00	1.88357+00	1.11668+04
2.50000+04	1.83018+05	3.58825-06	1.32413-06	0.	2.59005+01	2.83485+00	1.91916+00	1.37967+04
3.00000+04	2.60479+05	2.52116-06	1.21877-06	0.	2.63047+01	3.13014+00	1.94835+00	1.63825+04
3.50000+04	3.51562+05	1.86796-06	1.18488-06	0.	2.66443+01	3.38419+00	1.97303+00	1.89328+04
4.00000+04	4.56248+05	1.43935-06	1.15033-06	0.	2.69366+01	3.60730+00	1.99437+00	2.14534+04
4.50000+04	5.74576+05	1.14293-06	1.12850-06	0.	2.71929+01	3.80648+00	2.01313+00	2.39487+04
5.00000+04	7.06492+05	9.29518-07	1.11553-06	0.	2.74206+01	3.98650+00	2.02983+00	2.64222+04
5.50000+04	8.52058+05	7.70718-07	1.10897-06	0.	2.76252+01	4.15096+00	2.04485+00	2.88764+04
6.00000+04	1.01120+06	6.49429-07	1.10722-06	0.	2.78107+01	4.30242+00	2.05850+00	3.13135+04
6.50000+04	1.18398+06	5.54652-07	1.10917-06	0.	2.79802+01	4.44293+00	2.07097+00	3.37351+04
7.00000+04	1.37039+06	4.79202-07	1.11405-06	0.	2.81361+01	4.57406+00	2.08245+00	3.61428+04
7.50000+04	1.57033+06	4.18187-07	1.12129-06	0.	2.82802+01	4.69699+00	2.09307+00	3.85377+04
8.00000+04	1.78403+06	3.68196-07	1.13047-06	0.	2.84141+01	4.81286+00	2.10294+00	4.09210+04
8.50000+04	2.01143+06	3.26497-07	1.14127-06	0.	2.85391+01	4.92239+00	2.11216+00	4.32934+04
9.00000+04	2.25207+06	2.91595-07	1.15342-06	0.	2.86562+01	5.02620+00	2.12080+00	4.56558+04
9.50000+04	2.50685+06	2.61959-07	1.16678-06	0.	2.87662+01	5.12512+00	2.12892+00	4.80088+04
1.00000+05	2.77495+06	2.36650-07	1.18113-06	0.	2.88700+01	5.21934+00	2.13658+00	5.03533+04

THK = 7.0882-01 THL = 2.8200-01

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