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CHARGED PARTICLE TRACKS IN POLYMERS: NO. 3 - RANGE AND ENERGY LOSS TABLES

by

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ABSTRACT

The range and energy loss rate for the ions ^{1}H, ^{4}He, ^{12}C, ^{16}O, ^{20}Ne, ^{28}Si, ^{40}Ar, ^{56}Fe, and ^{84}K are given in the energy/nucleon interval 0.1 - 1200 MeV/amu. These quantities are tabulated for the stopping materials cellulose nitrate, cellulose acetate butyrate, HBpaIT polyester, Lexan, Mylar, muscovite and phlogopite mica, soda lime and phosphate glass and olivine. The values for a given stopping material can be extended to other materials with similar values of the mean excitation potential by simple scaling. The computation involved a published mathematical method which was modified and extended to lower energies.

SUMMARY

The Problem

A new field of dosimetry has been developed using solid state materials to detect heavy charged nuclear particles. The range and energy loss data pertinent to the investigation and the use of these new detectors has not been thoroughly presented in the literature, thus creating a need for a machine computation of this information.

The Findings

Computed values of the range and energy loss for a wide spectrum of particles and particle energies is presented for the most commonly used detecting materials. An estimation of the accuracy of the results for solid state detecting materials is made by comparison of the computed results with experimental results for more common materials.

INTRODUCTION

The recent development and use of solid-state nuclear track detectors in a variety of applications in nuclear physics and dosimetry has created a need for accurate range-energy and energy loss relations.[1-5] Tracks are delineated in these materials as a result of a preferential removal, by etching, of the high chemical reactivity material along the particle trajectory.

Range-energy relations and the associated derivative relations of dE/dx - energy have been measured and calculated extensively for protons and alpha particles in many common materials. However, many of the solid state detecting materials, such a cellulose nitrate, Lexan, and Mica do not have comprehensive range-energy data available. Such information is essential for the investigation of the properties of these detectors since: (1) the energy loss rate, (dE/dx), plays a critical role in particle registration efficiency and (2) the length of tracks, location of maximum energy deposition, etc., are dependent upon the ranges of particles.

It is the goal of this report to provide range-energy relations for a wide variety of particles and a broad energy spectrum. For very low energy, heavy particles this has only been achieved, however, by sacrificing a certain amount of accuracy.

METHOD OF CALCULATION

To achieve a broad coverage of the spectrum of particles, energies, and stopping materials, the fits to range-energy data published by Barkas and Berger[6] have been modified and extended to lower energies. Particle ranges in gm/cm^2 and energy loss rates in MeV cm^2/gm are calculated as functions of the four parameters, A/Z, I_{adj}, z, and E. The ratio A/Z is the atomic mass per electron of the stopping material in amu/electron; I_{adj} is the mean value of the ionization energy for the stopping material adjusted by assuming that the shell correction for relativistic particles is zero;[6] z and E are the atomic number and energy of the incident ion. The quantity A/Z can be calculated for an arbitrary stopping material, and if Bragg's rule[6] is assumed, I_{adj} can also be calculated for this material.

For a velocity of βc the range, R, of a particle of mass M and charge z relative to a proton is given by:

$$R = \frac{M}{z^2} \left[\lambda(\beta) + B_z(\beta)\right]. \qquad 1$$

For the stopping material in question $\lambda(\beta)$ is the range of an ideal proton with velocity βc, and $B_z(\beta)$ is the extension of the range caused by the neutralization of the moving ion's charge by charge pick-up near the stopping end of the trajectory. An ideal proton is entirely ionized during the energy loss process in contrast to an actual proton which incurs charge pick-up. The subscript, z, on $B_z(\beta)$ indicates that the range extension is dependent upon the atomic number of the moving ion.

Barkas and Berger have made fits for λ of the form:

$$\log \lambda = \log \frac{A}{Z} + \sum_{mn} a_{mn} (\log I_{adj})^m (\log E)^n \quad , \qquad 2$$

where E is the energy of the proton corresponding to velocity βc. The quoted regions of validity of their two fits are 1 - 9 MeV and

7 - 1200 MeV. They represent $B_z(\beta)$ by a linear function of β for $\frac{137\beta}{z} < 2.0$ and an asymptotic value independent of β for $\frac{137\beta}{z} > 2.0$.

The representation of Barkas and Berger has been modified as follows:

1. A least squares fit of the form given above (Equation 2) was made to all of the low energy range-energy points given by Whaling[7] up to 0.95 MeV also points from the fit of Barkas and Berger at 1, 2, and 3 MeV were included to insure a smooth connection in this region. The ideal proton's range was calculated by subtracting the range extension from the real range.

2. The fits in the different energy ranges have been connected at the appropriate points, functions of I_{adj}, which provide a minimum discontinuity in both λ and its derivative.

3. The range extension expression for emulsion measured by Heckman, et al.,[8] and Henke and Benton[9] has been scaled to other materials to provide a smooth replacement of the $B_z(\beta)$ given. This was achieved by scaling the range extension for emulsion to correspond to the extension given by Barkas and Berger in the asymptotic, high energy region. In the lower energy region the scaled emulsion expression agrees quite well with B_z given by Barkas and Berger; the scaled emulsion range extension, however, has a continuous first derivative, which is the requirement for continuity in the calculated energy loss rate curve.

The values of I_{adj} are those recommended by the National Academy of Sciences subcommittee on penetration of charged particles.[10] In materials for which I_{adj} is not listed it is calculated assuming the validity of Bragg's rule of the additivity of stopping effects. In this case the I_{adj} for the constituent ions in the compound form is used when it is listed; otherwise I_{adj} is computed from a fit to the recommended values of I_{adj}. This function, $I_{adj}(z)$, is given by Barkas and Berger.[6]

DISCUSSION

The R.M.S. dispersions of the input range energy points about the computed points for the high (7 - 1200 MeV/nuc.) and medium (1 - 9 MeV/nuc.) energy regions are 0.6% and 2% respectively.[6] For the high energy region the spread of the stopping power values is 1.3%. The R.M.S. spread of Whaling's data about the computed values for the low energy region are given in Table I for several values of the proton energy.

The error in the smoothed relations may be considerably smaller since the error quoted largely represents fluctuation of the data, not the poorness of the fit. There are only 16 stopping materials involved, however; hence the error of the smoothed curve probably exceeds $1/\sqrt{16}$ of the quoted spreads. A large contributor to the extreme spread of the data about the smoothed relations seems to be the integration constants used by Whaling.[7] His range-energy curves were obtained by the integration of energy loss rate data. Another possible contributor is the questionable practice of using I_{adj} as the smoothing parameter for this low energy region.

The range extension, $B_z(\beta)$, is given by the following expression:[6]

$$B_z(\rho) = \int_0^{\beta} \left[(z/z^*)^2 - 1 \right] (d\lambda/d\beta) d\beta \qquad 3$$

where z^*e is the effective charge of the moving ion with atomic number z. We obtain $B_z(\beta)$ by scaling the corresponding experimental expression for emulsion to other materials. It can be seen from Equation 3 that this procedure relies on two assumptions: (1) the effective charge, z^*e, is only a function of β and z, not a function of the stopping material, (2) the proton range expression, $\lambda(\beta)$, can be scaled for different stopping materials.

The validity of the first assumption, that z^*/z is independent of the stopping material, seems to be demonstrated experimentally except for very low incident particle energy and very low stopping material density.[8]

The second assumption is approximately true for small values of β. Barkas and Berger have used the expression:

Table I

SMOOTHNESS OF LOW ENERGY DATA

Energy (MeV)	R.M.S. Spread in Range %	R.M.S. Spread in Energy Loss Rate (%)
0.1	28.2	23.3
0.2	17.1	14.5
0.5	8.5	5.2
1.0	4.8	2.3
2.0	4.4	1.7

$$\lambda = (11.1 + 1.34\ I_{adj}^{5/8})\ (A/Z)\ \beta^{10/3}\ gm/cm^2 \qquad 4$$

We have retained the $(1 + 0.121\ I_{adj}^{5/8})$ dependence of the range-energy relation and hence of B_z, but have used the experimental results for emulsion to obtain the universal function that is to be scaled. Deriving B_z in this fashion is an improvement over the use of the simplified analytic expression obtained from Equations 3 and 4, but still does not take into account the slight dependence of the shape of the curve $\lambda(\beta)$ upon the stopping material. Thus an error will be introduced when I_{adj} of the material deviates significantly from I_{adj} for emulsion if $B_z(\beta)/\lambda(\beta)$ is not small. This situation is encountered when β is small and z is large.

Various parameters for the stopping materials for which range-energy relations were calculated are given in Table II. The chemical formulae used are taken from Fleisher, et al.,[11] and may not be representative of all the commercial materials available under a given name. The differences are due to such factors as the amount and type of plasticizers used, the degree of nitration, etc., and the method of sample preparation (solvents used, amount of drying, etc.).

For energies in excess of approximately 500 MeV/nuc. the probability for a nuclear interaction becomes significant. In such situations the full range given in the table may not be achieved. The probabilities for these inelastic interactions for protons have been calculated by Janni.[12]

The energy loss rate relations have been obtained by taking the derivative of Equation 1. This procedure essentially reproduces the experimental data and for lower energies has been considered superior to using the equation:

$$\left(\frac{dE}{dx}\right)_\beta = \left[\ z^*(\beta)\ \right]^2 \left(\frac{dE_p}{dx}\right)_\beta \qquad 5$$

where $z^*(\beta)$ is the effective charge of the heavy ion[8] and $\left(\frac{dE_p}{dx}\right)$ is the energy loss rate for the ideal proton. For $\beta > 2\ \frac{137}{z}$ the two approaches give identical results.

Table II

PARAMETERS OF THE STOPPING MATERIALS

Material	I_{adj}	A/Z	Composition
Cellulose nitrate	81.1	1.939	$C_6H_8O_9N_2$
Cellulose acetate butyrate	63.4	1.835	$C_{20}H_{32}O_5$
HBpaIt polyester	72.5	1.931	$C_{17}H_9O_2$
Bisphenol-A polycarbonate (Lexan)	69.5	1.896	$C_{16}H_{14}O_3$
Polyethylene terephthalate (Mylar)	73.2	1.915	$C_{19}H_{16}O_7$
Muscovite mica	128.3	2.011	$KAl_3Si_3O_{10}(OH)_2$
Phlogopite mica	129.4	2.009	$KMg_2Al_2Si_3O_{10}(OH)_2$
Soda lime glass	131.6	2.014	$67SiO_2:14Na_2O:14CaO:5Al_2O_3$
Phosphate glass	196.8	2.138	$63P_2O_5:11UO_2:8Al_2O_3:9Ag_2O:9K_2O$
Olivine	158.9	2.050	$MgFeSiO_4$

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RANGE AND ENERGY LOSS RATE TABLES

In the following tables the ranges in gm/cm^2 and the (dE/dx) values in MeV cm^2/gm are listed for nine representative ions in each stopping material. The intervals between the forty-eight energy points have been chosen such that a linear interpolation contributes less than 1% error. The values of I_{adj} are labeled by a non-subscripted I for typographical reasons. More places of precision are given than are significant to eliminate rounding errors and for the sake of differential measurements.

RANGE IN CELLULOSE NITRATE (GM/CM2) I = 81.1 A/Z = 1.939

ENRG./NUC. (MEV/AMU)	1 H	4 HE	12 C	16 O	20 NE	28 SI	40 AR	56 FE	84 KR
0.10	1.396E-04	2.328E-04	2.427E-04	2.598E-04	2.764E-04	3.058E-04	3.723E-04	4.228E-04	5.367E-04
0.12	1.667E-04	2.739E-04	2.770E-04	2.951E-04	3.132E-04	3.455E-04	4.183E-04	4.720E-04	5.967E-04
0.15	2.104E-04	3.361E-04	3.269E-04	3.458E-04	3.656E-04	4.025E-04	4.838E-04	5.412E-04	6.803E-04
0.20	2.911E-04	4.424E-04	4.076E-04	4.263E-04	4.479E-04	4.905E-04	5.866E-04	6.480E-04	8.079E-04
0.25	3.817E-04	5.526E-04	4.867E-04	5.039E-04	5.262E-04	5.727E-04	6.842E-04	7.477E-04	9.254E-04
0.30	4.816E-04	6.671E-04	5.653E-04	5.800E-04	6.020E-04	6.511E-04	7.783E-04	8.425E-04	1.036E-03
0.40	7.076E-04	9.095E-04	7.231E-04	7.299E-04	7.495E-04	8.007E-04	9.489E-04	1.022E-03	1.242E-03
0.50	9.670E-04	1.173E-03	8.837E-04	8.797E-04	8.945E-04	9.444E-04	1.113E-03	1.194E-03	1.436E-03
0.60	1.258E-03	1.465E-03	1.049E-03	1.031E-03	1.039E-03	1.085E-03	1.270E-03	1.359E-03	1.621E-03
0.70	1.580E-03	1.787E-03	1.219E-03	1.185E-03	1.185E-03	1.224E-03	1.425E-03	1.513E-03	1.799E-03
0.80	1.931E-03	2.139E-03	1.394E-03	1.342E-03	1.332E-03	1.363E-03	1.577E-03	1.665E-03	1.973E-03
1.00	2.720E-03	2.928E-03	1.763E-03	1.667E-03	1.633E-03	1.640E-03	1.877E-03	1.959E-03	2.312E-03
1.20	3.621E-03	3.830E-03	2.157E-03	2.009E-03	1.945E-03	1.922E-03	2.177E-03	2.246E-03	2.642E-03
1.50	5.177E-03	5.385E-03	2.796E-03	2.556E-03	2.437E-03	2.357E-03	2.631E-03	2.670E-03	3.102E-03
2.00	8.299E-03	8.507E-03	3.997E-03	3.564E-03	3.330E-03	3.124E-03	3.413E-03	3.374E-03	3.857E-03
2.50	1.200E-02	1.221E-02	5.349E-03	4.681E-03	4.306E-03	3.941E-03	4.230E-03	4.086E-03	4.599E-03
3.00	1.625E-02	1.646E-02	6.850E-03	5.908E-03	5.366E-03	4.813E-03	5.088E-03	4.815E-03	5.339E-03
3.50	2.109E-02	2.130E-02	8.513E-03	7.255E-03	6.521E-03	5.749E-03	5.996E-03	5.569E-03	6.089E-03
4.00	2.650E-02	2.670E-02	1.034E-02	8.724E-03	7.772E-03	6.749E-03	6.956E-03	6.351E-03	6.853E-03
5.00	3.902E-02	3.923E-02	1.453E-02	1.203E-02	1.057E-02	8.953E-03	9.043E-03	8.013E-03	8.436E-03
6.00	5.382E-02	5.403E-02	1.946E-02	1.584E-02	1.376E-02	1.144E-02	1.136E-02	9.815E-03	1.011E-02
7.00	7.089E-02	7.109E-02	2.516E-02	2.016E-02	1.736E-02	1.420E-02	1.392E-02	1.177E-02	1.189E-02
8.00	9.023E-02	9.044E-02	3.161E-02	2.502E-02	2.138E-02	1.726E-02	1.673E-02	1.388E-02	1.377E-02
10.00	1.350E-01	1.352E-01	4.652E-02	3.621E-02	3.050E-02	2.416E-02	2.300E-02	1.851E-02	1.785E-02
12.00	1.864E-01	1.866E-01	6.366E-02	4.908E-02	4.084E-02	3.191E-02	3.001E-02	2.363E-02	2.227E-02
15.00	2.776E-01	2.778E-01	9.408E-02	7.189E-02	5.912E-02	4.540E-02	4.211E-02	3.233E-02	2.968E-02
20.00	4.659E-01	4.661E-01	1.568E-01	1.189E-01	9.677E-02	7.271E-02	6.642E-02	4.957E-02	4.409E-02
25.00	6.974E-01	6.976E-01	2.340E-01	1.768E-01	1.431E-01	1.059E-01	9.577E-02	7.015E-02	6.105E-02
30.00	9.705E-01	9.707E-01	3.250E-01	2.451E-01	1.977E-01	1.449E-01	1.300E-01	9.396E-02	8.049E-02
35.00	1.284E+00	1.284E+00	4.294E-01	3.234E-01	2.603E-01	1.897E-01	1.689E-01	1.209E-01	1.024E-01
40.00	1.635E+00	1.635E+00	5.466E-01	4.113E-01	3.306E-01	2.399E-01	2.124E-01	1.509E-01	1.266E-01
50.00	2.449E+00	2.449E+00	8.179E-01	6.147E-01	4.934E-01	3.562E-01	3.130E-01	2.197E-01	1.818E-01
60.00	3.403E+00	3.403E+00	1.136E+00	8.533E-01	6.842E-01	4.925E-01	4.308E-01	2.997E-01	2.458E-01
70.00	4.490E+00	4.490E+00	1.498E+00	1.125E+00	9.016E-01	6.478E-01	5.650E-01	3.904E-01	3.181E-01
80.00	5.703E+00	5.703E+00	1.902E+00	1.428E+00	1.144E+00	8.210E-01	7.147E-01	4.911E-01	3.982E-01
100.00	8.482E+00	8.482E+00	2.829E+00	2.123E+00	1.700E+00	1.218E+00	1.058E+00	7.216E-01	5.808E-01
120.00	1.170E+01	1.170E+01	3.901E+00	2.927E+00	2.344E+00	1.678E+00	1.455E+00	9.883E-01	7.910E-01
150.00	1.727E+01	1.727E+01	5.759E+00	4.321E+00	3.458E+00	2.474E+00	2.143E+00	1.450E+00	1.154E+00
200.00	2.832E+01	2.832E+01	9.441E+00	7.082E+00	5.668E+00	4.052E+00	3.507E+00	2.365E+00	1.871E+00
250.00	4.127E+01	4.127E+01	1.376E+01	1.032E+01	8.257E+00	5.902E+00	5.105E+00	3.438E+00	2.710E+00
300.00	5.585E+01	5.585E+01	1.862E+01	1.396E+01	1.117E+01	7.984E+00	6.905E+00	4.645E+00	3.655E+00
400.00	8.908E+01	8.908E+01	2.969E+01	2.227E+01	1.782E+01	1.273E+01	1.101E+01	7.398E+00	5.809E+00
500.00	1.267E+02	1.267E+02	4.224E+01	3.168E+01	2.535E+01	1.811E+01	1.565E+01	1.052E+01	8.249E+00
600.00	1.678E+02	1.678E+02	5.595E+01	4.196E+01	3.357E+01	2.398E+01	2.073E+01	1.392E+01	1.091E+01
700.00	2.118E+02	2.118E+02	7.059E+01	5.295E+01	4.236E+01	3.026E+01	2.616E+01	1.756E+01	1.376E+01
800.00	2.580E+02	2.580E+02	8.599E+01	6.450E+01	5.160E+01	3.686E+01	3.186E+01	2.139E+01	1.676E+01
1000.00	3.556E+02	3.556E+02	1.185E+02	8.891E+01	7.113E+01	5.081E+01	4.391E+01	2.948E+01	2.309E+01
1200.00	4.583E+02	4.583E+02	1.528E+02	1.146E+02	9.166E+01	6.548E+01	5.659E+01	3.798E+01	2.974E+01

DE/DX IN CELLULOSE NITRATE (MEV CM2/GM) I = 81.1 A/Z = 1.939

ENRG./NUC. (MEV/AMU)	1 H	4 HE	12 C	16 O	20 NE	28 SI	40 AR	56 FE	84 KR
0.10	7.560E+02	1.954E+03	6.869E+03	8.864E+03	1.058E+04	1.380E+04	1.695E+04	2.207E+04	2.705E+04
0.12	7.163E+02	1.942E+03	7.090E+03	9.247E+03	1.112E+04	1.438E+04	1.780E+04	2.342E+04	2.892E+04
0.15	6.607E+02	1.912E+03	7.320E+03	9.680E+03	1.176E+04	1.504E+04	1.881E+04	2.509E+04	3.130E+04
0.20	5.827E+02	1.849E+03	7.534E+03	1.015E+04	1.251E+04	1.653E+04	2.004E+04	2.725E+04	3.447E+04
0.25	5.248E+02	1.781E+03	7.624E+03	1.044E+04	1.301E+04	1.748E+04	2.091E+04	2.888E+04	3.697E+04
0.30	4.791E+02	1.713E+03	7.640E+03	1.060E+04	1.335E+04	1.820E+04	2.155E+04	3.016E+04	3.902E+04
0.40	4.115E+02	1.605E+03	7.550E+03	1.070E+04	1.372E+04	1.917E+04	2.388E+04	3.203E+04	4.219E+04
0.50	3.631E+02	1.440E+03	7.378E+03	1.064E+04	1.383E+04	1.974E+04	2.495E+04	3.329E+04	4.453E+04
0.60	3.263E+02	1.302E+03	7.171E+03	1.049E+04	1.380E+04	2.006E+04	2.568E+04	3.418E+04	4.632E+04
0.70	2.971E+02	1.188E+03	6.950E+03	1.030E+04	1.368E+04	2.020E+04	2.617E+04	3.638E+04	4.771E+04
0.80	2.733E+02	1.092E+03	6.728E+03	1.008E+04	1.351E+04	2.022E+04	2.647E+04	3.733E+04	4.880E+04
1.00	2.365E+02	9.460E+02	6.299E+03	9.599E+03	1.306E+04	2.004E+04	2.672E+04	3.864E+04	5.033E+04
1.20	2.097E+02	8.387E+02	5.913E+03	9.138E+03	1.259E+04	1.969E+04	2.666E+04	3.942E+04	5.128E+04
1.50	1.810E+02	7.241E+02	5.428E+03	8.520E+03	1.190E+04	1.906E+04	2.630E+04	3.998E+04	5.493E+04
2.00	1.483E+02	5.934E+02	4.757E+03	7.612E+03	1.081E+04	1.784E+04	2.523E+04	3.985E+04	5.655E+04
2.50	1.262E+02	5.047E+02	4.224E+03	6.853E+03	9.858E+03	1.663E+04	2.396E+04	3.900E+04	5.688E+04
3.00	1.100E+02	4.400E+02	3.793E+03	6.218E+03	9.031E+03	1.550E+04	2.267E+04	3.781E+04	5.645E+04
3.50	9.764E+01	3.905E+02	3.439E+03	5.684E+03	8.317E+03	1.447E+04	2.142E+04	3.648E+04	5.556E+04
4.00	8.783E+01	3.513E+02	3.138E+03	5.228E+03	7.698E+03	1.354E+04	2.025E+04	3.509E+04	5.439E+04
5.00	7.320E+01	2.928E+02	2.630E+03	4.497E+03	6.682E+03	1.196E+04	1.817E+04	3.237E+04	5.165E+04
6.00	6.314E+01	2.526E+02	2.272E+03	3.959E+03	5.922E+03	1.073E+04	1.649E+04	2.998E+04	4.891E+04
7.00	5.592E+01	2.237E+02	2.013E+03	3.556E+03	5.345E+03	9.769E+03	1.514E+04	2.797E+04	4.641E+04
8.00	5.028E+01	2.011E+02	1.809E+03	3.208E+03	4.874E+03	8.970E+03	1.399E+04	2.617E+04	4.405E+04
10.00	4.200E+01	1.680E+02	1.512E+03	2.687E+03	4.151E+03	7.719E+03	1.216E+04	2.317E+04	3.985E+04
12.00	3.620E+01	1.448E+02	1.303E+03	2.317E+03	3.608E+03	6.784E+03	1.076E+04	2.078E+04	3.631E+04
15.00	3.015E+01	1.206E+02	1.085E+03	1.929E+03	3.013E+03	5.758E+03	9.200E+03	1.802E+04	3.201E+04
20.00	2.379E+01	9.514E+01	8.563E+02	1.522E+03	2.378E+03	4.625E+03	7.446E+03	1.480E+04	2.676E+04
25.00	1.979E+01	7.918E+01	7.126E+02	1.267E+03	1.979E+03	3.873E+03	6.287E+03	1.261E+04	2.306E+04
30.00	1.705E+01	6.819E+01	6.137E+02	1.091E+03	1.705E+03	3.340E+03	5.465E+03	1.103E+04	2.032E+04
35.00	1.504E+01	6.014E+01	5.413E+02	9.623E+02	1.504E+03	2.947E+03	4.856E+03	9.829E+03	1.822E+04
40.00	1.350E+01	5.399E+01	4.859E+02	8.639E+02	1.350E+03	2.645E+03	4.366E+03	8.892E+03	1.655E+04
50.00	1.129E+01	4.518E+01	4.066E+02	7.228E+02	1.129E+03	2.214E+03	3.658E+03	7.517E+03	1.407E+04
60.00	9.787E+00	3.915E+01	3.523E+02	6.264E+02	9.787E+02	1.918E+03	3.171E+03	6.555E+03	1.232E+04
70.00	8.689E+00	3.476E+01	3.128E+02	5.561E+02	8.689E+02	1.703E+03	2.815E+03	5.844E+03	1.102E+04
80.00	7.852E+00	3.141E+01	2.827E+02	5.025E+02	7.852E+02	1.539E+03	2.543E+03	5.298E+03	1.000E+04
100.00	6.656E+00	2.662E+01	2.396E+02	4.260E+02	6.656E+02	1.305E+03	2.156E+03	4.497E+03	8.537E+03
120.00	5.840E+00	2.336E+01	2.102E+02	3.738E+02	5.840E+02	1.145E+03	1.892E+03	3.947E+03	7.520E+03
150.00	5.006E+00	2.003E+01	1.802E+02	3.204E+02	5.006E+02	9.812E+02	1.622E+03	3.384E+03	6.469E+03
200.00	4.150E+00	1.660E+01	1.494E+02	2.656E+02	4.150E+02	8.134E+02	1.345E+03	2.805E+03	5.375E+03
250.00	3.622E+00	1.449E+01	1.304E+02	2.318E+02	3.622E+02	7.100E+02	1.174E+03	2.449E+03	4.694E+03
300.00	3.264E+00	1.306E+01	1.175E+02	2.089E+02	3.264E+02	6.397E+02	1.058E+03	2.206E+03	4.230E+03
400.00	2.808E+00	1.123E+01	1.011E+02	1.797E+02	2.808E+02	5.504E+02	9.098E+02	1.898E+03	3.639E+03
500.00	2.531E+00	1.012E+01	9.111E+01	1.620E+02	2.531E+02	4.960E+02	8.200E+02	1.711E+03	3.280E+03
600.00	2.346E+00	9.383E+00	8.445E+01	1.501E+02	2.346E+02	4.598E+02	7.601E+02	1.586E+03	3.040E+03
700.00	2.215E+00	8.860E+00	7.974E+01	1.418E+02	2.215E+02	4.341E+02	7.177E+02	1.497E+03	2.871E+03
800.00	2.119E+00	8.475E+00	7.628E+01	1.356E+02	2.119E+02	4.153E+02	6.865E+02	1.432E+03	2.746E+03
1000.00	1.990E+00	7.961E+00	7.165E+01	1.274E+02	1.990E+02	3.901E+02	6.449E+02	1.345E+03	2.579E+03
1200.00	1.913E+00	7.652E+00	6.886E+01	1.224E+02	1.913E+02	3.749E+02	6.198E+02	1.293E+03	2.479E+03

RANGE IN CELLULOSE ACETATE BUTYRATE (GM/CM2) I = 63.4 A/Z = 1.835

ENRG./NUC. (MEV/AMU)	1 H	4 HE	12 C	16 O	20 NE	28 SI	40 AR	56 FE	84 KR
0.10	1.167E-04	1.967E-04	2.071E-04	2.221E-04	2.364E-04	2.618E-04	3.189E-04	3.623E-04	4.601E-04
0.12	1.385E-04	2.304E-04	2.361E-04	2.520E-04	2.677E-04	2.956E-04	3.582E-04	4.044E-04	5.114E-04
0.15	1.739E-04	2.817E-04	2.782E-04	2.949E-04	3.122E-04	3.442E-04	4.141E-04	4.636E-04	5.830E-04
0.20	2.399E-04	3.697E-04	3.463E-04	3.632E-04	3.822E-04	4.192E-04	5.019E-04	5.549E-04	6.922E-04
0.25	3.150E-04	4.615E-04	4.132E-04	4.291E-04	4.487E-04	4.894E-04	5.852E-04	6.402E-04	7.927E-04
0.30	3.985E-04	5.576E-04	4.799E-04	4.937E-04	5.133E-04	5.563E-04	6.657E-04	7.213E-04	8.874E-04
0.40	5.898E-04	7.629E-04	6.144E-04	6.217E-04	6.393E-04	6.842E-04	8.117E-04	8.753E-04	1.064E-03
0.50	8.120E-04	9.886E-04	7.521E-04	7.501E-04	7.637E-04	8.074E-04	9.520E-04	1.022E-03	1.230E-03
0.60	1.064E-03	1.241E-03	8.942E-04	8.804E-04	8.881E-04	9.283E-04	1.088E-03	1.165E-03	1.389E-03
0.70	1.343E-03	1.522E-03	1.041E-03	1.013E-03	1.014E-03	1.048E-03	1.220E-03	1.297E-03	1.542E-03
0.80	1.651E-03	1.829E-03	1.194E-03	1.150E-03	1.141E-03	1.168E-03	1.351E-03	1.427E-03	1.692E-03
1.00	2.345E-03	2.523E-03	1.516E-03	1.433E-03	1.403E-03	1.408E-03	1.611E-03	1.681E-03	1.983E-03
1.20	3.141E-03	3.319E-03	1.861E-03	1.732E-03	1.675E-03	1.654E-03	1.871E-03	1.929E-03	2.268E-03
1.50	4.518E-03	4.697E-03	2.424E-03	2.212E-03	2.106E-03	2.033E-03	2.266E-03	2.296E-03	2.665E-03
2.00	7.269E-03	7.447E-03	3.478E-03	3.094E-03	2.886E-03	2.700E-03	2.945E-03	2.906E-03	3.318E-03
2.50	1.053E-02	1.071E-02	4.666E-03	4.074E-03	3.740E-03	3.414E-03	3.657E-03	3.524E-03	3.959E-03
3.00	1.432E-02	1.450E-02	6.001E-03	5.162E-03	4.678E-03	4.182E-03	4.410E-03	4.161E-03	4.603E-03
3.50	1.864E-02	1.881E-02	7.484E-03	6.359E-03	5.702E-03	5.009E-03	5.210E-03	4.821E-03	5.257E-03
4.00	2.347E-02	2.365E-02	9.113E-03	7.668E-03	6.814E-03	5.895E-03	6.058E-03	5.509E-03	5.925E-03
5.00	3.468E-02	3.486E-02	1.287E-02	1.062E-02	9.305E-03	7.852E-03	7.906E-03	6.973E-03	7.314E-03
6.00	4.794E-02	4.812E-02	1.729E-02	1.403E-02	1.216E-02	1.006E-02	9.965E-03	8.565E-03	8.786E-03
7.00	6.324E-02	6.342E-02	2.239E-02	1.790E-02	1.538E-02	1.253E-02	1.224E-02	1.029E-02	1.035E-02
8.00	8.058E-02	8.076E-02	2.817E-02	2.225E-02	1.897E-02	1.526E-02	1.474E-02	1.216E-02	1.202E-02
10.00	1.212E-01	1.214E-01	4.171E-02	3.242E-02	2.725E-02	2.149E-02	2.040E-02	1.633E-02	1.566E-02
12.00	1.678E-01	1.680E-01	5.725E-02	4.408E-02	3.662E-02	2.850E-02	2.672E-02	2.092E-02	1.962E-02
15.00	2.507E-01	2.509E-01	8.487E-02	6.480E-02	5.322E-02	4.073E-02	3.766E-02	2.877E-02	2.627E-02
20.00	4.220E-01	4.221E-01	1.420E-01	1.076E-01	8.748E-02	6.556E-02	5.974E-02	4.437E-02	3.927E-02
25.00	6.331E-01	6.333E-01	2.123E-01	1.604E-01	1.297E-01	9.581E-02	8.645E-02	6.306E-02	5.462E-02
30.00	8.824E-01	8.826E-01	2.954E-01	2.227E-01	1.796E-01	1.315E-01	1.177E-01	8.473E-02	7.228E-02
35.00	1.168E+00	1.169E+00	3.908E-01	2.942E-01	2.368E-01	1.723E-01	1.532E-01	1.093E-01	9.217E-02
40.00	1.490E+00	1.490E+00	4.980E-01	3.746E-01	3.011E-01	2.183E-01	1.930E-01	1.367E-01	1.142E-01
50.00	2.235E+00	2.235E+00	7.463E-01	5.608E-01	4.501E-01	3.247E-01	2.850E-01	1.996E-01	1.647E-01
60.00	3.109E+00	3.109E+00	1.038E+00	7.794E-01	6.249E-01	4.496E-01	3.930E-01	2.728E-01	2.231E-01
70.00	4.105E+00	4.105E+00	1.370E+00	1.028E+00	8.241E-01	5.919E-01	5.159E-01	3.559E-01	2.892E-01
80.00	5.217E+00	5.217E+00	1.740E+00	1.306E+00	1.047E+00	7.507E-01	6.532E-01	4.482E-01	3.626E-01
100.00	7.767E+00	7.767E+00	2.590E+00	1.944E+00	1.557E+00	1.115E+00	9.681E-01	6.597E-01	5.300E-01
120.00	1.072E+01	1.072E+01	3.575E+00	2.682E+00	2.147E+00	1.537E+00	1.333E+00	9.045E-01	7.229E-01
150.00	1.584E+01	1.584E+01	5.281E+00	3.962E+00	3.171E+00	2.268E+00	1.965E+00	1.328E+00	1.056E+00
200.00	2.599E+01	2.599E+01	8.665E+00	6.500E+00	5.201E+00	3.718E+00	3.218E+00	2.169E+00	1.715E+00
250.00	3.789E+01	3.789E+01	1.263E+01	9.476E+00	7.582E+00	5.419E+00	4.687E+00	3.156E+00	2.486E+00
300.00	5.130E+01	5.130E+01	1.710E+01	1.283E+01	1.026E+01	7.334E+00	6.343E+00	4.266E+00	3.356E+00
400.00	8.188E+01	8.188E+01	2.730E+01	2.047E+01	1.638E+01	1.170E+01	1.012E+01	6.800E+00	5.338E+00
500.00	1.165E+02	1.165E+02	3.885E+01	2.914E+01	2.331E+01	1.665E+01	1.440E+01	9.671E+00	7.584E+00
600.00	1.544E+02	1.544E+02	5.148E+01	3.861E+01	3.089E+01	2.207E+01	1.907E+01	1.281E+01	1.004E+01
700.00	1.949E+02	1.949E+02	6.498E+01	4.873E+01	3.899E+01	2.785E+01	2.407E+01	1.616E+01	1.266E+01
800.00	2.375E+02	2.375E+02	7.918E+01	5.939E+01	4.751E+01	3.394E+01	2.933E+01	1.969E+01	1.543E+01
1000.00	3.277E+02	3.277E+02	1.092E+02	8.192E+01	6.553E+01	4.681E+01	4.046E+01	2.716E+01	2.127E+01
1200.00	4.225E+02	4.225E+02	1.408E+02	1.056E+02	8.450E+01	6.036E+01	5.217E+01	3.502E+01	2.741E+01

DE/DX IN CELLULOSE ACETATE BUTYRATE (MEV CM2/GM) I = 63.4 A/Z = 1.835

ENRG./NUC. (MEV/AMU)	1 H	4 HE	12 C	16 O	20 NE	28 SI	40 AR	56 FE	84 KR
0.10	9.429E+02	2.379E+03	8.144E+03	1.046E+04	1.245E+04	1.620E+04	1.985E+04	2.581E+04	3.160E+04
0.12	8.887E+02	2.361E+03	8.406E+03	1.092E+04	1.309E+04	1.687E+04	2.085E+04	2.739E+04	3.379E+04
0.15	8.128E+02	2.317E+03	8.675E+03	1.142E+04	1.384E+04	1.765E+04	2.204E+04	2.935E+04	3.657E+04
0.20	7.077E+02	2.227E+03	8.913E+03	1.197E+04	1.472E+04	1.939E+04	2.347E+04	3.186E+04	4.027E+04
0.25	6.305E+02	2.130E+03	8.996E+03	1.228E+04	1.528E+04	2.049E+04	2.447E+04	3.375E+04	4.318E+04
0.30	5.704E+02	2.035E+03	8.990E+03	1.245E+04	1.566E+04	2.131E+04	2.520E+04	3.523E+04	4.556E+04
0.40	4.830E+02	1.884E+03	8.833E+03	1.251E+04	1.603E+04	2.239E+04	2.788E+04	3.737E+04	4.923E+04
0.50	4.218E+02	1.673E+03	8.585E+03	1.239E+04	1.611E+04	2.299E+04	2.907E+04	3.881E+04	5.191E+04
0.60	3.761E+02	1.501E+03	8.303E+03	1.217E+04	1.601E+04	2.330E+04	2.986E+04	3.978E+04	5.395E+04
0.70	3.405E+02	1.361E+03	8.013E+03	1.189E+04	1.583E+04	2.341E+04	3.037E+04	4.229E+04	5.551E+04
0.80	3.118E+02	1.246E+03	7.729E+03	1.160E+04	1.558E+04	2.339E+04	3.067E+04	4.334E+04	5.673E+04
1.00	2.682E+02	1.073E+03	7.195E+03	1.100E+04	1.500E+04	2.309E+04	3.085E+04	4.476E+04	5.841E+04
1.20	2.388E+02	9.552E+02	6.769E+03	1.049E+04	1.447E+04	2.270E+04	3.080E+04	4.566E+04	5.953E+04
1.50	2.052E+02	8.206E+02	6.181E+03	9.729E+03	1.362E+04	2.189E+04	3.027E+04	4.619E+04	6.362E+04
2.00	1.672E+02	6.689E+02	5.382E+03	8.638E+03	1.230E+04	2.038E+04	2.890E+04	4.584E+04	6.529E+04
2.50	1.418E+02	5.670E+02	4.758E+03	7.742E+03	1.117E+04	1.891E+04	2.734E+04	4.470E+04	6.547E+04
3.00	1.233E+02	4.933E+02	4.259E+03	7.002E+03	1.019E+04	1.756E+04	2.577E+04	4.321E+04	6.480E+04
3.50	1.093E+02	4.371E+02	3.852E+03	6.384E+03	9.364E+03	1.635E+04	2.429E+04	4.158E+04	6.362E+04
4.00	9.818E+01	3.927E+02	3.509E+03	5.862E+03	8.650E+03	1.527E+04	2.291E+04	3.991E+04	6.215E+04
5.00	8.172E+01	3.269E+02	2.936E+03	5.029E+03	7.488E+03	1.345E+04	2.049E+04	3.668E+04	5.880E+04
6.00	7.004E+01	2.801E+02	2.521E+03	4.396E+03	6.589E+03	1.198E+04	1.846E+04	3.375E+04	5.533E+04
7.00	6.201E+01	2.480E+02	2.232E+03	3.945E+03	5.940E+03	1.089E+04	1.692E+04	3.141E+04	5.239E+04
8.00	5.566E+01	2.227E+02	2.002E+03	3.552E+03	5.404E+03	9.977E+03	1.560E+04	2.932E+04	4.958E+04
10.00	4.638E+01	1.855E+02	1.670E+03	2.967E+03	4.587E+03	8.552E+03	1.350E+04	2.584E+04	4.465E+04
12.00	3.991E+01	1.596E+02	1.437E+03	2.554E+03	3.979E+03	7.497E+03	1.192E+04	2.310E+04	4.053E+04
15.00	3.317E+01	1.327E+02	1.194E+03	2.123E+03	3.314E+03	6.344E+03	1.015E+04	1.995E+04	3.558E+04
20.00	2.611E+01	1.044E+02	9.399E+02	1.671E+03	2.611E+03	5.079E+03	8.189E+03	1.632E+04	2.961E+04
25.00	2.169E+01	8.678E+01	7.810E+02	1.388E+03	2.169E+03	4.245E+03	6.899E+03	1.387E+04	2.543E+04
30.00	1.866E+01	7.465E+01	6.719E+02	1.194E+03	1.866E+03	3.656E+03	5.987E+03	1.210E+04	2.236E+04
35.00	1.645E+01	6.579E+01	5.921E+02	1.053E+03	1.645E+03	3.224E+03	5.313E+03	1.077E+04	2.001E+04
40.00	1.476E+01	5.902E+01	5.312E+02	9.444E+02	1.476E+03	2.892E+03	4.773E+03	9.736E+03	1.815E+04
50.00	1.233E+01	4.934E+01	4.440E+02	7.894E+02	1.233E+03	2.418E+03	3.995E+03	8.217E+03	1.541E+04
60.00	1.068E+01	4.273E+01	3.845E+02	6.836E+02	1.068E+03	2.094E+03	3.461E+03	7.158E+03	1.347E+04
70.00	9.478E+00	3.791E+01	3.412E+02	6.066E+02	9.478E+02	1.858E+03	3.071E+03	6.377E+03	1.203E+04
80.00	8.561E+00	3.424E+01	3.082E+02	5.479E+02	8.561E+02	1.678E+03	2.773E+03	5.778E+03	1.092E+04
100.00	7.252E+00	2.901E+01	2.611E+02	4.642E+02	7.252E+02	1.421E+03	2.350E+03	4.900E+03	9.308E+03
120.00	6.361E+00	2.544E+01	2.290E+02	4.071E+02	6.361E+02	1.247E+03	2.061E+03	4.299E+03	8.194E+03
150.00	5.450E+00	2.180E+01	1.962E+02	3.488E+02	5.450E+02	1.068E+03	1.766E+03	3.684E+03	7.044E+03
200.00	4.515E+00	1.806E+01	1.625E+02	2.890E+02	4.515E+02	8.849E+02	1.463E+03	3.052E+03	5.848E+03
250.00	3.939E+00	1.576E+01	1.418E+02	2.521E+02	3.939E+02	7.721E+02	1.276E+03	2.663E+03	5.104E+03
300.00	3.548E+00	1.419E+01	1.277E+02	2.271E+02	3.548E+02	6.954E+02	1.150E+03	2.399E+03	4.598E+03
400.00	3.050E+00	1.220E+01	1.098E+02	1.952E+02	3.050E+02	5.979E+02	9.883E+02	2.062E+03	3.953E+03
500.00	2.748E+00	1.099E+01	9.892E+01	1.759E+02	2.748E+02	5.386E+02	8.903E+02	1.857E+03	3.561E+03
600.00	2.546E+00	1.018E+01	9.164E+01	1.629E+02	2.546E+02	4.989E+02	8.248E+02	1.721E+03	3.299E+03
700.00	2.402E+00	9.610E+00	8.649E+01	1.538E+02	2.402E+02	4.709E+02	7.784E+02	1.624E+03	3.114E+03
800.00	2.297E+00	9.188E+00	8.269E+01	1.470E+02	2.297E+02	4.502E+02	7.442E+02	1.553E+03	2.977E+03
1000.00	2.156E+00	8.622E+00	7.760E+01	1.380E+02	2.156E+02	4.225E+02	6.984E+02	1.457E+03	2.794E+03
1200.00	2.070E+00	8.279E+00	7.451E+01	1.325E+02	2.070E+02	4.057E+02	6.706E+02	1.399E+03	2.682E+03

RANGE IN HBPAIT (GM/CM2) I = 72.5 A/Z = 1.931

ENRG./NUC. (MEV/AMU)	1 H	4 HE	12 C	16 O	20 NE	28 SI	40 AR	56 FE	84 KR
0.10	1.314E-04	2.201E-04	2.304E-04	2.469E-04	2.627E-04	2.907E-04	3.541E-04	4.021E-04	5.105E-04
0.12	1.565E-04	2.584E-04	2.629E-04	2.803E-04	2.976E-04	3.284E-04	3.977E-04	4.489E-04	5.675E-04
0.15	1.969E-04	3.166E-04	3.100E-04	3.282E-04	3.472E-04	3.825E-04	4.599E-04	5.146E-04	6.470E-04
0.20	2.721E-04	4.161E-04	3.862E-04	4.044E-04	4.252E-04	4.659E-04	5.575E-04	6.161E-04	7.683E-04
0.25	3.570E-04	5.195E-04	4.610E-04	4.779E-04	4.993E-04	5.440E-04	6.502E-04	7.109E-04	8.800E-04
0.30	4.509E-04	6.274E-04	5.354E-04	5.500E-04	5.713E-04	6.184E-04	7.396E-04	8.010E-04	9.850E-04
0.40	6.647E-04	8.568E-04	6.851E-04	6.923E-04	7.113E-04	7.605E-04	9.018E-04	9.719E-04	1.181E-03
0.50	9.114E-04	1.107E-03	8.379E-04	8.348E-04	8.493E-04	8.973E-04	1.057E-03	1.135E-03	1.366E-03
0.60	1.189E-03	1.387E-03	9.952E-04	9.791E-04	9.872E-04	1.031E-03	1.208E-03	1.293E-03	1.541E-03
0.70	1.498E-03	1.695E-03	1.158E-03	1.126E-03	1.126E-03	1.164E-03	1.355E-03	1.439E-03	1.711E-03
0.80	1.835E-03	2.033E-03	1.326E-03	1.276E-03	1.267E-03	1.296E-03	1.500E-03	1.584E-03	1.877E-03
1.00	2.595E-03	2.793E-03	1.679E-03	1.588E-03	1.555E-03	1.562E-03	1.787E-03	1.865E-03	2.200E-03
1.20	3.464E-03	3.662E-03	2.058E-03	1.916E-03	1.854E-03	1.832E-03	2.073E-03	2.138E-03	2.515E-03
1.50	4.966E-03	5.164E-03	2.674E-03	2.442E-03	2.327E-03	2.248E-03	2.508E-03	2.543E-03	2.954E-03
2.00	7.989E-03	8.187E-03	3.834E-03	3.414E-03	3.187E-03	2.985E-03	3.258E-03	3.218E-03	3.676E-03
2.50	1.154E-02	1.173E-02	5.129E-03	4.484E-03	4.120E-03	3.767E-03	4.039E-03	3.898E-03	4.383E-03
3.00	1.566E-02	1.585E-02	6.580E-03	5.669E-03	5.144E-03	4.607E-03	4.864E-03	4.597E-03	5.092E-03
3.50	2.034E-02	2.054E-02	8.191E-03	6.972E-03	6.259E-03	5.509E-03	5.738E-03	5.321E-03	5.811E-03
4.00	2.558E-02	2.578E-02	9.958E-03	8.394E-03	7.469E-03	6.475E-03	6.664E-03	6.074E-03	6.544E-03
5.00	3.774E-02	3.794E-02	1.403E-02	1.160E-02	1.018E-02	8.606E-03	8.679E-03	7.674E-03	8.066E-03
6.00	5.210E-02	5.230E-02	1.882E-02	1.530E-02	1.327E-02	1.101E-02	1.092E-02	9.412E-03	9.677E-03
7.00	6.868E-02	6.888E-02	2.434E-02	1.949E-02	1.676E-02	1.369E-02	1.340E-02	1.130E-02	1.139E-02
8.00	8.747E-02	8.766E-02	3.061E-02	2.420E-02	2.066E-02	1.665E-02	1.612E-02	1.334E-02	1.321E-02
10.00	1.312E-01	1.314E-01	4.518E-02	3.515E-02	2.957E-02	2.338E-02	2.223E-02	1.785E-02	1.717E-02
12.00	1.814E-01	1.816E-01	6.192E-02	4.771E-02	3.967E-02	3.094E-02	2.905E-02	2.281E-02	2.145E-02
15.00	2.705E-01	2.707E-01	9.164E-02	7.000E-02	5.753E-02	4.411E-02	4.085E-02	3.129E-02	2.865E-02
20.00	4.546E-01	4.548E-01	1.530E-01	1.160E-01	9.435E-02	7.081E-02	6.460E-02	4.811E-02	4.269E-02
25.00	6.813E-01	6.815E-01	2.286E-01	1.727E-01	1.397E-01	1.033E-01	9.331E-02	6.821E-02	5.923E-02
30.00	9.488E-01	9.490E-01	3.177E-01	2.396E-01	1.932E-01	1.415E-01	1.268E-01	9.150E-02	7.823E-02
35.00	1.256E+00	1.256E+00	4.200E-01	3.162E-01	2.545E-01	1.854E-01	1.649E-01	1.179E-01	9.961E-02
40.00	1.600E+00	1.600E+00	5.349E-01	4.024E-01	3.235E-01	2.346E-01	2.076E-01	1.473E-01	1.233E-01
50.00	2.398E+00	2.399E+00	8.009E-01	6.019E-01	4.831E-01	3.486E-01	3.062E-01	2.147E-01	1.774E-01
60.00	3.334E+00	3.335E+00	1.113E+00	8.360E-01	6.703E-01	4.824E-01	4.218E-01	2.931E-01	2.401E-01
70.00	4.401E+00	4.401E+00	1.468E+00	1.103E+00	8.836E-01	6.347E-01	5.535E-01	3.821E-01	3.110E-01
80.00	5.591E+00	5.591E+00	1.865E+00	1.400E+00	1.122E+00	8.048E-01	7.005E-01	4.810E-01	3.896E-01
100.00	8.320E+00	8.320E+00	2.775E+00	2.082E+00	1.667E+00	1.195E+00	1.037E+00	7.073E-01	5.687E-01
120.00	1.148E+01	1.148E+01	3.828E+00	2.872E+00	2.299E+00	1.646E+00	1.427E+00	9.691E-01	7.752E-01
150.00	1.695E+01	1.695E+01	5.653E+00	4.241E+00	3.394E+00	2.428E+00	2.103E+00	1.423E+00	1.132E+00
200.00	2.781E+01	2.781E+01	9.271E+00	6.954E+00	5.565E+00	3.979E+00	3.443E+00	2.322E+00	1.836E+00
250.00	4.053E+01	4.053E+01	1.351E+01	1.014E+01	8.110E+00	5.796E+00	5.014E+00	3.376E+00	2.661E+00
300.00	5.486E+01	5.486E+01	1.829E+01	1.372E+01	1.098E+01	7.844E+00	6.783E+00	4.563E+00	3.590E+00
400.00	8.754E+01	8.754E+01	2.918E+01	2.189E+01	1.751E+01	1.251E+01	1.082E+01	7.270E+00	5.707E+00
500.00	1.246E+02	1.246E+02	4.152E+01	3.114E+01	2.491E+01	1.780E+01	1.539E+01	1.034E+01	8.107E+00
600.00	1.650E+02	1.650E+02	5.501E+01	4.126E+01	3.301E+01	2.358E+01	2.038E+01	1.369E+01	1.073E+01
700.00	2.082E+02	2.082E+02	6.941E+01	5.206E+01	4.165E+01	2.975E+01	2.572E+01	1.727E+01	1.353E+01
800.00	2.537E+02	2.537E+02	8.457E+01	6.343E+01	5.075E+01	3.625E+01	3.133E+01	2.104E+01	1.648E+01
1000.00	3.498E+02	3.498E+02	1.166E+02	8.746E+01	6.997E+01	4.998E+01	4.320E+01	2.900E+01	2.271E+01
1200.00	4.509E+02	4.509E+02	1.503E+02	1.127E+02	9.019E+01	6.443E+01	5.568E+01	3.737E+01	2.926E+01

DE/DX IN HBPAIT (MEV CM2/GM) I = 72.5 A/Z = 1.931

ENRG./NUC. (MEV/AMU)	1 H	4 HE	12 C	16 O	20 NE	28 SI	40 AR	56 FE	84 KR
0.10	8.193E+02	2.095E+03	7.276E+03	9.369E+03	1.117E+04	1.455E+04	1.785E+04	2.323E+04	2.846E+04
0.12	7.745E+02	2.081E+03	7.510E+03	9.774E+03	1.174E+04	1.516E+04	1.875E+04	2.465E+04	3.043E+04
0.15	7.116E+02	2.046E+03	7.751E+03	1.023E+04	1.241E+04	1.586E+04	1.981E+04	2.641E+04	3.293E+04
0.20	6.239E+02	1.973E+03	7.972E+03	1.073E+04	1.320E+04	1.742E+04	2.111E+04	2.867E+04	3.626E+04
0.25	5.592E+02	1.894E+03	8.057E+03	1.101E+04	1.372E+04	1.842E+04	2.202E+04	3.038E+04	3.889E+04
0.30	5.083E+02	1.816E+03	8.063E+03	1.117E+04	1.407E+04	1.916E+04	2.268E+04	3.173E+04	4.104E+04
0.40	4.337E+02	1.692E+03	7.947E+03	1.126E+04	1.443E+04	2.016E+04	2.511E+04	3.367E+04	4.436E+04
0.50	3.809E+02	1.510E+03	7.746E+03	1.118E+04	1.453E+04	2.074E+04	2.622E+04	3.499E+04	4.680E+04
0.60	3.410E+02	1.361E+03	7.511E+03	1.100E+04	1.447E+04	2.104E+04	2.696E+04	3.589E+04	4.866E+04
0.70	3.097E+02	1.238E+03	7.266E+03	1.078E+04	1.433E+04	2.117E+04	2.744E+04	3.818E+04	5.009E+04
0.80	2.843E+02	1.136E+03	7.022E+03	1.053E+04	1.412E+04	2.117E+04	2.774E+04	3.916E+04	5.122E+04
1.00	2.454E+02	9.814E+02	6.557E+03	1.001E+04	1.363E+04	2.094E+04	2.795E+04	4.049E+04	5.278E+04
1.20	2.180E+02	8.721E+02	6.163E+03	9.535E+03	1.314E+04	2.059E+04	2.790E+04	4.131E+04	5.379E+04
1.50	1.878E+02	7.513E+02	5.644E+03	8.871E+03	1.240E+04	1.989E+04	2.748E+04	4.185E+04	5.756E+04
2.00	1.535E+02	6.141E+02	4.932E+03	7.902E+03	1.124E+04	1.858E+04	2.631E+04	4.162E+04	5.917E+04
2.50	1.304E+02	5.215E+02	4.370E+03	7.099E+03	1.023E+04	1.728E+04	2.494E+04	4.067E+04	5.944E+04
3.00	1.136E+02	4.542E+02	3.919E+03	6.432E+03	9.353E+03	1.608E+04	2.355E+04	3.938E+04	5.891E+04
3.50	1.007E+02	4.028E+02	3.549E+03	5.872E+03	8.603E+03	1.499E+04	2.223E+04	3.794E+04	5.792E+04
4.00	9.054E+01	3.622E+02	3.235E+03	5.397E+03	7.955E+03	1.402E+04	2.100E+04	3.647E+04	5.664E+04
5.00	7.541E+01	3.016E+02	2.709E+03	4.636E+03	6.896E+03	1.236E+04	1.881E+04	3.358E+04	5.369E+04
6.00	6.489E+01	2.596E+02	2.335E+03	4.071E+03	6.095E+03	1.106E+04	1.702E+04	3.102E+04	5.072E+04
7.00	5.742E+01	2.297E+02	2.067E+03	3.652E+03	5.494E+03	1.006E+04	1.560E+04	2.889E+04	4.805E+04
8.00	5.159E+01	2.063E+02	1.856E+03	3.291E+03	5.005E+03	9.224E+03	1.441E+04	2.700E+04	4.555E+04
10.00	4.304E+01	1.722E+02	1.550E+03	2.753E+03	4.255E+03	7.923E+03	1.249E+04	2.386E+04	4.112E+04
12.00	3.707E+01	1.483E+02	1.335E+03	2.372E+03	3.695E+03	6.955E+03	1.104E+04	2.136E+04	3.740E+04
15.00	3.084E+01	1.234E+02	1.110E+03	1.974E+03	3.082E+03	5.894E+03	9.426E+03	1.849E+04	3.291E+04
20.00	2.431E+01	9.723E+01	8.751E+02	1.556E+03	2.430E+03	4.728E+03	7.616E+03	1.515E+04	2.745E+04
25.00	2.021E+01	8.086E+01	7.277E+02	1.294E+03	2.021E+03	3.955E+03	6.424E+03	1.290E+04	2.362E+04
30.00	1.740E+01	6.960E+01	6.264E+02	1.114E+03	1.740E+03	3.409E+03	5.579E+03	1.127E+04	2.079E+04
35.00	1.534E+01	6.137E+01	5.523E+02	9.818E+02	1.534E+03	3.007E+03	4.955E+03	1.004E+04	1.862E+04
40.00	1.377E+01	5.507E+01	4.956E+02	8.811E+02	1.377E+03	2.698E+03	4.453E+03	9.076E+03	1.691E+04
50.00	1.151E+01	4.606E+01	4.145E+02	7.369E+02	1.151E+03	2.257E+03	3.729E+03	7.667E+03	1.436E+04
60.00	9.975E+00	3.990E+01	3.591E+02	6.384E+02	9.975E+02	1.955E+03	3.232E+03	6.683E+03	1.257E+04
70.00	8.854E+00	3.541E+01	3.187E+02	5.666E+02	8.854E+02	1.735E+03	2.868E+03	5.956E+03	1.123E+04
80.00	7.999E+00	3.199E+01	2.880E+02	5.119E+02	7.999E+02	1.568E+03	2.591E+03	5.398E+03	1.020E+04
100.00	6.778E+00	2.711E+01	2.440E+02	4.338E+02	6.778E+02	1.329E+03	2.196E+03	4.579E+03	8.696E+03
120.00	5.946E+00	2.379E+01	2.141E+02	3.806E+02	5.946E+02	1.165E+03	1.927E+03	4.019E+03	7.659E+03
150.00	5.096E+00	2.038E+01	1.835E+02	3.262E+02	5.096E+02	9.988E+02	1.651E+03	3.445E+03	6.586E+03
200.00	4.223E+00	1.689E+01	1.520E+02	2.703E+02	4.223E+02	8.277E+02	1.368E+03	2.854E+03	5.470E+03
250.00	3.686E+00	1.474E+01	1.327E+02	2.359E+02	3.686E+02	7.224E+02	1.194E+03	2.491E+03	4.776E+03
300.00	3.320E+00	1.328E+01	1.195E+02	2.125E+02	3.320E+02	6.508E+02	1.076E+03	2.245E+03	4.303E+03
400.00	2.856E+00	1.142E+01	1.028E+02	1.828E+02	2.856E+02	5.597E+02	9.252E+02	1.930E+03	3.701E+03
500.00	2.573E+00	1.029E+01	9.263E+01	1.647E+02	2.573E+02	5.043E+02	8.336E+02	1.739E+03	3.334E+03
600.00	2.384E+00	9.538E+00	8.584E+01	1.526E+02	2.384E+02	4.673E+02	7.725E+02	1.612E+03	3.090E+03
700.00	2.251E+00	9.004E+00	8.103E+01	1.441E+02	2.251E+02	4.412E+02	7.293E+02	1.522E+03	2.917E+03
800.00	2.153E+00	8.611E+00	7.750E+01	1.378E+02	2.153E+02	4.219E+02	6.975E+02	1.455E+03	2.790E+03
1000.00	2.021E+00	8.085E+00	7.276E+01	1.294E+02	2.021E+02	3.962E+02	6.549E+02	1.366E+03	2.620E+03
1200.00	1.942E+00	7.767E+00	6.991E+01	1.243E+02	1.942E+02	3.806E+02	6.292E+02	1.313E+03	2.517E+03

RANGE IN LEXAN (GM/CM2) I = 69.5 A/Z = 1.896

ENRG./NUC. (MEV/AMU)	1 H	4 HE	12 C	16 O	20 NE	28 SI	40 AR	56 FE	84 KR
0.10	1.263E-04	2.120E-04	2.223E-04	2.382E-04	2.536E-04	2.807E-04	3.419E-04	3.883E-04	4.930E-04
0.12	1.503E-04	2.487E-04	2.536E-04	2.704E-04	2.872E-04	3.170E-04	3.840E-04	4.334E-04	5.480E-04
0.15	1.890E-04	3.045E-04	2.989E-04	3.166E-04	3.351E-04	3.692E-04	4.440E-04	4.969E-04	6.248E-04
0.20	2.610E-04	4.000E-04	3.723E-04	3.901E-04	4.102E-04	4.497E-04	5.382E-04	5.949E-04	7.418E-04
0.25	3.425E-04	4.994E-04	4.444E-04	4.609E-04	4.818E-04	5.250E-04	6.276E-04	6.863E-04	8.496E-04
0.30	4.328E-04	6.032E-04	5.161E-04	5.304E-04	5.511E-04	5.968E-04	7.139E-04	7.733E-04	9.510E-04
0.40	6.388E-04	8.243E-04	6.605E-04	6.678E-04	6.863E-04	7.340E-04	8.704E-04	9.383E-04	1.141E-03
0.50	8.770E-04	1.066E-03	8.081E-04	8.054E-04	8.196E-04	8.660E-04	1.021E-03	1.096E-03	1.318E-03
0.60	1.146E-03	1.336E-03	9.601E-04	9.448E-04	9.527E-04	9.954E-04	1.166E-03	1.248E-03	1.488E-03
0.70	1.444E-03	1.635E-03	1.117E-03	1.087E-03	1.087E-03	1.124E-03	1.308E-03	1.390E-03	1.653E-03
0.80	1.771E-03	1.962E-03	1.280E-03	1.232E-03	1.223E-03	1.251E-03	1.448E-03	1.529E-03	1.813E-03
1.00	2.508E-03	2.699E-03	1.623E-03	1.534E-03	1.502E-03	1.508E-03	1.726E-03	1.801E-03	2.125E-03
1.20	3.352E-03	3.543E-03	1.990E-03	1.852E-03	1.792E-03	1.770E-03	2.003E-03	2.066E-03	2.429E-03
1.50	4.810E-03	5.002E-03	2.587E-03	2.362E-03	2.250E-03	2.173E-03	2.424E-03	2.457E-03	2.853E-03
2.00	7.738E-03	7.929E-03	3.710E-03	3.303E-03	3.082E-03	2.886E-03	3.149E-03	3.109E-03	3.551E-03
2.50	1.118E-02	1.137E-02	4.967E-03	4.341E-03	3.988E-03	3.644E-03	3.906E-03	3.768E-03	4.235E-03
3.00	1.519E-02	1.538E-02	6.378E-03	5.492E-03	4.981E-03	4.459E-03	4.706E-03	4.445E-03	4.922E-03
3.50	1.974E-02	1.993E-02	7.944E-03	6.758E-03	6.065E-03	5.334E-03	5.554E-03	5.147E-03	5.618E-03
4.00	2.484E-02	2.503E-02	9.662E-03	8.140E-03	7.240E-03	6.273E-03	6.453E-03	5.877E-03	6.328E-03
5.00	3.667E-02	3.686E-02	1.362E-02	1.126E-02	9.871E-03	8.342E-03	8.409E-03	7.430E-03	7.804E-03
6.00	5.064E-02	5.084E-02	1.828E-02	1.486E-02	1.288E-02	1.068E-02	1.059E-02	9.117E-03	9.367E-03
7.00	6.677E-02	6.696E-02	2.366E-02	1.893E-02	1.628E-02	1.328E-02	1.299E-02	1.095E-02	1.103E-02
8.00	8.505E-02	8.524E-02	2.976E-02	2.352E-02	2.007E-02	1.617E-02	1.563E-02	1.293E-02	1.290E-02
10.00	1.277E-01	1.279E-01	4.397E-02	3.419E-02	2.876E-02	2.272E-02	2.159E-02	1.732E-02	1.654E-02
12.00	1.766E-01	1.768E-01	6.029E-02	4.643E-02	3.860E-02	3.009E-02	2.823E-02	2.215E-02	2.081E-02
15.00	2.636E-01	2.638E-01	8.926E-02	6.817E-02	5.601E-02	4.292E-02	3.974E-02	3.041E-02	2.782E-02
20.00	4.432E-01	4.433E-01	1.491E-01	1.131E-01	9.194E-02	6.897E-02	6.290E-02	4.680E-02	4.149E-02
25.00	6.644E-01	6.645E-01	2.229E-01	1.684E-01	1.362E-01	1.007E-01	9.090E-02	6.640E-02	5.762E-02
30.00	9.254E-01	9.256E-01	3.099E-01	2.336E-01	1.884E-01	1.380E-01	1.236E-01	8.912E-02	7.614E-02
35.00	1.225E+00	1.225E+00	4.097E-01	3.085E-01	2.483E-01	1.808E-01	1.608E-01	1.149E-01	9.700E-02
40.00	1.561E+00	1.562E+00	5.219E-01	3.926E-01	3.156E-01	2.289E-01	2.025E-01	1.435E-01	1.201E-01
50.00	2.341E+00	2.341E+00	7.817E-01	5.875E-01	4.715E-01	3.402E-01	2.988E-01	2.094E-01	1.729E-01
60.00	3.255E+00	3.255E+00	1.086E+00	8.160E-01	6.543E-01	4.708E-01	4.116E-01	2.860E-01	2.341E-01
70.00	4.297E+00	4.297E+00	1.434E+00	1.076E+00	8.626E-01	6.196E-01	5.403E-01	3.729E-01	3.033E-01
80.00	5.459E+00	5.460E+00	1.821E+00	1.367E+00	1.095E+00	7.857E-01	6.838E-01	4.695E-01	3.801E-01
100.00	8.125E+00	8.125E+00	2.710E+00	2.034E+00	1.628E+00	1.167E+00	1.013E+00	6.905E-01	5.551E-01
120.00	1.121E+01	1.121E+01	3.739E+00	2.805E+00	2.246E+00	1.608E+00	1.394E+00	9.463E-01	7.568E-01
150.00	1.656E+01	1.656E+01	5.522E+00	4.142E+00	3.315E+00	2.372E+00	2.054E+00	1.389E+00	1.105E+00
200.00	2.717E+01	2.717E+01	9.057E+00	6.794E+00	5.437E+00	3.887E+00	3.364E+00	2.268E+00	1.793E+00
250.00	3.960E+01	3.960E+01	1.320E+01	9.903E+00	7.924E+00	5.663E+00	4.899E+00	3.298E+00	2.599E+00
300.00	5.361E+01	5.361E+01	1.787E+01	1.340E+01	1.072E+01	7.664E+00	6.628E+00	4.458E+00	3.507E+00
400.00	8.554E+01	8.554E+01	2.851E+01	2.139E+01	1.711E+01	1.223E+01	1.057E+01	7.104E+00	5.577E+00
500.00	1.217E+02	1.217E+02	4.058E+01	3.043E+01	2.435E+01	1.739E+01	1.504E+01	1.010E+01	7.922E+00
600.00	1.613E+02	1.613E+02	5.376E+01	4.032E+01	3.226E+01	2.305E+01	1.992E+01	1.338E+01	1.049E+01
700.00	2.035E+02	2.035E+02	6.785E+01	5.089E+01	4.071E+01	2.908E+01	2.514E+01	1.688E+01	1.322E+01
800.00	2.480E+02	2.480E+02	8.267E+01	6.200E+01	4.960E+01	3.543E+01	3.063E+01	2.056E+01	1.611E+01
1000.00	3.420E+02	3.420E+02	1.140E+02	8.550E+01	6.840E+01	4.886E+01	4.223E+01	2.835E+01	2.220E+01
1200.00	4.409E+02	4.409E+02	1.470E+02	1.102E+02	8.818E+01	6.299E+01	5.444E+01	3.654E+01	2.861E+01

DE/DX IN LEXAN (MEV CM2/GM) I = 69.5 A/Z = 1.896

ENRG./NUC. (MEV/AMU)	1 H	4 HE	12 C	16 O	20 NE	28 SI	40 AR	56 FE	84 KR
0.10	8.582E+02	2.185E+03	7.555E+03	9.721E+03	1.158E+04	1.508E+04	1.850E+04	2.407E+04	2.948E+04
0.12	8.105E+02	2.170E+03	7.799E+03	1.014E+04	1.218E+04	1.571E+04	1.943E+04	2.554E+04	3.152E+04
0.15	7.437E+02	2.133E+03	8.049E+03	1.062E+04	1.288E+04	1.644E+04	2.053E+04	2.736E+04	3.411E+04
0.20	6.506E+02	2.054E+03	8.275E+03	1.113E+04	1.369E+04	1.806E+04	2.188E+04	2.971E+04	3.756E+04
0.25	5.820E+02	1.969E+03	8.360E+03	1.142E+04	1.423E+04	1.909E+04	2.281E+04	3.148E+04	4.028E+04
0.30	5.283E+02	1.887E+03	8.363E+03	1.159E+04	1.458E+04	1.986E+04	2.349E+04	3.286E+04	4.251E+04
0.40	4.496E+02	1.754E+03	8.234E+03	1.167E+04	1.495E+04	2.088E+04	2.601E+04	3.487E+04	4.594E+04
0.50	3.941E+02	1.563E+03	8.018E+03	1.157E+04	1.504E+04	2.147E+04	2.714E+04	3.623E+04	4.846E+04
0.60	3.524E+02	1.407E+03	7.769E+03	1.138E+04	1.497E+04	2.178E+04	2.790E+04	3.715E+04	5.037E+04
0.70	3.197E+02	1.278E+03	7.510E+03	1.114E+04	1.481E+04	2.190E+04	2.839E+04	3.952E+04	5.185E+04
0.80	2.933E+02	1.172E+03	7.253E+03	1.088E+04	1.460E+04	2.190E+04	2.869E+04	4.052E+04	5.301E+04
1.00	2.529E+02	1.011E+03	6.766E+03	1.033E+04	1.408E+04	2.164E+04	2.890E+04	4.188E+04	5.462E+04
1.20	2.249E+02	8.995E+02	6.362E+03	9.846E+03	1.358E+04	2.128E+04	2.885E+04	4.273E+04	5.566E+04
1.50	1.935E+02	7.742E+02	5.821E+03	9.153E+03	1.280E+04	2.055E+04	2.839E+04	4.326E+04	5.953E+04
2.00	1.581E+02	6.323E+02	5.081E+03	8.145E+03	1.159E+04	1.917E+04	2.716E+04	4.300E+04	6.117E+04
2.50	1.342E+02	5.366E+02	4.499E+03	7.312E+03	1.054E+04	1.782E+04	2.573E+04	4.199E+04	6.141E+04
3.00	1.168E+02	4.672E+02	4.032E+03	6.621E+03	9.631E+03	1.657E+04	2.429E+04	4.064E+04	6.084E+04
3.50	1.036E+02	4.142E+02	3.649E+03	6.042E+03	8.855E+03	1.544E+04	2.291E+04	3.914E+04	5.979E+04
4.00	9.308E+01	3.723E+02	3.326E+03	5.551E+03	8.185E+03	1.443E+04	2.163E+04	3.760E+04	5.845E+04
5.00	7.751E+01	3.100E+02	2.785E+03	4.767E+03	7.093E+03	1.272E+04	1.936E+04	3.461E+04	5.537E+04
6.00	6.654E+01	2.666E+02	2.398E+03	4.181E+03	6.263E+03	1.137E+04	1.750E+04	3.194E+04	5.226E+04
7.00	5.895E+01	2.358E+02	2.122E+03	3.750E+03	5.643E+03	1.033E+04	1.604E+04	2.972E+04	4.948E+04
8.00	5.295E+01	2.118E+02	1.905E+03	3.378E+03	5.138E+03	9.474E+03	1.480E+04	2.777E+04	4.688E+04
10.00	4.416E+01	1.766E+02	1.590E+03	2.825E+03	4.366E+03	8.133E+03	1.283E+04	2.452E+04	4.229E+04
12.00	3.802E+01	1.521E+02	1.369E+03	2.433E+03	3.790E+03	7.136E+03	1.134E+04	2.194E+04	3.844E+04
15.00	3.162E+01	1.265E+02	1.138E+03	2.024E+03	3.160E+03	6.045E+03	9.670E+03	1.898E+04	3.380E+04
20.00	2.491E+01	9.965E+01	8.969E+02	1.594E+03	2.491E+03	4.846E+03	7.809E+03	1.554E+04	2.817E+04
25.00	2.071E+01	8.285E+01	7.456E+02	1.326E+03	2.071E+03	4.053E+03	6.584E+03	1.322E+04	2.423E+04
30.00	1.783E+01	7.130E+01	6.417E+02	1.141E+03	1.783E+03	3.492E+03	5.716E+03	1.155E+04	2.132E+04
35.00	1.571E+01	6.286E+01	5.657E+02	1.006E+03	1.571E+03	3.080E+03	5.075E+03	1.029E+04	1.909E+04
40.00	1.410E+01	5.640E+01	5.076E+02	9.024E+02	1.410E+03	2.763E+03	4.561E+03	9.298E+03	1.733E+04
50.00	1.179E+01	4.716E+01	4.245E+02	7.546E+02	1.179E+03	2.311E+03	3.819E+03	7.852E+03	1.472E+04
60.00	1.021E+01	4.085E+01	3.677E+02	6.537E+02	1.021E+03	2.002E+03	3.309E+03	6.843E+03	1.287E+04
70.00	9.064E+00	3.626E+01	3.263E+02	5.801E+02	9.064E+02	1.777E+03	2.937E+03	6.098E+03	1.150E+04
80.00	8.189E+00	3.275E+01	2.948E+02	5.241E+02	8.189E+02	1.605E+03	2.653E+03	5.526E+03	1.044E+04
100.00	6.938E+00	2.775E+01	2.498E+02	4.441E+02	6.938E+02	1.360E+03	2.248E+03	4.688E+03	8.903E+03
120.00	6.086E+00	2.435E+01	2.191E+02	3.895E+02	6.086E+02	1.193E+03	1.972E+03	4.114E+03	7.839E+03
150.00	5.216E+00	2.086E+01	1.878E+02	3.338E+02	5.216E+02	1.022E+03	1.690E+03	3.526E+03	6.741E+03
200.00	4.322E+00	1.729E+01	1.556E+02	2.766E+02	4.322E+02	8.471E+02	1.400E+03	2.921E+03	5.598E+03
250.00	3.771E+00	1.509E+01	1.358E+02	2.414E+02	3.771E+02	7.392E+02	1.222E+03	2.549E+03	4.887E+03
300.00	3.397E+00	1.359E+01	1.223E+02	2.174E+02	3.397E+02	6.659E+02	1.101E+03	2.297E+03	4.403E+03
400.00	2.921E+00	1.169E+01	1.052E+02	1.870E+02	2.921E+02	5.726E+02	9.466E+02	1.975E+03	3.786E+03
500.00	2.632E+00	1.053E+01	9.476E+01	1.685E+02	2.632E+02	5.159E+02	8.528E+02	1.779E+03	3.411E+03
600.00	2.439E+00	9.756E+00	8.780E+01	1.561E+02	2.439E+02	4.780E+02	7.902E+02	1.649E+03	3.161E+03
700.00	2.302E+00	9.209E+00	8.288E+01	1.473E+02	2.302E+02	4.512E+02	7.459E+02	1.556E+03	2.984E+03
800.00	2.202E+00	8.806E+00	7.926E+01	1.409E+02	2.202E+02	4.315E+02	7.133E+02	1.488E+03	2.853E+03
1000.00	2.067E+00	8.267E+00	7.441E+01	1.323E+02	2.067E+02	4.051E+02	6.696E+02	1.397E+03	2.679E+03
1200.00	1.985E+00	7.941E+00	7.147E+01	1.271E+02	1.985E+02	3.891E+02	6.432E+02	1.342E+03	2.573E+03

RANGE IN MYLAR (GM/CM2) I = 73.2 A/Z = 1.915

ENRG./NUC. (MEV/AMU)	1 H	4 HE	12 C	16 O	20 NE	28 SI	40 AR	56 FE	84 KR
0.10	1.310E-04	2.193E-04	2.295E-04	2.458E-04	2.616E-04	2.895E-04	3.525E-04	4.004E-04	5.083E-04
0.12	1.560E-04	2.575E-04	2.618E-04	2.791E-04	2.963E-04	3.270E-04	3.960E-04	4.469E-04	5.651E-04
0.15	1.964E-04	3.155E-04	3.087E-04	3.268E-04	3.458E-04	3.809E-04	4.580E-04	5.124E-04	6.442E-04
0.20	2.714E-04	4.147E-04	3.846E-04	4.027E-04	4.234E-04	4.640E-04	5.551E-04	6.135E-04	7.650E-04
0.25	3.560E-04	5.178E-04	4.591E-04	4.760E-04	4.973E-04	5.417E-04	6.474E-04	7.078E-04	8.762E-04
0.30	4.496E-04	6.253E-04	5.332E-04	5.477E-04	5.689E-04	6.158E-04	7.365E-04	7.975E-04	9.808E-04
0.40	6.626E-04	8.538E-04	6.823E-04	6.895E-04	7.084E-04	7.573E-04	8.979E-04	9.678E-04	1.176E-03
0.50	9.082E-04	1.103E-03	8.345E-04	8.314E-04	8.458E-04	8.935E-04	1.053E-03	1.130E-03	1.360E-03
0.60	1.185E-03	1.381E-03	9.911E-04	9.750E-04	9.830E-04	1.027E-03	1.203E-03	1.287E-03	1.535E-03
0.70	1.492E-03	1.688E-03	1.153E-03	1.121E-03	1.121E-03	1.159E-03	1.349E-03	1.433E-03	1.704E-03
0.80	1.827E-03	2.024E-03	1.320E-03	1.271E-03	1.261E-03	1.290E-03	1.493E-03	1.577E-03	1.869E-03
1.00	2.583E-03	2.780E-03	1.672E-03	1.581E-03	1.548E-03	1.555E-03	1.779E-03	1.856E-03	2.190E-03
1.20	3.447E-03	3.645E-03	2.048E-03	1.907E-03	1.846E-03	1.823E-03	2.064E-03	2.129E-03	2.504E-03
1.50	4.941E-03	5.138E-03	2.661E-03	2.430E-03	2.316E-03	2.238E-03	2.496E-03	2.532E-03	2.941E-03
2.00	7.948E-03	8.146E-03	3.815E-03	3.398E-03	3.172E-03	2.971E-03	3.244E-03	3.203E-03	3.659E-03
2.50	1.147E-02	1.167E-02	5.103E-03	4.461E-03	4.100E-03	3.749E-03	4.020E-03	3.880E-03	4.363E-03
3.00	1.557E-02	1.577E-02	6.546E-03	5.640E-03	5.118E-03	4.584E-03	4.841E-03	4.575E-03	5.069E-03
3.50	2.023E-02	2.042E-02	8.147E-03	6.935E-03	6.227E-03	5.481E-03	5.710E-03	5.296E-03	5.784E-03
4.00	2.544E-02	2.563E-02	9.903E-03	8.348E-03	7.430E-03	6.442E-03	6.631E-03	6.044E-03	6.513E-03
5.00	3.752E-02	3.771E-02	1.395E-02	1.154E-02	1.012E-02	8.560E-03	8.635E-03	7.636E-03	8.027E-03
6.00	5.179E-02	5.199E-02	1.871E-02	1.521E-02	1.320E-02	1.095E-02	1.086E-02	9.365E-03	9.630E-03
7.00	6.826E-02	6.846E-02	2.420E-02	1.937E-02	1.667E-02	1.361E-02	1.333E-02	1.124E-02	1.133E-02
8.00	8.694E-02	8.713E-02	3.043E-02	2.406E-02	2.054E-02	1.656E-02	1.603E-02	1.326E-02	1.314E-02
10.00	1.304E-01	1.305E-01	4.490E-02	3.493E-02	2.939E-02	2.324E-02	2.210E-02	1.775E-02	1.707E-02
12.00	1.802E-01	1.804E-01	6.153E-02	4.741E-02	3.942E-02	3.075E-02	2.888E-02	2.268E-02	2.134E-02
15.00	2.688E-01	2.690E-01	9.104E-02	6.955E-02	5.716E-02	4.383E-02	4.060E-02	3.111E-02	2.849E-02
20.00	4.516E-01	4.518E-01	1.520E-01	1.153E-01	9.373E-02	7.035E-02	6.419E-02	4.781E-02	4.243E-02
25.00	6.767E-01	6.769E-01	2.270E-01	1.715E-01	1.388E-01	1.026E-01	9.271E-02	6.778E-02	5.887E-02
30.00	9.423E-01	9.425E-01	3.156E-01	2.379E-01	1.919E-01	1.406E-01	1.260E-01	9.091E-02	7.774E-02
35.00	1.247E+00	1.247E+00	4.171E-01	3.141E-01	2.528E-01	1.841E-01	1.638E-01	1.171E-01	9.897E-02
40.00	1.589E+00	1.589E+00	5.312E-01	3.996E-01	3.212E-01	2.330E-01	2.062E-01	1.463E-01	1.225E-01
50.00	2.382E+00	2.382E+00	7.953E-01	5.978E-01	4.797E-01	3.462E-01	3.041E-01	2.132E-01	1.763E-01
60.00	3.311E+00	3.311E+00	1.105E+00	8.301E-01	6.656E-01	4.790E-01	4.189E-01	2.911E-01	2.385E-01
70.00	4.370E+00	4.370E+00	1.458E+00	1.095E+00	8.774E-01	6.303E-01	5.496E-01	3.795E-01	3.088E-01
80.00	5.552E+00	5.552E+00	1.852E+00	1.390E+00	1.114E+00	7.991E-01	6.955E-01	4.776E-01	3.869E-01
100.00	8.261E+00	8.261E+00	2.755E+00	2.068E+00	1.656E+00	1.186E+00	1.030E+00	7.023E-01	5.648E-01
120.00	1.140E+01	1.140E+01	3.801E+00	2.852E+00	2.283E+00	1.634E+00	1.417E+00	9.623E-01	7.697E-01
150.00	1.683E+01	1.683E+01	5.612E+00	4.210E+00	3.370E+00	2.411E+00	2.088E+00	1.412E+00	1.123E+00
200.00	2.761E+01	2.761E+01	9.204E+00	6.904E+00	5.525E+00	3.950E+00	3.419E+00	2.305E+00	1.823E+00
250.00	4.024E+01	4.024E+01	1.341E+01	1.006E+01	8.052E+00	5.755E+00	4.978E+00	3.352E+00	2.642E+00
300.00	5.447E+01	5.447E+01	1.816E+01	1.362E+01	1.090E+01	7.787E+00	6.734E+00	4.530E+00	3.564E+00
400.00	8.690E+01	8.690E+01	2.897E+01	2.173E+01	1.738E+01	1.242E+01	1.074E+01	7.217E+00	5.666E+00
500.00	1.236E+02	1.236E+02	4.122E+01	3.091E+01	2.473E+01	1.767E+01	1.527E+01	1.026E+01	8.048E+00
600.00	1.638E+02	1.638E+02	5.460E+01	4.095E+01	3.276E+01	2.341E+01	2.023E+01	1.359E+01	1.065E+01
700.00	2.067E+02	2.067E+02	6.891E+01	5.168E+01	4.135E+01	2.954E+01	2.553E+01	1.714E+01	1.343E+01
800.00	2.518E+02	2.518E+02	8.395E+01	6.296E+01	5.037E+01	3.598E+01	3.110E+01	2.088E+01	1.636E+01
1000.00	3.473E+02	3.473E+02	1.158E+02	8.682E+01	6.946E+01	4.961E+01	4.288E+01	2.879E+01	2.254E+01
1200.00	4.476E+02	4.476E+02	1.492E+02	1.119E+02	8.953E+01	6.395E+01	5.527E+01	3.710E+01	2.905E+01

DE/DX IN MYLAR (MEV CM2/GM) I = 73.2 A/Z = 1.915

ENRG./NUC. (MEV/AMU)	1 H	4 HE	12 C	16 O	20 NE	28 SI	40 AR	56 FE	84 KR
0.10	8.205E+02	2.100E+03	7.302E+03	9.405E+03	1.121E+04	1.461E+04	1.793E+04	2.333E+04	2.858E+04
0.12	7.758E+02	2.086E+03	7.537E+03	9.812E+03	1.179E+04	1.522E+04	1.882E+04	2.476E+04	3.056E+04
0.15	7.131E+02	2.052E+03	7.780E+03	1.027E+04	1.246E+04	1.592E+04	1.990E+04	2.652E+04	3.307E+04
0.20	6.256E+02	1.978E+03	8.002E+03	1.077E+04	1.326E+04	1.750E+04	2.120E+04	2.880E+04	3.642E+04
0.25	5.609E+02	1.900E+03	8.088E+03	1.106E+04	1.378E+04	1.849E+04	2.211E+04	3.051E+04	3.906E+04
0.30	5.101E+02	1.823E+03	8.095E+03	1.122E+04	1.413E+04	1.924E+04	2.277E+04	3.186E+04	4.122E+04
0.40	4.355E+02	1.699E+03	7.980E+03	1.131E+04	1.449E+04	2.025E+04	2.522E+04	3.382E+04	4.455E+04
0.50	3.826E+02	1.517E+03	7.780E+03	1.123E+04	1.459E+04	2.083E+04	2.633E+04	3.514E+04	4.701E+04
0.60	3.427E+02	1.368E+03	7.546E+03	1.105E+04	1.454E+04	2.114E+04	2.708E+04	3.605E+04	4.887E+04
0.70	3.113E+02	1.245E+03	7.301E+03	1.083E+04	1.439E+04	2.127E+04	2.757E+04	3.835E+04	5.032E+04
0.80	2.858E+02	1.142E+03	7.057E+03	1.058E+04	1.419E+04	2.127E+04	2.787E+04	3.933E+04	5.145E+04
1.00	2.467E+02	9.869E+02	6.591E+03	1.006E+04	1.370E+04	2.105E+04	2.809E+04	4.068E+04	5.303E+04
1.20	2.192E+02	8.768E+02	6.195E+03	9.583E+03	1.321E+04	2.069E+04	2.804E+04	4.150E+04	5.403E+04
1.50	1.889E+02	7.554E+02	5.674E+03	8.917E+03	1.247E+04	1.999E+04	2.762E+04	4.205E+04	5.783E+04
2.00	1.544E+02	6.177E+02	4.960E+03	7.946E+03	1.130E+04	1.868E+04	2.644E+04	4.183E+04	5.946E+04
2.50	1.312E+02	5.246E+02	4.396E+03	7.140E+03	1.028E+04	1.737E+04	2.507E+04	4.088E+04	5.973E+04
3.00	1.142E+02	4.570E+02	3.942E+03	6.470E+03	9.406E+03	1.617E+04	2.368E+04	3.959E+04	5.921E+04
3.50	1.013E+02	4.053E+02	3.570E+03	5.907E+03	8.653E+03	1.508E+04	2.235E+04	3.815E+04	5.821E+04
4.00	9.110E+01	3.644E+02	3.255E+03	5.430E+03	8.002E+03	1.410E+04	2.111E+04	3.666E+04	5.694E+04
5.00	7.588E+01	3.035E+02	2.726E+03	4.665E+03	6.938E+03	1.243E+04	1.892E+04	3.377E+04	5.398E+04
6.00	6.531E+01	2.612E+02	2.350E+03	4.097E+03	6.133E+03	1.113E+04	1.712E+04	3.120E+04	5.100E+04
7.00	5.779E+01	2.312E+02	2.080E+03	3.676E+03	5.529E+03	1.012E+04	1.570E+04	2.906E+04	4.833E+04
8.00	5.193E+01	2.077E+02	1.868E+03	3.313E+03	5.037E+03	9.283E+03	1.450E+04	2.717E+04	4.582E+04
10.00	4.333E+01	1.733E+02	1.560E+03	2.772E+03	4.283E+03	7.975E+03	1.258E+04	2.401E+04	4.137E+04
12.00	3.732E+01	1.493E+02	1.344E+03	2.388E+03	3.720E+03	7.001E+03	1.112E+04	2.150E+04	3.763E+04
15.00	3.105E+01	1.242E+02	1.118E+03	1.987E+03	3.103E+03	5.934E+03	9.489E+03	1.861E+04	3.312E+04
20.00	2.448E+01	9.790E+01	8.811E+02	1.566E+03	2.447E+03	4.760E+03	7.669E+03	1.526E+04	2.763E+04
25.00	2.036E+01	8.142E+01	7.328E+02	1.303E+03	2.036E+03	3.983E+03	6.469E+03	1.299E+04	2.373E+04
30.00	1.752E+01	7.009E+01	6.308E+02	1.121E+03	1.752E+03	3.433E+03	5.619E+03	1.135E+04	2.094E+04
35.00	1.545E+01	6.180E+01	5.562E+02	9.888E+02	1.545E+03	3.028E+03	4.990E+03	1.011E+04	1.875E+04
40.00	1.387E+01	5.546E+01	4.992E+02	8.874E+02	1.387E+03	2.717E+03	4.485E+03	9.140E+03	1.703E+04
50.00	1.160E+01	4.639E+01	4.175E+02	7.422E+02	1.160E+03	2.273E+03	3.756E+03	7.721E+03	1.447E+04
60.00	1.005E+01	4.019E+01	3.617E+02	6.430E+02	1.005E+03	1.969E+03	3.255E+03	6.731E+03	1.266E+04
70.00	8.917E+00	3.567E+01	3.210E+02	5.707E+02	8.917E+02	1.748E+03	2.889E+03	5.998E+03	1.131E+04
80.00	8.057E+00	3.223E+01	2.900E+02	5.156E+02	8.057E+02	1.579E+03	2.610E+03	5.437E+03	1.027E+04
100.00	6.827E+00	2.731E+01	2.458E+02	4.370E+02	6.827E+02	1.338E+03	2.212E+03	4.613E+03	8.759E+03
120.00	5.990E+00	2.396E+01	2.156E+02	3.833E+02	5.990E+02	1.174E+03	1.941E+03	4.048E+03	7.714E+03
150.00	5.133E+00	2.053E+01	1.848E+02	3.285E+02	5.133E+02	1.006E+03	1.663E+03	3.470E+03	6.634E+03
200.00	4.254E+00	1.702E+01	1.531E+02	2.723E+02	4.254E+02	8.338E+02	1.378E+03	2.875E+03	5.510E+03
250.00	3.713E+00	1.485E+01	1.337E+02	2.376E+02	3.713E+02	7.277E+02	1.203E+03	2.510E+03	4.811E+03
300.00	3.345E+00	1.338E+01	1.204E+02	2.141E+02	3.345E+02	6.556E+02	1.084E+03	2.261E+03	4.335E+03
400.00	2.877E+00	1.151E+01	1.036E+02	1.841E+02	2.877E+02	5.638E+02	9.320E+02	1.945E+03	3.728E+03
500.00	2.592E+00	1.037E+01	9.331E+01	1.659E+02	2.592E+02	5.080E+02	8.398E+02	1.752E+03	3.359E+03
600.00	2.402E+00	9.608E+00	8.648E+01	1.537E+02	2.402E+02	4.708E+02	7.783E+02	1.624E+03	3.113E+03
700.00	2.268E+00	9.071E+00	8.164E+01	1.451E+02	2.268E+02	4.445E+02	7.347E+02	1.533E+03	2.939E+03
800.00	2.169E+00	8.675E+00	7.808E+01	1.388E+02	2.169E+02	4.251E+02	7.027E+02	1.466E+03	2.811E+03
1000.00	2.036E+00	8.146E+00	7.331E+01	1.303E+02	2.036E+02	3.991E+02	6.598E+02	1.377E+03	2.639E+03
1200.00	1.956E+00	7.826E+00	7.043E+01	1.252E+02	1.956E+02	3.835E+02	6.339E+02	1.323E+03	2.536E+03

RANGE IN MUSCOVITE (GM/CM2) I = 128.3 A/Z = 2.011

ENRG./NUC. (MEV/AMU)	1 H	4 HE	12 C	16 O	20 NE	28 SI	40 AR	56 FE	84 KR
0.10	1.819E-04	2.996E-04	3.082E-04	3.293E-04	3.500E-04	3.867E-04	4.706E-04	5.341E-04	6.777E-04
0.12	2.203E-04	3.555E-04	3.529E-04	3.749E-04	3.973E-04	4.374E-04	5.292E-04	5.965E-04	7.536E-04
0.15	2.813E-04	4.399E-04	4.178E-04	4.403E-04	4.646E-04	5.102E-04	6.125E-04	6.843E-04	8.595E-04
0.20	3.920E-04	5.829E-04	5.226E-04	5.442E-04	5.701E-04	6.225E-04	7.433E-04	8.198E-04	1.021E-03
0.25	5.136E-04	7.293E-04	6.248E-04	6.439E-04	6.704E-04	7.273E-04	8.674E-04	9.462E-04	1.170E-03
0.30	6.452E-04	8.793E-04	7.258E-04	7.413E-04	7.672E-04	8.270E-04	9.869E-04	1.066E-03	1.310E-03
0.40	9.365E-04	1.191E-03	9.270E-04	9.320E-04	9.545E-04	1.017E-03	1.203E-03	1.294E-03	1.571E-03
0.50	1.263E-03	1.523E-03	1.130E-03	1.121E-03	1.137E-03	1.198E-03	1.409E-03	1.510E-03	1.815E-03
0.60	1.624E-03	1.885E-03	1.335E-03	1.310E-03	1.319E-03	1.374E-03	1.608E-03	1.719E-03	2.048E-03
0.70	2.017E-03	2.279E-03	1.546E-03	1.501E-03	1.500E-03	1.548E-03	1.801E-03	1.911E-03	2.272E-03
0.80	2.443E-03	2.706E-03	1.761E-03	1.695E-03	1.682E-03	1.720E-03	1.990E-03	2.102E-03	2.491E-03
1.00	3.391E-03	3.654E-03	2.211E-03	2.094E-03	2.052E-03	2.064E-03	2.363E-03	2.469E-03	2.915E-03
1.20	4.465E-03	4.728E-03	2.687E-03	2.509E-03	2.433E-03	2.411E-03	2.734E-03	2.826E-03	3.328E-03
1.50	6.315E-03	6.577E-03	3.456E-03	3.171E-03	3.032E-03	2.943E-03	3.293E-03	3.351E-03	3.900E-03
2.00	1.004E-02	1.030E-02	4.899E-03	4.389E-03	4.115E-03	3.880E-03	4.253E-03	4.222E-03	4.839E-03
2.50	1.454E-02	1.481E-02	6.550E-03	5.757E-03	5.314E-03	4.888E-03	5.264E-03	5.107E-03	5.765E-03
3.00	1.955E-02	1.981E-02	8.323E-03	7.215E-03	6.579E-03	5.937E-03	6.302E-03	5.997E-03	6.675E-03
3.50	2.521E-02	2.547E-02	1.028E-02	8.805E-03	7.949E-03	7.054E-03	7.393E-03	6.912E-03	7.593E-03
4.00	3.152E-02	3.179E-02	1.241E-02	1.053E-02	9.425E-03	8.244E-03	8.542E-03	7.857E-03	8.524E-03
5.00	4.610E-02	4.636E-02	1.729E-02	1.440E-02	1.271E-02	1.085E-02	1.102E-02	9.852E-03	1.044E-02
6.00	6.326E-02	6.353E-02	2.301E-02	1.883E-02	1.643E-02	1.377E-02	1.376E-02	1.200E-02	1.246E-02
7.00	8.302E-02	8.329E-02	2.960E-02	2.383E-02	2.062E-02	1.700E-02	1.677E-02	1.432E-02	1.458E-02
8.00	1.054E-01	1.057E-01	3.706E-02	2.945E-02	2.528E-02	2.057E-02	2.006E-02	1.681E-02	1.683E-02
10.00	1.555E-01	1.558E-01	5.378E-02	4.201E-02	3.554E-02	2.837E-02	2.720E-02	2.214E-02	2.157E-02
12.00	2.138E-01	2.140E-01	7.318E-02	5.657E-02	4.725E-02	3.720E-02	3.522E-02	2.804E-02	2.672E-02
15.00	3.166E-01	3.169E-01	1.075E-01	8.228E-02	6.785E-02	5.247E-02	4.897E-02	3.800E-02	3.527E-02
20.00	5.278E-01	5.280E-01	1.779E-01	1.351E-01	1.101E-01	8.317E-02	7.640E-02	5.758E-02	5.174E-02
25.00	7.866E-01	7.869E-01	2.641E-01	1.998E-01	1.619E-01	1.203E-01	1.093E-01	8.078E-02	7.098E-02
30.00	1.091E+00	1.091E+00	3.656E-01	2.759E-01	2.228E-01	1.638E-01	1.475E-01	1.075E-01	9.291E-02
35.00	1.439E+00	1.439E+00	4.817E-01	3.629E-01	2.924E-01	2.136E-01	1.909E-01	1.376E-01	1.175E-01
40.00	1.830E+00	1.830E+00	6.118E-01	4.606E-01	3.705E-01	2.694E-01	2.392E-01	1.711E-01	1.446E-01
50.00	2.732E+00	2.732E+00	9.125E-01	6.861E-01	5.509E-01	3.982E-01	3.507E-01	2.475E-01	2.062E-01
60.00	3.788E+00	3.788E+00	1.264E+00	9.500E-01	7.621E-01	5.491E-01	4.811E-01	3.362E-01	2.773E-01
70.00	4.988E+00	4.989E+00	1.665E+00	1.250E+00	1.002E+00	7.206E-01	6.293E-01	4.365E-01	3.574E-01
80.00	6.327E+00	6.327E+00	2.111E+00	1.585E+00	1.270E+00	9.118E-01	7.946E-01	5.477E-01	4.461E-01
100.00	9.390E+00	9.390E+00	3.132E+00	2.351E+00	1.883E+00	1.349E+00	1.173E+00	8.018E-01	6.477E-01
120.00	1.293E+01	1.293E+01	4.313E+00	3.236E+00	2.591E+00	1.855E+00	1.610E+00	1.095E+00	8.794E-01
150.00	1.906E+01	1.906E+01	6.355E+00	4.768E+00	3.816E+00	2.731E+00	2.366E+00	1.603E+00	1.279E+00
200.00	3.119E+01	3.119E+01	1.040E+01	7.800E+00	6.242E+00	4.463E+00	3.864E+00	2.608E+00	2.066E+00
250.00	4.539E+01	4.539E+01	1.513E+01	1.135E+01	9.082E+00	6.492E+00	5.617E+00	3.784E+00	2.987E+00
300.00	6.136E+01	6.136E+01	2.046E+01	1.534E+01	1.228E+01	8.774E+00	7.589E+00	5.107E+00	4.022E+00
400.00	9.773E+01	9.773E+01	3.258E+01	2.444E+01	1.955E+01	1.397E+01	1.208E+01	8.120E+00	6.379E+00
500.00	1.389E+02	1.389E+02	4.629E+01	3.472E+01	2.778E+01	1.985E+01	1.716E+01	1.153E+01	9.046E+00
600.00	1.838E+02	1.838E+02	6.126E+01	4.595E+01	3.676E+01	2.626E+01	2.270E+01	1.525E+01	1.196E+01
700.00	2.317E+02	2.317E+02	7.724E+01	5.793E+01	4.635E+01	3.311E+01	2.862E+01	1.922E+01	1.506E+01
800.00	2.821E+02	2.821E+02	9.402E+01	7.052E+01	5.642E+01	4.030E+01	3.484E+01	2.339E+01	1.833E+01
1000.00	3.884E+02	3.884E+02	1.295E+02	9.709E+01	7.768E+01	5.549E+01	4.796E+01	3.220E+01	2.522E+01
1200.00	4.999E+02	4.999E+02	1.666E+02	1.250E+02	9.999E+01	7.143E+01	6.173E+01	4.144E+01	3.245E+01

DE/DX IN MUSCOVITE (MEV CM2/GM) I = 128.3 A/Z = 2.011

ENRG./NUC. (MEV/AMU)	1 H	4 HE	12 C	16 O	20 NE	28 SI	40 AR	56 FE	84 KR
0.10	5.335E+02	1.435E+03	5.280E+03	6.869E+03	8.241E+03	1.082E+04	1.332E+04	1.740E+04	2.136E+04
0.12	5.091E+02	1.428E+03	5.446E+03	7.162E+03	8.658E+03	1.126E+04	1.398E+04	1.846E+04	2.284E+04
0.15	4.759E+02	1.413E+03	5.627E+03	7.499E+03	9.155E+03	1.178E+04	1.478E+04	1.977E+04	2.471E+04
0.20	4.296E+02	1.383E+03	5.814E+03	7.885E+03	9.757E+03	1.296E+04	1.576E+04	2.148E+04	2.722E+04
0.25	3.947E+02	1.350E+03	5.913E+03	8.134E+03	1.018E+04	1.373E+04	1.646E+04	2.278E+04	2.921E+04
0.30	3.666E+02	1.316E+03	5.959E+03	8.295E+03	1.047E+04	1.432E+04	1.699E+04	2.382E+04	3.085E+04
0.40	3.233E+02	1.262E+03	5.956E+03	8.451E+03	1.084E+04	1.516E+04	1.889E+04	2.535E+04	3.341E+04
0.50	2.908E+02	1.153E+03	5.882E+03	8.475E+03	1.101E+04	1.569E+04	1.982E+04	2.642E+04	3.533E+04
0.60	2.651E+02	1.058E+03	5.770E+03	8.421E+03	1.105E+04	1.602E+04	2.047E+04	2.719E+04	3.680E+04
0.70	2.440E+02	9.757E+02	5.637E+03	8.319E+03	1.102E+04	1.621E+04	2.094E+04	2.901E+04	3.797E+04
0.80	2.263E+02	9.042E+02	5.493E+03	8.186E+03	1.093E+04	1.629E+04	2.125E+04	2.984E+04	3.890E+04
1.00	1.978E+02	7.912E+02	5.193E+03	7.869E+03	1.066E+04	1.625E+04	2.157E+04	3.102E+04	4.023E+04
1.20	1.758E+02	7.032E+02	4.896E+03	7.522E+03	1.031E+04	1.603E+04	2.159E+04	3.172E+04	4.106E+04
1.50	1.509E+02	6.035E+02	4.485E+03	7.006E+03	9.745E+03	1.551E+04	2.131E+04	3.220E+04	4.403E+04
2.00	1.249E+02	4.996E+02	3.978E+03	6.331E+03	8.954E+03	1.467E+04	2.063E+04	3.233E+04	4.560E+04
2.50	1.070E+02	4.279E+02	3.564E+03	5.749E+03	8.232E+03	1.378E+04	1.975E+04	3.186E+04	4.612E+04
3.00	9.372E+01	3.749E+02	3.222E+03	5.252E+03	7.592E+03	1.293E+04	1.880E+04	3.107E+04	4.601E+04
3.50	8.349E+01	3.339E+02	2.936E+03	4.825E+03	7.029E+03	1.214E+04	1.786E+04	3.013E+04	4.549E+04
4.00	7.531E+01	3.012E+02	2.689E+03	4.458E+03	6.534E+03	1.141E+04	1.697E+04	2.912E+04	4.472E+04
5.00	6.308E+01	2.523E+02	2.266E+03	3.862E+03	5.715E+03	1.016E+04	1.534E+04	2.706E+04	4.280E+04
6.00	5.503E+01	2.201E+02	1.980E+03	3.444E+03	5.130E+03	9.227E+03	1.409E+04	2.538E+04	4.098E+04
7.00	4.893E+01	1.957E+02	1.761E+03	3.110E+03	4.655E+03	8.452E+03	1.302E+04	2.382E+04	3.914E+04
8.00	4.413E+01	1.765E+02	1.587E+03	2.814E+03	4.264E+03	7.798E+03	1.210E+04	2.242E+04	3.736E+04
10.00	3.704E+01	1.482E+02	1.334E+03	2.369E+03	3.656E+03	6.760E+03	1.060E+04	2.002E+04	3.412E+04
12.00	3.205E+01	1.282E+02	1.154E+03	2.051E+03	3.193E+03	5.975E+03	9.436E+03	1.808E+04	3.131E+04
15.00	2.680E+01	1.072E+02	9.647E+02	1.715E+03	2.678E+03	5.102E+03	8.120E+03	1.579E+04	2.784E+04
20.00	2.124E+01	8.497E+01	7.647E+02	1.360E+03	2.124E+03	4.127E+03	6.621E+03	1.308E+04	2.351E+04
25.00	1.774E+01	7.094E+01	6.385E+02	1.135E+03	1.774E+03	3.469E+03	5.619E+03	1.121E+04	2.040E+04
30.00	1.531E+01	6.124E+01	5.512E+02	9.798E+02	1.531E+03	2.999E+03	4.901E+03	9.846E+03	1.806E+04
35.00	1.353E+01	5.411E+01	4.870E+02	8.658E+02	1.353E+03	2.651E+03	4.367E+03	8.804E+03	1.625E+04
40.00	1.216E+01	4.865E+01	4.378E+02	7.784E+02	1.216E+03	2.384E+03	3.933E+03	7.984E+03	1.480E+04
50.00	1.020E+01	4.080E+01	3.672E+02	6.528E+02	1.020E+03	1.999E+03	3.303E+03	6.773E+03	1.264E+04
60.00	8.853E+00	3.541E+01	3.187E+02	5.666E+02	8.853E+02	1.735E+03	2.868E+03	5.922E+03	1.110E+04
70.00	7.870E+00	3.148E+01	2.833E+02	5.037E+02	7.870E+02	1.542E+03	2.550E+03	5.289E+03	9.946E+03
80.00	7.118E+00	2.847E+01	2.563E+02	4.556E+02	7.118E+02	1.395E+03	2.306E+03	4.802E+03	9.048E+03
100.00	6.043E+00	2.417E+01	2.175E+02	3.868E+02	6.043E+02	1.184E+03	1.958E+03	4.082E+03	7.739E+03
120.00	5.308E+00	2.123E+01	1.911E+02	3.397E+02	5.308E+02	1.040E+03	1.720E+03	3.588E+03	6.829E+03
150.00	4.556E+00	1.822E+01	1.640E+02	2.916E+02	4.556E+02	8.930E+02	1.476E+03	3.080E+03	5.885E+03
200.00	3.782E+00	1.513E+01	1.362E+02	2.421E+02	3.782E+02	7.413E+02	1.225E+03	2.556E+03	4.898E+03
250.00	3.305E+00	1.322E+01	1.190E+02	2.115E+02	3.305E+02	6.477E+02	1.071E+03	2.234E+03	4.282E+03
300.00	2.980E+00	1.192E+01	1.073E+02	1.907E+02	2.980E+02	5.841E+02	9.656E+02	2.015E+03	3.862E+03
400.00	2.567E+00	1.027E+01	9.243E+01	1.643E+02	2.567E+02	5.032E+02	8.318E+02	1.736E+03	3.327E+03
500.00	2.317E+00	9.266E+00	8.339E+01	1.483E+02	2.317E+02	4.540E+02	7.506E+02	1.566E+03	3.002E+03
600.00	2.149E+00	8.598E+00	7.738E+01	1.376E+02	2.149E+02	4.213E+02	6.964E+02	1.453E+03	2.786E+03
700.00	2.031E+00	8.126E+00	7.313E+01	1.300E+02	2.031E+02	3.982E+02	6.582E+02	1.373E+03	2.633E+03
800.00	1.945E+00	7.779E+00	7.001E+01	1.245E+02	1.945E+02	3.812E+02	6.301E+02	1.315E+03	2.520E+03
1000.00	1.830E+00	7.319E+00	6.587E+01	1.171E+02	1.830E+02	3.586E+02	5.928E+02	1.237E+03	2.371E+03
1200.00	1.761E+00	7.045E+00	6.340E+01	1.127E+02	1.761E+02	3.452E+02	5.706E+02	1.191E+03	2.283E+03

RANGE IN PHLOGOPITE MICA (GM/CM2) I = 129.4 A/Z = 2.009

ENRG./NUC. (MEV/AMU)	1 H	4 HE	12 C	16 O	20 NE	28 SI	40 AR	56 FE	84 KR
0.10	1.825E-04	3.006E-04	3.091E-04	3.304E-04	3.511E-04	3.879E-04	4.720E-04	5.357E-04	6.797E-04
0.12	2.211E-04	3.567E-04	3.540E-04	3.761E-04	3.985E-04	4.387E-04	5.308E-04	5.983E-04	7.559E-04
0.15	2.824E-04	4.416E-04	4.192E-04	4.417E-04	4.660E-04	5.118E-04	6.144E-04	6.864E-04	8.622E-04
0.20	3.936E-04	5.852E-04	5.243E-04	5.459E-04	5.720E-04	6.244E-04	7.456E-04	8.224E-04	1.024E-03
0.25	5.158E-04	7.321E-04	6.269E-04	6.460E-04	6.725E-04	7.296E-04	8.701E-04	9.492E-04	1.173E-03
0.30	6.479E-04	8.827E-04	7.283E-04	7.437E-04	7.696E-04	8.296E-04	9.899E-04	1.070E-03	1.314E-03
0.40	9.402E-04	1.196E-03	9.300E-04	9.351E-04	9.576E-04	1.020E-03	1.207E-03	1.298E-03	1.575E-03
0.50	1.268E-03	1.528E-03	1.133E-03	1.124E-03	1.141E-03	1.202E-03	1.414E-03	1.514E-03	1.820E-03
0.60	1.629E-03	1.892E-03	1.340E-03	1.314E-03	1.323E-03	1.379E-03	1.613E-03	1.724E-03	2.054E-03
0.70	2.024E-03	2.287E-03	1.551E-03	1.506E-03	1.504E-03	1.553E-03	1.806E-03	1.917E-03	2.279E-03
0.80	2.451E-03	2.714E-03	1.767E-03	1.700E-03	1.687E-03	1.726E-03	1.996E-03	2.108E-03	2.498E-03
1.00	3.400E-03	3.664E-03	2.217E-03	2.100E-03	2.058E-03	2.070E-03	2.371E-03	2.477E-03	2.923E-03
1.20	4.477E-03	4.741E-03	2.694E-03	2.516E-03	2.440E-03	2.418E-03	2.742E-03	2.834E-03	3.338E-03
1.50	6.330E-03	6.593E-03	3.465E-03	3.180E-03	3.040E-03	2.952E-03	3.302E-03	3.361E-03	3.912E-03
2.00	1.006E-02	1.032E-02	4.911E-03	4.400E-03	4.126E-03	3.890E-03	4.265E-03	4.234E-03	4.853E-03
2.50	1.458E-02	1.484E-02	6.566E-03	5.772E-03	5.327E-03	4.901E-03	5.278E-03	5.122E-03	5.781E-03
3.00	1.959E-02	1.985E-02	8.342E-03	7.232E-03	6.596E-03	5.952E-03	6.318E-03	6.013E-03	6.694E-03
3.50	2.526E-02	2.552E-02	1.030E-02	8.825E-03	7.968E-03	7.072E-03	7.412E-03	6.930E-03	7.614E-03
4.00	3.158E-02	3.185E-02	1.243E-02	1.055E-02	9.447E-03	8.264E-03	8.564E-03	7.878E-03	8.547E-03
5.00	4.618E-02	4.644E-02	1.732E-02	1.443E-02	1.273E-02	1.087E-02	1.105E-02	9.877E-03	1.047E-02
6.00	6.337E-02	6.363E-02	2.305E-02	1.887E-02	1.647E-02	1.380E-02	1.379E-02	1.203E-02	1.249E-02
7.00	8.315E-02	8.341E-02	2.965E-02	2.387E-02	2.066E-02	1.704E-02	1.681E-02	1.435E-02	1.462E-02
8.00	1.055E-01	1.058E-01	3.712E-02	2.950E-02	2.532E-02	2.061E-02	2.010E-02	1.685E-02	1.687E-02
10.00	1.557E-01	1.560E-01	5.385E-02	4.206E-02	3.559E-02	2.842E-02	2.725E-02	2.219E-02	2.162E-02
12.00	2.140E-01	2.143E-01	7.327E-02	5.663E-02	4.731E-02	3.726E-02	3.527E-02	2.809E-02	2.677E-02
15.00	3.169E-01	3.172E-01	1.076E-01	8.237E-02	6.793E-02	5.254E-02	4.904E-02	3.806E-02	3.533E-02
20.00	5.282E-01	5.285E-01	1.780E-01	1.352E-01	1.102E-01	8.326E-02	7.649E-02	5.766E-02	5.183E-02
25.00	7.872E-01	7.875E-01	2.643E-01	1.999E-01	1.620E-01	1.204E-01	1.094E-01	8.087E-02	7.108E-02
30.00	1.092E+00	1.092E+00	3.659E-01	2.761E-01	2.229E-01	1.639E-01	1.477E-01	1.076E-01	9.302E-02
35.00	1.440E+00	1.440E+00	4.820E-01	3.632E-01	2.926E-01	2.137E-01	1.910E-01	1.378E-01	1.176E-01
40.00	1.831E+00	1.831E+00	6.122E-01	4.608E-01	3.707E-01	2.695E-01	2.394E-01	1.712E-01	1.447E-01
50.00	2.733E+00	2.734E+00	9.130E-01	6.865E-01	5.512E-01	3.985E-01	3.509E-01	2.477E-01	2.064E-01
60.00	3.789E+00	3.790E+00	1.265E+00	9.505E-01	7.624E-01	5.493E-01	4.813E-01	3.364E-01	2.775E-01
70.00	4.990E+00	4.991E+00	1.665E+00	1.251E+00	1.003E+00	7.209E-01	6.296E-01	4.367E-01	3.577E-01
80.00	6.329E+00	6.329E+00	2.112E+00	1.585E+00	1.270E+00	9.122E-01	7.949E-01	5.480E-01	4.464E-01
100.00	9.393E+00	9.394E+00	3.133E+00	2.351E+00	1.883E+00	1.350E+00	1.173E+00	8.022E-01	6.480E-01
120.00	1.294E+01	1.294E+01	4.314E+00	3.237E+00	2.592E+00	1.856E+00	1.611E+00	1.096E+00	8.798E-01
150.00	1.906E+01	1.906E+01	6.357E+00	4.769E+00	3.817E+00	2.731E+00	2.367E+00	1.603E+00	1.279E+00
200.00	3.120E+01	3.120E+01	1.040E+01	7.802E+00	6.244E+00	4.465E+00	3.865E+00	2.608E+00	2.066E+00
250.00	4.540E+01	4.540E+01	1.513E+01	1.135E+01	9.084E+00	6.493E+00	5.618E+00	3.785E+00	2.987E+00
300.00	6.137E+01	6.137E+01	2.046E+01	1.535E+01	1.228E+01	8.775E+00	7.590E+00	5.108E+00	4.023E+00
400.00	9.774E+01	9.774E+01	3.258E+01	2.444E+01	1.955E+01	1.397E+01	1.208E+01	8.121E+00	6.380E+00
500.00	1.389E+02	1.389E+02	4.630E+01	3.473E+01	2.778E+01	1.985E+01	1.716E+01	1.153E+01	9.047E+00
600.00	1.838E+02	1.838E+02	6.127E+01	4.595E+01	3.676E+01	2.626E+01	2.270E+01	1.525E+01	1.196E+01
700.00	2.317E+02	2.317E+02	7.724E+01	5.793E+01	4.635E+01	3.311E+01	2.862E+01	1.922E+01	1.506E+01
800.00	2.821E+02	2.821E+02	9.403E+01	7.052E+01	5.642E+01	4.031E+01	3.484E+01	2.339E+01	1.833E+01
1000.00	3.884E+02	3.884E+02	1.295E+02	9.710E+01	7.768E+01	5.549E+01	4.796E+01	3.220E+01	2.522E+01
1200.00	5.000E+02	5.000E+02	1.667E+02	1.250E+02	10.000E+01	7.143E+01	6.174E+01	4.144E+01	3.245E+01

DE/DX IN PHLOGOPITE MICA (MEV CM2/GM) I = 129.4 A/Z = 2.009

ENRG./NUC. (MEV/AMU)	1 H	4 HE	12 C	16 O	20 NE	28 SI	40 AR	56 FE	84 KR
0.10	5.308E+02	1.428E+03	5.261E+03	6.846E+03	8.213E+03	1.078E+04	1.327E+04	1.735E+04	2.130E+04
0.12	5.066E+02	1.421E+03	5.426E+03	7.137E+03	8.629E+03	1.123E+04	1.394E+04	1.840E+04	2.277E+04
0.15	4.737E+02	1.407E+03	5.607E+03	7.473E+03	9.125E+03	1.175E+04	1.473E+04	1.971E+04	2.464E+04
0.20	4.277E+02	1.378E+03	5.793E+03	7.859E+03	9.725E+03	1.292E+04	1.571E+04	2.141E+04	2.714E+04
0.25	3.932E+02	1.345E+03	5.893E+03	8.107E+03	1.014E+04	1.368E+04	1.641E+04	2.271E+04	2.912E+04
0.30	3.652E+02	1.311E+03	5.939E+03	8.268E+03	1.044E+04	1.428E+04	1.694E+04	2.374E+04	3.076E+04
0.40	3.223E+02	1.258E+03	5.938E+03	8.425E+03	1.080E+04	1.511E+04	1.884E+04	2.528E+04	3.331E+04
0.50	2.900E+02	1.150E+03	5.865E+03	8.450E+03	1.097E+04	1.564E+04	1.976E+04	2.634E+04	3.522E+04
0.60	2.645E+02	1.055E+03	5.754E+03	8.398E+03	1.102E+04	1.597E+04	2.041E+04	2.711E+04	3.670E+04
0.70	2.435E+02	9.734E+02	5.622E+03	8.297E+03	1.099E+04	1.616E+04	2.088E+04	2.893E+04	3.786E+04
0.80	2.258E+02	9.023E+02	5.479E+03	8.165E+03	1.091E+04	1.625E+04	2.119E+04	2.976E+04	3.878E+04
1.00	1.974E+02	7.896E+02	5.181E+03	7.850E+03	1.064E+04	1.621E+04	2.151E+04	3.093E+04	4.011E+04
1.20	1.755E+02	7.019E+02	4.886E+03	7.505E+03	1.029E+04	1.599E+04	2.154E+04	3.164E+04	4.094E+04
1.50	1.506E+02	6.023E+02	4.475E+03	6.989E+03	9.722E+03	1.548E+04	2.125E+04	3.211E+04	4.391E+04
2.00	1.247E+02	4.987E+02	3.970E+03	6.318E+03	8.935E+03	1.464E+04	2.058E+04	3.225E+04	4.548E+04
2.50	1.068E+02	4.271E+02	3.557E+03	5.738E+03	8.215E+03	1.375E+04	1.970E+04	3.178E+04	4.600E+04
3.00	9.357E+01	3.743E+02	3.216E+03	5.242E+03	7.578E+03	1.290E+04	1.876E+04	3.100E+04	4.589E+04
3.50	8.336E+01	3.334E+02	2.931E+03	4.817E+03	7.017E+03	1.211E+04	1.783E+04	3.006E+04	4.538E+04
4.00	7.520E+01	3.008E+02	2.685E+03	4.451E+03	6.523E+03	1.139E+04	1.693E+04	2.905E+04	4.462E+04
5.00	6.300E+01	2.520E+02	2.263E+03	3.857E+03	5.707E+03	1.014E+04	1.532E+04	2.703E+04	4.271E+04
6.00	5.497E+01	2.199E+02	1.978E+03	3.440E+03	5.123E+03	9.214E+03	1.407E+04	2.534E+04	4.090E+04
7.00	4.888E+01	1.955E+02	1.759E+03	3.106E+03	4.650E+03	8.441E+03	1.300E+04	2.378E+04	3.907E+04
8.00	4.409E+01	1.763E+02	1.586E+03	2.812E+03	4.259E+03	7.789E+03	1.208E+04	2.238E+04	3.730E+04
10.00	3.701E+01	1.480E+02	1.332E+03	2.367E+03	3.653E+03	6.753E+03	1.059E+04	2.000E+04	3.407E+04
12.00	3.202E+01	1.281E+02	1.153E+03	2.049E+03	3.191E+03	5.970E+03	9.426E+03	1.806E+04	3.127E+04
15.00	2.678E+01	1.071E+02	9.640E+02	1.714E+03	2.676E+03	5.098E+03	8.113E+03	1.578E+04	2.781E+04
20.00	2.123E+01	8.492E+01	7.643E+02	1.359E+03	2.123E+03	4.124E+03	6.617E+03	1.307E+04	2.349E+04
25.00	1.773E+01	7.090E+01	6.381E+02	1.134E+03	1.773E+03	3.467E+03	5.616E+03	1.120E+04	2.038E+04
30.00	1.530E+01	6.121E+01	5.509E+02	9.794E+02	1.530E+03	2.998E+03	4.898E+03	9.840E+03	1.805E+04
35.00	1.352E+01	5.409E+01	4.868E+02	8.655E+02	1.352E+03	2.650E+03	4.365E+03	8.800E+03	1.624E+04
40.00	1.216E+01	4.863E+01	4.377E+02	7.781E+02	1.216E+03	2.383E+03	3.931E+03	7.980E+03	1.479E+04
50.00	1.020E+01	4.078E+01	3.670E+02	6.525E+02	1.020E+03	1.998E+03	3.302E+03	6.771E+03	1.263E+04
60.00	8.850E+00	3.540E+01	3.186E+02	5.664E+02	8.850E+02	1.735E+03	2.867E+03	5.920E+03	1.110E+04
70.00	7.867E+00	3.147E+01	2.832E+02	5.035E+02	7.867E+02	1.542E+03	2.549E+03	5.287E+03	9.942E+03
80.00	7.116E+00	2.846E+01	2.562E+02	4.554E+02	7.116E+02	1.395E+03	2.305E+03	4.801E+03	9.045E+03
100.00	6.042E+00	2.417E+01	2.175E+02	3.867E+02	6.042E+02	1.184E+03	1.957E+03	4.081E+03	7.737E+03
120.00	5.307E+00	2.123E+01	1.911E+02	3.397E+02	5.307E+02	1.040E+03	1.720E+03	3.587E+03	6.827E+03
150.00	4.555E+00	1.822E+01	1.640E+02	2.915E+02	4.555E+02	8.928E+02	1.476E+03	3.079E+03	5.884E+03
200.00	3.781E+00	1.513E+01	1.361E+02	2.420E+02	3.781E+02	7.412E+02	1.225E+03	2.556E+03	4.898E+03
250.00	3.304E+00	1.322E+01	1.190E+02	2.115E+02	3.304E+02	6.477E+02	1.071E+03	2.234E+03	4.282E+03
300.00	2.980E+00	1.192E+01	1.073E+02	1.907E+02	2.980E+02	5.841E+02	9.655E+02	2.014E+03	3.862E+03
400.00	2.567E+00	1.027E+01	9.242E+01	1.643E+02	2.567E+02	5.032E+02	8.318E+02	1.735E+03	3.327E+03
500.00	2.316E+00	9.266E+00	8.339E+01	1.482E+02	2.316E+02	4.540E+02	7.505E+02	1.566E+03	3.002E+03
600.00	2.149E+00	8.597E+00	7.738E+01	1.376E+02	2.149E+02	4.213E+02	6.964E+02	1.453E+03	2.786E+03
700.00	2.031E+00	8.125E+00	7.313E+01	1.300E+02	2.031E+02	3.981E+02	6.582E+02	1.373E+03	2.633E+03
800.00	1.945E+00	7.779E+00	7.001E+01	1.245E+02	1.945E+02	3.812E+02	6.301E+02	1.315E+03	2.520E+03
1000.00	1.830E+00	7.319E+00	6.587E+01	1.171E+02	1.830E+02	3.586E+02	5.929E+02	1.237E+03	2.371E+03
1200.00	1.761E+00	7.045E+00	6.341E+01	1.127E+02	1.761E+02	3.452E+02	5.707E+02	1.191E+03	2.283E+03

RANGE IN SODA LIME GLASS (GM/CM2) I = 131.6 A/Z = 2.014

ENRG./NUC. (MEV/AMU)	1 H	4 HE	12 C	16 O	20 NE	28 SI	40 AR	56 FE	84 KR
0.10	1.846E-04	3.038E-04	3.123E-04	3.337E-04	3.546E-04	3.918E-04	4.768E-04	5.411E-04	6.866E-04
0.12	2.237E-04	3.607E-04	3.577E-04	3.799E-04	4.026E-04	4.432E-04	5.361E-04	6.043E-04	7.635E-04
0.15	2.858E-04	4.466E-04	4.236E-04	4.463E-04	4.708E-04	5.170E-04	6.207E-04	6.933E-04	8.708E-04
0.20	3.985E-04	5.919E-04	5.299E-04	5.516E-04	5.779E-04	6.308E-04	7.532E-04	8.307E-04	1.035E-03
0.25	5.221E-04	7.406E-04	6.336E-04	6.528E-04	6.795E-04	7.371E-04	8.789E-04	9.588E-04	1.185E-03
0.30	6.558E-04	8.929E-04	7.360E-04	7.515E-04	7.776E-04	8.382E-04	1.000E-03	1.080E-03	1.327E-03
0.40	9.512E-04	1.209E-03	9.399E-04	9.448E-04	9.675E-04	1.030E-03	1.219E-03	1.311E-03	1.591E-03
0.50	1.282E-03	1.545E-03	1.145E-03	1.136E-03	1.153E-03	1.214E-03	1.428E-03	1.530E-03	1.839E-03
0.60	1.647E-03	1.912E-03	1.354E-03	1.328E-03	1.336E-03	1.393E-03	1.629E-03	1.741E-03	2.074E-03
0.70	2.045E-03	2.311E-03	1.567E-03	1.521E-03	1.520E-03	1.569E-03	1.824E-03	1.937E-03	2.302E-03
0.80	2.476E-03	2.741E-03	1.785E-03	1.717E-03	1.704E-03	1.743E-03	2.016E-03	2.129E-03	2.523E-03
1.00	3.433E-03	3.699E-03	2.239E-03	2.120E-03	2.078E-03	2.091E-03	2.394E-03	2.501E-03	2.953E-03
1.20	4.518E-03	4.784E-03	2.720E-03	2.541E-03	2.464E-03	2.442E-03	2.769E-03	2.862E-03	3.371E-03
1.50	6.385E-03	6.652E-03	3.497E-03	3.210E-03	3.069E-03	2.980E-03	3.335E-03	3.394E-03	3.951E-03
2.00	1.015E-02	1.041E-02	4.956E-03	4.441E-03	4.164E-03	3.927E-03	4.306E-03	4.275E-03	4.901E-03
2.50	1.470E-02	1.497E-02	6.625E-03	5.825E-03	5.377E-03	4.947E-03	5.329E-03	5.171E-03	5.838E-03
3.00	1.975E-02	2.002E-02	8.414E-03	7.296E-03	6.655E-03	6.007E-03	6.378E-03	6.071E-03	6.759E-03
3.50	2.546E-02	2.573E-02	1.038E-02	8.901E-03	8.038E-03	7.136E-03	7.480E-03	6.996E-03	7.687E-03
4.00	3.183E-02	3.210E-02	1.253E-02	1.064E-02	9.528E-03	8.338E-03	8.641E-03	7.951E-03	8.629E-03
5.00	4.653E-02	4.680E-02	1.746E-02	1.454E-02	1.284E-02	1.097E-02	1.115E-02	9.966E-03	1.057E-02
6.00	6.384E-02	6.410E-02	2.323E-02	1.901E-02	1.660E-02	1.391E-02	1.391E-02	1.214E-02	1.260E-02
7.00	8.375E-02	8.402E-02	2.987E-02	2.405E-02	2.082E-02	1.718E-02	1.695E-02	1.447E-02	1.475E-02
8.00	1.063E-01	1.066E-01	3.739E-02	2.972E-02	2.552E-02	2.077E-02	2.027E-02	1.699E-02	1.702E-02
10.00	1.568E-01	1.570E-01	5.421E-02	4.235E-02	3.584E-02	2.863E-02	2.746E-02	2.236E-02	2.180E-02
12.00	2.154E-01	2.156E-01	7.374E-02	5.701E-02	4.763E-02	3.752E-02	3.553E-02	2.830E-02	2.699E-02
15.00	3.189E-01	3.191E-01	1.082E-01	8.289E-02	6.836E-02	5.289E-02	4.938E-02	3.835E-02	3.561E-02
20.00	5.314E-01	5.316E-01	1.791E-01	1.360E-01	1.109E-01	8.378E-02	7.699E-02	5.806E-02	5.221E-02
25.00	7.917E-01	7.920E-01	2.659E-01	2.011E-01	1.630E-01	1.211E-01	1.101E-01	8.141E-02	7.157E-02
30.00	1.098E+00	1.098E+00	3.679E-01	2.776E-01	2.242E-01	1.649E-01	1.486E-01	1.083E-01	9.364E-02
35.00	1.448E+00	1.448E+00	4.846E-01	3.652E-01	2.942E-01	2.149E-01	1.921E-01	1.386E-01	1.184E-01
40.00	1.841E+00	1.841E+00	6.155E-01	4.633E-01	3.728E-01	2.710E-01	2.407E-01	1.722E-01	1.456E-01
50.00	2.748E+00	2.748E+00	9.179E-01	6.901E-01	5.542E-01	4.006E-01	3.528E-01	2.491E-01	2.076E-01
60.00	3.809E+00	3.809E+00	1.272E+00	9.554E-01	7.664E-01	5.522E-01	4.839E-01	3.383E-01	2.791E-01
70.00	5.016E+00	5.016E+00	1.674E+00	1.257E+00	1.008E+00	7.247E-01	6.329E-01	4.391E-01	3.597E-01
80.00	6.361E+00	6.362E+00	2.122E+00	1.593E+00	1.277E+00	9.168E-01	7.990E-01	5.509E-01	4.488E-01
100.00	9.440E+00	9.440E+00	3.149E+00	2.363E+00	1.893E+00	1.357E+00	1.179E+00	8.063E-01	6.515E-01
120.00	1.300E+01	1.300E+01	4.335E+00	3.253E+00	2.605E+00	1.865E+00	1.619E+00	1.101E+00	8.844E-01
150.00	1.916E+01	1.916E+01	6.387E+00	4.792E+00	3.836E+00	2.745E+00	2.379E+00	1.611E+00	1.285E+00
200.00	3.134E+01	3.134E+01	1.045E+01	7.839E+00	6.273E+00	4.486E+00	3.883E+00	2.621E+00	2.077E+00
250.00	4.561E+01	4.561E+01	1.521E+01	1.141E+01	9.127E+00	6.524E+00	5.645E+00	3.803E+00	3.002E+00
300.00	6.166E+01	6.166E+01	2.055E+01	1.542E+01	1.234E+01	8.816E+00	7.626E+00	5.132E+00	4.042E+00
400.00	9.819E+01	9.819E+01	3.273E+01	2.455E+01	1.964E+01	1.404E+01	1.214E+01	8.159E+00	6.410E+00
500.00	1.395E+02	1.395E+02	4.651E+01	3.488E+01	2.791E+01	1.994E+01	1.724E+01	1.158E+01	9.088E+00
600.00	1.846E+02	1.846E+02	6.154E+01	4.616E+01	3.693E+01	2.638E+01	2.281E+01	1.532E+01	1.201E+01
700.00	2.328E+02	2.328E+02	7.759E+01	5.819E+01	4.656E+01	3.326E+01	2.875E+01	1.931E+01	1.513E+01
800.00	2.833E+02	2.833E+02	9.445E+01	7.084E+01	5.667E+01	4.048E+01	3.499E+01	2.350E+01	1.841E+01
1000.00	3.901E+02	3.901E+02	1.300E+02	9.752E+01	7.802E+01	5.573E+01	4.817E+01	3.234E+01	2.533E+01
1200.00	5.021E+02	5.021E+02	1.674E+02	1.255E+02	1.004E+02	7.174E+01	6.201E+01	4.162E+01	3.259E+01

DE/DX IN SODA LIME GLASS (MEV CM2/GM) I = 131.6 A/Z = 2.014

ENRG./NUC. (MEV/AMU)	1 H	4 HE	12 C	16 O	20 NE	28 SI	40 AR	56 FE	84 KR
0.10	5.234E+02	1.410E+03	5.203E+03	6.772E+03	8.127E+03	1.067E+04	1.314E+04	1.717E+04	2.108E+04
0.12	4.996E+02	1.404E+03	5.367E+03	7.060E+03	8.538E+03	1.111E+04	1.379E+04	1.821E+04	2.254E+04
0.15	4.674E+02	1.390E+03	5.545E+03	7.393E+03	9.028E+03	1.162E+04	1.458E+04	1.951E+04	2.439E+04
0.20	4.224E+02	1.361E+03	5.730E+03	7.775E+03	9.623E+03	1.279E+04	1.555E+04	2.120E+04	2.686E+04
0.25	3.885E+02	1.329E+03	5.830E+03	8.022E+03	1.004E+04	1.354E+04	1.624E+04	2.248E+04	2.883E+04
0.30	3.611E+02	1.296E+03	5.877E+03	8.182E+03	1.033E+04	1.413E+04	1.677E+04	2.351E+04	3.045E+04
0.40	3.190E+02	1.245E+03	5.878E+03	8.341E+03	1.070E+04	1.496E+04	1.865E+04	2.502E+04	3.298E+04
0.50	2.873E+02	1.139E+03	5.808E+03	8.368E+03	1.087E+04	1.549E+04	1.957E+04	2.608E+04	3.487E+04
0.60	2.621E+02	1.046E+03	5.700E+03	8.318E+03	1.092E+04	1.582E+04	2.022E+04	2.684E+04	3.634E+04
0.70	2.413E+02	9.650E+02	5.571E+03	8.220E+03	1.089E+04	1.601E+04	2.068E+04	2.865E+04	3.749E+04
0.80	2.239E+02	8.947E+02	5.431E+03	8.091E+03	1.081E+04	1.609E+04	2.099E+04	2.947E+04	3.841E+04
1.00	1.958E+02	7.833E+02	5.137E+03	7.782E+03	1.054E+04	1.606E+04	2.131E+04	3.064E+04	3.973E+04
1.20	1.741E+02	6.963E+02	4.845E+03	7.441E+03	1.020E+04	1.584E+04	2.134E+04	3.134E+04	4.055E+04
1.50	1.493E+02	5.973E+02	4.437E+03	6.929E+03	9.636E+03	1.534E+04	2.106E+04	3.181E+04	4.349E+04
2.00	1.237E+02	4.948E+02	3.939E+03	6.265E+03	8.860E+03	1.451E+04	2.040E+04	3.195E+04	4.506E+04
2.50	1.060E+02	4.239E+02	3.530E+03	5.692E+03	8.149E+03	1.364E+04	1.953E+04	3.150E+04	4.558E+04
3.00	9.289E+01	3.715E+02	3.192E+03	5.202E+03	7.519E+03	1.280E+04	1.860E+04	3.073E+04	4.548E+04
3.50	8.276E+01	3.310E+02	2.910E+03	4.781E+03	6.964E+03	1.202E+04	1.768E+04	2.981E+04	4.498E+04
4.00	7.467E+01	2.987E+02	2.666E+03	4.418E+03	6.475E+03	1.130E+04	1.680E+04	2.881E+04	4.424E+04
5.00	6.259E+01	2.504E+02	2.248E+03	3.831E+03	5.668E+03	1.007E+04	1.521E+04	2.682E+04	4.236E+04
6.00	5.462E+01	2.185E+02	1.966E+03	3.418E+03	5.089E+03	9.151E+03	1.397E+04	2.514E+04	4.058E+04
7.00	4.857E+01	1.943E+02	1.748E+03	3.087E+03	4.620E+03	8.385E+03	1.291E+04	2.361E+04	3.877E+04
8.00	4.382E+01	1.753E+02	1.576E+03	2.794E+03	4.233E+03	7.738E+03	1.200E+04	2.223E+04	3.702E+04
10.00	3.679E+01	1.472E+02	1.325E+03	2.353E+03	3.631E+03	6.711E+03	1.052E+04	1.986E+04	3.383E+04
12.00	3.184E+01	1.274E+02	1.146E+03	2.037E+03	3.172E+03	5.934E+03	9.368E+03	1.794E+04	3.106E+04
15.00	2.663E+01	1.065E+02	9.586E+02	1.704E+03	2.661E+03	5.069E+03	8.065E+03	1.568E+04	2.763E+04
20.00	2.111E+01	8.446E+01	7.601E+02	1.351E+03	2.111E+03	4.101E+03	6.580E+03	1.299E+04	2.334E+04
25.00	1.763E+01	7.053E+01	6.347E+02	1.128E+03	1.763E+03	3.449E+03	5.585E+03	1.114E+04	2.026E+04
30.00	1.522E+01	6.089E+01	5.480E+02	9.743E+02	1.522E+03	2.982E+03	4.872E+03	9.786E+03	1.795E+04
35.00	1.345E+01	5.381E+01	4.843E+02	8.610E+02	1.345E+03	2.637E+03	4.342E+03	8.753E+03	1.615E+04
40.00	1.210E+01	4.838E+01	4.355E+02	7.741E+02	1.210E+03	2.371E+03	3.911E+03	7.939E+03	1.472E+04
50.00	1.015E+01	4.058E+01	3.652E+02	6.493E+02	1.015E+03	1.988E+03	3.285E+03	6.736E+03	1.257E+04
60.00	8.807E+00	3.523E+01	3.170E+02	5.636E+02	8.807E+02	1.726E+03	2.853E+03	5.890E+03	1.104E+04
70.00	7.829E+00	3.132E+01	2.818E+02	5.011E+02	7.829E+02	1.535E+03	2.536E+03	5.262E+03	9.893E+03
80.00	7.082E+00	2.833E+01	2.550E+02	4.533E+02	7.082E+02	1.388E+03	2.294E+03	4.778E+03	9.001E+03
100.00	6.013E+00	2.405E+01	2.165E+02	3.848E+02	6.013E+02	1.179E+03	1.948E+03	4.062E+03	7.700E+03
120.00	5.282E+00	2.113E+01	1.902E+02	3.381E+02	5.282E+02	1.035E+03	1.711E+03	3.570E+03	6.795E+03
150.00	4.534E+00	1.814E+01	1.632E+02	2.902E+02	4.534E+02	8.887E+02	1.469E+03	3.065E+03	5.856E+03
200.00	3.764E+00	1.506E+01	1.355E+02	2.409E+02	3.764E+02	7.378E+02	1.220E+03	2.544E+03	4.875E+03
250.00	3.289E+00	1.316E+01	1.184E+02	2.105E+02	3.289E+02	6.447E+02	1.066E+03	2.224E+03	4.262E+03
300.00	2.967E+00	1.187E+01	1.068E+02	1.899E+02	2.967E+02	5.815E+02	9.612E+02	2.005E+03	3.845E+03
400.00	2.556E+00	1.022E+01	9.201E+01	1.636E+02	2.556E+02	5.009E+02	8.281E+02	1.728E+03	3.312E+03
500.00	2.306E+00	9.225E+00	8.302E+01	1.476E+02	2.306E+02	4.520E+02	7.472E+02	1.559E+03	2.989E+03
600.00	2.140E+00	8.560E+00	7.704E+01	1.370E+02	2.140E+02	4.194E+02	6.933E+02	1.447E+03	2.773E+03
700.00	2.023E+00	8.090E+00	7.281E+01	1.294E+02	2.023E+02	3.964E+02	6.553E+02	1.367E+03	2.621E+03
800.00	1.936E+00	7.746E+00	6.971E+01	1.239E+02	1.936E+02	3.796E+02	6.274E+02	1.309E+03	2.510E+03
1000.00	1.822E+00	7.288E+00	6.559E+01	1.166E+02	1.822E+02	3.571E+02	5.904E+02	1.232E+03	2.361E+03
1200.00	1.754E+00	7.016E+00	6.314E+01	1.123E+02	1.754E+02	3.438E+02	5.683E+02	1.186E+03	2.273E+03

RANGE IN PHOSPHATE GLASS (GM/CM2) I = 196.8 A/Z = 2.138

ENRG./NUC. (MEV/AMU)	1 H	4 HE	12 C	16 O	20 NE	28 SI	40 AR	56 FE	84 KR
0.10	2.439E-04	3.965E-04	4.023E-04	4.290E-04	4.554E-04	5.026E-04	6.112E-04	6.931E-04	8.792E-04
0.12	2.985E-04	4.738E-04	4.619E-04	4.893E-04	5.177E-04	5.690E-04	6.877E-04	7.744E-04	9.780E-04
0.15	3.847E-04	5.904E-04	5.484E-04	5.759E-04	6.064E-04	6.644E-04	7.967E-04	8.889E-04	1.116E-03
0.20	5.389E-04	7.864E-04	6.878E-04	7.132E-04	7.454E-04	8.115E-04	9.676E-04	1.066E-03	1.326E-03
0.25	7.052E-04	9.848E-04	8.232E-04	8.447E-04	8.770E-04	9.486E-04	1.129E-03	1.230E-03	1.519E-03
0.30	8.824E-04	1.186E-03	9.564E-04	9.726E-04	1.004E-03	1.079E-03	1.285E-03	1.386E-03	1.701E-03
0.40	1.267E-03	1.598E-03	1.220E-03	1.222E-03	1.248E-03	1.326E-03	1.566E-03	1.682E-03	2.040E-03
0.50	1.691E-03	2.028E-03	1.482E-03	1.467E-03	1.485E-03	1.561E-03	1.834E-03	1.962E-03	2.356E-03
0.60	2.151E-03	2.491E-03	1.747E-03	1.710E-03	1.719E-03	1.789E-03	2.090E-03	2.232E-03	2.658E-03
0.70	2.649E-03	2.989E-03	2.015E-03	1.955E-03	1.951E-03	2.012E-03	2.339E-03	2.481E-03	2.948E-03
0.80	3.183E-03	3.523E-03	2.289E-03	2.202E-03	2.184E-03	2.233E-03	2.583E-03	2.726E-03	3.230E-03
1.00	4.363E-03	4.704E-03	2.855E-03	2.706E-03	2.654E-03	2.672E-03	3.060E-03	3.199E-03	3.777E-03
1.20	5.691E-03	6.032E-03	3.451E-03	3.229E-03	3.135E-03	3.112E-03	3.533E-03	3.656E-03	4.308E-03
1.50	7.971E-03	8.312E-03	4.409E-03	4.057E-03	3.888E-03	3.786E-03	4.243E-03	4.327E-03	5.043E-03
2.00	1.257E-02	1.291E-02	6.203E-03	5.579E-03	5.247E-03	4.967E-03	5.459E-03	5.437E-03	6.246E-03
2.50	1.823E-02	1.857E-02	8.283E-03	7.308E-03	6.764E-03	6.247E-03	6.747E-03	6.570E-03	7.433E-03
3.00	2.431E-02	2.466E-02	1.045E-02	9.097E-03	8.324E-03	7.550E-03	8.043E-03	7.690E-03	8.588E-03
3.50	3.117E-02	3.152E-02	1.282E-02	1.104E-02	1.000E-02	8.931E-03	9.399E-03	8.836E-03	9.747E-03
4.00	3.880E-02	3.914E-02	1.539E-02	1.313E-02	1.180E-02	1.039E-02	1.082E-02	1.001E-02	1.092E-02
5.00	5.630E-02	5.664E-02	2.126E-02	1.780E-02	1.578E-02	1.357E-02	1.387E-02	1.249E-02	1.331E-02
6.00	7.682E-02	7.716E-02	2.810E-02	2.311E-02	2.027E-02	1.711E-02	1.720E-02	1.513E-02	1.581E-02
7.00	1.004E-01	1.007E-01	3.595E-02	2.908E-02	2.528E-02	2.101E-02	2.085E-02	1.796E-02	1.844E-02
8.00	1.267E-01	1.270E-01	4.472E-02	3.568E-02	3.078E-02	2.525E-02	2.478E-02	2.097E-02	2.118E-02
10.00	1.848E-01	1.852E-01	6.412E-02	5.026E-02	4.271E-02	3.438E-02	3.319E-02	2.731E-02	2.688E-02
12.00	2.527E-01	2.531E-01	8.675E-02	6.724E-02	5.637E-02	4.475E-02	4.265E-02	3.433E-02	3.306E-02
15.00	3.722E-01	3.725E-01	1.266E-01	9.711E-02	8.031E-02	6.256E-02	5.876E-02	4.610E-02	4.324E-02
20.00	6.163E-01	6.166E-01	2.079E-01	1.581E-01	1.291E-01	9.812E-02	9.066E-02	6.902E-02	6.268E-02
25.00	9.141E-01	9.145E-01	3.072E-01	2.326E-01	1.887E-01	1.408E-01	1.287E-01	9.597E-02	8.517E-02
30.00	1.263E+00	1.264E+00	4.236E-01	3.199E-01	2.586E-01	1.908E-01	1.726E-01	1.268E-01	1.107E-01
35.00	1.662E+00	1.662E+00	5.565E-01	4.195E-01	3.383E-01	2.477E-01	2.223E-01	1.615E-01	1.391E-01
40.00	2.108E+00	2.108E+00	7.052E-01	5.311E-01	4.275E-01	3.115E-01	2.775E-01	1.999E-01	1.703E-01
50.00	3.136E+00	3.137E+00	1.048E+00	7.881E-01	6.332E-01	4.584E-01	4.046E-01	2.873E-01	2.411E-01
60.00	4.337E+00	4.337E+00	1.448E+00	1.088E+00	8.733E-01	6.299E-01	5.529E-01	3.884E-01	3.224E-01
70.00	5.700E+00	5.700E+00	1.902E+00	1.429E+00	1.146E+00	8.246E-01	7.211E-01	5.023E-01	4.137E-01
80.00	7.217E+00	7.217E+00	2.408E+00	1.808E+00	1.449E+00	1.041E+00	9.085E-01	6.285E-01	5.145E-01
100.00	1.068E+01	1.068E+01	3.564E+00	2.675E+00	2.143E+00	1.537E+00	1.336E+00	9.161E-01	7.431E-01
120.00	1.469E+01	1.469E+01	4.898E+00	3.675E+00	2.943E+00	2.108E+00	1.830E+00	1.248E+00	1.005E+00
150.00	2.160E+01	2.160E+01	7.201E+00	5.403E+00	4.325E+00	3.095E+00	2.684E+00	1.820E+00	1.456E+00
200.00	3.525E+01	3.525E+01	1.175E+01	8.817E+00	7.056E+00	5.046E+00	4.370E+00	2.952E+00	2.342E+00
250.00	5.121E+01	5.121E+01	1.707E+01	1.281E+01	1.025E+01	7.326E+00	6.340E+00	4.274E+00	3.377E+00
300.00	6.914E+01	6.914E+01	2.305E+01	1.729E+01	1.383E+01	9.888E+00	8.554E+00	5.759E+00	4.540E+00
400.00	1.099E+02	1.099E+02	3.664E+01	2.748E+01	2.199E+01	1.571E+01	1.359E+01	9.137E+00	7.182E+00
500.00	1.560E+02	1.560E+02	5.199E+01	3.900E+01	3.120E+01	2.229E+01	1.927E+01	1.295E+01	1.017E+01
600.00	2.062E+02	2.062E+02	6.873E+01	5.155E+01	4.124E+01	2.947E+01	2.547E+01	1.711E+01	1.342E+01
700.00	2.597E+02	2.597E+02	8.658E+01	6.494E+01	5.195E+01	3.711E+01	3.208E+01	2.155E+01	1.689E+01
800.00	3.159E+02	3.159E+02	1.053E+02	7.899E+01	6.319E+01	4.514E+01	3.902E+01	2.620E+01	2.054E+01
1000.00	4.345E+02	4.345E+02	1.448E+02	1.086E+02	8.690E+01	6.207E+01	5.365E+01	3.602E+01	2.822E+01
1200.00	5.587E+02	5.587E+02	1.862E+02	1.397E+02	1.117E+02	7.982E+01	6.899E+01	4.631E+01	3.627E+01

DE/DX IN PHOSPHATE GLASS (MEV CM2/GM) I = 196.8 A/Z = 2.138

ENRG./NUC. (MEV/AMU)	1 H	4 HE	12 C	16 O	20 NE	28 SI	40 AR	56 FE	84 KR
0.10	3.741E+02	1.037E+03	3.963E+03	5.194E+03	6.259E+03	8.256E+03	1.019E+04	1.335E+04	1.643E+04
0.12	3.586E+02	1.032E+03	4.085E+03	5.410E+03	6.571E+03	8.594E+03	1.070E+04	1.416E+04	1.756E+04
0.15	3.386E+02	1.026E+03	4.224E+03	5.666E+03	6.949E+03	8.993E+03	1.131E+04	1.517E+04	1.899E+04
0.20	3.114E+02	1.015E+03	4.379E+03	5.972E+03	7.418E+03	9.898E+03	1.207E+04	1.649E+04	2.093E+04
0.25	2.910E+02	1.002E+03	4.474E+03	6.181E+03	7.756E+03	1.050E+04	1.262E+04	1.750E+04	2.247E+04
0.30	2.741E+02	9.869E+02	4.532E+03	6.327E+03	8.006E+03	1.098E+04	1.304E+04	1.831E+04	2.375E+04
0.40	2.473E+02	9.652E+02	4.574E+03	6.496E+03	8.335E+03	1.167E+04	1.455E+04	1.954E+04	2.575E+04
0.50	2.262E+02	8.966E+02	4.557E+03	6.561E+03	8.514E+03	1.213E+04	1.531E+04	2.040E+04	2.727E+04
0.60	2.087E+02	8.328E+02	4.505E+03	6.560E+03	8.596E+03	1.243E+04	1.587E+04	2.103E+04	2.845E+04
0.70	1.938E+02	7.749E+02	4.429E+03	6.516E+03	8.612E+03	1.262E+04	1.627E+04	2.249E+04	2.939E+04
0.80	1.809E+02	7.230E+02	4.340E+03	6.443E+03	8.580E+03	1.273E+04	1.656E+04	2.318E+04	3.014E+04
1.00	1.596E+02	6.382E+02	4.138E+03	6.239E+03	8.422E+03	1.277E+04	1.688E+04	2.417E+04	3.124E+04
1.20	1.424E+02	5.697E+02	3.922E+03	5.994E+03	8.184E+03	1.264E+04	1.696E+04	2.478E+04	3.194E+04
1.50	1.222E+02	4.887E+02	3.601E+03	5.597E+03	7.754E+03	1.227E+04	1.678E+04	2.521E+04	3.433E+04
2.00	1.016E+02	4.063E+02	3.215E+03	5.091E+03	7.172E+03	1.168E+04	1.635E+04	2.544E+04	3.569E+04
2.50	8.762E+01	3.505E+02	2.906E+03	4.662E+03	6.648E+03	1.105E+04	1.575E+04	2.522E+04	3.628E+04
3.00	7.718E+01	3.087E+02	2.645E+03	4.289E+03	6.173E+03	1.044E+04	1.509E+04	2.473E+04	3.636E+04
3.50	6.905E+01	2.762E+02	2.424E+03	3.963E+03	5.748E+03	9.854E+03	1.442E+04	2.410E+04	3.611E+04
4.00	6.251E+01	2.500E+02	2.230E+03	3.679E+03	5.370E+03	9.311E+03	1.376E+04	2.340E+04	3.565E+04
5.00	5.307E+01	2.123E+02	1.906E+03	3.236E+03	4.768E+03	8.410E+03	1.262E+04	2.205E+04	3.452E+04
6.00	4.652E+01	1.861E+02	1.674E+03	2.905E+03	4.308E+03	7.694E+03	1.168E+04	2.082E+04	3.328E+04
7.00	4.152E+01	1.661E+02	1.494E+03	2.637E+03	3.932E+03	7.088E+03	1.086E+04	1.966E+04	3.199E+04
8.00	3.757E+01	1.503E+02	1.351E+03	2.395E+03	3.617E+03	6.572E+03	1.014E+04	1.861E+04	3.070E+04
10.00	3.170E+01	1.268E+02	1.141E+03	2.027E+03	3.124E+03	5.741E+03	8.953E+03	1.676E+04	2.830E+04
12.00	2.753E+01	1.101E+02	9.911E+02	1.762E+03	2.742E+03	5.104E+03	8.022E+03	1.524E+04	2.617E+04
15.00	2.312E+01	9.248E+01	8.323E+02	1.480E+03	2.310E+03	4.387E+03	6.952E+03	1.342E+04	2.347E+04
20.00	1.842E+01	7.369E+01	6.632E+02	1.179E+03	1.842E+03	3.575E+03	5.715E+03	1.122E+04	2.002E+04
25.00	1.544E+01	6.174E+01	5.557E+02	9.879E+02	1.544E+03	3.019E+03	4.876E+03	9.677E+03	1.750E+04
30.00	1.336E+01	5.344E+01	4.810E+02	8.551E+02	1.336E+03	2.617E+03	4.270E+03	8.538E+03	1.558E+04
35.00	1.183E+01	4.733E+01	4.259E+02	7.572E+02	1.183E+03	2.319E+03	3.817E+03	7.662E+03	1.407E+04
40.00	1.066E+01	4.262E+01	3.836E+02	6.819E+02	1.066E+03	2.088E+03	3.444E+03	6.967E+03	1.286E+04
50.00	8.960E+00	3.584E+01	3.225E+02	5.734E+02	8.960E+02	1.756E+03	2.901E+03	5.935E+03	1.104E+04
60.00	7.793E+00	3.117E+01	2.805E+02	4.987E+02	7.793E+02	1.527E+03	2.525E+03	5.205E+03	9.726E+03
70.00	6.938E+00	2.775E+01	2.498E+02	4.440E+02	6.938E+02	1.360E+03	2.248E+03	4.659E+03	8.737E+03
80.00	6.283E+00	2.513E+01	2.262E+02	4.021E+02	6.283E+02	1.232E+03	2.035E+03	4.238E+03	7.965E+03
100.00	5.345E+00	2.138E+01	1.924E+02	3.421E+02	5.345E+02	1.048E+03	1.732E+03	3.610E+03	6.833E+03
120.00	4.702E+00	1.881E+01	1.693E+02	3.009E+02	4.702E+02	9.216E+02	1.523E+03	3.178E+03	6.042E+03
150.00	4.042E+00	1.617E+01	1.455E+02	2.587E+02	4.042E+02	7.923E+02	1.310E+03	2.733E+03	5.219E+03
200.00	3.362E+00	1.345E+01	1.210E+02	2.152E+02	3.362E+02	6.590E+02	1.089E+03	2.273E+03	4.354E+03
250.00	2.942E+00	1.177E+01	1.059E+02	1.883E+02	2.942E+02	5.766E+02	9.532E+02	1.989E+03	3.812E+03
300.00	2.656E+00	1.062E+01	9.562E+01	1.700E+02	2.656E+02	5.206E+02	8.606E+02	1.795E+03	3.442E+03
400.00	2.292E+00	9.167E+00	8.251E+01	1.467E+02	2.292E+02	4.492E+02	7.425E+02	1.549E+03	2.970E+03
500.00	2.070E+00	8.282E+00	7.454E+01	1.325E+02	2.070E+02	4.058E+02	6.708E+02	1.400E+03	2.683E+03
600.00	1.923E+00	7.692E+00	6.923E+01	1.231E+02	1.923E+02	3.769E+02	6.231E+02	1.300E+03	2.492E+03
700.00	1.819E+00	7.277E+00	6.549E+01	1.164E+02	1.819E+02	3.566E+02	5.894E+02	1.230E+03	2.358E+03
800.00	1.743E+00	6.972E+00	6.275E+01	1.116E+02	1.743E+02	3.416E+02	5.647E+02	1.178E+03	2.259E+03
1000.00	1.642E+00	6.569E+00	5.912E+01	1.051E+02	1.642E+02	3.219E+02	5.321E+02	1.110E+03	2.128E+03
1200.00	1.583E+00	6.331E+00	5.698E+01	1.013E+02	1.583E+02	3.102E+02	5.128E+02	1.070E+03	2.051E+03

RANGE IN OLIVINE (GM/CM2) I = 158.9 A/Z = 2.050

ENRG./NUC. (MEV/AMU)	1 H	4 HE	12 C	16 O	20 NE	28 SI	40 AR	56 FE	84 KR
0.10	2.076E-04	3.399E-04	3.475E-04	3.710E-04	3.941E-04	4.352E-04	5.294E-04	6.007E-04	7.621E-04
0.12	2.528E-04	4.048E-04	3.985E-04	4.228E-04	4.477E-04	4.925E-04	5.955E-04	6.710E-04	8.476E-04
0.15	3.245E-04	5.029E-04	4.725E-04	4.971E-04	5.239E-04	5.748E-04	6.897E-04	7.700E-04	9.669E-04
0.20	4.536E-04	6.683E-04	5.918E-04	6.150E-04	6.436E-04	7.017E-04	8.373E-04	9.228E-04	1.149E-03
0.25	5.942E-04	8.366E-04	7.080E-04	7.281E-04	7.570E-04	8.200E-04	9.772E-04	1.065E-03	1.316E-03
0.30	7.450E-04	1.008E-03	8.225E-04	8.383E-04	8.664E-04	9.326E-04	1.112E-03	1.200E-03	1.474E-03
0.40	1.075E-03	1.362E-03	1.050E-03	1.053E-03	1.078E-03	1.146E-03	1.355E-03	1.456E-03	1.767E-03
0.50	1.442E-03	1.735E-03	1.277E-03	1.266E-03	1.283E-03	1.350E-03	1.587E-03	1.699E-03	2.042E-03
0.60	1.845E-03	2.139E-03	1.508E-03	1.478E-03	1.486E-03	1.548E-03	1.810E-03	1.934E-03	2.303E-03
0.70	2.281E-03	2.576E-03	1.742E-03	1.691E-03	1.689E-03	1.742E-03	2.026E-03	2.150E-03	2.555E-03
0.80	2.751E-03	3.046E-03	1.982E-03	1.907E-03	1.892E-03	1.935E-03	2.238E-03	2.363E-03	2.800E-03
1.00	3.794E-03	4.089E-03	2.479E-03	2.349E-03	2.303E-03	2.318E-03	2.655E-03	2.774E-03	3.276E-03
1.20	4.972E-03	5.267E-03	3.004E-03	2.809E-03	2.726E-03	2.704E-03	3.068E-03	3.173E-03	3.738E-03
1.50	6.997E-03	7.292E-03	3.851E-03	3.539E-03	3.388E-03	3.294E-03	3.689E-03	3.759E-03	4.378E-03
2.00	1.108E-02	1.137E-02	5.439E-03	4.883E-03	4.585E-03	4.332E-03	4.756E-03	4.729E-03	5.427E-03
2.50	1.609E-02	1.638E-02	7.276E-03	6.407E-03	5.921E-03	5.457E-03	5.885E-03	5.720E-03	6.464E-03
3.00	2.151E-02	2.181E-02	9.202E-03	7.995E-03	7.304E-03	6.608E-03	7.027E-03	6.703E-03	7.475E-03
3.50	2.766E-02	2.796E-02	1.133E-02	9.729E-03	8.801E-03	7.834E-03	8.228E-03	7.714E-03	8.492E-03
4.00	3.451E-02	3.481E-02	1.364E-02	1.161E-02	1.041E-02	9.136E-03	9.488E-03	8.756E-03	9.522E-03
5.00	5.028E-02	5.058E-02	1.892E-02	1.580E-02	1.397E-02	1.198E-02	1.220E-02	1.095E-02	1.164E-02
6.00	6.881E-02	6.911E-02	2.510E-02	2.059E-02	1.801E-02	1.515E-02	1.519E-02	1.330E-02	1.386E-02
7.00	9.011E-02	9.041E-02	3.220E-02	2.598E-02	2.254E-02	1.866E-02	1.846E-02	1.583E-02	1.619E-02
8.00	1.142E-01	1.145E-01	4.023E-02	3.203E-02	2.756E-02	2.251E-02	2.203E-02	1.854E-02	1.865E-02
10.00	1.674E-01	1.677E-01	5.797E-02	4.536E-02	3.846E-02	3.083E-02	2.966E-02	2.427E-02	2.377E-02
12.00	2.295E-01	2.298E-01	7.866E-02	6.088E-02	5.095E-02	4.028E-02	3.826E-02	3.062E-02	2.933E-02
15.00	3.389E-01	3.392E-01	1.151E-01	8.825E-02	7.288E-02	5.656E-02	5.295E-02	4.131E-02	3.854E-02
20.00	5.631E-01	5.634E-01	1.899E-01	1.443E-01	1.177E-01	8.919E-02	8.216E-02	6.223E-02	5.621E-02
25.00	8.373E-01	8.376E-01	2.813E-01	2.129E-01	1.726E-01	1.285E-01	1.171E-01	8.692E-02	7.675E-02
30.00	1.159E+00	1.160E+00	3.886E-01	2.934E-01	2.370E-01	1.746E-01	1.576E-01	1.153E-01	1.001E-01
35.00	1.527E+00	1.528E+00	5.113E-01	3.854E-01	3.106E-01	2.271E-01	2.034E-01	1.472E-01	1.262E-01
40.00	1.940E+00	1.940E+00	6.487E-01	4.884E-01	3.930E-01	2.860E-01	2.544E-01	1.826E-01	1.549E-01
50.00	2.891E+00	2.891E+00	9.659E-01	7.263E-01	5.833E-01	4.220E-01	3.720E-01	2.634E-01	2.202E-01
60.00	4.003E+00	4.004E+00	1.337E+00	1.004E+00	8.058E-01	5.809E-01	5.094E-01	3.569E-01	2.953E-01
70.00	5.267E+00	5.268E+00	1.758E+00	1.320E+00	1.059E+00	7.614E-01	6.654E-01	4.625E-01	3.797E-01
80.00	6.675E+00	6.675E+00	2.227E+00	1.672E+00	1.340E+00	9.626E-01	8.393E-01	5.795E-01	4.732E-01
100.00	9.895E+00	9.896E+00	3.301E+00	2.477E+00	1.984E+00	1.423E+00	1.237E+00	8.466E-01	6.853E-01
120.00	1.362E+01	1.362E+01	4.541E+00	3.407E+00	2.728E+00	1.954E+00	1.696E+00	1.155E+00	9.289E-01
150.00	2.005E+01	2.005E+01	6.684E+00	5.015E+00	4.014E+00	2.873E+00	2.490E+00	1.688E+00	1.348E+00
200.00	3.277E+01	3.277E+01	1.092E+01	8.195E+00	6.558E+00	4.690E+00	4.060E+00	2.742E+00	2.174E+00
250.00	4.765E+01	4.765E+01	1.588E+01	1.191E+01	9.534E+00	6.816E+00	5.897E+00	3.974E+00	3.138E+00
300.00	6.437E+01	6.437E+01	2.146E+01	1.610E+01	1.288E+01	9.205E+00	7.963E+00	5.360E+00	4.223E+00
400.00	1.024E+02	1.024E+02	3.415E+01	2.561E+01	2.049E+01	1.464E+01	1.266E+01	8.513E+00	6.690E+00
500.00	1.455E+02	1.455E+02	4.849E+01	3.637E+01	2.910E+01	2.079E+01	1.797E+01	1.208E+01	9.479E+00
600.00	1.924E+02	1.924E+02	6.414E+01	4.811E+01	3.849E+01	2.750E+01	2.377E+01	1.597E+01	1.252E+01
700.00	2.425E+02	2.425E+02	8.083E+01	6.063E+01	4.850E+01	3.465E+01	2.995E+01	2.012E+01	1.577E+01
800.00	2.951E+02	2.951E+02	9.837E+01	7.378E+01	5.902E+01	4.217E+01	3.645E+01	2.447E+01	1.918E+01
1000.00	4.060E+02	4.061E+02	1.354E+02	1.015E+02	8.122E+01	5.802E+01	5.014E+01	3.366E+01	2.637E+01
1200.00	5.225E+02	5.225E+02	1.742E+02	1.306E+02	1.045E+02	7.464E+01	6.452E+01	4.331E+01	3.391E+01

DE/DX IN OLIVINE (MEV CM2/GM) I = 158.9 A/Z = 2.050

ENRG./NUC. (MEV/AMU)	1 H	4 HE	12 C	16 O	20 NE	28 SI	40 AR	56 FE	84 KR
0.10	4.517E+02	1.234E+03	4.632E+03	6.049E+03	7.273E+03	9.570E+03	1.180E+04	1.544E+04	1.897E+04
0.12	4.321E+02	1.229E+03	4.776E+03	6.304E+03	7.639E+03	9.964E+03	1.238E+04	1.638E+04	2.028E+04
0.15	4.061E+02	1.219E+03	4.937E+03	6.601E+03	8.078E+03	1.043E+04	1.309E+04	1.754E+04	2.194E+04
0.20	3.701E+02	1.199E+03	5.109E+03	6.949E+03	8.616E+03	1.147E+04	1.397E+04	1.906E+04	2.417E+04
0.25	3.431E+02	1.177E+03	5.209E+03	7.181E+03	8.997E+03	1.216E+04	1.460E+04	2.022E+04	2.595E+04
0.30	3.210E+02	1.154E+03	5.263E+03	7.337E+03	9.275E+03	1.270E+04	1.508E+04	2.115E+04	2.741E+04
0.40	2.865E+02	1.118E+03	5.288E+03	7.506E+03	9.627E+03	1.347E+04	1.679E+04	2.254E+04	2.971E+04
0.50	2.599E+02	1.031E+03	5.246E+03	7.555E+03	9.807E+03	1.397E+04	1.765E+04	2.352E+04	3.144E+04
0.60	2.385E+02	9.517E+02	5.167E+03	7.532E+03	9.877E+03	1.430E+04	1.826E+04	2.422E+04	3.278E+04
0.70	2.205E+02	8.817E+02	5.065E+03	7.462E+03	9.873E+03	1.449E+04	1.870E+04	2.588E+04	3.384E+04
0.80	2.052E+02	8.200E+02	4.950E+03	7.361E+03	9.817E+03	1.459E+04	1.901E+04	2.664E+04	3.469E+04
1.00	1.802E+02	7.207E+02	4.700E+03	7.103E+03	9.605E+03	1.460E+04	1.934E+04	2.774E+04	3.591E+04
1.20	1.605E+02	6.419E+02	4.443E+03	6.807E+03	9.313E+03	1.443E+04	1.939E+04	2.841E+04	3.669E+04
1.50	1.372E+02	5.489E+02	4.063E+03	6.333E+03	8.793E+03	1.396E+04	1.914E+04	2.884E+04	3.936E+04
2.00	1.142E+02	4.566E+02	3.625E+03	5.753E+03	8.121E+03	1.326E+04	1.861E+04	2.906E+04	4.087E+04
2.50	9.811E+01	3.924E+02	3.261E+03	5.246E+03	7.496E+03	1.251E+04	1.787E+04	2.872E+04	4.144E+04
3.00	8.618E+01	3.447E+02	2.958E+03	4.809E+03	6.937E+03	1.177E+04	1.707E+04	2.809E+04	4.144E+04
3.50	7.693E+01	3.077E+02	2.703E+03	4.431E+03	6.441E+03	1.108E+04	1.626E+04	2.730E+04	4.106E+04
4.00	6.951E+01	2.780E+02	2.481E+03	4.103E+03	6.001E+03	1.044E+04	1.548E+04	2.645E+04	4.045E+04
5.00	5.861E+01	2.344E+02	2.105E+03	3.581E+03	5.288E+03	9.363E+03	1.410E+04	2.476E+04	3.894E+04
6.00	5.125E+01	2.050E+02	1.844E+03	3.204E+03	4.762E+03	8.535E+03	1.300E+04	2.329E+04	3.741E+04
7.00	4.565E+01	1.826E+02	1.643E+03	2.900E+03	4.334E+03	7.841E+03	1.205E+04	2.193E+04	3.585E+04
8.00	4.124E+01	1.650E+02	1.483E+03	2.630E+03	3.978E+03	7.251E+03	1.122E+04	2.069E+04	3.431E+04
10.00	3.471E+01	1.388E+02	1.249E+03	2.220E+03	3.423E+03	6.310E+03	9.867E+03	1.856E+04	3.148E+04
12.00	3.008E+01	1.203E+02	1.083E+03	1.925E+03	2.997E+03	5.593E+03	8.812E+03	1.681E+04	2.900E+04
15.00	2.521E+01	1.008E+02	9.074E+02	1.613E+03	2.519E+03	4.791E+03	7.610E+03	1.474E+04	2.589E+04
20.00	2.003E+01	8.012E+01	7.211E+02	1.282E+03	2.003E+03	3.889E+03	6.229E+03	1.227E+04	2.198E+04
25.00	1.675E+01	6.701E+01	6.031E+02	1.072E+03	1.675E+03	3.276E+03	5.300E+03	1.055E+04	1.913E+04
30.00	1.448E+01	5.792E+01	5.213E+02	9.267E+02	1.448E+03	2.836E+03	4.632E+03	9.283E+03	1.698E+04
35.00	1.281E+01	5.123E+01	4.611E+02	8.197E+02	1.281E+03	2.510E+03	4.133E+03	8.315E+03	1.531E+04
40.00	1.152E+01	4.610E+01	4.149E+02	7.375E+02	1.152E+03	2.259E+03	3.726E+03	7.551E+03	1.397E+04
50.00	9.676E+00	3.871E+01	3.484E+02	6.193E+02	9.676E+02	1.897E+03	3.134E+03	6.418E+03	1.196E+04
60.00	8.407E+00	3.363E+01	3.027E+02	5.380E+02	8.407E+02	1.648E+03	2.724E+03	5.619E+03	1.052E+04
70.00	7.479E+00	2.991E+01	2.692E+02	4.786E+02	7.479E+02	1.466E+03	2.423E+03	5.024E+03	9.436E+03
80.00	6.768E+00	2.707E+01	2.437E+02	4.332E+02	6.768E+02	1.327E+03	2.192E+03	4.566E+03	8.592E+03
100.00	5.751E+00	2.301E+01	2.070E+02	3.681E+02	5.751E+02	1.127E+03	1.863E+03	3.885E+03	7.359E+03
120.00	5.056E+00	2.022E+01	1.820E+02	3.236E+02	5.056E+02	9.909E+02	1.638E+03	3.417E+03	6.500E+03
150.00	4.342E+00	1.737E+01	1.563E+02	2.779E+02	4.342E+02	8.511E+02	1.407E+03	2.935E+03	5.608E+03
200.00	3.608E+00	1.443E+01	1.299E+02	2.309E+02	3.608E+02	7.072E+02	1.169E+03	2.439E+03	4.673E+03
250.00	3.155E+00	1.262E+01	1.136E+02	2.019E+02	3.155E+02	6.183E+02	1.022E+03	2.133E+03	4.088E+03
300.00	2.846E+00	1.139E+01	1.025E+02	1.822E+02	2.846E+02	5.579E+02	9.222E+02	1.924E+03	3.689E+03
400.00	2.454E+00	9.815E+00	8.834E+01	1.570E+02	2.454E+02	4.809E+02	7.950E+02	1.659E+03	3.180E+03
500.00	2.215E+00	8.862E+00	7.975E+01	1.418E+02	2.215E+02	4.342E+02	7.178E+02	1.498E+03	2.871E+03
600.00	2.057E+00	8.226E+00	7.404E+01	1.316E+02	2.057E+02	4.031E+02	6.663E+02	1.390E+03	2.665E+03
700.00	1.945E+00	7.778E+00	7.000E+01	1.244E+02	1.945E+02	3.811E+02	6.300E+02	1.314E+03	2.520E+03
800.00	1.862E+00	7.450E+00	6.705E+01	1.192E+02	1.862E+02	3.650E+02	6.034E+02	1.259E+03	2.414E+03
1000.00	1.753E+00	7.014E+00	6.312E+01	1.122E+02	1.753E+02	3.437E+02	5.681E+02	1.185E+03	2.272E+03
1200.00	1.689E+00	6.755E+00	6.080E+01	1.081E+02	1.689E+02	3.310E+02	5.472E+02	1.142E+03	2.189E+03

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13. ABSTRACT

The range and energy loss rate for the ions ^{1}H, ^{4}He, ^{12}C, ^{16}O, ^{20}Ne, ^{28}Si, ^{40}Ar, ^{56}Fe, and ^{84}K are given in the energy/nucleon interval 0.1 - 1200 MeV/amu. These quantities are tabulated for the stopping materials cellulose nitrate, cellulose acetate butyrate, HBpaIT polyester, Lexan, Mylar, muscovite and phlogopite mica, soda lime and phosphate glass and olivine. The values for a given stopping material can be extended to other materials with similar values of the mean excitation potential by simple scaling. The computation involved a published mathematical method which was modified and extended to lower energies.

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14. KEY WORDS	LINK A ROLE	LINK A WT	LINK B ROLE	LINK B WT	LINK C ROLE	LINK C WT
Charged particle tracks						
Polymers						
Range						
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