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**LOS ALAMOS SCIENTIFIC LABORATORY**  
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LOS ALAMOS • NEW MEXICO

**The Scattering of Gamma Rays**  
in An Exponential Atmosphere

LOS ALAMOS NATIONAL LABORATORY



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**The Scattering of Gamma Rays**  
**in An Exponential Atmosphere**

by

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# THE SCATTERING OF GAMMA RAYS IN AN EXPONENTIAL ATMOSPHERE

by

E. D. Cashwell, Conrad Longmire, and J. R. Neergaard

## ABSTRACT

In studying the electromagnetic signal from the explosion of a nuclear device at high altitudes, a problem of importance is the determination of the time dependence of a gamma-ray pulse as it undergoes Compton scattering in the earth's atmosphere. This report gives the results of Monte Carlo calculations designed to study this problem.

### I. Description of Problem.

In connection with the electromagnetic pulse produced by a high-altitude nuclear burst, it is of interest to determine the time-smearing of a gamma-ray pulse as it enters the atmosphere and undergoes Compton scattering. This report gives the results of Monte Carlo calculations for gamma rays with energies 0.5, 1.5, and 5.0 MeV which enter the atmosphere in the downward vertical direction. Only those photons which never fall more than 3.2  $\mu$ sec behind the incident beam are considered. Since this restriction rules out photons which, as a result of scattering, are displaced very far laterally, approximate results for other than vertical angles of entry can be obtained by simple scaling, as will be described below.

In these calculations it was assumed that the density of electrons is given as a function of altitude by

$$N(z) = N_0 e^{-z/h},$$

where

$$N_0 = 1.0 \times 10^{20} \text{ electrons/cc}$$

$$h = 6.7 \text{ kilometers.}$$

The point  $z = 0$  corresponds to an altitude of approximately 10 Km above sea level; gammas were not carried below this altitude. The beam was started at  $z = 40$  km, which corresponds to a true altitude

of about 50 km; there is less than 0.1 scattering mean free path above this altitude for even the lowest gamma energy considered.

The calculations were performed using the general Monte Carlo photon code. The latter is a general geometry program with the Klein-Nishina scattering distribution for Compton collisions built in as a permanent feature. A wide variety of information is available as standard output, some of which we mention below.

The flow of gammas downward across the surface is given at each of the infinite planes  $z = 0, 4, 8, 12, 16, 20, 24, 28, 32,$  and  $36$  km (the upward flows were found to be of negligible importance). At each plane, the flow per source particle is given as a function of energy, angle, and retarded time. The latter quantity denotes the time lag of the incident gamma ray behind the direct beam. The angular bins and the (retarded) time bins do not vary with source energy and are as follows:

Angle bins ( $\cos \theta$ , where  $\theta$  is the angle with the normal to the plane)

1.0-0.9, 0.9-0.75, 0.75-0.6, 0.6-0.

Retarded time bins:

0-0.01, 0.01-5, 5-10, 10-20, 20-40, 40-80,  
80-160, 160-320 shakes.

The energy bins for each source are as follows:

Energy bins for 5.0 MeV source:

0.1-1, 1-2, 2-3, 3-4, 4-5 MeV.

Energy bins for 1.5 MeV source:

0.1-0.3, 0.3-0.6, 0.6-0.9, 0.9-1.2, 1.2-1.5 MeV.

Energy bins for 0.5 MeV source:

0.1-0.2, 0.2-0.3, 0.3-0.4, 0.4-0.5 MeV.

We present below a table of the Compton scattering cross sections used, which were taken from National Bureau of Standards Circular 542, "Graphs of the Compton Energy-Angle Relationship and the Klein-Nishina Formula from 10 KeV to 500 MeV." Absorption of gamma rays is ignored in these calculations.

#### Compton Cross Sections

$E$ (MeV)	$\sigma_{\text{comp}}$ (Barns/electron)	$E$ (MeV)	$\sigma_{\text{comp}}$ (Barns/electron)
0.10	0.49	0.90	0.22
0.15	0.44	1.0	0.21
0.20	0.40	1.5	0.17
0.25	0.375	2.0	0.145
0.30	0.35	2.5	0.128
0.35	0.334	3.0	0.114
0.40	0.315	3.5	0.104
0.50	0.29	4.0	0.095
0.60	0.265	5.0	0.083
0.70	0.247	6.0	0.073
0.80	0.233		

The results of the Monte Carlo calculation are given in Tables III, IV, and V. Here the surface numbers 2, 3, ..., 11 correspond to planes at  $z = 36, 32, \dots, 0$  km, respectively (or to true altitudes of 46, 42, ..., 10 km, with the source beam originating at 50 km above sea level). A number written in the form  $3.96^{-4}$  means  $3.96 \times 10^{-4}$ . Also, the integer which appears below such a number refers to the rounded statistical error in the number above it. For example, the first entry in the sample matrix on page 27 states that  $3.96 \times 10^{-4}$  gammas per starting 5.0 MeV gamma crossed surface 2 downward with energy between 4.0 and 5.0 MeV, with  $\cos \theta$  between 1.0 and 0.9 ( $\theta$  is the angle with the normal to the plane), and with a retarded time between 10 and 20 shakes. The integer 20 gives the statistical error in the number  $3.96 \times 10^{-4}$  as 20%. The interpretation of this is that  $(.2) \times (3.96 \times 10^{-4})$  is the standard deviation of the mean. In other words, for each entry in the matrix, there is ap-

proximately a 68% chance that the entry is correct to within the error quoted (in this case, 20%).

#### II. Scaling to other Entry Angles.

To scale to other angles of entry, we make the following argument. Let  $\phi$  be the angle of entry of the gamma ray beam, measured from the vertical. The mass of air above an altitude  $z$ , for vertical entry, is

$$m(z) = Ae^{-z/h},$$

where  $A$  is a constant, and the mass penetrated by gammas entering at angle  $\phi$ , at altitude  $z'$ , is

$$m(z') = \frac{A}{\cos \phi} e^{-z'/h}.$$

These two masses are equal when  $z'$  is higher than  $z$  by an amount

$$z' - z = h \ln \left( \frac{1}{\cos \phi} \right).$$

Ignoring the effect of lateral spreading of the beam, the same number and types of collisions will have occurred when the beam has passed through the same mass of air. However, since the effective scale height seen by obliquely entering gammas is  $h/\cos \phi$ , mean free paths will be longer by a factor  $\frac{1}{\cos \phi}$ , and the retarded time at which the same number and types of collisions will have occurred will be proportional to  $\frac{1}{\cos \phi}$ .

Table I gives the approximate true altitudes at the various surfaces as a function of entry angle  $\phi$ , and Table II gives the equivalent retarded times corresponding to the time boxes used in the Monte Carlo calculation.

#### III. Reduction of Monte Carlo Data.

In order to reduce the rather voluminous Monte Carlo data in a way of significance for EMP applications, we have summed the Monte Carlo data in the following way. For a given incident gamma energy, given surface, and given time bin, we have summed over angular and energy bins with a weighting factor such that the result is proportional to the total forward Compton electron charge displacement that would result. The weighting factor used was

$$w(E, \theta) = \cos \theta \frac{f(E)}{f(E_0)},$$

where

$$f(E) = \frac{E^2}{1 + 0.88E + 0.265E^2},$$

E is the gamma energy in Mev, and  $E_0$  is the incident gamma energy. The function  $f(E)$  is a fit to the product of total Compton cross section and the mean forward range of the Compton electron produced by a gamma of energy E. The values of E and  $\cos \theta$  used in the weighted sum were the values at the centers of the bins, except that for the unscattered gammas ( $\Delta t = 0$ ),  $E = E_0$  and  $\cos \theta = 1$  were used, so that the weight factor was unity.

The weighted sums are given in Tables VI, VII, and VIII.

#### ACKNOWLEDGMENT

The authors are deeply indebted to Lena Furrh for the meticulous care she displayed in tabulating the data in this report from the machine listings.

TABLE I  
Altitudes of Surfaces as Function of Entry Angle  $\phi$   
Altitudes in kilometers

$\phi$ s	0 (vertical)	30°	60°	75°
1	50	51	55	59
2	46	47	51	55
3	42	43	47	51
4	38	39	43	47
5	34	35	39	43
6	30	31	35	39
7	26	27	31	35
8	22	23	27	31
9	18	19	23	27
10	14	15	19	23
11	10	11	15	19

TABLE II  
Retarded Times as Function of Entry Angle  $\phi$   
Times in shakes

$\phi$	Retarded Times							
0	0	5	10	20	40	80	160	320
30°	0	5.78	11.55	23.1	46.2	92.4	185	369
60°	0	10	20	40	80	120	320	640
75°	0	19.3	38.6	77.3	155	309	618	1236

TABLE III  
 Monte Carlo Data for 0.5 MeV Gammas

SAMPLE MATRIX WITH ROWS AND COLUMNS LABELED  
 FOR  $E_0 = 0.5$  MeV

(ENTRIES IN MATRIX ARE NO. GAMMAS PER SOURCE PARTICLE)

SURFACE NO. = 2

$\Delta t = 5 - 10$  SHAKES

$\begin{matrix} \text{Cos } \theta \\ E \end{matrix}$	1.0 - 0.9	0.9 - 0.75	0.75 - 0.6	0.6 - 0
0.4 - 0.5 MeV	$5.81^{-4}$ 11	$1.42^{-4}$ 21		
0.3 - 0.4			$2.58^{-5}$ 50	$1.29^{-5}$ 71
0.2 - 0.3				
0.1 - 0.2				



TABLE III (continued)

$E_0 = 0.5$  MeV

SURFACE No. = 2

$\Delta t = 0$

$9.59^{-4}$ 1			

$\Delta t = 0+ - 5$  SHAKES

$1.18^{-3}$ 7	$1.10^{-4}$ 24	$1.29^{-5}$ 71	
		$7.10^{-5}$ 30	$6.46^{-5}$ 32
			$1.29^{-5}$ 71

$\Delta t = 5 - 10$

$5.81^{-4}$ 11	$1.42^{-4}$ 21		
		$2.58^{-5}$ 50	$1.29^{-5}$ 71

$\Delta t = 10 - 20$

$1.03^{-3}$ 8	$3.87^{-4}$ 13		
		$1.10^{-4}$ 24	$5.16^{-5}$ 35
			$1.29^{-5}$ 71

$\Delta t = 20 - 40$

$1.37^{-3}$ 7	$7.29^{-4}$ 9	$1.29^{-5}$ 71	
		$1.94^{-4}$ 18	$8.39^{-5}$ 28

$\Delta t = 40 - 80$

$1.23^{-3}$ 7	$1.25^{-3}$ 7	$6.46^{-6}$ 100	
$6.46^{-6}$ 100		$3.03^{-4}$ 15	$2.32^{-4}$ 17
			$3.23^{-5}$ 45
		$6.46^{-6}$ 100	

$\Delta t = 80 - 160$

$5.81^{-4}$ 11	$2.03^{-3}$ 6	$3.23^{-5}$ 45	
	$6.46^{-6}$ 100	$7.04^{-4}$ 10	$4.00^{-4}$ 13
$6.46^{-6}$ 100	$6.46^{-6}$ 100		$8.39^{-5}$ 28
	$6.46^{-6}$ 100		$6.46^{-6}$ 100

$\Delta t = 160 - 320$

	$1.83^{-3}$ 6	$4.52^{-5}$ 38	
$6.46^{-6}$ 100	$1.29^{-5}$ 71	$1.13^{-3}$ 8	$7.55^{-4}$ 9
$1.29^{-5}$ 71	$6.46^{-6}$ 100	$6.46^{-6}$ 100	$1.81^{-4}$ 19
			$1.94^{-5}$ 58

TABLE III (continued)

$E_0 = \text{---}0.5\text{---}$  MeV

SURFACE No. = 3

$\Delta t = 0$

8.91 <sup>-7</sup> < 1			

$\Delta t = 0+ - 5$  SHAKES

2.03 <sup>-3</sup> 6	2.65 <sup>-4</sup> 16	1.94 <sup>-5</sup> 58	
		1.29 <sup>-4</sup> 22	3.23 <sup>-5</sup> 45

$\Delta t = 5 - 10$

1.34 <sup>-3</sup> 7	3.10 <sup>-4</sup> 14	6.46 <sup>-6</sup> 100	
6.46 <sup>-6</sup> 100		7.75 <sup>-5</sup> 29	3.87 <sup>-5</sup> 41
			1.29 <sup>-5</sup> 71

$\Delta t = 10 - 20$

1.92 <sup>-3</sup> 6	6.13 <sup>-4</sup> 10	1.94 <sup>-5</sup> 58	
1.29 <sup>-5</sup> 71		1.48 <sup>-4</sup> 21	1.03 <sup>-4</sup> 25
			6.46 <sup>-6</sup> 100

$\Delta t = 20 - 40$

2.63 <sup>-3</sup> 5	1.14 <sup>-3</sup> 8	2.58 <sup>-5</sup> 50	
6.46 <sup>-6</sup> 100	1.29 <sup>-5</sup> 71	3.16 <sup>-4</sup> 14	1.61 <sup>-4</sup> 20
			3.87 <sup>-5</sup> 41

$\Delta t = 40 - 80$

3.15 <sup>-3</sup> 5	2.15 <sup>-3</sup> 5	5.81 <sup>-5</sup> 33	6.46 <sup>-6</sup> 100
3.23 <sup>-5</sup> 45	3.23 <sup>-5</sup> 45	5.62 <sup>-4</sup> 11	3.36 <sup>-4</sup> 14
		6.46 <sup>-6</sup> 100	7.10 <sup>-5</sup> 30

$\Delta t = 80 - 160$

3.05 <sup>-3</sup> 5	3.63 <sup>-3</sup> 4	7.75 <sup>-5</sup> 29	
3.23 <sup>-5</sup> 45	4.52 <sup>-5</sup> 38	1.09 <sup>-3</sup> 8	7.62 <sup>-4</sup> 9
6.46 <sup>-6</sup> 100	1.29 <sup>-5</sup> 71	1.29 <sup>-5</sup> 71	1.55 <sup>-4</sup> 20
6.46 <sup>-6</sup> 100	6.46 <sup>-6</sup> 100		

$\Delta t = 160 - 320$

1.09 <sup>-3</sup> 8	5.20 <sup>-3</sup> 4	1.36 <sup>-4</sup> 22	
4.52 <sup>-5</sup> 38	7.75 <sup>-5</sup> 29	2.25 <sup>-3</sup> 5	1.42 <sup>-3</sup> 7
2.58 <sup>-5</sup> 50	3.87 <sup>-5</sup> 41	5.16 <sup>-5</sup> 35	2.90 <sup>-4</sup> 15
6.46 <sup>-6</sup> 100	6.46 <sup>-6</sup> 100		6.46 <sup>-6</sup> 100

TABLE III (continued)

$E_0 = 0.5$  MeV

SURFACE No. = 4

$\Delta t = 0$

$7.79^{-1}$ < 1	$1.29^{-5}$ 71		
		$6.46^{-8}$ 100	

$\Delta t = 0+ - 5$  SHAKES

$3.34^{-3}$ 4	$4.20^{-4}$ 12	$1.29^{-5}$ 71	
		$1.61^{-4}$ 20	$7.10^{-5}$ 30
			$1.29^{-5}$ 71

$\Delta t = 5 - 10$

$2.21^{-3}$ 5	$4.58^{-4}$ 12	$1.29^{-5}$ 71	
		$7.10^{-5}$ 30	$2.58^{-5}$ 50

$\Delta t = 10 - 20$

$3.40^{-3}$ 4	$9.10^{-4}$ 8	$1.94^{-5}$ 58	
$6.46^{-8}$ 100		$1.87^{-4}$ 19	$1.61^{-4}$ 20
			$2.58^{-5}$ 50

$\Delta t = 20 - 40$

$4.60^{-3}$ 4	$1.75^{-3}$ 6	$2.58^{-5}$ 50	
$3.23^{-5}$ 45	$2.58^{-5}$ 50	$4.78^{-4}$ 12	$3.36^{-4}$ 14
$6.46^{-8}$ 100	$1.29^{-5}$ 71	$1.29^{-5}$ 71	$5.81^{-5}$ 33

$\Delta t = 40 - 80$

$5.60^{-3}$ 3	$3.56^{-3}$ 4	$5.81^{-5}$ 33	
$3.87^{-5}$ 41	$1.94^{-5}$ 58	$9.94^{-4}$ 8	$6.52^{-4}$ 10
$6.46^{-8}$ 100	$6.46^{-8}$ 100	$6.46^{-8}$ 100	$1.42^{-4}$ 21
$6.46^{-8}$ 100	$6.46^{-8}$ 100		

$\Delta t = 80 - 160$

$5.53^{-3}$ 3	$5.65^{-3}$ 3	$1.10^{-4}$ 24	
$8.39^{-5}$ 28	$7.75^{-5}$ 29	$1.77^{-3}$ 6	$1.16^{-3}$ 7
$2.58^{-5}$ 50	$3.23^{-5}$ 45	$3.23^{-5}$ 45	$2.71^{-4}$ 15
$6.46^{-8}$ 100		$6.46^{-8}$ 100	$1.94^{-5}$ 58

$\Delta t = 160 - 320$

$3.79^{-3}$ 4	$8.06^{-3}$ 3	$2.39^{-4}$ 16	
$2.39^{-4}$ 16	$2.52^{-4}$ 16	$3.26^{-3}$ 4	$2.41^{-3}$ 5
$7.10^{-5}$ 30	$6.46^{-5}$ 32	$7.10^{-5}$ 30	$4.97^{-4}$ 11
$5.16^{-5}$ 35	$5.81^{-5}$ 33	$3.23^{-5}$ 45	$3.23^{-5}$ 45

TABLE III (continued)

$E_0 = \text{---}0.5 \text{ MeV}$

SURFACE No. = 5

$\Delta t = 0$

$6.09^{-1}$ 4			

$\Delta t = 0+ - 5$  SHAKES

$4.55^{-3}$ 4	$5.68^{-4}$ 11	$6.46^{-6}$ 100	
		$1.81^{-4}$ 19	$1.36^{-4}$ 22

$\Delta t = 5 - 10$

$3.21^{-3}$ 4	$6.58^{-4}$ 10	$1.29^{-5}$ 71	
		$2.07^{-4}$ 18	$9.68^{-5}$ 26
	$6.46^{-6}$ 100		$6.46^{-6}$ 100

$\Delta t = 10 - 20$

$4.85^{-3}$ 4	$1.46^{-3}$ 7	$1.94^{-5}$ 58	
$4.52^{-5}$ 38		$3.42^{-4}$ 14	$2.58^{-4}$ 16
$1.29^{-5}$ 71			$1.94^{-5}$ 58
$6.46^{-6}$ 100			

$\Delta t = 20 - 40$

$6.78^{-3}$ 3	$2.54^{-3}$ 5	$5.16^{-5}$ 35	$6.46^{-6}$ 100
$8.39^{-5}$ 28	$1.29^{-5}$ 71	$5.68^{-4}$ 11	$4.97^{-4}$ 11
$1.29^{-5}$ 71	$1.94^{-5}$ 58		$6.46^{-6}$ 32
$6.46^{-6}$ 100	$6.46^{-6}$ 100		

$\Delta t = 40 - 80$

$8.89^{-3}$ 3	$4.80^{-3}$ 4	$7.10^{-5}$ 30	$1.29^{-5}$ 71
$9.04^{-5}$ 27	$8.39^{-5}$ 28	$1.53^{-3}$ 6	$9.68^{-4}$ 8
$3.87^{-5}$ 41	$1.94^{-5}$ 58	$3.23^{-5}$ 45	$1.94^{-4}$ 18
$1.29^{-5}$ 71	$1.29^{-5}$ 71	$6.46^{-6}$ 100	

$\Delta t = 80 - 160$

$9.24^{-3}$ 3	$8.26^{-3}$ 3	$2.00^{-4}$ 18	$6.46^{-6}$ 100
$2.52^{-4}$ 16	$3.87^{-4}$ 15	$2.63^{-3}$ 5	$1.73^{-3}$ 6
$9.68^{-5}$ 26	$7.75^{-5}$ 29	$7.10^{-5}$ 30	$4.33^{-4}$ 12
$3.23^{-5}$ 45	$1.94^{-5}$ 58	$3.23^{-5}$ 45	$1.94^{-5}$ 58

$\Delta t = 160 - 320$

$6.42^{-3}$ 3	$1.15^{-2}$ 2	$2.97^{-4}$ 15	$6.46^{-6}$ 100
$4.84^{-4}$ 12	$5.68^{-4}$ 11	$4.45^{-3}$ 4	$3.22^{-3}$ 4
$1.94^{-4}$ 18	$2.78^{-4}$ 15	$2.13^{-4}$ 17	$1.05^{-3}$ 8
$9.68^{-5}$ 26	$7.75^{-5}$ 29	$8.39^{-5}$ 28	$7.10^{-5}$ 30

TABLE III (continued)

$E_0 = 0.5$  MeV

SURFACE No. = 6

$\Delta t = 0$

$3.93^{-3}$ < 1	$6.46^{-6}$ 100		

$\Delta t = 0+ - 5$  SHAKES

$5.55^{-3}$ 3	$7.68^{-4}$ 9	$3.23^{-5}$ 45	
		$2.71^{-4}$ 15	$1.29^{-4}$ 22
			$1.94^{-5}$ 58
$6.46^{-6}$ 100			

$\Delta t = 5 - 10$

$3.62^{-3}$ 4	$6.97^{-4}$ 10	$1.94^{-5}$ 58	
$1.94^{-5}$ 58	$1.29^{-5}$ 71	$1.94^{-4}$ 18	$2.00^{-4}$ 18
			$1.29^{-5}$ 71

$\Delta t = 10 - 20$

$5.78^{-3}$ 3	$1.58^{-3}$ 6	$3.87^{-5}$ 41	
$3.23^{-5}$ 45	$6.46^{-6}$ 100	$3.29^{-4}$ 14	$3.10^{-4}$ 14
$6.46^{-6}$ 100	$6.46^{-6}$ 100	$6.46^{-6}$ 100	$5.81^{-5}$ 33

$\Delta t = 20 - 40$

$8.03^{-3}$ 3	$2.93^{-3}$ 5	$1.94^{-5}$ 58	
$9.68^{-5}$ 26	$1.03^{-4}$ 25	$8.33^{-4}$ 9	$5.23^{-4}$ 11
$1.29^{-5}$ 71	$1.94^{-5}$ 58	$6.46^{-6}$ 100	$1.29^{-4}$ 22
$2.58^{-5}$ 50			$6.46^{-6}$ 100

$\Delta t = 40 - 80$

$1.04^{-2}$ 2	$5.10^{-3}$ 4	$1.87^{-4}$ 19	
$2.32^{-4}$ 17	$1.42^{-4}$ 21	$1.59^{-3}$ 6	$1.01^{-3}$ 8
$7.75^{-5}$ 29	$9.68^{-5}$ 26	$2.58^{-5}$ 50	$2.00^{-4}$ 18
$1.94^{-5}$ 58	$6.46^{-6}$ 100	$1.29^{-5}$ 71	$6.46^{-6}$ 100

$\Delta t = 80 - 160$

$1.12^{-2}$ 2	$9.37^{-3}$ 3	$3.36^{-4}$ 14	$3.23^{-5}$ 45
$6.58^{-4}$ 10	$6.13^{-4}$ 10	$3.31^{-3}$ 4	$2.20^{-3}$ 5
$1.74^{-4}$ 19	$1.87^{-4}$ 19	$1.10^{-4}$ 24	$5.04^{-4}$ 11
$7.10^{-5}$ 30	$5.16^{-5}$ 35	$3.87^{-5}$ 41	$6.46^{-6}$ 32

$\Delta t = 160 - 320$

$8.81^{-3}$ 3	$1.36^{-2}$ 2	$7.04^{-4}$ 10	$4.52^{-5}$ 38
$1.07^{-3}$ 8	$1.28^{-3}$ 7	$5.69^{-3}$ 3	$3.88^{-3}$ 4
$5.36^{-4}$ 11	$5.10^{-4}$ 11	$4.00^{-4}$ 13	$1.28^{-3}$ 7
$2.07^{-4}$ 18	$2.45^{-4}$ 16	$1.87^{-4}$ 19	$1.42^{-4}$ 21

TABLE III (continued)

$E_0 = \text{---}0.2\text{---}$  MeV

SURFACE No. =    7   

$\Delta t = 0$

$1.76^{-1}$ < 1			

$\Delta t = 0+ -5$  SHAKES

$4.43^{-3}$ 4	$6.46^{-4}$ 10	$1.29^{-5}$ 71	
	$6.46^{-6}$ 100	$1.42^{-4}$ 21	$9.68^{-5}$ 26
			$3.23^{-5}$ 45

$\Delta t = 5 - 10$

$2.98^{-3}$ 5	$6.52^{-4}$ 10	$1.29^{-5}$ 71	
	$1.94^{-5}$ 58	$1.68^{-4}$ 20	$1.10^{-4}$ 24
$6.46^{-6}$ 100			$1.94^{-5}$ 58
$1.29^{-5}$ 71			

$\Delta t = 10 - 20$

$4.87^{-3}$ 4	$1.38^{-3}$ 7	$2.58^{-5}$ 50	
$3.23^{-5}$ 45	$1.94^{-5}$ 58	$3.68^{-4}$ 13	$2.26^{-4}$ 17
$1.94^{-5}$ 58		$1.29^{-5}$ 71	$3.87^{-5}$ 41
$6.46^{-6}$ 100			

$\Delta t = 20 - 40$

$6.71^{-3}$ 3	$2.36^{-3}$ 5	$6.46^{-5}$ 30	
$1.94^{-4}$ 18	$1.16^{-4}$ 24	$6.13^{-4}$ 10	$3.87^{-4}$ 13
$4.52^{-5}$ 38	$3.23^{-5}$ 45	$1.94^{-5}$ 58	$1.16^{-4}$ 24
$2.58^{-5}$ 50			

$\Delta t = 40 - 80$

$8.99^{-3}$ 3	$4.41^{-3}$ 4	$2.07^{-4}$ 18	
$3.87^{-4}$ 13	$3.03^{-4}$ 15	$1.45^{-3}$ 7	$9.04^{-4}$ 8
$1.61^{-4}$ 20	$5.81^{-5}$ 33	$5.16^{-5}$ 35	$2.45^{-4}$ 16
$5.81^{-5}$ 33	$1.29^{-5}$ 71	$1.29^{-5}$ 71	$1.94^{-5}$ 58

$\Delta t = 80 - 160$

$9.79^{-3}$ 3	$7.69^{-3}$ 3	$4.00^{-4}$ 13	$6.46^{-6}$ 100
$1.00^{-3}$ 8	$9.23^{-4}$ 8	$2.82^{-3}$ 5	$1.96^{-3}$ 6
$3.68^{-4}$ 13	$3.55^{-4}$ 13	$2.45^{-4}$ 16	$5.55^{-4}$ 11
$2.13^{-4}$ 17	$1.23^{-4}$ 23	$1.16^{-4}$ 24	$7.10^{-5}$ 30

$\Delta t = 160 - 320$

$7.74^{-3}$ 3	$1.06^{-2}$ 2	$6.07^{-4}$ 10	$4.52^{-5}$ 38
$1.95^{-3}$ 6	$1.78^{-3}$ 6	$4.80^{-3}$ 4	$3.89^{-3}$ 4
$7.94^{-4}$ 9	$1.00^{-3}$ 8	$7.68^{-4}$ 9	$1.43^{-3}$ 7
$4.58^{-4}$ 12	$4.07^{-4}$ 13	$3.23^{-4}$ 14	$3.23^{-4}$ 14

TABLE III (continued)

$E_0 = .025$  MeV

SURFACE No. = 8

$\Delta t = 0$

$4.11^{-2}$ ← 1			

$\Delta t = 0+ - 5$  SHAKES

$1.82^{-3}$ 4	$2.78^{-4}$ 11		
$6.46^{-6}$ 71		$7.10^{-5}$ 21	$6.13^{-5}$ 23
			$9.68^{-6}$ 58

$\Delta t = 5 - 10$

$1.26^{-3}$ 5	$2.87^{-4}$ 11		
$9.68^{-6}$ 58	$6.46^{-6}$ 71	$7.10^{-5}$ 21	$2.58^{-5}$ 35
$3.23^{-6}$ 100	$3.23^{-6}$ 100		$2.58^{-5}$ 35
$3.23^{-6}$ 100		$3.23^{-6}$ 100	$6.46^{-6}$ 71

$\Delta t = 10 - 20$

$2.05^{-3}$ 4	$5.49^{-4}$ 8	$1.29^{-5}$ 50	
$4.84^{-5}$ 25	$1.29^{-5}$ 50	$1.61^{-4}$ 14	$7.10^{-5}$ 21
$1.94^{-5}$ 41			$3.23^{-5}$ 32

$\Delta t = 20 - 40$

$3.15^{-3}$ 3	$1.02^{-3}$ 6	$1.94^{-5}$ 41	
$1.00^{-4}$ 18	$9.36^{-5}$ 19	$3.13^{-4}$ 10	$2.16^{-4}$ 12
$4.52^{-5}$ 27	$1.61^{-5}$ 45	$1.29^{-5}$ 50	$6.13^{-5}$ 23
$2.26^{-5}$ 38	$1.61^{-5}$ 45		$6.46^{-6}$ 71

$\Delta t = 40 - 80$

$4.12^{-3}$ 3	$1.99^{-3}$ 4	$9.04^{-5}$ 19	$3.23^{-6}$ 100
$3.78^{-4}$ 9	$2.94^{-4}$ 11	$6.68^{-4}$ 7	$4.13^{-4}$ 9
$1.23^{-4}$ 17	$6.78^{-5}$ 22	$3.87^{-5}$ 29	$1.00^{-4}$ 18
$5.49^{-5}$ 24	$2.90^{-5}$ 33	$2.26^{-5}$ 38	$1.29^{-5}$ 50

$\Delta t = 80 - 160$

$4.35^{-3}$ 3	$3.23^{-6}$ 3	$2.19^{-4}$ 12	$9.68^{-6}$ 58
$8.26^{-4}$ 6	$6.16^{-4}$ 7	$1.19^{-3}$ 5	$8.29^{-4}$ 6
$3.55^{-4}$ 10	$3.07^{-4}$ 10	$1.61^{-4}$ 14	$3.23^{-4}$ 10
$1.78^{-4}$ 14	$1.39^{-4}$ 15	$6.13^{-5}$ 23	$9.36^{-5}$ 19

$\Delta t = 160 - 320$

$3.38^{-3}$ 3	$4.43^{-3}$ 3	$4.78^{-4}$ 8	$5.16^{-5}$ 25
$1.37^{-3}$ 5	$1.48^{-3}$ 5	$2.21^{-3}$ 4	$1.55^{-3}$ 5
$8.29^{-4}$ 6	$9.42^{-4}$ 6	$5.84^{-4}$ 7	$9.65^{-4}$ 6
$3.71^{-4}$ 9	$4.84^{-4}$ 8	$3.03^{-4}$ 10	$4.39^{-4}$ 9

TABLE III (continued)

$E_0 = \text{---}0.5\text{---}$  MeV

SURFACE No. = 9

$\Delta t = 0$

$2.91^{-3}$ 2			

$\Delta t = 0+ - 5$  SHAKES

$2.28^{-4}$ 8	$4.20^{-5}$ 20		
$4.84^{-6}$ 58		$9.68^{-6}$ 41	$4.84^{-6}$ 58
			$3.23^{-6}$ 71

$\Delta t = 5 - 10$

$1.52^{-4}$ 10	$3.71^{-5}$ 21	$1.61^{-6}$ 100	
		$9.68^{-6}$ 41	$4.84^{-6}$ 58

$\Delta t = 10 - 20$

$2.60^{-4}$ 8	$5.81^{-5}$ 17		
$4.84^{-6}$ 58	$3.23^{-6}$ 71	$1.61^{-5}$ 32	$1.29^{-5}$ 35
$1.61^{-6}$ 100			
$1.61^{-6}$ 100			

$\Delta t = 20 - 40$

$4.47^{-4}$ 6	$1.47^{-4}$ 10	$3.23^{-6}$ 71	
$3.07^{-5}$ 23	$2.74^{-5}$ 24	$4.68^{-5}$ 19	$2.90^{-5}$ 24
$1.29^{-5}$ 35	$6.46^{-6}$ 50	$1.61^{-6}$ 100	$3.23^{-6}$ 71
$1.61^{-6}$ 100	$1.61^{-6}$ 100	$1.61^{-6}$ 100	

$\Delta t = 40 - 80$

$6.49^{-4}$ 5	$2.73^{-4}$ 8	$1.94^{-5}$ 29	
$8.39^{-5}$ 14	$6.46^{-5}$ 16	$9.84^{-5}$ 13	$6.46^{-5}$ 16
$3.07^{-5}$ 23	$2.58^{-5}$ 25	$1.45^{-5}$ 33	$2.90^{-5}$ 24
$1.61^{-5}$ 32	$4.84^{-6}$ 58	$3.23^{-6}$ 71	$4.84^{-6}$ 58

$\Delta t = 80 - 160$

$7.08^{-4}$ 5	$4.91^{-4}$ 6	$5.49^{-5}$ 17	$8.07^{-6}$ 45
$2.24^{-4}$ 8	$1.73^{-4}$ 10	$1.94^{-4}$ 9	$1.34^{-4}$ 11
$1.00^{-4}$ 13	$1.02^{-4}$ 13	$5.81^{-5}$ 17	$9.20^{-5}$ 13
$4.20^{-5}$ 20	$6.13^{-5}$ 16	$1.29^{-5}$ 35	$4.68^{-5}$ 19

$\Delta t = 160 - 320$

$5.12^{-4}$ 6	$5.28^{-4}$ 6	$6.46^{-5}$ 16	$6.46^{-5}$ 50
$3.76^{-4}$ 7	$3.60^{-4}$ 7	$3.76^{-4}$ 7	$2.94^{-4}$ 8
$2.40^{-4}$ 8	$2.60^{-4}$ 8	$1.95^{-4}$ 9	$2.36^{-4}$ 8
$1.63^{-4}$ 10	$1.82^{-4}$ 9	$1.18^{-4}$ 12	$1.57^{-4}$ 10



TABLE III (continued)

$E_0 = 0.5$  MeV

SURFACE No. = 10

$\Delta t = 0$

$1.94^{-5}$ 20			

$\Delta t = 0+ - 5$  SHAKES

$4.03^{-6}$ 45			
			$8.07^{-7}$ 100

$\Delta t = 5 - 10$

$2.42^{-6}$ 58			
$1.61^{-6}$ 71			

$\Delta t = 10 - 20$

$5.65^{-6}$ 38	$8.07^{-7}$ 100		
		$8.07^{-7}$ 100	

$\Delta t = 20 - 40$

$4.84^{-6}$ 41	$3.23^{-6}$ 50		
$8.07^{-7}$ 100			

$\Delta t = 40 - 80$

$1.37^{-5}$ 24	$3.23^{-6}$ 50		
$1.61^{-6}$ 71	$1.61^{-6}$ 71	$1.61^{-6}$ 71	$2.42^{-6}$ 58
	$2.42^{-6}$ 58		
	$1.61^{-6}$ 71	$8.07^{-7}$ 100	$8.07^{-7}$ 100

$\Delta t = 80 - 160$

$1.61^{-5}$ 22	$1.13^{-5}$ 29		
$4.03^{-6}$ 45	$7.26^{-6}$ 33	$3.23^{-6}$ 50	$4.84^{-6}$ 41
$3.23^{-6}$ 50	$3.23^{-6}$ 50	$3.23^{-6}$ 50	$1.61^{-6}$ 71
$1.61^{-6}$ 71	$2.42^{-6}$ 58	$2.42^{-6}$ 58	$2.42^{-6}$ 58

$\Delta t = 160 - 320$

$1.05^{-5}$ 28	$1.05^{-5}$ 28	$1.61^{-6}$ 71	
$1.61^{-5}$ 22	$9.68^{-6}$ 29	$5.65^{-6}$ 38	$2.42^{-6}$ 58
$8.07^{-6}$ 32	$8.88^{-6}$ 30	$6.46^{-6}$ 35	$8.88^{-6}$ 30
$9.68^{-6}$ 29	$1.69^{-5}$ 22	$3.23^{-6}$ 50	$1.37^{-5}$ 26

TABLE IV  
 Monte Carlo Data for 1.5 MeV Gammas

SAMPLE MATRIX WITH ROWS AND COLUMNS LABELED  
 FOR  $E_0 = 1.5$  MeV

(ENTRIES IN MATRIX ARE NO. GAMMAS PER SOURCE PARTICLE)  
 SURFACE NO. = 2  
 $\Delta t = 40 - 80$  SHAKES

$\begin{array}{l} \text{Cos } \theta \\ E \end{array}$	1.0 - 0.9	0.9 - 0.75	0.75 - 0.6	0.6 - 0
1.2 - 1.5 MeV	$8.29^{-4}$ 11			
0.9 - 1.2	$1.62^{-4}$ 24	$6.10^{-4}$ 12		
0.6 - 0.9	$9.52^{-6}$ 100	$1.14^{-4}$ 29	$1.81^{-4}$ 23	$6.67^{-5}$ 38
0.3 - 0.6				$9.52^{-5}$ 32
0.1 - 0.3				

TABLE IV (continued)

$E_0 = 1.5$  MeV

SURFACE No. = 2

$\Delta t = 0$

$9.77^{-1}$ 4			

$\Delta t = 0+ - 5$  SHAKES

$9.52^{-4}$ 10			
$1.90^{-5}$ 71	$6.67^{-5}$ 38		
		$6.67^{-5}$ 38	$9.52^{-5}$ 100
			$1.90^{-5}$ 71

$\Delta t = 5 - 10$

$5.43^{-4}$ 13			
$3.81^{-5}$ 50	$1.05^{-4}$ 30		
		$3.81^{-5}$ 50	$9.52^{-5}$ 100
			$9.52^{-5}$ 100

$\Delta t = 10 - 20$

$8.29^{-4}$ 11			
$3.81^{-5}$ 50	$1.14^{-4}$ 29		
	$1.90^{-5}$ 71	$3.81^{-5}$ 50	$2.86^{-5}$ 58
			$9.52^{-5}$ 100

$\Delta t = 20 - 40$

$1.13^{-3}$ 9			
$1.24^{-4}$ 28	$4.00^{-4}$ 15		
	$2.86^{-5}$ 58	$1.24^{-4}$ 28	$1.90^{-5}$ 71
			$1.90^{-5}$ 71

$\Delta t = 40 - 80$

$8.29^{-4}$ 11			
$1.62^{-4}$ 24	$6.10^{-4}$ 12		
$9.52^{-5}$ 100	$1.14^{-4}$ 29	$1.81^{-4}$ 23	$6.67^{-5}$ 38
			$9.52^{-5}$ 32

$\Delta t = 80 - 160$

$1.71^{-4}$ 24			
$1.90^{-4}$ 22	$1.20^{-3}$ 9		
	$5.71^{-5}$ 41	$3.90^{-4}$ 16	$1.33^{-4}$ 27
			$1.05^{-4}$ 30
$9.52^{-5}$ 100			

$\Delta t = 160 - 320$

	$9.14^{-4}$ 10		
	$1.81^{-4}$ 23	$6.48^{-4}$ 12	$1.81^{-4}$ 23
$1.90^{-5}$ 71	$9.52^{-5}$ 100		$2.48^{-4}$ 20
		$9.52^{-5}$ 100	

TABLE IV (continued)

$E_0 = 1.5$  MeV

SURFACE No. = 3

$\Delta t = 0$

$9.76^{-1}$ 1			

$\Delta t = 0+ - 5$  SHAKES

$1.84^{-3}$ 7			
$9.52^{-5}$ 32	$1.81^{-4}$ 23		
	$9.52^{-6}$ 100	$3.81^{-5}$ 50	$9.52^{-6}$ 100
			$1.90^{-5}$ 71

$\Delta t = 5 - 10$

$1.29^{-3}$ 9	$9.52^{-6}$ 100		
$8.57^{-5}$ 33	$2.38^{-4}$ 20		
	$1.90^{-5}$ 71	$5.71^{-5}$ 41	$9.52^{-6}$ 100
			$2.86^{-5}$ 58

$\Delta t = 10 - 20$

$1.74^{-3}$ 7			
$1.14^{-4}$ 29	$3.43^{-4}$ 17		
	$1.90^{-5}$ 71	$1.43^{-4}$ 26	$2.86^{-5}$ 58
			$4.76^{-5}$ 45

$\Delta t = 20 - 40$

$2.24^{-3}$ 7			
$1.43^{-4}$ 26	$5.62^{-4}$ 13		
	$2.86^{-5}$ 58	$1.90^{-4}$ 22	$4.76^{-5}$ 45
			$4.76^{-5}$ 45

$\Delta t = 40 - 80$

$2.58^{-3}$ 6	$9.52^{-6}$ 100		
$3.05^{-4}$ 18	$1.39^{-3}$ 8		
$9.52^{-6}$ 100	$9.52^{-5}$ 32	$3.52^{-4}$ 16	$1.52^{-4}$ 25
			$1.90^{-4}$ 22

$\Delta t = 80 - 160$

$1.89^{-3}$ 7	$9.52^{-6}$ 100		
$3.90^{-4}$ 16	$2.06^{-3}$ 7		
$9.52^{-6}$ 100	$1.71^{-4}$ 24	$5.43^{-4}$ 13	$2.29^{-4}$ 20
$1.90^{-5}$ 71	$9.52^{-6}$ 100		$2.67^{-4}$ 19
		$9.52^{-6}$ 100	

$\Delta t = 160 - 320$

$3.71^{-4}$ 16			
$4.19^{-4}$ 15	$3.00^{-3}$ 6	$9.52^{-6}$ 100	
$9.52^{-6}$ 100	$3.62^{-4}$ 16	$1.17^{-3}$ 9	$4.57^{-4}$ 14
$2.86^{-5}$ 58	$2.86^{-5}$ 58		$3.81^{-4}$ 16
$1.90^{-5}$ 71	$9.52^{-6}$ 100		$9.52^{-6}$ 100

TABLE IV (continued)

$E_0 = 1.5$  MeV

SURFACE No. = 4

$\Delta t = 0$

$8.66^{-1}$ <1			

$\Delta t = 0+ -5$  SHAKES

$3.21^{-3}$ 5			
$6.67^{-5}$ 38	$3.24^{-4}$ 17		
	$1.90^{-5}$ 71	$1.14^{-4}$ 29	$1.90^{-5}$ 71
$9.52^{-6}$ 100			$1.90^{-5}$ 71

$\Delta t = 5 - 10$

$2.25^{-3}$ 7			
$9.52^{-5}$ 32	$3.05^{-4}$ 18		
	$2.86^{-5}$ 58	$2.86^{-5}$ 58	$4.76^{-5}$ 45
			$3.81^{-5}$ 50

$\Delta t = 10 - 20$

$3.07^{-3}$ 6			
$2.95^{-4}$ 18	$4.76^{-4}$ 14		
	$3.81^{-5}$ 50	$1.33^{-4}$ 27	$8.57^{-5}$ 33
			$6.67^{-5}$ 38

$\Delta t = 20 - 40$

$4.13^{-3}$ 5			
$3.14^{-4}$ 17	$1.09^{-3}$ 9		
	$6.67^{-5}$ 38	$2.67^{-4}$ 19	$1.24^{-4}$ 28
	$1.90^{-5}$ 71		$1.14^{-4}$ 29

$\Delta t = 40 - 80$

$4.69^{-3}$ 4			
$4.48^{-4}$ 15	$2.22^{-3}$ 7	$9.52^{-6}$ 100	
$6.67^{-5}$ 38	$2.29^{-4}$ 20	$6.86^{-4}$ 12	$2.29^{-4}$ 20
	$9.52^{-6}$ 100		$1.33^{-4}$ 27

$\Delta t = 80 - 160$

$4.38^{-3}$ 5			
$9.33^{-4}$ 10	$3.44^{-3}$ 5	$9.52^{-6}$ 100	
$2.86^{-5}$ 58	$4.38^{-4}$ 15	$1.21^{-3}$ 9	$3.71^{-4}$ 16
$2.86^{-5}$ 58	$2.86^{-5}$ 58	$9.52^{-6}$ 100	$4.67^{-4}$ 14
$9.52^{-6}$ 100			

$\Delta t = 160 - 320$

$2.03^{-3}$ 7	$1.90^{-5}$ 71		
$9.33^{-4}$ 10	$4.99^{-3}$ 4	$5.71^{-5}$ 41	
$6.67^{-5}$ 38	$5.33^{-4}$ 13	$2.31^{-3}$ 6	$6.67^{-4}$ 12
$4.76^{-5}$ 45	$9.52^{-5}$ 32	$2.86^{-5}$ 58	$8.67^{-4}$ 10
$2.86^{-5}$ 58	$1.90^{-5}$ 71	$9.52^{-6}$ 100	$1.90^{-5}$ 71

TABLE IV (continued)

$E_0 = 1.5$  MeV

SURFACE No. = 5

$\Delta t = 0$

$7.51^{-1}$ <1			

$\Delta t = 0+ - 5$  SHAKES

$5.18^{-3}$ 4			
$1.81^{-4}$ 23	$4.57^{-4}$ 14		
	$4.76^{-5}$ 45	$9.52^{-5}$ 32	$5.71^{-5}$ 41
			$7.62^{-5}$ 35

$\Delta t = 5 - 10$

$3.23^{-3}$ 5			
$1.90^{-4}$ 22	$3.81^{-4}$ 16		
	$6.67^{-5}$ 38	$1.33^{-4}$ 27	$1.90^{-5}$ 71
			$4.76^{-5}$ 45

$\Delta t = 10 - 20$

$5.13^{-3}$ 4			
$3.24^{-4}$ 17	$1.11^{-3}$ 9		
	$5.71^{-5}$ 41	$1.90^{-4}$ 22	$8.57^{-5}$ 33
			$5.71^{-5}$ 41

$\Delta t = 20 - 40$

$6.94^{-3}$ 4	$9.52^{-5}$ 100		
$3.71^{-4}$ 16	$1.46^{-3}$ 8	$9.52^{-5}$ 100	
$2.86^{-5}$ 58	$1.52^{-4}$ 25	$5.71^{-4}$ 13	$1.71^{-4}$ 24
$9.52^{-5}$ 100	$2.86^{-5}$ 58	$9.52^{-5}$ 100	$1.62^{-4}$ 24

$\Delta t = 40 - 80$

$7.85^{-3}$ 3	$2.86^{-5}$ 58		
$9.62^{-4}$ 10	$3.20^{-3}$ 5	$2.86^{-5}$ 58	
$8.57^{-5}$ 33	$3.52^{-4}$ 16	$1.19^{-3}$ 9	$3.14^{-4}$ 17
$9.52^{-5}$ 100	$2.86^{-5}$ 58	$9.52^{-5}$ 100	$4.76^{-4}$ 14
	$8.52^{-5}$ 100		

$\Delta t = 80 - 160$

$7.40^{-3}$ 4	$1.90^{-5}$ 71		
$1.41^{-3}$ 8	$5.13^{-3}$ 4	$4.76^{-5}$ 45	
$1.24^{-4}$ 28	$4.95^{-4}$ 14	$1.93^{-3}$ 7	$7.05^{-4}$ 12
$4.76^{-5}$ 45	$4.76^{-5}$ 45	$3.81^{-5}$ 50	$8.19^{-4}$ 11
$9.52^{-5}$ 100	$9.52^{-5}$ 100	$1.90^{-5}$ 71	$9.52^{-5}$ 100

$\Delta t = 160 - 320$

$4.88^{-3}$ 4	$1.90^{-5}$ 71		
$1.67^{-3}$ 8	$7.99^{-3}$ 3	$7.62^{-5}$ 35	
$1.71^{-4}$ 24	$1.12^{-3}$ 9	$3.17^{-3}$ 5	$1.17^{-3}$ 9
$1.33^{-4}$ 27	$1.52^{-4}$ 25	$1.71^{-4}$ 24	$1.30^{-3}$ 9
$3.81^{-5}$ 50	$5.71^{-5}$ 41	$2.86^{-5}$ 58	$4.76^{-5}$ 45

TABLE IV (continued)

$E_0 = 1.5$  MeV

SURFACE No. = 6

$\Delta t = 0$

$5.78^{-1}$ 4			

$\Delta t = 0+ - 5$  SHAKES

$7.10^{-3}$ 4			
$2.19^{-4}$ 21	$6.95^{-4}$ 12		
	$2.86^{-5}$ 58	$1.90^{-4}$ 22	$4.76^{-5}$ 45
			$6.67^{-5}$ 38

$\Delta t = 5 - 10$

$4.77^{-3}$ 4	$9.52^{-6}$ 100		
$1.81^{-4}$ 23	$6.76^{-4}$ 12		
	$3.81^{-5}$ 50	$1.05^{-4}$ 30	$9.52^{-5}$ 32
$2.86^{-5}$ 58			$4.76^{-5}$ 45

$\Delta t = 10 - 20$

$7.34^{-3}$ 4			
$4.10^{-4}$ 15	$1.24^{-3}$ 9	$9.52^{-6}$ 100	
$4.76^{-5}$ 45	$1.71^{-4}$ 24	$3.14^{-4}$ 17	$1.33^{-4}$ 27
$1.90^{-5}$ 71	$9.52^{-6}$ 100		$1.05^{-4}$ 30
$9.52^{-6}$ 100	$9.52^{-6}$ 100		

$\Delta t = 20 - 40$

$9.55^{-3}$ 3	$3.81^{-5}$ 50		
$7.52^{-4}$ 11	$2.72^{-3}$ 6	$9.52^{-6}$ 100	
$4.76^{-5}$ 45	$2.19^{-4}$ 21	$6.29^{-4}$ 12	$2.38^{-4}$ 20
$3.81^{-5}$ 50		$9.52^{-6}$ 100	$2.76^{-4}$ 19
$3.81^{-5}$ 50	$9.52^{-6}$ 100		

$\Delta t = 40 - 80$

$1.20^{-2}$ 3	$5.71^{-5}$ 41		
$1.54^{-3}$ 8	$4.53^{-3}$ 5	$1.90^{-5}$ 71	
$1.71^{-4}$ 24	$4.57^{-4}$ 14	$1.50^{-3}$ 8	$4.57^{-4}$ 14
$6.67^{-5}$ 38	$5.71^{-5}$ 41	$1.90^{-5}$ 71	$4.19^{-4}$ 15
$1.90^{-5}$ 71	$2.86^{-5}$ 58	$9.52^{-6}$ 100	$1.90^{-5}$ 71

$\Delta t = 80 - 160$

$1.07^{-2}$ 3	$4.76^{-5}$ 45		
$2.29^{-3}$ 6	$7.86^{-3}$ 3	$6.67^{-5}$ 38	
$4.00^{-4}$ 15	$1.12^{-3}$ 9	$2.32^{-3}$ 6	$1.12^{-3}$ 9
$1.62^{-4}$ 24	$1.90^{-4}$ 22	$1.33^{-4}$ 27	$1.04^{-3}$ 10
$9.52^{-5}$ 32	$3.81^{-5}$ 50	$5.71^{-5}$ 41	$5.71^{-5}$ 41

$\Delta t = 160 - 320$

$7.41^{-3}$ 4	$5.71^{-5}$ 41		
$2.50^{-3}$ 6	$1.04^{-2}$ 3	$2.00^{-4}$ 22	
$6.10^{-4}$ 12	$1.90^{-3}$ 7	$4.09^{-3}$ 5	$1.68^{-3}$ 8
$4.00^{-4}$ 15	$4.86^{-4}$ 14	$4.00^{-4}$ 15	$1.95^{-3}$ 7
$1.22^{-4}$ 25	$1.81^{-4}$ 25	$1.92^{-4}$ 30	$1.43^{-4}$ 26

TABLE IV (continued)

$E_0 = \underline{\underline{1.5}}$  MeV

SURFACE No. = 7

$\Delta t = 0$

$3.61^{-1}$ 1			
		$9.52^{-6}$ 100	

$\Delta t = 0+ - 5$  SHAKES

$8.52^{-3}$ 3			
$1.90^{-4}$ 22	$6.67^{-4}$ 12		
$9.52^{-6}$ 100	$8.75^{-5}$ 33	$2.00^{-4}$ 22	$7.62^{-5}$ 35
			$5.71^{-5}$ 41

$\Delta t = 5 - 10$

$5.65^{-3}$ 4			
$2.95^{-4}$ 18	$7.33^{-4}$ 11		
$2.86^{-5}$ 58	$4.76^{-5}$ 45	$2.76^{-4}$ 19	$7.62^{-5}$ 35
	$9.52^{-6}$ 100	$9.52^{-6}$ 100	$5.71^{-5}$ 41

$\Delta t = 10 - 20$

$8.22^{-3}$ 3	$9.52^{-6}$ 100		
$5.14^{-4}$ 14	$1.49^{-3}$ 8		
$1.90^{-5}$ 71	$1.43^{-4}$ 26	$3.52^{-4}$ 16	$1.14^{-4}$ 29
$9.52^{-6}$ 100	$9.52^{-6}$ 100		$2.38^{-4}$ 20
		$9.52^{-6}$ 100	

$\Delta t = 20 - 40$

$1.08^{-2}$ 3	$2.86^{-5}$ 58		
$1.19^{-3}$ 9	$3.12^{-3}$ 6	$3.81^{-5}$ 50	
$1.71^{-4}$ 24	$3.14^{-4}$ 17	$9.33^{-4}$ 10	$3.04^{-4}$ 18
$6.67^{-5}$ 38		$1.90^{-5}$ 70	$3.04^{-4}$ 18
$9.52^{-6}$ 100			

$\Delta t = 40 - 80$

$1.34^{-2}$ 3	$5.71^{-5}$ 41		
$1.96^{-3}$ 7	$5.26^{-3}$ 4	$5.71^{-5}$ 41	
$3.05^{-4}$ 18	$7.81^{-4}$ 11	$1.68^{-3}$ 8	$4.76^{-4}$ 14
$1.24^{-4}$ 28	$1.52^{-4}$ 25	$9.52^{-5}$ 32	$7.05^{-4}$ 12
$4.76^{-5}$ 45	$6.67^{-5}$ 38	$1.90^{-5}$ 71	$4.76^{-5}$ 45

$\Delta t = 80 - 160$

$1.29^{-2}$ 3	$1.52^{-4}$ 25		
$3.05^{-3}$ 6	$8.92^{-3}$ 3	$1.71^{-4}$ 24	
$6.48^{-4}$ 12	$1.55^{-3}$ 8	$2.88^{-3}$ 6	$1.11^{-3}$ 9
$4.00^{-4}$ 15	$4.95^{-4}$ 14	$3.14^{-4}$ 17	$1.24^{-3}$ 9
$8.57^{-5}$ 33	$8.57^{-5}$ 33	$7.62^{-5}$ 35	$7.62^{-5}$ 35

$\Delta t = 160 - 320$

$8.22^{-3}$ 3	$2.10^{-4}$ 21		
$3.10^{-3}$ 6	$1.23^{-2}$ 3	$4.76^{-4}$ 14	$1.90^{-5}$ 71
$1.21^{-3}$ 9	$2.36^{-3}$ 6	$5.05^{-3}$ 4	$2.40^{-3}$ 6
$7.62^{-4}$ 11	$1.04^{-3}$ 10	$6.00^{-4}$ 13	$2.85^{-3}$ 6
$3.33^{-4}$ 17	$3.24^{-4}$ 17	$2.29^{-4}$ 20	$4.38^{-4}$ 15



TABLE IV (continued)

$E_\gamma = 1.5$  MeV

SURFACE No. = 8

$\Delta t = 0$

$1.53^{-1}$ 1			

$\Delta t = 0+ -5$  SHAKES

$6.51^{-3}$ 3	$4.76^{-6}$ 100		
$1.81^{-4}$ 16	$4.95^{-4}$ 10		
$1.43^{-5}$ 58	$5.71^{-5}$ 29	$1.57^{-4}$ 17	$6.19^{-5}$ 28
			$5.24^{-5}$ 30

$\Delta t = 5 - 10$

$4.56^{-3}$ 3			
$2.19^{-4}$ 15	$5.52^{-4}$ 9	$4.76^{-6}$ 100	
$1.90^{-5}$ 50	$3.81^{-8}$ 35	$1.33^{-4}$ 19	$4.76^{-5}$ 32
$9.52^{-6}$ 71			$4.29^{-5}$ 33
$9.52^{-6}$ 71			

$\Delta t = 10 - 20$

$6.49^{-3}$ 3	$9.52^{-6}$ 71		
$4.24^{-4}$ 11	$1.09^{-3}$ 7	$1.43^{-5}$ 58	
$6.19^{-5}$ 28	$9.52^{-5}$ 22	$3.05^{-4}$ 12	$1.24^{-4}$ 20
$2.86^{-5}$ 41		$1.43^{-5}$ 58	$8.57^{-5}$ 24
$4.76^{-8}$ 100	$9.52^{-8}$ 71	$4.76^{-8}$ 100	

$\Delta t = 20 - 40$

$8.72^{-3}$ 3	$3.81^{-5}$ 35		
$1.16^{-3}$ 6	$2.31^{-3}$ 5	$1.90^{-5}$ 50	$4.76^{-6}$ 100
$2.00^{-4}$ 15	$2.67^{-4}$ 13	$6.86^{-4}$ 8	$2.14^{-4}$ 15
$6.19^{-5}$ 28	$3.33^{-5}$ 38	$2.86^{-5}$ 41	$2.86^{-4}$ 13
$1.90^{-5}$ 50	$2.38^{-5}$ 45		$4.76^{-8}$ 100

$\Delta t = 40 - 80$

$1.01^{-2}$ 2	$9.52^{-5}$ 22		
$2.01^{-3}$ 5	$4.03^{-3}$ 3	$8.57^{-5}$ 24	$4.76^{-6}$ 100
$5.29^{-4}$ 10	$6.48^{-4}$ 9	$1.36^{-3}$ 6	$4.14^{-4}$ 11
$1.76^{-4}$ 16	$2.10^{-4}$ 15	$1.14^{-4}$ 20	$7.10^{-4}$ 8
$9.05^{-5}$ 23	$3.33^{-5}$ 38	$2.38^{-5}$ 45	$2.86^{-5}$ 41

$\Delta t = 80 - 160$

$9.45^{-3}$ 3	$2.05^{-4}$ 16		
$2.96^{-3}$ 4	$7.10^{-3}$ 3	$3.14^{-4}$ 12	
$1.19^{-3}$ 6	$1.61^{-3}$ 5	$2.29^{-3}$ 5	$1.05^{-3}$ 7
$4.71^{-4}$ 10	$5.48^{-4}$ 9	$4.33^{-4}$ 10	$1.19^{-3}$ 6
$2.29^{-4}$ 15	$2.38^{-4}$ 14	$1.19^{-4}$ 20	$1.33^{-4}$ 19

$\Delta t = 160 - 320$

$5.89^{-3}$ 3	$2.86^{-4}$ 14		
$3.13^{-3}$ 4	$9.21^{-3}$ 2	$6.38^{-4}$ 9	$1.90^{-5}$ 50
$1.53^{-3}$ 6	$2.70^{-3}$ 4	$3.98^{-3}$ 3	$1.99^{-3}$ 5
$1.23^{-3}$ 6	$1.60^{-3}$ 5	$1.08^{-3}$ 7	$2.55^{-3}$ 4
$6.00^{-4}$ 9	$6.19^{-4}$ 9	$4.10^{-4}$ 11	$6.43^{-4}$ 9

TABLE IV (continued)

$\epsilon_0 = \underline{1.5}$  MeV

SURFACE No. = 9

$\Delta t = 0$

$3.24^{-2}$ <1			
	$2.38^{-6}$ 100		

$\Delta t = 0+ -5$  SHAKES

$2.49^{-3}$ 3			
$7.62^{-5}$ 18	$2.79^{-4}$ 9	$4.76^{-6}$ 71	
$7.14^{-6}$ 58	$2.38^{-5}$ 32	$5.00^{-5}$ 22	$2.14^{-5}$ 33
			$2.38^{-5}$ 32

$\Delta t = 5 - 10$

$1.72^{-3}$ 4	$2.38^{-6}$ 100		
$7.38^{-5}$ 18	$2.52^{-4}$ 10	$2.38^{-6}$ 100	
$1.43^{-5}$ 41	$3.33^{-5}$ 27	$5.00^{-5}$ 22	$1.67^{-5}$ 38
$2.38^{-6}$ 100	$2.38^{-6}$ 100		$2.14^{-5}$ 33
$2.38^{-6}$ 100			

$\Delta t = 10 - 20$

$2.53^{-3}$ 3	$1.19^{-5}$ 45		
$2.76^{-4}$ 9	$5.07^{-4}$ 7	$7.14^{-6}$ 58	
$3.57^{-5}$ 26	$7.38^{-5}$ 18	$1.64^{-4}$ 12	$4.52^{-5}$ 23
$1.43^{-5}$ 41	$1.43^{-5}$ 41	$4.76^{-6}$ 71	$5.00^{-5}$ 22
$7.14^{-6}$ 58	$2.38^{-6}$ 100		$2.38^{-6}$ 100

$\Delta t = 20 - 40$

$3.57^{-3}$ 3	$2.86^{-5}$ 29		
$5.19^{-4}$ 7	$9.29^{-4}$ 5	$1.90^{-5}$ 35	
$1.50^{-4}$ 13	$1.40^{-4}$ 13	$2.95^{-4}$ 9	$1.24^{-4}$ 14
$4.52^{-5}$ 23	$4.05^{-5}$ 24	$3.10^{-5}$ 28	$1.24^{-4}$ 14
$2.38^{-6}$ 100	$4.76^{-6}$ 71	$4.76^{-6}$ 71	$2.38^{-6}$ 100

$\Delta t = 40 - 80$

$4.09^{-3}$ 3	$6.19^{-5}$ 20		
$1.03^{-3}$ 5	$1.77^{-3}$ 4	$5.71^{-5}$ 20	$2.38^{-6}$ 100
$3.52^{-4}$ 8	$4.60^{-4}$ 7	$5.21^{-4}$ 7	$2.52^{-4}$ 10
$1.62^{-4}$ 12	$1.55^{-4}$ 13	$9.52^{-5}$ 16	$3.05^{-4}$ 9
$4.76^{-5}$ 22	$5.00^{-5}$ 22	$3.57^{-5}$ 26	$2.86^{-5}$ 29

$\Delta t = 80 - 160$

$3.44^{-3}$ 3	$1.31^{-4}$ 13		
$1.59^{-3}$ 4	$2.65^{-3}$ 3	$1.45^{-4}$ 13	$4.76^{-6}$ 71
$7.40^{-4}$ 6	$9.69^{-4}$ 5	$1.00^{-3}$ 5	$5.17^{-4}$ 7
$4.57^{-4}$ 7	$4.26^{-4}$ 7	$3.19^{-4}$ 9	$6.69^{-4}$ 6
$1.71^{-4}$ 12	$1.69^{-4}$ 12	$1.05^{-4}$ 15	$1.38^{-4}$ 15

$\Delta t = 160 - 320$

$2.18^{-3}$ 4	$1.33^{-4}$ 14		
$1.48^{-3}$ 4	$3.29^{-3}$ 3	$3.14^{-4}$ 9	$1.43^{-5}$ 41
$1.22^{-3}$ 5	$1.66^{-3}$ 4	$1.45^{-3}$ 4	$8.74^{-4}$ 5
$9.10^{-4}$ 5	$1.06^{-3}$ 5	$8.05^{-4}$ 5	$1.41^{-3}$ 4
$5.24^{-4}$ 7	$6.62^{-4}$ 6	$4.62^{-4}$ 7	$5.74^{-4}$ 6

TABLE IV (continued)

$E_0 = 1.5$  MeV

SURFACE No. = 10

$\Delta t = 0$

$1.99^{-3}$ 3			

$\Delta t = 0+ -5$  SHAKES

$2.75^{-4}$ 7	$1.19^{-6}$ 100		
$1.43^{-5}$ 29	$3.21^{-5}$ 19		
	$3.57^{-6}$ 58	$4.76^{-6}$ 50	

$\Delta t = 5 - 10$

$1.76^{-4}$ 8			
$1.07^{-5}$ 33	$2.38^{-5}$ 22		
$1.19^{-6}$ 100	$1.19^{-6}$ 100	$7.14^{-6}$ 41	$3.57^{-6}$ 58
	$1.19^{-6}$ 100		$3.57^{-6}$ 58

$\Delta t = 10 - 20$

$2.77^{-4}$ 7			
$3.81^{-5}$ 18	$4.52^{-5}$ 16	$2.38^{-5}$ 71	
$7.14^{-6}$ 41	$1.07^{-5}$ 33	$2.50^{-5}$ 22	$4.76^{-6}$ 50
$4.76^{-6}$ 50	$3.57^{-6}$ 58	$3.57^{-6}$ 58	$3.57^{-6}$ 58
		$1.19^{-6}$ 100	

$\Delta t = 20 - 40$

$3.80^{-4}$ 6	$1.07^{-5}$ 33		
$8.81^{-5}$ 12	$8.93^{-5}$ 12	$7.14^{-6}$ 41	
$2.50^{-5}$ 22	$2.50^{-5}$ 22	$4.29^{-5}$ 17	$1.79^{-5}$ 26
$8.33^{-6}$ 38	$4.76^{-6}$ 50	$4.76^{-6}$ 50	$1.07^{-5}$ 33
$2.38^{-6}$ 71	$1.19^{-6}$ 100	$2.38^{-6}$ 71	$4.76^{-6}$ 50

$\Delta t = 40 - 80$

$4.44^{-4}$ 5	$1.19^{-5}$ 32		
$1.79^{-4}$ 8	$2.02^{-4}$ 8	$1.55^{-5}$ 28	
$7.98^{-5}$ 12	$7.14^{-5}$ 13	$8.10^{-5}$ 12	$2.86^{-5}$ 20
$3.21^{-5}$ 19	$2.98^{-5}$ 20	$2.38^{-5}$ 22	$3.33^{-5}$ 19
$5.95^{-6}$ 45	$1.07^{-5}$ 33	$7.14^{-6}$ 41	$8.33^{-6}$ 38

$\Delta t = 80 - 160$

$3.19^{-4}$ 6	$3.10^{-5}$ 20		
$2.76^{-4}$ 7	$3.00^{-4}$ 6	$2.86^{-5}$ 20	
$1.51^{-4}$ 9	$1.61^{-4}$ 9	$1.18^{-4}$ 10	$6.90^{-5}$ 13
$8.81^{-5}$ 12	$1.02^{-4}$ 11	$7.38^{-5}$ 13	$1.19^{-4}$ 10
$4.88^{-5}$ 16	$4.17^{-5}$ 17	$2.26^{-5}$ 23	$3.69^{-5}$ 18

$\Delta t = 160 - 320$

$2.04^{-4}$ 8	$2.14^{-5}$ 24		
$2.12^{-4}$ 8	$3.31^{-4}$ 6	$4.17^{-5}$ 17	$3.57^{-6}$ 58
$1.80^{-4}$ 8	$2.36^{-4}$ 7	$2.15^{-4}$ 7	$1.10^{-4}$ 10
$2.15^{-4}$ 8	$2.33^{-4}$ 7	$1.67^{-4}$ 8	$2.25^{-4}$ 7
$1.50^{-4}$ 9	$1.74^{-4}$ 8	$1.43^{-4}$ 9	$1.83^{-4}$ 8

TABLE IV (continued)

$E_0 = 1.5$  MeV

SURFACE No. = 11

$\Delta t = 0$

$1.49^{-6}$ 20			

$\Delta t = 0 - 5$  SHAKES

$1.19^{-6}$ 71	$5.95^{-7}$ 100		
			$5.95^{-7}$ 100

$\Delta t = 5 - 10$

$2.38^{-6}$ 50			

$\Delta t = 10 - 20$

$4.17^{-6}$ 38			
$1.19^{-6}$ 71	$5.95^{-7}$ 100	$5.95^{-7}$ 100	
			$5.95^{-7}$ 100

$\Delta t = 20 - 40$

$3.57^{-6}$ 41			
$1.79^{-6}$ 58	$2.38^{-6}$ 50		
$5.95^{-7}$ 100		$1.79^{-6}$ 58	
	$1.19^{-6}$ 71		
	$5.95^{-7}$ 100		

$\Delta t = 40 - 80$

$4.17^{-6}$ 38			
$4.76^{-6}$ 35	$2.38^{-6}$ 50		
$5.95^{-7}$ 100	$5.95^{-7}$ 100	$1.19^{-6}$ 71	$5.95^{-7}$ 100
$1.19^{-6}$ 71	$2.38^{-6}$ 50		$5.95^{-7}$ 100
$5.95^{-7}$ 100		$1.19^{-6}$ 71	

$\Delta t = 80 - 160$

$2.38^{-6}$ 50			
$4.76^{-6}$ 35	$7.14^{-6}$ 29		
$1.79^{-6}$ 58	$4.17^{-6}$ 38	$2.38^{-6}$ 50	$5.95^{-7}$ 100
$3.57^{-6}$ 41	$4.17^{-6}$ 38	$1.79^{-6}$ 58	$2.98^{-6}$ 45
	$1.19^{-6}$ 71	$2.38^{-6}$ 50	$1.19^{-6}$ 71

$\Delta t = 160 - 320$

$2.38^{-6}$ 50			
$3.57^{-6}$ 41	$3.57^{-6}$ 41	$1.19^{-6}$ 71	
$5.95^{-7}$ 100	$4.17^{-6}$ 38	$3.57^{-6}$ 41	$1.79^{-6}$ 58
$3.57^{-6}$ 41	$7.74^{-6}$ 28	$1.79^{-6}$ 58	$4.17^{-6}$ 38
$5.36^{-6}$ 33	$7.14^{-6}$ 29	$3.57^{-6}$ 41	$2.98^{-6}$ 45

TABLE V  
 Monte Carlo Data for 5.0 MeV Gammas

SAMPLE MATRIX WITH ROWS AND COLUMNS LABELED  
 FOR  $E_0 = 5.0$  MeV

(ENTRIES IN MATRIX ARE NO. GAMMAS PER SOURCE PARTICLE)  
 SURFACE NO. = 2  
 $\Delta t = 10 - 20$  SHAKES

$\begin{matrix} \text{Cos } \theta \\ E \end{matrix}$	1.0 - 0.9	0.9 - 0.75	0.75 - 0.6	0.6 - 0
4.0 - 5.0 MeV	$3.96^{-4}$ 20			
3.0 - 4.0	$2.59^{-4}$ 24			
2.0 - 3.0	$6.09^{-5}$ 50	$4.57^{-5}$ 58		
1.0 - 2.0		$6.09^{-5}$ 50	$1.52^{-5}$ 100	
0.1 - 1.0				$1.52^{-5}$ 100

TABLE V (continued)

$E_0 = 5.0$  MeV

SURFACE No. = 2

$\Delta t = 0$

9.88 <sup>-1</sup> < 1			

$\Delta t = 0+ - 5$  SHAKES

8.83 <sup>-4</sup> 13			
1.07 <sup>-4</sup> 38			
3.05 <sup>-5</sup> 71	3.05 <sup>-5</sup> 71		
	1.52 <sup>-5</sup> 100	1.52 <sup>-5</sup> 100	

$\Delta t = 5 - 10$

2.89 <sup>-4</sup> 23			
1.22 <sup>-4</sup> 35			
3.05 <sup>-5</sup> 71	1.52 <sup>-5</sup> 100		
	1.52 <sup>-5</sup> 100	3.05 <sup>-5</sup> 71	

$\Delta t = 10 - 20$

3.96 <sup>-4</sup> 20			
2.59 <sup>-4</sup> 24			
6.09 <sup>-5</sup> 50	4.57 <sup>-5</sup> 58		
	6.09 <sup>-5</sup> 50	1.52 <sup>-5</sup> 100	
			1.52 <sup>-5</sup> 100

$\Delta t = 20 - 40$

1.07 <sup>-4</sup> 38			
4.26 <sup>-4</sup> 19			
1.83 <sup>-4</sup> 29	6.09 <sup>-5</sup> 50		
	1.68 <sup>-4</sup> 30	3.05 <sup>-5</sup> 71	
			3.05 <sup>-5</sup> 71

$\Delta t = 40 - 80$

3.96 <sup>-4</sup> 20			
2.44 <sup>-4</sup> 25	1.68 <sup>-4</sup> 30		
	1.98 <sup>-4</sup> 28	6.09 <sup>-5</sup> 50	
			3.05 <sup>-5</sup> 71

$\Delta t = 80 - 160$

3.05 <sup>-5</sup> 71			
1.98 <sup>-4</sup> 28	3.20 <sup>-4</sup> 22		
	2.59 <sup>-4</sup> 24	1.52 <sup>-4</sup> 32	
			4.57 <sup>-5</sup> 58

$\Delta t = 160 - 320$

	1.22 <sup>-4</sup> 35		
	3.81 <sup>-4</sup> 20	2.74 <sup>-4</sup> 24	
	1.52 <sup>-5</sup> 100		1.98 <sup>-4</sup> 28

TABLE V (continued)

$E_0 = \text{---} 5.0 \text{---} \text{ MeV}$

SURFACE No. =  $\text{---} 3 \text{---}$

$\Delta t = 0$

$9.67^{-1}$ < 1			

$\Delta t = 0+ -5$  SHAKES

$1.45^{-3}$ 10			
$3.96^{-4}$ 20			
$7.61^{-5}$ 45	$9.14^{-5}$ 41		
		$1.52^{-5}$ 100	
			$3.05^{-5}$ 71

$\Delta t = 5 - 10$

$6.70^{-4}$ 15			
$3.05^{-4}$ 22			
$4.57^{-5}$ 58	$7.61^{-5}$ 45		
	$3.05^{-5}$ 71		
			$3.05^{-5}$ 71

$\Delta t = 10 - 20$

$1.11^{-3}$ 12			
$3.50^{-4}$ 21			
$1.37^{-4}$ 33	$4.57^{-5}$ 58		
	$1.68^{-4}$ 30	$4.57^{-5}$ 58	
			$3.05^{-5}$ 71

$\Delta t = 20 - 40$

$8.07^{-4}$ 14			
$9.75^{-4}$ 12			
$2.89^{-4}$ 23	$2.59^{-4}$ 24		
	$1.98^{-4}$ 28	$9.14^{-5}$ 41	
			$7.61^{-5}$ 45

$\Delta t = 40 - 80$

$2.28^{-4}$ 26			
$1.05^{-4}$ 12			
$3.50^{-4}$ 21	$4.26^{-4}$ 19		
$1.52^{-5}$ 100	$3.35^{-4}$ 21	$1.37^{-4}$ 33	
$1.52^{-5}$ 100			$1.37^{-4}$ 33

$\Delta t = 80 - 160$

$8.22^{-4}$ 14			
$6.85^{-4}$ 15	$5.18^{-4}$ 17		
$1.52^{-5}$ 100	$4.42^{-4}$ 19	$2.74^{-4}$ 24	$1.52^{-5}$ 100
$1.52^{-5}$ 100			$2.13^{-4}$ 27

$\Delta t = 160 - 320$

$3.05^{-5}$ 71			
$5.03^{-4}$ 17	$6.70^{-4}$ 15		
$3.05^{-5}$ 71	$9.29^{-4}$ 13	$5.03^{-4}$ 17	$1.52^{-5}$ 100
	$3.05^{-5}$ 71	$3.05^{-5}$ 71	$4.42^{-4}$ 19

TABLE V (continued)

$E_0 = 5.0$  MeV

SURFACE No. = 4

$\Delta t = 0$

9.31 <sup>-3</sup> < 1			

$\Delta t = 0+ - 5$  SHAKES

2.70 <sup>-3</sup> 8			
4.87 <sup>-4</sup> 18			
1.22 <sup>-4</sup> 35	3.05 <sup>-5</sup> 71		
	1.22 <sup>-4</sup> 35	4.57 <sup>-5</sup> 58	

$\Delta t = 5 - 10$

1.39 <sup>-3</sup> 10			
4.42 <sup>-4</sup> 19			
6.09 <sup>-5</sup> 50	1.52 <sup>-5</sup> 100		
	7.61 <sup>-5</sup> 45	7.61 <sup>-5</sup> 45	
			1.52 <sup>-5</sup> 100

$\Delta t = 10 - 20$

1.49 <sup>-3</sup> 10			
1.19 <sup>-3</sup> 11			
1.52 <sup>-4</sup> 32	1.37 <sup>-4</sup> 33		
	1.52 <sup>-4</sup> 32	9.14 <sup>-5</sup> 41	
			6.09 <sup>-5</sup> 50

$\Delta t = 20 - 40$

1.85 <sup>-3</sup> 9			
1.68 <sup>-3</sup> 10			
3.65 <sup>-4</sup> 20	3.05 <sup>-4</sup> 22		
	1.68 <sup>-4</sup> 30	1.68 <sup>-4</sup> 30	1.52 <sup>-5</sup> 100
			1.37 <sup>-4</sup> 33

$\Delta t = 40 - 80$

1.14 <sup>-3</sup> 12			
2.25 <sup>-3</sup> 8	1.52 <sup>-5</sup> 100		
8.38 <sup>-4</sup> 13	6.70 <sup>-4</sup> 15		
3.05 <sup>-5</sup> 71	4.87 <sup>-4</sup> 18	2.59 <sup>-4</sup> 24	1.52 <sup>-5</sup> 100
			2.59 <sup>-4</sup> 24

$\Delta t = 80 - 160$

1.22 <sup>-4</sup> 35			
2.10 <sup>-3</sup> 9			
1.07 <sup>-3</sup> 12	1.19 <sup>-3</sup> 11		
7.61 <sup>-5</sup> 45	8.83 <sup>-4</sup> 13	4.57 <sup>-4</sup> 18	6.09 <sup>-5</sup> 50
4.57 <sup>-5</sup> 58			2.74 <sup>-4</sup> 24

$\Delta t = 160 - 320$

6.09 <sup>-4</sup> 16			
1.16 <sup>-3</sup> 11	1.51 <sup>-3</sup> 10		
4.57 <sup>-5</sup> 58	1.39 <sup>-3</sup> 10	6.55 <sup>-4</sup> 15	1.22 <sup>-4</sup> 35
3.05 <sup>-5</sup> 71	4.57 <sup>-5</sup> 58	4.57 <sup>-5</sup> 58	6.09 <sup>-4</sup> 16



TABLE V (continued)

$E_0 = 5.0 \text{ MeV}$

SURFACE No. = 5

$\Delta t = 0$

8.70 <sup>-1</sup> < 1			

$\Delta t = 0+ - 5 \text{ SHAKES}$

4.77 <sup>-3</sup> 6			
7.61 <sup>-4</sup> 14			
1.93 <sup>-4</sup> 28	1.52 <sup>-4</sup> 32		
	1.22 <sup>-4</sup> 35	6.09 <sup>-5</sup> 50	
			1.52 <sup>-5</sup> 100

$\Delta t = 5 - 10$

2.56 <sup>-3</sup> 8			
7.77 <sup>-4</sup> 14			
7.61 <sup>-5</sup> 45	2.13 <sup>-4</sup> 27		
	7.61 <sup>-5</sup> 45	1.37 <sup>-4</sup> 33	
			3.05 <sup>-5</sup> 71

$\Delta t = 10 - 20$

2.80 <sup>-3</sup> 7			
1.39 <sup>-3</sup> 10			
4.87 <sup>-4</sup> 18	3.20 <sup>-4</sup> 22		
1.52 <sup>-5</sup> 100	1.83 <sup>-4</sup> 29	1.37 <sup>-4</sup> 33	1.52 <sup>-5</sup> 100
1.52 <sup>-5</sup> 100			7.61 <sup>-5</sup> 45

$\Delta t = 20 - 40$

2.97 <sup>-3</sup> 7			
2.30 <sup>-3</sup> 8	1.52 <sup>-5</sup> 100		
8.22 <sup>-4</sup> 14	6.85 <sup>-4</sup> 15		
4.57 <sup>-5</sup> 58	4.87 <sup>-4</sup> 18	2.74 <sup>-4</sup> 24	
			1.52 <sup>-4</sup> 32

$\Delta t = 40 - 80$

2.19 <sup>-3</sup> 8			
4.29 <sup>-3</sup> 6			
1.25 <sup>-3</sup> 11	1.32 <sup>-3</sup> 11		
3.05 <sup>-5</sup> 71	8.07 <sup>-4</sup> 14	4.72 <sup>-4</sup> 18	1.52 <sup>-5</sup> 100
3.05 <sup>-5</sup> 71			3.65 <sup>-4</sup> 20

$\Delta t = 80 - 160$

6.24 <sup>-4</sup> 16			
3.88 <sup>-3</sup> 6			
1.40 <sup>-3</sup> 10	1.69 <sup>-3</sup> 9		
1.22 <sup>-4</sup> 35	1.16 <sup>-3</sup> 11	1.08 <sup>-3</sup> 12	3.05 <sup>-5</sup> 71
3.05 <sup>-5</sup> 71	1.52 <sup>-5</sup> 100	3.05 <sup>-5</sup> 71	5.63 <sup>-4</sup> 16

$\Delta t = 160 - 320$

2.03 <sup>-3</sup> 9	1.52 <sup>-5</sup> 100		
2.27 <sup>-3</sup> 8	2.27 <sup>-3</sup> 8		
1.37 <sup>-4</sup> 33	2.30 <sup>-3</sup> 8	1.46 <sup>-3</sup> 10	1.52 <sup>-4</sup> 32
1.07 <sup>-4</sup> 38	7.61 <sup>-5</sup> 45	1.07 <sup>-4</sup> 38	1.45 <sup>-3</sup> 10

TABLE V (continued)

$E_0 = \text{---} 5.0 \text{---} \text{ MeV}$

SURFACE No. =  $\text{---} 6 \text{---}$

$\Delta t = 0$

$7.63^{-3}$ 4			
$< 1$			

$\Delta t = 0+ - 5 \text{ SHAKES}$

$7.83^{-3}$ 4			
$1.54^{-3}$ 10			
$2.89^{-4}$ 23	$1.68^{-4}$ 30		
	$1.68^{-4}$ 30	$9.14^{-5}$ 41	
			$6.09^{-5}$ 50

$\Delta t = 5 - 10$

$4.08^{-3}$ 6			
$1.17^{-3}$ 11			
$3.05^{-4}$ 22	$3.50^{-4}$ 21		
	$1.22^{-4}$ 35	$1.22^{-4}$ 35	$1.52^{-5}$ 100
			$4.57^{-5}$ 58

$\Delta t = 10 - 20$

$5.15^{-3}$ 5			
$2.44^{-3}$ 8			
$5.94^{-4}$ 16	$5.18^{-4}$ 17		
	$2.59^{-4}$ 24	$1.98^{-4}$ 28	
			$1.37^{-4}$ 33

$\Delta t = 20 - 40$

$5.04^{-3}$ 5			
$3.70^{-3}$ 6			
$1.13^{-3}$ 12	$9.29^{-4}$ 13		
$1.52^{-5}$ 100	$7.77^{-4}$ 14	$3.81^{-4}$ 20	$1.52^{-5}$ 100
		$1.52^{-5}$ 100	$3.20^{-4}$ 22

$\Delta t = 40 - 80$

$3.56^{-3}$ 7			
$5.76^{-3}$ 5			
$1.96^{-3}$ 9	$1.69^{-3}$ 9		
$1.68^{-4}$ 30	$1.29^{-3}$ 11	$8.83^{-4}$ 13	$4.57^{-5}$ 58
$3.05^{-5}$ 71	$3.05^{-5}$ 71	$1.52^{-5}$ 100	$5.48^{-4}$ 17

$\Delta t = 80 - 160$

$1.58^{-3}$ 10			
$6.43^{-3}$ 5	$3.05^{-5}$ 71		
$3.27^{-3}$ 7	$2.76^{-3}$ 7	$3.05^{-5}$ 71	
$3.05^{-4}$ 22	$2.30^{-3}$ 8	$1.37^{-3}$ 11	$4.57^{-5}$ 58
$1.37^{-4}$ 33	$1.07^{-4}$ 38	$1.22^{-4}$ 35	$1.16^{-5}$ 11

$\Delta t = 160 - 320$

$3.05^{-5}$ 71			
$3.70^{-3}$ 6	$3.05^{-5}$ 71		
$3.00^{-3}$ 7	$3.72^{-3}$ 6		
$5.48^{-4}$ 17	$3.87^{-3}$ 6	$2.57^{-3}$ 8	$2.44^{-4}$ 25
$3.50^{-4}$ 21	$3.35^{-4}$ 21	$9.14^{-5}$ 41	$2.13^{-5}$ 8

TABLE V (continued)

$E_0 = \text{---} 5.0 \text{ MeV}$

SURFACE No. =  $\text{---} 7 \text{---}$

$\Delta t = 0$

$6.10^{-3}$ 4			
< 1			

$\Delta t = 0+ - 5 \text{ SHAKES}$

$1.06^{-2}$ 4			
$1.95^{-3}$ 9			
$5.33^{-4}$ 17	$4.42^{-4}$ 19		
$1.52^{-5}$ 100	$2.89^{-4}$ 23	$1.83^{-4}$ 29	$1.52^{-5}$ 100
			$9.14^{-5}$ 41

$\Delta t = 5 - 10$

$6.47^{-3}$ 5			
$1.95^{-3}$ 9			
$4.42^{-4}$ 19	$3.20^{-4}$ 22		
$3.05^{-5}$ 71	$2.89^{-4}$ 23	$2.44^{-4}$ 25	
			$9.14^{-5}$ 41

$\Delta t = 10 - 20$

$7.36^{-3}$ 5			
$3.36^{-3}$ 7			
$9.14^{-4}$ 13	$5.79^{-4}$ 16		
$1.52^{-5}$ 100	$5.18^{-4}$ 17	$3.05^{-4}$ 22	$1.52^{-5}$ 100
$1.52^{-5}$ 100		$1.52^{-5}$ 100	$2.59^{-4}$ 24

$\Delta t = 20 - 40$

$8.10^{-3}$ 4			
$6.33^{-3}$ 5			
$1.86^{-3}$ 9	$1.23^{-3}$ 11		
$1.22^{-4}$ 35	$1.05^{-3}$ 12	$7.61^{-4}$ 14	$3.05^{-5}$ 71
$4.57^{-5}$ 58	$4.57^{-5}$ 58	$1.52^{-5}$ 100	$3.35^{-4}$ 21

$\Delta t = 40 - 80$

$5.07^{-3}$ 5			
$8.89^{-3}$ 4	$3.05^{-5}$ 71		
$3.29^{-3}$ 7	$2.53^{-3}$ 8		
$2.74^{-4}$ 24	$2.07^{-3}$ 9	$1.17^{-3}$ 11	$1.22^{-4}$ 35
$6.09^{-5}$ 50	$1.07^{-4}$ 38	$7.61^{-5}$ 45	$6.40^{-4}$ 15

$\Delta t = 80 - 160$

$2.22^{-3}$ 8			
$9.02^{-3}$ 4	$3.05^{-5}$ 71		
$3.79^{-3}$ 6	$3.76^{-3}$ 6		
$4.72^{-4}$ 18	$3.88^{-3}$ 6	$2.21^{-3}$ 8	$1.37^{-4}$ 33
$3.96^{-4}$ 20	$3.50^{-4}$ 21	$2.28^{-4}$ 26	$1.74^{-3}$ 9

$\Delta t = 160 - 320$

$1.98^{-4}$ 28			
$5.44^{-3}$ 5	$6.09^{-5}$ 50		
$4.86^{-3}$ 6	$5.18^{-3}$ 5	$4.57^{-5}$ 58	
$1.01^{-3}$ 12	$5.16^{-3}$ 5	$3.79^{-3}$ 6	$3.05^{-4}$ 22
$7.31^{-4}$ 14	$9.75^{-4}$ 12	$6.24^{-4}$ 16	$3.65^{-3}$ 6

TABLE V (continued)

$E_0 = \dots 5.0 \text{ MeV}$

SURFACE No. = 8

$\Delta t = 0$

4.03 <sup>-1</sup> < 1			
1.52 <sup>-5</sup> 71			

$\Delta t = 0+ -5 \text{ SHAKES}$

1.36 <sup>-2</sup> 2			
2.37 <sup>-3</sup> 6			
5.86 <sup>-4</sup> 11	4.34 <sup>-4</sup> 13		
3.05 <sup>-5</sup> 50	3.43 <sup>-4</sup> 15	2.13 <sup>-4</sup> 19	7.61 <sup>-6</sup> 100
7.61 <sup>-6</sup> 100			1.22 <sup>-4</sup> 25

$\Delta t = 5 - 10$

6.78 <sup>-3</sup> 4			
2.44 <sup>-3</sup> 6			
5.94 <sup>-4</sup> 11	4.57 <sup>-4</sup> 13		
3.81 <sup>-5</sup> 45	3.81 <sup>-4</sup> 14	2.21 <sup>-4</sup> 19	1.52 <sup>-5</sup> 71
7.61 <sup>-6</sup> 100			1.07 <sup>-4</sup> 27

$\Delta t = 10 - 20$

8.65 <sup>-3</sup> 3			
4.30 <sup>-3</sup> 4	7.61 <sup>-6</sup> 100		
1.25 <sup>-3</sup> 8	8.07 <sup>-4</sup> 10		
9.14 <sup>-5</sup> 29	7.92 <sup>-4</sup> 10	4.04 <sup>-4</sup> 14	2.28 <sup>-5</sup> 58
3.81 <sup>-5</sup> 45	2.28 <sup>-5</sup> 58	7.61 <sup>-6</sup> 100	2.51 <sup>-4</sup> 17

$\Delta t = 20 - 40$

9.19 <sup>-3</sup> 3			
7.30 <sup>-3</sup> 3	2.28 <sup>-5</sup> 58		
2.31 <sup>-3</sup> 6	1.67 <sup>-3</sup> 7	7.61 <sup>-6</sup> 100	
2.82 <sup>-4</sup> 17	1.27 <sup>-3</sup> 8	7.16 <sup>-4</sup> 10	6.85 <sup>-5</sup> 33
7.61 <sup>-5</sup> 32	6.85 <sup>-5</sup> 33	1.52 <sup>-5</sup> 71	5.71 <sup>-4</sup> 12

$\Delta t = 40 - 80$

6.92 <sup>-3</sup> 4			
1.03 <sup>-2</sup> 3	3.05 <sup>-5</sup> 50		
3.98 <sup>-3</sup> 4	3.18 <sup>-3</sup> 5		
5.79 <sup>-4</sup> 11	2.68 <sup>-3</sup> 5	1.63 <sup>-3</sup> 7	1.37 <sup>-4</sup> 24
2.89 <sup>-4</sup> 16	2.59 <sup>-4</sup> 17	1.90 <sup>-4</sup> 20	9.14 <sup>-4</sup> 9

$\Delta t = 80 - 160$

2.63 <sup>-3</sup> 7			
1.09 <sup>-2</sup> 3	1.60 <sup>-4</sup> 22		
5.23 <sup>-3</sup> 4	4.86 <sup>-3</sup> 4	1.52 <sup>-5</sup> 71	
1.04 <sup>-3</sup> 9	4.65 <sup>-3</sup> 4	2.82 <sup>-3</sup> 5	3.50 <sup>-4</sup> 15
6.17 <sup>-4</sup> 11	7.69 <sup>-4</sup> 10	5.03 <sup>-4</sup> 12	2.33 <sup>-3</sup> 6

$\Delta t = 160 - 320$

3.73 <sup>-4</sup> 19			
6.31 <sup>-3</sup> 4	9.90 <sup>-5</sup> 30		
5.06 <sup>-3</sup> 5	5.86 <sup>-3</sup> 4	5.33 <sup>-5</sup> 38	
1.58 <sup>-3</sup> 7	6.49 <sup>-3</sup> 3	4.48 <sup>-3</sup> 4	5.86 <sup>-4</sup> 11
1.48 <sup>-3</sup> 7	2.03 <sup>-3</sup> 6	1.47 <sup>-3</sup> 7	4.07 <sup>-3</sup> 4

TABLE V (continued)

$E_0 = \dots 5.0 \text{ MeV}$

SURFACE No. =  $\dots 9 \dots$

$\Delta t = 0$

$1.91^{-1}$ < 1			
$1.14^{-5}$ 58			
$1.14^{-5}$ 58			

$\Delta t = 0+ - 5 \text{ SHAKES}$

$1.15^{-2}$ 2			
$2.10^{-3}$ 4			
$5.75^{-4}$ 8	$4.30^{-4}$ 9		
$1.14^{-5}$ 58	$2.55^{-4}$ 12	$1.41^{-4}$ 16	$1.14^{-5}$ 58
$7.61^{-6}$ 71	$1.14^{-5}$ 58		$8.76^{-5}$ 21

$\Delta t = 5 - 10$

$6.08^{-3}$ 3			
$2.19^{-3}$ 4			
$5.98^{-4}$ 8	$3.92^{-4}$ 10		
$3.43^{-5}$ 33	$3.27^{-4}$ 11	$1.68^{-4}$ 15	
$1.52^{-5}$ 50	$3.81^{-6}$ 100		$1.10^{-4}$ 19

$\Delta t = 10 - 20$

$7.58^{-3}$ 3			
$3.88^{-3}$ 3	$1.90^{-5}$ 45		
$1.22^{-3}$ 6	$7.69^{-4}$ 7		
$1.37^{-4}$ 17	$6.55^{-4}$ 8	$3.69^{-4}$ 10	$1.90^{-5}$ 45
$7.23^{-5}$ 23	$2.66^{-5}$ 38	$1.52^{-5}$ 50	$1.94^{-4}$ 14

$\Delta t = 20 - 40$

$7.69^{-3}$ 3			
$6.45^{-3}$ 2	$3.05^{-5}$ 35		
$2.49^{-3}$ 4	$1.40^{-3}$ 5		
$4.07^{-4}$ 10	$1.34^{-3}$ 5	$6.70^{-4}$ 8	$6.47^{-5}$ 24
$2.02^{-4}$ 14	$1.18^{-4}$ 18	$5.71^{-5}$ 26	$4.57^{-4}$ 9

$\Delta t = 40 - 80$

$5.86^{-3}$ 3			
$8.68^{-3}$ 2	$9.52^{-5}$ 20		
$3.70^{-3}$ 3	$2.70^{-3}$ 4	$1.90^{-5}$ 45	
$9.59^{-4}$ 6	$2.33^{-3}$ 4	$1.45^{-3}$ 5	$1.79^{-4}$ 15
$4.19^{-4}$ 10	$3.65^{-4}$ 10	$2.89^{-4}$ 11	$9.75^{-4}$ 6

$\Delta t = 80 - 160$

$2.20^{-3}$ 6			
$8.72^{-3}$ 3	$1.48^{-4}$ 16		
$4.74^{-3}$ 3	$4.23^{-3}$ 3	$4.19^{-5}$ 30	
$1.71^{-3}$ 5	$4.37^{-3}$ 3	$2.46^{-3}$ 4	$3.54^{-4}$ 10
$1.02^{-3}$ 6	$1.23^{-3}$ 6	$9.71^{-4}$ 6	$2.19^{-3}$ 4

$\Delta t = 160 - 320$

$3.69^{-4}$ 15			
$5.03^{-3}$ 4	$1.83^{-4}$ 15		
$4.01^{-3}$ 4	$4.62^{-3}$ 3	$6.85^{-5}$ 24	
$1.85^{-3}$ 5	$5.36^{-3}$ 3	$3.29^{-3}$ 3	$8.38^{-4}$ 7
$2.06^{-3}$ 4	$2.84^{-3}$ 4	$2.28^{-3}$ 4	$4.84^{-3}$ 3

TABLE V (continued)

$E_0 = 5.0$  MeV

SURFACE No. = 10

$\Delta t = 0$

$4.80^{-2}$ 1			
$3.81^{-6}$ 71			

$\Delta t = 0+ -5$  SHAKES

$5.36^{-3}$ 2			
$1.06^{-3}$ 4	$3.81^{-6}$ 71		
$2.40^{-4}$ 9	$2.07^{-4}$ 10	$1.90^{-6}$ 100	
$1.52^{-5}$ 35	$1.77^{-4}$ 10	$1.12^{-4}$ 13	
$5.71^{-6}$ 58	$3.81^{-6}$ 71		$4.76^{-5}$ 20

$\Delta t = 5 - 10$

$2.84^{-3}$ 3			
$1.09^{-3}$ 4	$1.90^{-6}$ 100		
$3.05^{-4}$ 8	$2.19^{-4}$ 9		
$3.62^{-5}$ 23	$1.35^{-4}$ 12	$9.14^{-5}$ 14	$1.90^{-6}$ 100
$1.71^{-5}$ 33	$7.61^{-6}$ 50	$1.90^{-6}$ 100	$5.52^{-5}$ 19

$\Delta t = 10 - 20$

$3.60^{-3}$ 2			
$2.00^{-3}$ 3	$1.33^{-5}$ 38		
$6.76^{-4}$ 5	$3.98^{-4}$ 7		
$1.43^{-4}$ 12	$3.43^{-4}$ 7	$1.71^{-4}$ 11	$1.14^{-5}$ 41
$4.38^{-5}$ 21	$2.86^{-5}$ 26	$2.28^{-5}$ 29	$1.26^{-4}$ 12

$\Delta t = 20 - 40$

$3.51^{-3}$ 3			
$3.33^{-3}$ 2	$3.62^{-5}$ 23		
$1.32^{-3}$ 4	$7.77^{-4}$ 5	$5.71^{-6}$ 58	
$3.54^{-4}$ 7	$7.25^{-4}$ 5	$3.27^{-4}$ 8	$3.81^{-5}$ 22
$1.01^{-4}$ 14	$1.28^{-4}$ 12	$8.76^{-5}$ 15	$2.51^{-4}$ 9

$\Delta t = 40 - 80$

$2.51^{-3}$ 3			
$4.08^{-3}$ 2	$5.90^{-5}$ 18		
$2.07^{-3}$ 3	$1.28^{-3}$ 4	$1.71^{-5}$ 33	
$8.01^{-4}$ 5	$1.39^{-3}$ 4	$7.10^{-4}$ 5	$9.90^{-5}$ 14
$3.22^{-4}$ 8	$3.67^{-4}$ 7	$2.61^{-4}$ 9	$5.84^{-4}$ 6

$\Delta t = 80 - 160$

$1.05^{-3}$ 5			
$3.55^{-3}$ 3	$1.31^{-4}$ 12		
$2.52^{-3}$ 3	$1.99^{-3}$ 3	$5.33^{-5}$ 19	
$1.20^{-3}$ 4	$2.14^{-3}$ 3	$1.24^{-3}$ 4	$2.57^{-4}$ 9
$9.18^{-4}$ 5	$1.08^{-3}$ 4	$7.86^{-4}$ 5	$1.38^{-3}$ 4

$\Delta t = 160 - 320$

$1.48^{-4}$ 14			
$1.92^{-3}$ 4	$1.12^{-4}$ 14		
$1.55^{-3}$ 4	$1.86^{-3}$ 3	$5.33^{-5}$ 19	
$1.11^{-3}$ 4	$2.27^{-3}$ 3	$1.53^{-3}$ 4	$4.85^{-4}$ 6
$1.72^{-3}$ 3	$2.24^{-3}$ 3	$1.60^{-3}$ 3	$3.02^{-3}$ 3

TABLE V (continued)

$E_0 = \text{--5.0-- MeV}$

SURFACE No. = 11

$\Delta t = 0$

$4.03^{-3}$ 2			

$\Delta t = 0+ - 5$  SHAKES

$8.32^{-4}$ 3			
$1.68^{-4}$ 8			
$3.24^{-5}$ 17	$2.28^{-5}$ 20		
$1.90^{-6}$ 71	$2.47^{-5}$ 20	$1.43^{-5}$ 26	
$9.52^{-7}$ 100	$9.52^{-7}$ 100		$3.81^{-6}$ 50

$\Delta t = 5 - 10$

$4.00^{-4}$ 5			
$1.95^{-4}$ 7			
$5.04^{-5}$ 14	$2.75^{-5}$ 19		
$1.43^{-5}$ 26	$2.09^{-5}$ 21	$1.05^{-5}$ 30	$9.52^{-7}$ 100
$2.86^{-6}$ 58	$1.90^{-6}$ 71	$9.52^{-7}$ 100	$8.57^{-6}$ 33

$\Delta t = 10 - 20$

$5.42^{-4}$ 4			
$3.44^{-4}$ 5	$3.81^{-6}$ 50		
$1.28^{-4}$ 9	$6.28^{-5}$ 12	$9.52^{-7}$ 100	
$2.95^{-5}$ 18	$6.38^{-5}$ 12	$2.95^{-5}$ 18	$2.86^{-6}$ 58
$1.14^{-5}$ 29	$6.66^{-6}$ 38	$2.86^{-6}$ 58	$2.28^{-5}$ 20

$\Delta t = 20 - 40$

$5.09^{-4}$ 4			
$5.45^{-4}$ 4	$8.57^{-6}$ 33		
$2.48^{-4}$ 6	$1.31^{-4}$ 9		
$7.42^{-5}$ 11	$1.35^{-4}$ 8	$6.66^{-5}$ 12	$6.66^{-6}$ 38
$2.76^{-5}$ 19	$3.04^{-5}$ 18	$2.19^{-5}$ 21	$4.66^{-5}$ 14

$\Delta t = 40 - 80$

$3.58^{-4}$ 6			
$6.06^{-4}$ 4	$7.61^{-6}$ 35		
$4.00^{-4}$ 5	$2.16^{-4}$ 7	$5.71^{-6}$ 41	
$1.64^{-4}$ 8	$2.41^{-4}$ 6	$1.15^{-4}$ 9	$2.38^{-5}$ 20
$9.99^{-5}$ 10	$1.05^{-4}$ 10	$6.57^{-5}$ 12	$1.28^{-4}$ 9

$\Delta t = 80 - 160$

$1.24^{-4}$ 9			
$4.41^{-4}$ 5	$2.38^{-5}$ 20		
$3.45^{-4}$ 5	$2.81^{-4}$ 6	$6.66^{-6}$ 38	
$2.39^{-4}$ 6	$3.46^{-4}$ 5	$1.73^{-4}$ 7	$6.28^{-5}$ 12
$2.19^{-4}$ 7	$2.89^{-4}$ 6	$2.11^{-4}$ 7	$3.29^{-4}$ 5

$\Delta t = 160 - 320$

$1.43^{-5}$ 26			
$1.78^{-4}$ 8	$1.90^{-5}$ 22		
$1.99^{-4}$ 7	$1.96^{-4}$ 7	$1.52^{-5}$ 25	
$1.57^{-4}$ 8	$2.69^{-4}$ 6	$1.81^{-4}$ 7	$7.52^{-5}$ 11
$3.64^{-4}$ 5	$4.84^{-4}$ 4	$3.53^{-4}$ 5	$5.99^{-4}$ 4

TABLE VI  
WEIGHTED GAMMA CURRENT  
0.5 MeV Source

$\Delta t$ s	0	0+-5	5-10	10-20	20-40	40-80	80-160	160-320
2	9.59-1	1.07-3	5.75-4	1.15-3	1.69-3	2.01-3	2.24-3	1.38-3
3	8.91-1	1.87-3	1.33-3	2.05-3	3.06-3	4.35-3	5.60-3	5.75-3
4	7.79-1	3.05-3	2.13-3	3.46-3	5.18-3	7.51-3	9.38-3	1.07-2
5	6.09-1	4.13-3	3.12-3	5.10-3	7.58-3	1.13-2	1.49-2	1.63-2
6	3.93-1	5.11-3	3.51-3	5.94-3	8.98-3	1.30-2	1.80-2	2.14-2
7	1.76-1	4.08-3	2.94-4	5.08-3	7.52-3	1.15-2	1.61-2	1.91-2
8	4.11-2	1.69-3	1.25-3	2.14-3	3.51-3	5.46-3	7.43-3	9.35-3
9	2.91-3	2.18-4	1.52-4	2.61-4	5.18-4	8.63-4	1.32-3	1.61-3
10	1.94-5	3.36-6	2.78-6	5.24-6	6.53-6	1.66-5	3.14-5	4.21-5

s = surface number  
 $\Delta t$  in shakes

TABLE VII  
WEIGHTED GAMMA CURRENT  
1.5 MeV Source

$\Delta t$ s	0	0+-5	5-10	10-20	20-40	40-80	80-160	160-320
2	9.77-1	9.00-4	5.53-4	8.06-4	1.28-3	1.23-3	1.04-3	7.73-4
3	9.36-1	1.68-3	1.28-3	1.78-3	2.31-3	3.27-3	3.20-3	2.71-3
4	8.66-1	2.93-3	2.14-3	3.07-3	4.36-3	5.71-3	6.63-3	5.97-3
5	7.51-1	4.83-3	3.12-3	5.19-3	7.10-3	9.47-3	1.07-2	1.10-2
6	5.78-1	6.54-3	4.52-3	7.33-3	1.04-2	1.43-2	1.61-2	1.58-2
7	3.61-1	7.69-3	5.47-3	8.23-3	1.20-2	1.63-2	1.96-2	1.92-2
8	1.53-1	5.97-3	4.32-3	6.47-3	9.71-3	1.30-2	1.59-2	1.59-2
9	3.24-2	2.32-3	1.66-3	2.68-3	4.06-3	5.61-3	6.60-3	6.81-3
10	1.99-3	2.60-4	1.71-4	3.00-4	4.65-4	7.01-4	8.33-4	8.47-4
11	1.49-5	1.06-6	1.97-6	4.79-6	6.17-6	9.19-6	1.32-5	1.24-5

s = surface number  
 $\Delta t$  in shakes



TABLE VIII  
WEIGHTED GAMMA CURRENT  
5.0 MeV Source

$\Delta t$ s	0	0+-5	5-10	10-20	20-40	40-80	80-160	160-320
2	9.88-1	9.15-4	3.90-4	6.35-4	6.20-4	6.08-4	4.22-4	2.54-4
3	9.67-1	1.69-3	9.09-4	1.43-3	1.86-3	1.58-3	1.51-3	1.10-3
4	9.31-1	2.92-3	1.67-3	2.48-3	3.39-3	3.82-3	3.38-3	2.56-3
5	8.70-1	5.10-3	3.10-3	4.12-3	5.50-3	7.05-3	5.91-3	5.25-3
6	7.68-1	8.52-3	4.98-3	7.22-3	8.83-3	1.03-2	1.09-2	8.71-3
7	6.10-1	1.17-2	7.87-3	1.02-2	1.44-2	1.57-2	1.51-2	1.31-2
8	4.03-1	1.47-2	8.72-3	1.26-2	1.67-2	1.96-2	1.91-2	1.54-2
9	1.91-1	1.26-2	7.84-3	1.12-2	1.48-2	1.71-2	1.66-2	1.29-2
10	4.80-2	5.96-3	3.74-3	5.57-3	7.35-3	8.27-3	7.93-3	5.59-3
11	4.03-3	9.16-4	5.66-4	8.98-4	1.18-3	1.32-3	1.12-3	6.85-4

s = Surface Number  
 $\Delta t$  in shakes