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500-MeV electron beam bench-mark experiments and calculations

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December 1979

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Livermore
Laboratory**

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ABSTRACT

Experiments measuring the energy deposited by electron beams were performed to provide bench marks against which to evaluate our HANDYL76 electron beam computer code. The experiments, done at Stanford's Mk III accelerator, measured dose vs depth and dose vs radius profiles induced in layered aluminum targets by 500-MeV electrons. The dose was measured by passive thermoluminescence dosimeters and photographic film placed between aluminum plates. The calculations predict a dose vs radius profile that forward-peaks on axis after the beam passes through a 200-cm air gap; the experimental measurements do not show this peak. This discrepancy indicates there may be a problem in using HANDYL76 to calculate deep penetration of a target with a large gap.

INTRODUCTION

Previous calculations of the effects of exposing multi-material flat-plate targets to 500-MeV electron beams predicted significant (nearly twofold) on-axis disagreement deep within a target with several air gaps.¹⁻³ We decided to investigate this phenomenon more closely in case the calculations were correct and the experimental thermoluminescent dosimeter (TLD) array missed the peak because of the physical spacing of the dosimeters. We therefore fielded experiments that combined fewer materials with denser arrays of detectors, simplifying both experiment and calculations. Some similarities were maintained between these experiments and the previous set: the total area density of the targets (73 g/cm^2 previously, 70 g/cm^2 for this work) and the sum of the air gaps (10 gaps totalling 192 cm previously, 1 gap of 200 cm for this work).

EXPERIMENTAL PROCEDURES

The experiments were performed at the Stanford Mk III electron accelerator facility. Beam energy was 500 MeV with a full-width-half-maximum (FWHM) intensity of the beam profile of about 0.4 cm. Figure 1 is a schematic of the two runs (Run 91 and Run 92) relevant to this study. The primary diagnostic was thermoluminescent dosimeters (TLD's) in the shape of 1-by-1-by-3-mm "rods." These TLD's were placed in holes in a 0.250-in.-thick lucite plate. A 0.125-in. lucite plate on either side of the TLD plate kept

FIG. 1. Experimental geometries. Each plate, 20-by-20-in., consists of lucite TLD assemblies, aluminum, polyethylene, and film. The incident electron beam was 500 MeV with 0.4-cm full width at half maximum in each case.

the TLD's from falling out. The TLD array (shown in Fig. 2) was made as dense as possible in the center of the plate. In planning and developing a data analysis code, we assumed that we would have enough TLD's to fill every hole in the plate. We were unable to obtain enough TLD's do this, however, so we chose to do the following:

1. Fill every hole in the central rectangular array (93 TLD's) and the first eight rings (192 TLD's).
2. Fill every other hole in the last six rings (96 TLD's rather than 192).
3. Modify the data reduction codes to interpolate for missing TLD locations.

The experiments contained a total of 3810 TLD's in 10 assemblies. Packets containing several pieces of 5-by-7-in. Type M x-ray film were placed between the target plates.

During the experiments we first established the beam conditions with facility-supplied secondary emission monitors (SEM's) to monitor current and we radiation-browned glass slides to locate the beam and get a crude idea of beam size and shape. The glass slides were supported at the ends of a target stand on which the target would be assembled. The target stand was clamped to a hydraulic table so that the target could be easily raised into the beam line. A laser, directed along the beam axis, was used to align the target stand on the table and demonstrate the reproducibility of the hydraulic table movement. After final alignment, the hydraulic table was lowered, the target assembled, the machine tuned and then turned off briefly, and the target raised into position. The exposures took less than 10 seconds with a beam current of ~ 15 nA. Activation of the front Al plate at beam center was ~ 0.1 mR/hr immediately after the exposure, decaying quickly. The SEM's were calibrated about a month and a half after these exposures because of problems with the Faraday cup. These calibrations yielded an SEM efficiency of 4.78% with a σ of 0.26%.

After the exposures, the disassembled targets were brought to LLL where the TLD's were removed and read at our automated reading facility.

The film was developed according to previously determined techniques.

CALCULATIONAL PROCEDURES

The LLL Code HANDYL76⁴ was used to calculate these experiments. One geometry was designed which, with minor alterations, could be used for both exposures. Figure 3 is a schematic (not to scale) picture of the geometry and dimensions.

HANDYL76 is a Monte Carlo electron/photon transport code and attention must be given to reducing statistics problems in deep-penetration calculations. For this reason, the major difference between the calculation and reality is in the treatment of the TLD's (represented as solid annuli between the lucite retaining plates rather than as discrete "rods" surrounded by lucite).

The source was a 500-MeV beam with an intensity distribution chosen to represent the beam shape displayed by the data from the first TLD plate in each run. The shapes, experimental data, and calculations for these positions are shown in Figs. 4 and 5. The calculations were run until we had sufficient statistics or until the running time became unreasonable (as it did for Run 92, which ran 18 hours and still had 30% statistics in one zone of interest).

EXPERIMENTAL DATA ANALYSIS

The TLD output data is in the form of light units (LU's) emitted by a rod while it is slowly heated. Calibration is achieved by exposing rods to known doses of ⁶⁰CO gamma rays to obtain a dose vs LU curve. The LU data, LU vs dose conversion, and TLD position within a package are input to data reduction codes; these codes interpolate for missing TLD's--or those which had no reading (0 LU's)--and produce plots of the data.

The film is scanned by a densitometer after development. This information is then combined with data from calibration films (also exposed to known doses of ⁶⁰CO gamma rays) to relate film opacity to absorbed dose, yielding spatially continuous data. Plots of these data may then also be obtained.

FIG. 3a. Calculational geometry for run 91. The incident electron beam was 500 MeV.

FIG. 3b. The calculational geometry for run 92. The incident electron beam was 500 MeV.

FIG. 4. Comparison of calculational input and output data vs experiment for Run 91, at location 1.

FIG. 5. Comparison of calculational input and output data vs experiment for Run 92, at location 1. Top figure has linear scale, lower has semi-log.

RESULTS

A complete set of the experimental TLD isodose contours is given in Appendix A. In addition, four scans across the arrays (at 0° , 45° , 90° , and 135°) are shown across the bottom of each page of this appendix. There are two sets of plots for each array, one for the full 48-cm radius and a second "zoom" of the inner 6 cm. The numerical data are presented in Appendix E. The radius (in cm) and angle (in degrees) for each TLD are given. The automated reading facility had difficulty with some of the rods because of their size. This accounts for the unusually high number of obviously bad readings. There were also some beam problems that were not obvious at the time of the experiment such as "spray" at 90° and the general asymmetry of the beam.

The TLD packages were stacked near the beam dump while the beam was being tuned. Some asymmetrical background contribution is therefore superimposed on the data, which depends on the location of a given array in the stack and the distance of a given rod from the edge of its plate. This background contribution is thought to be on the order 0.2 rad. No backgrounds have been subtracted from the data in Appendixes A and B.

Plots comparing the calculation with the experimental data are shown in Figs. 6-15. The experimental data have been offset to the approximate beam centerline and an assumed background (0.19 rad) has been subtracted from all experimental data. The plots are shown in terms of MeV/g per source electron. The sources and assumed beam centerline offsets for the two experiments are given in Table 1.

The statistics for the calculations are all better than 10% except where error bars are shown. The individual TLD dose readings are thought to be good to $\pm 10\%$. The additional error in the source strength and background uncertainties increases the experimental error to about $\pm 12\%$ at high dose levels (relative to the background dose) and roughly $\pm 50\%$ at a few tenths of a rad.

(a)

(b)

FIG. 6. Comparison of experimental data and HANDYL76 calculation for Run 91, location 1.

(a)

(b)

FIG. 7. Comparison of experimental data and HANDYL76 calculation for Run 91, location 2.

(a)

(b)

FIG. 8. Comparison of experimental data and HANDYL76 calculation for Run 91, location 4.

(a)

(b)

FIG. 9. Comparison of experimental data and HANDYL76 calculation for Run 91, location 5.

(a)

(b)

FIG. 10. Comparison of experimental data and HANDYL76 calculation for Run 91, location 6.

(a)

(b)

FIG. 11. Comparison of experimental data and HANDYL76 calculation for Run 92, location 1.

(a)

(b)

FIG. 12. Comparison of experimental data and HANDYL76 calculation for Run 92, location 3.

(a)

(b)

FIG. 13. Comparison of experimental data and HANDYL76 calculation for Run 92, location 5.

(a)

(b)

FIG. 14. Comparison of experimental data and HANDYL76 calculation for Run 92, location 6.

(a)

(b)

FIG. 15. Comparison of experimental data and HANDYL76 calculation for Run 92, location 7.

TABLE 1. Stanford e-beam experiments source data.

	Beam relative to array geometric center		SEM integrator reading	Number of electrons
	Radius (cm)	Angle (deg)		
Run 91	0.065	305 ^O	49	6.73 × 10 ¹¹ ± 0.3%
Run 92	0.12	270 ^O	52.5	7.21 × 10 ¹¹ ± 0.3%

CONCLUSIONS

The agreement between the bench-mark experiments and the HANDYL76 calculations is reasonably good if there are no gaps and the radii are large compared to the beam size even after a large gap. Most of the differences noted either fall within the uncertainties of the experiment or calculation or both or can be explained by the small, asymmetric beam, e.g., Run 91 Loc. 1 (Fig. 6). After the 200-cm gap of Run 92, however, the differences cannot be described in such a fashion. The calculations show a forward peak with a radius of roughly 0.6 cm which is not present in the experimental data (see Figs. 14 and 15). This suggests a problem internal to HANDYL76 which may involve the handling of small angle scattering.

As a result of this work we are reviewing the status of HANDYL76 and will suggest appropriate action.

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BSS:rb

A P P E N D I X A

TLD ISODOSE CONTOUR PLOTS

DOSE - RADS
 B - 2.500E-01
 C - 3.000E-01
 D - 5.000E-01
 E - 7.500E-01
 F - 1.000E+00
 G - 3.000E+00
 H - 1.000E+01
 I - 1.000E+02
 J - 1.000E+03
 K - 2.500E+04

RUN DATE.....1/17/78
 PARTICLE.....ELECTRON
 BEAM ENERGY.....500 MEV
 TARGET.....FP RUN 91
 PLATE NO.....PP1
 PLATE LOCATION..1

DOSE - RADS
 B - 6.000E-01
 C - 7.000E-01
 D - 8.000E-01
 E - 1.300E+00
 F - 2.000E+00
 G - 3.000E+00
 H - 5.000E+00
 I - 5.000E+01
 J - 5.000E+02
 K - 2.500E+04

RUN DATE.....1/17/78
 PARTICLE.....ELECTRON
 BEAM ENERGY.....500 MEV
 TARGET.....FP RUN 91
 PLATE NO.....PP1
 PLATE LOCATION..1

DOSE - RAD
 B - 3.000E-01
 C - 4.000E-01
 D - 5.000E-01
 E - 2.000E+00
 F - 5.000E+00
 G - 1.000E+01
 H - 2.000E+01
 I - 5.000E+01
 J - 5.000E+02
 K - 5.000E+04

RUN DATE.....1/17/78
 PARTICLE.....ELECTRON
 BEAM ENERGY.....500 MEV
 TARGET.....FP RUN 91
 PLATE NO.....PP2
 PLATE LOCATION..2

DOSE - RADS
 B - 1.000E+01
 C - 2.000E+01
 D - 5.000E+01
 E - 1.000E+02
 F - 2.000E+02
 G - 5.000E+02
 H - 1.000E+03
 I - 2.000E+03
 J - 1.250E+04
 K - 2.400E+04

RUN DATE.....1/17/78
 PARTICLE.....ELECTRON
 BEAM ENERGY.....500 MEV
 TARGET.....FP RUN 91
 PLATE NO.....PP3
 PLATE LOCATION..4

DOSE - RADS
 B - 3.000E-01
 C - 5.000E-01
 D - 2.000E+00
 E - 5.000E+00
 F - 1.000E+01
 G - 2.000E+01
 H - 5.000E+01
 I - 1.000E+02
 J - 1.000E+03
 K - 4.700E+03

RUN DATE.....1/17/78
 PARTICLE.....ELECTRON
 BEAM ENERGY.....500 MEV
 TARGET.....FP RUN 91
 PLATE NO.....PP4
 PLATE LOCATION..5

DOSE - RAD5
 B - 3.000E+01
 C - 5.000E+01
 D - 1.000E+02
 E - 2.000E+02
 F - 5.000E+02
 G - 1.000E+03
 H - 2.000E+03
 I - 3.000E+03
 J - 4.700E+03
 K - 9.200E+03

RUN DATE.....1/17/78
 PARTICLE.....ELECTRON
 BEAM ENERGY.....500 MEV
 TARGET.....FP RUN 91
 PLATE NO.....PP4
 PLATE LOCATION..5

DOSE - RADS
 B - 5.000E-01
 C - 7.000E-01
 D - 2.000E+00
 E - 5.000E+00
 F - 1.000E+01
 G - 2.000E+01
 H - 5.000E+01
 I - 1.000E+02
 J - 1.000E+03
 K - 1.500E+03

RUN DATE.....1/17/78
 PARTICLE.....ELECTRON
 BEAM ENERGY.....500 MEV
 TARGET.....FP RUN 91
 PLATE NO.....PP5
 PLATE LOCATION..6

DOSE - RADS
 B - 5.000E+01
 C - 1.000E+02
 D - 2.000E+02
 E - 5.000E+02
 F - 7.000E+02
 G - 1.000E+03
 H - 1.750E+03
 I - 2.000E+03
 J - 2.500E+03
 K - 4.750E+03

RUN DATE.....1/17/78
 PARTICLE.....ELECTRON
 BEAM ENERGY.....500 MEV
 TARGET.....FP RUN 91
 PLATE NO.....PP5
 PLATE LOCATION..6

DOSE - RADS
 B - 1.000E-01
 C - 2.000E-01
 D - 5.000E-01
 E - 2.000E+00
 F - 5.000E+00
 G - 7.000E+00
 H - 1.000E+01
 I - 2.000E+01
 J - 5.000E+01
 K - 4.300E+04

RUN DATE.....1/17/78
 PARTICLE.....ELECTRON
 BEAM ENERGY.....500 MEV
 TARGET.....FP RUN 92
 PLATE NO.....PP6
 PLATE LOCATION..1

DOSE - RADS
 B - 7.000E-01
 C - 8.000E-01
 D - 2.000E+00
 E - 5.000E+00
 F - 1.000E+01
 G - 1.000E+02
 H - 5.000E+02
 I - 1.000E+03
 J - 4.300E+04
 K - 8.000E+04

RUN DATE.....1/17/78
 PARTICLE.....ELECTRON
 BEAM ENERGY.....500 MEV
 TARGET.....FP RUN 92
 PLATE NO.....PP6
 PLATE LOCATION..1

DOSE - RADS
 B - 4.000E-01
 C - 7.000E-01
 D - 2.000E+00
 E - 5.000E+00
 F - 1.000E+01
 G - 5.000E+01
 H - 1.000E+02
 I - 5.000E+02
 J - 1.000E+03
 K - 2.400E+04

RUN DATE.....1/17/78
 PARTICLE.....ELECTRON
 BEAM ENERGY.....500 MEV
 TARGET.....FP RUN 92
 PLATE NO.....PP7
 PLATE LOCATION..3

DOSE - RADS

B - 6.000E+00

C - 1.000E+01

D - 2.000E+01

E - 5.000E+01

F - 1.000E+02

G - 5.000E+02

H - 1.000E+03

I - 5.000E+03

J - 2.400E+04

K - 4.700E+04

RUN DATE.....1/17/78

PARTICLE.....ELECTRON

BEAM ENERGY.....500 MEV

TARGET.....FP RUN 92

PLATE NO.....PP7

PLATE LOCATION..3

DOSE - RADS
 B - 4.000E+00
 C - 5.000E+00
 D - 6.000E+00
 E - 8.000E+00
 F - 9.000E+00
 G - 1.000E+01
 H - 1.200E+01
 I - 1.500E+01
 J - 2.000E+01
 K - 2.500E+01*

RUN DATE.....1/17/78
 PARTICLE.....ELECTRON
 BEAM ENERGY....500 MEV
 TARGET.....FP RUN 92
 PLATE NO.....PP9
 PLATE LOCATION..6

DOSE - RADS

B - 2.900E+01

C - 5.000E+01

D - 1.000E+02

E - 2.000E+02

F - 5.000E+02

G - 1.000E+03

H - 2.000E+03

I - 3.000E+03

J - 5.600E+03

K - 1.000E+04

PUN DATE.....1/17/78

PARTICLE.....ELECTRON

BEAM ENERGY.....500 MEV

TARGET.....FP RUH 92

PLATE NO.....PPB

PLATE LOCATION..5

DOSE - RADS
 B - 6.000E-01
 C - 1.000E+00
 D - 2.000E+00
 E - 5.000E+00
 F - 1.000E+01
 G - 5.000E+01
 H - 1.000E+02
 I - 5.000E+02
 J - 1.000E+03
 K - 5.600E+03

RUN DATE.....1/17/78
 PARTICLE.....ELECTRON
 BEAM ENERGY.....500 MEV
 TARGET.....FP RUN 92
 PLATE NO.....PP8
 PLATE LOCATION..5

DOSE - RADS
 B - 1.100E+01
 C - 1.200E+01
 D - 1.300E+01
 E - 1.500E+01
 F - 1.700E+01
 G - 1.900E+01
 H - 2.000E+01
 I - 2.500E+01
 J - 3.000E+01
 K - 3.300E+01

RUN DATE.....1/17/78
 PARTICLE.....ELECTRON
 BEAM ENERGY.....500 MEV
 TARGET.....FP RUN 92
 PLATE NO.....PP9
 PLATE LOCATION..6

DOSE - RADS
 B - 4.000E+00
 C - 5.000E+00
 D - 6.000E+00
 E - 7.000E+00
 F - 1.000E+01
 G - 2.000E+01
 H - 3.000E+01
 I - 5.000E+01
 J - 7.500E+01
 K - 9.000E+01

RUN DATE.....1/17/78
 PARTICLE.....ELECTRON
 BEAM ENERGY.....500 MEV
 TARGET.....FP RUN 92
 PLATE NO.....P10
 PLATE LOCATION..7

DOSE - RADS

B - 2.500E+01

C - 3.000E+01

D - 4.000E+01

E - 5.000E+01

F - 6.000E+01

G - 7.000E+01

H - 8.000E+01

I - 9.000E+01

J - 9.500E+01

K - 1.000E+02

RUN DATE.....1/17/78

PARTICLE.....ELECTRON

BEAM ENERGY.....500 MEV

TARGET.....FP RUN 92

PLATE NO.....P10

PLATE LOCATION..7

RUN DATE.....1/17/78
 PARTICLE.....ELECTRON
 BEAM ENERGY.....500 MEV
 TARGET.....FP RUN 91
 PLATE NO.....PP1
 PLATE LOCATION..1

NO	ANGLE	RADIUS	DOSE	NO	ANGLE	RADIUS	DOSE	NO	ANGLE	RADIUS	DOSE	NO	ANGLE	RADIUS	DOSE	NO	ANGLE	RADIUS	DOSE
1	124.99	1.147	1.390E+01	2	116.57	1.051	1.170E+01	3	106.70	0.981	2.270E+01	4	95.71	0.945	2.600E+01				
5	84.29	0.945	2.260E+01	6	73.30	0.981	2.320E+01	7	63.44	1.051	1.420E+01	8	55.01	1.147	1.360E+01				
9	135.00	1.063	5.830E+01	10	126.87	0.940	4.750E+01	11	116.57	0.841	3.670E+01	12	104.04	0.775	6.570E+01				
13	90.00	0.752	6.485E+01	14	75.96	0.775	6.400E+01	15	63.44	0.841	4.770E+01	16	53.13	0.940	3.300E+01				
17	45.00	1.064	1.720E+01	18	139.40	0.867	3.550E+01	19	129.81	0.734	5.970E+01	20	116.57	0.631	7.640E+01				
21	99.46	0.572	1.870E+02	22	80.54	0.572	2.090E+02	23	63.44	0.631	1.800E+02	24	50.19	0.734	9.860E+01				
25	40.60	0.867	5.150E+01	26	153.43	0.841	3.480E+01	27	146.31	0.678	9.750E+01	28	135.00	0.532	2.190E+02				
29	116.57	0.420	5.890E+02	30	90.00	0.376	1.490E+03	31	83.44	0.420	1.550E+03	32	45.00	0.532	2.640E+02				
33	33.69	0.678	1.420E+02	34	26.57	0.841	5.170E+01	35	164.05	0.684	9.040E+01	36	158.20	0.506	2.680E+02				
37	145.31	0.0339	1.860E+03	38	116.57	0.210	1.680E+04	39	83.43	0.210	3.220E+04	40	33.69	0.339	1.040E+04				
41	21.80	0.506	7.440E+02	42	15.95	0.684	1.420E+02	43	180.00	0.752	6.980E+01	44	180.00	0.564	7.400E+02				
45	180.00	0.376	2.090E+03	46	180.00	0.188	2.180E+04	47	0.00	0.00	4.990E+04	48	0.00	0.188	3.580E+04				
49	0.00	0.376	4.890E+03	50	0.00	0.364	2.200E+02	51	0.00	0.752	1.160E+02	52	195.95	0.684	1.220E+02				
53	201.80	0.639	5.060E+02	54	213.69	0.339	2.190E+04	55	243.43	0.210	4.330E+04	56	296.57	0.210	4.320E+04				
57	326.31	0.0339	1.860E+04	58	338.20	0.506	8.480E+02	59	338.20	0.684	1.920E+02	60	206.57	0.841	3.680E+02				
61	213.69	0.678	4.530E+02	62	225.00	0.532	5.400E+02	63	243.43	0.420	4.640E+03	64	270.00	0.376	2.780E+04				
65	296.57	0.420	1.350E+04	66	315.00	0.532	1.030E+03	67	326.31	0.678	2.420E+02	68	333.43	0.841	7.430E+01				
69	220.60	0.867	5.230E+01	70	230.19	0.734	1.270E+02	71	243.43	0.631	4.340E+02	72	260.54	0.572	8.130E+02				
73	279.46	0.572	1.040E+03	74	296.57	0.631	4.960E+02	75	309.81	0.734	2.210E+02	76	319.40	0.867	8.120E+01				
77	225.00	1.064	2.220E+01	78	233.10	0.940	4.810E+01	79	243.40	0.841	7.540E+01	80	255.96	0.775	1.440E+02				
81	270.00	0.752	2.270E+02	82	284.00	0.775	2.090E+02	83	296.57	0.341	1.260E+02	84	306.87	0.940	6.650E+01				
85	315.00	1.064	3.260E+01	86	235.00	1.147	2.030E+01	87	243.43	1.051	3.220E+01	88	253.30	0.981	5.590E+01				
89	264.29	0.945	5.520E+01	90	275.71	0.945	6.230E+01	91	246.70	0.981	5.130E+01	92	296.57	1.051	3.550E+01				
93	304.99	1.147	2.590E+01	94	0.00	2.000	2.620E+00	95	12.50	2.000	2.460E+00	96	45.00	2.000	2.245E+00				
97	67.50	2.000	2.030E+00	98	90.00	2.000	2.330E+00	99	112.50	2.000	1.810E+00	100	135.00	2.000	1.360E+00				
101	157.50	2.000	2.040E+00	102	180.00	2.000	2.120E+00	103	202.50	2.000	2.090E+00	104	225.00	2.000	2.260E+00				
105	247.50	2.000	2.430E+00	106	270.00	2.000	2.470E+00	107	292.50	2.000	2.470E+00	108	315.00	2.000	2.470E+00				
109	337.50	2.000	1.700E+00	110	0.00	3.000	1.700E+00	111	22.50	3.000	1.200E+00	112	45.00	3.000	1.040E+00				
113	157.50	3.000	1.000E+00	114	90.00	3.000	1.380E+00	115	112.50	3.000	1.090E+00	116	135.00	3.000	9.970E-01				
117	157.50	3.000	1.220E+00	118	180.00	3.000	1.310E+00	119	232.50	3.000	1.220E+00	120	225.00	3.000	1.180E+00				
121	247.50	3.000	1.310E+00	122	270.00	3.000	1.270E+00	123	292.50	3.000	1.040E+00	124	315.00	3.000	1.225E+00				
125	337.50	3.000	1.410E+00	126	0.00	4.000	9.000E-01	127	22.50	4.000	8.860E-01	128	45.00	4.000	7.600E-01				
129	157.50	4.000	7.330E-01	130	90.00	4.000	1.310E+00	131	112.50	4.000	7.830E-01	132	135.00	4.000	7.110E-01				
133	157.50	4.000	7.310E-01	134	180.00	4.000	8.080E-01	135	232.50	4.000	7.870E-01	136	225.00	4.000	7.970E-01				
137	247.50	4.000	8.370E-01	138	270.00	4.000	7.340E-01	139	292.50	4.000	7.750E-01	140	315.00	4.000	8.400E-01				
141	337.50	4.000	9.030E-01	142	0.00	5.000	6.740E-01	143	22.50	5.000	8.490E-01	144	45.00	5.000	6.660E-01				
145	157.50	5.000	6.510E-01	146	90.00	5.000	8.960E-01	147	112.50	5.000	6.290E-01	148	135.00	5.000	6.130E-01				
149	157.50	5.000	6.700E-01	150	180.00	5.000	6.350E-01	151	232.50	5.000	7.155E-01	152	225.00	5.000	7.558E-01				
153	247.50	5.000	7.960E-01	154	270.00	5.000	7.370E-01	155	292.50	5.000	9.980E-01	156	315.00	5.000	6.610E-01				
157	337.50	5.000	6.630E-01	158	0.00	6.000	5.390E-01	159	11.25	6.000	5.840E-01	160	22.50	6.000	5.030E-01				
161	33.75	6.000	5.115E-01	162	45.00	6.000	5.200E-01	163	66.25	6.000	5.180E-00	164	67.50	6.000	4.880E-01				
165	78.75	6.000	5.020E-01	166	90.00	6.000	8.560E-01	167	101.25	6.000	5.110E-01	168	112.50	6.000	5.340E-01				
169	123.75	6.000	5.310E-01	170	135.00	6.000	5.650E-01	171	146.25	6.000	5.180E-01	172	157.50	6.000	5.390E-01				
173	168.75	6.000	5.180E-01	174	180.00	6.000	5.360E-01	175	191.25	6.000	5.220E-01	176	202.50	6.000	5.330E-01				
177	213.75	6.000	5.340E-01	178	225.00	6.000	6.610E-01	179	236.25	6.000	5.610E-01	180	247.50	6.000	5.830E-01				
181	258.75	6.000	5.830E-01	182	270.00	6.000	5.130E-01	183	231.25	6.000	5.010E-01	184	292.50	6.000	6.230E-01				
185	303.75	6.000	5.320E-01	186	315.00	6.000	5.610E-01	187	326.25	6.000	5.280E-01	188	337.50	6.000	5.950E-01				
189	348.75	6.000	5.560E-01	190	0.00	7.000	4.850E-01	191	11.25	7.000	4.800E-01	192	22.50	7.000	5.010E-01				
193	33.75	7.000	4.820E-01	194	45.00	7.000	4.860E-01	195	66.25	7.000	4.780E-01	196	67.50	7.000	4.530E-01				
197	78.75	7.000	4.440E-01	198	90.00	7.000	7.570E-01	199	101.25	7.000	1.950E-01	200	112.50	7.000	4.460E-01				
201	123.75	7.000	4.540E-01	202	135.00	7.000	4.820E-01	203	146.25	7.000	4.530E-01	204	157.50	7.000	5.120E-01				

[illegible]

RUN DATE.....1/17/78
 PARTICLE.....ELECTRON
 BEAM ENERGY.....500 MEV
 TARGET.....FP RUN 91
 PLATE NO.....PP3
 PLATE LOCATION..4

NO	ANGLE	RADIUS	DOSE	NO	ANGLE	RADIUS	DOSE	NO	ANGLE	RADIUS	DOSE	NO	ANGLE	RADIUS	DOSE
1	124.99	1.147	2.150E+03	2	116.57	1.051	2.790E+03	3	106.70	0.981	2.910E+03	4	95.71	0.945	3.030E+03
5	84.29	0.945	3.380E+03	6	73.30	0.981	3.330E+03	7	63.44	1.051	2.680E+03	8	55.01	1.147	2.510E+03
9	135.00	1.063	2.700E+03	10	126.87	0.940	3.020E+03	11	116.57	0.841	4.090E+03	12	104.04	0.775	4.460E+03
13	90.00	0.752	4.960E+03	14	75.96	0.775	4.980E+03	15	63.44	0.841	4.450E+03	16	53.13	0.940	3.700E+03
17	45.00	1.064	3.000E+03	18	139.40	0.867	3.880E+03	19	129.81	0.734	4.960E+03	20	116.57	0.631	5.640E+03
21	99.46	0.572	7.430E+03	22	80.54	0.572	6.810E+03	23	63.44	0.631	6.470E+03	24	50.19	0.734	5.430E+03
25	40.60	0.867	4.450E+03	26	153.43	0.841	4.240E+03	27	146.31	0.678	9.350E+03	28	135.00	0.532	7.410E+03
29	116.57	0.420	8.940E+03	30	90.00	0.376	1.090E+04	31	63.44	0.420	1.060E+04	32	45.00	0.532	8.220E+03
33	33.69	0.678	6.820E+03	34	26.57	0.841	4.880E+03	35	164.05	0.584	1.390E+04	36	158.20	0.508	6.350E+03
37	146.31	0.339	1.020E+04	38	116.57	0.210	1.320E+04	39	63.43	0.210	1.460E+04	40	33.69	0.339	1.360E+04
41	21.80	0.508	9.530E+03	42	15.95	0.684	6.610E+03	43	180.00	0.752	5.140E+03	44	180.00	0.564	7.500E+03
45	180.00	0.376	1.160E+04	46	180.00	0.188	1.400E+04	47	0.	0.	1.640E+04	48	0.	0.188	1.700E+04
49	0.	0.376	1.230E+04	50	0.	0.564	8.840E+03	51	0.	0.752	5.520E+03	52	195.95	0.684	6.470E+03
53	201.80	0.506	5.450E+03	54	213.69	0.339	1.270E+04	55	243.43	0.210	1.570E+04	56	296.57	0.210	1.860E+04
57	326.31	0.339	1.045E+04	58	338.20	0.506	1.230E+04	59	344.05	0.684	7.140E+03	60	206.57	0.841	4.790E+03
61	213.69	0.678	7.070E+03	62	225.00	0.532	9.610E+03	63	243.43	0.420	1.150E+04	64	270.00	0.376	1.800E+04
65	296.57	0.420	2.450E+04	66	315.00	0.532	1.020E+04	67	326.31	0.678	7.630E+03	68	333.43	0.841	5.420E+03
69	220.60	0.867	4.720E+03	70	230.19	0.734	6.160E+03	71	243.43	0.631	8.630E+03	72	260.54	0.572	9.550E+03
73	279.46	0.572	9.870E+03	74	296.57	0.631	8.910E+03	75	309.81	0.734	7.220E+03	76	319.40	0.867	5.390E+03
77	225.00	1.064	3.370E+03	78	233.10	0.940	4.620E+03	79	243.40	0.841	5.080E+03	80	255.96	0.775	6.060E+03
81	270.00	0.752	6.870E+03	82	284.00	0.775	6.700E+03	83	296.57	0.841	5.530E+03	84	306.87	0.940	4.950E+03
85	315.00	1.064	3.650E+03	86	235.00	1.147	2.950E+03	87	243.43	1.051	3.640E+03	88	253.30	0.981	4.210E+03
89	264.29	0.945	4.590E+03	90	275.71	0.945	4.750E+03	91	286.70	0.981	4.300E+03	92	296.57	1.051	4.060E+03
93	304.99	1.147	3.200E+03	94	0.	2.000	5.670E+02	95	22.50	2.000	5.280E+02	96	45.00	2.000	5.340E+02
97	67.50	2.000	4.870E+02	98	90.00	2.000	4.910E+02	99	112.50	2.000	5.060E+02	100	135.00	2.000	5.135E+02
101	157.50	2.000	5.210E+02	102	180.00	2.000	5.340E+02	103	202.50	2.000	4.970E+02	104	225.00	2.000	5.250E+02
105	247.50	2.000	5.500E+02	106	270.00	2.000	7.375E+02	107	292.50	2.000	8.312E+02	108	315.00	2.000	9.250E+02
109	337.50	2.000	6.470E+02	110	0.	3.000	1.270E+02	111	22.50	3.000	1.380E+02	112	45.00	3.000	1.420E+02
113	67.50	3.000	1.230E+02	114	90.00	3.000	1.160E+02	115	112.50	3.000	1.190E+02	116	135.00	3.000	1.220E+02
117	157.50	3.000	1.150E+02	118	180.00	3.000	1.210E+02	119	202.50	3.000	1.370E+02	120	225.00	3.000	1.380E+02
121	247.50	3.000	1.420E+02	122	270.00	3.000	1.570E+02	123	292.50	3.000	1.440E+02	124	315.00	3.000	1.445E+02
125	337.50	3.000	1.450E+02	126	0.	4.000	4.500E+01	127	22.50	4.000	4.500E+01	128	45.00	4.000	4.485E+01
129	67.50	4.000	4.470E+01	130	90.00	4.000	3.870E+01	131	112.50	4.000	3.570E+01	132	135.00	4.000	4.220E+01
133	157.50	4.000	3.930E+01	134	180.00	4.000	4.155E+01	135	202.50	4.000	4.380E+01	136	225.00	4.000	4.710E+01
137	247.50	4.000	4.230E+01	138	270.00	4.000	4.480E+01	139	292.50	4.000	4.750E+01	140	315.00	4.000	4.480E+01
141	337.50	4.000	4.780E+01	142	0.	5.000	1.840E+01	143	22.50	5.000	1.935E+01	144	45.00	5.000	2.040E+01
145	67.50	5.000	1.780E+01	146	90.00	5.000	1.820E+01	147	112.50	5.000	1.720E+01	148	135.00	5.000	2.040E+01
149	157.50	5.000	1.800E+01	149	180.00	5.000	1.910E+01	151	202.50	5.000	1.690E+01	152	225.00	5.000	1.980E+01
153	247.50	5.000	1.550E+01	154	270.00	5.000	1.970E+01	155	292.50	5.000	2.090E+01	156	315.00	5.000	1.700E+01
157	337.50	5.000	1.700E+01	158	0.	6.000	9.660E+00	159	11.25	6.000	1.020E+01	160	22.50	6.000	9.120E+00
161	33.75	6.000	7.680E+00	162	45.00	6.000	9.100E+00	163	56.25	6.000	9.430E+00	164	67.50	6.000	9.760E+00
165	78.75	6.000	9.500E+00	166	90.00	6.000	9.490E+00	167	101.25	6.000	9.130E+00	168	112.50	6.000	8.890E+00
169	123.75	6.000	9.320E+00	170	135.00	6.000	9.610E+00	171	146.25	6.000	7.180E+00	172	157.50	6.000	9.650E+00
173	168.75	6.000	8.730E+00	174	180.00	6.000	1.030E+01	175	191.25	6.000	1.020E+01	176	202.50	6.000	9.320E+00
177	213.75	6.000	9.320E+00	178	225.00	6.000	9.790E+00	179	236.25	6.000	9.390E+00	180	247.50	6.000	1.060E+01
181	258.75	6.000	9.540E+00	182	270.00	6.000	1.110E+01	183	281.25	6.000	8.980E+00	184	292.50	6.000	1.040E+01
185	303.75	6.000	1.050E+01	186	315.00	6.000	1.030E+01	187	326.25	6.000	1.030E+01	188	337.50	6.000	9.720E+00
189	348.75	6.000	1.020E+01	190	0.	7.000	5.060E+00	191	11.25	7.000	5.570E+00	192	22.50	7.000	5.180E+00
193	33.75	7.000	4.810E+00	194	45.00	7.000	4.870E+00	195	56.25	7.000	6.085E+00	196	67.50	7.000	1.130E+01
197	78.75	7.000	5.300E+00	198	90.00	7.000	5.240E+00	199	101.25	7.000	4.680E+00	200	112.50	7.000	4.600E+00
201	123.75	7.000	5.270E+00	202	135.00	7.000	4.740E+00	203	146.25	7.000	5.120E+00	204	157.50	7.000	5.210E+00

[illegible]

RUN DATE.....1/17/78
 PARTICLE.....ELECTRON
 BEAM ENERGY.....500 MEV
 TARGET.....PP RUN 91
 PLATE NO.....PP5
 PLATE LOCATION..6

B-6

NO	ANGLE	RADIUS	DOSE	NO	ANGLE	RADIUS	DOSE	NO	ANGLE	RADIUS	DOSE	NO	ANGLE	RADIUS	DOSE	NO	ANGLE	RADIUS	DOSE
1	124.99	1.147	1.100E+03	2	116.57	1.051	1.330E+03	3	106.70	0.981	1.470E+03	4	95.71	0.945	1.340E+03	5	85.01	0.945	1.340E+03
6	84.29	0.945	1.550E+03	6	73.30	0.981	1.310E+03	7	63.44	1.051	1.290E+03	8	55.01	1.147	1.330E+03	9	45.00	1.147	1.330E+03
13	135.00	1.063	1.180E+03	10	126.87	0.940	1.360E+03	11	116.57	0.841	1.590E+03	12	104.04	0.775	1.880E+03	13	95.00	0.775	1.880E+03
17	90.00	0.752	1.800E+03	14	75.96	0.775	1.860E+03	15	63.44	0.841	1.540E+03	16	53.13	0.940	1.470E+03	17	45.00	0.940	1.470E+03
21	45.00	1.064	1.370E+03	18	139.40	0.867	1.550E+03	19	129.81	0.734	1.790E+03	20	116.57	0.631	2.080E+03	21	104.04	0.631	2.080E+03
25	99.46	0.572	2.140E+03	22	80.54	0.572	2.230E+03	23	63.44	0.631	2.080E+03	24	50.19	0.734	1.780E+03	25	45.00	0.734	1.780E+03
29	40.90	0.867	1.630E+03	26	153.43	0.841	1.480E+03	27	146.31	0.678	1.930E+03	28	135.00	0.532	2.540E+03	29	126.87	0.532	2.540E+03
33	116.69	0.420	2.570E+03	30	90.00	0.376	2.790E+03	31	83.44	0.420	2.800E+03	32	45.00	0.532	2.540E+03	33	45.00	0.532	2.540E+03
37	133.69	0.678	1.860E+03	34	25.57	0.841	1.940E+03	35	164.05	0.678	1.930E+03	36	158.20	0.505	2.400E+03	37	146.31	0.505	2.400E+03
41	148.31	0.339	2.620E+03	38	115.57	0.610	2.010E+03	39	63.43	0.510	2.370E+03	40	33.69	0.339	2.140E+03	41	21.80	0.339	2.140E+03
45	180.00	0.376	1.790E+03	42	15.95	0.684	2.070E+03	43	180.00	0.752	1.930E+03	44	180.00	0.564	2.220E+03	45	180.00	0.564	2.220E+03
49	0.00	0.376	1.120E+03	46	180.00	0.188	3.250E+03	47	0.00	0.00	3.480E+03	48	0.00	0.188	3.710E+03	49	0.00	0.188	3.710E+03
53	201.80	0.506	2.470E+03	50	0.00	0.564	3.690E+03	51	0.00	0.752	2.120E+03	52	195.95	0.684	1.890E+03	53	180.00	0.684	1.890E+03
57	326.31	0.339	3.530E+03	54	213.69	0.339	3.290E+03	55	243.43	0.210	3.610E+03	56	296.57	0.210	3.710E+03	57	296.57	0.210	3.710E+03
61	213.69	0.678	2.220E+03	58	338.20	0.506	3.020E+03	59	344.05	0.684	2.450E+03	60	206.57	0.841	1.750E+03	61	206.57	0.841	1.750E+03
65	226.57	0.420	3.010E+03	62	225.00	0.532	2.440E+03	63	243.43	0.420	3.020E+03	64	270.00	0.376	3.380E+03	65	270.00	0.376	3.380E+03
69	220.60	0.867	1.880E+03	66	315.00	0.532	2.740E+03	67	326.31	0.678	2.450E+03	68	333.43	0.841	1.970E+03	69	333.43	0.841	1.970E+03
73	279.46	0.572	2.690E+03	70	230.19	0.734	2.140E+03	71	241.43	0.531	2.810E+03	72	260.54	0.572	2.560E+03	73	260.54	0.572	2.560E+03
77	225.00	1.064	1.440E+03	74	296.57	0.631	2.800E+03	75	309.81	0.734	2.370E+03	76	319.40	0.867	2.070E+03	77	319.40	0.867	2.070E+03
81	270.00	0.752	2.380E+03	78	233.10	0.940	1.760E+03	79	243.40	0.841	1.940E+03	80	255.96	0.775	2.080E+03	81	255.96	0.775	2.080E+03
85	315.00	1.064	1.490E+03	82	284.00	0.775	2.250E+03	83	296.57	0.841	2.170E+03	84	306.87	0.940	1.680E+03	85	306.87	0.940	1.680E+03
89	264.29	0.945	1.820E+03	86	235.00	1.147	1.330E+03	87	243.43	1.051	1.490E+03	88	253.30	0.981	1.670E+03	89	253.30	0.981	1.670E+03
93	304.99	1.147	1.470E+03	90	275.71	0.945	1.690E+03	91	286.70	0.881	1.610E+03	92	296.57	1.051	1.690E+03	93	296.57	1.051	1.690E+03
97	67.50	2.000	6.090E+02	94	0.00	2.000	5.510E+02	95	22.50	2.000	6.430E+02	96	45.00	2.000	6.070E+02	97	45.00	2.000	6.070E+02
101	157.50	2.000	5.240E+02	102	90.00	2.000	4.890E+02	103	112.50	2.000	5.370E+02	104	135.00	2.000	5.315E+02	105	135.00	2.000	5.315E+02
105	247.50	2.000	5.710E+02	106	160.00	2.000	4.170E+02	107	202.50	2.000	4.990E+02	108	225.00	2.000	5.700E+02	109	225.00	2.000	5.700E+02
109	337.50	2.000	6.690E+02	110	270.00	2.000	6.660E+02	111	292.50	2.000	6.170E+02	112	315.00	2.000	6.670E+02	113	315.00	2.000	6.670E+02
113	67.50	3.000	2.250E+02	114	0.00	3.000	5.400E+02	115	22.50	3.000	5.600E+02	116	45.00	3.000	2.280E+02	117	45.00	3.000	2.280E+02
117	157.50	3.000	2.930E+02	118	90.00	3.000	2.700E+02	119	112.50	3.000	2.330E+02	120	135.00	3.000	2.130E+02	121	135.00	3.000	2.130E+02
121	247.50	3.000	2.800E+02	122	180.00	3.000	2.320E+02	123	202.50	3.000	2.050E+02	124	225.00	3.000	2.590E+02	125	225.00	3.000	2.590E+02
125	337.50	3.000	2.600E+02	126	270.00	4.000	2.605E+02	127	292.50	4.000	2.930E+02	128	315.00	4.000	3.420E+02	129	315.00	4.000	3.420E+02
129	67.50	4.000	9.870E+01	130	0.00	4.000	8.000E+02	131	22.50	4.000	1.110E+02	132	45.00	4.000	1.040E+02	133	45.00	4.000	1.040E+02
133	157.50	4.000	9.950E+01	134	90.00	4.000	8.790E+01	135	112.50	4.000	9.780E+01	136	135.00	4.000	9.330E+01	137	135.00	4.000	9.330E+01
137	247.50	4.000	1.180E+02	138	180.00	4.000	1.120E+02	139	202.50	4.000	1.080E+02	140	225.00	4.000	1.090E+02	141	225.00	4.000	1.090E+02
141	337.50	4.000	1.100E+02	142	270.00	5.000	1.160E+02	143	292.50	5.000	1.060E+02	144	315.00	5.000	1.080E+02	145	315.00	5.000	1.080E+02
145	67.50	5.000	4.720E+01	146	0.00	5.000	4.670E+01	147	112.50	5.000	4.750E+01	148	135.00	5.000	4.650E+01	149	135.00	5.000	4.650E+01
149	157.50	5.000	4.490E+01	150	90.00	5.000	4.725E+01	151	112.50	5.000	4.080E+01	152	135.00	5.000	4.390E+01	153	135.00	5.000	4.390E+01
153	247.50	5.000	5.250E+01	154	180.00	5.000	3.310E+01	155	202.50	5.000	4.960E+01	156	225.00	5.000	4.850E+01	157	225.00	5.000	4.850E+01
157	337.50	5.000	5.130E+01	158	270.00	6.000	3.820E+01	159	292.50	6.000	5.570E+01	160	315.00	6.000	5.020E+01	161	315.00	6.000	5.020E+01
161	67.50	6.000	2.700E+01	162	0.00	6.000	2.580E+01	163	112.50	6.000	2.670E+01	164	135.00	6.000	2.730E+01	165	135.00	6.000	2.730E+01
165	157.50	6.000	2.585E+01	166	90.00	6.000	2.440E+01	167	101.25	6.000	2.320E+01	168	112.50	6.000	2.530E+01	169	112.50	6.000	2.530E+01
169	247.50	6.000	2.680E+01	170	135.00	6.000	2.220E+01	171	146.25	6.000	2.370E+01	172	157.50	6.000	2.270E+01	173	157.50	6.000	2.270E+01
173	168.75	6.000	3.455E+01	174	180.00	6.000	4.640E+01	175	191.25	6.000	2.450E+01	176	202.50	6.000	2.560E+01	177	202.50	6.000	2.560E+01
177	213.75	6.000	2.620E+01	178	225.00	6.000	3.170E+01	179	236.25	6.000	2.730E+01	180	247.50	6.000	2.650E+01	181	247.50	6.000	2.650E+01
181	258.75	6.000	3.170E+01	182	270.00	6.000	2.680E+01	183	281.25	6.000	2.700E+01	184	292.50	6.000	2.880E+01	185	292.50	6.000	2.880E+01
185	303.75	6.000	2.720E+01	186	315.00	6.000	2.820E+01	187	326.25	6.000	2.620E+01	188	337.50	6.000	2.710E+01	189	337.50	6.000	2.710E+01
189	348.75	6.000	2.700E+01	190	0.00	7.000	1.520E+01	191	11.25	7.000	1.620E+01	192	22.50	7.000	1.530E+01	193	22.50	7.000	1.530E+01
193	33.75	7.000	1.425E+01	194	45.00	7.000	1.320E+01	195	56.25	7.000	1.410E+01	196	67.50	7.000	2.620E+01	197	67.50	7.000	2.620E+01
197	78.75	7.000	1.410E+01	198	90.00	7.000	1.420E+01	199	101.25	7.000	1.420E+01	200	112.50	7.000	1.400E+01	201	112.50	7.000	1.400E+01
201	123.75	7.000	1.290E+01	202	135.00	7.000	1.370E+01	203	146.25	7.000	1.450E+01	204	157.50	7.000	1.100E+01	205	157.50	7.000	1.100E+01

RUN DATE.....1/17/78
 PARTICLE.....ELECTRON
 BEAM ENERGY.....500 MEV
 TARGET.....FP RUN 92
 PLATE NO.....PP6
 PLATE LOCATION..1

NO	ANGLE	RADIUS	DOSE	NO	ANGLE	RADIUS	DOSE	NO	ANGLE	RADIUS	DOSE	NO	ANGLE	RADIUS	DOSE
1	124.99	1.147	7.60E+00	6	116.57	1.051	9.230E+00	3	106.70	0.981	1.150E+01	8	95.71	0.945	1.260E+01
5	84.29	0.945	1.360E+01	7	73.30	0.981	1.180E+01	7	63.44	1.051	1.010E+01	4	55.01	1.147	7.040E+00
9	135.00	1.063	8.620E+00	10	126.87	0.940	1.290E+01	11	116.57	0.841	1.810E+01	12	104.04	0.775	2.410E+01
13	90.00	0.752	2.510E+01	14	75.96	0.775	2.610E+01	15	63.44	0.841	1.910E+01	16	53.13	0.940	1.230E+01
17	45.00	1.054	9.550E+00	18	139.40	0.867	2.187E+01	19	129.81	0.734	3.420E+01	20	116.57	0.631	7.460E+01
21	99.46	0.572	1.150E+02	22	80.54	0.572	9.190E+01	23	63.44	0.631	6.750E+01	24	50.19	0.734	4.000E+01
25	40.60	0.867	2.000E+02	26	153.43	0.841	2.300E+01	27	146.31	0.678	4.940E+01	28	135.00	0.532	1.240E+02
29	116.37	0.420	2.910E+02	30	90.00	0.376	4.580E+02	31	63.44	0.420	4.250E+02	32	45.00	0.532	1.580E+02
33	33.69	0.678	4.710E+01	34	26.57	0.841	2.190E+01	35	164.05	0.684	9.911E+03	36	158.20	0.506	1.980E+03
37	146.31	0.339	1.660E+04	38	116.57	0.210	1.340E+04	39	63.43	0.210	3.320E+04	40	33.69	0.309	3.800E+03
41	21.80	0.506	9.10E+02	42	19.95	0.684	5.240E+01	43	180.00	0.752	4.390E+01	44	180.00	0.564	1.880E+02
45	180.00	0.376	2.104E+04	46	180.00	0.188	4.790E+04	47	0.00	0.00	8.600E+04	48	0.00	0.188	4.350E+04
49	0.00	0.376	2.177E+04	50	0.00	0.564	1.080E+04	51	0.00	0.752	3.790E+01	52	195.95	0.684	7.880E+01
53	201.80	0.506	1.049E+04	54	213.69	0.339	2.190E+04	55	243.43	0.210	5.540E+04	56	296.57	0.210	6.700E+04
57	326.31	0.339	3.353E+04	58	338.20	0.506	1.680E+04	59	344.05	0.684	6.650E+01	60	206.57	0.841	3.330E+01
61	213.69	0.678	1.070E+02	62	225.00	0.532	2.673E+03	63	243.43	0.420	5.240E+03	64	270.00	0.376	7.670E+03
65	296.57	0.420	1.010E+04	66	315.00	0.532	3.440E+02	67	326.31	0.678	8.260E+01	68	333.43	0.841	2.970E+01
69	220.60	0.867	3.260E+01	70	230.19	0.734	9.080E+01	71	243.43	0.631	2.709E+02	72	260.54	0.572	4.510E+02
73	279.46	0.572	4.510E+02	74	296.57	0.631	1.940E+02	75	309.81	0.734	7.210E+01	76	319.40	0.867	2.660E+01
77	225.00	1.054	4.470E+01	78	233.10	0.940	2.700E+01	79	243.40	0.841	1.010E+02	80	255.96	0.775	8.870E+01
81	270.00	0.752	8.820E+01	82	284.00	0.775	8.770E+01	83	296.37	0.841	4.850E+01	84	306.87	0.940	2.490E+01
85	315.00	1.054	3.370E+01	86	235.00	1.147	1.350E+01	87	243.43	1.051	2.220E+01	88	253.30	0.981	2.870E+01
89	264.29	0.945	6.280E+01	90	275.71	0.945	3.330E+01	91	246.70	0.981	2.390E+01	92	296.57	1.051	1.830E+01
93	304.99	1.147	1.280E+01	94	0.00	2.000	2.060E+00	95	22.50	2.000	1.950E+00	96	45.00	2.000	1.790E+00
97	67.50	2.000	1.550E+00	98	90.00	2.000	2.810E+00	99	112.50	2.000	1.520E+00	100	135.00	2.000	1.660E+00
101	157.50	2.000	1.750E+00	102	180.00	2.000	1.660E+00	103	202.50	2.000	1.860E+00	104	225.00	2.000	2.100E+00
105	247.50	2.000	1.980E+00	106	270.00	2.000	1.770E+00	107	292.50	2.000	1.895E+00	108	315.00	2.000	2.020E+00
109	337.50	2.000	2.180E+00	110	0.00	3.000	1.640E+00	111	22.50	3.000	1.100E+00	112	45.00	3.000	1.040E+00
113	67.50	3.000	1.190E+00	114	90.00	3.000	2.350E+00	115	112.50	3.000	1.070E+00	116	135.00	3.000	9.880E-01
117	157.50	3.000	1.020E+00	118	180.00	3.000	1.110E+00	119	202.50	3.000	1.130E+00	120	225.00	3.000	1.120E+00
121	247.50	3.000	1.100E+00	122	270.00	3.000	1.190E+00	123	292.50	3.000	1.030E+00	124	315.00	3.000	1.050E+00
125	337.50	3.000	1.330E+00	126	0.00	4.000	8.310E-01	127	22.50	4.000	7.990E-01	128	45.00	4.000	7.350E-01
129	67.50	4.000	8.125E-01	130	90.00	4.000	8.300E-01	131	112.50	4.000	8.650E-01	132	135.00	4.000	9.375E-01
133	157.50	4.000	8.130E-01	134	180.00	4.000	8.630E-01	135	202.50	4.000	8.440E-01	136	225.00	4.000	8.430E-01
137	247.50	4.000	8.070E-01	138	270.00	4.000	7.445E-01	139	22.50	5.000	6.490E-01	140	45.00	4.000	8.680E-01
141	337.50	4.000	8.560E-01	142	0.00	5.000	7.445E-01	143	22.50	5.000	6.330E-01	144	45.00	5.000	6.670E-01
145	67.50	5.000	6.900E-01	146	90.00	5.000	2.020E+00	147	112.50	5.000	6.790E-01	148	135.00	5.000	6.840E-01
149	157.50	5.000	7.140E-01	150	180.00	5.000	6.930E-01	151	202.50	5.000	6.260E-01	152	225.00	5.000	6.250E-01
153	247.50	5.000	6.910E-01	154	270.00	5.000	6.980E-01	155	292.50	5.000	6.620E-01	156	315.00	5.000	6.660E-01
157	337.50	5.000	6.780E-01	158	0.00	6.000	6.900E-01	159	22.50	6.000	5.450E-01	160	45.00	6.000	6.070E-01
161	33.75	6.000	5.850E-01	162	45.00	6.000	5.890E-01	163	56.25	6.000	5.670E-01	164	67.50	6.000	5.410E-01
165	78.75	6.000	5.520E-01	166	90.00	6.000	2.120E+00	167	101.25	6.000	5.630E-01	168	112.50	6.000	5.100E-01
169	123.75	6.000	5.900E-01	170	135.00	6.000	5.605E-01	171	146.25	6.000	5.310E-01	172	157.50	6.000	5.470E-01
173	168.75	6.000	5.180E-01	174	180.00	6.000	5.670E-01	175	191.25	6.000	5.710E-01	176	202.50	6.000	5.000E-01
177	213.75	6.000	5.290E-01	178	225.00	6.000	5.450E-01	179	236.25	6.000	5.540E-01	180	247.50	6.000	5.545E-01
181	258.75	6.000	5.550E-01	182	270.00	6.000	5.010E-01	183	281.25	6.000	5.560E-01	184	302.50	6.000	5.880E-01
185	303.75	6.000	5.630E-01	186	315.00	6.000	5.990E-01	187	326.25	6.000	5.670E-01	188	337.50	6.000	5.500E-01
189	348.75	6.000	0.80E-01	190	0.00	7.000	6.990E-01	191	56.25	7.000	5.120E-01	192	67.50	7.000	5.400E-01
193	33.75	7.000	4.740E-01	194	45.00	7.000	5.110E-01	195	56.25	7.000	4.830E-01	196	67.50	7.000	5.320E-01
197	78.75	7.000	5.370E-01	198	90.00	7.000	1.660E+00	199	101.25	7.000	4.310E-01	200	112.50	7.000	4.720E-01
201	123.75	7.000	4.950E-01	202	135.00	7.000	4.925E-01	203	146.25	7.000	4.900E-01	204	157.50	7.000	4.980E-01

RUN DATE.....1/17/78
 PARTICLE.....ELECTRON
 BEAM ENERGY.....500 MEV
 TARGET.....FB RUN 92
 PLATE NO.....PP7
 PLATE LOCATION..3

NO	ANGLE	RADIUS	DOSE	NO	ANGLE	RADIUS	DOSE	NO	ANGLE	RADIUS	DOSE	NO	ANGLE	RADIUS	DOSE
1	124.99	1.147	2.200E+03	2	116.57	1.051	1.510E+03	3	106.70	0.981	1.620E+03	4	95.71	0.945	1.950E+03
5	84.29	0.945	2.030E+03	6	73.30	0.981	1.800E+03	7	63.44	1.051	1.510E+03	8	55.01	1.147	1.270E+03
9	135.00	1.063	1.420E+03	10	126.87	0.940	2.030E+03	11	116.57	0.841	2.640E+03	12	104.04	0.775	3.430E+03
13	90.00	0.752	3.590E+03	14	75.96	0.775	3.060E+03	15	63.44	0.841	2.640E+03	16	53.13	0.940	2.150E+03
17	45.00	1.064	1.560E+03	18	139.40	0.867	2.940E+03	19	129.81	0.734	4.170E+03	20	115.57	0.631	5.460E+03
21	99.46	0.420	6.330E+03	22	80.54	0.572	6.030E+03	23	63.44	0.631	5.470E+03	24	50.19	0.734	4.320E+03
25	40.60	0.867	2.680E+03	26	153.43	0.841	4.050E+03	27	145.31	0.678	5.420E+03	28	135.00	0.532	8.000E+03
29	116.57	0.420	1.210E+04	30	90.00	0.376	3.100E+04	31	63.44	0.420	1.330E+04	32	45.00	0.532	8.510E+03
33	33.69	0.678	5.280E+03	34	26.57	0.841	3.340E+03	35	164.05	0.684	5.470E+03	36	158.20	0.506	1.110E+04
37	146.31	0.339	1.890E+04	38	116.57	0.210	2.490E+04	39	53.43	0.210	2.550E+04	40	33.69	0.339	1.030E+04
41	21.80	0.506	1.710E+04	42	15.95	0.684	5.060E+03	43	180.00	0.752	5.220E+03	44	180.00	0.564	1.030E+04
45	180.00	0.376	2.275E+04	46	180.00	0.188	8.520E+04	47	0.	0.	3.880E+04	48	0.	0.188	3.340E+04
49	0.	0.376	1.860E+04	50	0.	0.564	8.650E+03	51	0.	0.752	4.850E+04	52	195.95	0.684	1.012E+04
53	201.80	0.506	1.540E+04	54	213.69	0.339	2.680E+04	55	243.43	0.210	4.810E+04	56	296.57	0.210	3.130E+04
57	326.31	0.339	2.750E+04	58	338.20	0.506	1.400E+04	59	344.05	0.684	6.300E+03	60	206.57	0.841	4.560E+03
61	213.69	0.678	8.940E+03	62	225.00	0.532	1.600E+04	63	243.43	0.420	2.640E+04	64	270.00	0.376	3.100E+04
65	296.57	0.420	2.640E+04	66	315.00	0.532	1.550E+04	67	326.31	0.678	7.510E+03	68	333.43	0.841	4.810E+03
69	220.60	0.867	4.980E+03	70	230.19	0.734	7.310E+03	71	326.31	0.631	1.100E+04	72	260.54	0.572	1.910E+04
73	229.46	0.572	1.630E+04	74	296.57	0.631	1.230E+04	75	309.81	0.734	7.530E+03	76	319.40	0.867	4.520E+03
77	225.00	1.064	2.520E+03	78	233.10	0.940	3.680E+03	79	243.43	0.841	5.330E+03	80	305.96	0.775	7.400E+03
81	270.00	0.752	8.350E+03	82	284.00	0.775	6.470E+03	83	296.57	0.841	5.330E+03	84	306.57	0.940	3.840E+03
85	315.00	1.064	2.260E+03	86	235.00	1.147	1.470E+03	87	243.43	1.051	3.610E+03	88	253.90	0.981	3.710E+03
89	264.29	0.945	4.200E+03	90	273.71	0.945	4.280E+03	91	286.70	0.981	3.610E+03	92	296.57	1.051	2.580E+03
93	304.99	1.147	1.415E+03	94	0.	2.000	2.500E+02	95	22.50	2.000	2.680E+02	96	45.00	2.000	1.352E+02
97	67.50	2.000	2.390E+00	98	90.00	2.000	2.850E+02	99	112.50	2.000	2.330E+02	100	135.00	2.000	2.440E+02
101	157.50	2.000	2.600E+02	102	180.00	2.000	3.480E+02	103	202.50	2.000	3.040E+02	104	225.00	2.000	3.705E+02
105	247.50	2.000	4.370E+02	106	270.00	2.000	3.900E+02	107	292.50	2.000	4.210E+02	108	315.00	2.000	3.640E+02
109	337.50	2.000	3.400E+02	110	0.	3.000	7.000E+01	111	22.50	3.000	5.960E+01	112	45.00	3.000	5.500E+01
113	67.50	3.000	5.210E+01	114	90.00	3.000	5.460E+01	115	112.50	3.000	5.520E+01	116	135.00	3.000	6.170E+01
117	157.50	3.000	5.740E+01	118	180.00	3.000	6.340E+01	119	202.50	3.000	6.590E+01	120	225.00	3.000	7.720E+01
121	247.50	3.000	7.270E+01	122	270.00	3.000	7.090E+01	123	292.50	3.000	5.960E+01	124	315.00	3.000	6.410E+01
125	337.50	3.000	6.000E+01	126	0.	4.000	2.100E+01	127	22.50	4.000	2.000E+01	128	45.00	4.000	1.960E+01
129	67.50	4.000	1.600E+01	130	90.00	4.000	1.980E+01	131	112.50	4.000	1.850E+01	132	135.00	4.000	2.070E+01
133	157.50	4.000	2.190E+01	134	180.00	4.000	2.160E+01	135	202.50	4.000	2.010E+01	136	225.00	4.000	2.450E+01
137	247.50	4.000	2.240E+01	138	270.00	4.000	2.450E+01	139	292.50	4.000	2.280E+01	140	315.00	4.000	2.440E+01
141	337.50	4.000	2.020E+01	142	0.	5.000	9.530E+00	143	22.50	5.000	7.680E+00	144	45.00	5.000	9.160E+00
145	67.50	5.000	7.480E+00	146	90.00	5.000	1.090E+01	147	112.50	5.000	7.620E+00	148	135.00	5.000	8.640E+00
149	157.50	5.000	9.090E+00	150	180.00	5.000	9.670E+00	151	202.50	5.000	9.480E+00	152	225.00	5.000	1.040E+01
153	247.50	5.000	1.090E+01	154	270.00	5.000	1.110E+01	155	292.50	5.000	9.820E+00	156	315.00	5.000	1.010E+01
157	337.50	5.000	8.620E+00	158	0.	6.000	4.200E+00	159	11.25	6.000	4.950E+00	160	22.50	6.000	4.810E+00
161	33.75	6.000	4.570E+00	162	45.00	6.000	4.470E+00	163	56.25	6.000	4.480E+00	164	67.50	6.000	4.810E+00
165	75.75	6.000	4.530E+00	166	90.00	6.000	4.870E+00	167	101.25	6.000	4.710E+00	168	112.50	6.000	4.970E+00
169	123.75	6.000	4.450E+00	170	135.00	6.000	4.130E+00	171	146.25	6.000	4.260E+00	172	157.50	6.000	4.390E+00
173	168.75	6.000	4.410E+00	174	180.00	6.000	4.930E+00	175	191.25	6.000	4.970E+00	176	202.50	6.000	4.970E+00
177	213.75	6.000	4.620E+00	178	225.00	6.000	4.910E+00	179	236.25	6.000	4.770E+00	180	247.50	6.000	4.530E+00
181	258.75	6.000	4.820E+00	182	270.00	6.000	5.190E+00	183	281.25	6.000	4.860E+00	184	292.50	6.000	5.330E+00
185	303.75	6.000	4.940E+00	186	315.00	6.000	5.180E+00	187	326.25	6.000	5.160E+00	188	337.50	6.000	4.620E+00
189	348.75	6.000	5.110E+00	190	0.	7.000	4.030E+00	191	11.25	7.000	2.950E+00	192	22.50	7.000	2.940E+00
193	33.75	7.000	2.930E+00	194	45.00	7.000	2.920E+00	195	56.25	7.000	3.100E+00	196	67.50	7.000	3.230E+00
197	78.75	7.000	3.010E+00	198	90.00	7.000	4.210E+00	199	101.25	7.000	2.720E+00	200	112.50	7.000	2.950E+00
201	123.75	7.000	4.050E+00	202	135.00	7.000	5.150E+00	203	146.25	7.000	4.075E+00	204	157.50	7.000	3.000E+00

RUN DATE.....1/17/78
 PARTICLE.....ELECTRON
 BEAM ENERGY.....500 MEV
 TARGET.....FP RUN 92
 PLATE NO.....PP8
 PLATE LOCATION..5

NO	ANGLE	RADIUS	DOSE	NO	ANGLE	RADIUS	DOSE	NO	ANGLE	RADIUS	DOSE	NO	ANGLE	RADIUS	DOSE
1	124.99	1.147	2.130E+03	2	116.57	1.051	2.630E+03	3	106.70	0.981	2.590E+03	4	95.71	0.945	2.860E+03
5	84.29	0.945	2.770E+03	6	73.30	0.981	2.650E+03	7	63.44	1.051	2.530E+03	8	55.01	1.147	2.020E+03
9	135.00	1.063	2.610E+03	10	126.87	0.940	2.950E+03	11	116.57	0.841	7.310E+03	12	104.04	0.775	6.400E+03
13	90.00	0.752	6.890E+03	14	75.96	0.775	6.810E+03	15	63.44	0.841	4.740E+03	16	53.13	0.940	2.840E+03
17	45.00	1.064	2.330E+03	18	139.40	0.867	3.670E+03	19	129.81	0.734	3.660E+02	20	116.57	0.631	4.30E+03
21	99.46	0.572	4.850E+03	22	80.54	0.572	4.720E+03	23	63.44	0.631	4.590E+03	24	50.19	0.734	4.740E+03
25	40.60	0.867	4.680E+03	26	153.43	0.841	3.750E+03	27	146.31	0.678	1.810E+02	28	135.00	0.532	5.630E+03
29	116.57	0.420	5.150E+02	30	90.00	0.376	9.150E+03	31	83.44	0.420	4.730E+02	32	45.00	0.332	4.810E+03
33	33.69	0.678	4.880E+03	34	26.57	0.841	3.340E+03	35	164.05	0.684	1.100E+03	36	158.20	0.606	5.520E+03
37	145.31	0.339	6.520E+03	38	116.57	0.210	7.300E+03	39	83.43	0.210	7.300E+03	40	33.69	0.339	1.120E+04
41	180.00	0.376	3.310E+02	42	180.00	0.188	8.640E+03	43	180.00	0.752	4.840E+02	44	180.00	0.564	5.500E+03
45	0.00	0.376	9.950E+03	46	0.00	0.564	8.420E+03	47	0.00	0.752	3.410E+03	48	0.00	0.188	8.100E+03
49	0.00	0.506	9.950E+01	50	0.00	0.339	8.910E+03	51	0.00	0.210	5.700E+02	52	195.95	0.684	5.270E+03
53	201.80	0.339	7.490E+03	54	213.69	0.506	6.110E+03	55	243.43	0.684	3.690E+03	56	296.57	0.210	8.990E+02
57	326.31	0.678	5.280E+03	58	338.20	0.532	7.060E+02	59	344.05	0.420	6.160E+03	60	206.57	0.841	4.610E+03
61	213.69	0.867	4.940E+03	62	225.00	0.532	4.850E+03	63	243.43	0.678	3.660E+03	64	270.00	0.376	6.130E+03
65	296.57	0.420	5.340E+03	66	315.00	0.734	4.960E+03	67	326.31	0.631	5.190E+02	68	333.43	0.841	4.090E+03
69	220.60	0.867	4.940E+03	70	230.19	0.940	4.390E+03	71	243.43	0.841	4.340E+03	72	260.54	0.572	9.010E+02
73	279.46	0.572	6.950E+03	74	296.57	0.631	6.470E+03	75	309.81	0.734	3.330E+03	76	319.40	0.867	4.640E+03
77	225.00	1.064	3.650E+03	78	233.10	0.940	4.390E+03	79	243.40	0.841	4.340E+03	80	255.96	0.775	4.700E+03
81	270.00	0.752	5.360E+03	82	284.00	0.775	3.950E+03	83	296.57	0.841	3.360E+03	84	306.87	0.940	4.220E+03
85	315.00	1.064	3.320E+03	86	235.00	1.147	3.310E+03	87	243.43	1.051	3.630E+03	88	253.30	0.981	4.350E+03
89	264.29	0.945	4.420E+03	90	275.71	0.945	4.550E+03	91	286.70	0.981	3.650E+03	92	296.57	1.051	3.370E+03
93	304.99	1.147	3.040E+03	94	0.00	2.000	6.830E+02	95	22.50	2.000	6.170E+02	96	45.00	2.000	6.230E+02
97	67.50	2.000	5.990E+02	98	90.00	2.000	6.210E+02	99	112.50	2.000	6.430E+02	100	135.00	2.000	6.110E+02
101	157.50	2.000	6.870E+02	102	180.00	2.000	8.110E+02	103	202.50	2.000	7.810E+02	104	225.00	2.000	8.025E+02
105	247.50	2.000	8.240E+02	106	270.00	2.000	8.490E+02	107	292.50	2.000	8.610E+02	108	315.00	2.000	7.930E+02
109	337.50	2.000	7.620E+02	110	0.00	3.000	2.010E+02	111	22.50	3.000	1.800E+02	112	45.00	3.000	1.980E+02
113	67.50	3.000	3.320E+00	114	90.00	3.000	1.720E+02	115	112.50	3.000	1.850E+02	116	135.00	3.000	1.840E+02
117	157.50	3.000	2.190E+02	118	180.00	3.000	1.770E+02	119	202.50	3.000	2.210E+02	120	225.00	3.000	2.510E+02
121	247.50	3.000	2.660E+02	122	270.00	3.000	2.810E+02	123	292.50	3.000	2.540E+02	124	315.00	3.000	1.980E+02
125	337.50	3.000	2.210E+02	126	0.00	4.000	7.180E+01	127	22.50	4.000	6.540E+01	128	45.00	4.000	6.450E+01
129	67.50	4.000	6.410E+01	130	90.00	4.000	6.370E+01	131	112.50	4.000	9.180E+01	132	135.00	4.000	6.520E+01
133	157.50	4.000	1.120E+01	134	180.00	4.000	7.960E+01	135	202.50	4.000	9.400E+01	136	225.00	4.000	8.520E+01
137	247.50	4.000	8.540E+01	138	270.00	4.000	7.680E+01	139	292.50	4.000	7.810E+01	140	315.00	4.000	7.940E+01
141	337.50	4.000	6.200E+01	142	0.00	5.000	2.840E+01	143	22.50	5.000	2.740E+01	144	45.00	5.000	2.540E+01
145	67.50	5.000	2.550E+01	146	90.00	5.000	2.790E+01	147	112.50	5.000	2.340E+01	148	135.00	5.000	2.670E+01
149	157.50	5.000	1.810E+01	150	180.00	5.000	3.630E+01	151	202.50	5.000	3.240E+01	152	225.00	5.000	3.610E+01
153	247.50	5.000	3.090E+01	154	270.00	5.000	3.360E+01	155	292.50	5.000	3.300E+01	156	315.00	5.000	2.920E+01
157	337.50	5.000	2.830E+01	158	0.00	6.000	1.430E+01	159	11.25	6.000	1.330E+01	160	22.50	6.000	1.530E+01
161	33.75	6.000	1.360E+01	162	45.00	6.000	1.190E+01	163	56.25	6.000	1.310E+01	164	67.50	6.000	1.220E+01
165	78.75	6.000	1.420E+01	166	90.00	6.000	1.350E+01	167	101.25	6.000	1.370E+01	168	112.50	6.000	1.250E+01
169	123.75	6.000	1.320E+01	170	135.00	6.000	1.190E+01	171	146.25	6.000	1.210E+01	172	157.50	6.000	1.430E+01
173	168.75	6.000	1.370E+01	174	180.00	6.000	1.340E+01	175	191.25	6.000	1.590E+01	176	202.50	6.000	1.560E+01
177	213.75	6.000	1.460E+01	178	225.00	6.000	1.460E+01	179	236.25	6.000	1.510E+01	180	247.50	6.000	1.450E+01
181	258.75	6.000	1.630E+01	182	270.00	6.000	1.600E+01	183	281.25	6.000	1.410E+01	184	292.50	6.000	1.620E+01
185	303.75	6.000	1.460E+01	186	315.00	6.000	1.330E+01	187	326.25	6.000	1.540E+01	188	337.50	6.000	1.510E+01
189	348.75	6.000	1.350E+01	190	0.00	7.000	7.660E+00	191	11.25	7.000	7.270E+00	192	22.50	7.000	7.110E+00
193	33.75	7.000	7.560E+00	194	45.00	7.000	6.350E+00	195	56.25	7.000	7.410E+00	196	67.50	7.000	6.850E+00
197	78.75	7.000	6.650E+00	198	90.00	7.000	6.490E+00	199	101.25	7.000	7.150E+00	200	112.50	7.000	5.860E+00
201	123.75	7.000	6.150E+00	202	135.00	7.000	7.120E+00	203	146.25	7.000	6.570E+00	204	157.50	7.000	7.360E+00

RUN DATE.....1/17/78
 PARTICLE.....ELECTRON
 BEAM ENERGY.....500 MEV
 TARGET.....PP RUN 92
 PLATE NO.....PP9
 PLATE LOCATION..6

B-10

NO	ANGLE	RADIUS	DOSE	NO	ANGLE	RADIUS	DOSE	NO	ANGLE	RADIUS	DOSE	NO	ANGLE	RADIUS	DOSE	NO	ANGLE	RADIUS	DOSE
1	124.99	1.17	9.500E+00	1	116.57	1.051	1.425E+01	3	106.70	0.981	1.900E+01	4	95.71	0.945	1.870E+01	5	84.29	0.945	1.870E+01
5	84.29	0.945	1.970E+01	9	73.30	0.981	2.050E+01	13	63.44	0.981	3.480E+01	17	55.01	1.147	1.970E+01	21	45.00	0.775	2.160E+01
13	90.00	0.763	0.050E+01	14	75.96	0.940	3.100E+01	18	116.57	0.841	2.140E+01	22	104.04	0.775	2.160E+01	25	99.46	0.775	2.160E+01
17	45.00	0.763	0.050E+01	18	139.40	0.775	2.150E+01	19	63.44	0.841	1.830E+01	23	53.13	0.940	0.895E+01	29	40.60	0.631	3.70E+01
21	99.46	0.064	1.960E+01	22	80.54	0.857	1.970E+01	27	129.81	0.734	2.140E+01	31	116.57	0.631	3.70E+01	33	33.69	0.775	2.160E+01
25	40.60	0.572	1.70E+01	26	153.43	0.572	1.30E+01	31	146.31	0.631	2.90E+01	35	158.20	0.533	0.60E+01	37	146.31	0.339	3.30E+01
29	116.57	0.867	0.340E+01	30	90.00	0.841	4.30E+01	37	163.43	0.678	1.80E+01	41	180.00	0.339	3.30E+01	45	180.00	0.339	3.30E+01
33	33.69	0.878	3.20E+01	38	256.57	0.841	4.10E+01	41	180.00	0.420	2.40E+01	49	0.00	0.376	3.70E+01	53	201.80	0.376	3.70E+01
37	146.31	0.339	3.30E+01	42	15.95	0.210	3.64E+01	47	0.00	0.210	7.30E+01	57	326.31	0.339	3.30E+01	61	213.69	0.339	3.30E+01
41	21.80	0.506	3.30E+01	46	180.00	0.188	7.50E+01	51	243.43	0.752	9.90E+01	65	236.57	0.678	2.70E+01	69	220.60	0.678	2.70E+01
45	180.00	0.376	3.70E+01	50	0.00	0.564	4.90E+01	55	243.43	0.210	9.10E+01	73	279.46	0.420	2.40E+01	77	225.00	0.420	2.40E+01
49	0.00	0.376	2.90E+01	54	213.69	0.339	3.30E+01	59	243.43	0.684	0.60E+01	81	270.00	0.678	2.70E+01	85	315.00	0.678	2.70E+01
53	201.80	0.506	1.80E+01	58	338.20	0.532	2.20E+01	63	243.43	0.420	7.60E+01	89	264.29	0.420	7.60E+01	93	304.99	0.420	7.60E+01
57	326.31	0.339	3.30E+01	62	225.00	0.532	2.40E+01	67	326.31	0.678	0.40E+01	97	67.50	0.678	0.40E+01	101	157.50	0.678	0.40E+01
61	213.69	0.678	3.70E+01	66	315.00	0.532	3.40E+01	71	243.43	0.631	5.00E+01	105	247.50	0.631	5.00E+01	109	337.50	0.631	5.00E+01
65	236.57	0.420	3.70E+01	70	230.19	0.734	3.80E+01	75	309.81	0.734	2.20E+01	113	157.50	0.734	3.80E+01	117	157.50	0.734	3.80E+01
69	220.60	0.867	0.90E+01	74	296.57	0.631	2.20E+01	79	243.43	0.841	1.90E+01	121	247.50	0.841	1.90E+01	125	337.50	0.841	1.90E+01
73	279.46	0.572	3.60E+01	78	233.10	0.940	2.140E+01	83	296.57	0.841	2.090E+01	129	157.50	0.841	1.90E+01	133	157.50	0.841	1.90E+01
77	225.00	0.644	0.50E+01	82	284.00	0.775	2.20E+01	87	243.43	0.981	1.850E+01	137	247.50	0.981	1.850E+01	141	247.50	0.981	1.850E+01
81	270.00	0.752	1.960E+01	86	235.00	1.147	1.30E+01	91	286.70	0.981	1.850E+01	145	157.50	0.981	1.850E+01	149	157.50	0.981	1.850E+01
85	315.00	0.644	1.780E+01	90	275.71	2.000	1.20E+01	95	22.50	2.000	1.670E+01	153	247.50	2.000	1.670E+01	157	337.50	2.000	1.670E+01
89	264.29	0.945	2.220E+01	94	0.00	2.000	1.720E+01	99	112.50	2.000	1.680E+01	161	33.75	2.000	1.680E+01	165	78.75	2.000	1.680E+01
93	304.99	1.147	1.930E+01	98	90.00	2.000	1.770E+01	103	202.50	2.000	1.710E+01	169	123.75	2.000	1.680E+01	173	168.75	2.000	1.680E+01
97	67.50	2.000	1.650E+01	102	180.00	3.000	1.670E+01	107	292.50	3.000	1.750E+01	177	221.33	2.000	1.680E+01	181	258.75	2.000	1.680E+01
101	157.50	2.000	1.580E+01	106	270.00	3.000	1.770E+01	111	112.50	3.000	1.410E+01	185	303.75	2.000	1.680E+01	189	348.75	2.000	1.680E+01
105	247.50	2.000	1.970E+01	110	0.00	3.000	1.670E+01	115	222.50	3.000	1.420E+01	193	33.75	2.000	1.680E+01	197	78.75	2.000	1.680E+01
109	337.50	2.000	1.690E+01	114	90.00	3.000	1.530E+01	119	292.50	3.000	1.350E+01	201	123.75	2.000	1.680E+01	205	168.75	2.000	1.680E+01
113	157.50	2.000	1.450E+01	118	180.00	3.000	1.440E+01	123	292.50	3.000	1.510E+01	209	258.75	2.000	1.680E+01	213	303.75	2.000	1.680E+01
117	157.50	2.000	1.500E+01	122	270.00	4.000	1.220E+01	127	112.50	4.000	1.190E+01	217	348.75	2.000	1.680E+01	221	383.75	2.000	1.680E+01
121	247.50	2.000	1.390E+01	126	0.00	4.000	1.230E+01	131	292.50	4.000	1.380E+01	225	383.75	2.000	1.680E+01	229	418.75	2.000	1.680E+01
125	337.50	2.000	1.340E+01	130	90.00	4.000	1.370E+01	135	292.50	4.000	1.70E+01	233	383.75	2.000	1.680E+01	237	453.75	2.000	1.680E+01
129	157.50	2.000	1.210E+01	134	180.00	5.000	1.080E+01	139	112.50	5.000	1.160E+01	241	418.75	2.000	1.680E+01	245	453.75	2.000	1.680E+01
133	157.50	2.000	1.310E+01	138	270.00	5.000	1.280E+01	143	292.50	5.000	1.070E+01	249	453.75	2.000	1.680E+01	253	488.75	2.000	1.680E+01
137	247.50	2.000	1.250E+01	142	0.00	5.000	1.310E+01	147	112.50	5.000	0.70E+01	257	488.75	2.000	1.680E+01	261	523.75	2.000	1.680E+01
141	247.50	2.000	1.100E+01	146	90.00	6.000	1.080E+01	151	292.50	6.000	1.100E+01	265	523.75	2.000	1.680E+01	269	558.75	2.000	1.680E+01
145	157.50	2.000	1.260E+01	150	180.00	6.000	1.230E+01	155	112.50	6.000	1.090E+01	273	558.75	2.000	1.680E+01	277	593.75	2.000	1.680E+01
149	157.50	2.000	1.150E+01	154	270.00	6.000	1.060E+01	159	292.50	6.000	1.150E+01	281	593.75	2.000	1.680E+01	285	628.75	2.000	1.680E+01
153	247.50	2.000	0.990E+01	158	0.00	6.000	1.150E+01	163	112.50	6.000	1.100E+01	289	628.75	2.000	1.680E+01	293	663.75	2.000	1.680E+01
157	337.50	2.000	1.020E+01	162	45.00	6.000	1.090E+01	167	292.50	6.000	1.110E+01	297	663.75	2.000	1.680E+01	301	698.75	2.000	1.680E+01
161	33.75	2.000	1.040E+01	166	90.00	6.000	1.020E+01	171	146.25	6.000	1.020E+01	305	698.75	2.000	1.680E+01	309	733.75	2.000	1.680E+01
165	78.75	2.000	1.140E+01	170	135.00	6.000	1.170E+01	175	191.25	6.000	1.000E+01	313	733.75	2.000	1.680E+01	317	768.75	2.000	1.680E+01
169	123.75	2.000	1.080E+01	174	180.00	6.000	1.100E+01	179	236.25	6.000	1.020E+01	321	768.75	2.000	1.680E+01	325	803.75	2.000	1.680E+01
173	168.75	2.000	1.180E+01	182	225.00	6.000	1.180E+01	183	281.25	6.000	1.030E+01	329	803.75	2.000	1.680E+01	333	838.75	2.000	1.680E+01
177	221.33	2.000	1.160E+01	186	270.00	6.000	1.160E+01	187	326.25	6.000	1.020E+01	337	838.75	2.000	1.680E+01	341	873.75	2.000	1.680E+01
181	258.75	2.000	1.150E+01	194	315.00	7.000	1.110E+01	195	56.25	7.000	0.930E+01	345	873.75	2.000	1.680E+01	349	908.75	2.000	1.680E+01
185	303.75	2.000	1.150E+01	198	0.00	7.000	1.110E+01	199	101.25	7.000	0.930E+01	353	908.75	2.000	1.680E+01	357	943.75	2.000	1.680E+01
189	348.75	2.000	1.150E+01	202	135.00	7.000	1.080E+01	203	146.25	7.000	0.930E+01	361	943.75	2.000	1.680E+01	365	978.75	2.000	1.680E+01

RUN DATE.....1/17/78
 PARTICLE.....ELECTRON
 BEAM ENERGY.....500 MEV
 TARGET.....FP RUN 92
 PLATE NO.....P10
 PLATE LOCATION..7

NO	ANGLE	RADIUS	DOSE	NO	ANGLE	RADIUS	DOSE	NO	ANGLE	RADIUS	DOSE	NO	ANGLE	RADIUS	DOSE	
1	124.99	1.147	6.160E+01	116	57	1.051	6.100E+01	3	106.70	0.281	6.560E+01	95	71	0.945	6.385E+01	
5	84.29	0.945	6.210E+01	126	87	0.981	6.310E+01	7	63.44	0.051	6.350E+01	4	55.01	0.147	6.620E+01	
9	135.00	1.063	7.470E+01	14	75.96	0.940	7.250E+01	11	113.57	0.841	6.460E+01	12	104.04	0.775	6.530E+01	
13	90.00	0.752	7.070E+01	14	75.96	0.775	7.030E+01	15	63.44	0.841	6.310E+01	16	53.13	0.940	6.440E+01	
17	45.00	1.064	6.210E+01	18	139.40	0.867	7.000E+01	19	129.81	0.734	7.330E+01	20	116.57	0.631	7.800E+01	
21	99.46	0.572	8.080E+01	22	80.54	0.572	7.030E+01	23	63.44	0.631	6.920E+01	24	50.19	0.734	6.585E+01	
25	40.60	0.867	6.250E+01	26	153.43	0.841	7.630E+01	27	146.31	0.678	7.870E+01	28	135.00	0.532	8.270E+01	
29	116.57	0.420	7.930E+01	30	90.00	0.376	8.570E+01	31	63.44	0.420	7.830E+01	32	45.00	0.532	6.995E+01	
33	33.69	0.678	6.160E+01	34	26.57	0.841	6.210E+01	35	164.05	0.684	7.620E+01	36	158.20	0.506	8.990E+01	
37	146.31	0.339	8.440E+01	38	116.57	0.210	7.890E+01	39	63.43	0.210	3.390E+01	40	33.69	0.339	7.550E+01	
41	121.80	0.506	7.080E+01	42	15.95	0.684	7.400E+01	43	180.00	0.752	6.710E+01	44	180.00	0.564	7.540E+01	
45	180.00	0.376	9.140E+01	46	180.00	0.188	9.290E+01	47	0.	0.	0.600E+01	48	0.	0.188	8.740E+01	
49	0.	0.506	9.690E+01	50	0.	0.339	1.130E+01	51	0.	0.	0.684	8.040E+01	52	0.	0.210	8.290E+01
53	201.80	0.339	7.880E+01	54	213.69	0.506	7.560E+01	55	243.43	0.210	6.630E+01	56	236.57	0.841	7.190E+01	
57	326.31	0.678	7.700E+01	58	338.20	0.532	8.630E+01	59	344.05	0.678	6.840E+01	60	270.00	0.376	8.460E+01	
61	213.69	0.420	7.910E+01	62	225.00	0.734	7.930E+01	63	243.43	0.841	7.130E+01	64	270.00	0.841	6.390E+01	
65	296.57	0.867	7.160E+01	66	315.00	0.631	7.540E+01	67	326.31	0.631	8.140E+01	68	333.43	0.572	8.350E+01	
69	220.60	0.572	8.560E+01	70	230.19	0.940	6.960E+01	71	243.43	0.841	6.500E+01	72	260.54	0.867	7.340E+01	
73	279.46	1.064	6.890E+01	74	236.57	0.775	6.800E+01	75	309.81	0.051	6.930E+01	76	319.40	0.775	6.940E+01	
77	225.00	0.752	7.540E+01	78	233.10	1.147	7.120E+01	79	243.40	0.981	7.090E+01	80	255.96	0.940	6.420E+01	
81	270.00	1.064	6.340E+01	82	284.00	0.945	6.680E+01	83	296.57	0.281	6.350E+01	84	306.87	0.981	7.190E+01	
85	315.00	0.945	7.480E+01	86	235.00	2.000	4.600E+01	87	243.43	0.981	6.930E+01	88	253.30	1.051	6.220E+01	
89	264.29	1.147	6.150E+01	90	275.71	2.000	4.365E+01	91	266.70	2.000	4.660E+01	92	296.57	2.000	4.540E+01	
93	304.99	2.000	4.010E+01	94	0.	2.000	5.170E+01	95	22.50	2.000	4.530E+01	96	45.00	2.000	5.110E+01	
97	67.50	2.000	4.680E+01	98	90.00	2.000	3.590E+01	99	112.50	2.000	4.490E+01	100	135.00	2.000	3.760E+01	
101	157.50	3.000	3.690E+01	102	180.00	3.000	3.720E+01	103	202.50	3.000	3.950E+01	104	225.00	3.000	3.740E+01	
105	247.50	3.000	3.480E+01	106	270.00	3.000	3.350E+01	107	292.50	3.000	3.580E+01	108	315.00	3.000	3.240E+01	
109	337.50	3.000	3.745E+01	110	0.	3.000	2.630E+01	111	22.50	3.000	3.250E+01	112	45.00	3.000	2.930E+01	
113	67.50	4.000	2.970E+01	114	90.00	4.000	2.910E+01	115	112.50	4.000	3.030E+01	116	135.00	4.000	2.850E+01	
117	157.50	4.000	2.970E+01	118	180.00	4.000	3.050E+01	119	202.50	4.000	3.030E+01	120	225.00	4.000	2.980E+01	
121	247.50	4.000	2.970E+01	122	270.00	4.000	3.020E+01	123	292.50	4.000	3.260E+01	124	315.00	4.000	3.110E+01	
125	337.50	4.000	2.970E+01	126	0.	5.000	2.050E+01	127	22.50	4.000	2.980E+01	128	45.00	4.000	3.400E+01	
129	67.50	5.000	2.450E+01	129	90.00	5.000	2.320E+01	130	112.50	5.000	2.530E+01	131	135.00	5.000	2.770E+01	
133	157.50	5.000	2.400E+01	132	180.00	5.000	2.400E+01	133	202.50	5.000	2.400E+01	134	225.00	5.000	2.360E+01	
137	247.50	5.000	2.400E+01	133	270.00	5.000	2.000E+01	135	292.50	5.000	2.090E+01	136	315.00	5.000	2.040E+01	
141	337.50	5.000	2.400E+01	134	0.	6.000	2.000E+01	137	22.50	5.000	1.870E+01	138	45.00	5.000	1.200E+01	
145	67.50	6.000	2.130E+01	135	90.00	6.000	2.170E+01	139	112.50	6.000	2.000E+01	139	135.00	6.000	1.900E+01	
149	157.50	6.000	2.130E+01	136	180.00	6.000	2.150E+01	140	202.50	6.000	2.000E+01	140	225.00	6.000	1.900E+01	
153	247.50	6.000	2.130E+01	137	270.00	6.000	2.100E+01	141	292.50	6.000	2.000E+01	141	315.00	6.000	1.900E+01	
157	337.50	6.000	2.130E+01	138	0.	6.000	2.260E+01	142	22.50	6.000	2.000E+01	142	45.00	6.000	2.000E+01	
161	67.50	6.000	2.130E+01	139	90.00	6.000	2.100E+01	143	112.50	6.000	2.000E+01	143	135.00	6.000	2.000E+01	
165	157.50	6.000	2.130E+01	140	180.00	6.000	2.100E+01	144	202.50	6.000	2.000E+01	144	225.00	6.000	2.000E+01	
169	247.50	6.000	2.130E+01	141	270.00	6.000	2.100E+01	145	292.50	6.000	2.000E+01	145	315.00	6.000	2.000E+01	
173	337.50	6.000	2.130E+01	142	0.	7.000	1.790E+01	146	22.50	6.000	1.630E+01	146	45.00	6.000	1.650E+01	
177	67.50	7.000	1.770E+01	143	90.00	7.000	1.740E+01	147	112.50	7.000	1.780E+01	147	135.00	7.000	1.780E+01	
181	157.50	7.000	1.770E+01	144	180.00	7.000	1.760E+01	148	202.50	7.000	1.650E+01	148	225.00	7.000	1.790E+01	
185	247.50	7.000	1.770E+01	145	270.00	7.000	1.570E+01	149	292.50	7.000	1.570E+01	149	315.00	7.000	1.790E+01	
189	337.50	7.000	1.770E+01	146	0.	7.000	1.570E+01	150	22.50	7.000	1.570E+01	150	45.00	7.000	1.790E+01	
193	67.50	7.000	1.770E+01	147	90.00	7.000	1.570E+01	151	112.50	7.000	1.570E+01	151	135.00	7.000	1.790E+01	
197	157.50	7.000	1.770E+01	148	180.00	7.000	1.570E+01	152	202.50	7.000	1.570E+01	152	225.00	7.000	1.790E+01	
201	247.50	7.000	1.770E+01	149	270.00	7.000	1.570E+01	153	292.50	7.000	1.570E+01	153	315.00	7.000	1.790E+01	
				150	0.	7.000	1.570E+01	154	22.50	7.000	1.570E+01	154	45.00	7.000	1.790E+01	
				151	90.00	7.000	1.570E+01	155	112.50	7.000	1.570E+01	155	135.00	7.000	1.790E+01	
				152	180.00	7.000	1.570E+01	156	202.50	7.000	1.570E+01	156	225.00	7.000	1.790E+01	
				153	270.00	7.000	1.570E+01	157	292.50	7.000	1.570E+01	157	315.00	7.000	1.790E+01	
				154	0.	7.000	1.570E+01	158	22.50	7.000	1.570E+01	158	45.00	7.000	1.790E+01	
				155	90.00	7.000	1.570E+01	159	112.50	7.000	1.570E+01	159	135.00	7.000	1.790E+01	
				156	180.00	7.000	1.570E+01	160	202.50	7.000	1.570E+01	160	225.00	7.000	1.790E+01	
				157	270.00	7.000	1.570E+01	161	292.50	7.000	1.570E+01	161	315.00	7.000	1.790E+01	
				158	0.	7.000	1.570E+01	162	22.50	7.000	1.570E+01	162	45.00	7.000	1.790E+01	
				159	90.00	7.000	1.570E+01	163	112.50	7.000	1.570E+01	163	135.00	7.000	1.790E+01	
				160	180.00	7.000	1.570E+01	164	202.50	7.000	1.570E+01	164	225.00	7.000	1.790E+01	
				161	270.00	7.000	1.570E+01	165	292.50	7.000	1.570E+01	165	315.00	7.000	1.790E+01	
				162	0.	7.000	1.570E+01	166	22.50	7.000	1.570E+01	166	45.00	7.000	1.790E+01	
				163	90.00	7.000	1.570E+01	167	112.50	7.000	1.570E+01	167	135.00	7.000	1.790E+01	
				164	180.00	7.000	1.570E+01	168	202.50	7.000	1.570E+01	168	225.00	7.000	1.790E+01	
				165	270.00	7.000	1.570E+01	169	292.50	7.000	1.570E+01	169	315.00	7.000	1.790E+01	
				166	0.	7.000	1.570E+01	170	22.50	7.000	1.570E+01	170	45.00	7.000	1.790E+01	
				167	90.00	7.000	1.570E+01	171	112.50	7.000	1.570E+01	171	135.00	7.000	1.790E+01	
				168	180.00	7.000	1.570E+01	172	202.50	7.000	1.570E+01	172	225.00	7.000	1.790E+01	
				169	270.00	7.000	1.570E+01	173	292.50	7.000	1.570E+01	173	315.00	7.000	1.790E+01	
				170	0.	7.000	1.570E+01	174	22.50	7.000	1.570E+01	174	45.00	7.000	1.790E+01	
				171	90.00	7.000	1.570E+01	175	112.50	7.000	1.570E+01	175	135.00	7.000	1.790E+01	
				172	180.00	7.000	1.570E+01	176	202.50	7.00						