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# Calculations on Uniform-Field Bending Magnets

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The focal properties of some uniform-field bending magnets have been calculated. This report gives tables and graphs of the image distance and magnification for deflection angles of 20, 22-1/2, 35, 40, and 45 degrees, as a function of the object distance and the angle the particle beam makes with the entrance and exit faces of the magnet. These numerical results are useful when designing ion-optical systems for particle accelerators.

## INTRODUCTION

The beam transport system for the NRL Sector-Focusing Cyclotron Facility is now being designed. This beam transport system will use uniform-field bending magnets to steer the beam, an inhomogeneous-field magnet for energy calibration and high resolution, and quadrupole magnets for focusing. It is convenient to study the response of an entire beam transport system by ray tracing using the matrix techniques described by Penner (1). However, when selecting elements for a trial beam transport system, it is necessary to know the ion-optical properties of each individual element of the system.

Numerical data on the various ion-optical elements is available throughout the literature (2). However, the particular examples shown in the literature are not often useful for our design needs, nor are the results usually given to enough accuracy to be used as input data for ray-tracing calculations. Hence, to satisfy our needs, we have computed some of the ion-optical properties of various beam transport elements. This report gives the focal properties of uniform-field bending magnets as a function of the angle the particle beam makes with the entrance and exit faces of the magnet for several possible deflection angles.

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## BRIEF DESCRIPTION OF BEAM TRANSPORT SYSTEM

The beam from the NRL cyclotron can be brought into any of three rooms for use by experimenters. The floor plan of the facility (Fig. 1) has been designed so that personnel can work on experimental equipment in two of the experimental rooms while the charged particle beam experiment is brought into the third experimental room.

The virtual source inside the cyclotron is focused by means of two quadrupole doublets onto the entrance slit of the inhomogeneous-field ($n = 1/2$) beam analyzing magnet. The beam analyzing magnet can be rotated into either of the two positions shown in Fig. 1 so that a beam well defined in energy ($\Delta E/E \approx 2 \times 10^{-4}$) can be directed toward either Room 2 or Room 3. The beam can also be directed to Room 1 for experiments which do not require the good energy resolution available with the analyzing magnet.

A uniform-field bending magnet for each experimental room is located in the cyclotron vault so that the beam can be deflected into one of the several beam paths shown in the experimental room. These magnets have been located in the cyclotron vault to minimize background in the experimental rooms.

A suitable system utilizing the combined focusing properties of the quadrupoles and the

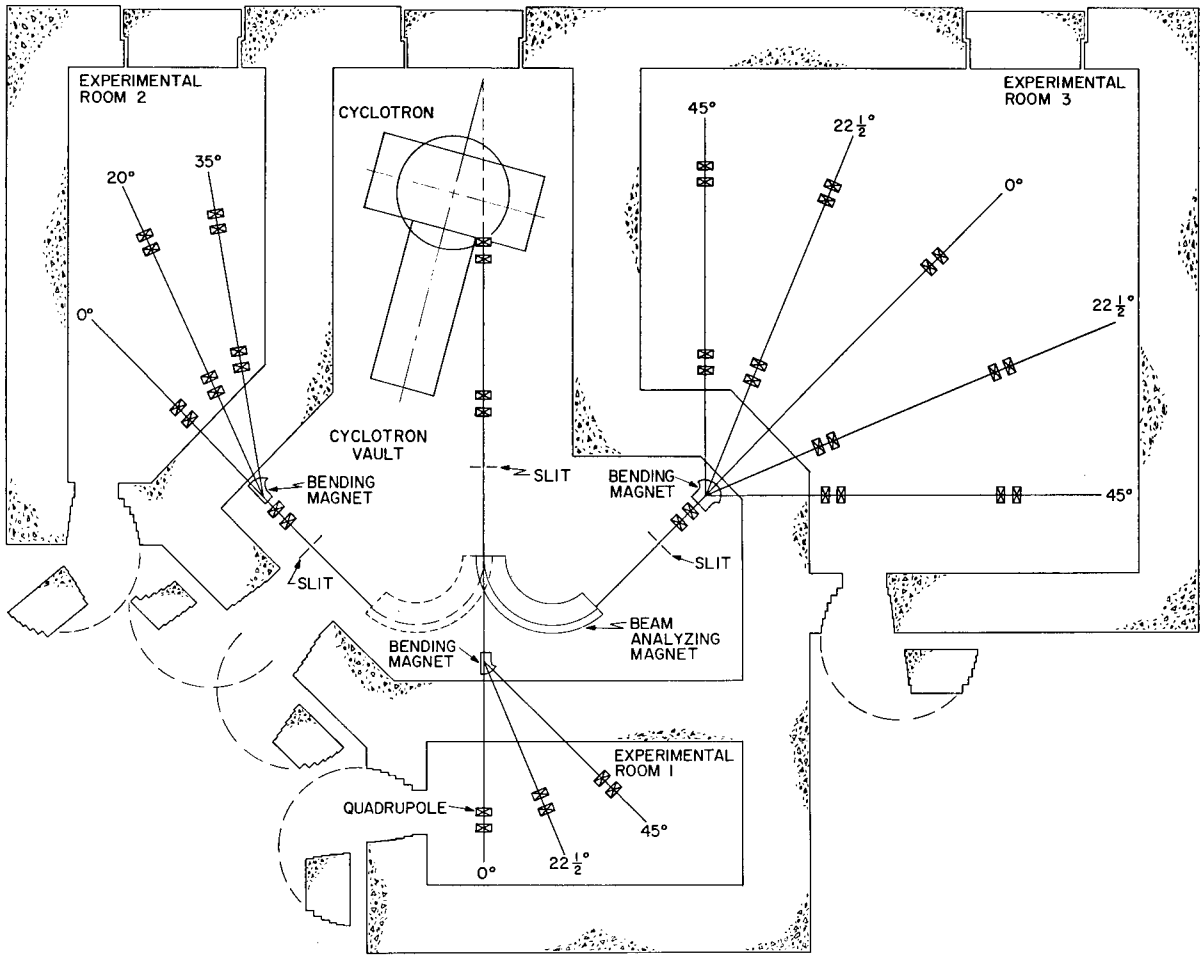


Fig. 1 — Floor plan for the NRL cyclotron facility

beam bending magnets indicated in Fig. 1 must be devised to bring a focused image of the exit slit of the beam analyzing magnet to the location required for experiments along the various beam paths in Rooms 2 and 3. Similarly, the image of the virtual source inside the cyclotron must be imaged onto the required locations on the various beam paths in Room 1.

The problem encountered in meeting the foregoing criteria is that the bending magnet for each experimental room must be designed to have the correct focal properties for each of the required angles of deflection. In this design one may utilize the fact that the focal length of a uniform-field bending magnet is strongly dependent on both the angle the incident particle beam makes with the pole edge on entering the magnet and the angle the particle beam makes with the pole edge on leaving the magnet. The data presented in this report were computed to show for particular deflection angles the available range of the horizontal and vertical magnifications and object distances as functions of the entrance angles, exit angles, and image distances and thus facilitate the design of the beam transport system.

## DESCRIPTION OF CALCULATIONS

Uniform-field bending magnets will focus in the radial plane but will not focus in the vertical plane if the ion beam both enters and leaves the magnet normal to the pole edge. This characteristic makes it difficult to incorporate a uniform-field bending

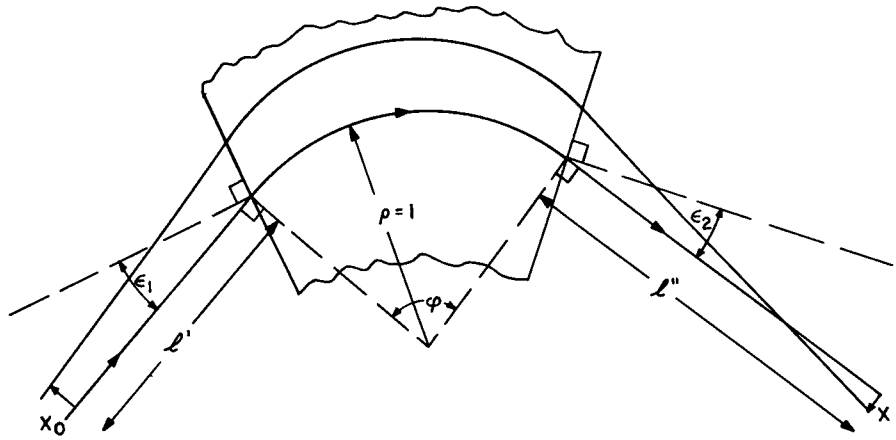


Fig. 2 — Notation for motion in the radial plane of the magnet

magnet into a system that requires double focusing. However, if the direction of the ion beam on entering or leaving the field is not perpendicular to the pole edge, the fringe field of the magnet provides focusing in the vertical plane. Thus proper choice of the entrance and exit angle makes it possible to obtain double focusing.

A NELIAC-N program* has been written to compute the entrance and exit angles, as a function of object distance, which lead to double focusing. This calculation has been performed for the deflection angles of interest in designing the NRL facility: 20, 22-1/2, 35, 40, and 45 degrees.

The calculations made herein use the conditions for double focusing given by Cross (3), and the notation follows that of Cross and is illustrated in Fig. 2, where the motion in the radial plane of the magnet is shown. The quantity $\varphi$ is the deflection angle of the magnet. The quantity $\ell'$ is the distance from the object to the pole edge, and the quantity $\ell''$ is the distance from the pole edge to the double-focused image. The quantity $\rho$ is the radius of curvature in the magnet. Since all distances will be shown as multiples of $\rho$, $\rho = 1$ for the optic axis of the magnet. As shown in Fig. 2, $\epsilon_1$ and $\epsilon_2$ are the angles the incident beam and the exit beam, respectively, make with the normal to the field. The angles $\epsilon_1$ and $\epsilon_2$ are taken as positive if the path outside the field lies on the same side of the normal to the boundary as does the center of curvature of the particle's deflection ($\epsilon_1$ and $\epsilon_2$ are both positive as shown in Fig. 2).

The conditions for double focusing in the notation used by Cross (3) are

$$\tan \epsilon_2 = \frac{1}{2}\left[ \tan (\varphi - \psi) + \frac{1}{(\varphi - \cot \eta)} \right] \quad (1)$$

and

$$\frac{1}{\ell''} = \frac{1}{2}\left[ \tan (\varphi - \psi) - \frac{1}{(\varphi - \cot \eta)} \right], \quad (2)$$

where

$$\tan \psi = \tan \epsilon_1 + \frac{1}{\ell'} \quad (3)$$

and

$$\tan \eta = \tan \epsilon_1 - \frac{1}{\ell'}. \quad (4)$$

From Eq. (1), the value of $\epsilon_2$ which will give double focusing can be determined for a given value of $\epsilon_1$ and $\ell'$. Then $\ell''$ is determined from Eq. (2).

An expression for the magnification is not given explicity by Cross. However, Cross does give an expression (Eq. (1) of Ref. 3) for the displacement of a ray from the optic axis after it has left the magnetic field. At a focal plane, this displacement is independent of the angle the ray leaving the object makes with the optic axis. Using this consideration, the magnification in the horizontal (radial) plane is obtained:

$$M_H = -\frac{q \cos \epsilon_2}{\cos \epsilon_1}, \quad (5)$$

*NELIAC-N is a compiler language for NAREC, the NRL digital computer.

where

$$q = \frac{\ell'' \sin \Omega}{\cos^2 \epsilon_2} - \frac{\cos (\varphi - \epsilon_1)}{\cos \epsilon_2}, \tag{6}$$

with

$$\Omega = \varphi - \epsilon_1 - \epsilon_2. \tag{7}$$

Similarly, the magnification in the vertical plane, $M_V$, is obtained from Eq. (3) in Ref. 3:

$$M_V = 1 - \varphi \tan \epsilon_1 - \ell''[\tan \epsilon_1 + (1 - \varphi \tan \epsilon_1) \tan \epsilon_2]. \tag{8}$$

## RESULTS

The printouts from the NELIAC-N calculation are given in Appendix A, and graphs of some of the results are shown in Appendix B. It is intended that the graphs be used to explore the range of available parameters but that the more exact values of the parameters to be used in ray-tracing calculations be obtained from the computer printouts.

There is a slight difference between the notation used in the preceding section of this report and the notation used in the printout. This difference is due to format limitations in the computer output. The relationship between the two notations is given in Table 1.

Each block of results in the printout corresponds to a fixed value of *PHI* and *LP* with *E*1 as a running parameter. All angles are shown in degrees and all distances are given in multiples of the radius of curvature of the particles in the magnetic field. The computed values of *LD* are shown as a decimal followed by the power of ten by which this decimal should be multiplied. The printout has been formatted so that if $|M_H|$ or $|M_V|$ is greater than 999.99, asterisks appear in the printout. Such large values are not considered to be of interest. Also, no computations have been made for negative values of $\epsilon_1$, since these values generally do not lead to double focusing, and since at these values the defocusing at the entrance to the magnet causes the vertical acceptance angle of the magnet to become too small.

TABLE 1
Identification of the Printout Notation in Appendix A

| Notation in Report Text | Printout Notation | Quantity |
|---|---|---|
| $\ell'$ | LP | Object distance |
| $\ell''$ | LD | Image distance |
| $\epsilon_1$ | E1 | Entrance angle |
| $\epsilon_2$ | E2 | Exit angle |
| $M_H$ | MH | Horizontal magnification |
| $M_V$ | MV | Vertical magnification |
| $\varphi$ | PHI | Deflection angle |

## ACKNOWLEDGMENTS

The authors wish to thank Drs. L. A. Beach and R. O. Bondelid for many helpful discussions during the course of the work. We would also like to thank Dr. C. V. Strain for his continued support in this work.

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2. For example, W.G. Cross, *Rev. Sci. Instr.* **22**:717 (1951); R.M. Sternheimer, *Rev. Sci. Instr.* **23**:629 (1952); J.P. Blewett, Brookhaven National Laboratory Report JPB-11, Oct. 2, 1958, and BNL-4654, May 11, 1959; H.A. Enge, *Rev. Sci. Instr.* **30**:248 (1959) and **32**:662 (1961)
3. W.G. Cross, *Rev. Sci. Instr.* **22**:717 (1951)

## APPENDIX A
## Printouts From the NELIAC-N Calculation

PHI = 20.0 LP = .5

| E1 | LD | E2 | MH | MV |
|---|---|---|---|---|
| 0 | -.9414 +000 | 6.59 | 1.16 | 1.11 |
| 5 | -.9406 +000 | 4.79 | 1.14 | 1.13 |
| 10 | -.9409 +000 | 2.95 | 1.12 | 1.15 |
| 15 | -.9423 +000 | 1.04 | 1.10 | 1.17 |
| 20 | -.9450 +000 | -.97 | 1.08 | 1.20 |
| 25 | -.9493 +000 | -3.12 | 1.06 | 1.24 |
| 30 | -.9557 +000 | -5.47 | 1.05 | 1.28 |
| 35 | -.9651 +000 | -8.09 | 1.04 | 1.33 |
| 40 | -.9788 +000 | -11.07 | 1.02 | 1.39 |
| 45 | -.9993 +000 | -14.54 | 1.02 | 1.48 |
| 50 | -.1032 +001 | -18.72 | 1.02 | 1.61 |
| 55 | -.1087 +001 | -23.91 | 1.03 | 1.81 |
| 60 | -.1195 +001 | -30.61 | 1.08 | 2.19 |
| 65 | -.1476 +001 | -39.68 | 1.25 | 3.11 |

PHI = 20.0 LP = 1.0

| E1 | LD | E2 | MH | MV |
|---|---|---|---|---|
| 0 | -.1656 +001 | 7.83 | 1.29 | 1.23 |
| 5 | -.1652 +001 | 4.96 | 1.26 | 1.25 |
| 10 | -.1655 +001 | 2.03 | 1.23 | 1.29 |
| 15 | -.1664 +001 | -1.02 | 1.21 | 1.33 |
| 20 | -.1682 +001 | -4.23 | 1.20 | 1.38 |
| 25 | -.1711 +001 | -7.66 | 1.19 | 1.44 |
| 30 | -.1756 +001 | -11.38 | 1.19 | 1.53 |
| 35 | -.1823 +001 | -15.48 | 1.20 | 1.65 |
| 40 | -.1931 +001 | -20.08 | 1.23 | 1.83 |
| 45 | -.2112 +001 | -25.33 | 1.30 | 2.11 |
| 50 | -.2465 +001 | -31.43 | 1.46 | 2.64 |
| 55 | -.3376 +001 | -38.64 | 1.91 | 3.97 |
| 60 | -.9801 +001 | -47.34 | 5.23 | 13.17 |
| 65 | .3282 +001 | -58.01 | -1.63 | -5.47 |

PHI = 20.0 LP = 1.5

| E1 | LD | E2 | MH | MV |
|---|---|---|---|---|
| 0 | -.2550 +001 | 8.45 | 1.46 | 1.38 |
| 5 | -.2538 +001 | 5.02 | 1.41 | 1.41 |
| 10 | -.2547 +001 | 1.49 | 1.38 | 1.45 |
| 15 | -.2578 +001 | -2.17 | 1.36 | 1.51 |
| 20 | -.2637 +001 | -6.02 | 1.36 | 1.59 |
| 25 | -.2733 +001 | -10.13 | 1.37 | 1.70 |
| 30 | -.2889 +001 | -14.55 | 1.41 | 1.87 |
| 35 | -.3146 +001 | -19.38 | 1.49 | 2.12 |
| 40 | -.3610 +001 | -24.73 | 1.65 | 2.56 |
| 45 | -.4612 +001 | -30.71 | 2.04 | 3.48 |
| 50 | -.8047 +001 | -37.50 | 3.41 | 6.57 |
| 55 | .3630 +002 | -45.27 | -14.61 | -32.96 |
| 60 | .3280 +001 | -54.29 | -1.24 | -3.48 |
| 65 | .1085 +001 | -64.86 | -.38 | -1.49 |

PHI = 20.0 LP = 2.0

| E1 | LD | E2 | MH | MV |
|---|---|---|---|---|
| 0 | -.3698 +001 | 8.83 | 1.66 | 1.57 |
| 5 | -.3672 +001 | 5.04 | 1.61 | 1.60 |
| 10 | -.3694 +001 | 1.15 | 1.58 | 1.66 |
| 15 | -.3771 +001 | -2.89 | 1.57 | 1.74 |
| 20 | -.3920 +001 | -7.14 | 1.59 | 1.87 |
| 25 | -.4176 +001 | -11.65 | 1.64 | 2.06 |
| 30 | -.4620 +001 | -16.49 | 1.77 | 2.37 |
| 35 | -.5453 +001 | -21.73 | 2.02 | 2.93 |
| 40 | -.7381 +001 | -27.48 | 2.64 | 4.19 |
| 45 | -.1549 +002 | -33.83 | 5.33 | 9.38 |
| 50 | .2218 +002 | -40.92 | -7.30 | -14.62 |
| 55 | .4407 +001 | -48.89 | -1.38 | -3.26 |
| 60 | .1768 +001 | -57.93 | -.52 | -1.55 |
| 65 | .7411 +000 | -68.29 | -.20 | -.87 |

PHI = 20.0 LP = 2.5

| E1 | LD | E2 | MH | MV |
|---|---|---|---|---|
| 0 | -.5230 +001 | 9.08 | 1.94 | 1.84 |
| 5 | -.5172 +001 | 5.05 | 1.87 | 1.87 |
| 10 | -.5222 +001 | .91 | 1.84 | 1.94 |
| 15 | -.5394 +001 | -3.39 | 1.85 | 2.06 |
| 20 | -.5738 +001 | -7.90 | 1.91 | 2.27 |
| 25 | -.6369 +001 | -12.67 | 2.06 | 2.61 |
| 30 | -.7594 +001 | -17.78 | 2.38 | 3.24 |
| 35 | -.1051 +002 | -23.29 | 3.19 | 4.69 |
| 40 | -.2366 +002 | -29.29 | 6.94 | 11.18 |
| 45 | .2753 +002 | -35.85 | -7.76 | -13.93 |
| 50 | .6314 +001 | -43.10 | -1.70 | -3.49 |
| 55 | .2760 +001 | -51.15 | -.71 | -1.72 |
| 60 | .1339 +001 | -60.15 | -.32 | -1.00 |
| 65 | .6008 +000 | -70.32 | -.13 | -.61 |

PHI = 20.0 LP = 3.0

| E1 | LD | E2 | MH | MV |
|---|---|---|---|---|
| 0 | -.7373 +001 | 9.26 | 2.33 | 2.20 |
| 5 | -.7254 +001 | 5.06 | 2.23 | 2.23 |
| 10 | -.7360 +001 | .74 | 2.20 | 2.33 |
| 15 | -.7733 +001 | -3.74 | 2.25 | 2.52 |
| 20 | -.8515 +001 | -8.44 | 2.41 | 2.87 |
| 25 | -.1010 +002 | -13.41 | 2.78 | 3.53 |
| 30 | -.1390 +002 | -18.71 | 3.70 | 5.07 |
| 35 | -.3040 +002 | -24.40 | 7.84 | 11.62 |
| 40 | .4206 +002 | -30.56 | -10.46 | -17.03 |
| 45 | .9250 +001 | -37.26 | -2.21 | -4.02 |
| 50 | .4175 +001 | -44.60 | -.95 | -1.99 |
| 55 | .2173 +001 | -52.68 | -.47 | -1.17 |
| 60 | .1135 +001 | -61.64 | -.23 | -.74 |
| 65 | .5245 +000 | -71.67 | -.10 | -.48 |

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PHI = 20.0 LP = 3.5

| E1 | LD | E2 | MH | MV |
|---|---|---|---|---|
| 0 | -.1059 +002 | 9.39 | 2.92 | 2.75 |
| 5 | -.1033 +002 | 5.07 | 2.77 | 2.76 |
| 10 | -.1056 +002 | .61 | 2.75 | 2.91 |
| 15 | -.1139 +002 | -4.01 | 2.88 | 3.24 |
| 20 | -.1328 +002 | -8.85 | 3.27 | 3.90 |
| 25 | -.1767 +002 | -13.97 | 4.27 | 5.45 |
| 30 | -.3630 +002 | -19.40 | 8.40 | 11.55 |
| 35 | .7434 +002 | -25.23 | -16.63 | -24.83 |
| 40 | .1370 +002 | -31.50 | -2.95 | -4.85 |
| 45 | .6160 +001 | -38.30 | -1.28 | -2.35 |
| 50 | .3328 +001 | -45.70 | -.66 | -1.39 |
| 55 | .1871 +001 | -53.79 | -.35 | -.89 |
| 60 | .1016 +001 | -62.70 | -.18 | -.59 |
| 65 | .4765 +000 | -72.62 | -.08 | -.39 |

PHI = 20.0 LP = 4.0

| E1 | LD | E2 | MH | MV |
|---|---|---|---|---|
| 0 | -.1594 +002 | 9.49 | 3.89 | 3.67 |
| 5 | -.1536 +002 | 5.07 | 3.64 | 3.63 |
| 10 | -.1590 +002 | .51 | 3.66 | 3.87 |
| 15 | -.1794 +002 | -4.22 | 4.02 | 4.51 |
| 20 | -.2335 +002 | -9.17 | 5.08 | 6.08 |
| 25 | -.4396 +002 | -14.40 | 9.28 | 11.89 |
| 30 | .1488 +003 | -19.94 | -30.42 | -41.99 |
| 35 | .2029 +002 | -25.87 | -4.01 | -6.02 |
| 40 | .8996 +001 | -32.23 | -1.71 | -2.83 |
| 45 | .4914 +001 | -39.09 | -.90 | -1.66 |
| 50 | .2873 +001 | -46.53 | -.50 | -1.07 |
| 55 | .1687 +001 | -54.63 | -.28 | -.72 |
| 60 | .9387 +000 | -63.50 | -.15 | -.49 |
| 65 | .4436 +000 | -73.33 | -.06 | -.33 |

PHI = 20.0 LP = 4.5

| E1 | LD | E2 | MH | MV |
|---|---|---|---|---|
| 0 | -.2664 +002 | 9.57 | 5.83 | 5.49 |
| 5 | -.2503 +002 | 5.07 | 5.32 | 5.31 |
| 10 | -.2654 +002 | .43 | 5.48 | 5.80 |
| 15 | -.3299 +002 | -4.39 | 6.62 | 7.45 |
| 20 | -.5879 +002 | -9.43 | 11.46 | 13.74 |
| 25 | .2741 +003 | -14.74 | -51.83 | -66.59 |
| 30 | .2942 +002 | -20.37 | -5.39 | -7.46 |
| 35 | .1285 +002 | -26.38 | -2.28 | -3.43 |
| 40 | .7064 +001 | -32.81 | -1.21 | -2.00 |
| 45 | .4223 +001 | -39.72 | -.69 | -1.29 |
| 50 | .2590 +001 | -47.19 | -.40 | -.87 |
| 55 | .1564 +001 | -55.28 | -.23 | -.60 |
| 60 | .8838 +000 | -64.11 | -.12 | -.42 |
| 65 | .4196 +000 | -73.88 | -.05 | -.28 |

PHI = 20.0 LP = 5.0

| E1 | LD | E2 | MH | MV |
|---|---|---|---|---|
| 0 | -.5864 +002 | 9.64 | 11.63 | 10.96 |
| 5 | -.5125 +002 | 5.07 | 9.87 | 9.86 |
| 10 | -.5823 +002 | .36 | 10.90 | 11.55 |
| 15 | -.1039 +003 | -4.53 | 18.90 | 21.29 |
| 20 | .2504 +003 | -9.64 | -44.22 | -53.12 |
| 25 | .3978 +002 | -15.03 | -6.81 | -8.77 |
| 30 | .1780 +002 | -20.73 | -2.95 | -4.10 |
| 35 | .9895 +001 | -26.79 | -1.59 | -2.40 |
| 40 | .6610 +001 | -33.27 | -.93 | -1.55 |
| 45 | .3787 +001 | -40.23 | -.56 | -1.05 |
| 50 | .2396 +001 | -47.71 | -.34 | -.73 |
| 55 | .1475 +001 | -55.81 | -.20 | -.52 |
| 60 | .8430 +000 | -64.61 | -.11 | -.36 |
| 65 | .4012 +000 | -74.31 | -.05 | -.25 |

PHI = 20.0 LP = 5.5

| E1 | LD | E2 | MH | MV |
|---|---|---|---|---|
| 0 | -.1646 +005 | 9.70 | ******* | ******* |
| 5 | -.3914 +003 | 5.07 | 68.97 | 68.90 |
| 10 | -.6107 +004 | .30 | ******* | ******* |
| 15 | .1327 +003 | -4.65 | -22.06 | -24.87 |
| 20 | .4669 +002 | -9.82 | -7.54 | -9.07 |
| 25 | .2327 +002 | -15.26 | -3.64 | -4.70 |
| 30 | .1340 +002 | -21.02 | -2.03 | -2.83 |
| 35 | .8307 +001 | -27.14 | -1.22 | -1.84 |
| 40 | .5347 +001 | -33.66 | -.75 | -1.26 |
| 45 | .3488 +001 | -40.65 | -.47 | -.89 |
| 50 | .2255 +001 | -48.15 | -.29 | -.63 |
| 55 | .1408 +001 | -56.24 | -.17 | -.45 |
| 60 | .8114 +000 | -65.01 | -.09 | -.32 |
| 65 | .3868 +000 | -74.67 | -.04 | -.22 |

PHI = 20.0 LP = 6.0

| E1 | LD | E2 | MH | MV |
|---|---|---|---|---|
| 0 | .7014 +002 | 9.75 | -11.73 | -11.05 |
| 5 | .8522 +002 | 5.07 | -13.84 | -13.82 |
| 10 | .7057 +002 | .26 | -11.13 | -11.80 |
| 15 | .4546 +002 | -4.74 | -6.96 | -7.85 |
| 20 | .2770 +002 | -9.97 | -4.12 | -4.96 |
| 25 | .1724 +002 | -15.46 | -2.49 | -3.21 |
| 30 | .1109 +002 | -21.27 | -1.55 | -2.16 |
| 35 | .7316 +001 | -27.43 | -.99 | -1.50 |
| 40 | .4892 +001 | -33.99 | -.64 | -1.07 |
| 45 | .3269 +001 | -41.00 | -.41 | -.77 |
| 50 | .2149 +001 | -48.51 | -.26 | -.56 |
| 55 | .1356 +001 | -56.60 | -.15 | -.40 |
| 60 | .7663 +000 | -65.35 | -.08 | -.29 |
| 65 | .3752 +000 | -74.96 | -.04 | -.20 |

PHI = 20.0 LP = 6.5

| E1 | LD | E2 | MH | MV |
|---|---|---|---|---|
| 0 | .3775 +002 | 9.79 | -5.85 | -5.51 |
| 5 | .4177 +002 | 5.07 | -6.29 | -6.28 |
| 10 | .3786 +002 | .22 | -5.53 | -5.87 |
| 15 | .2911 +002 | -4.83 | -4.13 | -4.66 |
| 20 | .2055 +002 | -10.10 | -2.83 | -3.41 |
| 25 | .1411 +002 | -15.63 | -1.89 | -2.44 |
| 30 | .9665 +001 | -21.48 | -1.25 | -1.74 |
| 35 | .6639 +001 | -27.68 | -.83 | -1.26 |
| 40 | .4559 +001 | -34.27 | -.55 | -.92 |
| 45 | .3103 +001 | -41.30 | -.36 | -.68 |
| 50 | .2065 +001 | -48.82 | -.23 | -.50 |
| 55 | .1314 +001 | -56.90 | -.14 | -.36 |
| 60 | .7658 +000 | -65.64 | -.07 | -.26 |
| 65 | .3656 +000 | -75.21 | -.03 | -.18 |

PHI = 20.0 LP = 7.0

| E1 | LD | E2 | MH | MV |
|---|---|---|---|---|
| 0 | .2699 +002 | 9.82 | -3.90 | -3.67 |
| 5 | .2900 +002 | 5.07 | -4.07 | -4.06 |
| 10 | .2703 +002 | .18 | -3.68 | -3.91 |
| 15 | .2221 +002 | -4.90 | -2.94 | -3.32 |
| 20 | .1681 +002 | -10.21 | -2.16 | -2.60 |
| 25 | .1220 +002 | -15.78 | -1.52 | -1.96 |
| 30 | .8699 +001 | -21.66 | -1.05 | -1.46 |
| 35 | .6147 +001 | -27.89 | -.72 | -1.09 |
| 40 | .4306 +001 | -34.51 | -.48 | -.81 |
| 45 | .2972 +001 | -41.56 | -.32 | -.61 |
| 50 | .1997 +001 | -49.09 | -.20 | -.45 |
| 55 | .1279 +001 | -57.16 | -.12 | -.33 |
| 60 | .7488 +000 | -65.88 | -.07 | -.24 |
| 65 | .3575 +000 | -75.43 | -.03 | -.17 |

PHI = 20.0 LP = 7.5

| E1 | LD | E2 | MH | MV |
|---|---|---|---|---|
| 0 | .2161 +002 | 9.85 | -2.92 | -2.75 |
| 5 | .2289 +002 | 5.08 | -3.01 | -3.00 |
| 10 | .2163 +002 | .15 | -2.76 | -2.93 |
| 15 | .1840 +002 | -4.97 | -2.28 | -2.57 |
| 20 | .1450 +002 | -10.31 | -1.74 | -2.10 |
| 25 | .1091 +002 | -15.91 | -1.27 | -1.65 |
| 30 | .8000 +001 | -21.82 | -.90 | -1.26 |
| 35 | .5773 +001 | -28.08 | -.63 | -.96 |
| 40 | .4106 +001 | -34.72 | -.43 | -.73 |
| 45 | .2866 +001 | -41.78 | -.29 | -.55 |
| 50 | .1941 +001 | -49.32 | -.19 | -.41 |
| 55 | .1251 +001 | -57.39 | -.11 | -.30 |
| 60 | .7344 +000 | -66.09 | -.06 | -.22 |
| 65 | .3507 +000 | -75.61 | -.03 | -.16 |

PHI = 20.0 LP = 8.0

| E1 | LD | E2 | MH | MV |
|---|---|---|---|---|
| 0 | .1938 +002 | 9.88 | -2.34 | -2.20 |
| 5 | .1931 +002 | 5.08 | -2.38 | -2.38 |
| 10 | .1840 +002 | .12 | -2.21 | -2.34 |
| 15 | .1599 +002 | -5.02 | -1.86 | -2.10 |
| 20 | .1294 +002 | -10.39 | -1.46 | -1.76 |
| 25 | .9980 +001 | -16.03 | -1.09 | -1.42 |
| 30 | .7472 +001 | -21.97 | -.79 | -1.11 |
| 35 | .5479 +001 | -28.25 | -.56 | -.86 |
| 40 | .3945 +001 | -34.90 | -.39 | -.66 |
| 45 | .2778 +001 | -41.98 | -.26 | -.50 |
| 50 | .1895 +001 | -49.52 | -.17 | -.38 |
| 55 | .1226 +001 | -57.59 | -.10 | -.28 |
| 60 | .7221 +000 | -66.28 | -.06 | -.21 |
| 65 | .3448 +000 | -75.77 | -.03 | -.15 |

PHI = 20.0 LP = 8.5

| E1 | LD | E2 | MH | MV |
|---|---|---|---|---|
| 0 | .1623 +002 | 9.90 | -1.95 | -1.83 |
| 5 | .1696 +002 | 5.08 | -1.98 | -1.97 |
| 10 | .1624 +002 | .10 | -1.84 | -1.95 |
| 15 | .1432 +002 | -5.07 | -1.57 | -1.78 |
| 20 | .1181 +002 | -10.47 | -1.26 | -1.52 |
| 25 | .9279 +001 | -16.13 | -.96 | -1.24 |
| 30 | .7058 +001 | -22.09 | -.71 | -.99 |
| 35 | .5243 +001 | -28.39 | -.51 | -.77 |
| 40 | .3812 +001 | -35.07 | -.35 | -.60 |
| 45 | .2705 +001 | -42.16 | -.24 | -.46 |
| 50 | .1855 +001 | -49.70 | -.16 | -.35 |
| 55 | .1205 +001 | -57.77 | -.10 | -.26 |
| 60 | .7115 +000 | -66.44 | -.05 | -.19 |
| 65 | .3396 +000 | -75.91 | -.02 | -.14 |

PHI = 20.0 LP = 9.0

| E1 | LD | E2 | MH | MV |
|---|---|---|---|---|
| 0 | .1470 +002 | 9.93 | -1.67 | -1.57 |
| 5 | .1529 +002 | 5.08 | -1.69 | -1.69 |
| 10 | .1470 +002 | .07 | -1.57 | -1.67 |
| 15 | .1310 +002 | -5.12 | -1.36 | -1.54 |
| 20 | .1095 +002 | -10.54 | -1.10 | -1.33 |
| 25 | .8730 +001 | -16.22 | -.85 | -1.11 |
| 30 | .6725 +001 | -22.20 | -.64 | -.89 |
| 35 | .5048 +001 | -28.52 | -.46 | -.71 |
| 40 | .3701 +001 | -35.21 | -.33 | -.55 |
| 45 | .2643 +001 | -42.31 | -.22 | -.43 |
| 50 | .1821 +001 | -49.86 | -.15 | -.32 |
| 55 | .1187 +001 | -57.92 | -.09 | -.24 |
| 60 | .7022 +000 | -66.59 | -.05 | -.18 |
| 65 | .3351 +000 | -76.04 | -.02 | -.13 |



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PHI = 20.0 LP = 9.5

| E1 | LO | E2 | MH | MV |
|---|---|---|---|---|
| 0 | .1355 +002 | 9.95 | -1.46 | -1.38 |
| 5 | .1405 +002 | 5.08 | -1.47 | -1.47 |
| 10 | .1355 +002 | .05 | -1.38 | -1.46 |
| 15 | .1217 +002 | -5.16 | -1.20 | -1.36 |
| 20 | .1028 +002 | -10.60 | -.98 | -1.19 |
| 25 | .8290 +001 | -16.30 | -.77 | -1.00 |
| 30 | .6452 +001 | -22.30 | -.58 | -.81 |
| 35 | .4884 +001 | -28.64 | -.42 | -.65 |
| 40 | .3606 +001 | -35.35 | -.30 | -.51 |
| 45 | .2589 +001 | -42.45 | -.21 | -.40 |
| 50 | .1791 +001 | -50.01 | -.14 | -.30 |
| 55 | .1171 +001 | -58.06 | -.08 | -.23 |
| 60 | .6941 +000 | -66.72 | -.05 | -.17 |
| 65 | .3311 +000 | -76.15 | -.02 | -.12 |

PHI = 20.0 LP = 10.0

| E1 | LO | E2 | MH | MV |
|---|---|---|---|---|
| 0 | .1265 +002 | 9.96 | -1.30 | -1.22 |
| 5 | .1309 +002 | 5.08 | -1.30 | -1.30 |
| 10 | .1265 +002 | .03 | -1.22 | -1.30 |
| 15 | .1144 +002 | -5.20 | -1.07 | -1.21 |
| 20 | .9746 +001 | -10.66 | -.89 | -1.07 |
| 25 | .7929 +001 | -16.38 | -.70 | -.91 |
| 30 | .6223 +001 | -22.40 | -.53 | -.75 |
| 35 | .4746 +001 | -28.75 | -.39 | -.60 |
| 40 | .3524 +001 | -35.46 | -.28 | -.47 |
| 45 | .2542 +001 | -42.58 | -.19 | -.37 |
| 50 | .1765 +001 | -50.14 | -.13 | -.29 |
| 55 | .1157 +001 | -58.19 | -.08 | -.22 |
| 60 | .6868 +000 | -66.83 | -.04 | -.16 |
| 65 | .3276 +000 | -76.25 | -.02 | -.11 |

PHI = 20.0 LP = 10.5

| E1 | LO | E2 | MH | MV |
|---|---|---|---|---|
| 0 | .1194 +002 | 9.98 | -1.17 | -1.10 |
| 5 | .1233 +002 | 5.08 | -1.17 | -1.17 |
| 10 | .1194 +002 | .02 | -1.10 | -1.17 |
| 15 | .1084 +002 | -5.23 | -.97 | -1.10 |
| 20 | .9304 +001 | -10.71 | -.81 | -.98 |
| 25 | .7627 +001 | -16.44 | -.64 | -.83 |
| 30 | .6029 +001 | -22.48 | -.49 | -.69 |
| 35 | .4626 +001 | -28.84 | -.36 | -.56 |
| 40 | .3453 +001 | -35.57 | -.26 | -.44 |
| 45 | .2501 +001 | -42.70 | -.18 | -.35 |
| 50 | .1742 +001 | -50.25 | -.12 | -.27 |
| 55 | .1145 +001 | -58.30 | -.07 | -.20 |
| 60 | .6803 +000 | -66.94 | -.04 | -.15 |
| 65 | .3244 +000 | -76.34 | -.02 | -.11 |

PHI = 20.0 LP = 20.0

| E1 | LO | E2 | MH | MV |
|---|---|---|---|---|
| 0 | .7716 +001 | 10.13 | -.40 | -.38 |
| 5 | .7884 +001 | 5.08 | -.40 | -.40 |
| 10 | .7712 +001 | -.14 | -.38 | -.40 |
| 15 | .7216 +001 | -5.56 | -.34 | -.39 |
| 20 | .6469 +001 | -11.20 | -.30 | -.36 |
| 25 | .5573 +001 | -17.10 | -.25 | -.33 |
| 30 | .4631 +001 | -23.29 | -.20 | -.28 |
| 35 | .3719 +001 | -29.78 | -.16 | -.24 |
| 40 | .2889 +001 | -36.61 | -.12 | -.20 |
| 45 | .2162 +001 | -43.80 | -.08 | -.16 |
| 50 | .1546 +001 | -51.37 | -.06 | -.13 |
| 55 | .1036 +001 | -59.39 | -.04 | -.10 |
| 60 | .6223 +000 | -67.94 | -.02 | -.08 |
| 65 | .2953 +000 | -77.21 | -.01 | -.05 |

PHI = 20.0 LP = 30.0

| E1 | LO | E2 | MH | MV |
|---|---|---|---|---|
| 0 | .6809 +001 | 10.19 | -.24 | -.22 |
| 5 | .6942 +001 | 5.08 | -.24 | -.24 |
| 10 | .6806 +001 | -.20 | -.22 | -.24 |
| 15 | .6410 +001 | -5.68 | -.20 | -.23 |
| 20 | .5803 +001 | -11.39 | -.18 | -.22 |
| 25 | .5060 +001 | -17.35 | -.15 | -.20 |
| 30 | .4258 +001 | -23.59 | -.12 | -.18 |
| 35 | .3463 +001 | -30.13 | -.10 | -.15 |
| 40 | .2720 +001 | -37.00 | -.07 | -.13 |
| 45 | .2056 +001 | -44.21 | -.05 | -.10 |
| 50 | .1482 +001 | -51.79 | -.04 | -.08 |
| 55 | .9991 +000 | -59.79 | -.02 | -.06 |
| 60 | .5824 +000 | -68.30 | -.01 | -.05 |
| 65 | .2852 +000 | -77.52 | -.01 | -.04 |

PHI = 20.0 LP = 1000000.0

| E1 | LO | E2 | MH | MV |
|---|---|---|---|---|
| 0 | .5495 +001 | 10.31 | -.00 | -.00 |
| 5 | .5584 +001 | 5.08 | -.00 | -.00 |
| 10 | .5491 +001 | -.33 | -.00 | -.00 |
| 15 | .5221 +001 | -5.94 | -.00 | -.00 |
| 20 | .4797 +001 | -11.78 | -.00 | -.00 |
| 25 | .4260 +001 | -17.86 | -.00 | -.00 |
| 30 | .3658 +001 | -24.21 | -.00 | -.00 |
| 35 | .3036 +001 | -30.85 | -.00 | -.00 |
| 40 | .2431 +001 | -37.79 | -.00 | -.00 |
| 45 | .1869 +001 | -45.04 | -.00 | -.00 |
| 50 | .1367 +001 | -52.62 | -.00 | -.00 |
| 55 | .9313 +000 | -60.59 | -.00 | -.00 |
| 60 | .5648 +000 | -69.03 | -.00 | -.00 |
| 65 | .2656 +000 | -78.15 | -.00 | -.00 |

PHI = 22.5 LP = .5

| E1 | LD | E2 | MH | MV |
|---|---|---|---|---|
| 0 | -.1006 +001 | 7.21 | 1.19 | 1.13 |
| 5 | -.1005 +001 | 5.56 | 1.17 | 1.15 |
| 10 | -.1005 +001 | 3.89 | 1.14 | 1.17 |
| 15 | -.1007 +001 | 2.15 | 1.12 | 1.20 |
| 20 | -.1009 +001 | .31 | 1.10 | 1.23 |
| 25 | -.1014 +001 | -1.66 | 1.09 | 1.27 |
| 30 | -.1021 +001 | -3.82 | 1.07 | 1.31 |
| 35 | -.1031 +001 | -6.24 | 1.05 | 1.37 |
| 40 | -.1046 +001 | -9.01 | 1.04 | 1.44 |
| 45 | -.1069 +001 | -12.27 | 1.03 | 1.54 |
| 50 | -.1105 +001 | -16.24 | 1.03 | 1.68 |
| 55 | -.1168 +001 | -21.27 | 1.04 | 1.91 |
| 60 | -.1294 +001 | -27.94 | 1.10 | 2.34 |
| 65 | -.1639 +001 | -37.35 | 1.31 | 3.48 |

PHI = 22.5 LP = 1.0

| E1 | LD | E2 | MH | MV |
|---|---|---|---|---|
| 0 | -.1766 +001 | 8.64 | 1.35 | 1.27 |
| 5 | -.1761 +001 | 5.93 | 1.31 | 1.30 |
| 10 | -.1762 +001 | 3.15 | 1.28 | 1.33 |
| 15 | -.1773 +001 | .25 | 1.26 | 1.38 |
| 20 | -.1792 +001 | -2.80 | 1.24 | 1.43 |
| 25 | -.1825 +001 | -6.09 | 1.23 | 1.51 |
| 30 | -.1876 +001 | -9.68 | 1.23 | 1.61 |
| 35 | -.1955 +001 | -13.67 | 1.24 | 1.75 |
| 40 | -.2083 +001 | -18.20 | 1.28 | 1.96 |
| 45 | -.2306 +001 | -23.44 | 1.37 | 2.31 |
| 50 | -.2761 +001 | -29.66 | 1.57 | 2.99 |
| 55 | -.4087 +001 | -37.21 | 2.21 | 4.91 |
| 60 | -.3337 +002 | -46.60 | 16.94 | 46.83 |
| 65 | .2240 +001 | -58.51 | -1.05 | -4.07 |

PHI = 22.5 LP = 1.5

| E1 | LD | E2 | MH | MV |
|---|---|---|---|---|
| 0 | -.2754 +001 | 9.38 | 1.56 | 1.46 |
| 5 | -.2736 +001 | 6.07 | 1.50 | 1.49 |
| 10 | -.2744 +001 | 2.67 | 1.47 | 1.53 |
| 15 | -.2778 +001 | -.87 | 1.45 | 1.60 |
| 20 | -.2847 +001 | -4.62 | 1.44 | 1.70 |
| 25 | -.2963 +001 | -8.63 | 1.46 | 1.83 |
| 30 | -.3155 +001 | -12.99 | 1.50 | 2.03 |
| 35 | -.3483 +001 | -17.80 | 1.60 | 2.35 |
| 40 | -.4104 +001 | -23.20 | 1.82 | 2.93 |
| 45 | -.5596 +001 | -29.35 | 2.39 | 4.29 |
| 50 | -.1294 +002 | -36.46 | 5.28 | 10.87 |
| 55 | .1072 +002 | -44.80 | -4.14 | -10.20 |
| 60 | .2392 +001 | -54.72 | -.87 | -2.74 |
| 65 | .8285 +000 | -66.63 | -.28 | -1.32 |

PHI = 22.5 LP = 2.0

| E1 | LD | E2 | MH | MV |
|---|---|---|---|---|
| 0 | -.4090 +001 | 9.84 | 1.83 | 1.71 |
| 5 | -.4046 +001 | 6.15 | 1.76 | 1.74 |
| 10 | -.4066 +001 | 2.36 | 1.72 | 1.80 |
| 15 | -.4158 +001 | -1.60 | 1.71 | 1.91 |
| 20 | -.4344 +001 | -5.77 | 1.73 | 2.06 |
| 25 | -.4678 +001 | -10.23 | 1.81 | 2.31 |
| 30 | -.5281 +001 | -15.06 | 1.98 | 2.72 |
| 35 | -.6500 +001 | -20.36 | 2.35 | 3.53 |
| 40 | -.9818 +001 | -26.25 | 3.42 | 5.66 |
| 45 | -.4208 +002 | -32.86 | 14.05 | 26.18 |
| 50 | .1007 +002 | -40.38 | -3.20 | -6.91 |
| 55 | .3232 +001 | -49.02 | -.97 | -2.54 |
| 60 | .1387 +001 | -59.02 | -.39 | -1.34 |
| 65 | .5589 +000 | -70.69 | -.14 | -.79 |

PHI = 22.5 LP = 2.5

| E1 | LD | E2 | MH | MV |
|---|---|---|---|---|
| 0 | -.5997 +001 | 10.15 | 2.23 | 2.07 |
| 5 | -.5894 +001 | 6.20 | 2.12 | 2.10 |
| 10 | -.5944 +001 | 2.14 | 2.08 | 2.19 |
| 15 | -.6167 +001 | -2.10 | 2.09 | 2.35 |
| 20 | -.6640 +001 | -6.56 | 2.18 | 2.62 |
| 25 | -.7558 +001 | -11.33 | 2.41 | 3.10 |
| 30 | -.9513 +001 | -16.48 | 2.93 | 4.09 |
| 35 | -.1526 +002 | -22.09 | 4.54 | 6.93 |
| 40 | -.1378 +003 | -28.27 | 39.42 | 66.59 |
| 45 | .1242 +002 | -35.16 | -3.40 | -6.50 |
| 50 | .4552 +001 | -42.90 | -1.19 | -2.64 |
| 55 | .2175 +001 | -51.66 | -.54 | -1.46 |
| 60 | .1063 +001 | -61.64 | -.24 | -.89 |
| 65 | .4442 +000 | -73.08 | -.09 | -.56 |

PHI = 22.5 LP = 3.0

| E1 | LD | E2 | MH | MV |
|---|---|---|---|---|
| 0 | -.8941 +001 | 10.37 | 2.83 | 2.64 |
| 5 | -.8702 +001 | 6.24 | 2.67 | 2.65 |
| 10 | -.8822 +001 | 1.98 | 2.63 | 2.77 |
| 15 | -.9367 +001 | -2.46 | 2.71 | 3.04 |
| 20 | -.1060 +002 | -7.14 | 2.97 | 3.58 |
| 25 | -.1340 +002 | -12.13 | 3.63 | 4.71 |
| 30 | -.2207 +002 | -17.49 | 5.78 | 8.14 |
| 35 | -.3965 +003 | -23.32 | 100.18 | 154.43 |
| 40 | .1656 +002 | -29.72 | -4.02 | -6.89 |
| 45 | .6431 +001 | -36.78 | -1.49 | -2.90 |
| 50 | .3257 +001 | -44.65 | -.72 | -1.64 |
| 55 | .1752 +001 | -53.47 | -.37 | -1.02 |
| 60 | .9036 +000 | -63.40 | -.18 | -.67 |
| 65 | .3807 +000 | -74.66 | -.07 | -.44 |

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PHI = 22.5 LP = 3.5

| E1 | LO | E2 | MH | MV |
|---|---|---|---|---|
| 0 | -.1409 +002 | 10.53 | 3.90 | 3.62 |
| 5 | -.1348 +002 | 6.26 | 3.61 | 3.57 |
| 10 | -.1379 +002 | 1.85 | 3.58 | 3.78 |
| 15 | -.1526 +002 | -2.74 | 3.84 | 4.33 |
| 20 | -.1908 +002 | -7.58 | 4.65 | 5.63 |
| 25 | -.3165 +002 | -12.73 | 7.46 | 9.73 |
| 30 | -.1548 +004 | -18.26 | 352.69 | 499.55 |
| 35 | .2944 +002 | -24.25 | -4.93 | -7.66 |
| 40 | .8998 +001 | -30.79 | -1.90 | -3.28 |
| 45 | .4716 +001 | -37.98 | -.95 | -1.87 |
| 50 | .2678 +001 | -45.93 | -.51 | -1.19 |
| 55 | .1524 +001 | -54.77 | -.28 | -.79 |
| 60 | .8863 +000 | -64.65 | -.14 | -.53 |
| 65 | .3402 +000 | -75.77 | -.05 | -.36 |

PHI = 22.5 LP = 4.0

| E1 | LO | E2 | MH | MV |
|---|---|---|---|---|
| 0 | -.2537 +002 | 10.66 | 6.22 | 5.77 |
| 5 | -.2341 +002 | 6.28 | 5.56 | 5.50 |
| 10 | -.2442 +002 | 1.76 | 5.62 | 5.93 |
| 15 | -.2970 +002 | -2.96 | 6.62 | 7.48 |
| 20 | -.5007 +002 | -7.93 | 10.80 | 13.10 |
| 25 | .5854 +003 | -13.21 | -122.17 | -159.94 |
| 30 | .2943 +002 | -18.86 | -5.93 | -8.44 |
| 35 | .1232 +002 | -24.97 | -2.39 | -3.74 |
| 40 | .6638 +001 | -31.62 | -1.24 | -2.16 |
| 45 | .3903 +001 | -38.90 | -.70 | -1.38 |
| 50 | .2350 +001 | -46.91 | -.40 | -.93 |
| 55 | .1382 +001 | -55.76 | -.22 | -.64 |
| 60 | .7450 +000 | -65.59 | -.11 | -.45 |
| 65 | .3122 +000 | -76.60 | -.04 | -.30 |

PHI = 22.5 LP = 4.5

| E1 | LO | E2 | MH | MV |
|---|---|---|---|---|
| 0 | -.6998 +002 | 10.76 | 15.41 | 14.30 |
| 5 | -.5659 +002 | 6.29 | 12.06 | 11.94 |
| 10 | -.6322 +002 | 1.68 | 13.05 | 13.80 |
| 15 | -.1207 +003 | -3.14 | 24.12 | 27.30 |
| 20 | .1706 +003 | -8.21 | -33.02 | -40.14 |
| 25 | .3539 +002 | -13.59 | -6.62 | -8.70 |
| 30 | .1623 +002 | -19.35 | -2.93 | -4.19 |
| 35 | .9061 +001 | -25.55 | -1.58 | -2.48 |
| 40 | .5486 +001 | -32.28 | -.92 | -1.61 |
| 45 | .3428 +001 | -39.63 | -.55 | -1.10 |
| 50 | .2139 +001 | -47.68 | -.32 | -.77 |
| 55 | .1285 +001 | -56.53 | -.18 | -.54 |
| 60 | .6999 +000 | -66.32 | -.09 | -.38 |
| 65 | .2917 +000 | -77.24 | -.04 | -.26 |

PHI = 22.5 LP = 5.0

| E1 | LO | E2 | MH | MV |
|---|---|---|---|---|
| 0 | .1614 +003 | 10.85 | -32.27 | -29.94 |
| 5 | .3643 +003 | 6.31 | -70.48 | -69.79 |
| 10 | .2145 +003 | 1.61 | -40.18 | -42.51 |
| 15 | .8064 +002 | -3.29 | -14.62 | -16.57 |
| 20 | .3714 +002 | -8.44 | -6.52 | -7.94 |
| 25 | .2003 +002 | -13.90 | -3.40 | -4.47 |
| 30 | .1188 +002 | -19.74 | -1.95 | -2.79 |
| 35 | .7449 +001 | -26.02 | -1.17 | -1.85 |
| 40 | .4803 +001 | -32.82 | -.73 | -1.28 |
| 45 | .3117 +001 | -40.22 | -.45 | -.91 |
| 50 | .1991 +001 | -48.30 | -.27 | -.65 |
| 55 | .1214 +001 | -57.15 | -.16 | -.47 |
| 60 | .6661 +000 | -66.90 | -.08 | -.33 |
| 65 | .2760 +000 | -77.74 | -.03 | -.23 |

PHI = 22.5 LP = 5.5

| E1 | LO | E2 | MH | MV |
|---|---|---|---|---|
| 0 | .4309 +002 | 10.92 | -7.89 | -7.31 |
| 5 | .5076 +002 | 6.31 | -8.99 | -8.90 |
| 10 | .4614 +002 | 1.56 | -7.91 | -8.37 |
| 15 | .3380 +002 | -3.41 | -5.61 | -6.36 |
| 20 | .2250 +002 | -8.63 | -3.61 | -4.41 |
| 25 | .1472 +002 | -14.16 | -2.28 | -3.01 |
| 30 | .9717 +001 | -20.07 | -1.45 | -2.09 |
| 35 | .6488 +001 | -26.42 | -.94 | -1.48 |
| 40 | .4352 +001 | -33.27 | -.60 | -1.07 |
| 45 | .2898 +001 | -40.71 | -.38 | -.78 |
| 50 | .1883 +001 | -48.81 | -.24 | -.57 |
| 55 | .1160 +001 | -57.66 | -.14 | -.41 |
| 60 | .6398 +000 | -67.38 | -.07 | -.30 |
| 65 | .2636 +000 | -78.15 | -.03 | -.21 |

PHI = 22.5 LP = 6.0

| E1 | LO | E2 | MH | MV |
|---|---|---|---|---|
| 0 | .2662 +002 | 10.98 | -4.49 | -4.16 |
| 5 | .2940 +002 | 6.32 | -4.80 | -4.75 |
| 10 | .2776 +002 | 1.51 | -4.38 | -4.64 |
| 15 | .2268 +002 | -3.51 | -3.47 | -3.94 |
| 20 | .1689 +002 | -8.79 | -2.50 | -3.05 |
| 25 | .1203 +002 | -14.38 | -1.72 | -2.27 |
| 30 | .8420 +001 | -20.35 | -1.16 | -1.67 |
| 35 | .5850 +001 | -26.75 | -.78 | -1.23 |
| 40 | .4031 +001 | -33.65 | -.51 | -.91 |
| 45 | .2735 +001 | -41.12 | -.33 | -.68 |
| 50 | .1799 +001 | -49.24 | -.21 | -.50 |
| 55 | .1118 +001 | -58.08 | -.12 | -.37 |
| 60 | .6188 +000 | -67.77 | -.06 | -.27 |
| 65 | .2536 +000 | -78.50 | -.02 | -.19 |

PHI = 22.5 LP = 6.5

| E1 | LD | E2 | MH | MV |
|---|---|---|---|---|
| 0 | .2006 +002 | 11.03 | -3.14 | -2.91 |
| 5 | .2162 +002 | 6.33 | -3.27 | -3.24 |
| 10 | .2070 +002 | 1.47 | -3.03 | -3.21 |
| 15 | .1770 +002 | -3.60 | -2.51 | -2.85 |
| 20 | .1392 +002 | -8.93 | -1.91 | -2.33 |
| 25 | .1040 +002 | -14.57 | -1.38 | -1.82 |
| 30 | .7556 +001 | -20.59 | -.97 | -1.39 |
| 35 | .5395 +001 | -27.03 | -.66 | -1.06 |
| 40 | .3792 +001 | -33.97 | -.45 | -.80 |
| 45 | .2603 +001 | -41.47 | -.29 | -.60 |
| 50 | .1733 +001 | -49.60 | -.19 | -.45 |
| 55 | .1064 +001 | -58.44 | -.11 | -.33 |
| 60 | .6016 +000 | -68.11 | -.06 | -.24 |
| 65 | .2453 +000 | -78.78 | -.02 | -.17 |

PHI = 22.5 LP = 7.0

| E1 | LD | E2 | MH | MV |
|---|---|---|---|---|
| 0 | .1654 +002 | 11.07 | -2.41 | -2.24 |
| 5 | .1760 +002 | 6.34 | -2.48 | -2.46 |
| 10 | .1697 +002 | 1.43 | -2.32 | -2.46 |
| 15 | .1487 +002 | -3.68 | -1.97 | -2.23 |
| 20 | .1208 +002 | -9.05 | -1.54 | -1.89 |
| 25 | .9309 +001 | -14.74 | -1.15 | -1.52 |
| 30 | .6940 +001 | -20.80 | -.83 | -1.20 |
| 35 | .5055 +001 | -27.28 | -.58 | -.92 |
| 40 | .3606 +001 | -34.25 | -.40 | -.71 |
| 45 | .2508 +001 | -41.77 | -.26 | -.54 |
| 50 | .1680 +001 | -49.91 | -.17 | -.41 |
| 55 | .1056 +001 | -58.75 | -.10 | -.30 |
| 60 | .5873 +000 | -68.39 | -.05 | -.22 |
| 65 | .2383 +000 | -79.03 | -.02 | -.16 |

PHI = 22.5 LP = 7.5

| E1 | LD | E2 | MH | MV |
|---|---|---|---|---|
| 0 | .1434 +002 | 11.11 | -1.96 | -1.82 |
| 5 | .1513 +002 | 6.34 | -2.00 | -1.98 |
| 10 | .1466 +002 | 1.40 | -1.88 | -1.99 |
| 15 | .1305 +002 | -3.75 | -1.62 | -1.84 |
| 20 | .1083 +002 | -9.16 | -1.30 | -1.59 |
| 25 | .8528 +001 | -14.88 | -.99 | -1.31 |
| 30 | .6478 +001 | -20.98 | -.72 | -1.05 |
| 35 | .4790 +001 | -27.49 | -.51 | -.82 |
| 40 | .3458 +001 | -34.49 | -.36 | -.64 |
| 45 | .2426 +001 | -42.04 | -.24 | -.49 |
| 50 | .1635 +001 | -50.19 | -.15 | -.37 |
| 55 | .1032 +001 | -59.02 | -.09 | -.28 |
| 60 | .5752 +000 | -68.64 | -.05 | -.21 |
| 65 | .2323 +000 | -79.24 | -.02 | -.15 |

PHI = 22.5 LP = 8.0

| E1 | LD | E2 | MH | MV |
|---|---|---|---|---|
| 0 | .1283 +002 | 11.15 | -1.65 | -1.53 |
| 5 | .1347 +002 | 6.34 | -1.68 | -1.66 |
| 10 | .1309 +002 | 1.37 | -1.58 | -1.67 |
| 15 | .1178 +002 | -3.81 | -1.37 | -1.56 |
| 20 | .9923 +001 | -9.25 | -1.12 | -1.37 |
| 25 | .7940 +001 | -15.01 | -.86 | -1.15 |
| 30 | .6119 +001 | -21.14 | -.64 | -.93 |
| 35 | .4579 +001 | -27.68 | -.46 | -.74 |
| 40 | .3336 +001 | -34.71 | -.32 | -.58 |
| 45 | .2358 +001 | -42.27 | -.22 | -.45 |
| 50 | .1598 +001 | -50.43 | -.14 | -.34 |
| 55 | .1012 +001 | -59.25 | -.08 | -.26 |
| 60 | .5649 +000 | -68.86 | -.04 | -.19 |
| 65 | .2272 +000 | -79.43 | -.02 | -.14 |

PHI = 22.5 LP = 8.5

| E1 | LD | E2 | MH | MV |
|---|---|---|---|---|
| 0 | .1174 +002 | 11.18 | -1.43 | -1.32 |
| 5 | .1228 +002 | 6.35 | -1.44 | -1.43 |
| 10 | .1196 +002 | 1.35 | -1.36 | -1.44 |
| 15 | .1085 +002 | -3.86 | -1.19 | -1.36 |
| 20 | .9238 +001 | -9.34 | -.98 | -1.20 |
| 25 | .7482 +001 | -15.13 | -.77 | -1.02 |
| 30 | .5832 +001 | -21.28 | -.58 | -.84 |
| 35 | .4407 +001 | -27.85 | -.42 | -.67 |
| 40 | .3236 +001 | -34.90 | -.30 | -.53 |
| 45 | .2301 +001 | -42.47 | -.20 | -.41 |
| 50 | .1566 +001 | -50.64 | -.13 | -.32 |
| 55 | .9950 +000 | -59.46 | -.08 | -.24 |
| 60 | .5559 +000 | -69.05 | -.04 | -.18 |
| 65 | .2227 +000 | -79.59 | -.01 | -.13 |

PHI = 22.5 LP = 9.0

| E1 | LD | E2 | MH | MV |
|---|---|---|---|---|
| 0 | .1091 +002 | 11.21 | -1.25 | -1.16 |
| 5 | .1138 +002 | 6.35 | -1.26 | -1.25 |
| 10 | .1110 +002 | 1.33 | -1.19 | -1.27 |
| 15 | .1013 +002 | -3.91 | -1.05 | -1.20 |
| 20 | .8700 +001 | -9.41 | -.87 | -1.07 |
| 25 | .7116 +001 | -15.23 | -.69 | -.92 |
| 30 | .5597 +001 | -21.41 | -.52 | -.76 |
| 35 | .4263 +001 | -28.00 | -.38 | -.62 |
| 40 | .3151 +001 | -35.07 | -.27 | -.49 |
| 45 | .2251 +001 | -42.66 | -.19 | -.38 |
| 50 | .1538 +001 | -50.83 | -.12 | -.30 |
| 55 | .9800 +000 | -59.64 | -.07 | -.23 |
| 60 | .5480 +000 | -69.22 | -.04 | -.17 |
| 65 | .2188 +000 | -79.74 | -.01 | -.12 |



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PHI = 22.5 LP = 9.5

| E1 | LD | E2 | MH | MV |
|---|---|---|---|---|
| 0 | .1026 +002 | 11.23 | -1.12 | -1.04 |
| 5 | .1067 +002 | 6.35 | -1.13 | -1.12 |
| 10 | .1042 +002 | 1.31 | -1.06 | -1.13 |
| 15 | .9556 +001 | -3.96 | -.94 | -1.07 |
| 20 | .8268 +001 | -9.48 | -.79 | -.97 |
| 25 | .6815 +001 | -15.32 | -.63 | -.84 |
| 30 | .5401 +001 | -21.52 | -.48 | -.70 |
| 35 | .4141 +001 | -28.14 | -.35 | -.57 |
| 40 | .3078 +001 | -35.22 | -.25 | -.46 |
| 45 | .2209 +001 | -42.82 | -.17 | -.36 |
| 50 | .1514 +001 | -50.99 | -.11 | -.28 |
| 55 | .9668 +000 | -59.81 | -.07 | -.21 |
| 60 | .5411 +000 | -69.37 | -.04 | -.16 |
| 65 | .2153 +000 | -79.86 | -.01 | -.11 |

PHI = 22.5 LP = 10.0

| E1 | LD | E2 | MH | MV |
|---|---|---|---|---|
| 0 | .9733 +001 | 11.25 | -1.01 | -.94 |
| 5 | .1010 +002 | 6.36 | -1.01 | -1.01 |
| 10 | .9881 +001 | 1.29 | -.96 | -1.02 |
| 15 | .9093 +001 | -3.99 | -.85 | -.97 |
| 20 | .7913 +001 | -9.54 | -.72 | -.88 |
| 25 | .6565 +001 | -15.40 | -.58 | -.77 |
| 30 | .5236 +001 | -21.63 | -.44 | -.64 |
| 35 | .4037 +001 | -28.26 | -.33 | -.53 |
| 40 | .3015 +001 | -35.36 | -.23 | -.42 |
| 45 | .2172 +001 | -42.97 | -.16 | -.34 |
| 50 | .1493 +001 | -51.15 | -.11 | -.26 |
| 55 | .9552 +000 | -59.96 | -.06 | -.20 |
| 60 | .5349 +000 | -69.51 | -.03 | -.15 |
| 65 | .2122 +000 | -79.98 | -.01 | -.11 |

PHI = 22.5 LP = 10.5

| E1 | LD | E2 | MH | MV |
|---|---|---|---|---|
| 0 | .9300 +001 | 11.27 | -.92 | -.85 |
| 5 | .9840 +001 | 6.36 | -.92 | -.92 |
| 10 | .9435 +001 | 1.27 | -.87 | -.93 |
| 15 | .8710 +001 | -4.03 | -.78 | -.89 |
| 20 | .7615 +001 | -9.60 | -.66 | -.81 |
| 25 | .6353 +001 | -15.48 | -.53 | -.71 |
| 30 | .5094 +001 | -21.72 | -.41 | -.60 |
| 35 | .3947 +001 | -28.37 | -.31 | -.49 |
| 40 | .2959 +001 | -35.49 | -.22 | -.40 |
| 45 | .2139 +001 | -43.10 | -.15 | -.32 |
| 50 | .1474 +001 | -51.28 | -.10 | -.25 |
| 55 | .9448 +000 | -60.09 | -.06 | -.19 |
| 60 | .5294 +000 | -69.63 | -.03 | -.14 |
| 65 | .2095 +000 | -80.09 | -.01 | -.10 |

PHI = 22.5 LP = 20.0

| E1 | LD | E2 | MH | MV |
|---|---|---|---|---|
| 0 | .6498 +001 | 11.47 | -.34 | -.32 |
| 5 | .6670 +001 | 6.38 | -.34 | -.34 |
| 10 | .6564 +001 | 1.11 | -.32 | -.35 |
| 15 | .6184 +001 | -4.38 | -.30 | -.34 |
| 20 | .5581 +001 | -10.15 | -.26 | -.32 |
| 25 | .4836 +001 | -16.22 | -.22 | -.29 |
| 30 | .4033 +001 | -22.64 | -.17 | -.25 |
| 35 | .3242 +001 | -29.46 | -.13 | -.22 |
| 40 | .2511 +001 | -36.70 | -.10 | -.18 |
| 45 | .1865 +001 | -44.40 | -.07 | -.15 |
| 50 | .1313 +001 | -52.60 | -.05 | -.12 |
| 55 | .8533 +000 | -61.37 | -.03 | -.09 |
| 60 | .4798 +000 | -70.80 | -.01 | -.07 |
| 65 | .1640 +000 | -81.07 | -.01 | -.05 |

PHI = 22.5 LP = 30.0

| E1 | LD | E2 | MH | MV |
|---|---|---|---|---|
| 0 | .5834 +001 | 11.55 | -.21 | -.19 |
| 5 | .5975 +001 | 6.39 | -.21 | -.20 |
| 10 | .5887 +001 | 1.05 | -.20 | -.21 |
| 15 | .5574 +001 | -4.52 | -.18 | -.20 |
| 20 | .5070 +001 | -10.36 | -.16 | -.19 |
| 25 | .4436 +001 | -16.50 | -.13 | -.18 |
| 30 | .3738 +001 | -22.99 | -.11 | -.16 |
| 35 | .3037 +001 | -29.86 | -.08 | -.14 |
| 40 | .2375 +001 | -37.15 | -.06 | -.12 |
| 45 | .1778 +001 | -44.88 | -.04 | -.10 |
| 50 | .1260 +001 | -53.09 | -.03 | -.08 |
| 55 | .8225 +000 | -61.84 | -.02 | -.06 |
| 60 | .4627 +000 | -71.22 | -.01 | -.05 |
| 65 | .1751 +000 | -81.43 | -.00 | -.03 |

PHI = 22.5 LP = 1000000.0

| E1 | LD | E2 | MH | MV |
|---|---|---|---|---|
| 0 | .4828 +001 | 11.70 | -.00 | -.00 |
| 5 | .4927 +001 | 6.41 | -.00 | -.00 |
| 10 | .4865 +001 | .92 | -.00 | -.00 |
| 15 | .4639 +001 | -4.80 | -.00 | -.00 |
| 20 | .4271 +001 | -10.79 | -.00 | -.00 |
| 25 | .3794 +001 | -17.08 | -.00 | -.00 |
| 30 | .3252 +001 | -23.71 | -.00 | -.00 |
| 35 | .2688 +001 | -30.70 | -.00 | -.00 |
| 40 | .2136 +001 | -38.07 | -.00 | -.00 |
| 45 | .1623 +001 | -45.86 | -.00 | -.00 |
| 50 | .1163 +001 | -54.08 | -.00 | -.00 |
| 55 | .7649 +000 | -62.78 | -.00 | -.00 |
| 60 | .4303 +000 | -72.08 | -.00 | -.00 |
| 65 | .1579 +000 | -82.15 | -.00 | -.00 |

PHI = 35.0 LP = .5

| E1 | LD | E2 | MH | MV |
|---|---|---|---|---|
| 0 | -.1387 +001 | 10.17 | 1.41 | 1.25 |
| 5 | -.1384 +001 | 9.05 | 1.37 | 1.28 |
| 10 | -.1382 +001 | 7.91 | 1.34 | 1.31 |
| 15 | -.1382 +001 | 6.73 | 1.30 | 1.34 |
| 20 | -.1384 +001 | 5.47 | 1.27 | 1.38 |
| 25 | -.1389 +001 | 4.12 | 1.24 | 1.43 |
| 30 | -.1398 +001 | 2.63 | 1.22 | 1.50 |
| 35 | -.1412 +001 | .94 | 1.19 | 1.57 |
| 40 | -.1434 +001 | -1.05 | 1.17 | 1.68 |
| 45 | -.1468 +001 | -3.46 | 1.16 | 1.82 |
| 50 | -.1525 +001 | -6.54 | 1.15 | 2.04 |
| 55 | -.1631 +001 | -10.71 | 1.17 | 2.42 |
| 60 | -.1870 +001 | -16.93 | 1.26 | 3.21 |
| 65 | -.2762 +001 | -27.50 | 1.73 | 6.06 |

PHI = 35.0 LP = 1.0

| E1 | LD | E2 | MH | MV |
|---|---|---|---|---|
| 0 | -.2509 +001 | 12.53 | 1.80 | 1.56 |
| 5 | -.2482 +001 | 10.37 | 1.72 | 1.59 |
| 10 | -.2472 +001 | 8.16 | 1.65 | 1.64 |
| 15 | -.2480 +001 | 5.86 | 1.60 | 1.71 |
| 20 | -.2508 +001 | 3.39 | 1.57 | 1.81 |
| 25 | -.2563 +001 | .70 | 1.54 | 1.93 |
| 30 | -.2657 +001 | -2.32 | 1.54 | 2.11 |
| 35 | -.2817 +001 | -5.80 | 1.57 | 2.38 |
| 40 | -.3104 +001 | -9.96 | 1.66 | 2.83 |
| 45 | -.3694 +001 | -15.15 | 1.88 | 3.69 |
| 50 | -.5387 +001 | -21.94 | 2.59 | 6.10 |
| 55 | -.3325 +002 | -31.38 | 15.03 | 45.03 |
| 60 | .3191 +001 | -45.31 | -1.34 | -5.77 |
| 65 | .6577 +000 | -66.35 | -.25 | -2.19 |

PHI = 35.0 LP = 1.5

| E1 | LD | E2 | MH | MV |
|---|---|---|---|---|
| 0 | -.4436 +001 | 13.94 | 2.46 | 2.10 |
| 5 | -.4319 +001 | 11.10 | 2.30 | 2.13 |
| 10 | -.4282 +001 | 8.18 | 2.19 | 2.20 |
| 15 | -.4326 +001 | 5.11 | 2.13 | 2.32 |
| 20 | -.4470 +001 | 1.82 | 2.11 | 2.52 |
| 25 | -.4764 +001 | -1.80 | 2.16 | 2.83 |
| 30 | -.5329 +001 | -5.88 | 2.32 | 3.37 |
| 35 | -.6527 +001 | -10.62 | 2.71 | 4.44 |
| 40 | -.1003 +002 | -16.30 | 3.97 | 7.47 |
| 45 | -.7292 +002 | -23.38 | 27.39 | 61.05 |
| 50 | .7414 +001 | -32.54 | -2.62 | -7.28 |
| 55 | .2330 +001 | -44.84 | -.77 | -2.90 |
| 60 | .8274 +000 | -61.51 | -.25 | -1.58 |
| 65 | .1381 +000 | -82.83 | -.04 | -.95 |

PHI = 35.0 LP = 2.0

| E1 | LD | E2 | MH | MV |
|---|---|---|---|---|
| 0 | -.8521 +001 | 14.88 | 3.85 | 3.26 |
| 5 | -.8012 +001 | 11.57 | 3.47 | 3.20 |
| 10 | -.7873 +001 | 8.15 | 3.26 | 3.29 |
| 15 | -.8088 +001 | 4.55 | 3.21 | 3.54 |
| 20 | -.8786 +001 | .67 | 3.34 | 4.06 |
| 25 | -.1043 +002 | -3.60 | 3.80 | 5.11 |
| 30 | -.1495 +002 | -8.42 | 5.20 | 7.85 |
| 35 | -.4590 +002 | -14.03 | 15.22 | 26.15 |
| 40 | .2041 +002 | -20.74 | -6.43 | -12.87 |
| 45 | .6065 +001 | -29.03 | -1.81 | -4.37 |
| 50 | .2688 +001 | -39.55 | -.75 | -2.33 |
| 55 | .1234 +001 | -53.12 | -.32 | -1.42 |
| 60 | .4563 +000 | -70.27 | -.11 | -.92 |
| 65 | -.5548 -002 | 89.68 | .00 | -.61 |

PHI = 35.0 LP = 2.5

| E1 | LD | E2 | MH | MV |
|---|---|---|---|---|
| 0 | -.2301 +002 | 15.54 | 8.78 | 7.40 |
| 5 | -.1926 +002 | 11.89 | 7.01 | 6.47 |
| 10 | -.1843 +002 | 8.11 | 6.41 | 6.49 |
| 15 | -.1996 +002 | 4.12 | 6.64 | 7.39 |
| 20 | -.2604 +002 | -.18 | 8.29 | 10.19 |
| 25 | -.5834 +002 | -4.93 | 17.73 | 24.32 |
| 30 | .5621 +002 | -10.30 | -16.88 | -26.11 |
| 35 | .1412 +002 | -16.53 | -3.89 | -6.91 |
| 40 | .6420 +001 | -23.96 | -1.68 | -3.51 |
| 45 | .3368 +001 | -33.03 | -.83 | -2.13 |
| 50 | .1799 +001 | -44.35 | -.42 | -1.39 |
| 55 | .8812 +000 | -58.46 | -.19 | -.95 |
| 60 | .3041 +000 | -75.48 | -.06 | -.65 |
| 65 | -.7344 -001 | 85.59 | .01 | -.45 |

PHI = 35.0 LP = 3.0

| E1 | LD | E2 | MH | MV |
|---|---|---|---|---|
| 0 | .9753 +002 | 16.02 | -32.18 | -27.01 |
| 5 | .9743 +003 | 12.12 | -306.22 | -282.36 |
| 10 | -.7056 +003 | 8.07 | 211.62 | 214.63 |
| 15 | .2966 +003 | 3.79 | -84.95 | -95.08 |
| 20 | .6029 +002 | -.84 | -16.49 | -20.48 |
| 25 | .2470 +002 | -5.95 | -6.44 | -8.96 |
| 30 | .1264 +002 | -11.73 | -3.14 | -4.95 |
| 35 | .7157 +001 | -18.42 | -1.69 | -3.07 |
| 40 | .4232 +001 | -26.36 | -.95 | -2.04 |
| 45 | .2509 +001 | -35.98 | -.53 | -1.41 |
| 50 | .1423 +001 | -47.77 | -.28 | -1.00 |
| 55 | .7067 +000 | -62.12 | -.13 | -.71 |
| 60 | .2210 +000 | -78.87 | -.04 | -.51 |
| 65 | -.1132 +000 | 83.04 | .02 | -.35 |



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PHI = 35.0 LP = 3.5

| E1 | LD | E2 | MH | MV |
|---|---|---|---|---|
| 0 | .1958 +002 | 16.40 | -5.69 | -4.76 |
| 5 | .2425 +002 | 12.30 | -6.71 | -6.18 |
| 10 | .2584 +002 | 8.04 | -6.81 | -6.92 |
| 15 | .2272 +002 | 3.52 | -5.71 | -6.42 |
| 20 | .1711 +002 | -1.36 | -4.10 | -5.13 |
| 25 | .1183 +002 | -6.76 | -2.70 | -3.80 |
| 30 | .7894 +001 | -12.85 | -1.72 | -2.74 |
| 35 | .5181 +001 | -19.90 | -1.07 | -1.98 |
| 40 | .3342 +001 | -28.22 | -.65 | -1.44 |
| 45 | .2085 +001 | -38.23 | -.38 | -1.06 |
| 50 | .1214 +001 | -50.32 | -.21 | -.78 |
| 55 | .6023 +000 | -64.76 | -.10 | -.57 |
| 60 | .1685 +000 | -81.23 | -.02 | -.41 |
| 65 | -.1393 +000 | 81.31 | .02 | -.29 |

PHI = 35.0 LP = 4.0

| E1 | LD | E2 | MH | MV |
|---|---|---|---|---|
| 0 | .1203 +002 | 16.70 | -3.12 | -2.61 |
| 5 | .1374 +002 | 12.44 | -3.39 | -3.12 |
| 10 | .1424 +002 | 8.01 | -3.35 | -3.41 |
| 15 | .1317 +002 | 3.31 | -2.95 | -3.33 |
| 20 | .1094 +002 | -1.78 | -2.34 | -2.94 |
| 25 | .8385 +001 | -7.41 | -1.70 | -2.42 |
| 30 | .6085 +001 | -13.76 | -1.18 | -1.90 |
| 35 | .4247 +001 | -21.08 | -.78 | -1.46 |
| 40 | .2859 +001 | -29.70 | -.49 | -1.12 |
| 45 | .1833 +001 | -39.99 | -.30 | -.85 |
| 50 | .1082 +001 | -52.29 | -.16 | -.64 |
| 55 | .5329 +000 | -66.74 | -.07 | -.48 |
| 60 | .1323 +000 | -82.96 | -.02 | -.35 |
| 65 | -.1578 +000 | 80.06 | .02 | -.25 |

PHI = 35.0 LP = 4.5

| E1 | LD | E2 | MH | MV |
|---|---|---|---|---|
| 0 | .9176 +001 | 16.94 | -2.15 | -1.80 |
| 5 | .1018 +002 | 12.55 | -2.27 | -2.09 |
| 10 | .1046 +002 | 7.98 | -2.22 | -2.26 |
| 15 | .9832 +001 | 3.13 | -1.99 | -2.25 |
| 20 | .8474 +001 | -2.13 | -1.63 | -2.06 |
| 25 | .6786 +001 | -7.94 | -1.24 | -1.77 |
| 30 | .5131 +001 | -14.50 | -.89 | -1.46 |
| 35 | .3703 +001 | -22.05 | -.61 | -1.16 |
| 40 | .2555 +001 | -30.90 | -.40 | -.91 |
| 45 | .1666 +001 | -41.40 | -.24 | -.71 |
| 50 | .9905 +000 | -53.84 | -.14 | -.54 |
| 55 | .4833 +000 | -68.28 | -.06 | -.41 |
| 60 | .1058 +000 | -84.28 | -.01 | -.30 |
| 65 | -.1715 +000 | 79.12 | .02 | -.22 |

PHI = 35.0 LP = 5.0

| E1 | LD | E2 | MH | MV |
|---|---|---|---|---|
| 0 | .7676 +001 | 17.14 | -1.64 | -1.37 |
| 5 | .8393 +001 | 12.65 | -1.71 | -1.57 |
| 10 | .8584 +001 | 7.96 | -1.66 | -1.69 |
| 15 | .8136 +001 | 2.98 | -1.50 | -1.70 |
| 20 | .7146 +001 | -2.42 | -1.25 | -1.59 |
| 25 | .5862 +001 | -8.39 | -.98 | -1.40 |
| 30 | .4541 +001 | -15.12 | -.72 | -1.18 |
| 35 | .3347 +001 | -22.85 | -.50 | -.96 |
| 40 | .2347 +001 | -31.89 | -.33 | -.77 |
| 45 | .1547 +001 | -42.56 | -.21 | -.61 |
| 50 | .9234 +000 | -55.09 | -.11 | -.47 |
| 55 | .4461 +000 | -69.51 | -.05 | -.36 |
| 60 | .8559 -001 | -85.32 | -.01 | -.27 |
| 65 | -.1822 +000 | 78.38 | .02 | -.19 |

PHI = 35.0 LP = 5.5

| E1 | LD | E2 | MH | MV |
|---|---|---|---|---|
| 0 | .6752 +001 | 17.31 | -1.33 | -1.10 |
| 5 | .7317 +001 | 12.73 | -1.37 | -1.26 |
| 10 | .7462 +001 | 7.94 | -1.32 | -1.35 |
| 15 | .7108 +001 | 2.85 | -1.20 | -1.36 |
| 20 | .6316 +001 | -2.67 | -1.01 | -1.29 |
| 25 | .5261 +001 | -8.77 | -.80 | -1.16 |
| 30 | .4140 +001 | -15.64 | -.60 | -.99 |
| 35 | .3095 +001 | -23.53 | -.42 | -.82 |
| 40 | .2195 +001 | -32.73 | -.28 | -.67 |
| 45 | .1458 +001 | -43.52 | -.18 | -.53 |
| 50 | .8721 +000 | -56.13 | -.10 | -.41 |
| 55 | .4171 +000 | -70.51 | -.04 | -.32 |
| 60 | .6964 -001 | -86.16 | -.01 | -.24 |
| 65 | -.1908 +000 | 77.80 | .02 | -.17 |

PHI = 35.0 LP = 6.0

| E1 | LD | E2 | MH | MV |
|---|---|---|---|---|
| 0 | .6125 +001 | 17.46 | -1.12 | -.93 |
| 5 | .6598 +001 | 12.79 | -1.14 | -1.05 |
| 10 | .6717 +001 | 7.92 | -1.10 | -1.13 |
| 15 | .6419 +001 | 2.74 | -1.00 | -1.14 |
| 20 | .5748 +001 | -2.88 | -.85 | -1.09 |
| 25 | .4835 +001 | -9.10 | -.68 | -.99 |
| 30 | .3851 +001 | -16.09 | -.52 | -.86 |
| 35 | .2908 +001 | -24.11 | -.37 | -.72 |
| 40 | .2079 +001 | -33.43 | -.25 | -.59 |
| 45 | .1388 +001 | -44.34 | -.16 | -.47 |
| 50 | .8316 +000 | -57.00 | -.09 | -.37 |
| 55 | .3940 +000 | -71.34 | -.04 | -.29 |
| 60 | .5673 -001 | -86.85 | -.00 | -.22 |
| 65 | -.1977 +000 | 77.31 | .02 | -.16 |

PHI = 35.0 LP = 6.5

| E1 | LD | E2 | MH | MV |
|---|---|---|---|---|
| 0 | .5672 +001 | 17.58 | -.96 | -.80 |
| 5 | .6083 +001 | 12.85 | -.98 | -.90 |
| 10 | .6185 +001 | 7.91 | -.94 | -.96 |
| 15 | .5924 +001 | 2.64 | -.86 | -.98 |
| 20 | .5334 +001 | -3.07 | -.74 | -.94 |
| 25 | .4525 +001 | -9.38 | -.59 | -.86 |
| 30 | .3631 +001 | -16.48 | -.45 | -.75 |
| 35 | .2763 +001 | -24.62 | -.32 | -.64 |
| 40 | .1988 +001 | -34.04 | -.22 | -.53 |
| 45 | .1333 +001 | -45.03 | -.14 | -.42 |
| 50 | .7988 +000 | -57.74 | -.08 | -.34 |
| 55 | .3750 +000 | -72.04 | -.03 | -.26 |
| 60 | .4607 -001 | -87.42 | -.00 | -.20 |
| 65 | -.2035 +000 | 76.91 | .01 | -.14 |

PHI = 35.0 LP = 7.0

| E1 | LD | E2 | MH | MV |
|---|---|---|---|---|
| 0 | .5329 +001 | 17.69 | -.84 | -.70 |
| 5 | .5697 +001 | 12.90 | -.86 | -.79 |
| 10 | .5787 +001 | 7.89 | -.82 | -.84 |
| 15 | .5553 +001 | 2.56 | -.75 | -.86 |
| 20 | .5020 +001 | -3.23 | -.65 | -.83 |
| 25 | .4283 +001 | -9.63 | -.52 | -.76 |
| 30 | .3459 +001 | -16.82 | -.40 | -.67 |
| 35 | .2648 +001 | -25.05 | -.29 | -.57 |
| 40 | .1915 +001 | -34.58 | -.20 | -.48 |
| 45 | .1288 +001 | -45.64 | -.12 | -.39 |
| 50 | .7717 +000 | -58.37 | -.07 | -.31 |
| 55 | .3592 +000 | -72.64 | -.03 | -.24 |
| 60 | .3712 -001 | -87.91 | -.00 | -.18 |
| 65 | -.2084 +000 | 76.57 | .01 | -.13 |

PHI = 35.0 LP = 7.5

| E1 | LD | E2 | MH | MV |
|---|---|---|---|---|
| 0 | .5061 +001 | 17.79 | -.75 | -.62 |
| 5 | .5397 +001 | 12.95 | -.76 | -.70 |
| 10 | .5478 +001 | 7.88 | -.73 | -.75 |
| 15 | .5263 +001 | 2.48 | -.67 | -.76 |
| 20 | .4774 +001 | -3.38 | -.58 | -.74 |
| 25 | .4091 +001 | -9.85 | -.47 | -.68 |
| 30 | .3321 +001 | -17.13 | -.36 | -.61 |
| 35 | .2554 +001 | -25.44 | -.26 | -.52 |
| 40 | .1854 +001 | -35.04 | -.18 | -.43 |
| 45 | .1250 +001 | -46.17 | -.11 | -.35 |
| 50 | .7489 +000 | -58.92 | -.06 | -.28 |
| 55 | .3459 +000 | -73.15 | -.03 | -.22 |
| 60 | .2949 -001 | -88.34 | -.00 | -.17 |
| 65 | -.2126 +000 | 76.28 | .01 | -.12 |

PHI = 35.0 LP = 8.0

| E1 | LD | E2 | MH | MV |
|---|---|---|---|---|
| 0 | .4845 +001 | 17.88 | -.68 | -.56 |
| 5 | .5156 +001 | 12.99 | -.68 | -.63 |
| 10 | .5231 +001 | 7.87 | -.66 | -.67 |
| 15 | .5030 +001 | 2.41 | -.60 | -.69 |
| 20 | .4575 +001 | -3.50 | -.52 | -.67 |
| 25 | .3935 +001 | -10.04 | -.42 | -.62 |
| 30 | .3207 +001 | -17.39 | -.33 | -.55 |
| 35 | .2477 +001 | -25.78 | -.24 | -.48 |
| 40 | .1803 +001 | -35.45 | -.16 | -.40 |
| 45 | .1218 +001 | -46.63 | -.10 | -.33 |
| 50 | .7295 +000 | -59.41 | -.06 | -.26 |
| 55 | .3344 +000 | -73.61 | -.02 | -.20 |
| 60 | .2292 -001 | -88.70 | -.00 | -.16 |
| 65 | -.2162 +000 | 76.03 | .01 | -.12 |

PHI = 35.0 LP = 8.5

| E1 | LD | E2 | MH | MV |
|---|---|---|---|---|
| 0 | .4668 +001 | 17.95 | -.62 | -.51 |
| 5 | .4959 +001 | 13.02 | -.62 | -.57 |
| 10 | .5028 +001 | 7.86 | -.60 | -.61 |
| 15 | .4840 +001 | 2.35 | -.55 | -.63 |
| 20 | .4411 +001 | -3.62 | -.47 | -.61 |
| 25 | .3806 +001 | -10.22 | -.39 | -.57 |
| 30 | .3112 +001 | -17.63 | -.30 | -.51 |
| 35 | .2411 +001 | -26.09 | -.22 | -.44 |
| 40 | .1760 +001 | -35.82 | -.15 | -.37 |
| 45 | .1191 +001 | -47.05 | -.10 | -.30 |
| 50 | .7128 +000 | -59.84 | -.05 | -.24 |
| 55 | .3245 +000 | -74.00 | -.02 | -.19 |
| 60 | .1719 -001 | -89.02 | -.00 | -.15 |
| 65 | -.2194 +000 | 75.81 | .01 | -.11 |

PHI = 35.0 LP = 9.0

| E1 | LD | E2 | MH | MV |
|---|---|---|---|---|
| 0 | .4520 +001 | 18.02 | -.57 | -.47 |
| 5 | .4795 +001 | 13.05 | -.57 | -.53 |
| 10 | .4860 +001 | 7.85 | -.55 | -.56 |
| 15 | .4681 +001 | 2.30 | -.50 | -.58 |
| 20 | .4274 +001 | -3.72 | -.43 | -.56 |
| 25 | .3696 +001 | -10.38 | -.36 | -.52 |
| 30 | .3031 +001 | -17.85 | -.28 | -.47 |
| 35 | .2355 +001 | -26.36 | -.20 | -.41 |
| 40 | .1723 +001 | -36.15 | -.14 | -.34 |
| 45 | .1167 +001 | -47.41 | -.09 | -.28 |
| 50 | .6982 +000 | -60.22 | -.05 | -.23 |
| 55 | .3158 +000 | -74.36 | -.02 | -.18 |
| 60 | .1216 -001 | -89.31 | -.00 | -.14 |
| 65 | -.2222 +000 | 75.61 | .01 | -.10 |

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PHI = 35.0 LP = 9.5

| E1 | LD | E2 | MH | MV |
|---|---|---|---|---|
| 0 | .4394 +001 | 18.08 | -.53 | -.43 |
| 5 | .4656 +001 | 13.08 | -.53 | -.48 |
| 10 | .4717 +001 | 7.84 | -.51 | -.52 |
| 15 | .4547 +001 | 2.25 | -.46 | -.53 |
| 20 | .4157 +001 | -3.82 | -.40 | -.52 |
| 25 | .3603 +001 | -10.52 | -.33 | -.49 |
| 30 | .2962 +001 | -18.04 | -.26 | -.44 |
| 35 | .2306 +001 | -26.61 | -.19 | -.38 |
| 40 | .1690 +001 | -36.45 | -.13 | -.32 |
| 45 | .1146 +001 | -47.75 | -.08 | -.27 |
| 50 | .6854 +000 | -60.56 | -.05 | -.21 |
| 55 | .3081 +000 | -74.67 | -.02 | -.17 |
| 60 | .7703 -002 | -89.56 | -.00 | -.13 |
| 65 | -.2247 +000 | 75.44 | .01 | -.10 |

PHI = 35.0 LP = 10.0

| E1 | LD | E2 | MH | MV |
|---|---|---|---|---|
| 0 | .4286 +001 | 18.14 | -.49 | -.40 |
| 5 | .4537 +001 | 13.11 | -.49 | -.45 |
| 10 | .4595 +001 | 7.83 | -.47 | -.48 |
| 15 | .4431 +001 | 2.21 | -.43 | -.49 |
| 20 | .4057 +001 | -3.90 | -.37 | -.48 |
| 25 | .3522 +001 | -10.65 | -.31 | -.45 |
| 30 | .2901 +001 | -18.22 | -.24 | -.41 |
| 35 | .2264 +001 | -26.83 | -.18 | -.36 |
| 40 | .1662 +001 | -36.72 | -.12 | -.30 |
| 45 | .1128 +001 | -48.05 | -.08 | -.25 |
| 50 | .6741 +000 | -60.87 | -.04 | -.20 |
| 55 | .3012 +000 | -74.95 | -.02 | -.16 |
| 60 | .3727 -002 | -89.79 | -.00 | -.12 |
| 65 | -.2269 +000 | 75.28 | .01 | -.09 |

PHI = 35.0 LP = 10.5

| E1 | LD | E2 | MH | MV |
|---|---|---|---|---|
| 0 | .4192 +001 | 18.19 | -.46 | -.38 |
| 5 | .4434 +001 | 13.13 | -.46 | -.42 |
| 10 | .4490 +001 | 7.82 | -.44 | -.45 |
| 15 | .4331 +001 | 2.16 | -.40 | -.46 |
| 20 | .3969 +001 | -3.98 | -.35 | -.45 |
| 25 | .3452 +001 | -10.77 | -.29 | -.43 |
| 30 | .2848 +001 | -18.38 | -.23 | -.38 |
| 35 | .2226 +001 | -27.04 | -.17 | -.34 |
| 40 | .1637 +001 | -36.96 | -.12 | -.29 |
| 45 | .1112 +001 | -48.32 | -.07 | -.24 |
| 50 | .6639 +000 | -61.14 | -.04 | -.19 |
| 55 | .2951 +000 | -75.21 | -.02 | -.15 |
| 60 | .1580 -003 | -89.99 | -.00 | -.12 |
| 65 | -.2289 +000 | 75.14 | .01 | -.09 |

PHI = 35.0 LP = 20.0

| E1 | LD | E2 | MH | MV |
|---|---|---|---|---|
| 0 | .3450 +001 | 18.69 | -.20 | -.17 |
| 5 | .3625 +001 | 13.36 | -.20 | -.19 |
| 10 | .3663 +001 | 7.75 | -.19 | -.20 |
| 15 | .3546 +001 | 1.75 | -.18 | -.20 |
| 20 | .3277 +001 | -4.76 | -.16 | -.20 |
| 25 | .2885 +001 | -11.95 | -.13 | -.19 |
| 30 | .2414 +001 | -19.98 | -.10 | -.18 |
| 35 | .1912 +001 | -29.06 | -.08 | -.16 |
| 40 | .1421 +001 | -39.35 | -.05 | -.14 |
| 45 | .9699 +000 | -50.95 | -.03 | -.12 |
| 50 | .5740 +000 | -63.79 | -.02 | -.09 |
| 55 | .2400 +000 | -77.60 | -.01 | -.08 |
| 60 | -.3245 -001 | 88.11 | .00 | -.06 |
| 65 | -.2474 +000 | 73.85 | .01 | -.04 |

PHI = 35.0 LP = 30.0

| E1 | LD | E2 | MH | MV |
|---|---|---|---|---|
| 0 | .3231 +001 | 18.89 | -.13 | -.11 |
| 5 | .3389 +001 | 13.45 | -.13 | -.12 |
| 10 | .3422 +001 | 7.72 | -.12 | -.12 |
| 15 | .3315 +001 | 1.59 | -.11 | -.13 |
| 20 | .3071 +001 | -5.07 | -.10 | -.13 |
| 25 | .2713 +001 | -12.41 | -.08 | -.12 |
| 30 | .2279 +001 | -20.61 | -.06 | -.11 |
| 35 | .1813 +001 | -29.84 | -.05 | -.10 |
| 40 | .1351 +001 | -40.26 | -.03 | -.09 |
| 45 | .9228 +000 | -51.93 | -.02 | -.08 |
| 50 | .5435 +000 | -64.77 | -.01 | -.06 |
| 55 | .2210 +000 | -78.47 | -.00 | -.05 |
| 60 | -.4391 -001 | 87.43 | .00 | -.04 |
| 65 | -.2540 +000 | 73.39 | .00 | -.03 |

PHI = 35.0 LP = 1000000.0

| E1 | LD | E2 | MH | MV |
|---|---|---|---|---|
| 0 | .2856 +001 | 19.30 | -.00 | -.00 |
| 5 | .2986 +001 | 13.63 | -.00 | -.00 |
| 10 | .3012 +001 | 7.65 | -.00 | -.00 |
| 15 | .2922 +001 | 1.25 | -.00 | -.00 |
| 20 | .2717 +001 | -5.71 | -.00 | -.00 |
| 25 | .2414 +001 | -13.38 | -.00 | -.00 |
| 30 | .2042 +001 | -21.91 | -.00 | -.00 |
| 35 | .1635 +001 | -31.46 | -.00 | -.00 |
| 40 | .1224 +001 | -42.13 | -.00 | -.00 |
| 45 | .8356 +000 | -53.93 | -.00 | -.00 |
| 50 | .4862 +000 | -66.72 | -.00 | -.00 |
| 55 | .1847 +000 | -80.18 | -.00 | -.00 |
| 60 | -.6600 -001 | 86.10 | .00 | -.00 |
| 65 | -.2668 +000 | 72.49 | .00 | -.00 |

PHI = 40.0 LP = .5

| E1 | LD | E2 | MH | MV |
|---|---|---|---|---|
| 0 | -.1577 +001 | 11.34 | 1.54 | 1.32 |
| 5 | -.1571 +001 | 10.35 | 1.49 | 1.35 |
| 10 | -.1568 +001 | 9.34 | 1.45 | 1.38 |
| 15 | -.1567 +001 | 8.30 | 1.41 | 1.42 |
| 20 | -.1569 +001 | 7.20 | 1.37 | 1.46 |
| 25 | -.1574 +001 | 6.01 | 1.34 | 1.52 |
| 30 | -.1583 +001 | 4.69 | 1.31 | 1.59 |
| 35 | -.1598 +001 | 3.19 | 1.28 | 1.68 |
| 40 | -.1623 +001 | 1.43 | 1.25 | 1.79 |
| 45 | -.1662 +001 | -.73 | 1.23 | 1.96 |
| 50 | -.1730 +001 | -3.52 | 1.23 | 2.21 |
| 55 | -.1858 +001 | -7.38 | 1.25 | 2.66 |
| 60 | -.2160 +001 | -13.35 | 1.36 | 3.64 |
| 65 | -.3463 +001 | -24.20 | 2.02 | 7.70 |

PHI = 40.0 LP = 1.0

| E1 | LD | E2 | MH | MV |
|---|---|---|---|---|
| 0 | -.2957 +001 | 14.07 | 2.10 | 1.74 |
| 5 | -.2910 +001 | 12.07 | 1.99 | 1.78 |
| 10 | -.2887 +001 | 10.02 | 1.90 | 1.83 |
| 15 | -.2889 +001 | 7.88 | 1.83 | 1.91 |
| 20 | -.2919 +001 | 5.59 | 1.78 | 2.02 |
| 25 | -.2985 +001 | 3.08 | 1.75 | 2.17 |
| 30 | -.3105 +001 | .25 | 1.74 | 2.40 |
| 35 | -.3318 +001 | -3.06 | 1.78 | 2.74 |
| 40 | -.3718 +001 | -7.08 | 1.91 | 3.34 |
| 45 | -.4614 +001 | -12.23 | 2.25 | 4.61 |
| 50 | -.7842 +001 | -19.23 | 3.61 | 9.05 |
| 55 | .2285 +002 | -29.55 | -9.82 | -32.59 |
| 60 | .2168 +001 | -46.02 | -.86 | -4.44 |
| 65 | .3952 +000 | -72.46 | -.14 | -1.97 |

PHI = 40.0 LP = 1.5

| E1 | LD | E2 | MH | MV |
|---|---|---|---|---|
| 0 | -.5808 +001 | 15.79 | 3.24 | 2.64 |
| 5 | -.5549 +001 | 13.07 | 2.96 | 2.63 |
| 10 | -.5441 +001 | 10.29 | 2.77 | 2.70 |
| 15 | -.5473 +001 | 7.36 | 2.67 | 2.85 |
| 20 | -.5672 +001 | 4.21 | 2.65 | 3.12 |
| 25 | -.6127 +001 | .72 | 2.73 | 3.58 |
| 30 | -.7087 +001 | -3.26 | 3.02 | 4.45 |
| 35 | -.9457 +001 | -7.97 | 3.83 | 6.46 |
| 40 | -.2030 +002 | -13.78 | 7.81 | 15.39 |
| 45 | .2237 +002 | -21.29 | -8.12 | -19.44 |
| 50 | .4644 +001 | -31.53 | -1.58 | -4.89 |
| 55 | .1709 +001 | -46.14 | -.54 | -2.43 |
| 60 | .5494 +000 | -66.84 | -.16 | -1.43 |
| 65 | -.4240 -001 | 87.51 | .01 | -.89 |

PHI = 40.0 LP = 2.0

| E1 | LD | E2 | MH | MV |
|---|---|---|---|---|
| 0 | -.1518 +002 | 16.95 | 6.98 | 5.63 |
| 5 | -.1318 +002 | 13.73 | 5.76 | 5.12 |
| 10 | -.1249 +002 | 10.42 | 5.20 | 5.09 |
| 15 | -.1279 +002 | 6.93 | 5.07 | 5.50 |
| 20 | -.1442 +002 | 3.14 | 5.46 | 6.59 |
| 25 | -.1939 +002 | -1.07 | 6.99 | 9.47 |
| 30 | -.4612 +002 | -5.91 | 15.81 | 24.38 |
| 35 | .3786 +002 | -11.66 | -12.31 | -22.01 |
| 40 | .9577 +001 | -18.77 | -2.94 | -6.27 |
| 45 | .4206 +001 | -27.94 | -1.22 | -3.23 |
| 50 | .2030 +001 | -40.20 | -.55 | -1.96 |
| 55 | .9007 +000 | -56.77 | -.22 | -1.28 |
| 60 | .2403 +000 | -77.86 | -.05 | -.86 |
| 65 | -.1714 +000 | 79.26 | .03 | -.58 |

PHI = 40.0 LP = 2.5

| E1 | LD | E2 | MH | MV |
|---|---|---|---|---|
| 0 | .1244 +003 | 17.78 | -48.65 | -38.91 |
| 5 | -.2856 +003 | 14.20 | 105.82 | 93.77 |
| 10 | -.1224 +003 | 10.50 | 43.07 | 42.34 |
| 15 | -.1781 +003 | 6.58 | 59.61 | 65.24 |
| 20 | .1881 +003 | 2.32 | -59.84 | -73.38 |
| 25 | .3720 +002 | -2.44 | -11.25 | -15.60 |
| 30 | .1582 +002 | -7.92 | -4.54 | -7.22 |
| 35 | .8195 +001 | -14.46 | -2.23 | -4.15 |
| 40 | .4576 +001 | -22.52 | -1.17 | -2.64 |
| 45 | .2582 +001 | -32.83 | -.62 | -1.78 |
| 50 | .1381 +001 | -46.29 | -.31 | -1.24 |
| 55 | .6149 +000 | -63.63 | -.13 | -.87 |
| 60 | .1078 +000 | -84.14 | -.02 | -.62 |
| 65 | -.2339 +000 | 75.00 | .04 | -.43 |

PHI = 40.0 LP = 3.0

| E1 | LD | E2 | MH | MV |
|---|---|---|---|---|
| 0 | .1602 +002 | 18.41 | -5.45 | -4.33 |
| 5 | .2014 +002 | 14.55 | -6.48 | -5.73 |
| 10 | .2241 +002 | 10.54 | -6.83 | -6.73 |
| 15 | .2093 +002 | 6.29 | -6.05 | -6.67 |
| 20 | .1656 +002 | 1.67 | -4.55 | -5.64 |
| 25 | .1175 +002 | -3.52 | -3.06 | -4.32 |
| 30 | .7888 +001 | -9.50 | -1.95 | -3.17 |
| 35 | .5141 +001 | -16.63 | -1.20 | -2.30 |
| 40 | .3258 +001 | -25.40 | -.71 | -1.68 |
| 45 | .1973 +001 | -36.51 | -.41 | -1.23 |
| 50 | .1086 +001 | -50.70 | -.21 | -.90 |
| 55 | .4680 +000 | -68.27 | -.08 | -.66 |
| 60 | .3388 -001 | -88.09 | -.01 | -.48 |
| 65 | -.2710 +000 | 72.43 | .04 | -.34 |



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PHI = 40.0 LP = 3.5

| E1 | LD | E2 | MH | MV |
|---|---|---|---|---|
| 0 | .9608 +001 | 18.90 | -2.89 | -2.29 |
| 5 | .1107 +002 | 14.81 | -3.14 | -2.78 |
| 10 | .1176 +002 | 10.57 | -3.16 | -3.12 |
| 15 | .1128 +002 | 6.06 | -2.87 | -3.18 |
| 20 | .9739 +001 | 1.14 | -2.35 | -2.94 |
| 25 | .7691 +001 | -4.38 | -1.76 | -2.51 |
| 30 | .5677 +001 | -10.76 | -1.23 | -2.04 |
| 35 | .3977 +001 | -18.36 | -.81 | -1.60 |
| 40 | .2650 +001 | -27.67 | -.51 | -1.23 |
| 45 | .1653 +001 | -39.34 | -.30 | -.94 |
| 50 | .9172 +000 | -53.98 | -.15 | -.71 |
| 55 | .3784 +000 | -71.57 | -.06 | -.53 |
| 60 | -.1342 -001 | 89.23 | .00 | -.39 |
| 65 | -.2955 +000 | 70.73 | .04 | -.28 |

PHI = 40.0 LP = 4.0

| E1 | LD | E2 | MH | MV |
|---|---|---|---|---|
| 0 | .7297 +001 | 19.28 | -1.97 | -1.55 |
| 5 | .8165 +001 | 15.03 | -2.08 | -1.83 |
| 10 | .8549 +001 | 10.59 | -2.05 | -2.03 |
| 15 | .8263 +001 | 5.87 | -1.88 | -2.09 |
| 20 | .7342 +001 | .71 | -1.58 | -1.99 |
| 25 | .6034 +001 | -5.09 | -1.23 | -1.78 |
| 30 | .4638 +001 | -11.79 | -.89 | -1.50 |
| 35 | .3363 +001 | -19.76 | -.61 | -1.23 |
| 40 | .2299 +001 | -29.49 | -.39 | -.98 |
| 45 | .1456 +001 | -41.59 | -.23 | -.76 |
| 50 | .8075 +000 | -56.50 | -.12 | -.59 |
| 55 | .3180 +000 | -74.02 | -.04 | -.45 |
| 60 | -.4632 -001 | 87.29 | .01 | -.33 |
| 65 | -.3130 +000 | 69.52 | .03 | -.24 |

PHI = 40.0 LP = 4.5

| E1 | LD | E2 | MH | MV |
|---|---|---|---|---|
| 0 | .6106 +001 | 19.60 | -1.49 | -1.17 |
| 5 | .6733 +001 | 15.20 | -1.55 | -1.37 |
| 10 | .7001 +001 | 10.61 | -1.52 | -1.51 |
| 15 | .6792 +001 | 5.71 | -1.40 | -1.56 |
| 20 | .6119 +001 | .35 | -1.19 | -1.51 |
| 25 | .5133 +001 | -5.68 | -.94 | -1.37 |
| 30 | .4033 +001 | -12.64 | -.70 | -1.19 |
| 35 | .2983 +001 | -20.92 | -.49 | -.99 |
| 40 | .2070 +001 | -30.99 | -.32 | -.81 |
| 45 | .1322 +001 | -43.40 | -.19 | -.64 |
| 50 | .7306 +000 | -58.50 | -.10 | -.50 |
| 55 | .2745 +000 | -75.91 | -.03 | -.39 |
| 60 | -.7054 -001 | 85.84 | .01 | -.29 |
| 65 | -.3261 +000 | 68.62 | .03 | -.21 |

PHI = 40.0 LP = 5.0

| E1 | LD | E2 | MH | MV |
|---|---|---|---|---|
| 0 | .5380 +001 | 19.87 | -1.20 | -.94 |
| 5 | .5881 +001 | 15.34 | -1.24 | -1.09 |
| 10 | .6090 +001 | 10.62 | -1.21 | -1.20 |
| 15 | .5920 +001 | 5.57 | -1.11 | -1.24 |
| 20 | .5378 +001 | .05 | -.95 | -1.21 |
| 25 | .4567 +001 | -6.17 | -.76 | -1.12 |
| 30 | .3638 +001 | -13.36 | -.57 | -.99 |
| 35 | .2726 +001 | -21.89 | -.41 | -.84 |
| 40 | .1910 +001 | -32.23 | -.27 | -.69 |
| 45 | .1225 +001 | -44.88 | -.16 | -.56 |
| 50 | .6736 +000 | -60.11 | -.08 | -.44 |
| 55 | .2416 +000 | -77.40 | -.03 | -.34 |
| 60 | -.8913 -001 | 84.71 | .01 | -.26 |
| 65 | -.3363 +000 | 67.92 | .03 | -.19 |

PHI = 40.0 LP = 5.5

| E1 | LD | E2 | MH | MV |
|---|---|---|---|---|
| 0 | .4891 +001 | 20.09 | -1.01 | -.79 |
| 5 | .5315 +001 | 15.46 | -1.03 | -.91 |
| 10 | .5489 +001 | 10.63 | -1.00 | -.99 |
| 15 | .5343 +001 | 5.46 | -.92 | -1.03 |
| 20 | .4880 +001 | -.22 | -.79 | -1.02 |
| 25 | .4178 +001 | -6.60 | -.64 | -.95 |
| 30 | .3360 +001 | -13.97 | -.49 | -.84 |
| 35 | .2539 +001 | -22.71 | -.35 | -.72 |
| 40 | .1791 +001 | -33.28 | -.23 | -.60 |
| 45 | .1152 +001 | -46.13 | -.14 | -.49 |
| 50 | .6297 +000 | -61.43 | -.07 | -.39 |
| 55 | .2158 +000 | -78.60 | -.02 | -.30 |
| 60 | -.1039 +000 | 83.81 | .01 | -.23 |
| 65 | -.3445 +000 | 67.37 | .03 | -.17 |

PHI = 40.0 LP = 6.0

| E1 | LD | E2 | MH | MV |
|---|---|---|---|---|
| 0 | .4539 +001 | 20.28 | -.87 | -.68 |
| 5 | .4913 +001 | 15.57 | -.88 | -.78 |
| 10 | .5064 +001 | 10.63 | -.86 | -.85 |
| 15 | .4934 +001 | 5.35 | -.79 | -.88 |
| 20 | .4522 +001 | -.44 | -.68 | -.87 |
| 25 | .3895 +001 | -6.96 | -.55 | -.82 |
| 30 | .3153 +001 | -14.50 | -.42 | -.74 |
| 35 | .2398 +001 | -23.42 | -.30 | -.64 |
| 40 | .1699 +001 | -34.17 | -.20 | -.53 |
| 45 | .1095 +001 | -47.18 | -.12 | -.44 |
| 50 | .5948 +000 | -62.53 | -.06 | -.35 |
| 55 | .1951 +000 | -79.60 | -.02 | -.27 |
| 60 | -.1158 +000 | 83.07 | .01 | -.21 |
| 65 | -.3512 +000 | 66.92 | .03 | -.15 |

PHI = 40.0 LP = 6.5

| E1 | LD | E2 | MH | MV |
|---|---|---|---|---|
| 0 | .4274 +001 | 20.45 | -.76 | -.59 |
| 5 | .4612 +001 | 15.66 | -.77 | -.68 |
| 10 | .4747 +001 | 10.64 | -.75 | -.74 |
| 15 | .4628 +001 | 5.26 | -.69 | -.77 |
| 20 | .4253 +001 | -.64 | -.60 | -.77 |
| 25 | .3679 +001 | -7.28 | -.49 | -.72 |
| 30 | .2993 +001 | -14.96 | -.37 | -.65 |
| 35 | .2287 +001 | -24.04 | -.27 | -.57 |
| 40 | .1626 +001 | -34.95 | -.18 | -.48 |
| 45 | .1048 +001 | -48.08 | -.11 | -.39 |
| 50 | .5664 +000 | -63.47 | -.05 | -.32 |
| 55 | .1782 +000 | -80.43 | -.02 | -.25 |
| 60 | -.1257 +000 | 82.45 | .01 | -.19 |
| 65 | -.3568 +000 | 66.54 | .02 | -.14 |

PHI = 40.0 LP = 7.0

| E1 | LD | E2 | MH | MV |
|---|---|---|---|---|
| 0 | .4067 +001 | 20.60 | -.68 | -.53 |
| 5 | .4378 +001 | 15.73 | -.68 | -.60 |
| 10 | .4501 +001 | 10.64 | -.66 | -.66 |
| 15 | .4390 +001 | 5.18 | -.61 | -.69 |
| 20 | .4044 +001 | -.81 | -.53 | -.68 |
| 25 | .3509 +001 | -7.57 | -.43 | -.65 |
| 30 | .2866 +001 | -15.36 | -.33 | -.59 |
| 35 | .2198 +001 | -24.58 | -.24 | -.51 |
| 40 | .1567 +001 | -35.62 | -.16 | -.44 |
| 45 | .1010 +001 | -48.86 | -.10 | -.36 |
| 50 | .5429 +000 | -64.28 | -.05 | -.29 |
| 55 | .1639 +000 | -81.14 | -.01 | -.23 |
| 60 | -.1340 +000 | 81.94 | .01 | -.17 |
| 65 | -.3615 +000 | 66.23 | .02 | -.13 |

PHI = 40.0 LP = 7.5

| E1 | LD | E2 | MH | MV |
|---|---|---|---|---|
| 0 | .3900 +001 | 20.72 | -.61 | -.48 |
| 5 | .4191 +001 | 15.80 | -.62 | -.54 |
| 10 | .4305 +001 | 10.65 | -.59 | -.59 |
| 15 | .4201 +001 | 5.11 | -.55 | -.62 |
| 20 | .3876 +001 | -.97 | -.48 | -.62 |
| 25 | .3372 +001 | -7.82 | -.39 | -.59 |
| 30 | .2763 +001 | -15.72 | -.30 | -.53 |
| 35 | .2124 +001 | -25.05 | -.22 | -.47 |
| 40 | .1518 +001 | -36.22 | -.15 | -.40 |
| 45 | .9787 +000 | -49.54 | -.09 | -.33 |
| 50 | .5230 +000 | -64.97 | -.04 | -.27 |
| 55 | .1519 +000 | -81.75 | -.01 | -.21 |
| 60 | -.1412 +000 | 81.49 | .01 | -.16 |
| 65 | -.3655 +000 | 65.96 | .02 | -.12 |

PHI = 40.0 LP = 8.0

| E1 | LD | E2 | MH | MV |
|---|---|---|---|---|
| 0 | .3764 +001 | 20.84 | -.56 | -.43 |
| 5 | .4038 +001 | 15.86 | -.56 | -.49 |
| 10 | .4145 +001 | 10.65 | -.54 | -.54 |
| 15 | .4046 +001 | 5.05 | -.50 | -.56 |
| 20 | .3738 +001 | -1.10 | -.43 | -.56 |
| 25 | .3259 +001 | -8.04 | -.36 | -.53 |
| 30 | .2677 +001 | -16.04 | -.27 | -.49 |
| 35 | .2063 +001 | -25.48 | -.20 | -.43 |
| 40 | .1476 +001 | -36.74 | -.13 | -.37 |
| 45 | .9517 +000 | -50.14 | -.08 | -.31 |
| 50 | .5061 +000 | -65.59 | -.04 | -.25 |
| 55 | .1415 +000 | -82.28 | -.01 | -.20 |
| 60 | -.1473 +000 | 81.11 | .01 | -.15 |
| 65 | -.3690 +000 | 65.72 | .02 | -.11 |

PHI = 40.0 LP = 8.5

| E1 | LD | E2 | MH | MV |
|---|---|---|---|---|
| 0 | .3650 +001 | 20.94 | -.51 | -.40 |
| 5 | .3911 +001 | 15.92 | -.51 | -.45 |
| 10 | .4012 +001 | 10.65 | -.49 | -.49 |
| 15 | .3917 +001 | 4.99 | -.45 | -.51 |
| 20 | .3623 +001 | -1.23 | -.40 | -.51 |
| 25 | .3164 +001 | -8.24 | -.33 | -.49 |
| 30 | .2604 +001 | -16.33 | -.25 | -.45 |
| 35 | .2011 +001 | -25.86 | -.18 | -.40 |
| 40 | .1441 +001 | -37.21 | -.12 | -.34 |
| 45 | .9285 +000 | -50.68 | -.07 | -.28 |
| 50 | .4914 +000 | -66.12 | -.04 | -.23 |
| 55 | .1325 +000 | -82.74 | -.01 | -.18 |
| 60 | -.1527 +000 | 80.77 | .01 | -.14 |
| 65 | -.3721 +000 | 65.52 | .02 | -.11 |

PHI = 40.0 LP = 9.0

| E1 | LD | E2 | MH | MV |
|---|---|---|---|---|
| 0 | .3554 +001 | 21.03 | -.47 | -.37 |
| 5 | .3804 +001 | 15.97 | -.47 | -.42 |
| 10 | .3900 +001 | 10.65 | -.46 | -.45 |
| 15 | .3808 +001 | 4.94 | -.42 | -.48 |
| 20 | .3525 +001 | -1.34 | -.37 | -.48 |
| 25 | .3084 +001 | -8.42 | -.30 | -.46 |
| 30 | .2542 +001 | -16.59 | -.23 | -.42 |
| 35 | .1966 +001 | -26.20 | -.17 | -.37 |
| 40 | .1410 +001 | -37.64 | -.11 | -.32 |
| 45 | .9083 +000 | -51.15 | -.07 | -.27 |
| 50 | .4786 +000 | -66.60 | -.03 | -.22 |
| 55 | .1246 +000 | -83.15 | -.01 | -.17 |
| 60 | -.1574 +000 | 80.48 | .01 | -.13 |
| 65 | -.3748 +000 | 65.34 | .02 | -.10 |



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PHI = 40.0 LP = 9.5

| E1 | LD | E2 | MH | MV |
|---|---|---|---|---|
| 0 | .3471 +001 | 21.11 | -.44 | -.34 |
| 5 | .3712 +001 | 16.01 | -.44 | -.39 |
| 10 | .3804 +001 | 10.65 | -.42 | -.42 |
| 15 | .3715 +001 | 4.89 | -.39 | -.44 |
| 20 | .3442 +001 | -1.44 | -.34 | -.44 |
| 25 | .3014 +001 | -8.58 | -.28 | -.42 |
| 30 | .2489 +001 | -16.82 | -.22 | -.39 |
| 35 | .1927 +001 | -26.51 | -.16 | -.35 |
| 40 | .1383 +001 | -38.02 | -.11 | -.30 |
| 45 | .8906 +000 | -51.58 | -.06 | -.25 |
| 50 | .4673 +000 | -67.03 | -.03 | -.20 |
| 55 | .1177 +000 | -83.52 | -.01 | -.16 |
| 60 | -.1616 +000 | 80.21 | .01 | -.13 |
| 65 | -.3772 +000 | 65.18 | .02 | -.09 |

PHI = 40.0 LP = 10.0

| E1 | LD | E2 | MH | MV |
|---|---|---|---|---|
| 0 | .3399 +001 | 21.19 | -.41 | -.32 |
| 5 | .3632 +001 | 16.05 | -.41 | -.36 |
| 10 | .3721 +001 | 10.65 | -.39 | -.39 |
| 15 | .3635 +001 | 4.85 | -.36 | -.41 |
| 20 | .3369 +001 | -1.54 | -.32 | -.41 |
| 25 | .2954 +001 | -8.73 | -.26 | -.40 |
| 30 | .2442 +001 | -17.04 | -.20 | -.37 |
| 35 | .1893 +001 | -26.79 | -.15 | -.33 |
| 40 | .1360 +001 | -38.36 | -.10 | -.28 |
| 45 | .8750 +000 | -51.97 | -.06 | -.24 |
| 50 | .4573 +000 | -67.41 | -.03 | -.19 |
| 55 | .1114 +000 | -83.85 | -.01 | -.15 |
| 60 | -.1653 +000 | 79.98 | .01 | -.12 |
| 65 | -.3794 +000 | 65.04 | .02 | -.09 |

PHI = 40.0 LP = 10.5

| E1 | LD | E2 | MH | MV |
|---|---|---|---|---|
| 0 | .3336 +001 | 21.26 | -.38 | -.30 |
| 5 | .3562 +001 | 16.09 | -.38 | -.34 |
| 10 | .3649 +001 | 10.65 | -.37 | -.37 |
| 15 | .3564 +001 | 4.81 | -.34 | -.39 |
| 20 | .3306 +001 | -1.62 | -.30 | -.39 |
| 25 | .2901 +001 | -8.87 | -.25 | -.37 |
| 30 | .2401 +001 | -17.23 | -.19 | -.34 |
| 35 | .1863 +001 | -27.05 | -.14 | -.31 |
| 40 | .1339 +001 | -38.68 | -.09 | -.27 |
| 45 | .8611 +000 | -52.32 | -.06 | -.22 |
| 50 | .4483 +000 | -67.76 | -.03 | -.18 |
| 55 | .1059 +000 | -84.14 | -.01 | -.15 |
| 60 | -.1686 +000 | 79.77 | .01 | -.11 |
| 65 | -.3813 +000 | 64.91 | .02 | -.08 |

PHI = 40.0 LP = 20.0

| E1 | LD | E2 | MH | MV |
|---|---|---|---|---|
| 0 | .2821 +001 | 21.94 | -.18 | -.14 |
| 5 | .2996 +001 | 16.45 | -.18 | -.15 |
| 10 | .3060 +001 | 10.66 | -.17 | -.17 |
| 15 | .2992 +001 | 4.41 | -.15 | -.18 |
| 20 | .2787 +001 | -2.48 | -.14 | -.18 |
| 25 | .2463 +001 | -10.25 | -.11 | -.17 |
| 30 | .2055 +001 | -19.19 | -.09 | -.16 |
| 35 | .1606 +001 | -29.60 | -.06 | -.15 |
| 40 | .1157 +001 | -41.76 | -.04 | -.13 |
| 45 | .7383 +000 | -55.71 | -.03 | -.11 |
| 50 | .3683 +000 | -71.05 | -.01 | -.09 |
| 55 | .5540 -001 | -86.88 | -.00 | -.07 |
| 60 | -.1994 +000 | 77.83 | .01 | -.06 |
| 65 | -.3993 +000 | 63.74 | .01 | -.04 |

PHI = 40.0 LP = 30.0

| E1 | LD | E2 | MH | MV |
|---|---|---|---|---|
| 0 | .2662 +001 | 22.21 | -.11 | -.09 |
| 5 | .2823 +001 | 16.59 | -.11 | -.10 |
| 10 | .2881 +001 | 10.66 | -.11 | -.11 |
| 15 | .2817 +001 | 4.25 | -.10 | -.11 |
| 20 | .2627 +001 | -2.82 | -.09 | -.11 |
| 25 | .2326 +001 | -10.80 | -.07 | -.11 |
| 30 | .1945 +001 | -19.95 | -.06 | -.10 |
| 35 | .1523 +001 | -30.59 | -.04 | -.09 |
| 40 | .1097 +001 | -42.94 | -.03 | -.08 |
| 45 | .6971 +000 | -56.98 | -.02 | -.07 |
| 50 | .3409 +000 | -72.25 | -.01 | -.06 |
| 55 | .3782 -001 | -87.86 | -.00 | -.05 |
| 60 | -.2103 +000 | 77.14 | .00 | -.04 |
| 65 | -.4058 +000 | 63.33 | .01 | -.03 |

PHI = 40.0 LP = 1000000.0

| E1 | LD | E2 | MH | MV |
|---|---|---|---|---|
| 0 | .2384 +001 | 22.76 | -.00 | -.00 |
| 5 | .2521 +001 | 16.88 | -.00 | -.00 |
| 10 | .2569 +001 | 10.65 | -.00 | -.00 |
| 15 | .2513 +001 | 3.91 | -.00 | -.00 |
| 20 | .2348 +001 | -3.55 | -.00 | -.00 |
| 25 | .2085 +001 | -11.95 | -.00 | -.00 |
| 30 | .1749 +001 | -21.58 | -.00 | -.00 |
| 35 | .1372 +001 | -32.67 | -.00 | -.00 |
| 40 | .9872 +000 | -45.37 | -.00 | -.00 |
| 45 | .6201 +000 | -59.54 | -.00 | -.00 |
| 50 | .2891 +000 | -74.62 | -.00 | -.00 |
| 55 | .4156 -002 | -89.76 | -.00 | -.00 |
| 60 | -.2314 +000 | 75.82 | .00 | -.00 |
| 65 | -.4184 +000 | 62.53 | .00 | -.00 |

PHI = 45.0 LP = .5

| E1 | LD | E2 | MH | MV |
|---|---|---|---|---|
| 0 | -.1800 +001 | 12.53 | 1.70 | 1.40 |
| 5 | -.1791 +001 | 11.64 | 1.64 | 1.43 |
| 10 | -.1786 +001 | 10.74 | 1.59 | 1.47 |
| 15 | -.1783 +001 | 9.81 | 1.54 | 1.51 |
| 20 | -.1783 +001 | 8.83 | 1.50 | 1.56 |
| 25 | -.1788 +001 | 7.76 | 1.46 | 1.62 |
| 30 | -.1797 +001 | 6.59 | 1.42 | 1.70 |
| 35 | -.1814 +001 | 5.25 | 1.39 | 1.80 |
| 40 | -.1841 +001 | 3.67 | 1.36 | 1.93 |
| 45 | -.1887 +001 | 1.72 | 1.33 | 2.11 |
| 50 | -.1966 +001 | -.82 | 1.33 | 2.41 |
| 55 | -.2121 +001 | -4.40 | 1.35 | 2.93 |
| 60 | -.2504 +001 | -10.09 | 1.50 | 4.14 |
| 65 | -.4462 +001 | -21.16 | 2.45 | 10.07 |

PHI = 45.0 LP = 1.0

| E1 | LD | E2 | MH | MV |
|---|---|---|---|---|
| 0 | -.3571 +001 | 15.64 | 2.52 | 2.00 |
| 5 | -.3488 +001 | 13.76 | 2.36 | 2.03 |
| 10 | -.3441 +001 | 11.84 | 2.24 | 2.09 |
| 15 | -.3431 +001 | 9.83 | 2.14 | 2.18 |
| 20 | -.3460 +001 | 7.69 | 2.07 | 2.31 |
| 25 | -.3539 +001 | 5.34 | 2.03 | 2.49 |
| 30 | -.3695 +001 | 2.67 | 2.03 | 2.77 |
| 35 | -.3984 +001 | -.48 | 2.09 | 3.22 |
| 40 | -.4562 +001 | -4.37 | 2.27 | 4.05 |
| 45 | -.6000 +001 | -9.46 | 2.83 | 6.00 |
| 50 | -.1355 +002 | -16.68 | 6.00 | 15.95 |
| 55 | .8754 +001 | -27.96 | -3.61 | -13.19 |
| 60 | .1590 +001 | -47.55 | -.60 | -3.74 |
| 65 | .1851 +000 | -80.41 | -.06 | -1.83 |

PHI = 45.0 LP = 1.5

| E1 | LD | E2 | MH | MV |
|---|---|---|---|---|
| 0 | -.8419 +001 | 17.68 | 4.76 | 3.68 |
| 5 | -.7754 +001 | 15.06 | 4.17 | 3.55 |
| 10 | -.7440 +001 | 12.39 | 3.81 | 3.58 |
| 15 | -.7412 +001 | 9.58 | 3.61 | 3.76 |
| 20 | -.7703 +001 | 6.55 | 3.58 | 4.15 |
| 25 | -.8494 +001 | 3.17 | 3.75 | 4.89 |
| 30 | -.1041 +002 | -.72 | 4.37 | 6.48 |
| 35 | -.1659 +002 | -5.41 | 6.61 | 11.36 |
| 40 | -.8339 +003 | -11.35 | 313.75 | 643.00 |
| 45 | .9923 +001 | -19.33 | -3.51 | -8.96 |
| 50 | .3371 +001 | -30.84 | -1.11 | -3.82 |
| 55 | .1298 +001 | -48.34 | -.40 | -2.15 |
| 60 | .3271 +000 | -73.92 | -.09 | -1.34 |
| 65 | -.2068 +000 | 77.08 | .05 | -.86 |

PHI = 45.0 LP = 2.0

| E1 | LD | E2 | MH | MV |
|---|---|---|---|---|
| 0 | -.7788 +002 | 19.09 | 36.71 | 27.96 |
| 5 | -.3867 +002 | 15.95 | 17.23 | 14.60 |
| 10 | -.3078 +002 | 12.71 | 12.98 | 12.27 |
| 15 | -.3076 +002 | 9.30 | 12.30 | 13.01 |
| 20 | -.4006 +002 | 5.59 | 15.20 | 18.10 |
| 25 | -.1275 +003 | 1.43 | 45.84 | 62.09 |
| 30 | .4433 +002 | -3.42 | -15.09 | -23.60 |
| 35 | .1365 +002 | -9.33 | -4.39 | -8.10 |
| 40 | .6305 +001 | -16.89 | -1.91 | -4.30 |
| 45 | .3209 +001 | -27.10 | -.91 | -2.64 |
| 50 | .1590 +001 | -41.54 | -.42 | -1.74 |
| 55 | .6436 +000 | -61.87 | -.16 | -1.19 |
| 60 | .5305 -001 | -87.02 | -.01 | -.82 |
| 65 | -.3284 +000 | 68.92 | .06 | -.56 |

PHI = 45.0 LP = 2.5

| E1 | LD | E2 | MH | MV |
|---|---|---|---|---|
| 0 | .1610 +002 | 20.13 | -6.51 | -4.90 |
| 5 | .2136 +002 | 16.58 | -8.12 | -6.86 |
| 10 | .2547 +002 | 12.93 | -9.14 | -8.67 |
| 15 | .2518 +002 | 9.05 | -8.54 | -9.12 |
| 20 | .2025 +002 | 4.83 | -6.49 | -7.88 |
| 25 | .1413 +002 | .05 | -4.28 | -5.96 |
| 30 | .9195 +001 | -5.56 | -2.63 | -4.27 |
| 35 | .5795 +001 | -12.42 | -1.56 | -3.03 |
| 40 | .3549 +001 | -21.23 | -.90 | -2.17 |
| 45 | .2066 +001 | -33.05 | -.49 | -1.56 |
| 50 | .1072 +001 | -49.26 | -.23 | -1.13 |
| 55 | .3962 +000 | -70.46 | -.08 | -.82 |
| 60 | -.6849 -001 | 85.98 | .01 | -.59 |
| 65 | -.3884 +000 | 64.94 | .06 | -.42 |

PHI = 45.0 LP = 3.0

| E1 | LD | E2 | MH | MV |
|---|---|---|---|---|
| 0 | .8481 +001 | 20.91 | -3.00 | -2.24 |
| 5 | .9922 +001 | 17.06 | -3.29 | -2.77 |
| 10 | .1081 +002 | 13.08 | -3.38 | -3.21 |
| 15 | .1071 +002 | 8.84 | -3.15 | -3.39 |
| 20 | .9536 +001 | 4.20 | -2.65 | -3.26 |
| 25 | .7698 +001 | -1.06 | -2.02 | -2.87 |
| 30 | .5737 +001 | -7.27 | -1.42 | -2.37 |
| 35 | .4009 +001 | -14.89 | -.93 | -1.88 |
| 40 | .2633 +001 | -24.67 | -.57 | -1.46 |
| 45 | .1592 +001 | -37.64 | -.32 | -1.11 |
| 50 | .8241 +000 | -54.87 | -.15 | -.84 |
| 55 | .2654 +000 | -76.11 | -.05 | -.63 |
| 60 | -.1375 +000 | 81.78 | .02 | -.47 |
| 65 | -.4245 +000 | 62.62 | .06 | -.33 |



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PHI = 45.0 LP = 3.5

| E1 | LD | E2 | MH | MV |
|---|---|---|---|---|
| 0 | .6207 +001 | 21.53 | -1.95 | -1.45 |
| 5 | .7019 +001 | 17.43 | -2.07 | -1.74 |
| 10 | .7485 +001 | 13.19 | -2.07 | -1.97 |
| 15 | .7414 +001 | 8.67 | -1.93 | -2.09 |
| 20 | .6763 +001 | 3.69 | -1.66 | -2.06 |
| 25 | .5682 +001 | -1.97 | -1.31 | -1.89 |
| 30 | .4427 +001 | -8.66 | -.96 | -1.64 |
| 35 | .3217 +001 | -16.90 | -.65 | -1.36 |
| 40 | .2174 +001 | -27.42 | -.41 | -1.10 |
| 45 | .1331 +001 | -41.22 | -.24 | -.87 |
| 50 | .6782 +000 | -59.04 | -.11 | -.67 |
| 55 | .1842 +000 | -80.03 | -.03 | -.51 |
| 60 | -.1822 +000 | 79.01 | .02 | -.38 |
| 65 | -.4486 +000 | 61.11 | .05 | -.28 |

PHI = 45.0 LP = 4.0

| E1 | LD | E2 | MH | MV |
|---|---|---|---|---|
| 0 | .5115 +001 | 22.02 | -1.45 | -1.07 |
| 5 | .5694 +001 | 17.73 | -1.51 | -1.26 |
| 10 | .6014 +001 | 13.27 | -1.49 | -1.42 |
| 15 | .5956 +001 | 8.51 | -1.39 | -1.51 |
| 20 | .5489 +001 | 3.26 | -1.20 | -1.51 |
| 25 | .4696 +001 | -2.73 | -.97 | -1.41 |
| 30 | .3737 +001 | -9.82 | -.72 | -1.26 |
| 35 | .2770 +001 | -18.55 | -.50 | -1.07 |
| 40 | .1898 +001 | -29.66 | -.32 | -.88 |
| 45 | .1167 +001 | -44.07 | -.18 | -.71 |
| 50 | .5820 +000 | -62.23 | -.08 | -.56 |
| 55 | .1289 +000 | -82.89 | -.02 | -.43 |
| 60 | -.2135 +000 | 77.06 | .03 | -.33 |
| 65 | -.4658 +000 | 60.06 | .05 | -.24 |

PHI = 45.0 LP = 4.5

| E1 | LD | E2 | MH | MV |
|---|---|---|---|---|
| 0 | .4473 +001 | 22.43 | -1.15 | -.85 |
| 5 | .4936 +001 | 17.98 | -1.18 | -.99 |
| 10 | .5185 +001 | 13.34 | -1.17 | -1.11 |
| 15 | .5134 +001 | 8.38 | -1.08 | -1.18 |
| 20 | .4758 +001 | 2.90 | -.94 | -1.19 |
| 25 | .4112 +001 | -3.36 | -.77 | -1.13 |
| 30 | .3312 +001 | -10.79 | -.58 | -1.02 |
| 35 | .2483 +001 | -19.92 | -.41 | -.88 |
| 40 | .1714 +001 | -31.52 | -.26 | -.74 |
| 45 | .1053 +001 | -46.38 | -.15 | -.60 |
| 50 | .5137 +000 | -64.73 | -.07 | -.48 |
| 55 | .8864 -001 | -85.04 | -.01 | -.37 |
| 60 | -.2367 +000 | 75.62 | .03 | -.28 |
| 65 | -.4788 +000 | 59.27 | .04 | -.21 |

PHI = 45.0 LP = 5.0

| E1 | LD | E2 | MH | MV |
|---|---|---|---|---|
| 0 | .4050 +001 | 22.77 | -.95 | -.70 |
| 5 | .4444 +001 | 18.18 | -.98 | -.82 |
| 10 | .4652 +001 | 13.40 | -.96 | -.91 |
| 15 | .4606 +001 | 8.27 | -.89 | -.97 |
| 20 | .4283 +001 | 2.59 | -.77 | -.98 |
| 25 | .3724 +001 | -3.90 | -.63 | -.94 |
| 30 | .3023 +001 | -11.61 | -.48 | -.86 |
| 35 | .2282 +001 | -21.09 | -.34 | -.75 |
| 40 | .1582 +001 | -33.07 | -.22 | -.64 |
| 45 | .9702 +000 | -48.28 | -.12 | -.52 |
| 50 | .4627 +000 | -66.73 | -.05 | -.42 |
| 55 | .5807 -001 | -86.72 | -.01 | -.33 |
| 60 | -.2546 +000 | 74.52 | .02 | -.25 |
| 65 | -.4890 +000 | 58.68 | .04 | -.19 |

PHI = 45.0 LP = 5.5

| E1 | LD | E2 | MH | MV |
|---|---|---|---|---|
| 0 | .3751 +001 | 23.06 | -.82 | -.60 |
| 5 | .4100 +001 | 18.35 | -.83 | -.69 |
| 10 | .4281 +001 | 13.44 | -.81 | -.78 |
| 15 | .4238 +001 | 8.17 | -.75 | -.83 |
| 20 | .3949 +001 | 2.33 | -.66 | -.84 |
| 25 | .3449 +001 | -4.37 | -.54 | -.81 |
| 30 | .2814 +001 | -12.32 | -.41 | -.74 |
| 35 | .2134 +001 | -22.09 | -.29 | -.65 |
| 40 | .1483 +001 | -34.39 | -.19 | -.56 |
| 45 | .9067 +000 | -49.87 | -.11 | -.46 |
| 50 | .4232 +000 | -68.36 | -.05 | -.37 |
| 55 | .3405 -001 | -88.07 | -.00 | -.29 |
| 60 | -.2688 +000 | 73.64 | .02 | -.22 |
| 65 | -.4971 +000 | 58.20 | .04 | -.17 |

PHI = 45.0 LP = 6.0

| E1 | LD | E2 | MH | MV |
|---|---|---|---|---|
| 0 | .3528 +001 | 23.31 | -.71 | -.52 |
| 5 | .3845 +001 | 18.50 | -.72 | -.60 |
| 10 | .4008 +001 | 13.48 | -.70 | -.67 |
| 15 | .3967 +001 | 8.08 | -.65 | -.72 |
| 20 | .3703 +001 | 2.09 | -.57 | -.73 |
| 25 | .3243 +001 | -4.78 | -.47 | -.71 |
| 30 | .2656 +001 | -12.94 | -.36 | -.65 |
| 35 | .2021 +001 | -22.95 | -.26 | -.58 |
| 40 | .1406 +001 | -35.53 | -.17 | -.50 |
| 45 | .8565 +000 | -51.22 | -.09 | -.41 |
| 50 | .3916 +000 | -69.72 | -.04 | -.33 |
| 55 | .1467 -001 | -89.16 | -.00 | -.26 |
| 60 | -.2804 +000 | 72.93 | .02 | -.20 |
| 65 | -.5038 +000 | 57.82 | .04 | -.15 |

PHI = 45.0 LP = 6.5

| E1 | LD | E2 | MH | MV |
|---|---|---|---|---|
| 0 | .3355 +001 | 23.52 | -.63 | -.46 |
| 5 | .3649 +001 | 18.63 | -.64 | -.53 |
| 10 | .3799 +001 | 13.51 | -.62 | -.59 |
| 15 | .3759 +001 | 8.01 | -.58 | -.64 |
| 20 | .3513 +001 | 1.89 | -.50 | -.65 |
| 25 | .3084 +001 | -5.13 | -.41 | -.63 |
| 30 | .2532 +001 | -13.48 | -.32 | -.58 |
| 35 | .1931 +001 | -23.71 | -.23 | -.52 |
| 40 | .1345 +001 | -36.51 | -.15 | -.45 |
| 45 | .8159 +000 | -52.37 | -.08 | -.37 |
| 50 | .3658 +000 | -70.86 | -.03 | -.30 |
| 55 | -.1307 -002 | 89.93 | .00 | -.24 |
| 60 | -.2900 +000 | 72.34 | .02 | -.19 |
| 65 | -.5094 +000 | 57.50 | .03 | -.14 |

PHI = 45.0 LP = 7.0

| E1 | LD | E2 | MH | MV |
|---|---|---|---|---|
| 0 | .3218 +001 | 23.71 | -.57 | -.41 |
| 5 | .3493 +001 | 18.74 | -.57 | -.48 |
| 10 | .3633 +001 | 13.54 | -.56 | -.53 |
| 15 | .3595 +001 | 7.94 | -.51 | -.57 |
| 20 | .3362 +001 | 1.71 | -.45 | -.58 |
| 25 | .2956 +001 | -5.45 | -.37 | -.57 |
| 30 | .2432 +001 | -13.95 | -.29 | -.53 |
| 35 | .1858 +001 | -24.37 | -.20 | -.47 |
| 40 | .1294 +001 | -37.37 | -.13 | -.41 |
| 45 | .7824 +000 | -53.36 | -.07 | -.34 |
| 50 | .3443 +000 | -71.84 | -.03 | -.28 |
| 55 | -.1470 -001 | 89.15 | .00 | -.22 |
| 60 | -.2981 +000 | 71.85 | .02 | -.17 |
| 65 | -.5141 +000 | 57.23 | .03 | -.13 |

PHI = 45.0 LP = 7.5

| E1 | LD | E2 | MH | MV |
|---|---|---|---|---|
| 0 | .3106 +001 | 23.88 | -.52 | -.37 |
| 5 | .3367 +001 | 18.84 | -.52 | -.43 |
| 10 | .3499 +001 | 13.57 | -.50 | -.48 |
| 15 | .3461 +001 | 7.88 | -.47 | -.52 |
| 20 | .3239 +001 | 1.55 | -.41 | -.53 |
| 25 | .2852 +001 | -5.73 | -.34 | -.51 |
| 30 | .2350 +001 | -14.38 | -.26 | -.48 |
| 35 | .1798 +001 | -24.96 | -.18 | -.43 |
| 40 | .1252 +001 | -38.12 | -.12 | -.37 |
| 45 | .7543 +000 | -54.23 | -.07 | -.31 |
| 50 | .3261 000 | -72.68 | -.03 | -.26 |
| 55 | -.2610 -001 | 88.50 | .00 | -.21 |
| 60 | -.3051 +000 | 71.43 | .02 | -.16 |
| 65 | -.5181 +000 | 57.00 | .03 | -.12 |

PHI = 45.0 LP = 8.0

| E1 | LD | E2 | MH | MV |
|---|---|---|---|---|
| 0 | .3012 +001 | 24.03 | -.47 | -.34 |
| 5 | .3262 +001 | 18.93 | -.48 | -.40 |
| 10 | .3388 +001 | 13.59 | -.46 | -.44 |
| 15 | .3351 +001 | 7.82 | -.43 | -.47 |
| 20 | .3138 +001 | 1.40 | -.37 | -.48 |
| 25 | .2766 +001 | -5.98 | -.31 | -.47 |
| 30 | .2282 +001 | -14.76 | -.24 | -.44 |
| 35 | .1747 +001 | -25.49 | -.17 | -.40 |
| 40 | .1216 +001 | -38.80 | -.11 | -.35 |
| 45 | .7303 +000 | -55.00 | -.06 | -.29 |
| 50 | .3105 +000 | -73.41 | -.02 | -.24 |
| 55 | -.3591 -001 | 87.93 | .00 | -.19 |
| 60 | -.3111 +000 | 71.06 | .02 | -.15 |
| 65 | -.5217 +000 | 56.81 | .0 | -.11 |

PHI = 45.0 LP = 8.5

| E1 | LD | E2 | MH | MV |
|---|---|---|---|---|
| 0 | .2934 +001 | 24.16 | -.44 | -.32 |
| 5 | .3174 +001 | 19.01 | -.44 | -.36 |
| 10 | .3294 +001 | 13.61 | -.42 | -.41 |
| 15 | .3258 +001 | 7.77 | -.39 | -.43 |
| 20 | .3052 +001 | 1.27 | -.34 | -.45 |
| 25 | .2693 +001 | -6.21 | -.28 | -.44 |
| 30 | .2224 +001 | -15.10 | -.22 | -.41 |
| 35 | .1703 +001 | -25.96 | -.16 | -.37 |
| 40 | .1166 +001 | -39.40 | -.10 | -.32 |
| 45 | .7096 +000 | -55.68 | -.06 | -.27 |
| 50 | .2970 +000 | -74.06 | -.02 | -.22 |
| 55 | -.4445 -001 | 87.43 | .00 | -.18 |
| 60 | -.3163 +000 | 70.75 | .02 | -.14 |
| 65 | -.5248 +000 | 56.64 | .03 | -.10 |

PHI = 45.0 LP = 9.0

| E1 | LD | E2 | MH | MV |
|---|---|---|---|---|
| 0 | .2866 +001 | 24.28 | -.41 | -.29 |
| 5 | .3099 +001 | 19.08 | -.41 | -.34 |
| 10 | .3214 +001 | 13.62 | -.39 | -.38 |
| 15 | .3179 +001 | 7.73 | -.36 | -.40 |
| 20 | .2979 +001 | 1.16 | -.32 | -.41 |
| 25 | .2630 +001 | -6.41 | -.26 | -.41 |
| 30 | .2174 +001 | -15.41 | -.20 | -.38 |
| 35 | .1666 +001 | -26.39 | -.14 | -.34 |
| 40 | .1159 +001 | -39.94 | -.09 | -.30 |
| 45 | .6916 +000 | -56.29 | -.05 | -.25 |
| 50 | .2852 +000 | -74.63 | -.02 | -.21 |
| 55 | -.5195 -001 | 86.99 | .00 | -.17 |
| 60 | -.3209 +000 | 70.47 | .02 | -.13 |
| 65 | -.5275 +000 | 56.49 | .03 | -.10 |



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PHI = 45.0 LP = 9.5

| E1 | LD | E2 | MH | MV |
|---|---|---|---|---|
| 0 | .2808 +001 | 24.39 | -.38 | -.27 |
| 5 | .3034 +001 | 19.15 | -.38 | -.31 |
| 10 | .3146 +001 | 13.64 | -.37 | -.35 |
| 15 | .3111 +001 | 7.69 | -.34 | -.38 |
| 20 | .2916 +001 | 1.05 | -.30 | -.39 |
| 25 | .2575 +001 | -6.60 | -.24 | -.38 |
| 30 | .2130 +001 | -15.69 | -.19 | -.36 |
| 35 | .1633 +001 | -26.77 | -.13 | -.32 |
| 40 | .1136 +001 | -40.42 | -.09 | -.28 |
| 45 | .6757 +000 | -56.83 | -.05 | -.24 |
| 50 | .2748 +000 | -75.14 | -.02 | -.20 |
| 55 | -.5858 -001 | 86.61 | .00 | -.16 |
| 60 | -.3250 +000 | 70.23 | .02 | -.12 |
| 65 | -.5299 +000 | 56.35 | .02 | -.09 |

PHI = 45.0 LP = 10.0

| E1 | LD | E2 | MH | MV |
|---|---|---|---|---|
| 0 | .2757 +001 | 24.49 | -.35 | -.26 |
| 5 | .2977 +001 | 19.20 | -.35 | -.29 |
| 10 | .3086 +001 | 13.65 | -.34 | -.33 |
| 15 | .3051 +001 | 7.65 | -.32 | -.35 |
| 20 | .2861 +001 | .95 | -.28 | -.36 |
| 25 | .2528 +001 | -6.77 | -.23 | -.35 |
| 30 | .2092 +001 | -15.94 | -.18 | -.33 |
| 35 | .1605 +001 | 27.12 | -.13 | -.30 |
| 40 | .1115 +001 | -40.87 | -.08 | -.27 |
| 45 | .6617 +000 | -57.32 | -.04 | -.23 |
| 50 | .2655 +000 | -75.59 | -.02 | -.19 |
| 55 | -.6450 -001 | 86.26 | .00 | -.15 |
| 60 | -.3287 +000 | 70.01 | .02 | -.12 |
| 65 | -.5321 +000 | 56.24 | .02 | -.09 |

PHI = 45.0 LP = 10.5

| E1 | LD | E2 | MH | MV |
|---|---|---|---|---|
| 0 | .2712 +001 | 24.58 | -.33 | -.24 |
| 5 | .2927 +001 | 19.26 | -.33 | -.28 |
| 10 | .3033 +001 | 13.67 | -.32 | -.31 |
| 15 | .2999 +001 | 7.61 | -.30 | -.33 |
| 20 | .2812 +001 | .86 | -.26 | -.34 |
| 25 | .2486 +001 | -6.92 | -.21 | -.33 |
| 30 | .2058 +001 | -16.18 | -.17 | -.32 |
| 35 | .1579 +001 | -27.45 | -.12 | -.29 |
| 40 | .1097 +001 | -41.27 | -.08 | -.25 |
| 45 | .6492 +000 | -57.77 | -.04 | -.21 |
| 50 | .2573 +000 | -76.01 | -.02 | -.18 |
| 55 | -.6981 -001 | 85.95 | .00 | -.14 |
| 60 | -.3320 +000 | 69.81 | .02 | -.11 |
| 65 | -.5341 +000 | 56.13 | .02 | -.08 |

PHI = 45.0 LP = 20.0

| E1 | LD | E2 | MH | MV |
|---|---|---|---|---|
| 0 | .2335 +001 | 25.47 | -.16 | -.11 |
| 5 | .2510 +001 | 19.79 | -.16 | -.13 |
| 10 | .2594 +001 | 13.78 | -.15 | -.14 |
| 15 | .2563 +001 | 7.25 | -.14 | -.15 |
| 20 | .2406 +001 | -.07 | -.12 | -.16 |
| 25 | .2133 +001 | -8.52 | -.10 | -.16 |
| 30 | .1771 +001 | -18.55 | -.08 | -.15 |
| 35 | .1359 +001 | -30.67 | -.05 | -.14 |
| 40 | .9372 +000 | -45.24 | -.04 | -.12 |
| 45 | .5380 +000 | -62.03 | -.02 | -.11 |
| 50 | .1827 +000 | -79.84 | -.01 | -.09 |
| 55 | -.1182 +000 | 83.10 | .00 | -.07 |
| 60 | -.3623 +000 | 68.03 | .01 | -.06 |
| 65 | -.5523 +000 | 55.16 | .01 | -.04 |

PHI = 45.0 LP = 30.0

| E1 | LD | E2 | MH | MV |
|---|---|---|---|---|
| 0 | .2215 +001 | 25.83 | -.10 | -.07 |
| 5 | .2378 +001 | 20.00 | -.10 | -.08 |
| 10 | .2456 +001 | 13.83 | -.10 | -.09 |
| 15 | .2426 +001 | 7.11 | -.09 | -.10 |
| 20 | .2278 +001 | -.44 | -.08 | -.10 |
| 25 | .2021 +001 | -9.16 | -.06 | -.10 |
| 30 | .1678 +001 | -19.50 | -.05 | -.10 |
| 35 | .1287 +001 | -31.93 | -.03 | -.09 |
| 40 | .8839 +000 | -46.76 | -.02 | -.08 |
| 45 | .5002 +000 | -63.61 | -.01 | -.07 |
| 50 | .1569 +000 | -81.22 | -.00 | -.06 |
| 55 | -.1352 +000 | 82.10 | .00 | -.05 |
| 60 | -.3731 +000 | 67.41 | .01 | -.04 |
| 65 | -.5589 +000 | 54.82 | .01 | -.03 |

PHI = 45.0 LP = 1000000.0

| E1 | LD | E2 | MH | MV |
|---|---|---|---|---|
| 0 | .2000 +001 | 26.57 | -.00 | -.00 |
| 5 | .2144 +001 | 20.43 | -.00 | -.00 |
| 10 | .2210 +001 | 13.92 | -.00 | -.00 |
| 15 | .2182 +001 | 6.79 | -.00 | -.00 |
| 20 | .2049 +001 | -1.24 | -.00 | -.00 |
| 25 | .1819 +001 | -10.53 | -.00 | -.00 |
| 30 | .1510 +001 | -21.51 | -.00 | -.00 |
| 35 | .1155 +001 | -34.60 | -.00 | -.00 |
| 40 | .7848 +000 | -49.88 | -.00 | -.00 |
| 45 | .4292 +000 | -66.77 | -.00 | -.00 |
| 50 | .1079 +000 | -83.90 | -.00 | -.00 |
| 55 | -.1679 +000 | 80.19 | .00 | -.00 |
| 60 | -.3941 +000 | 66.22 | .00 | -.00 |
| 65 | -.5718 +000 | 54.17 | .00 | -.00 |

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# APPENDIX B
## Graphs of Some of the Results

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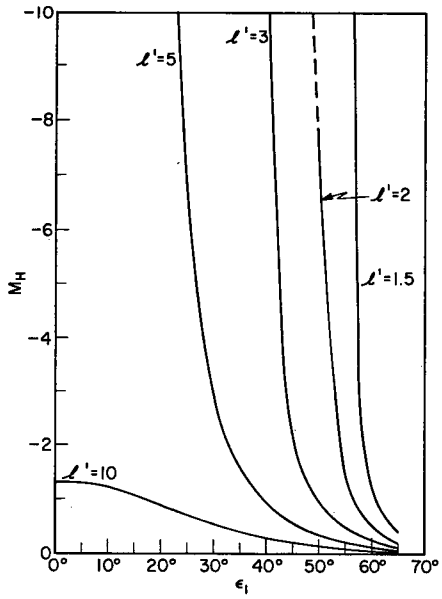
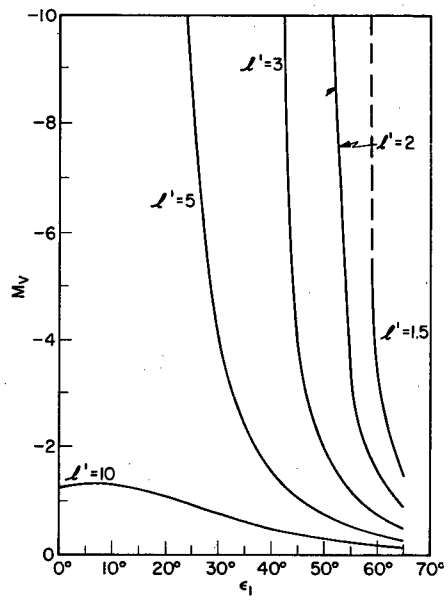
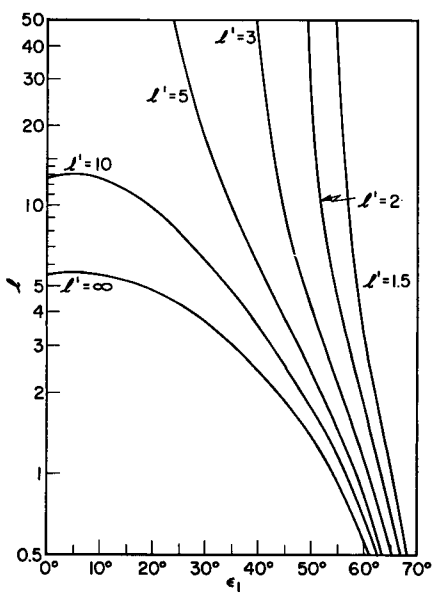


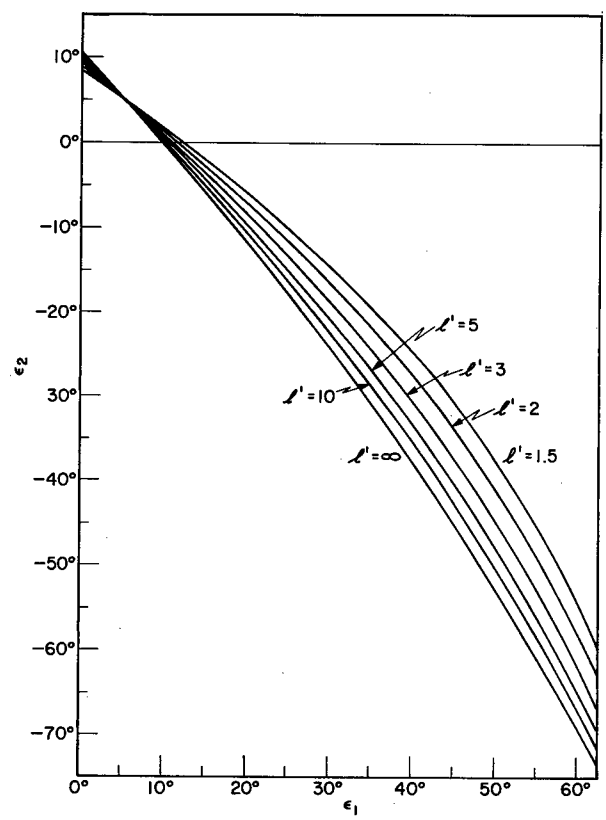

(a) Horizontal magnification vs entrance angle with object distance as a parameter




(b) Vertical magnification vs entrance angle with object distance as a parameter

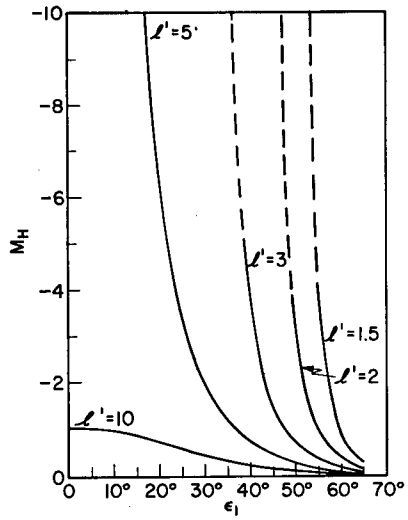



(c) Image distance vs entrance angle with object distance as a parameter

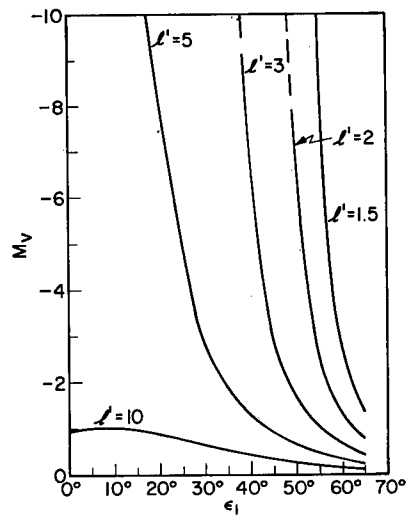



(d) Exit angle vs entrance angle with object distance as a parameter

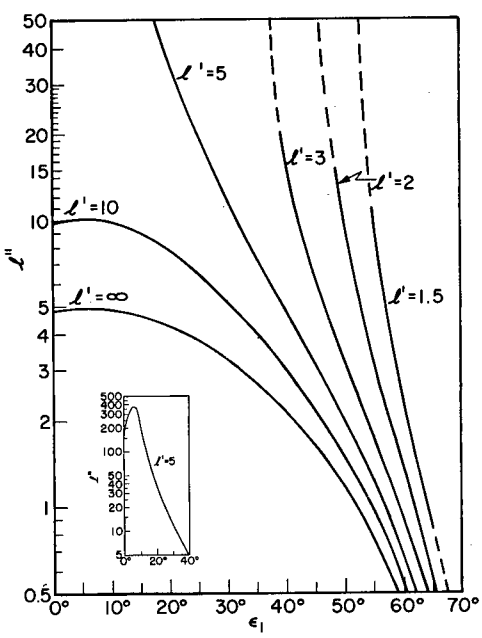
Fig. B1 – Portions of the results for a deflection angle $\varphi = 20$ degrees



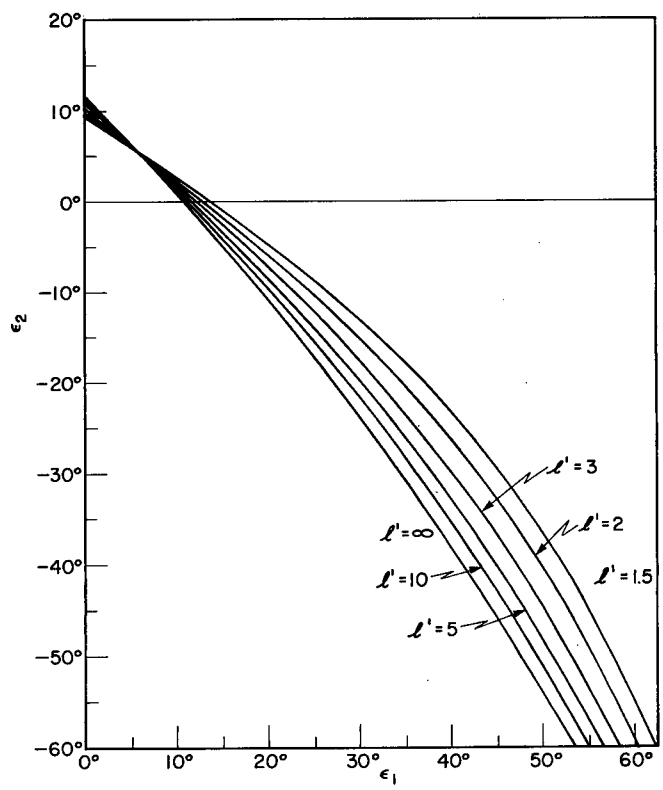

(a) Horizontal magnification vs entrance angle with object distance as a parameter




(b) Vertical magnification vs entrance angle with object distance as a parameter




(c) Image distance vs entrance angle with object distance as a parameter




(d) Exit angle vs entrance angle with object distance as a parameter

Fig. B2 — Portions of the results for a deflection angle $\varphi = 22.5$ degrees

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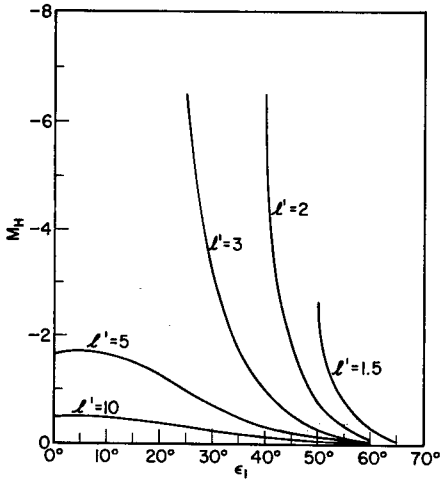
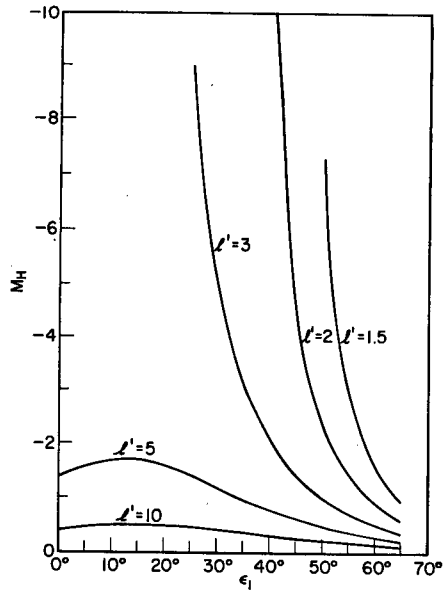
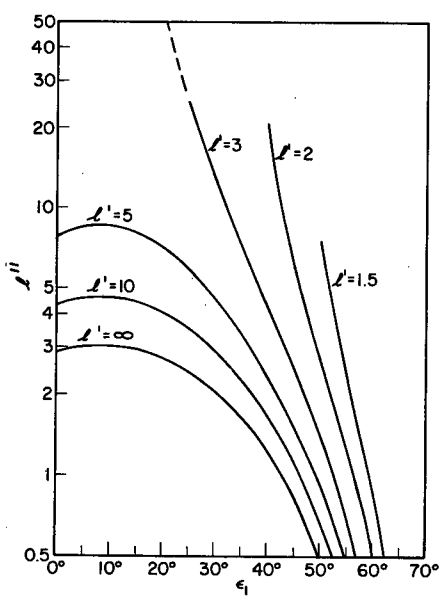


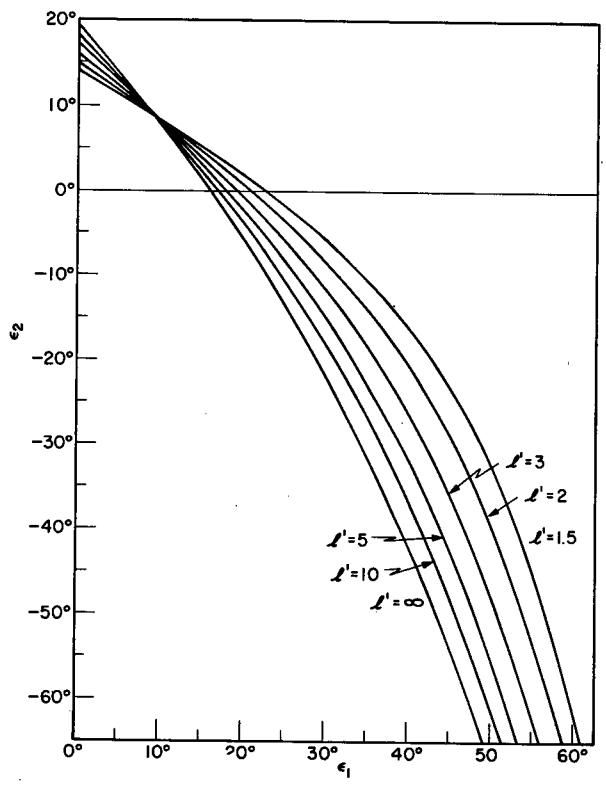

(a) Horizontal magnification vs entrance angle with object distance as a parameter




(b) Vertical magnification vs entrance angle with object distance as a parameter

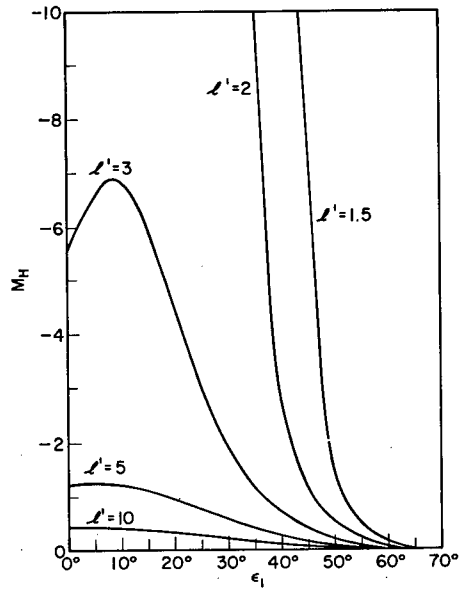



(c) Image distance vs entrance angle with object distance as a parameter

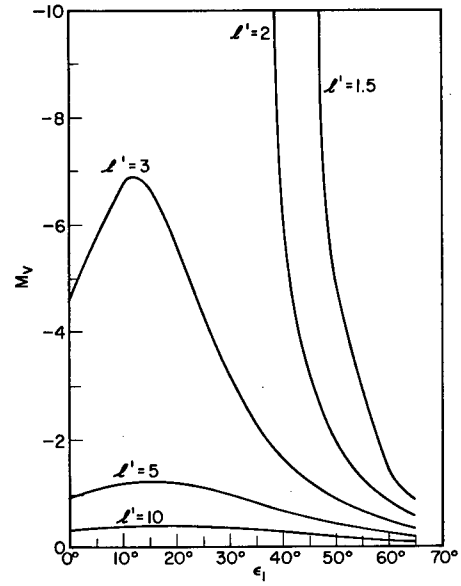



(d) Exit angle vs entrance angle with object distance as a parameter

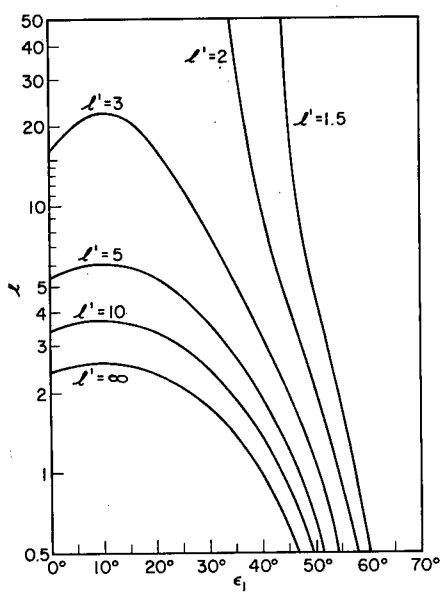
Fig. B3 — Portions of the results for a deflection angle $\varphi = 35$ degrees



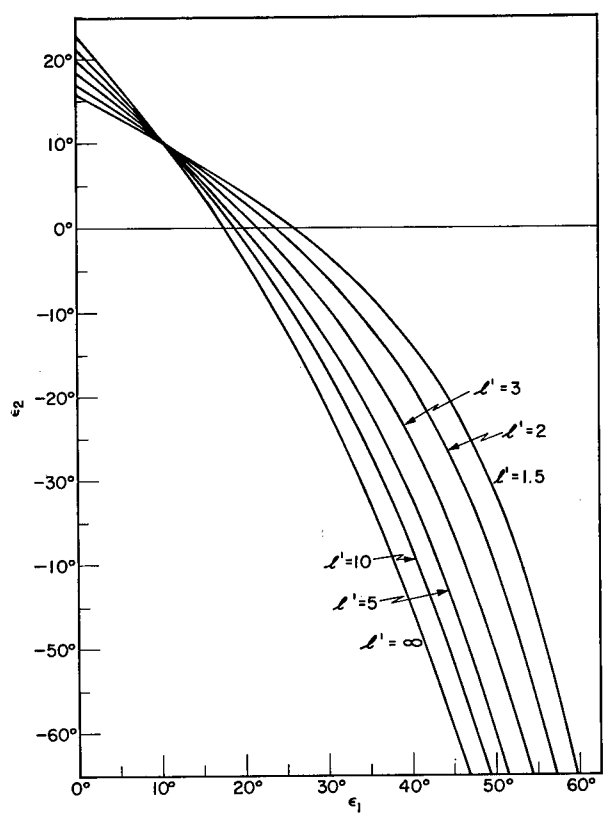

(a) Horizontal magnification vs entrance angle with object distance as a parameter




(b) Vertical magnification vs entrance angle with object distance as a parameter




(c) Image distance vs entrance angle with object distance as a parameter




(d) Exit angle vs entrance angle with object distance as a parameter

Fig. B4 — Portions of the results for a deflection angle $\varphi = 40$ degrees

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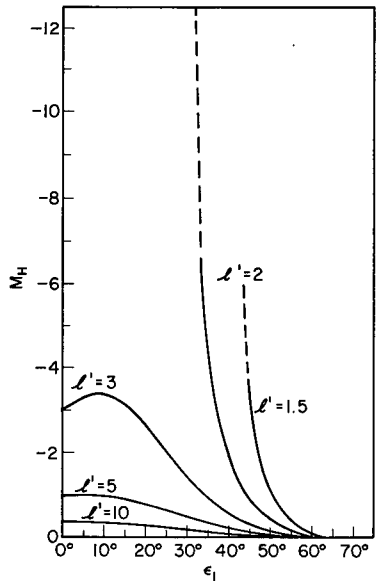
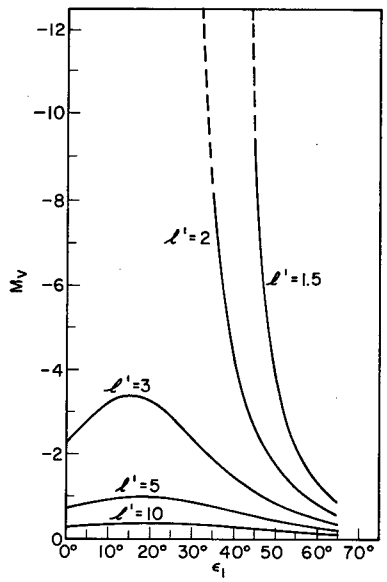
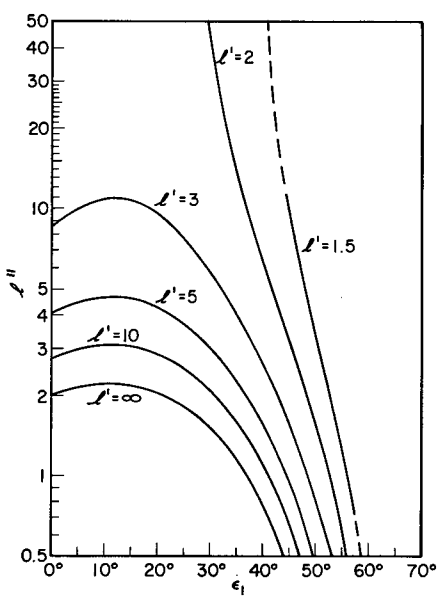


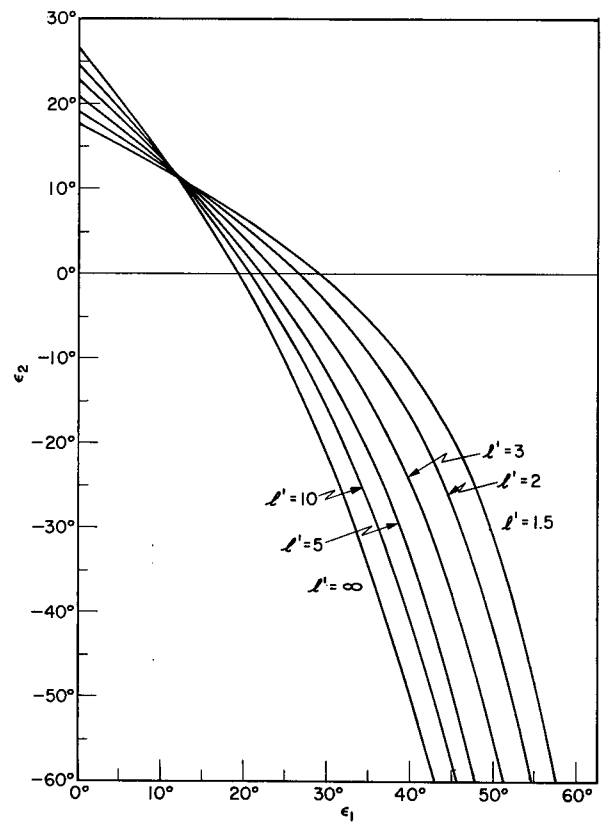

(a) Horizontal magnification vs entrance angle with object distance as a parameter




(b) Vertical magnification vs entrance angle with object distance as a parameter




(c) Image distance vs entrance angle with object distance as a parameter




(d) Exit angle vs entrance angle with object distance as a parameter

Fig. B5 — Portions of the results for a deflection angle $\varphi = 45$ degrees

Security Classification

## DOCUMENT CONTROL DATA - R&D

*(Security classification of title, body of abstract and indexing annotation must be entered when the overall report is classified)*

1. ORIGINATING ACTIVITY *(Corporate author)*

U.S. Naval Research Laboratory
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2a. REPORT SECURITY CLASSIFICATION

UNCLASSIFIED

2b. GROUP

3. REPORT TITLE

Calculations on Uniform-Field Bending Magnets

4. DESCRIPTIVE NOTES *(Type of report and inclusive dates)*

An interim report on one phase of the problem.

5. AUTHOR(S) *(Last name, first name, initial)*

Shapiro, P., Podgor, S., and Theus, R. B.

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9b. OTHER REPORT NO(S) *(Any other numbers that may be assigned this report)*

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12. SPONSORING MILITARY ACTIVITY

Department of the Navy
(Office of Naval Research)

13. ABSTRACT

The focal properties of some uniform-field bending magnets have been calculated. This report gives tables and graphs of the image distance and magnification for deflection angles of 20, 22-1/2, 35, 40, and 45 degrees, as a function of the object distance and the angle the particle beam makes with the entrance and exit faces of the magnet. These numerical results are useful when designing ion-optical systems for particle accelerators.

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Security Classification

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| 14. KEY WORDS | LINK A ROLE | LINK A WT | LINK B ROLE | LINK B WT | LINK C ROLE | LINK C WT |
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| Particle accelerator techniques | | | | | | |
| Magnets | | | | | | |
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