SCIENCE AND ENGINEERING RESEARCH COUNCIL SUN/13.1

RUTHERFORD & APPLETON LABORATORIES
COMPUTING DIVISION

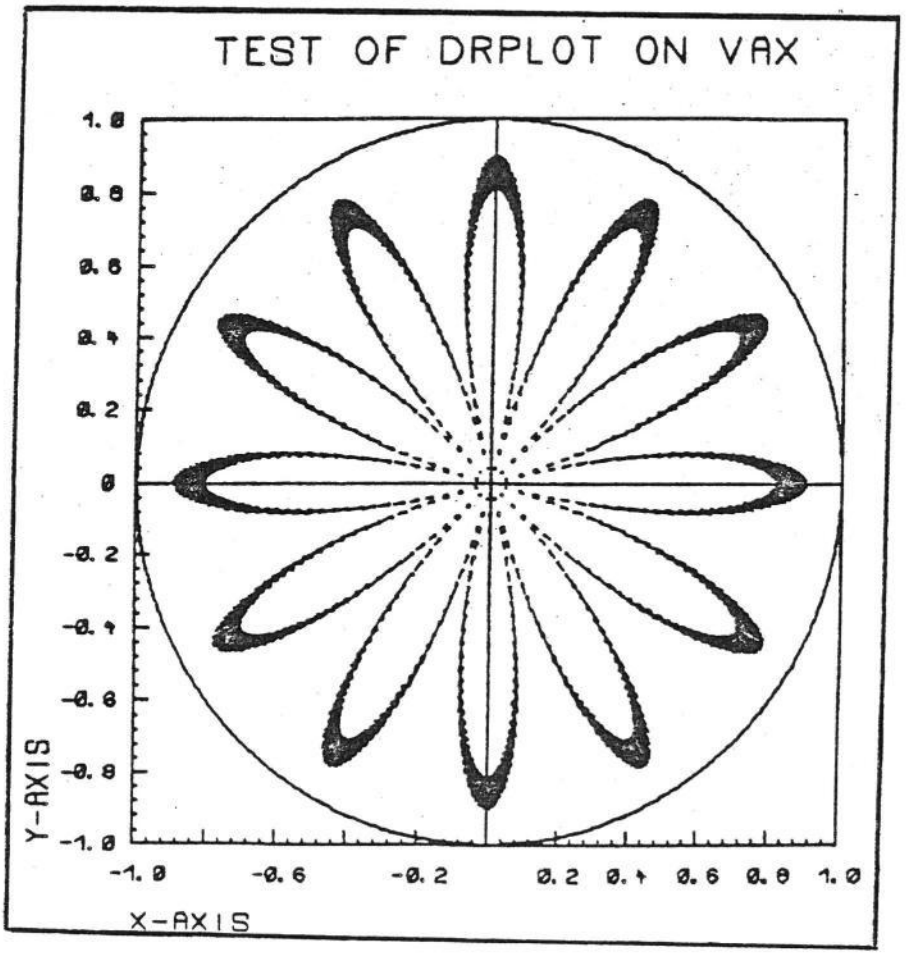
Starlink Project

S T A R L I N K U S E R N O T E 13.1

The DRPLOT Graphs and Histograms Package on VAX

12 June 1981

The DRPLOT subroutine package enables its user to draw graphs and histograms of several forms. A simple line graph can be drawn with just one command and more sophisticated drawings with perhaps several graphs and histograms on the same frame are simple to construct. The many user routines are documented here. This package was transferred from the central IBM computer.



SIMPLE USE OF DRPLOT

The VAX version of DRPLOT is written above the package GKS and it is normal to use the routines HIGR_GZBGN & HIGR_GZEND to set up & close GKS for DRPLOT. It is not necessary to consult GKS documentation for simple use of DRPLOT.

HIGR_GZBGN has four arguments which are the following:

(i) Workstation identifier. An integer of the user's choice
(ii) Connection identifier. An integer which distinguishes between devices of the same type. This is usually zero but this may change in future versions of GKS.
(iii) Workstation type. An integer which takes the following values

1: ARGS
2: TEKTRONIX
3: GOC

(iv) Text precision. This takes the values 0, 1, &2. Precision 2 allows character size to be accurately calculated by the package but precisions 0 & 1 are much faster in plotting.

HIGR_GZEND has only one parameter which is the first parameter in HIGR_GZBGN

So to use a TEKTRONIX for plotting with top precision , for instance, one should include the DRPLOT call between the calls 'CALL HIGR_GZBGN(4,0,2,2)' and 'CALL HIGR_GZEND(4)'.

Simple graphs

The simplest plotting routine in DRPLOT is called HIGR_DRPLOT. It has seven parameters which are as follows.

1: REAL array for X coordinates of plotting points
2: REAL array for Y coordinates of plotting points
3: Number of points to be plotted
4: Xaxis title
5: Yaxis title
6: Main title
7: Delimiting character for titles

A typical call might be

```
CALL HIGR_DRPLOT(X,Y,N,'Xaxis&','Yaxis&','Title&','&')
```

Here is an example of a program calling HIGR_DRPLOT. It plots an Astroid figure

```
      PROGRAM TEST
C     Set arrays
      REAL X(101),Y(101)
      DO  I=1,101
            THETA=THETA+0.06283
            Y(I)=SIN(THETA)** 3
            X(I)=COS(THETA)** 3
      END DO
C     Do plotting
      CALL HIGR_GZBGN(4,0,2,2)
      CALL HIGR_DRPLOT(X,Y,101,'Xaxis#','Yaxis#','TEST#','#')
      CALL HIGR_GZEND(4)
      END
```

This will produce figure 1.

The user may not wish to have the various features of a graph drawn in the same way as they are drawn by default. Various option setting routines are available. They are described later.

Histograms

Histograms can be drawn by the routine HIGR_DRHIST. Its arguments are as follows:

1: REAL array to be plotted
2: Number of points in array
3: Xtitle
4: Ytitle
5: Main title
6: Delimiting character

Here is a typical program using HIGR_DRHIST. This program produced figure 3.

```
      PROGRAM HIST
C     Work out array
      REAL Y(10)
      DO I=1,10
          Y(I)=FLOAT(I)**3-10.0*FLOAT(I)**2+1000.0
      END DO
C     Plot data
      CALL HIGR_GZBGN(4,0,2,2)
      CALL HIGR_DRHIST(Y,10,'Bin!','Number!','Histogram!','!')
      PAUSE
      CALL HIGR_GZEND(4)
      STOP
      END
```

The differently shaded and labelled histograms shown in figures 4 to 7 were made by use of HIGR_DRHISF and HIGR_DRHISO, which change the shading type, and HIGR_DRHISP , which changes the base value & bin width along the X-axis.

The X-axis labels are drawn at the divisions between consecutive bars to represent the maximum & minimum values of the bins to the left & right respectively.

FURTHER FACILITIES

Axes

A user may wish to choose the graph limits instead of allowing HIGR_DRPLOT to calculate them. This is done by a call to HIGR_DRAXES . This sets up the graphframe and it is followed by a call to one of the routines HIGR_DRLINE, HIGR_DRDASH, HIGR_DREBAS, HIGR_DRCHLN, HIGR_DRARRO, or HIGR_DRSIST to plot a graph upon it. HIGR_DRAXES has eight arguments.

1: X minimum value
2. Y minimum value
3: X maximum value
4: Y maximum value
5: X title
6: Y title
7: Main title
8: Delimiting character

A typical call might be

```
CALL HIGR_DRAXES(-1.0,-1.0,3.0,6.0,'Xaxis#','Yaxis#','TEST#','#')
```

The effects of such a call followed by a call to HIGR_DRDASH when substituted for the HIGR_DRPLOT call in program TEST (see above) is shown in figure 2

Note: HIGR_DRAXES will round the user's limits if they are badly chosen.

a user wants to set the histogram limits he or she should call HIGR_DRAXES then HIGR_HSTGMA, or HIGR_DRSIST; both are described later.

Error bar graphs

The main routine for error bar graphs is HIGR_DREBAR. Its eight parameters are as follows:

1: REAL X array
2: REAL Y array
3: REAL array of + or - errors in Y values
4: Number of points to be plotted
5: X title
6: Y title
7: Main title
8: Delimiting character

This is used in the same way as the HIGR_DRPLOT subroutine, setting its own graph limits

The option setting routine HIGR_DRESIZ is useful with HIGR_DREBAR. It sets the width of the error bar markers. The default width is zero.

Chain lines

Chain lines can be drawn through a set of points by using the routine HIGR_DRCHLN. Its parameters are as follows:

1: REAL X array
2: REAL Y array
3: Number of points to be plotted
4: GKS marker code for chainline.

A marker is drawn at each point (X,Y) and then, where there is a big enough gap, the points are joined up by lines. The marker size is reduced if necessary. Note: at present the ARGS has marker types 1 - 5. The TEKTRONIX & GOC have only 1 .

Arrow maps

Arrow maps (see figs 11 & 12) can be drawn by the routine HIGR_DRARRO. This is a new routine. Its parameters are as follows:

1: REAL X array
2: REAL Y array
3: REAL DX array
4: REAL DY array
5: Number of arrows to be plotted
6: Ratio of arrowhead size to arrow size.

The arrows are drawn from (X(i),Y(i)) to (X(i)+DX(i),Y(i)+DY(i)) for i = 1 to N where N is the number of arrows to be plotted. ARRSZ should be in the range 0.0 to 1.0 a sensible value being about 0.2. It is left to the user to decide in case arrows overlap in an initial run. In figures 11 & 12 ARRSZ is 0.2 and 0.1 respectively. Axes should be established (by calling HIGR_DRAXES) before calling HIGR_DRARRO.

Options

The user may change the form of his or her graph dramatically by using the various option setting routines described later. The form of tags may be completely changed or a graticule drawn; graphs may be superimposed; the error bar marker width may be adjusted; and the colours of various features may be changed on colour devices.

Log axes are not currently available

Note: The routines HIGR_DRINTN, HIGR_DRLIMT, HIGR_DRLIMS, HIGR_DRLIMV, & HIGR_DRLIMR, which exist in the version of DRPLOT implemented on the central IBM computer, are now obselete. HIGR_DRPEN or HIGR_GZHLS which are described later & the GKS function GKS_SVW should be used instead.

DRPLOT drawing styles

DRPLOT will, by default, distinguish certain aspects of a graph, if the facilities (chiefly colour) are available on a device. There are twelve numbered DRPLOT pens corresponding to the various features of the graph as follows.

1: Error bar graphs, line graphs, chainlines & arrow maps.
2: Axes & major tags (or major graticule)
3: Simple histograms.
4: Minor tags (or minor graticule)
5: Crosswire
6: Histogram shading
7: Dashed graphs
8: Spare
9: Main title
10: Axis titles
11: Axis lables
12: Spare

The DRPLOT pens are mapped onto a series of highlights which are set up by HIGR_GZBGN with a standard set of styles and colours. The DRPLOT pens are by default related to the highlights as follows:

DRPLOT PEN	HIGHLIGHT
1	1
2	2
3	4
4	8
5	9
6	10
7	20
8	3
9	1
10	6
11	7
12	8

The highlights, which can be the same from one high level package to another, are defined by default as follows:

Highlight	Definition
1	White or black (whichever contrasts background)
2	Red
3	Green
4	Blue
5	Cyan
6	Magenta
7	Yellow
8	Pink
9	Pale green
10	Pale blue
20	Dashed (linedrawing only). Colour as highlight 1.

ighlights 8, 9, &10 are suitable for minor parts of the picture such as the graticule.

The user can select different highlights for different aspects of the graph by calling HIGR_DRPEN(HILITE, DP) which causes the highlight number HILITE to be assigned to the DRPLOT pen DP for subsequent drawing.

If totally different colours or styles are required, a GKS or GKS-related routine must be used. These are covered under "USE OF GKS WITH HIGH LEVEL ROUTINES".

USE OF GKS WITH HIGH LEVEL ROUTINES

High level routines are written using GKS so care should be taken when using them together with GKS.

Starting up GKS

Subroutine HIGR_GZBGN looks like this:

```
      SUBROUTINE HIGR_GZBGN(WKID,CONID,WS,IPREC)
      INTEGER WKID,CONID,WS,IPREC
C     OPEN GKS
      CALL GKS_OPKS(22)
C     OPEN WORKSTATION
      CALL GKS_OPWK(WKID,CONID,WS)
C     ACTIVATE WORKSTATION
      CALL GKS_ACWK(WKID)
C     SET TEXT REPRESENTATION
      CALL GKS_STXRP(WKID,1000,1,IPREC)
C     SET HIGHLIGHT & PEN DEFAULTS
      CALL HIGR_GZDEF(WKID)
      RETURN
      END
```

More sophisticated users may wish to include their own version of this within a program and then close down where necessary.

Segments

High level routines use no GKS segments so the user is free to use them in any way

Window/Viewport Transfomations

The GKS routine GKS_SVW should be used for changing the aspect ratio of pictures or fitting more than one into the plotting area (see figures 7,9,10). Text shape will be preserved under such a transfomation but the size will changed by the same factor as the shorter side of the picture frame.

Pen number/Text number/Text spacing/Window/Marker size

High level routines may change any of these attributes. There are two user routines to help with this. HIGR_GZMEM will remember the user's settings of these attributes and HIGR_GZRST will reset them. High level routines will not reset them automatically

Changing Picture Colours

If the highlighting facilities provided are not sufficiently flexible then some GKS facilities must be used.

The user can either alter the assignment of GKS pens to highlights (HIGR_GZHLS) or change the GKS pen representations.

The assignment of a GKS pen to a highlight can be altered at any time. It allows high level routines to draw with a user's pen. It allows different pictures on the same frame to be coloured differently by altering the GKS pen number. Note that merely changing the GKS pen representation has restrictions which will not allow this. To change the assignment of a GKS pen to a highlight the routine HIGR_GZHLS(GKSPEN,HILITE) (both arguments are integers) must be called.

By default highlight m is represented as GKS pen 1000+m for each highlight m.

The user may change the representation of a GKS pen by using the routine GKS_SPRP, but this routine has one of the following three effects (depending on the device)

(a) It changes the representation of all output so far on this frame
(b) The change is deferred to the next frame change
(c) Frame change occurs implicitly and immediately

It is therefore advised that any changes to the GKS pen representation be made before plotting has begun (but obviously after opening GKS & the workstation).

Note:

If more than one workstation is active text positioning will be treated on all workstations as it is with the lowest precision chosen on any of the workstations. So if accurately positioned text is desired text precision 2 should be chosen for all workstations.

Error messages

Error messages from high level graphics packages are sent to the GKS error stream, which is 22 if HIGR_GZBGN is called.

DRPLOT USER ROUTINES

All user routines are listed with their arguments below. All the arguments are input arguments.

Abbreviations: R, REAL; I, INTEGER; L, LOGICAL.

HIGR_DROLIN

Controls production of crosswire at zero.

Format of call:

```
CALL HIGR_DROLIN(LOX, LOY)
```

List of arguments:

1: LOX	L	
2: LOY	L	

HIGR_DRAXES will draw a crosswire if LOX & LOY are both T.

HIGR_DRARRO

Draws an arrow map.

Format of call:

```
CALL HIGR_DRARRO(X, Y, DX, DY, N, ARRSZ)
```

List of arguments:

1: X	R	array of size N
2: Y	R	array of size N
3: DX	R	array of size N
4: DY	R	array of size N
5: N	I	
6: ARRSZ	R	

X & Y are arrays storing the arrow base points.
DX & DY are arrays storing the arrow vectors.
N is the number of arrows to be plotted.
ARRSZ is the ratio of the arrowhead size to the arrow size.

HIGR DRAXEF

Not currently available

HIGR DRAXEP

Form of tag positioning for axes.

Format of call:

```
CALL HIGR_DRAXEP(MODX,MODY)
```

List of arguments:

```
1:MODX          I
2:MODY          I
```

MODX, MODY:

1: Outside lower or left axis only.
2: Outside upper or right axis only.
3: Outside both axes.

HIGR DRAXES

This draws a graph frame.

Format of call:

```
CALL HIGR_DRAXES(XMIN,XMAX,YMIN,YMAX,SX,SY,SG,D)
```

List of arguments:

```
1:XMIN          R
2:YMIN          R
3:XMAX          R
4:YMAX          R
5:SX            L*1 array
6:SY            L*1 array
7:SG            L*1 array
8:D             L*1
```

(XMIN, YMIN)&(XMAX, YMAX) are the coordinates of the bottom left and top right corners of the frame
SX, SY, SG, D are the X & Y axis titles, the graph title and the delimiting character

HIGR DRAXET

Not currently available

HIGR DRCHLN

This routine draws a chain of characters though a set of points

Format of call:

```
CALL HIGR_DRCHLN(X,Y,N,ICODE)
```

List of arguments:

1: X	R array of size N
2: Y	R array of size N
3: N	I
4: ICODE	I

X & Y are arrays containing all the points to be plotted.
N is the number of points to be plotted.
ICODE is the GKS marker code.

HIGR DRDASH

This draws a dashed line through a set of points.

Format of call:

```
CALL HIGR_DRDASH(X,Y,N,ON1,ON2,OFF)
```

List of arguments:

1: X	R array of size N
2: Y	R array of size N
3: N	I
4: ON1	R
5: ON2	R
6: OFF	R

X & Y are arrays containing the N points to be plotted.
ON1, ON2, &OFF are the lengths of the dots, dashes, and gaps but they are arbitrary on the VAX.

HIGR DREBAR

This draws an error bar graph through a set of points & errors

Format of call:

```
CALL HIGR_DREBAR(X,Y,E,N,SX,SY,SG,D)
```

List of arguments:

1: X	R array of size N
2: Y	R array of size N
3: E	R array of size N
4: N	I
5: SX	L*1 array
6: SY	L*1 array
7: SG	L*1 array
8: D	L*1

X & Y are arrays containing the N points to be plotted. E is the array containing the + or - errors in Y for each point.
SX, SY, SG, D are the X & Y axis and main titles & delimiting character.

HIGR_DREBAS

This is as HIGR_DREBAR but used after a call to HIGR_DRAXES.

Format of call:

```
CALL HIGR_DREBAS(X,Y,E,N)
```

List of arguments:

1:X	R	
2:Y	R	As in
3:E	R	HIGR_DREBAR.
4:N	I	

HIGR_DRESIZ

This alters the width of error bar markers. Default is zero.

Format of call:

```
CALL HIGR_DRESIZ(SIZE)
```

List of arguments:

1:SIZE R

SIZE is the width of the error bar markers as a fraction of the total X width of the graph.

HIGR_DRFRAM

A call to this decides whether there will be frame advance between the plotting of subsequent graphs.

Format of call:

```
CALL HIGR_DRFRAM(BOOL)
```

List of arguments:

1:BOOL L

There will be frame advance if BOOL is T, and not if it is F.

HIGR_DRGRAT

This controls the form of graticule. Default is no graticule.

Format of call:

```
CALL HIGR_DRGRAT(MODX,MODY)
```

List of arguments:

1:MODX	I
2:MODY	I

MODX & MODY control the production of a graticule along the X & Y axes respectively. They can take the following values:

0 No graticule
1 Major graticule only
2 Major & minor graticules

The graticule is made in the same way as the tags so all routines controlling the tags may also affect the graticule.

HIGR_DRHISF & HIGR_DRHISO

These routines control histogram shading and borders.

Format of call:

```
CALL HIGR_DRHISF(IOPT)
CALL HIGR_DRHISO(ISRND,DX,DY)
```

List of arguments:

```
1: IOPT        I
2: ISRND       I
3: DX          R
4: DY          R
```

ISRND controls the histogram border production. It can be set as follows:

```
0 No border
1 Border
```

IOPT, DX & DY control the shading. Here is a list of patterns.

```
IOPT=-1 No shading connected horizontals & verticals only.
      0 Each bin drawn as an empty rectangle.
      1 Horizontal lines drawn , separated by DY
      2 Vertical lines drawn , separated by DX
      3 As 1 + 2
      4 Diagonals separated by DY, at TAN-1(DY/DX) to horizontal.
      5 Diagonals separated by DY at PI-TAN-1(DY/DX) to horizontal
      6 Cross hatching ( as 4 + 5 ).
      7 As 1 but with dashed lines.
      8 As 7 but alternating.
      9 As 2 but with dashed lines.
     10 As 9 but alternating.
```

See figure 7.

DY & DX are in Y & X axis units.

HIGR_DRHISP

This changes the base value and bin width for HIGR_DRHIST.

Format of call:

```
CALL HIGR_DRHISP(XMIN,DX)
```

List of arguments:

```
1: XMIN        R
2: DX          R
```

XMIN is the base value and DX is the bin width. In figures 4-7 the base value is 300.0 and the bin width is 1.0.

HIGR_DRHIST

This draws a histogram of an array. It also draws labelled axes.

Format of call:

```
CALL HIGR_DRHIST(Y,N,SX,SY,SG,D)
```

List of arguments:

```
1: Y           R array of size N
2: N           I
3: SX          L*1 array
4: SY          L*1 array
5: SG          L*1 array
6: D           L*1
```

Y is the array of which N bins will be plotted.

SX, SY, SG, D are the axis and main title and delimiting character

HIGR_DRINTN, HIGR_DRLIMR, HIGR_DRLIMS, HIGR_DRLIMT, HIGR_DRLIMV

See "FURTHER FACILITIES" & "USE OF GKS WITH HIGH LEVEL ROUTINES".

HIGR_DRLINE

This is as HIGR_DRPLOT but used after HIGR_DRAXES.

Format of call:

```
CALL HIGR_DRLINE(X,Y,N)
```

List of arguments:

1: X	R	
2: Y	R	Same as in HIGR_DRPLOT.
3: N	I	

HIGR_DRPEN

This assigns a highlight to a particular DRPLOT pen.

Format of call:

```
CALL HIGR_DRPEN(N,NPEN)
```

List of arguments:

1: N	I
2: NPEN	I

N is the highlight number and NPEN the pen number.

HIGR_DRPLOT

This plots a line graph through a given set of points.
It also draws labelled axes.

Format of call:

```
CALL HIGR_DRPLOT(X,Y,N,SX,SY,SG,D)
```

List of arguments:

1: X	R array of size N
2: Y	R array of size N
3: N	I
4: SX	L*1 array
5: SY	L*1 array
6: SG	L*1 array
7: D	L*1

The N points to be plotted are stored in the arrays X & Y.
SX, SY, SG, D are the axis and main titles and their deliminator.

HIGR_DRSIST

This plots a simple histogram of an array . It is used with HIGR_DRAXES

Format of call:

```
CALL HIGR_DRSIST(LOW,DELTA,Y,N)
```

List of arguments:

1: LOW	R
2: DELTA	R
3: Y	R Array of size N
4: N	I

LOW is the X base value and DELTA the bin width.
Y is the array of N values to be displayed.

HIGR DRTAGF

This controls the form of tags on the axes.

Format of call:

```
CALL HIGR_DRTAGF(IXF, IYF)
```

List of arguments:

```
1: IXF          I
2: IYF          I
```

IXF & IYF control the form of tags along the X & Y axes. They can take the following values:

0 No tags
1 Major tags along lower or left axis only.
2 Major tags along upper or right axis only.
3 Major tags along both axes.
4 Major & minor tags along lower or left axis only.
5 Major & minor tags along upper or right axis only.
6 Major & minor tags along both axes.

HIGR DRTAGS

This controls the number of minor tags per major tag, the size of major tags and the ratio of the size of minor tags to that.

Format of call:

```
CALL HIGR_DRTAGS(MINOR, SIZE, RATIO)
```

List of arguments:

```
1: MINOR        R
2: SIZE         R
3: RATIO        R
```

MINOR is in the range 1 to 9 - the number of minor tags per major tag. SIZE is the size of major tags as a ratio of the axis length. RATIO is the ratio of heights of minor tags to major tags.

EXTRA USER ROUTINES

HIGR_GZBGN

starts up GKS workstation and sets text & pen representations.

Format of call:

```
CALL HIGR_GZBGN(WKID,CONID,WS,PRECIS)
```

List of arguments:

```
1:WKID        I
2:CONID       I
3:WS          I
4:PRECIS      I
```

WKID is the workstation identifier.
CONID is the connection identifier.
WS is the workstation type.
PRECIS is the text precision.
See "SIMPLE USE OF DRPLOT"

HIGR_GZEND

Closes down active GKS workstation and shuts down GKS

Format of call:

```
CALL HIGR_GZEND(WKID)
```

List of arguments:

```
1:WKID        I
```

WKID is the workstation identifier.

HIGR_GZMEM

Remembers GKS attributes which DRPLOT changes. Used with HIGR_GZRST.

List of arguments:

None

HIGR_GZRST

Reset attributes remembered by HIGR_GZMEM.

List of arguments:

None

HIGR_GZHLS

Assigns new GKS pen to highlight.

Format of call:

```
CALL HIGR_GZHLS(GKSPEN,N)
```

List of arguments:

```
1:GKSPEN      I
2:N           I
```

N is the highlight number. GKSPEN is the GKS pen number.

HIGR GZDEF

Sets standard pen defaults.

Format of call:

```
CALL HIGR_GZDEF(WKID)
```

List of arguments:

```
1: WKID          I
```

WKID is the workstation identifier

HIGR HSTGMA

Draws histogram on users existing axes.

Format of call:

```
CALL HIGR_HSTGMA(XMIN, YMIN, DELTAX, DYAR, YMAX, DX, DY, TYPE, SRND)
```

List of arguments:

```
1: XMIN          R
2: YMIN          R
3: DELTAX        R
4: DYAR          R Array
5: YMAX          R
6: DX            R
7: DY            R
8: TYPE          R
9: SRND          R
```

(XMIN, YMIN) is the bottom left hand corner of the histogram.
DELTAX is the bin width.
DYAR is the Yaxis array of bin values.
YMAX is the REAL equivalent of the maximum dimension of DYAR
DX, DY, & TYPE control the shading. Here is a list of patterns.

```
 TYPE=0 Each bin drawn as an empty rectangle.
      1 Horizontal lines drawn , separated by DY
      2 Vertical lines drawn , separated by DX
      3 As 1 + 2
      4 Diagonals separated by DY, at TAN-1(DY/DX) to horizontal.
      5 Diagonals separated by DY at PI-TAN-1(DY/DX) to horizontal
      6 Cross hatching ( as 4 + 5 ).
      7 As 1 but with dashed lines.
      8 As 7 but alternating.
      9 As 2 but with dashed lines.
     10 As 9 but alternating.
```

TYPE is rounded towards zero.
SRND controls the production of a histogram border

```
SRND=1 Border
     0 No border
```

SRND is rounded towards zero.

Plus all GKS routines. Especially useful are GKS_SVW & GKS_SPRP.

LINKING AND EXECUTING DRPLOT PROGRAMS

To link the program PROG on the VAX use the following command:

```
LINK PROG,HIGRLINK/OPT
```

Before executing a program the following assignment must be made:

```
ASSIGN GKSWDT FOR030
```

*** A SET OF ILLUSTRATIONS AND A SAMPLE PROGRAM FOLLOW ***

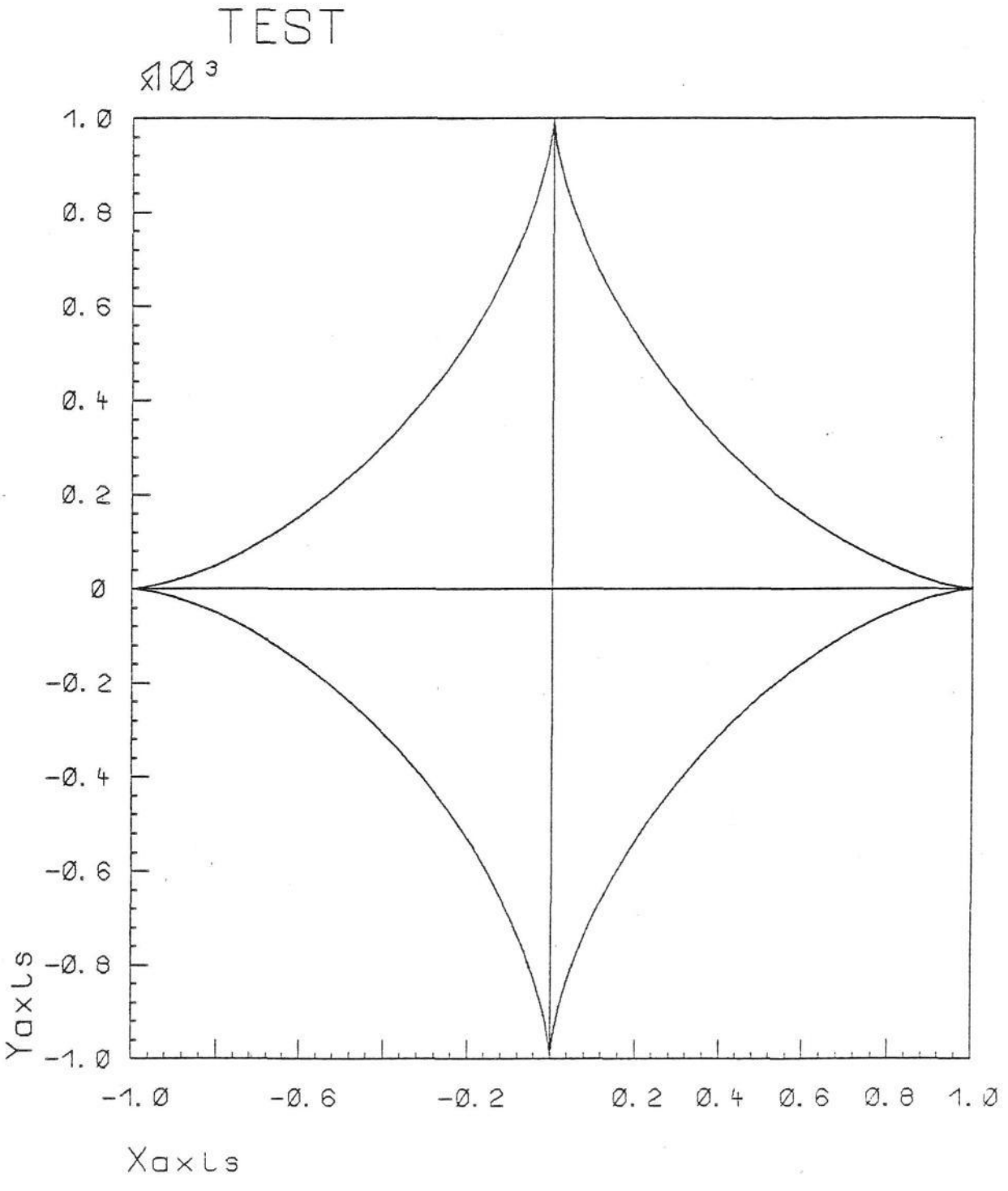
TEST PROGRAM

```
      PROGRAM DRTEST
* TEST OF HIGR_DRPLOT & HIGR_DRARRO
      DIMENSION X(721),Y(721),DX(721),DY(721),XDASH(721),YDASH(721)
* SET UP GKS & TEKTRONIX
      CALL HIGR_GZBGN(4,0,2,2)
* WORK OUT DATA
      DTHETA=2.0*3.1415926/720.0
      DO I=1,721
        THETA=THETA+DTHETA
        R=COS(6.0*THETA)*0.9
        X(I)=R*COS(THETA)
        Y(I)=R*SIN(THETA)
        DX(I)=-X(I)*0.1
        DY(I)=-Y(I)*0.1
        XDASH(I)=COS(THETA)
        YDASH(I)=SIN(THETA)
      END DO
* DRAW CIRCLE
      CALL HIGR_DRPLOT(XDASH,YDASH,721,'
     :X-AXIS#','Y-AXIS#','TEST OF DRPLOT ON VAX#','#')
* DRAW PETAL CURVE
      CALL HIGR_DRARRO(X,Y,DX,DY,721,0.1)
* CLOSE GKS
      CALL HIGR_GZEND(4)
      END
```

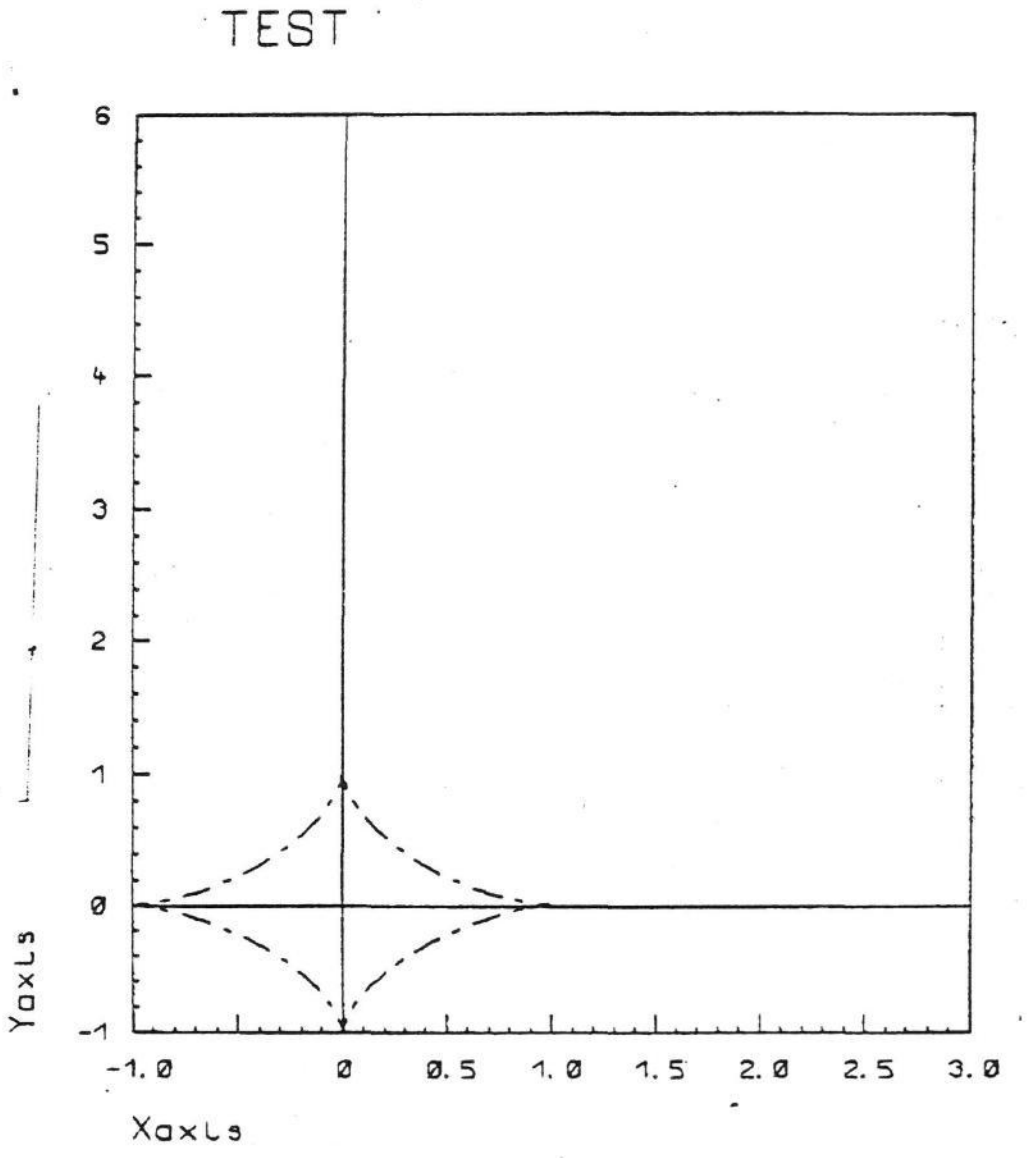
This produced the cover picture

J. M. R. Martin

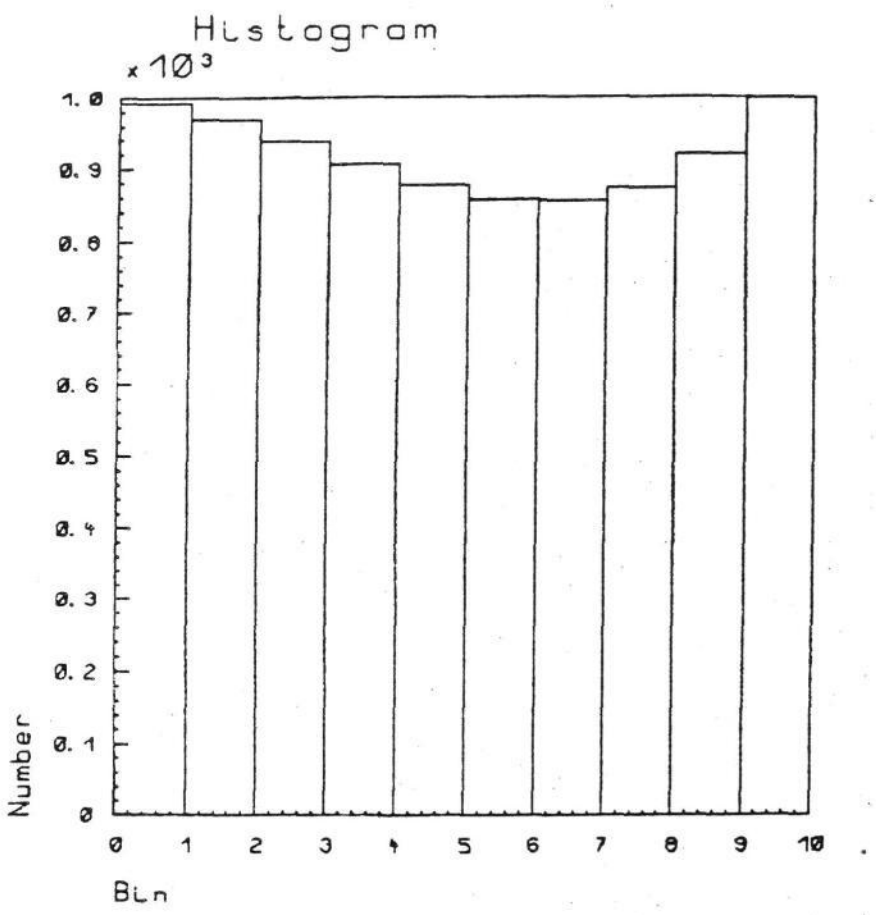
1


TEST
x10^3
1.0
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1.0
Yaxis
-1.0
-0.6
-0.2
0.2
0.4
0.6
0.8
1.0
Xaxis

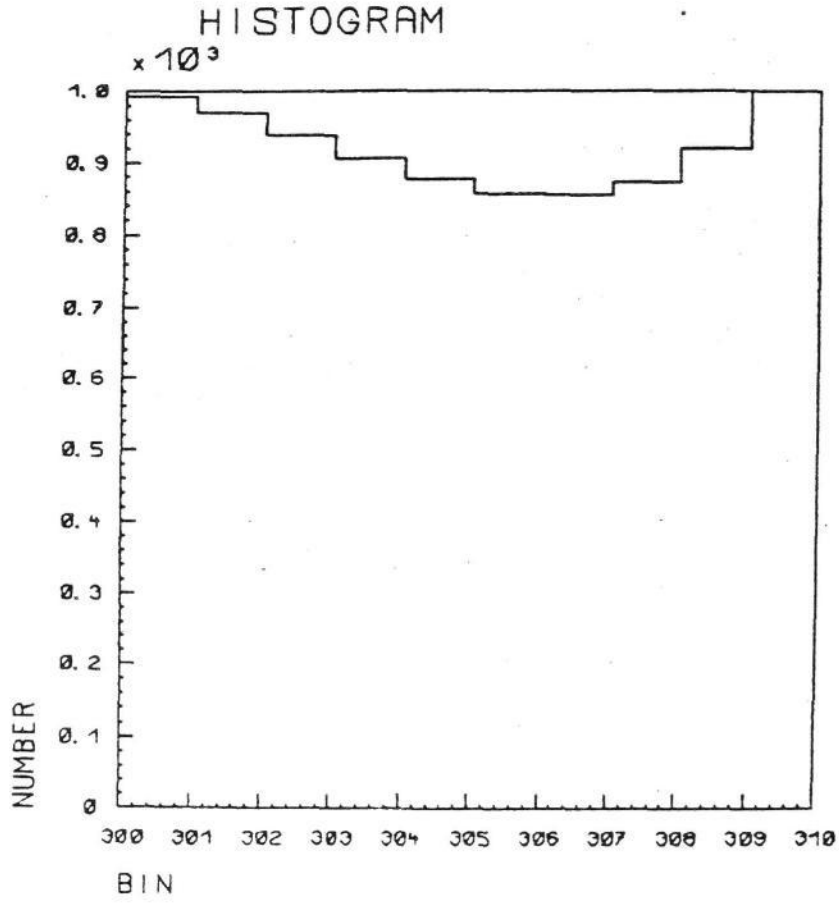
2



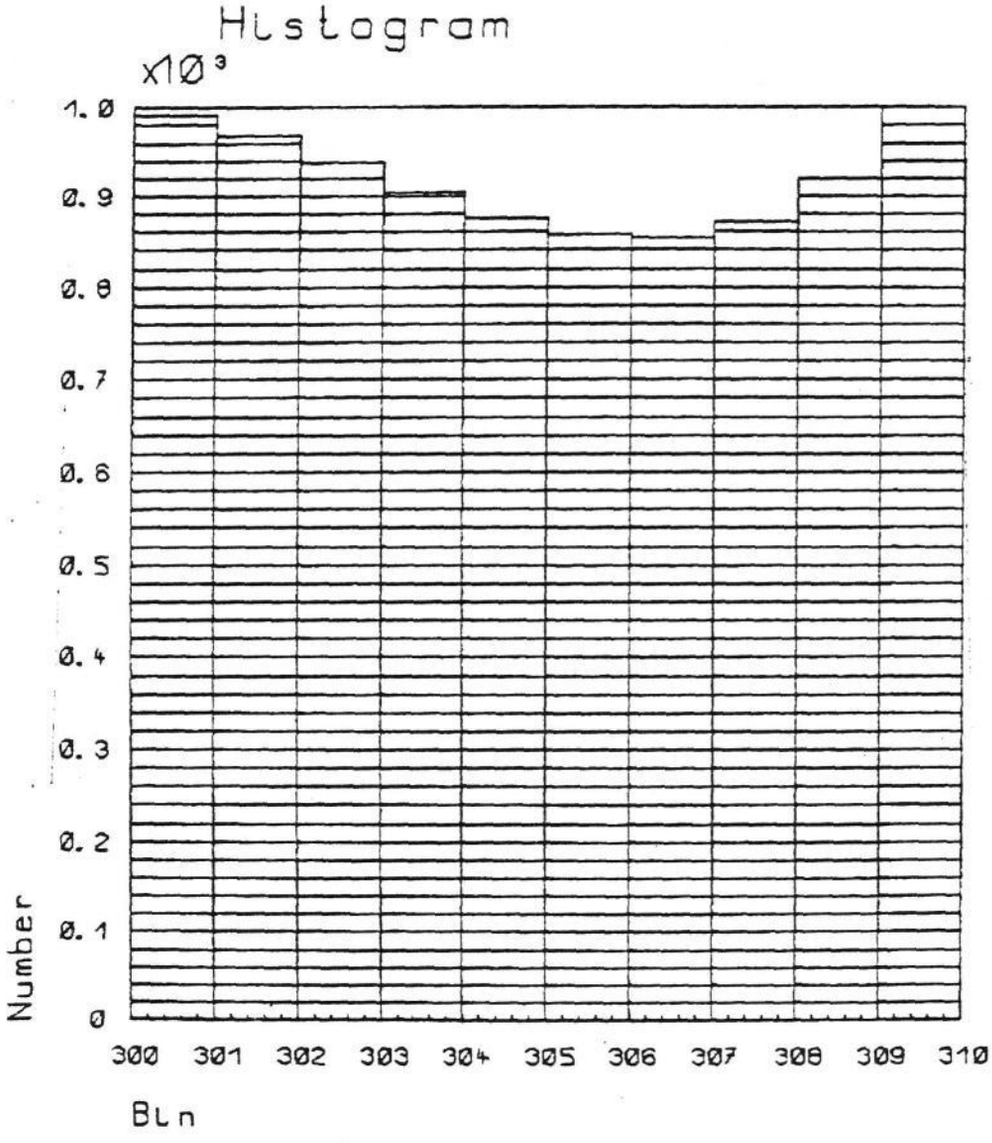
3


Histogram
x 10³
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
Number
0 1 2 3 4 5 6 7 8 9 10
Bin

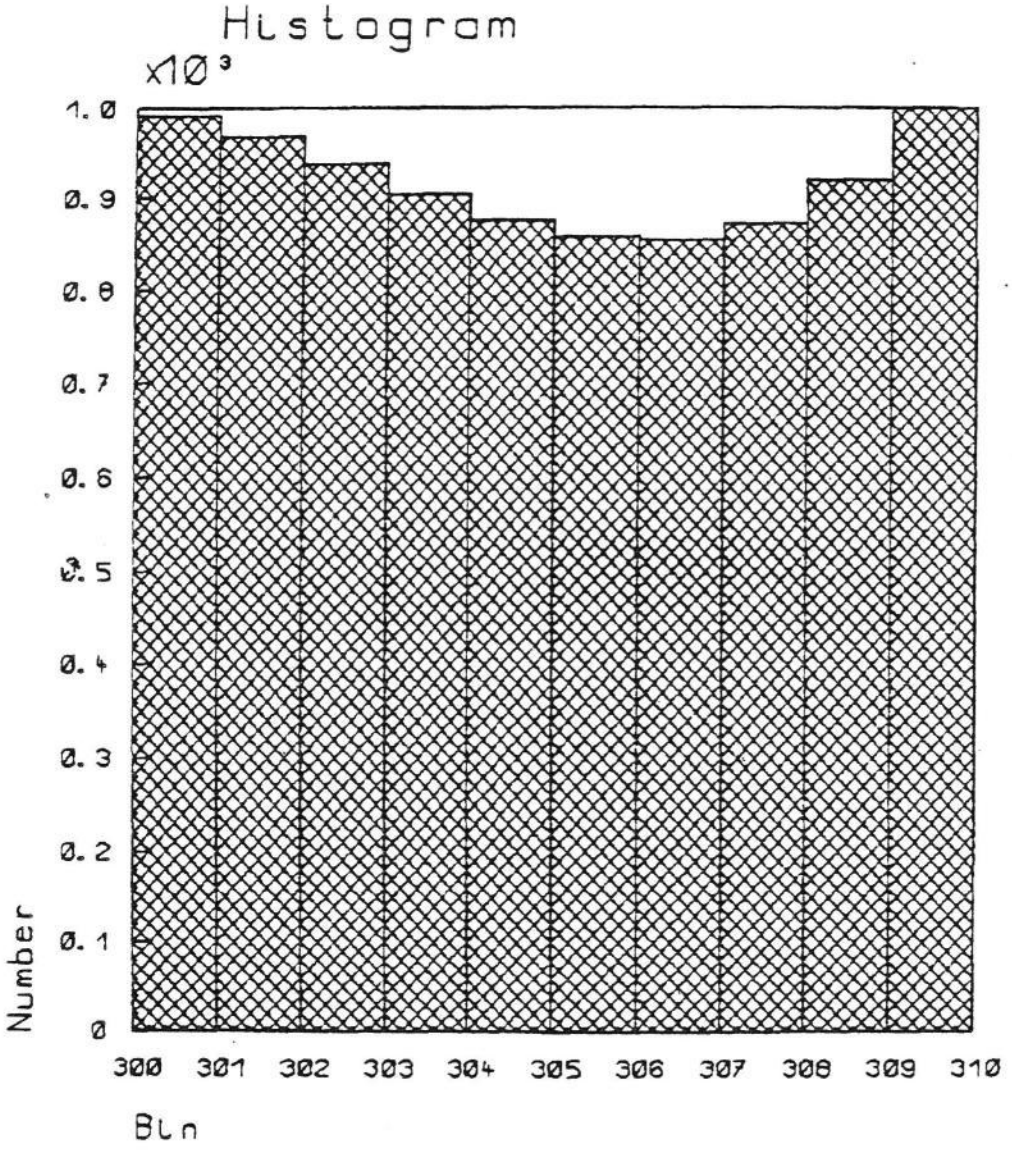
4


HISTOGRAM
x 10³
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
NUMBER
300 301 302 303 304 305 306 307 308 309 310
BIN

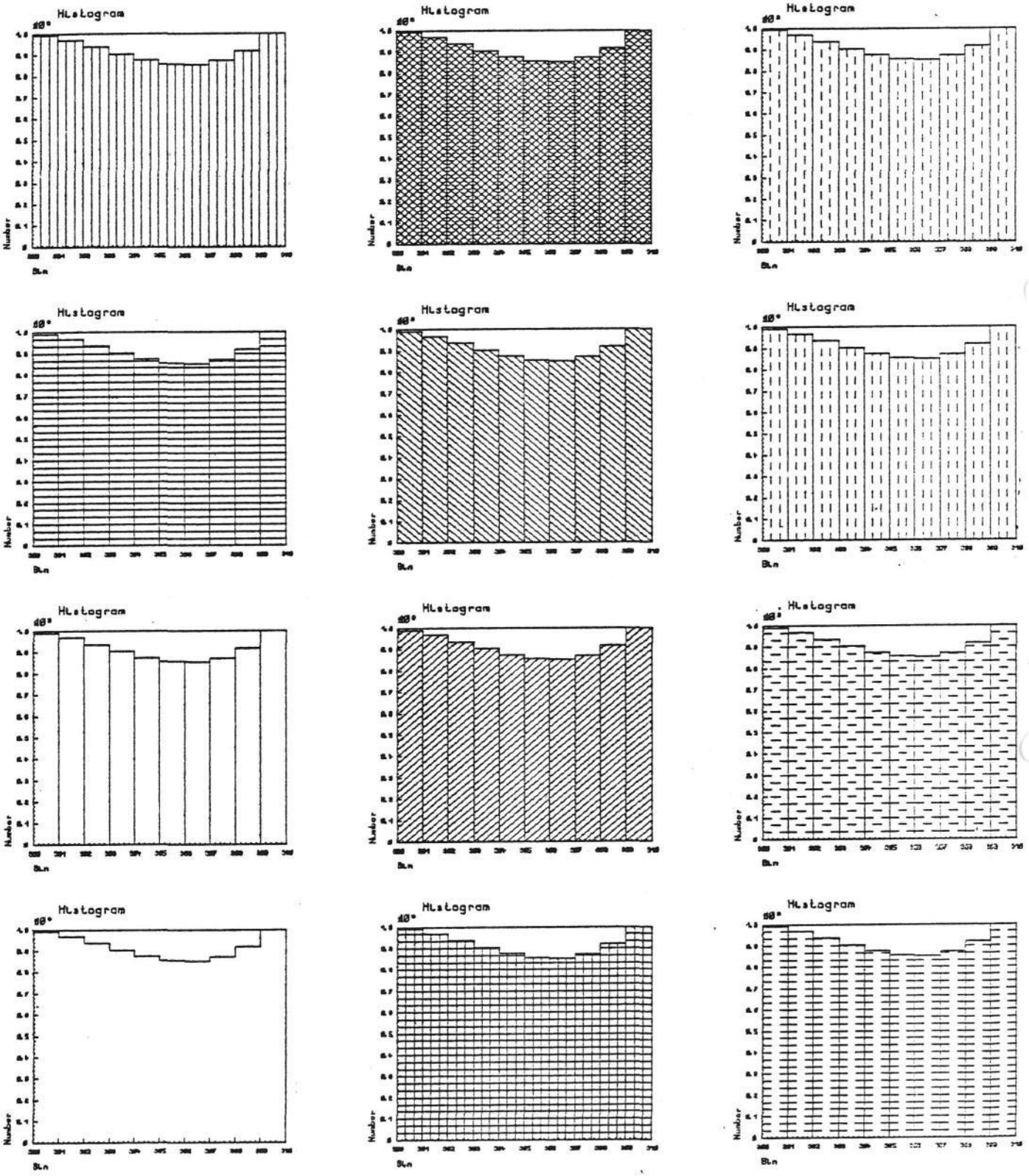
5


Histogram
x10³
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
Number
300
301
302
303
304
305
306
307
308
309
310
Bin

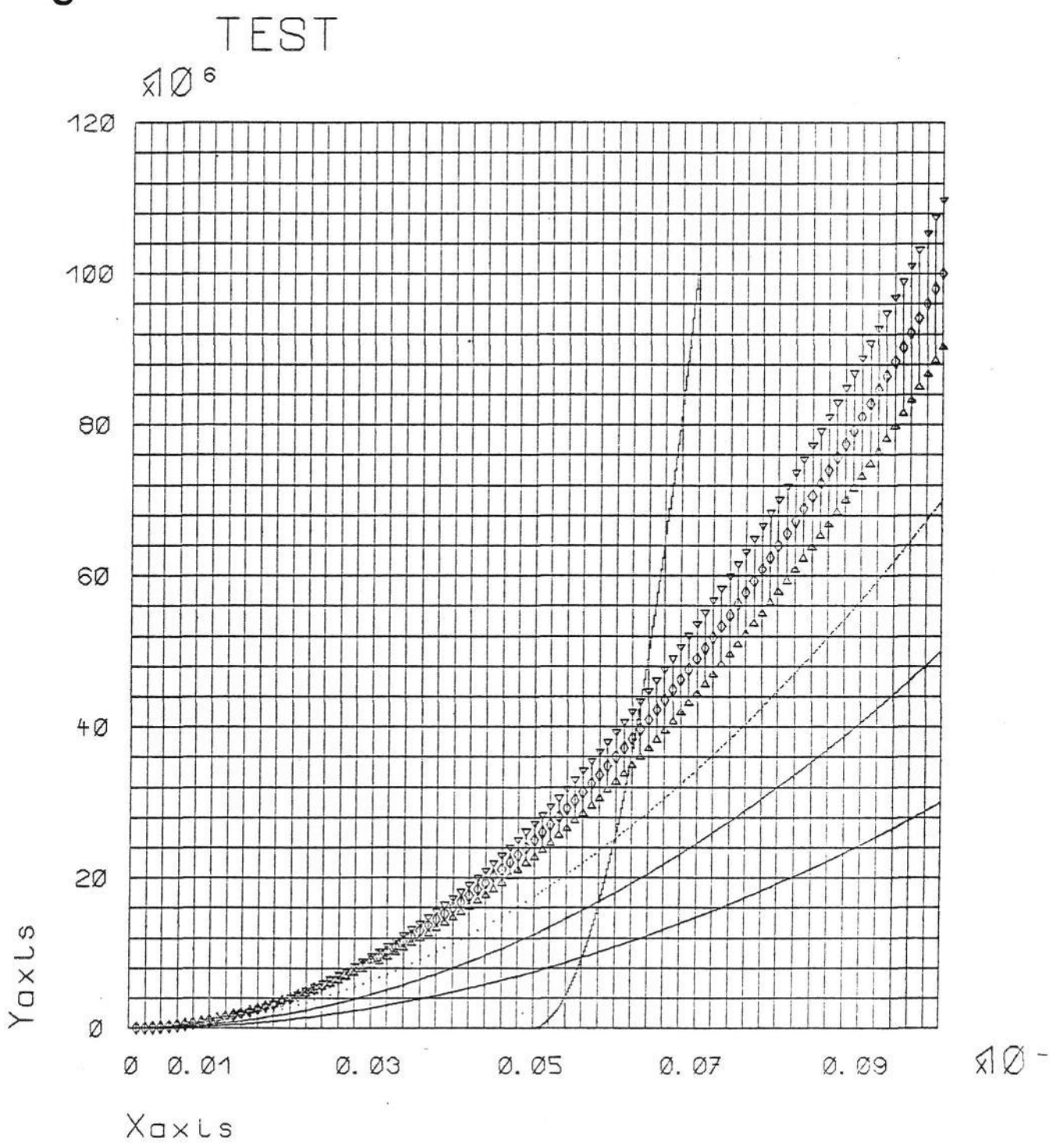
6


Histogram
x10³
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
Number
300
301
302
303
304
305
306
307
308
309
310
Bin

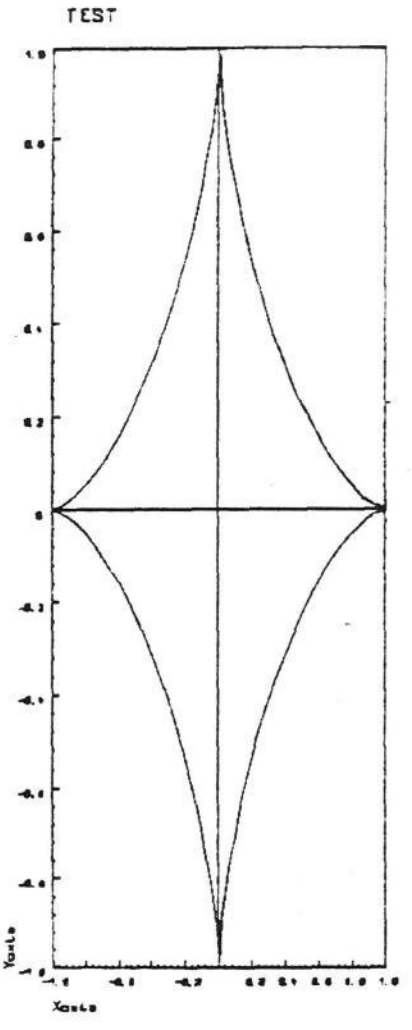
7



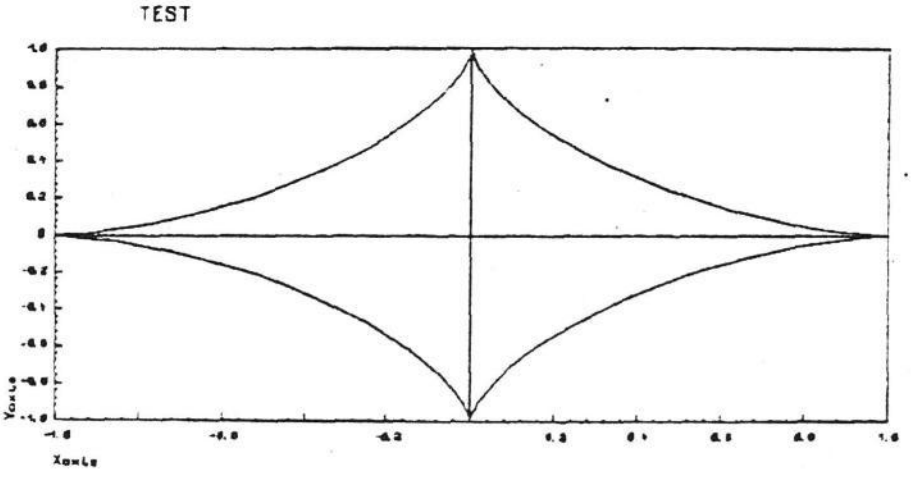
8


TEST
x10^6
120
100
80
60
40
20
0
Yaxis
0
0.01
0.03
0.05
0.07
0.09
x10^-
Xaxis

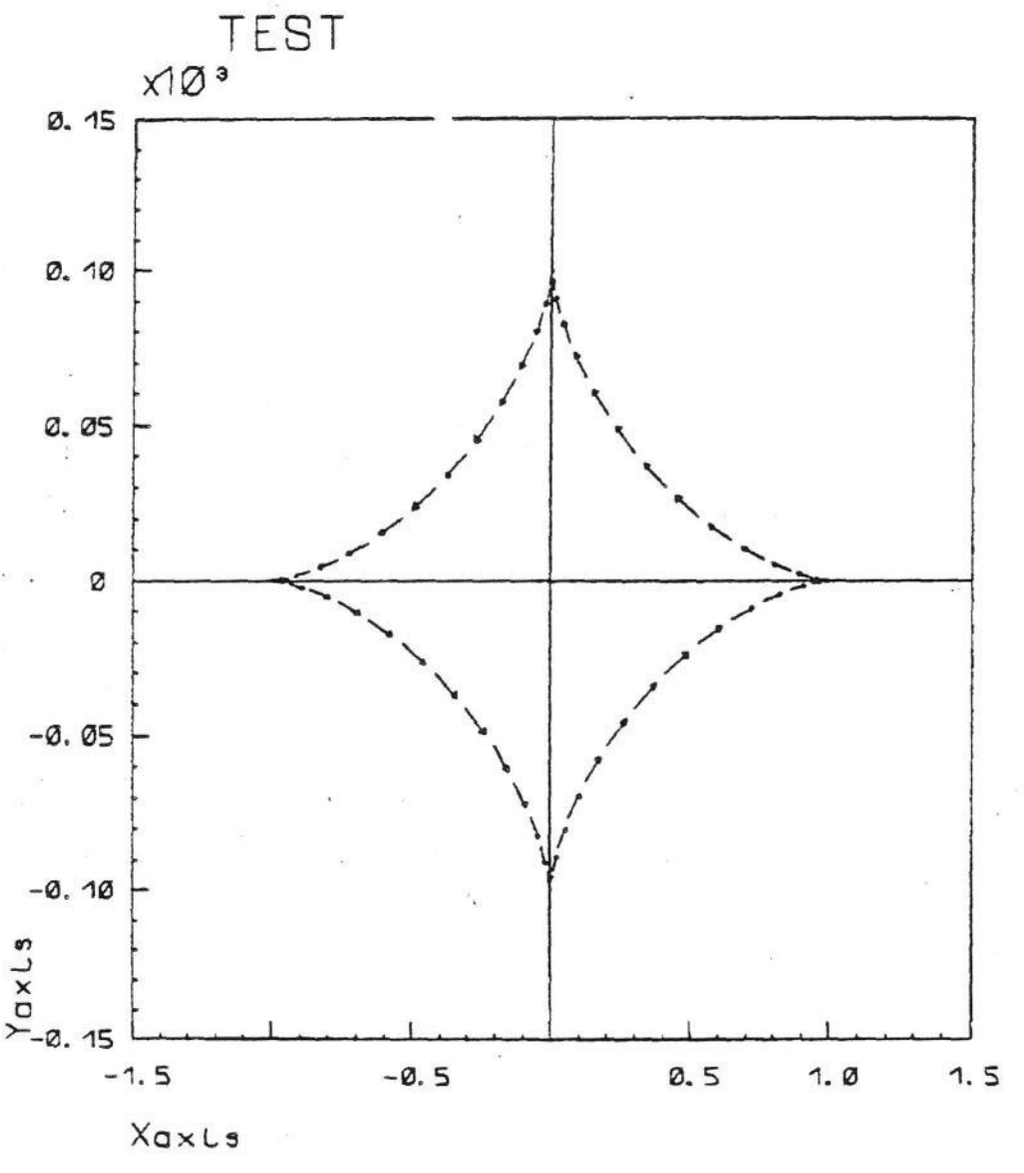
9



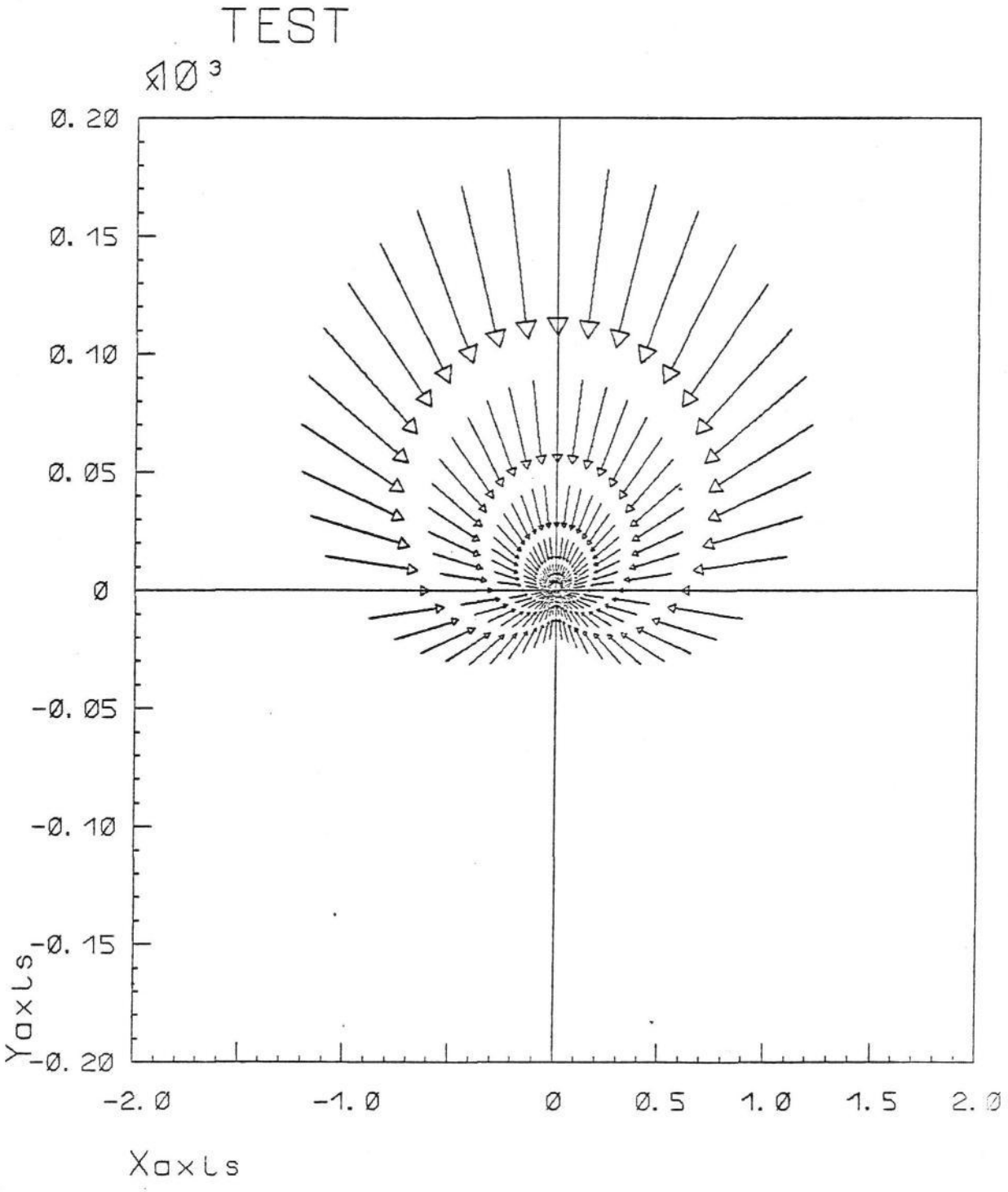
10



11



12


TEST
X10³
0.20
0.15
0.10
0.05
0
-0.05
-0.10
-0.15
-0.20
Yaxis
-2.0
-1.0
0
0.5
1.0
1.5
2.0
Xaxis