SCIENCE AND ENGINEERING RESEARCH COUNCIL SUN/16.1

RUTHERFORD & APPLETON LABORATORIES
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Starlink Project

S T A R L I N K U S E R N O T E 16.1

Drawing Three Dimensional Histograms on VAX

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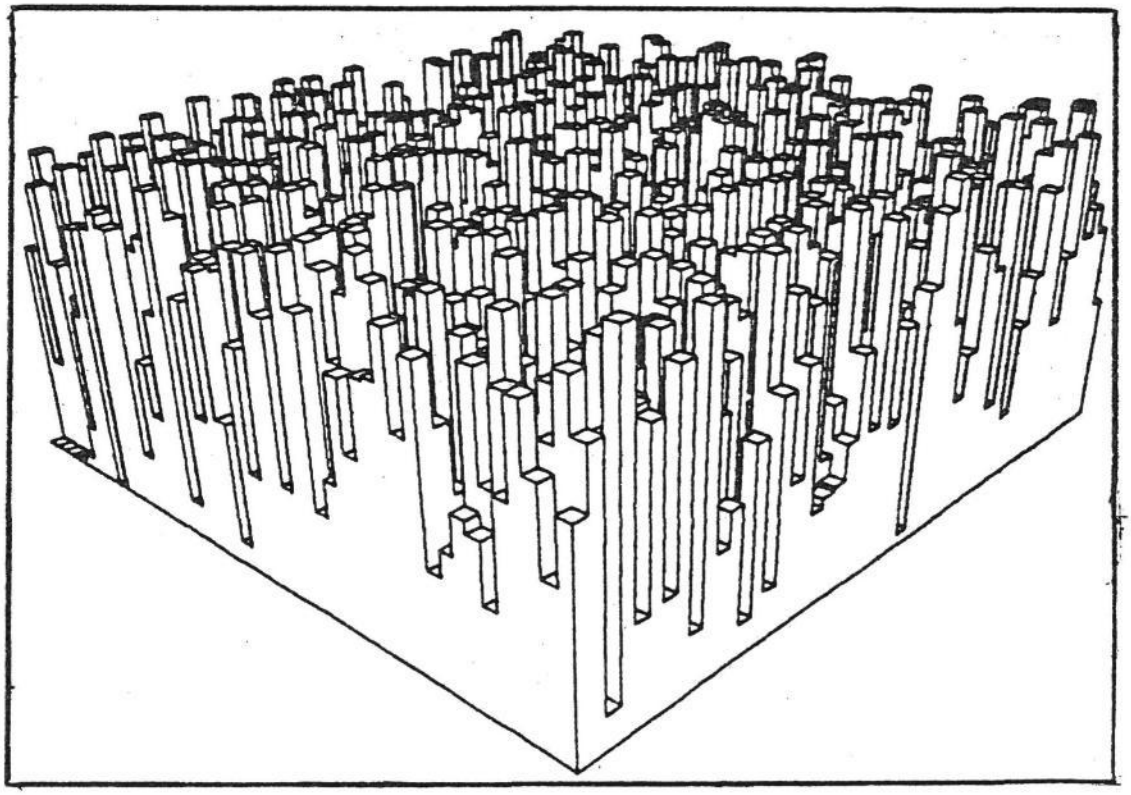
A FORTRAN routine HIGR_HIST3D which draws three dimensional histograms has been added to the VAX software. Data is supplied to the routine in a two dimensional array of values. The three dimensional histogram is drawn as a set of rectangular columns ("pillars") whose bases form a rectangular grid and whose heights are proportional to the corresponding array elements. It is drawn using a perspective projection with hidden line removal. Scaling factors for the histogram may be specified as well as horizontal and vertical viewing angles and the viewing distance. It is possible to shade the histogram on a "Raster" device.



SETTING UP GKS FOR HIGR_HIST3D

The VAX version of HIGR_HIST3D is written above the package GKS and it is normal to use the routines HIGR_GZBGN & HIGR_GZEND to set up & close GKS for HIGR_HIST3D. It is not necessary to consult GKS documentation for simple use of HIGR_HIST3D.

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 is irrelevant as far as HIGR_HIST3D is concerned

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

HIGR HIST3D AND OPTION SETTING USER ROUTINES

HIGR HIST3D

This draws a three dimensional histogram, setting up its own window limits.

Format of call:

```
CALL HIGR_HIST3D(HDATA, ID, MX, MY, ZS, YRAT, ZRAT, THETAH, THETAV, PERS)
```

List of arguments:

1: HDATA	R array of size (ID, MY)
2: ID	I
3: MX	I
4: MY	I
5: ZS	R
6: YRAT	R
7: ZRAT	R
8: THETAH	R
9: THETAV	R
10: PERS	R

HDATA is a two-dimensional array containing the data to be plotted in the three dimensional histogram.
ID is the first dimension of HDATA.
MX & MY are the numbers of pillars to be drawn in the X & Y directions
ZS is the height in the units of HDATA of the data cuboid the shape of which is defined by ZRAT & YRAT. If ZS is negative the maximum number in HDATA is taken for this height instead.
YRAT & ZRAT define the shape of the limiting data cuboid of the histogram, being the ratios of the lengths of the side in the y & z directions to the x length.
THETAV & THETAH are the vertical and horizontal viewing angles in degrees. They must lie in the range 0.0-90.0 exclusive.
PERS is the viewing distance, taking the side of the data cuboid in the X direction to be 1 unit in length. It is recommended that the value be about 20.0.
The quantities which set up the user's coordinate system are illustrated in figure 4 which also shows the transformation into the program's working coordinate system.

HIGR H3SHAD

This sets an option for all subsequently drawn histograms to be shaded or cancels this effect.

Format of call:

```
CALL HIGR_H3SHAD(BOOL)
```

List of arguments:

1: BOOL	L

If BOOL is set to .TRUE. subsequent histograms will be shaded. This shading inolves a certain amount of overwriting on the frame so it is only useful on "Raster" devices. The process is long if HDATA is large - 50x50 would take about fifteen minutes to draw. After the shading has been done the lines of the picture are drawn as in the unshaded case. The user may select the four colours used in this process.

HIGR H3FRAM

This sets an option concerning the frame border.

Format of call:

```
CALL HIGR_H3FRAM(BOOL)
```

List of arguments:

```
1:BOOL          L
```

If BOOL is set to .FALSE. no frame border will be drawn but if BOOL is .TRUE. as by default one will.

HIGR H3SPEN

This assigns a highlight to a HIGR_HIST3D pen. See "HIGR_HIST3D drawing styles" below.

Format of call:

```
CALL HIGR_H3SPEN(N,NPEN)
```

List of arguments:

```
1:N             I
2:NPEN          I
```

N is the highlight number and NPEN the HIGR_HIST3D pen number.

EXTRA USER ROUTINES

HIGR GZBGN

starts up GKS workstation and set 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.

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.

******SEE SUN/13.1:"EXTRA USER ROUTINES" FOR MORE******
******ALSO FOR USE OF GKS WITH HIGH LEVEL ROUTINES******

HIGR_HIST3D drawing styles

HIGR_HIST3D will, by default, distinguish certain aspects of a picture, if the facilities are available on a device. There are four numbered HIGR_HIST3D pens corresponding to the various features of a HIGR_HIST3D picture as follows:

1: Shading for top of blocks
2: Shading for left hand face of blocks
3: Shading for right hand face of blocks
4: Line drawing

The HIGR_HIST3D pens are mapped onto a series of highlights which are set up by HIGR_GZBGN with a standard set of styles & colours. The pens are lated to the highlights as follows:

HIGR_HIST3D PEN	HIGHLIGHT
1	2
2	6
3	8
4	1

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.

The user can select different highlights for different aspects of the picture by calling HIGR_H3SPEN(HILITE,HP) which causes the highlight number HILITE to be assigned to the HIGR_HIST3D pen HP for subsequent drawing.

If totally different colours or styles are required, GKS or GKS-related routines must be used. These are covered under "USE OF GKS WITH HIGH LEVEL ROUTINES" in SUN/13.1.

.INKING AND EXECUTING HIGR HIST3D 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
```

*** SOME ILLUSTRATIONS AND A TEST PROGRAM LISTING FOLLOW ***

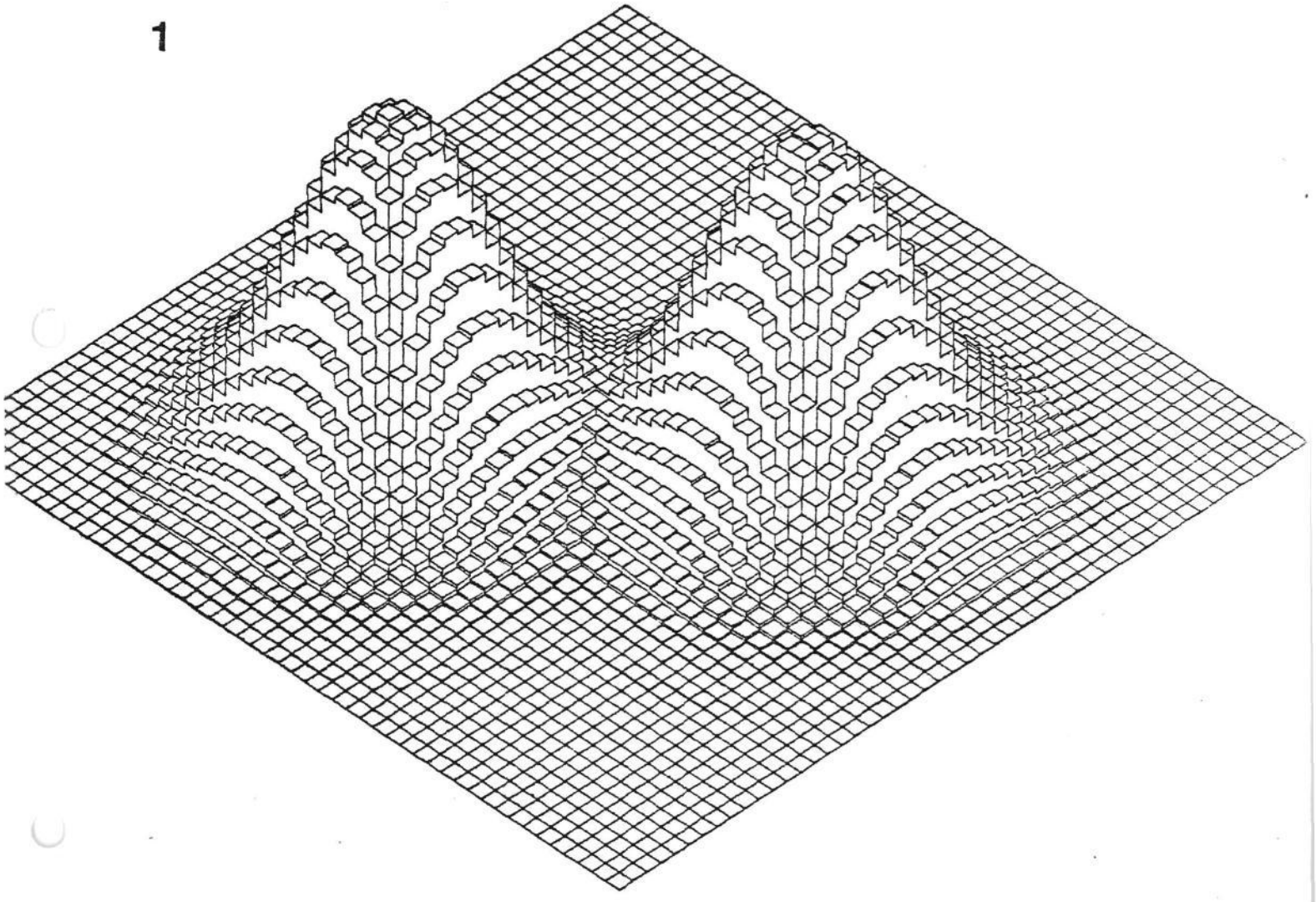
Sample Program

```
      PROGRAM H3TEST
* Test of HIGR_HIST3D
      REAL RMESH(50,50)
* Y Height ratio
      YRAT=1.0
* Z Height ratio
      ZRAT=0.5
* Horizontal viewing angle
      THETAH=45.0
* Vertical viewing angle
      THETAV=45.0
* Viewing distance
      PERS=1.0
* Set up GKS
      CALL HIGR_GZBGN(4,0,IDVICE,2)
* Work out data
      DO J=1,50
        Y=0.14*J-0.1
        DO K=1,50
          X=0.14*K-0.1
          Z1=8.0*EXP(-((X-2.3)*(X-2.3)+(Y-2.3)*(Y-2.3)))
          Z2=8.0*EXP(-((X-4.2)*(X-4.2)+(Y-4.6)*(Y-4.6)))
          RMESH(J,K)=Z1+Z2
        END DO
      END DO
* Draw picture
      CALL HIGR_HIST3D(RMESH,50,50,50,-1.0,YRAT,ZRAT,THETAH,THETAV,PERS)
* End program
      CALL HIGR_GZEND(4)
      END
```

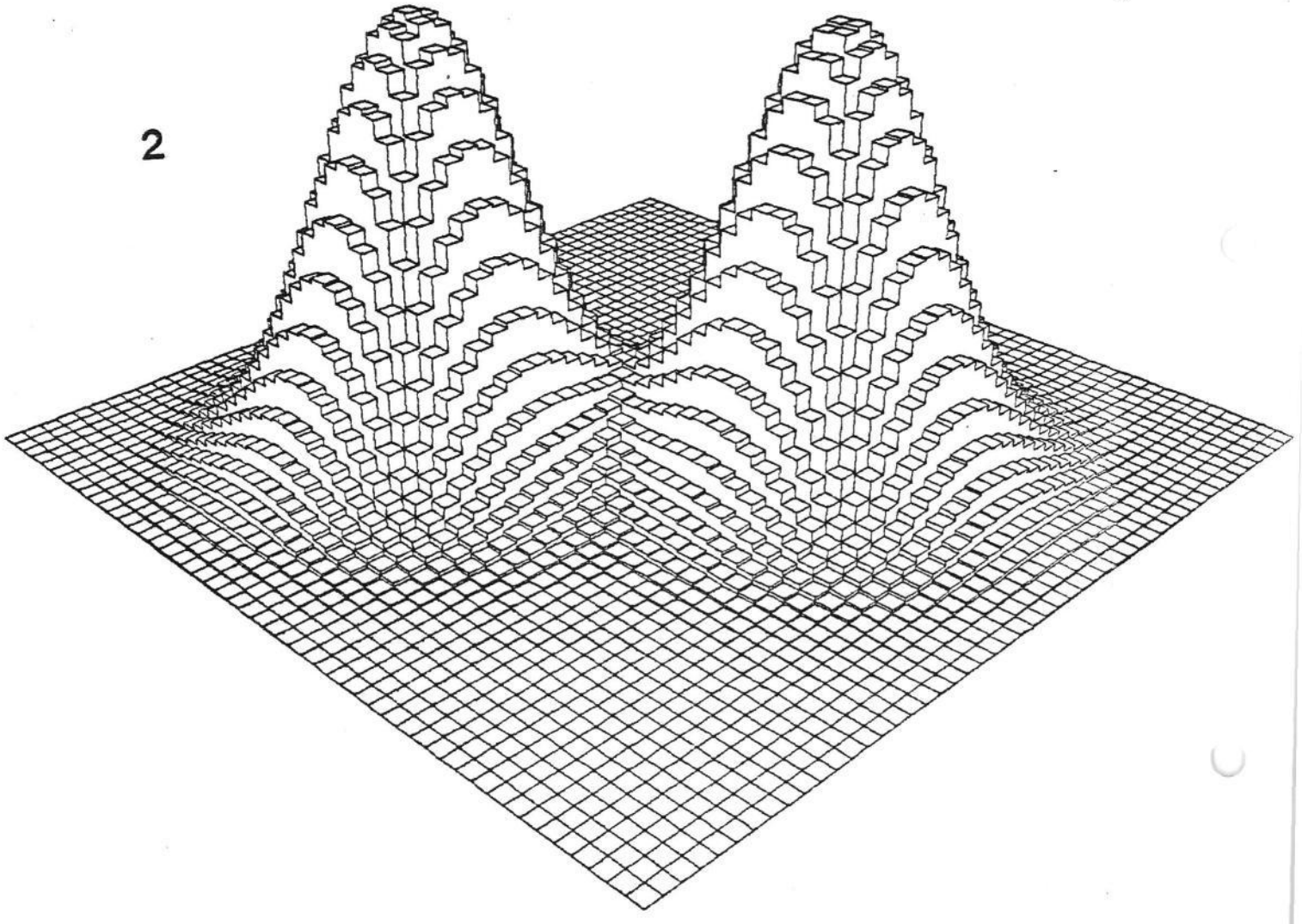
This produced figure 1.

J. M. R. Martin

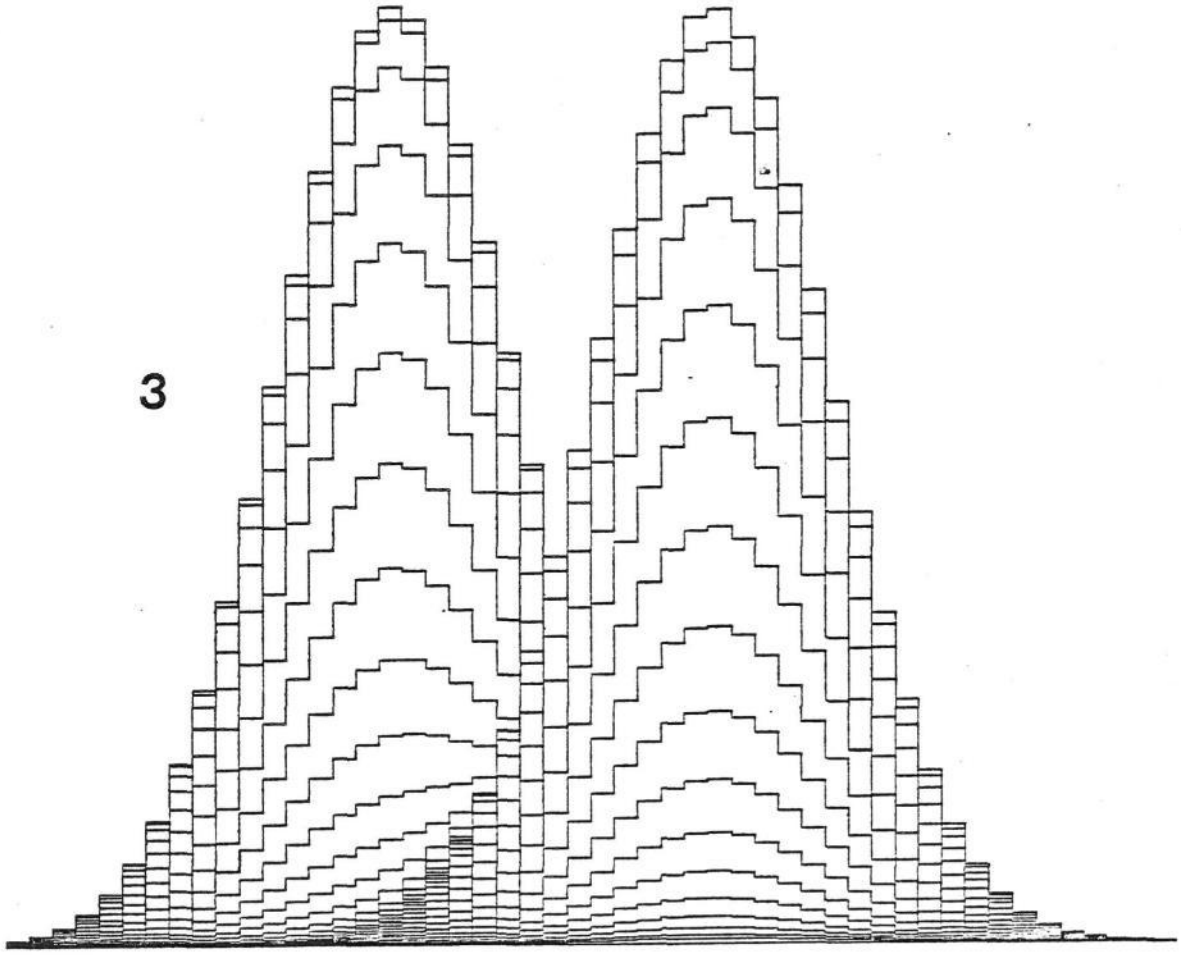
1

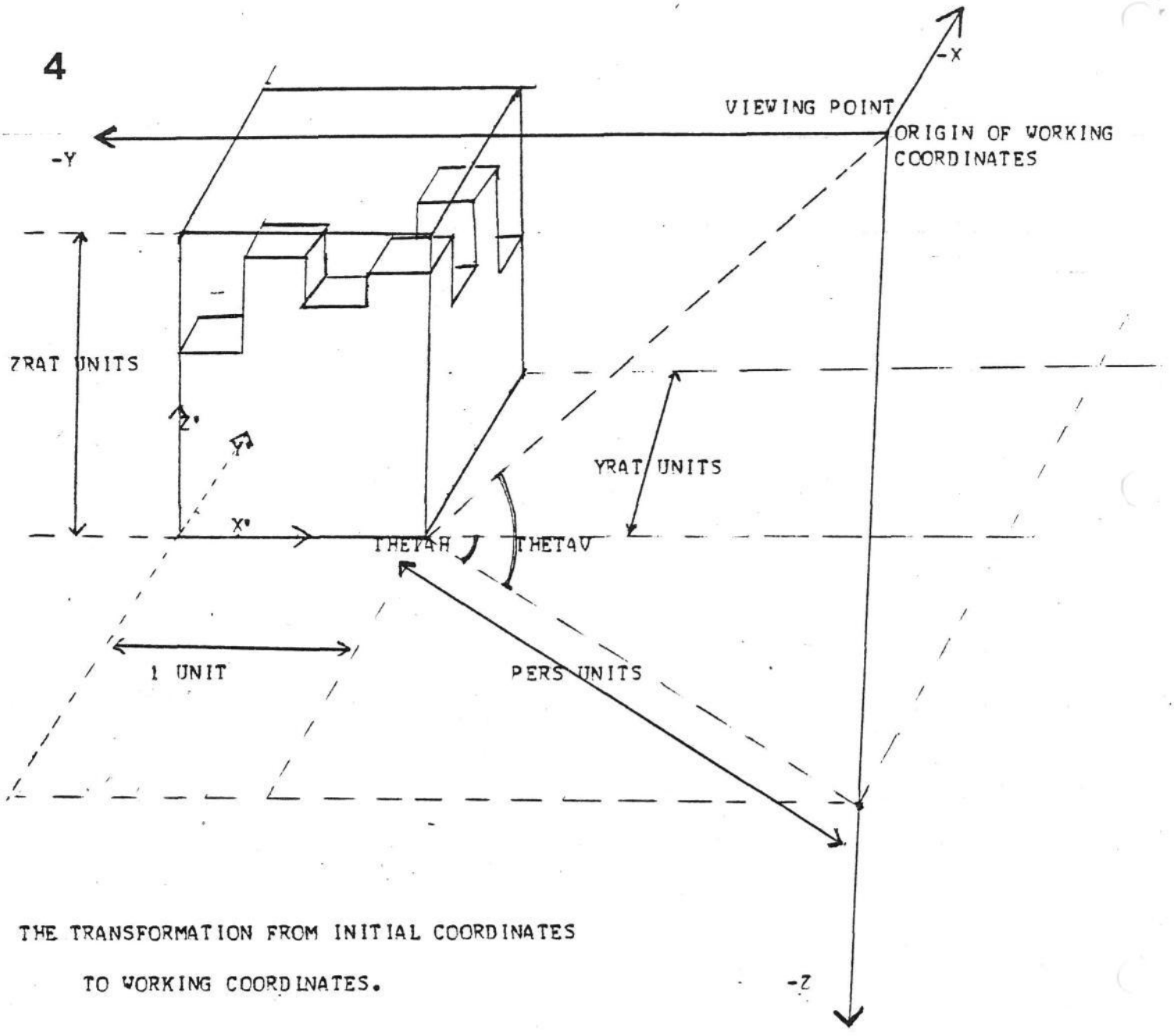


2



3





THE TRANSFORMATION FROM INITIAL COORDINATES

TO WORKING COORDINATES.

(X',Y',Z') ARE THE HISTOGRAM COORDINATES. (X,Y,Z) ARE THE WORKING COORDINATES FOR HIST3D. THESE ARE THEN MAPPED ONTO (XP,YP), THE SCREEN COORDINATES, WITH HIDDEN LINE REMOVAL. THETAH ,THETAV, ZRAT, YRAT, & PERS ARE ARGUMENTS OF HIST3D.