3 GETTING STARTED WITH THE CGIS SOFTWARE

Here is a sample session to get you off and running using CGIS software. Sit down at a CGIF workstation console and log in. The main body of the directions will describe what you see if you are using a VAXstation; we have placed any differences you will encounter as a DECstation user in the side notes. Once you have a DECterm window waiting at the system level prompt, you are ready to begin. (If you are unfamiliar with using the CGIF workstations, see chapter 3 of the *COBE Guest Investigator Handbook*.)

The problem:

* Extract and display the 696 GHz map from the FIRAS Project Data Set (PDS) skymaps

* Display the signal levels for pixels on a line through the galactic plane for the 696 GHz band

* Produce a hardcopy plot

Command sequences are provided so that you may do the example in both UIMAGE and UIDL. Our comments will refer you to specific sections of this guide or to the online help for more information.

In the examples below, we use **`this font for computer prompts and replies`**, `this font for your keyboard entries`, and *this font for our side comments*. Menu choices are presented like this:

Menu title:	Select this item:
Title of this menu	Choice from this menu

This is a comment relating to the menu item.

To make menu selections, use the mouse to position the screen cursor on the menu choice, and click (press and release) the left mouse button.

You will also see the following prompts:

$	when you are at the system level
UIDL>	when you are within UIDL
<CR>	means to press the `RETURN` key

3.1 USING UIMAGE

Setting up

$ CGIS

This starts the GI software (see section 2.1). End each command in the DECterm window with a <CR>. ULTRIX is case-sensitive, so DECstation users must enter the command in LOWER CASE (`cgis`).

Startup messages appear in the DECterm window, followed by the CGIS Main Menu.

Getting the data

Here is the first series of selections to be made:

Menu title:	Select this item:
CGIS Main Menu	COBE Data and Analysis Menus (UIMAGE)...

Move the mouse so that the arrow points to the selection, then push and release the left mouse button.

Menu title:	Select this item:
UIMAGE [MAIN MENU]	Data I/O and Management...

See section 4.3 for more information on UIMAGE data I/O.

Menu title:	Select this item:
Select Input Format	FITS files

See section 4.3.1 for more details on reading in Initial Product data sets.

Enter the directory to search for your data.

Press Return to use the default directory: CGIS_FITS.
Enter "back" to return to the previous menu.
CGIS_FITS is defined as ADBDISK:[PDS_FITS].

These messages appear in the DECterm window.

This is the location of the Project Data Sets. You can instead specify your own or another archive area directory. ULTRIX users will see the directory defined as /cuba_b/cgis/data/pds.

> <CR>

*Press the "*RETURN*" key to use the UIMAGE default directory.*

Menu title:	Select this item:
Select Data Set – CGIS_FITS:	FIRAS_ALL_SKY_SPECTRA_ RHSS.FITS;1

All available skymaps in this directory will be listed in this menu. You may find that the visible part of the menu title is truncated. ULTRIX users will see the directory in the menu title as $CGIS_FITS/ *and the file name as* firas_all_sky_spectra_rhss.fits.

Menu title:	Select this item:
Would you like to review the FITS header?	No

Menu title:	Select this item:
Would you like to review the Extension header?	No

Menu title:	Select this item:
Field List	REAL_SPE

```
You have selected field REAL_SPE  .

This field has an array of values for each pixel, so you should
now select a range of elements or the retrieve the entire field.
```

You may also choose a single frequency, as we shall do here.

```
   Dimensions of REAL_SPE   :   (1:168)

For a range, use a colon to separate the upper and lower bounds.
Type "ALL" if you want the data for the entire field REAL_SPE  .

Specify units with the range using one of the following:

                                          Valid Ranges
  IDX  (default)    - indices            (1,168)
  GHZ               - gigahertz          (67.913,2903.27)
  ICM               - wave numbers       (2.265,96.84)
```

Wave numbers are also known as inverse centimeters.

```
Examples:   ---> 1:50  IDX     (gets the first 50 indices.)
            ---> 60:80 ICM    (gets all indices within the
                               range of wave numbers 60 and 80.)

---> 696 GHZ
```

Here we enter our desired frequency value.

```
The index selected nearest to your specification is :

  696.1 GHZ at index          38
```

This index corresponds to the data I/O index; this channel is the 38th of the 168.

Menu title:	Select this item:
Select Map Face	All - Right-handed T

COBE data is projected onto a cube, which is then unfolded. You may choose one-sixth of the sky (a face) or the entire map (unfolded into a sideways "T" shape). The coordinates are skyward looking.

Reading FITS format file, CGIS_FITS:FIRAS_ALL_SKY_SPECTRA_RHSS.FITS;1

A delay between messages is not unusual. ULTRIX users will see the full file path echoed as **$CGIS_FITS/firas_all_sky_spectra_rhss.fits**.

```
beginning fits processing Thu Sep  9 07:42:23 1993
reading in data Thu Sep  9 07:42:28 1993
reading in pixel data Thu Sep  9 07:44:26 1993
beginning pixelization Thu Sep  9 07:45:14 1993
Placing data into UImage object.
```

A new window appears with title
CGIS_FITS:FIRAS_ALL_SKY_SPECTRA_RHSS [1]
*(***$CGIS_FITS/firas_all_sky_spectra_rhss [1]** *for ULTRIX).*
THE IMAGE IS AUTOMATICALLY DISPLAYED IN IT. When the display is complete, the label **RES 6** *will appear in the lower left corner. With the default scaling for this map, you should see three or four segments of the Initial Product galactic plane strip in the COBE unfolded skycube format. (One segment is much lower intensity and often difficult to see with this scaling and color table.) For more information on the skycube format, see Appendix C of the COBE Guest Investigator Handbook, Appendix D of the CDAC Orientation Handbook, or the Initial Product information files* **DIRBE_SKYMAP_INFO.FITS** *and* **DMR_FIRAS_SKYMAP_INFO.FITS**.

Getting information about the data

Menu title:	Select this item:
DATA I/O AND MANAGEMENT	Report object attributes

Display array dimensions, units, bad pixel values, etc.

Menu title:	Select this item:	
Report object attributes	CGIS_FITS:FIRAS_ALL_SKY_ SPECTRA_RHSS[1]	*Choose the image for which you want the information. The ULTRIX object name is* **$CGIS_FITS/firas_all_ sky_spectra_rhss [1]**.

<u>**Attributes of CGIS_FITS:FIRAS_ALL_SKY_SPECTRA_RHSS [1]**</u> — *The ULTRIX object name is* **$CGIS_FITS/firas_all_ sky_spectra_rhss [1]**.

Array dimensions:	**128 x 96**	*This is the size of the native data array.*
Associated 3-D object:	**<no link to a 3-D object>**	*This data object was read in as a single frequency, rather than stripped off of a several-frequency set.*
Associated weights:	**<no link to a weight array>**	*We read in only the data alone, without any errors.*
Hidden Object:	**<object is displayed>**	*UIMAGE objects may be kept in memory but not displayed to keep the workstation display less cluttered.*
Bad pixel value:	**0.000000**	*Pixels flagged as bad for some reason will contain this data value.*
Band number:	**0**	*This field is not currently filled.*
Band width:	**0.000000**	*This field is not currently filled.*
Coordinate-system:	**ECLIPTIC**	*This is the default for the unfolded skycube.*
Data minimum:	**9.486465e-02**	*This is the minimum value of the good pixels. ULTRIX users will see this as 0.0948647.*
Data maximum:	**180.001**	*This is the maximum value of the good pixels.*
Frequency:	**1.00000**	*This field is not currently filled.*

Instrument:	**FIRAS**	
Orientation:	**R**	*This indicates that the coordinates are skyward looking ("right-handed T" in COBE parlance).*
Projection:	**SKY-CUBE**	*This is the native format; objects may also be reprojected within UIMAGE.*
Resolution Index:	**6**	*This is the Quadtree pixelization order. The default for FIRAS and DMR is 6; the default for DIRBE is 9.*
Scaling minimum:	**9.486465e-02**	*This is the value used for the minimum of the display scaling. ULTRIX users will see this as 0.0948647.*
Scaling maximum:	**180.001**	*This is the value used for the maximum of the display scaling.*
Units:	**MJy/sr**	

Menu title:	Select this item:
Report object attributes	Return to previous menu

Menu title:	Select this item:
DATA I/O AND MANAGEMENT	Return to MAIN MENU

Making the image larger

Menu title:	Select this item:
UIMAGE [MAIN MENU]	Display Manipulation...

Menu title:	Select this item:
DISPLAY MANIPULATION	Resize/redraw all windows

This choice changes the size of all existing and future windows (see section 4.4.2.10 for more details).

Menu title:	Select this item:
Window magnification factor	4

The default factor for a resolution 6 image is 2; the default for a resolution 9 image is 1.

Menu title:	Select this item:
Window magnification factor	Return to previous menu

Menu title:	Select this item:
DISPLAY MANIPULATION	Return to MAIN MENU

Looking at the signal across a sky cut

Menu title:	Select this item:
UIMAGE [MAIN MENU]	Line Plots and Statistics...

Menu title:	Select this item:
LINE PLOTS AND STATISTICS	Cross sections, Sky cuts

See section 4.4.4.6 for more information on using the "Cross sections, Sky cuts" option.

Menu title:	Select this item:	
Cross sections, Sky cuts	CGIS_FITS:FIRAS_ALL_SKY_ SPECTRA_RHSS[1]	*Choose an image from the list. Here we have only one choice. ULTRIX users will see the image name as* **$CGIS_FITS/firas_all_ sky_spectra_rhss [1]**.

Menu title:	Select this item:	
Select Entry Mode	Longitude/Latitude	*Choose* **Longitude/Latitude** *to enter points from the keyboard; choose* **Cursor** *to identify points with the mouse.*

Menu title:	Select this item:	
Coordinate System	Galactic	*Choose the coordinate system in which you want to enter the coordinates.*

Please mark points on the window titled: CGIS_FITS:FIRAS_ALL_SKY_SPECTRA_RHSS [1]

This message appears in the DECterm window. Note that you will get this message even if you specified keyboard entry, as we did here. The points will be automatically marked on the image when you enter their coordinates. ULTRIX users will see the window title listed as **$CGIS_FITS/firas_all_ sky_spectra_rhss [1]**.

Click on the DECterm window if it is not the active window (frame is darkened). VAXstation users probably have their sessions set to let the DECterm window remain active.

Enter longitude & latitude of first point (Ex: 30,25):
0.,-15.

The values must be separated by a comma; do not use the "/" character. The decimal points are optional in these entries.

Enter longitude & latitude of second point: `0.,15.`

The line to show the sky cut along the great circle joining the two points appears on the image.

A large graph with title **SC (0.2,-14.9) to (0.1,15.1) G [1]** *appears.*

The title shows that this is a sky cut (SC) in galactic coordinates (G). The endpoint coordinates given are those of the centers of the pixels containing the specified endpoints.

Menu title:	Select this item:
Resize graph?	Yes/Resize the graph

This changes the size of the graph window only.

Menu title:	Select this item:
Select X size	8

The default is 12 in X and Y. (The observed size also depends on the previously set window magnification.) Note that using the same factor for X and Y does NOT give a square window. Users have choices of 8, 12, and 16.

Menu title:	Select this item:
Select Y size	8

Menu title:	Select this item:
[no name]	Exit this menu

Menu title:	Select this item:
Next action for C.S. plot	Return to previous menu

The "C.S." here stands for "Cross Section."

Menu title:	Select this item:
Cross sections, Sky cuts	Return to previous menu

Menu title:	Select this item:
LINE PLOTS AND STATISTICS	Return to MAIN MENU

Making a PostScript hardcopy

Menu title:	Select this item:
UIMAGE [MAIN MENU]	Data I/O and Management...

Menu title:	Select this item:
DATA I/O AND MANAGEMENT	Create a PostScript file

See section 4.3.11 for more information on using this option.

Menu title:	Select this item:
Create a PostScript file	SC (0.2,-14.9) to (0.1,15.1) G [1]

Choose what to print, here the galactic sky cut created before.

You will be prompted below to supply some information regarding the format of the PostScript file, as well as where it should be stored.

Menu title:	Select this item:
Color or Black&White?	Black&White

Menu title:	Select this item:
Portrait or Landscape?	Landscape

The default is **Portrait**. *The X axis of the graph will be aligned with the long axis of the paper.*

The PostScript output will by default be sent to SYS$LOGIN:IDL.PS

ULTRIX users will see the default file path and name as **$HOME/IDL.PS**.

Menu title:	Select this item:
Output file name:	Specify a different name

Click on the DECterm window if necessary.

Enter directory name: *yourdisk*:[*yourdir*]

You may specify a scratch area here. ULTRIX users should use the appropriate syntax. To write to your login directory, use $HOME/ *(do not neglect the slash).*

Enter filename: SKYCUT.PS
The PostScript output has been sent to *yourdisk*:**[***yourdir***]SKYCUT.PS**

Menu title:	Select this item:
Create a PostScript file	Return to previous menu

Menu title:	Select this item:
DATA I/O AND MANAGEMENT	Return to MAIN MENU

Printing the file

Menu title:	Select this item:
UIMAGE [MAIN MENU]	Exit UIMAGE

Menu title:	Select this item:
CGIS Main Menu	Shell to Operating System

You must return to the system prompt to print the file.

Type LOGOUT to return to CGIS

The ULTRIX version directs you to type **EXIT** *when you have finished.*

**$** PRINT/QUE=CGIF$LASER/NOTIFY *yourdisk*:[*yourdir*]SKYCUT.PS

(*ULTRIX users use the command*

csh> lpr -Pcgiflaser $HOME/SKYCUT.PS

Here the user had previously written the file to his or her home directory.)

Send the file to the CGIF laser printer.

Job SKYCUT (queue CGIF$LASER, entry 990) started on CGIF$LASER
Job SKYCUT (queue CGIF$LASER, entry 990) completed

These status messages do not appear in an ULTRIX session.

Now retrieve your printout from the printer.

$ LOGOUT

Leave the shell and return to the **CGIS Main Menu**. *ULTRIX users should type* exit. *Note the use of lower case here.*

Process *username*_**1 logged out at 24-MAY-1993 08:03:27.16**

This status message does not appear in an ULTRIX session.

Menu title:	Select this item:
CGIS Main Menu	Exit CGIS

The following CGIS exit warning message appears in the DECterm window:

```
**** CGIS EXIT ****

All data will be removed from memory upon exit.

Be sure you have written to disk any images or
arrays you have created and wish to save.

**** CGIS EXIT ****
```

Exit CGIS? (Y/N): Y<CR> *The default is* N.

3.2 USING UIDL

UIDL is command line IDL with additional tools written by the COBE group. The example that follows will show you how to do operations like those in the UIMAGE example at the UIDL command line. (You will see some minor differences in the output.) In practice, you will probably use UIDL when you want to run other IDL software that you have written yourself or in cases in which you need more flexibility than may be currently available in UIMAGE. See chapter 5 for more discussion about using UIDL.

Setting up

```
$ CGIS
```

This starts the GI software (see section 2.1 for more information on this option). End each command in the DECterm window with a <CR>. *ULTRIX is case-sensitive, so DECstation users must enter the command in LOWER CASE (*`cgis`*).*

Startup messages appear in the DECterm window, followed by the CGIS Main Menu.

Menu title:	Select this item:
CGIS Main Menu	Go to Command Line (UIDL)

```
Type EXIT to return to VMS or
type CGIS to return to the main menu...
```

NOTE: If you type `EXIT` *from UIDL, you will lose all of your unsaved data. Using CGIS gives you a small safety margin, as well as giving you access to the online documentation. ULTRIX users will return to their ULTRIX session, not be put into VMS.*

Getting the data

```
UIDL> DATAIN, $
UIDL> 'CGIS_FITS:FIRAS_ALL_SKY_SPECTRA_RHSS.FITS', $
```

For ULTRIX users, the prompt is **Uidl>**. *The entry in single quotes is the complete file name and location. For ULTRIX this is* **$CGIS_FITS/firas_all_sky_spectra_rhss.fits**. *While IDL ULTRIX accepts commands in upper case, the file name specification here must be entered in the given mix of cases. The* $ *is the IDL continuation character, allowing you to use more than one line per command.*

```
UIDL> DSFIELD = 'REAL_SPE', SUBSCR = '6', DATA = DATA,$
```

Field names, like REAL_SPE, are listed in the appropriate Explanatory Supplement for each instrument. SUBSCR is the array subscript(s) (frequency or wavelength) to pull out. Frequency subsetting information is found in the Supplements, or in Table 4.1.

```
UIDL> BADPIXVAL = BADPIXVAL, RES = RES, UNITS = UNITS,$
```

We are also storing the data value for bad pixels, the pixelization resolution, and the units associated with the data field.

```
UIDL> FREQUENCY = FREQ
```

The variable FREQ will contain the frequency value corresponding to the channel we have selected.

```
Reading FITS format file, CGIS_FITS:FIRAS_ALL_SKY_SPECTRA_RHSS.FITS
```

The corresponding ULTRIX path name appears here for that system.

```
beginning fits processing Tue Oct  5 16:17:13 1993
reading in data Tue Oct  5 16:17:19 1993
reading in pixel data Tue Oct  5 16:18:34 1993
beginning pixelization Tue Oct  5 16:19:03 1993
```

Getting information about the data

```
UIDL> HELP
```

Look at the data array size and type for all of the variables.

```
% At $MAIN$  .
Code area used: 0% (0/32768),  Symbol area used: 0% (78/8192)
```

The exact values of some of these numbers may be different on ULTRIX.

```
# local variables: 6,  # parameters: 0
BADPIXVAL       FLOAT     =      0.000000
DATA            FLOAT     = Array(128, 96)
FREQ            FLOAT     =       696.107
RES             LONG      =             6
UNITS           STRING    = 'MJy/sr  '
```

```
UIDL> PRINT, MIN(DATA)
     0.000000
```

Find data minimum to help with display scaling. Here the minimum value is that of blank pixels.

```
UIDL> PRINT, MIN( DATA( WHERE( DATA GT 0.))), MAX(DATA)
 9.486465e-02       180.001
```

Find minimum of actual data and the maximum. ULTRIX users will see the minimum written as `0.0948647`.

Looking at the map of a single frequency

Unlike UIMAGE, UIDL does not automatically display the data as an image.

```
UIDL> LOADCT, 3
% LOADCT: Loading table RED TEMPERATURE
```

Replace the default black-and-white color table with a new color scheme.

UIDL> `WINDOW, 0`

Create a window of the default size. (This is ample for the size of our data array.)

Click on DECterm to make it the active window if necessary.

UIDL> `TVSCL, DATA`

The data is displayed and scaled linearly from data minimum to data maximum.

Click on the words "IDL 0" to bring the DECterm window forward if necessary. The data, in the lower left corner, is a tiny version of the map you saw in UIMAGE with its three or four stripes visible. Now we will erase this and put up a magnified version. Click on the DECterm window again to activate it if necessary.

UIDL> `ERASE`

Erase the old image.

To verify that the window has been cleared, you can click on the same place on the IDL window again, then click back on the DECterm.

Making the image larger

UIDL> `BIG = CONGRID(DATA, 512, 384)`

Expand the size of the image by a factor of 4 (to 512 × 384).

UIDL> `TVSCL, BIG`

Click on the words "IDL 0" to see the whole plot if part of it has been obscured by another window.

When you're done looking at the plot, click anywhere in the DECterm window to reactivate it, if necessary.

Looking at the signal across a sky cut

```
UIDL> SKYCUT, BIG, N_PNTS = NPLOTS, CS_PLOT = GRAPHS,$
UIDL> CS_TITL = TITLES, WIN = 0
```

Look at the data in a slice through the Galactic Center. Store the number of plots, the data for the plots, and the plot titles. (Type `UHELP, 'SKYCUT'` *for more information.) The* `'$'` *here is the IDL continuation character, allowing you to enter long commands on multiple lines.*

Please enter Plot window: 1

Specify a different window for the plot. Giving the same number as the data image display will replace the image with the plot.

Please enter image offsets within window. (Ex: 32 32): 0 0

Give the offset of the lower left corner of the image relative to the lower left corner of the window in number of pixels in X and Y.

Menu title:	Select this item:
Select Entry Mode	Longitude/Latitude

Choose **Cursor** *to identify points with the mouse; choose* **Longitude/Latitude** *to enter points from the keyboard. The title on this and other menus may be truncated.*

Menu title:	Select this item:
Coordinate System	Galactic

Choose the coordinate system in which you want to enter the coordinates.

Enter longitude & latitude of first point (Ex: 30,25): 0.,-15.

The decimal points are optional in these entries.

Enter longitude & latitude of second point: 0.,15.

A window **IDL 0** *reappears in upper right corner of the screen. The image is flush with the lower left corner of the window. A line joining the two points appears on the image, although it may be covered by the DECterm window.*

*The plot of the data (***SC (0.2,-14.9) to (0.1,15.1) G***) appears in a new window (number 1) below the* **IDL 0** *window.*

A menu appears.

Menu title:	Select this item:
Do you wish to:	Save cross-sectional plot?

You MUST SAVE the plots for the data values to be stored in the arrays specified in the SKYCUT call!

Plot 1 stored

This message appears on the DECterm.

Menu title:	Select this item:
Do you wish to:	Exit procedure?

Making a PostScript hardcopy

Click on the DECterm window to activate it, if necessary.

```
UIDL> HELP, NPLOTS, GRAPHS, TITLES
NPLOTS          INT       = Array(1)
GRAPHS          FLOAT     = Array(62, 4)
TITLES          STRING    = Array(1)
```

GRAPHS(,0) holds the plot X data; GRAPHS(*,1) holds the Y data.*

UIDL> SET_PLOT, 'PS'

Switch the plotting device over from the workstation to a PostScript file.

UIDL> DEVICE, FILENAME = '*yourdisk*:[*yourdir*]SKYCUT.PS'

Specify a file name. Otherwise omit this line and use the default: your current directory and the file name **IDL.PS**. *For ULTRIX users, the file name (in single quotes)* **$HOME/skycut.ps** *will put the file in your login area with the name* **skycut.ps**.

UIDL> DEVICE, /LANDSCAPE

Set up the orientation of the plot on the page. The default is portrait.

```
UIDL> PLOT, GRAPHS(*, 0), GRAPHS(*, 1), /YNOZERO,$
UIDL> XTITLE = 'Degrees along arc', YTITLE = UNITS
```

Recreate the plot (in the file). Suppress zero on the Y axis and label the axes.

```
UIDL> DEVICE, /CLOSE
```

Close the file. THIS IS ESSENTIAL!

Printing the file

```
UIDL> SET_PLOT, 'X'
```

Reset plot displays to the work-station console.

UIDL> `$PRINT/QUE=CGIF$LASER/NOTIFY` *yourdisk*`:[`*yourdir*`]SKYCUT.PS`

Send the plot to the CGIF laser printer, asking to get a message when the job has finished. The initial `$` *signals a command to the operating system.*

(ULTRIX users should instead use the standard command

```
UIDL> $lpr -Pcgiflaser $HOME/skycut.ps
```

The case of the file name should match the case entered in the `DEVICE, FILENAME` *command above.*

to print the file.)

Job SKYCUT (queue CGIF$LASER, entry 109) started on CGIF$LASER

Job SKYCUT (queue CGIF$LASER, entry 109) completed

ULTRIX users will not see these printer status messages.

Now retrieve your printout from the printer.

UIDL> EXIT

Leave IDL and lose all of the data. (We haven't saved anything yet.) We could also have entered CGIS *to return to the* **CGIS Main Menu** *for further work.*

$

If you have done the example in both UIMAGE and UIDL, you will find that the output plots are not exactly the same. In particular, the UIDL plot treats the zero-value data points like any others, but does not blank out that part of the graph (near 30 degrees along arc in this example). The physical sizes of the plots are also slightly different.