The BU–FCRAO Milky Way Galactic Ring Survey

Observing Manual

Last edit: November 14, 2003

Written by Robert Simon
Maintained by Jill Rathborne & Ronak Shah

Contents

1. The project and observing strategy

1.1 Introduction

The main objective of the Galactic Ring Survey (GRS) is to explore the ring of dense molecular material located at a distance of $\sim$5 kpc from the sun in the ^{13}CO J=1$\rightarrow$0 transition using the FCRAO 14m telescope and the 32 pixel array receiver, SEQUOIA.

The observations will cover a range of 20° to 50° in Longitude and $-1°$ to 1° in Latitude on a nearly Nyquist sampled grid. The region is indicated as a rectangle on the distribution of the integrated intensity of ^{12}CO J=1$\rightarrow$0 (CfA, Dame et al.) shown in Fig. 1.1. Some observational parameters, partly obtained from experience in the £rst two months of observing, for ^{13}CO and CS (in brackets) are listed below. Line intensities are given on a T_A^* scale.

Number of Spectra	1.5×10^6
Angular Resolution	$46''$
Grid Spacing	$22''$
Spectral Resolution	0.21 km s^{-1}
Sensitivity	0.25 K

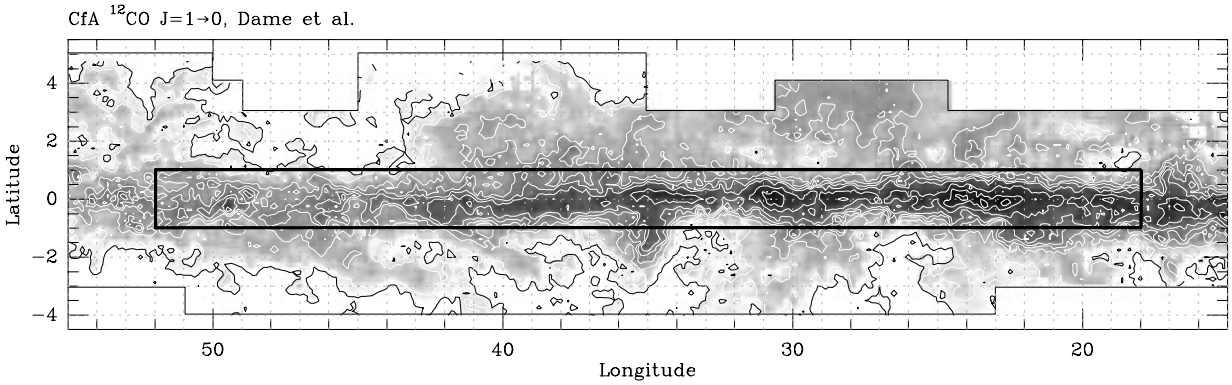

Fig. *1.1: Integrated intensity of ^{12}CO J=1$\rightarrow$0 from the CfA survey (Dame et al.) and the region of the Galactic Ring Survey.*

1.2 Footprints

The SEQUOIA pixel pattern on the sky was derived from pointing observations and a pointing model at the start of the observing season. The spacing of the pixels on the sky is $88.''56$ and the beamsize for ^{13}CO was determined to $46''$. A sketch of the pattern is shown in Fig. 1.2.

The 16 additional pixels were added in early 2002, and have different polarization than the £rst 16 pixels.

The basic unit of the fully sampled survey map, for historical reasons, is a so called footprint. A footprint was originally comprised of 4$\times$4 telescope pointings of the 16 element array. Each footprint contains 32$\times$32 pixels on a $22''.14$ grid and covers an area of roughly $6'\times6'$. Pixel 11

is the reference pixel for all GRS observations. If a certain position in Galactic coordinates is speci£ed, pixel 11 will point at this position.

The origin of the GRS map is the Galactic Center at (l,b)=(0,0). For the purposes of book keeping and clarity, the Galactic plane was divided into a grid of numbered footprints from l=0° to 60° and b= −2° to 2°. This division comprises 460 footprints in longitude and 41 in latitude with pixel 11 of footprint 12201 pointing directly towards the Galactic Center, (l,b)=(0,0).

To observe a map, the mapping software at FCRAO needs the origin of the map in absolute coordinates [i.e. (*l*,*b*)=(0,0) for the GRS] and the offsets from this position (loff,boff) in units of the map size (lsize,bsize). The center of the map then will be at:

(loff×lsize, boff×bsize)

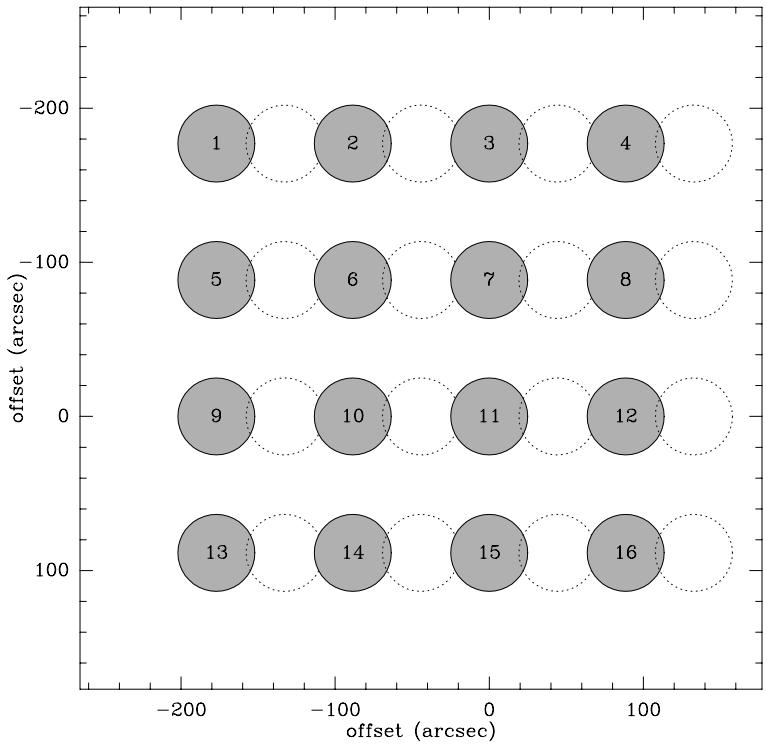

Fig. *1.2: SEQUOIA pixel pattern on the sky. The dashed circles indicate the additional 16 pixels completed in Spring 2002.*

2. A Typical Observing Run

2.1 Things you can do well in advance

- Check the status of the project with Jill *AND* Ronak.
- When is the GRS scheduled for observations?
- Who is scheduled to observe?
- What should be observed?
- You will £nd useful information, including links to the schedule, weather, status, and which footprints are to be observed on **http://www.bu.edu/grs**
- Get necessary plots and log sheets.
- Take your time to check and understand this information, e.g., check the reference positions (see details below) and plots for the upcoming observing run.

2.2 Remote Observing

To start a remote observing session use a normal **xterm** window or the MS Windows version of SSH after starting an X-server such as XWin32 and type:

ssh fcrao.astro.umass.edu -l observer
password=********* (ask Jill, Ronak, and Alex, or another experienced observer for it).
setenv DISPLAY machine.name.you.are.on:0.0

An additional window is required; type

xgterm &

We emulate the telescope operation interface with the *mterm* program. Start *mterm* with:

mterm
hit return

If someone else is observing and has locked the device, you will get the following message:

mterm is currently being run by observer on XXX with pid xxxxxx

IF YOU NEED TO ACCESS THE **mterm** RIGHT AWAY:

1. Try to contact the current, logged-on observer logged; you can get that information from the lock £les on /var/lock/. It will look like this:

Name: *observer's name*
Telephone: *observer's phone number*
Email: *observer's email*
at /dev/ttyp0
– or –

2. contact observatory staff (start with Jill, Ronak, Mark, Mike, ...)

You will also get this lock message if the previous observer forgot to EXIT and unlock the device. In this case somebody has to delete the £le **/var/lock/LCK..ttyS1**. If one of our observers did not properly exit the mterm then GRS will be the owner; in this case, you should delete the lock £le with **rm /var/lock/LCK..ttyS1**. If not, try to contact the previous observer with the information you got from mterm. If you cannot contact the observer, call Mark Heyer or Mike Brewer. If the device is not locked, you will be prompted for name, phone, email. This info gets logged to the £le **/var/lock/ttyS1.info**. Also, if another user starts mterm, the info is listed so the current user can be contacted (in case they are running over their time).

Commands are entered into the mterm in a strange way: one must hit any key to obtain the prompt, then type the commands. After that you will enter the system and have to refresh the screen:

spacebar
REFRESH

You may now change between the different screens without logging in just by typing: **SCREEN #**. You will be prompted for a username and password after the £rst essential command, e.g., if you try to change the source, line or backend con£guration. Username=GRS, password=******** (ask Jill, Ronak, or a competent observer for the password). From now on, you control the telescope tracking program and are ready to observe.

The SCREEN program provides the user with several screens of data about the tracking programs. These screens are selected with the SCREEN keyword, followed by the desired screen number. The default display is SCREEN 1, which contains a summary of basic information about all aspects of the system. Other screens provide more detailed information on individual subsystems. SCREENs containing important information for the GRS are highlighted.

SCREEN 1	**Basic display screen during observations.**
SCREEN 2	Sensor/Alarm status for Sensor/Alarm Number 17-19.
SCREEN 3	Filterbank bad channel list.
SCREEN 4	Receiver ”backend” status.
SCREEN 5	Pointing Information.
SCREEN 6	Sensor/Alarm status for Sensor/Alarm Numbers 1-16.
SCREEN 7	Status of CPU Tasks.
SCREEN 8	**Receiver ”frontend” frequency information and status.**
SCREEN 9	User-de£ned functions and REVIEW listings.
SCREEN 10	**Antenna temperature sensor readouts, incl. inside-outside temperature difference.**
SCREEN 11	DIP program results.
SCREEN 12	Not available.
SCREEN 13	Remote user message screen.
SCREEN 14	Receiver ”backend” counter display.
SCREEN 15	Receiver Information: Tsys and Beam Offsets.
SCREEN 16	**Integration Hold Sensor Status.**
SCREEN 17	**Recent Pointing Data.**
SCREEN 18	**Environment Status, incl. vents and hatch.**
SCREEN 19	**Pointing Information.**

The most important screens are SCREEN 1 WIND 0 for primary observing operations and SCREEN 19 for pointing and focusing.

2.2.1 Typical observing information to look for from the screens

Take your time to carefully £ll in the log sheets with information from the mterm! The logs provide a permanent record of what was done and a bridge between different observers. They should contain complete information on the weather data (T_{amb}, humidity, water vapor (WVP) on SCREEN 1 WIND 0), a summary of the initial state of the telescope, vents, and the hatch, source and map parameters, the scan numbers, the system temperatures, the pointing correction (after a pointing, SCREEN 1 RHS), the focus value (type SUBREF after the pointing to see the correct value), the reference position used for the maps, and some additional comments. A screen dump of SCREEN 1 WIND 0 at FCRAO is shown in Figure 2.1.

Note that SCREEN 1 now has two windows that are almost identical. WIND 0 contains the information on the weather parameters (TAUZ, TAMB, pointing offsets...) while WIND 2 shows the system temperature that we saw as TCOR in previous seasons. If you are on SCREEN 1, you can switch between the screens by just typing WIND 0 or WIND 2.

2.2.2 Status of telescope, weather, etc

- Check **SCREEN 16** for status of the HOLD ¤ags. Flags 1 through 5 MUST be ON since otherwise the software will take data while the telescope is moving between positions or the subre¤ector is moving during a focus measurement. Use HOLD # ON to switch the ¤ags on one by one. **Flag 6 should be OFF. Use Hold 6 OFF to turn this ¤ag off**.

- Check **SCREEN 18** for status of vents and hatch. Generally, the vents and hatch should be closed during the night, in winter, if it is raining, and at the end of an observing run.

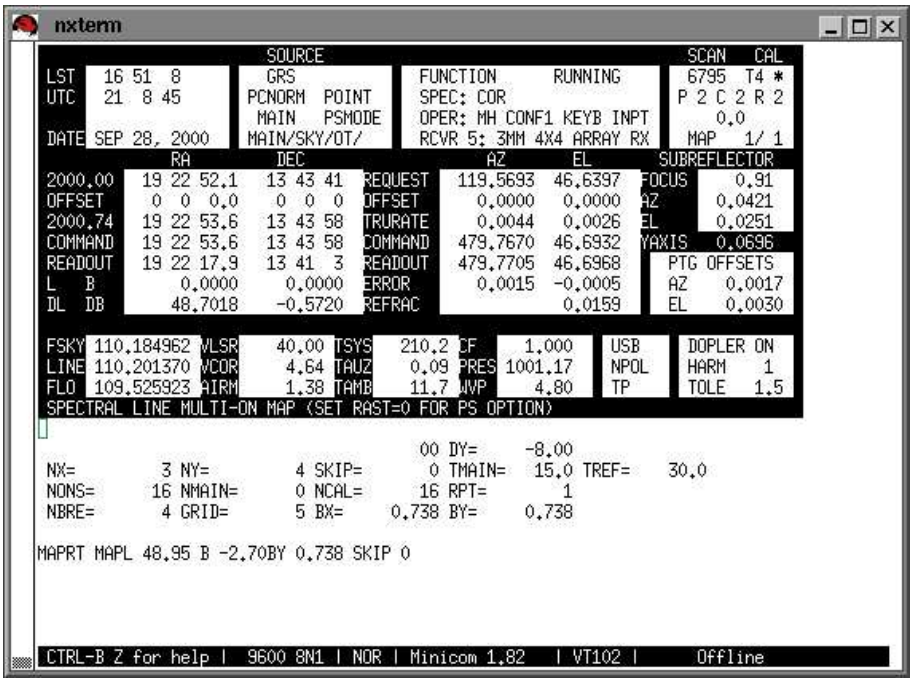

Fig. *2.1: SCREEN 1 WIND 0 at FCRAO. Note that this is a screen dump for the GRS with some typical observing parameters already typed in.*

As far as we know, there are serious problems with an inside-outside temperature gradient only in spring. From November to March it is usually not necessary to open the vents and hatch. Use **SCREEN 10** to check the difference between inside and outside temperatures (right hand side of the screen) and the temperature distribution over the dish and the subre¤ector legs. If the differences exceeds 3 degrees on a warm day, open both vents and the hatch before you start observing.

OPEN VENT 1 OPEN VENT 2 OPEN HATCH.

CLOSE the vents at sunset, the hatch a little later, and always after a GRS observing run.

2.2.3 Setting up some general parameters

The following steps set up Galactic Ring Survey observing session; these should always be the very £rst commands typed.

Keyboard input	Comment
AZOFF 0 ELOFF 0	Offsets in degrees in Azimuth/Elevation in addition to the pointing corrections, has to be 0.
FSOFF	Disable frequency switching. This command will only work if FS is already enabled. If it is not, you will get an error; simply ignore it and continue with the next command.
SPEC	Choose spectral line mode.
CATA FCRAO	Change to the FCRAO source catalog. The pointing sources reside here.
ROTANGLE 0	Angle between map rows and columns and the coordinate system
QSELECT 27	Keep tracking on pixel 11.

2.2.4 Pointing

Each observing session has to be started with a pointing and focus check. **Pointing and focus should be repeated about 2 hours after sunrise or sunset because of the temperature change in the radome**. Besides that, the pointing and focus should be fairly accurate during day and night.

The current pointing sources are XCYG (before 17:30 LST) and RCAS (after (17:30 LST). Note that the integration times for points are $t_{int}(\mathrm{XCYG}) = 15\,\mathrm{sec}$ **and** $t_{int}(\mathrm{RCAS}) = 10\,\mathrm{sec}$.

Keyboard input	Comment
APOIN	Lists pointing parameters.
APMOD 2	pointing + focus + pointing on best focus recommended.
OFFS 0	Let the £vepoint share one OFF (OFFS=1 for multiple refs).
IFTYPE 2	Select the new correlator (IFTYPE 1 would be the old FAAS)
CONF 2 RESET	***This usually gives an error; ignore it***
CONF 1 COR	Use the £rst part of the correlator.
CBAND 50	50 MHz band width, giving 48 kHz spectral resolution with the new correlator (1024 channels).
MAIN NAME XCYG	*Load source coordinates, use this source at 15:00 LST*
MAIN NAME RCAS	*Use this source after 17:30 LST, it's much stronger! Note that this also changes the value of VLSR*!
SAME REF AZOFF -0.2	Offset for reference position.
POINT	Move to the source
LINE SIO-4 LSB	Change frequency to SiO maser ($\sim$86 GHz) for pointing.
TMAIN 10 TREF 10	Set integration times for ON and REF to 10 sec. Set the time to 15 sec if you have high system temperatures.
RPT 1	Only one repetition.
Wait in between each of the following commands to see the resultant output	
REF START CAL	Start a calibration to check the system temperature
SCREEN 15 WIND 1	Look at the true T_{sys} (see £gure 2.2)
START PS	Do a quick PS measurement to check whether you see a line. **To look at the spectra, use SPA in an xgterm (§2.2.5)**
START APOIN	Starts the pointing, watch SCREEN 19.
SCREEN 19	View the progress of pointing

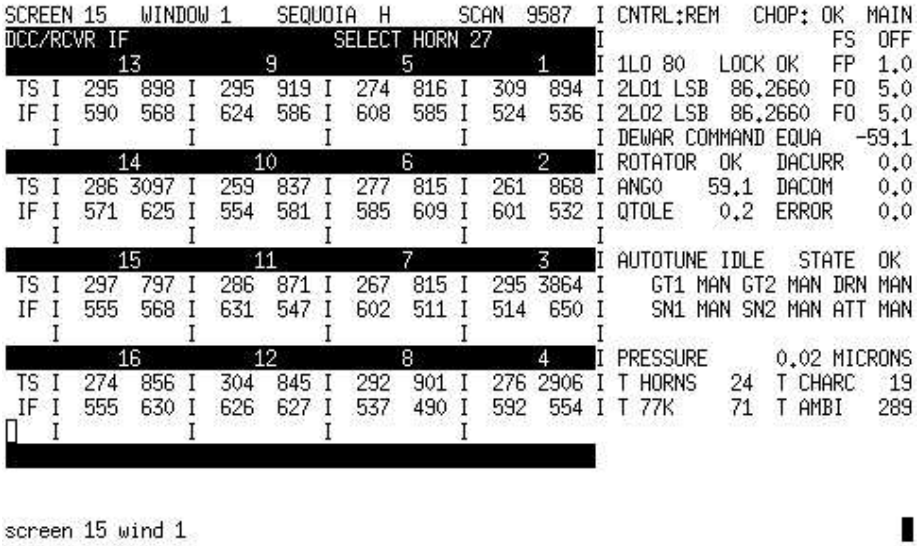

Fig. *2.2: A Screen shot of SCREEN 15 WIND 1. Look at the system temperatures (TS on the table) to get a feeling for the weather.*

The following list contains some crude estimates for you to decide whether you should observe or not. *Don't rely on the Tsys given on screen 1, as software bugs prevent this from being updated.* Instead, use **SCREEN 15 WIND 1**.

Molecule	T_{SYS} (K)	Observe	(TMAIN,TREF)
SiO (pointing)	>300	NO	–
	250< T_{SYS} <300	YES	(10,10)
	<250	YES	(10,10)
^{13}CO, CS	>400	NO	–
	T_{SYS} <400	YES	

2.2.5 Looking at the pointing and calibration data

It is always a good idea to look at some of the pointing and line calibrator (i.e., W51) data before starting with the actual mapping for the GRS and check the OTF scans from time to time. Usually, we looked at selected spectra with the FCRAO program that transfered a number of user speci£ed scans from the MODCOMP into CLASS format. As of early 2002, this is not possible anymore, since this procedure will almost certainly crash the bridge PC (pointing, line calibrator) and OTF scans are not even stored on the MODCOMP but on the new computer swift.

Since mid April 2002 there are 32 pixels in the array. After the pointing source or W51 has been observed, the corresponding scans will be dumped to a SPA T £le. For a PS observation of TCEPH, RCAS, or W51 this is only one scan which consists of now 32 individual spectra.

To look at those spectra, use another telnet session to connect to fcrao.astro.umass.edu, remember to use xhost or XWIN32 and to set the DISPLAY variable. From the GRS home directory /home/grs on the FCRAO computer open an xgterm window and start the SPA program from there. Do this with a dummy spa £le, in the case below the £le mickey.spa on /home/grs.

xgterm &
mcspa mickey.spa
Look for pixels 11 and 27

Inside SPA, you can plot spectra from individual scan numbers (top right corner on SCREEN 1) by typing this number followed by a plot command (always wait until the scan has been saved on the MODCOMP, i.e., the scan number you want to plot is increased by 1 on SCREEN 1). The example below is for scan 21527):

21527 mplo

This will open a graphic window and plot a 8×4 image of all 32 pixels for the scan.

Pointing scans

One of the pixels, number 30, is a lot noisier than the others at the low frequency used for pointing. Since all the other pixels are scaled with respect to the noisiest pixel, you may have trouble £nding the faint XCYG or TCEPH line in pixel 11 (27). In this case look at only pixel 11 by typing

mask ? 21527 plo

This will prompt for the mask type you want to use. Type

1,2

hit return and then type the number of the pixel

11 or **27**

This will show you a single spectrum just for pixel 11 or 27. For XCYG, as of November 2002, see £gure 2.3.

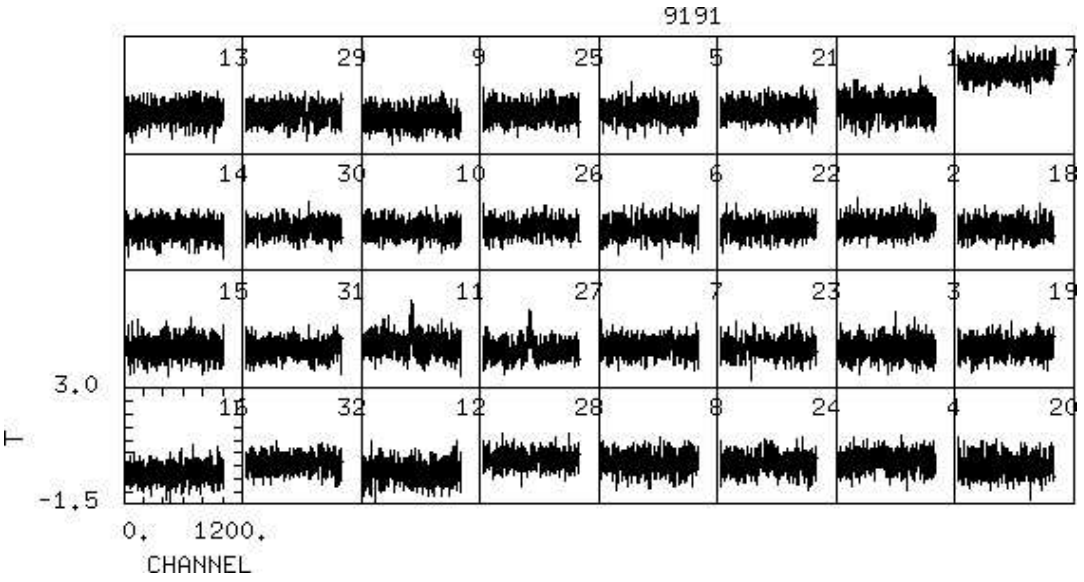

Fig. *2.3: A screen shot of XCYG from mcspa. Note the peaks in pixels 11 and 27, the spectra of the bright SiO maser from this star.*

Since RCAS is a much stronger source, this should not be necessary for the second pointing.

2.2.6 Calibrator check

A calibrator should be observed at least once per day after the £rst pointing and focus check and should be repeated after any additional pointing/focus check after sunrise/sunset. The name of the calibrator is W51.

Keyboard input	Comment
QSELECT 11	Track on pixel 11
SCREEN 1	Go back to main screen
MAIN NAME W51	Loads the source name and position and the reference position from the FCRAO catalog.
LINE (13)CO-1 USB VLSR 40	Change the line frequency ($\sim$ 110 GHz) and velocity, remember to change back to these values after pointing/focus.
RPT 1	Only one repetition.
TMAIN 15 TREF 15	Set integration time.
REF START CAL START PS	Start a position switch observation. Look at the spectra (SPA) and compare to the plot on the following page.

To look at the W51 spectra, follow the instructions on the previous page.

A plot of a 4$\times$4 array setting on W51 is shown in Fig. 2.4. This is what the calibrator W51 should look like in ^{13}CO J=1$\rightarrow$0 if the system is set up correctly and reasonable values for pointing and focus have been determined. Note that this observation has been done in a previous GRS season where the rotating dewar compensated the £eld rotation. From now on, concentrate on two things:

1. Do you see a ^{13}CO signal? and

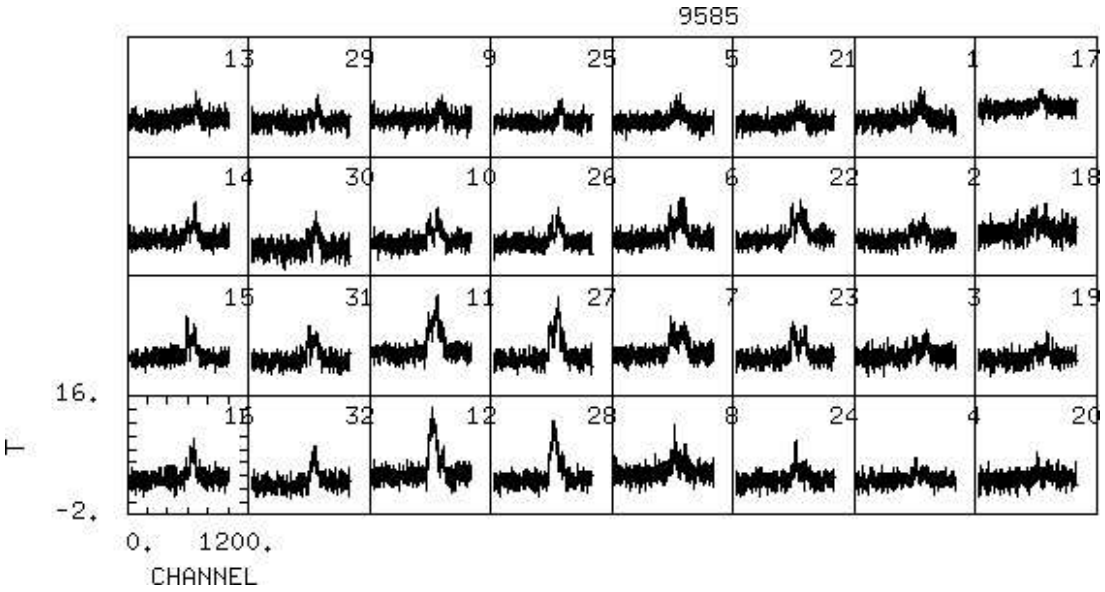

Fig. *2.4: The line calibrator W51 for* ^{13}*CO J=1→0.*

2. Is the line shape in pixels 11 and 27 what you expect?

Pixel 27 in the plot from last season below is the pixel at (x,y)=(3,3) counted from the lower left corner, but will be the pixel at (x,y)=(5,2) in the SPA display on the screen (remember that we now have 32 pixels; the pixels are numbered in the SPA display). A baseline has been subtracted to better display the intensity range, so expect a temperature offset in the spectra during the observing run.

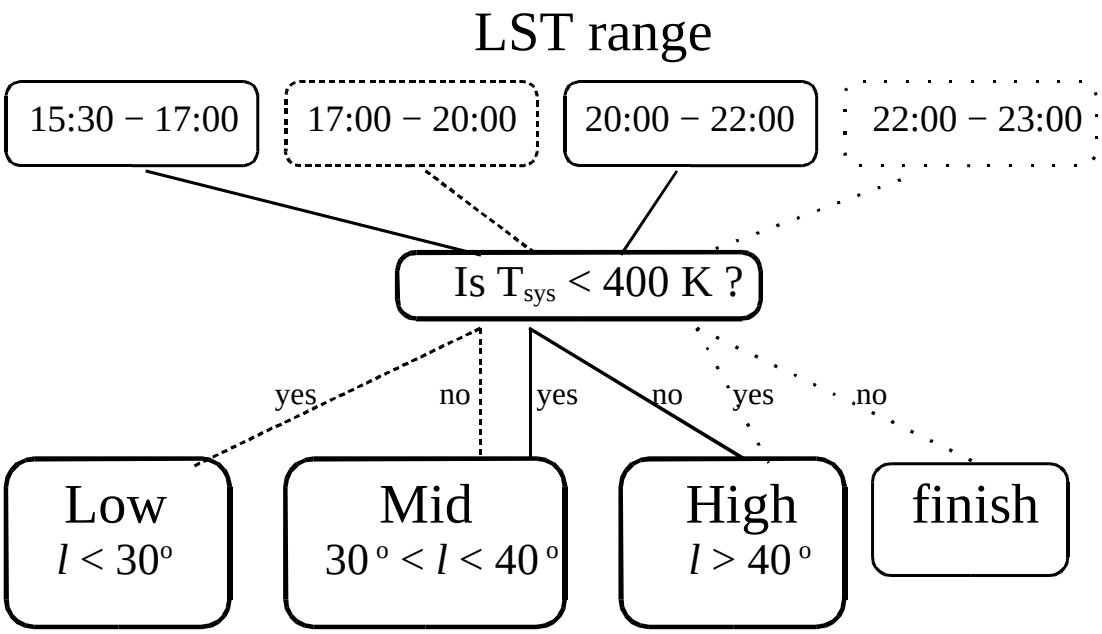

Fig. *2.5: Graphical representation of decision scheme used for GRS observations.*

2.2.7 Deciding which sources and/or whether or not to observe.

Among the most important tasks is choosing whether or not one should observe. Once the decision to observe has been made, the observer must then decide which sources to observe. The table below provides a the guide by which we observe sources, based on the approximate location of such regions above the horizon. Figure **??** provides a graphical decision scheme by which to decide when and if to observe sources.

Source lists are maintained on the GRS web page. The most current list is provided as otfweb-text. It's components can be cut and pasted into the mterm window by users, thus avoiding typing errors. Additional source lists are provide under links for "low", "medium", and "high" longitude regions. These three terms are crude indicators by which we judge when sources will be high enough for observations.

The source list is passed around on the document otfweb-text; it is always inside the blue observing binder. A copy is maintained on the web as well. Below is a table for determining what regions are to be observed. For reference, low longitude equals $\ell < 30^o$; mid longitude equals $30^o < \ell < 40^o$; and high is any subregion with galactic longitude greater than 40^o.

LST range	Longitude	Longitude range
15:30 to 17:00	mid	$30^o < \ell < 40^o$
17:00 to 20:00	low	$\ell < 30^o$
20:00 to 22:00	mid	$30^o < \ell < 40^o$
22:00 to 23:00	high	$\ell > 40^o$

2.2.8 OTF Mapping

The following commands set up the OTF maps:

Keyboard input	Comment
OTF	Lists OTF mapping parameters.
ROTANG 0	Angle between map rows and columns with respect to the coordinate system
SKIP 0	Set the row skip to 0
DY 0.75	Spacing between rows in units of the beam size (BY below) Use the value from the LST time table above
XRAMP 0.5	Half a beam ramps for the OTF map in X
YRAMP 1	one beam (BY is smaller than BX) in Y
TSAM 1	Dump time is set to 1 sec for the 2002 season
TREF 10	Integration time on the reference in sec calculated from length of the scan L and the beam size (set to 1.4 arcmin) the dump rate is set to 4 dumps per beam, so the number of dumps per row is $\mathrm{LX}/BY \times 4$ TREF = TSAM $\sqrt{NBREF \times \mathrm{LX}/BY \times 4}$
NBREF 2	Number of rows in the OTF map before reference is observed
RPT 1	Number of repetitions of the map, should always be 1
NCAL 10	Do calibration after x rows of the OTF map, the time between calibrations should be $\sim$10 minutes
BX 1.4 BY 0.75	Beam size in arcmin set to 45 arcsec in Y, but almost twice that in scan direction
You can type the following commands at once on one line	
KMAP #	OTF map with scan direction in longitude (5) or latitude (6).
LX #	Size of the map in the scan direction (arcmin) longitude (KMAP 5) or latitude (KMAP 6)
LY #	Size of the map perpendicular to the scan direction (arcmin) latitude (KMAP 5) or longitude (KMAP 6)
XOFF # YOFF #	Offset from the survey origin ((l,b)=(0,0)) in units of LX and LY, respectively. Does not have to be an integer number

At the end of the run, PLEASE set BX back to 0.75. The next observer may not notice that we signi£cantly changed BX!

Use the following commands to set up the correlator:

Keyboard input	Comment
IFTYPE 2	
CONF 2 COR	Use both correlators.
CONF 1 COR	Make sure you always use this last to have CONF 1 displayed on SCREEN 1
CBAND 50	50 MHz band width, giving 48 kHz spectral resolution with the new correlator.
HALT	Halt the telescope while loading the source position, you don't want to point the telescope at (l,b)=(0,0)
MAIN NAME GRS L 0 B 0	Source name and origin of the map.
SAME REF L dd.dd B dd.dd	Load the appropriate reference position from the list.
POINT	Start tracking the source.
LINE 1 (13)CO−1 LSB 1	Change the line frequency and sideband.
VLSR 1 20	LSR velocity at central channel of the £rst correlator.
LINE 2 (13)CO−1 USB 2	Change the line frequency and sideband.
VLSR 2 100	LSR velocity at central channel of the second correlator..

There is a macro GRS1 that does the frequency setup for you:
GRS1 = LINE 1 (13)CO−1 LSB 1 VLSR 1 20 LINE 2 (13)CO−1 USB 2 VLSR 2 100

Type SCREEN 9 to see if it is still there. If you don't see anything, type REVIEW FUNCTIONS to get a list of the available macros. If it is not there, you will not be able to use the macro unless you retype its de£nition.

Before you start the map, go to the next page and carefully check the parameters again!

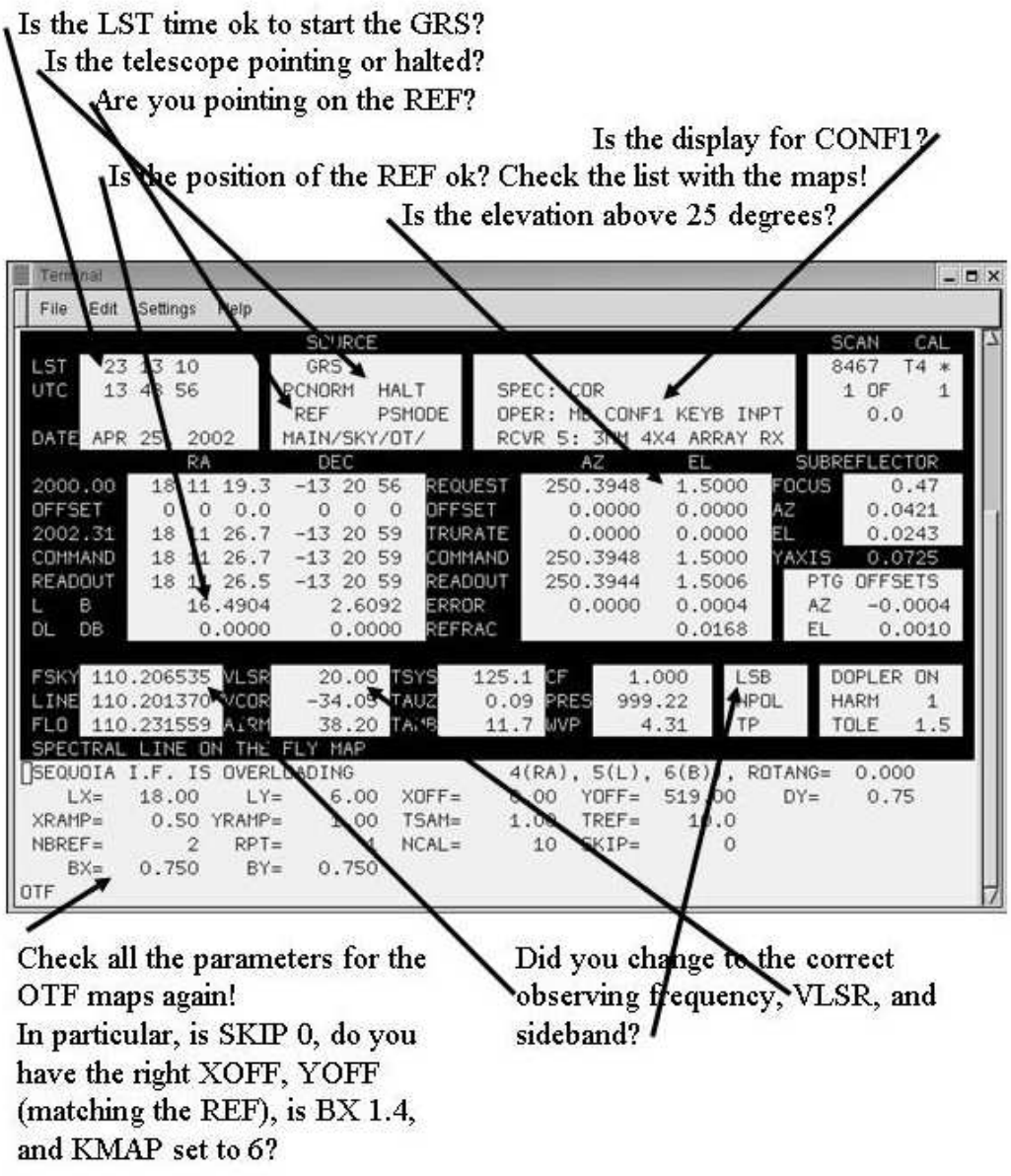

Fig. *2.6: Setup check prior to starting OTF maps*

Before you continue and start a map or a series of maps, take some time to very carefully check all the parameters. Note that the plot below is just a screen shot with the telescope DROPped and HALTed. The parameters as you see them in the plot are not identical to what you will see in the mterm window during your GRS observing run.

To begin observing:	
START OTF REF	Start the OTF map and move the telescope to the REF in case the map crashes or you used STOP OTF
To continue observing:	
YOFF # (XOFF # if necessary)	Set the new YOFF (and XOFF if necessary) position(s)
START OTF REF	Continue observing

At the end of the run, PLEASE set BX back to 0.75. The next observer may not notice that we signi£cantly changed BX!

2.2.9 Ending the Observing Run

You will end an observing run for one of a few reasons:

1. Our region of the Galaxy has set and you have no more sources to observe
2. The weather has prevented you from continuing
3. Mechanical, electronic, or political problems have prevented the continuing operation of the telescope.

In any case it is your responsibility to watch the system temperature over the complete observing run as the source rises and the weather changes (for better or worse).

To end the evening's observing, follow these instructions:

Shutdown Commands

- **DROP** and **HALT** the telescope after the last scan has been dumped to the MODCOMP.
- CLOSE VENT 1 CLOSE VENT 2 CLOSE HATCH.
- Set BX back to 0.75.
- Type **EXIT** to unlock the device (if observing remotely).
- **Ctrl-b x** to exit the mterm (if observing remotely).
- Email Jill and Ronak the list of completed sources and missed sources in 2 SEPARATE EMAILS with the subject headers OBSERVED and MISSED.

2.2.10 Important commands

Some important commands in alphabetical order.

AZPC 0.0 ELPC 0.0	Reset the pointing corrections to 0 if the current values seem wrong. Start a new pointing and redetermine the focus!
CLOSE VENT 1 CLOSE VENT 2 CLOSE HATCH	Use these commands to close the vents and hatch.
CPIX ALL ON	Switch on all SEQUOIA pixels.
Ctrl-B X	Always use this combination after a remote observing run to leave the mterm, don't forget to type EXIT £rst.
DROP	Moves the telescope to the horizon. Use at the end of a run before HALT.
EXIT	to unlock the device and leave the minicom.
FOCUS 1.0	Reset the focus value to 1 if the current value seems wrong. Start a new pointing!
FSOFF	Disable frequency switching (command will only work if FS is enabled).
HALT	Stop tracking a source, use at the end of a run after DROP.
HELP	To get a list of valid commands and help using them.
HOLD # ON	Switch on the hold ¤ags 1 to 6 by hand if they are switched off.
OPEN HATCH OPEN VENT 1 OPEN VENT 2	Open the vents and hatch to prevent high temperatures and temperature gradients in the radome during spring and summer.
POINT	Track the source. Use after HALT.
SCREEN number	Change between different screens, see next page for a summary.
WIND number	Switch between different windows of the same SCREEN.
SKIP number	Skip number of rows in an OTF map that have already been done before the STOP MAP command or a crash to resume observations of the same map, e.g., SKIP 10 to skip 10 footprints in the map.
SPEC	Change to spectral line mode.
STOP MAP STOP APOIN STOP PS	Stops the current map, a pointing, and a position switch observation, (use only after a calibration is £nished, e.g., at start of a new footprint).
SUBREF	Get the current FOCUS value.

2.3 Nonos

Things you should never do:

- Observe with bad pointing and focus (high offsets and high values of the focus on SCREEN 19) or without having done a pointing/focus at all.
- Observe with HOLD ¤ags 1 through 6 switched off (SCREEN 16).
- Observe with CONF2 as the active SCREEN 1.
- STOP CAL.
- Observe in frequency switch mode (use FSOFF even though this will produce an error message sometimes).
- Observe with closed vents and hatch on a warm day in spring or fall.
- Leave the mterm program without typing EXIT when you do remote observing.
- Leave the telescope control program by typing EXIT at the observatory. This will shut down the telescope control program.

2.4 Troubleshooting

The GRS is observed in spectral line mode and from 2002 on uses On-the-Fly mapping with shared reference positions. Continuum mode and frequency switching must be disabled. If one of the two is enabled by the time you start observing, you will get corresponding error messages if you type certain commands for the GRS project. Use the commands SPEC and FSOFF to disable continuum mode and frequency switching.

The following list contains some solutions for problems that occured during previous observing runs. Please report any problems so that we can extend and complete this list.

Error	*Possible reasons* and what to do
Device /dev/ttyS1 is locked	*The GRS or a previous remote user forgot to unlock the mterm*. Check the lock £les LCK..ttyS0/1: ls -l /var/lock/. If GRS is the owner, delete them. If someone else owns them, the mterm program will tell you who it is. Try to contact this observer with the information you get from mterm.
APOIN not converged or Pointing corrections too high or/and FOCUS much different from 1.0	*HOLD ¤ags off, pointing offsets wrong, AZOFF and ELOFF not 0 on the source (MAIN), wrong focus, bad weather, ...* Check the HOLD ¤ags (SCREEN 16) and, if necessary, switch them ON by hand (section 5.2.6). If the weather seems stable (watch T_{sys}), continue. If the weather is good, but T_{sys} is too high use Star QTUNE to tune the receivers; also consider that after a snow storm, there may be snow on the dome. Remove any additional pointing offset: AZOFF 0 ELOFF 0. Set pointing and focus back to initial values: AZPC 0 ELPC 0 FOCUS 1 Repeat the complete pointing procedure 5.2.3.
Source not in catalog	Change to FCRAO catalog, CATA FCRAO Retype MAIN NAME source.

Error	*Possible reasons* and what to do
Software takes data (i.e., counts the time) while the positional error is highlighted or/and the subre¤ector is moving during a focus scan	*The HOLD ¤ags are switched OFF*. Use HOLD # ON for # 1 to 6 to switch them on one by one. Repeat the complete pointing procedure 5.2.3.
One or more pixels are missing in the W51 plot	*The corrseponding SEQUOIA pixels have been switched off.* Switch the pixels back on using: CPIX ALL ON.
Continuous error messages from the platform PC (PPC), such as ”Platform PC program not running”; ”QCNTRL exiting”	*Crash of the PPC.* It has to be rebooted at the telescope. Call Jill or Ronak to inform Mark Heyer or Mike Brewer, or you can inform them.
OTF speci£c problems:	
DCC reports no time	Continued observing
DCC reports EXECUTE	Inform Jill or Ronak (or Mark, Mike, ...)
DCC reports no dump	Figure out how many rows have been observed and restart that map with SKIP #rows already done If this does not work, inform Ronak (or Mark, Mike, ...)
In any other cases	Inform Ronak, Mark Heyer, Mike Brewer, or Jim Jackson.

3. GRS members, accounts, documents, etc.

3.1 Phone numbers

If you run into problems during an observing run, try to track down the problem as far as you can, take notes of what happened, and try to solve the problem with this manual. On the other hand, if you checked that you set up the observations correctly and/or you encounter a problem or an error not included in this manual, do not spend too much time trying to £gure out what the problem is. Call somebode from the list below in the following order:
Jill, Ronak, Alex, Mark Heyer, Mike Brewer, Gopal Narayanan.

The long distance code to be used only for calling regarding GRS matters is 01859.

who	**where**	**phone**	**email**
Telescope	FCRAO	413–545–2676	
Ronak Shah	BU	617–353–2299	ronak@bu.edu
	home	617–469–8368	
	cell	617–680–9439	
Jill Rathborne	BU	617–358–1467	rathborn@bu.edu
	cell	617–230–7278	
Alexis Johnson	BU	617–353–8917	alexj@bu.edu
	cell	617–331–4941	
Mark Heyer	UMass	413–545–4264	heyer@astro.umass.edu
	home	413–549–7463	
	cell	413–222–1225	
Mike Brewer	UMass	413–545–0793	brewer@fcrao1.astro.umass.edu
	home	413–665–3274	
Gopal Narayanan	UMass	413–545–0925	gopal@fcrao1.astro.umass.edu
	home	413–549–0665	

3.2 Accounts

GRS accounts are available in Boston: on chub, apuaa, iar-lo, slime, and grunt and on fcrao.astro.umass.edu (linux). The username in all cases is grs; Jill, Ronak, and Alex know the passwords.

3.3 Directions to the site

From Boston, take Route 2 out of Boston for approximately 50 miles. Take the Route 202 South exit (which is different than the Route 202 North exit). Travel 8 miles until you see the dirt road which just precedes the Studio 45 sign on the left. This will lead you to Gate 17 for which you will need a gate key. Ask Ronak for the key.