TV-Guider 1.23 m, 2.2 m and 3.5 m Telescope – User's Manual –

Contents*

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1 General Introduction

1.1 Basics

The TV-Guiding-System at each telescope consists in principal of two components:

- the **TV-Cameras** in their housings at the telescope foci and
- the **control computer** with two monitors to operate these cameras.

1. **The Cameras:** Proxitronic Cameras (HL-A/MPIA-Version), consisting of
   - a MCP-proxifier as first stage, (S-25-Cathode)
   - an inverting image intensifier as second stage for size-adaption to the CCD and
   - a PULNIX TM860 (CCIR) CCD-Camera with 774 x 574 pixel of 11/11.5 μm
   The MCP-Gain and the Video-Gain are controlled by an external-voltage.

2. **The Control Computer**: a HP-486/25 MHz EISA PC, running under a standard System-V-UNIX Operating System with X11 Release 5 and OSF Motif as Graphical User Interface (GUI). Hence capitalization and use of small letters is strictly distinguished.

1.2 Monitors and Windows

The TV-Guider-System uses two monitors:

1. The **Video Display Monitor** shows the TV-camera images and related informations.

2. The **Control Monitor** is used for operating the TV-Guider. For this, two basic *windows* are opened, the

   - `TV-Guider Control Panel` (upper window) for usage with the mouse and the
   - `TV-Guider Command Shell` (lower window), where you enter via keyboard special commands and parameter.

3. **Note:** The Cursor has to be moved to the window you want to work in, - especially for using the Function-keys and the ESC-key, the Cursor must be in the Command Shell Window. More windows are opened on request, e.g. for Aperture, Filter list, etc.

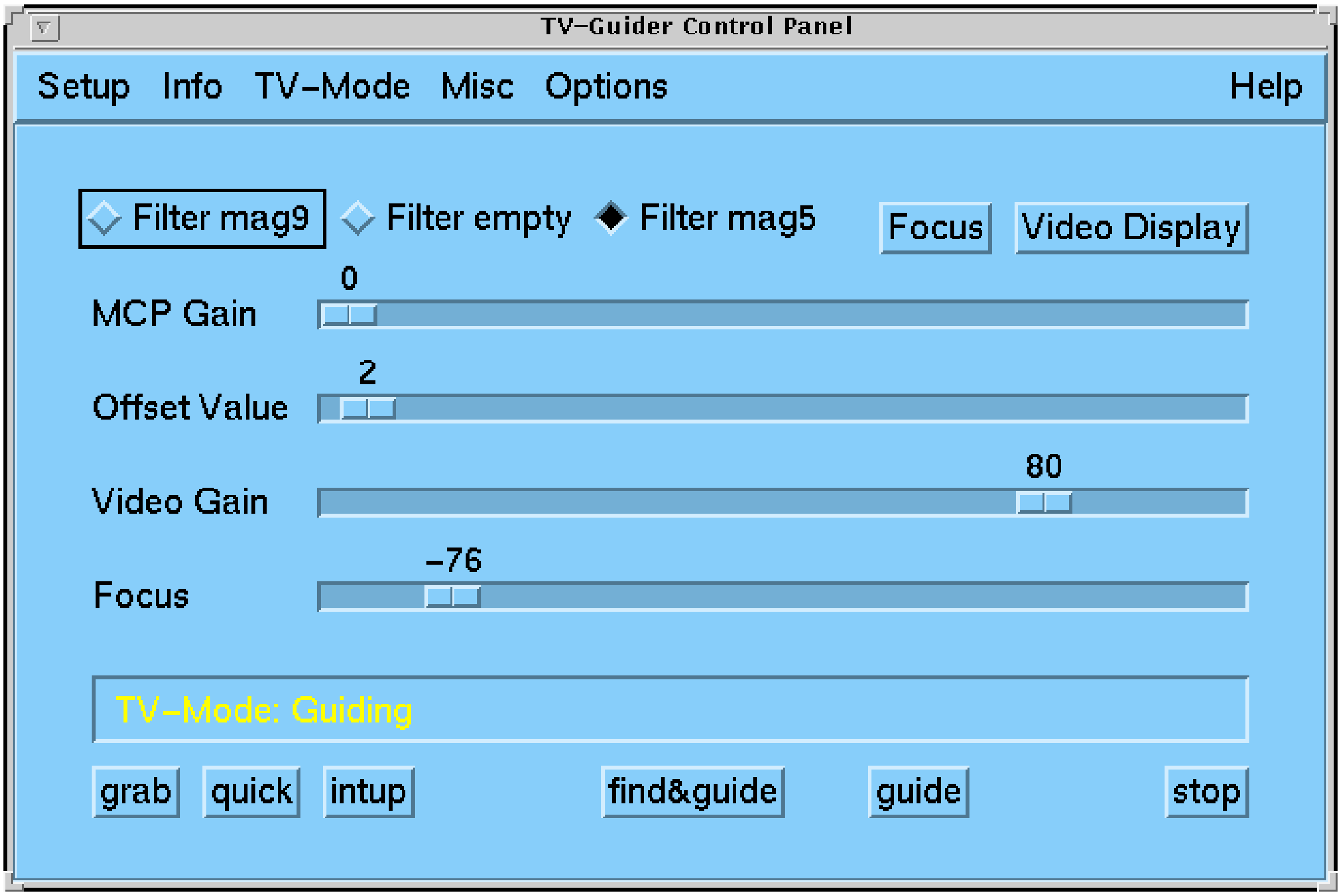

Figure 1: TV-Guider Control Monitor at Cassegrain focus 3.5, slit-view mode

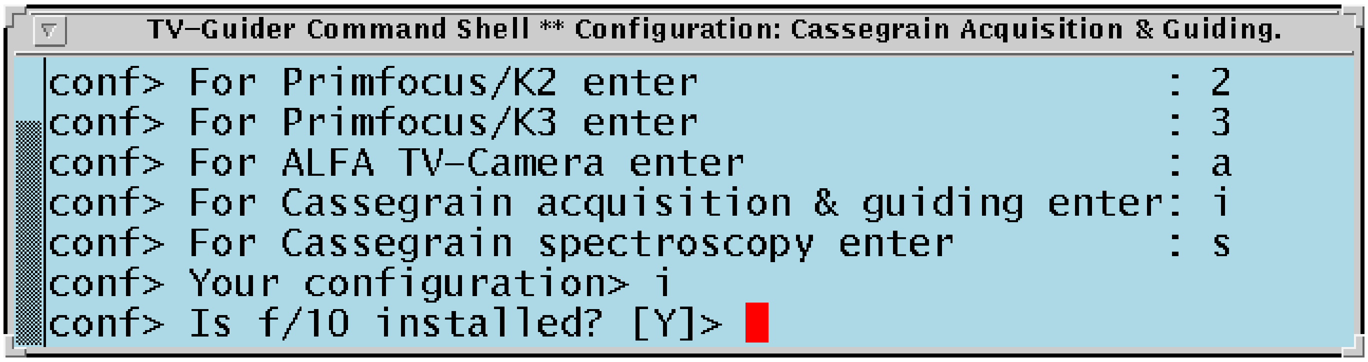

Figure 2: TV-Guider Command shell after startup of tvg program

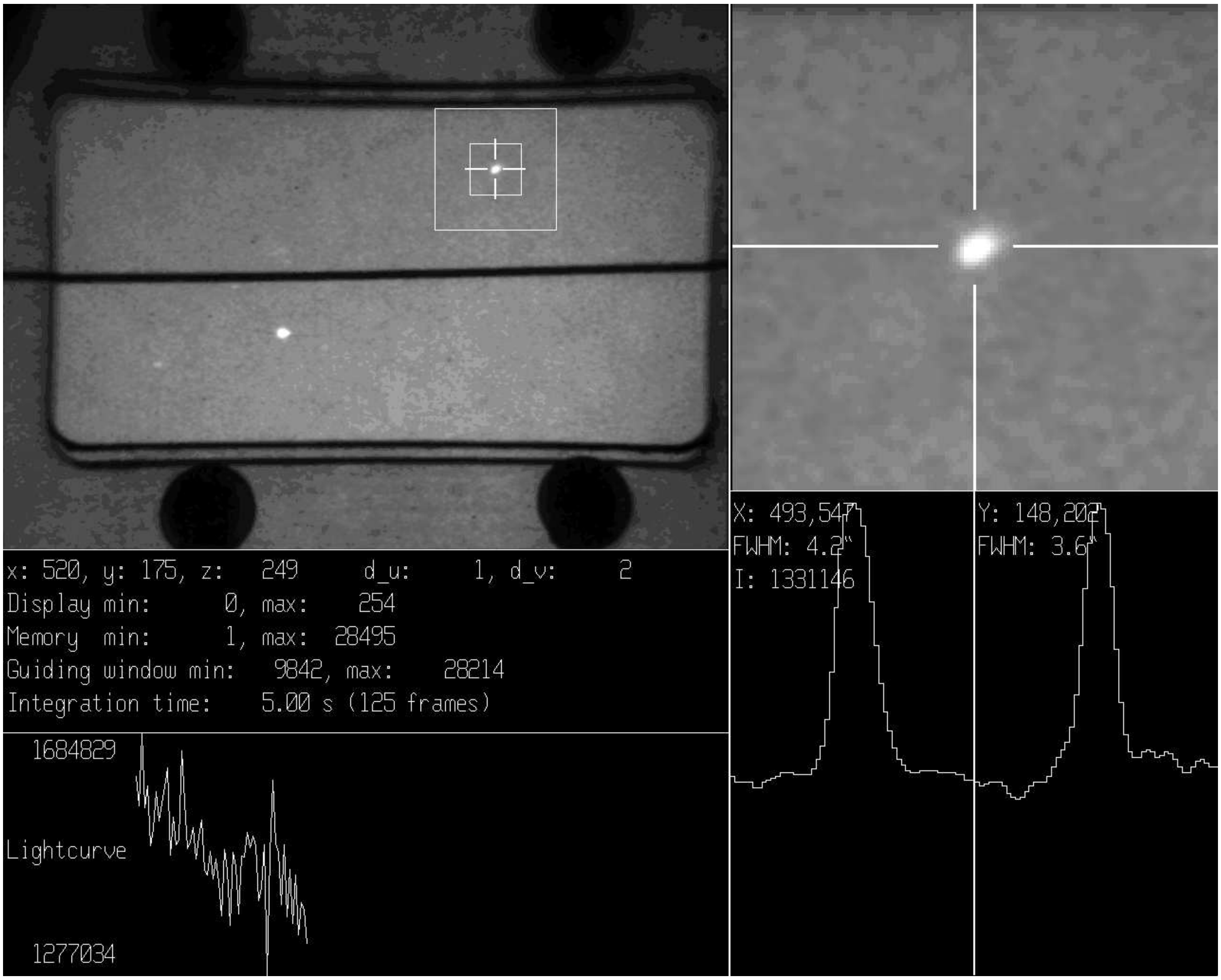

Figure 3: TV-Guider Video Display at the 3.5 m telescope in Slit-View Mode

1.3 Camera Configurations

1.3.1 The Configuration at the 3.5 m telescope:

One of the following 5 configurations has to be selected at startup of the TV-Guider program:

1. **Cassegrain Imaging** (Mode: Acquisition, Guiding)
2. **Cassegrain Spectroscopy** (Mode: Acquisition, Guiding, Slit-view)
3. **Prime-focus/K2** (Mode: Acquisition, Guiding)
4. **Prime-focus/K3** (Mode: Guiding)
5. **Cassegrain Adaptive Optics**

1. **Cassegrain imaging**
   In the Cassegrain focus the configuration **Imaging** is used with all imaging-like instrumentation (e.g. MAGIC, etc.) for Acquisition (on-axis field) and Guiding (Off-axis field).
   Camera-Options: 3 filter and focus.
2. **Cassegrain spectroscopy:** For **Cas Spectroscopy**, like for the TWIN-spectrograph, MOSCA, Spaltspinne, FOCES, etc., a slit-view is supplied *in addition* to the Imaging mode.
   Camera-Options: 3 filter and focus.
3. **Prime-focus/K2:**
   In the Prime-focus/K2 one single camera serves for acquisition when the **axis B** is selected at the telescope, and for guiding, when the telescope is moved to **axis A**.
   Camera-Options: 2 filter, aperture, and focus.
4. **Prime-focus/K3:**
   In the Prime-focus/K3 a single camera serves only for guiding.
   Camera-Options: 3 filter and focus.
5. **Cassegrain Adaptive Optics (ALFA):** This camera is part of the ALFA instrumentation. It's usage is described in the ALFA manual.
   Camera-Options: 3 filter and focus.

1.3.2 The Configurations at the 2.2 m telescope:

At the 2.2 one of three configurations has to be chosen at start of the program:

1. **Cas Imaging** with camera-modes Acquisition and Off-axis-Guiding
2. **Cas Spectroscopy** with camera-modes Acquisition, Off-axis-Guiding and Slit-view
3. **Coudé** with camera-mode Slit-view.

In configuration **Imaging** you can use the TV-Guider for Acquisition (On-axis camera) and for Guiding (Off-axis camera). To enhance the accessible field for finding a guide star the Off-axis camera can be moved in one direction (slider **Guide field**). If you are working with the Cassegrain spectrograph (Configuration **Spectroscopy**), the On-axis camera serves for Slit-view, too. The Slit-view mode can be used both for Acquisition and Guiding. At the **Coudé** focus only one camera

is installed, looking on the slit.
Camera-Options:
- Cas On-axis Camera: 3 filter, aperture and focus
- Cas Off-axis Camera: focus and transversal movement (slider "Guide field")
- Coudé Camera: 3 filter and aperture.

1.3.3 The Configuration at the 1.23 m telescope:

The TV-Guider of the 1.23 m telescope (Cassegrain focus) is part of the "Instrumentenansatz", which normally is used for CCD-direct imaging. Thus the TV-Guider can only be used if that "Instrumentenansatz" is installed at the telescope. The TV-Guider has only one configuration: it uses a single (movable) camera for both On-axis (acquisition) and off-axis (guiding) operations, — thus the camera position (slider **Position**) has to be set accordingly. The borders of the guiding regions left and right of the on-axis beam depend on the size of the used CCD-detector and will be given to you by the Calar Alto staff. Clicking on **TV-Mode/Acquisition** or **TV-Mode/Guiding** will move the camera to the on-axis position (0) or into the beginning of the right guiding region, respectively.
Camera-Options: 3 filter, aperture, and focus.
Note: The camera-focus is automatically adjusted for the difference between on-axis and off-axis positions if you once pressed the button `Focus ok!`. Yet be sure that you focussed the TV-Camera properly at the present position before initialization of the focus adjustment. Any movement of the focus slider (or entering "**set -f**" in the Command shell) stops the automatic adjustment of the focus difference!

1.3.4 Switching/Selecting camera modes

You switch between the different camera-modes of each configuration by a mouse-click on the equivalent command in the menue **TV-Mode** of the TV-Guider Control Panel. Changing mode/camera needs some activities, so you have to wait for completion of that action. The "Busy"-state is symbolized by a change of the Cursor shape: when "busy", the Cursor looks like a small watch.

2 How to login, start, finish ...

login: Login as user `tvg`. The actual password is given to you by the Calar Alto staff.

start: Enter `tvg` at the prompt.

setup: On startup the program will ask you for the **configuration** and some other parameters.

help: Type `help` or `?` to get a short command overview on the Control-Monitor.

finish: Enter `quit` in the Command shell to finish the program. Cameras are switched off automatically. If you want to logout completely you have to open the pull-down menue of *File* in the upper menue bar and select *Exit*.

- **Attention:** Don't forget to use "**quit**" at the end of observation in order to switch off the cameras.
- **Attention:** Never switch off the PC without successful shutdown procedure ! (Chapter 9)

3 Usage of the TV-cameras

3.1 Adjusting the camera(s):

All tasks related to selecting or adjusting a camera are performed within the TV-Guider Control Panel. Up to four sliders help you to adjust the parameters of the *active* camera, i.e. gains (**MCP-Gain**, **Video-Gain**), bias (**Offset**), and, - besides Coudé, also focus (**Focus**). If filters are supported, the diamond buttons allow you to select one of the available filters. Clicking with the mouse on menue "**Info/Filterlist**" will show you more informations about the filters installed. The iris-diaphragm is closed, opened or stopped by clicking on the equivalent commands in the window that is opened by menue "**Misc/Aperture**".

The sliders generally are scaled to 100. Moving the slider is done by mouse, i.e. by "dragging" it to the goal position or by clicking with the left mouse button, which causes a stepwise moving of the slider. For indication of "Busy"-state the Cursor shape changes to a small clock. The momentarily disabled functions always are shown slightly shadowed.

3.2 Shutter and Overload:

The shutters of the cameras normally open and close automatically when using the image acquisition commands ("**grab**", "**quick**", and "**intup**"). If too much light is seen by the camera, it will go in "**Overload on**", followed by a beep and a warning message on the control monitor. The shutter is closed automatically and the Overload status is reset when clicking on "**Dismiss**" in the warning window. Before starting a new image acquisition you first have to prepare for conditions to prevent the camera from going in overload again, e.g. by using a density filter or the iris-diaphragm, or by moving the camera or the telescope, respectively.

Attention: Too much light can cause damage to the camera.
So, be careful where the *active* camera looks at when you open the shutter by one of the image acquisition commands. The input plane of the camera, which is the input cathode of the intensifier, is the critical element that can be damaged. A very low MCP- and Video-Gain will pretend a sufficient low signal, although the incoming light itself may be already too bright for the cathode. Thus a medium or high MCP- and Video Gain ($> 50\%$) makes sure that the overload mechanism functions properly. When the camera does not go in overload with these gain values there is no problem to reduce the gains further. So, as a good precaution, use **grab** or **intup** and start with a high MCP- and Video-Gain (e.g. 70)!

4 Grabbing of images

grab grabs images in CCIR TV-mode (50 Hz interlaced).

quick [t_i] starts a loop, i.e.: integrates t_i seconds and then displays the integrated frame continuously ($t_i > 0.04$ seconds!). Just typing "**quick**" or clicking on the **quick**- button takes the last value of t_i. At start of the program t_i is always set to 1 [*sec*]. The actual value of t_i is shown in menue **Info/Parameter**. It also can be changed by "**set ti** *value*".

intup continuously integrates up, displaying every second the actual status. Pressing the **Esc**-key stops **intup**. When the count limit of 65536 is reached in distinct pixels (e.g. bright stars) these pixels keep this value, whereas integration continues in the other pixels with lower count values, i.e. sky background and fainter objects.

Esc -key or clicking on the **Stop**-Button generally stops all frame grabbing commands.

`Use "`**`intup`**`" or "`**`grab`**`" for an overview`
`Use "`**`grab`**`" or "`**`quick`**`" when telescope movement has to be watched`

5 Working with the images

Video Display-Cursor:
Via the button **Video Display** in the TV-Guider-Control Panel you have access to the Video Display Cursor on the Video-Monitor. Then a cursor appears on the Video-Screen thus symbolizing that you are now in Video Display CURSOR MODE. Look at the Video-Screen and move the mouse which controls now the Cursor on the Video-Screen. Click the right mouse button to return to the Control Monitor. If there are problems to leave the Video-Display see chapter 9 (Troubleshooting).

Note: CURSOR MODE on the Video-Screen partly is available with active "**grab**". It is not available during active "**quick**" or "**intup**" image acquisition.

In CURSOR MODE the following commands are supported:

q or **click the right mouse button** to leave the Video-Display and return to the TV-Control Panel on the Control Monitor.

c or **clicking with the left Mouse button** finds the center of moment at/near the current cursor position and moves the *cursor* onto this center. The telescope itself is not moved ! **Note: For the "Center"-procedure *all* image-acquisition must have been stopped!**

z zoom out area around cursor by a factor of 4.

o show actual orientation (North/East) of image. (Not valid for Coudé !)

h, **v** set/display horizontal/vertical line at current pointer position on Video-Screen.

k set/display a marker at current cursor position.

l display cuts along the horizontal and vertical direction (with cursor position as center).

0 .. 4 entering 0, 1, 2, 3, or 4 initializes a drawing of a circle of radius 5,10,15,20, or 25 pixels at the position of the cursor.

$\uparrow$,$\downarrow$ change upper limits of image LUT continuously.

$\leftarrow$,$\rightarrow$ change lower limits of image LUT continuously.

- **Moving the telescope by Mouse-click:** Click with the middle Mouse Button. First click defines position 1 (one beep). With the second click at position 2 (two beeps) the telescope moves from position 1 $\rightarrow$ 2.
- **Attention:** When "**grab**" is active, telescope movement can be done. Yet "**quick**" and "**intup**" have to be stopped before you can move the telescope by mouse click.
- **Overlay**: If you want the markers and lines to be kept through the following image acquisition actions you must disable the "**Autoclear overlay**" function in menue **Options/General**. The overlay of distinct windows can be cleared by "**clear** *n*" (n=1, .. 6), where n stands for:
  1: the frame window, 2: the zoom window, 3: the Info Area below the frame window,
  4: the x-Profile window, 5: the y-Profile window, and 6: the light-curve Window.
  For some more options see chapter 8.

6 The Autoguider

- $\boxed{\textbf{guide } [t_c]}$ Entering "**guide** t_c" in the command shell or clicking on the **Guide**-Button starts an autoguider session using *the last centered position* (by **c**, **af**, or a previously stopped **guide** sequence) *as reference position*. Thus, from the very beginning of the autoguider session the guide star is held on that (previously centered) reference position. Correction of the telescope, - if necessary, - is done after each integration period of t_c [seconds]. As the necessary telescope actions need some time for completion, the real cycle time of the guider always exceeds the entered value t_c, depending mainly on telescope reaction time. You can check the actual setting of t_c in menue **Info/Parameter**. Pressing the **Esc**-key or clicking on the **Stop**-Button stops the Autoguider — as do unexpected actions like moving the telescope by hand, etc.

- $\boxed{\textbf{Find\&Guide}}$. When clicking on this button the Autoguider takes the brightest object in the actual video-display frame as guiding object. I.e. an **autofind**-procedure is performed and a guide session is started using the found object as guide-star. Thus you do not need to select, i.e. to center, a guide star by yourself. However, this guide object must not be always the best one in the frame. As it may be too bright or too extended the astronomer is responsible for checking this selection and, if necessary, stop the autoguider session and center a suitable guide star by himself.

- **Normal procedure to start the auto-guider:**

  1. Preparations: Select the camera-mode **Guiding** (or **Slit-view** in case of spectroscopy). At the 1.23 m move the TV-Camera into one of the guiding regions left or right of the on-axis beam.
  2. Start **intup**.
     If there does not show up a suitable guide star you may move the camera (Slider **Guide field** at 2.2 m and slider **Position** at 1.23 m telescope, respectively) until you find one. In this case, — when moving through a field, **quick** or **grab** is more appropriate.
  3. Stop **intup** or **quick**, respectively. In any case, it should be an integrated image !
  4. If the brightest object on the frame seems to be a good guide star, click on button **Find&Guide**, else switch to the Video Display, center a guide star with a Mouse click left (or "**c**"), return to the TV-Control Panel (Mouse click right) and start **guide**.

  Note: Before starting the Autoguider you must have an actual image of the guiding object. Especially, if you moved the telescope for some corrections you have to get a new image ("**quick**"). If you don't use the **Find&Guide** button you also have to perform a new "centering".

- **Adjustments:** When the Seeing is very bad you should enlarge the guide window (enter "**set gw** *value*"), which at begin is set to 45 pixel (60 pixel at f:45 at 3.5 m telescope, respectively).

- **Guiding by hand:** For guiding manually the following procedure is proposed: Center your object as with the Autoguider, disable telescope control (menue **Options/General**) and start the guide-session. Thus you will have any information as with the Autoguider, yet without automatic telescope movement.

- **Lightcurve:** Always the last 200 Intensity-values of a guide-session are drawn using the minimum and the maximum as lower and upper limits. However, to ensure a reasonable resolution, the lower limit is kept at the value of the first 10 data points if the intensity is going low caused by e.g. vignetting effects like dome-moving, etc. In addition, the drawing of the light-curve can be restarted any time by entering a "**0**".

7 Focussing the camera

1. **Imaging** and **Guide**-mode:
   Once you have focussed the telescope for your instrument, click on button **Focus**. Then the TV-Guider gets the telescope focus and moves the TV-camera accordingly. When changing the telescope focus don't forget to adjust the TV-camera focus. If no connection to the telescope is available, you can enter the telescope focus manually by typing "**set fp** f_{tel}", where f_{tel} is the telescope focus in μm (an integer value, as you can read it from the display of the 3.5 m telescope). Then a click on the **Focus**-button leads to the equivalent camera movement. Note, that if a valid telescope focus is returned from the telescope computer the manually entered value is overwritten !

2. **Slit-view**-mode:
   In slit-view mode you have to focus the TV-camera manually to get a sharp image of the slit. This is best done with the dome closed and some dome-light on. With this camera focus fixed, the telescope is focussed by using a star on the reflecting slit-jaws of the spectrograph.

Note: At the 1.23 m telescope you still have to focus manually. Yet the camera-focus is automatically adjusted for the difference between on-axis and off-axis positions if you once pressed the button `Focus ok!`. Yet be sure that you focussed the TV-Camera properly at the present position before initialization of the off-axis focus adjustment. Any movement of the focus slider (or entering "**set -f**" in the Command shell) stops the automatic adjustment of the focus difference!

8 Some more commands and Options

1. **af:** (autofind) finds the position of the *brightest object* in the actual frame and performs a center ("**c**") command. As this may well be an extended object, it is not automatically the best guiding star.

2. **flip** $[x, y, b]$: mirrors displayed image over x,y or b(oth) axis when no grabbing is active.

3. During active image acquisition with "**quick**" and "**intup**" constant flipping can be set by "**flip = 1**" for x, "**flip = 2**" for y, and "**flip = 0**" for no flip (also reset).
   Attention: Only the display is flipped, all memory readings like **o**, **z** and, - above all, **c** and all Autoguider operations refer to the non-flipped image. Therefore use this command only for a view on the image and do not forget to reset flipping before starting auto-guider operation, etc. !

4. **cuts [min,max]:** sets display cuts on actual frame on Video-Screen (0-255). Usage for faint objects. Typing just **cuts** resets cuts-values to 0,255.
   When in Video-Display Mode cuts can be changed continuously with the cursor keys $\uparrow$ and $\downarrow$ for the upper limit and $\leftarrow$ and $\rightarrow$ for the lower limit. Autoscaling is reset by clicking on the equivalent button in menue **Options/General**.

5. **set gw** [*9...99*]: sets a new guide-window width [pixels]. (Default: 45). See also menue **Info/Parameter**.
   Attention: Enlargement may be necessary for very bad seeing conditions.

6. **Autoclear:** Menue **Options/General/"Autoclear Overlay"** allows to enable/disable autoclearing of the overlay on the Video-Screen. (Default: overlay is cleared automatically with each image acquisition process). When autoclear is disabled, you can clear the whole overlay by "**clear o**", or single overlay windows by "**clear 1**", ... ,"**clear 6**". Use disabled autoclear if you want to keep horizontal/vertical lines, circles or markers, set by the commands "**h**"/"**v**", "**0, ... 4**" or "**k**", through different acquisition processes.

7. **Telescope control:** Menue **Options/General/"Telescope control"** enables/disables the connection to the telescope.
   Note: In Coudé-mode (no Autoguider present at the moment) and for guiding with the Handguider you must disable the telescope control.

8. **save [filename.fits]:** saves actual data as FITS-format file on disk. Files are stored in the actual working directory users/tvg/observerx, where x stands for 1,2,3.

9. **load [filename.fits]:** loads previously saved FITS-format file from disk to Video-Screen.

10. **Copying files to DAT:** the saved fits-files and the LOG-files (see below) can be copied to a DAT-tape by the following procedure: Leave the tvg-program and enter a DAT-tape into the DAT-Drive of one of the work-stations (e.g. rst4 at CA2). Change to the equivalent directory of your files and enter:
    gtar cf server:/dev/rstX *.fits (server = CA2, and rstX = rst4, in our example)
    The following prompts for username and password must be answered
    (e.g. observer3 and the password for observer3 at CA2).

11. **LOG-File:** Every day a LOG-File with all important informations about the actual guiding sessions is created in the directory /users/tvg/LOG. The file name refers to the actual date, e.g.: tvGuiderLog.18-May-1995. See example and explanations in the appendix.

12. **set +/− f:** Enables/disables automatic adjusting of the TV-Camera focus when moving the camera out of the telescope axis. **(1.23 m telescope only)**.

13. **Move&Guide:** With the command "**mg** Δu**,** Δv" you start the following pocedure:

    (a) Move telescope by the given amount Δu and Δv (in [arcsec]).

    (b) Compute the new position of the last centered star on the TV-camera image

    (c) Start guiding on that star at it's new position.

14. **Seeing:** Entering **see** [len],[n],[x_c],[y_c] starts a procedure which measures the actual contribution to seeing caused by the irregular movement of the stars. For this reason a star on the displayed frame must have been "centered". The parameters are:

    (a) len: Size of window around the star in Pixel (Default = actual guide window width).

    (b) n: Number of CCIR-frames to be integrated for each frame. $n = 1$ gives a framerate of 12 Hz, ($n = 2 \rightarrow 8$ Hz, $n = 3 \rightarrow 6$ Hz, and so on (Default = 2).

    (c) x_c, y_c: Center-coordinates of window. (Default: x_c, y_c of last centered object).

    The data are stored in a file in directory /users/tvg/LOG.

15. **Overlay:** If you need the same overlay drawings (circles, lines, rectangles) very often, you can use an ascii-file with the necessary data. This file must be of the format of the default file *tvg.overlay* in the directory /users/tvg/observerX/ (X=1/2/3, respectivly). The command "**load_ov** *file*" loads the file and "**ov**" causes the program to draw the desired features. Don't forget to disable the function "Autoclear overlay" in menue Options/General !

16. **compLOG:** Typing "$compLOG" (or outside of TV-Guider program: compLOG) gives you a statistical overview on the guider-session LOG-files of a selected date.

17. **Statistics:** With the command **stat** [x_c, y_c, len] you will perform some statistics on the data in the window around x_c, y_c and size len Pixel. The default parameters are: last centered x_c, y_c and actual guide window width.

9 Some more remarks you should read

- **At the end of the TVG-Program:** You can switch off the monitors to enhance their life time, but, please, don't switch off the PC.

  Whereas the Control Monitor is supplied with a screen saver, the Video-Monitor should be cleared (Command "**clear**"), when there will be no TV-Guider activities for several hours.

- **Switching on/off cameras:** The cameras are switched on/off automatically, when you start/quit the TV-Guider program. Therefore **don't forget to finish the Guider program with "quit" at the end of your observation**. Otherwise the cameras would keep running all the day long. A camera also can be switched on/off explicitly by using the corresponding commands in menue **Setup**.

- **Autoguider at 1.23 m telescope:** For proper use of the Autoguider, check for the stepsize of the telescope Handguider at the Telescope Computer. Must be set to 0.1 *arcsec*.

- **Troubleshooting:** In case of "hanging" in the TV-program (e.g. if there is no way out of the Video-Display for the mouse) you may kill the TVG-program by following procedure:

  1. Press in one the keys <Ctrl> <Alt> <F1>
  2. Login as tvg
  3. Enter: "ps -ef | grep scosession"
  4. Read the given job number *jobnr* and enter " kill -9 *jobnr*"
  5. Type "exit", switch to <Ctrl> <Alt> <F2> again and restart tvg.

- **Reboot Procedure:** In emergency case the reboot is done by the following steps:

- 1. Press in one the keys <Ctrl> <Alt> <F1>
  2. Login as tvg
  3. Enter: /tcb/bin/asroot shutdown -g0 -y -i6

- **Shutdown of PC:** In order to switch off the computer you first have to do a "shutdown":

  1. Press in one the keys <Ctrl> <Alt> <F1>
  2. Login as tvg
  3. Enter: /tcb/bin/asroot shutdown -g0 -y
  4. Wait until the message "** Safe to Power off – or – Press Any Key to Reboot **" appears on the screen.
  5. Now you can switch off the power of the PC

- **In case of power failure** the electronic and the PC need some time to recover. If the communication with the TV-electronics fails after startup, the following action may help: switch off for some seconds the TV-electronics at the telescope and wait (some minutes !) for its new intialization.

- **FWHM:** The given FWHM-value for the guiding star profile and in the seeing computations does not represent the actual seeing value. As each light signal is widened by the image intensifier of the TV-camera to a fwhm of ≥ 75 [μm], the seeing width is only merged to this intrinsically widening of the TV-camera. Depending on the telescope focus these intensifier induced fwhm may be already equivalent to more than 1 [arcsec].

10 The most important commands in overview:

Login, start, quit, ... (Chapter 2)

login: Login as user "**tvg**". The actual password is given to you by the Calar Alto staff.

start: Enter "**tvg**" at the prompt.

help: Type "**help**" or "**?**" to get a short command overview on the Control-Monitor.

finish: Enter "**quit**" in the Command shell to finish the program. Cameras are switched off automatically. If you want to logout completely you have to open the upper left pull-down menue of **File** and select "**Exit**".

Attention: Don't forget to use "**quit**" at the end of observation in order to switch off the cameras.

Attention: Never switch off the PC without successful shutdown procedure ! (Chapter 9)

Image Grabbing (Chapter 4)

grab: grabs images in CCIR TV-mode (50 Hz interlaced).

quick [t_i]**:** starts a loop, i.e.: integrates t_i seconds and then displays the integrated frame. The minimum for t_i is 0.04 sec. Just typing "**quick**" or clicking on the **quick**- button takes the last value of t_i. At start of the program t_i is always set to 1 [*sec*].

intup: continuously integrates up, displaying every second the actual status.

Esc: -key (or **stop**-button) generally stops all frame grabbing and guiding activities.

Overload: In case of Camera-"**Overload**" refer to chapter 3.2 .

Usage: Use **intup** for an overview and **quick** or **grab** when telescope movement has to be watched.

Guiding (Chapter 6)

guide: [t_c] starts the autoguider, using *the last centered position* (by **c**, **af**, or a previously stopped **guide** sequence) *as reference position*. Thus, with **guide** the guide object must have been centered before. When using the **Find&Guide**-Button, the brightest object in the displayed frame is automatically selected (autofind-function "**af**") as reference star. Then, from the very beginning of the autoguider session, the guide star is held on that reference position. Correction of the telescope, - if necessary, - is done after each integration period of t_c [seconds]. The last value of t_c (which is 10 at start of the program) is taken. If you wish to change that value use "**set tc** t_c" or enter the "**guide** t_c" command with the appropiate t_c value. The actual value can be read from the menue **Info/Parameter**.

ESC: Pressing the **Esc**-key or a clicking on the **stop**-Button stops the Autoguider — as do unexpected actions like moving the telescope by hand, etc.

Centering a guide star: Stop the image acquisition (**intup**, **quick**, or **grab**, respectively). Either use "**af**" or switch to the Video Display and select a guide star with a Mouse click left. Return to the TV-Control Panel with Mouse click right.

Working in Video-Display Mode (Chapter 5):

Entering Video-Display: Click on button "**Video Display**"

Leaving Video-Display: Click on right Mouse button or type "**q**".

Center an object: Typing "**c**" or clicking with the left Mouse button finds the center of moment of an object at/near the current cursor position. The cursor is moved onto this center but the telescope itself is not moved !

Orientation: Use **"o"** to get the actual orientation (North/East) of the TV-image.

Flip: Use command "**flip** $[x, y, b]$" (see chapter 8) to mirror the displayed image.

Cuts: Cursor keys ↑ and ↓ change upper and ← and → change lower limits of image LUT.

Zoom: Command "**z**" zooms out area around cursor by a factor of 4.

Moving the telescope: When in Video-Mode click with the middle Mouse Button. First click defines position 1 (one beep). With the second click at position 2 (two beeps) the telescope moves from position 1 → 2.

Overlay drawing: At the current cursor position you can draw horizontal ("**h**") and vertical ("**v**") lines, markers ("**k**"), or circles with different radii ("**0, .. 4**"). If you want to keep these features through the following image acquisition actions you must disable the **Autoclear overlay**-function in menue **Options/General**.

11 Scales and sizes:

The Cameras have 764 x 574 Pixel. Their scales and Mag-limits for a 10 sec integration at the different telescope foci are as following:

Telescope focus	Pixel per [arcsec]	Field [arcmin x arcmin]	limit [mag]
1.23 m Cas	2.5	5 x 3.8	18.5
2.2 m Cas On-axis and Off-axis	4.5	2.8 x 2.1	18.5
2.2 m Cas Slit-View	2.7	4.5 x 3.4	19.5
2.2 m Cas Slit-View (FOCES)	12.2	1.0 x 0.8	
2.2 m Coudé			
3.5 m Prim K2	2.8	4.5 x 3.4	
3.5 m Prim K3	3.5	3.6 x 2.7	
3.5 m Cas On-axis and Off-axis (f:10)	2.7	4.6 x 3.6	
3.5 m Cas On-axis and Off-axis (f:45)	12.2	1 x 0.8	
3.5 m Cas Slit-view TWIN	2.5	5 x 3.8	
3.5 m Cas Slit-view Spaltspinne	4.3	2.9 x 2.2	
3.5 m ALFA	2.7	4.6 x 3.6	

12 Appendix

Example for a Log-File of a Guider-Session:

The meaning of the data are as following:
First line:
DATE, LID=Logical Camera ID, GWIDTH=Width for centroiding aperture
Second line: UT (= 21 17 24) Hour Angle (= 22 43 55.7)
Sideral Time (= 12 59 26.2) Deklination (= 19 11 30)
Third line (only 3.5):
Rectaszensation (= 14 15 30.5) Deklination (= 19 11 30) Cass-angle (= 359.9)
Each following line:
Time (from PC) in seconds after 0.0UT, Δu, Δv in $[0.1 arcsec]$, max. Counts in Guiding window, Intensity [counts], $Fwhm_x$, $Fwhm_y$ in $[arcsec]$
Last line:
UT (= 21 20 10) Hour Angle (= 22 46 41.7) Sideral Time (= 13 02 12.3) Deklination (= 19 11 29)

```
DATE=20-May-1995, LID=5, GWIDTH=55
TDATA=Q   T 21 17 24 22 43 55.7 12 59 26.2  19 11 30
TDATA_35=Q   W 14 15 30.5  19 11 30  359.9
76552, 6, -10, 5818, 102140, 4.0, 3.6
76563, -3, 0, 5917, 7126, 4.3, 4.0
76572, 1, 3, 5968, 61312, 4.2, 4.3
76581, -9, 0, 5937, 182999, 4.0, 3.3
76590, 17, -6, 5921, 243100, 4.3, 4.1
76599, -11, -4, 5943, 4984, 0.0, 0.6
76608, -6, 8, 5971, 215761, 4.2, 3.6
76620, -1, 2, 5972, 165606, 4.2, 3.8
76628, 11, 0, 5965, 140409, 3.8, 3.8
76638, 0, 0, 5949, 84287, 3.8, 3.8
76644, -3, -1, 5923, 64465, 3.9, 3.7
76654, -12, 0, 5986, 45071, 4.1, 3.4
76663, 7, -6, 5933, 197904, 3.5, 3.4
76672, 4, 8, 5982, 118589, 4.2, 4.2
76683, -5, -2, 5991, 84044, 4.2, 3.3
76692, 0, -4, 5984, 121386, 4.0, 3.1
76706, 12, 2, 6014, 200839, 4.6, 3.4
TDATA_END=Q   T 21 20 10 22 46 41.7 13 02 12.3  19 11 29
```

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