



W. M. KECK OBSERVATORY

On the summit of Mauna Kea, Island of Hawai'i

MAGIQ Observer UI Guide

Observers User Interface Guide for MAGIQ

Author(s): MAGIQ Software Team

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1 Introduction

MAGIQ is the new guider system at the Keck Observatory. It consists of new guider cameras for each instrument, and new software packages to control the camera and display and manipulate the guider images. The new cameras are much more sensitive than the original Keck guider cameras, which are no longer manufactured. The new software, and especially the new user and OA interfaces, are much more powerful than the old ones. They incorporate many new features summarized below.

- The new MAGIQ software allows the user to share a target list with the OA, and to highlight choices on it. This makes indicating the next object very straightforward, avoiding repeating long strings of numbers verbally.
- Overlays of the fields of objects in the target list with the DSS are now possible.
- The observer's GUI (graphical user interface) now has controls for image brightness, contrast, etc which are independent of those used by the OA.
- Image has an overlay of compass rose and scale ruler.
- Previews of objects (when they can be observed given the elevation and azimuth limits of each Keck telescope), and airmass as a function of sidereal time can be displayed.
- There are plots of seeing, guide star brightness, and sky brightness and SNR as a function of time as well.
- Eventually MAGIQ will permit continuous focus, but that is not yet implemented.
- Most areas on the UI have tooltips that will display if the mouse is left hovernig on an area. These provide some description of what the button or field is for.

Details of how to use each of the new features are given below. Sections marked "Advanced" can be ignored until you are more familiar with MAGIQ and its capabilities.

The observer's GUI is now much more powerful than before, with these and many other new features. You are encouraged to read the details below of how to use each of them, and try things for yourself. The observer's GUI (unlike the OA's GUI) has no way to send commands to the telescope or the guider camera, so nothing you can do while trying things out can affect guiding, nor mess up the guider camera or the GUI. If the GUI appears to hang up, just stop the MAGIQ observer UI and then restart it.

If, however, you are a newcomer to Keck, you might feel more comfortable not taking advantage of any of these features until you are more experienced. In that case, you can just treat the observer's GUI as a display for the guider image, and just look at it; this is a completely acceptable way of observing as well.

1.1 How to start and stop MAGIQ

The observer's GUI is brought up from the guider eavesdrop pull down menu on any of the Keck instrument control computers. The GUI comes up initialized for the instrument currently installed. This pull down menu should also be used to stop the GUI at the end of the night.

2 MAGIQ Menus

The menus are listed at the top of the MAGIQ observer's GUI.

File Catalogs Image Archives Preferences DSS UserImage Camera Themes Layout Manager Show View

- File – lets you load and append to starlists
- Catalogs – lets you choose which catalog to use for overlay queries
- Image Archives - lets you choose which image archive to use for DSS image retrieval
- Preferences – lets you set global preferences
- DSS– lets you manipulate or view attributes about the DSS image
- Camera - lets you manipulate or view attributes about the camera image
- UserImage – lets you manipulate or view attributes about a user loaded image
- Themes – lets you choose different look and feels
- Layout Manager – lets you control the layout of the UI
- Show View – lets you make any panel visible and to the front

3 The UI in general

3.1 Tooltips

Most areas on the UI have tooltips that will display if the mouse is left hovering on an area. These provide some description of what the button or field is for.

3.2 Am I connected ?

The MAGIQ title bar shows the current connection status. It shows which instrument and telescope MAGIQ is connected to. If there is a problem with the communication between the UI and the MAGIQ server it will show here (in addition to the log file), saying “trying to connect”, “disconnected” or the instrument and telescope name when properly connected.



Figure 1 UI Title bar

Another quick sanity check is to examine the telemetry and guider panels. If these values are not updating then something is probably wrong.

3.3 Right mouse clicks (popup menus)

Most MAGIQ functions are done directly from the various panels. Tables, graphs and image displays all have right mouse click enabled popup menus.

See the MAGIQ primer (the feature summary given as Appendix A of this document) for a brief overview and list of the available commands and features with very short explanations for each.

4 Acquisition and Guider Images

Camera images come in two forms:

- Full frames
 - Use for acquisition, can be binned as needed. Updates periodically while guiding.
- Guider sub frames
 - Used for guiding. Sub images are not binned.

Camera images update automatically once the OA starts the MAGIQ hardware. The current camera name is displayed on the title line at the top of the image display.

The guide star itself appears in a small box (region of interest) within the full guider image. This small region of interest updates more frequently than does the entire guider image. So if the target object looks as though it may have drifted slightly off the desired position, wait until the next full image update before asking the OA to tune up the guide star position.

The guide box is surrounded by a box. Typically this box is blue when guiding on an object. If the OA is performing centroiding only and not actively guiding then this box will be red. The FWHM and centroid location within the guide box is displayed by a circle that is drawn over the image. If there is problem determining the centroid of the guide star, this circle will turn red.

Note: When first turned on, the UI must receive a full frame image before guider images display begins.

What gets displayed on an image display?

- Camera Image (including sub-images), User or DSS image
- Guider compass rose for RA, Dec and az,el
- Scale ruler
- Optional guider Pointing Origins and FOV (FOV only for DSS)
- Optional overlay of catalog entries (item names may be shown or hidden)
- Optional grid showing RA and Dec at intersections
- Fiducial points on camera image
- Marker to indicate observer specified location on camera image
- Status information

The MAGIQ Image Display control is a composite of controls. It includes:

- A control toolbar
- An image display area
- A pan and zoom overlay
- A cut level and color bar control
- An image status area.

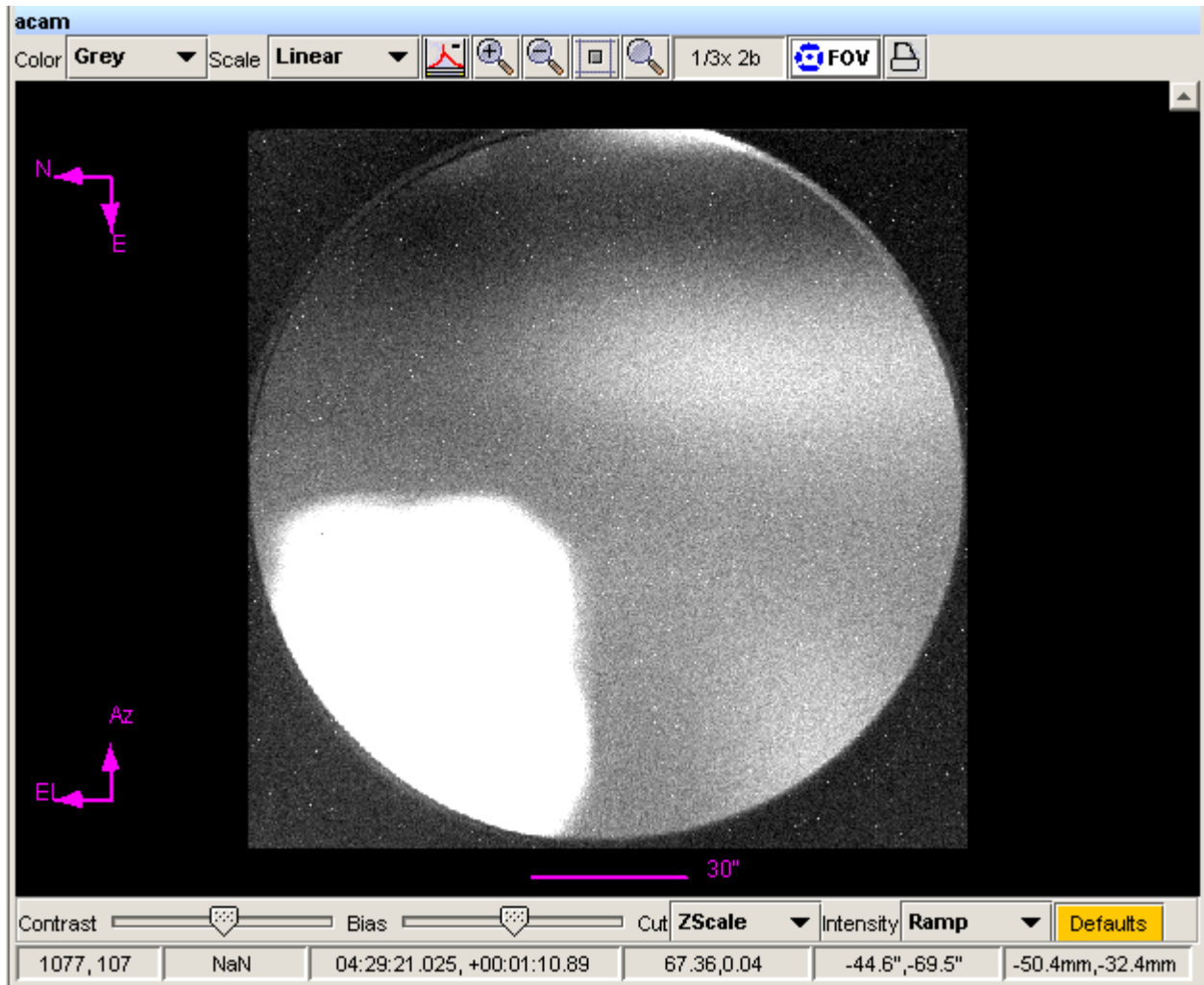


Figure 2 Camera image display

4.1 Adjusting Images

Images can be adjusted in the following way:

- Color
- Scale
- Zoom
- Intensity
- Cut Levels (black and white)
- Contrast and Bias

There are two control bars, one above and one below the image that allow these items to be changed.

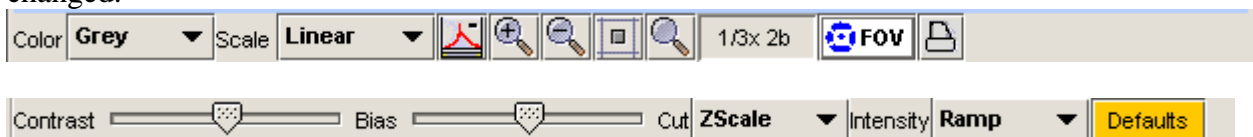


Figure 3 Image control bars

Along the top is the control bar which allows manipulation of the current display. In order from Left to Right the control bar has the following widgets:

- Color selection
- Image Scale Algorithm selection
- Advanced cut level dialog – including image histogram
- Zoom in
- Zoom out
- Zoom to fit (i.e. fit to current window size)
- No Zoom – image displays at normal size
- Current zoom and binning (zoom is identified as nx and binning as nb)
- Toggle Pointing origins overlay on/off
- Print current image

Along the bottom is the control bar which allows further manipulation of the current display. In order from Left to Right this control bar has the following widgets:

- Contrast and bias slider
 - The left hand side has the contrast and bias levels controls. The image allows DS9 style contrast and bias controls by holding down and dragging the right mouse button within the image display window and the sliders can be used in combination or as an alternative to this.
- Cut level algorithm
- Image Intensity selection
- Default button – restore all default options

4.1.1 Color

Sets the colormap for the image. The default is a greyscale from black to white, but false colors can be applied. Changes are applied as soon as a color is selected from the drop on the control bar.

4.1.2 Scale

Scale is used to set the distribution of colors based on pixel values. Changes are applied as soon as a scale algorithm is selected from the drop on the control bar. Using the drop down the color distribution can be changed to linear, log, squared, square root, and histogram or amplify small.

4.1.3 Zoom

By default an image is auto sized so that it fits into the current window size. This can be changed by using the zoom capability. There are two ways to zoom an image:

- Using the mouse
- Using the zoom buttons on the control bar

Note: the current zoom factor and binning are displayed on the top control bar.

4.1.3.1 Zooming using the mouse

If a mouse wheel is present it can be used to cause the image to zoom in and out once the cursor has been positioned in the display window.

If no wheel is present the middle mouse button can be used by holding the button down and dragging the mouse in the vertical direction. Moving up will zoom in, down will zoom out.

4.1.3.2 Zooming using the control bar

There are 4 buttons

- Zoom in
- Zoom out
- Zoom to fit (i.e. fit to current window size)
- No Zoom – image displays at normal size

4.1.4 Contrast and Bias

Contrast and Bias can be changed by using right mouse button and drag or by using sliders. The left hand side of the bottom control bar has the contrast and bias levels controls. The image allows DS9 style contrast and bias controls by holding down and dragging the right mouse button within the image display window. The sliders can be used in combination or as an alternative to this.

4.1.4.1 Using the mouse

The contrast and bias of the current colormap can be changed by holding down the shift button while clicking and dragging the right mouse button. Contrast is changed by moving the mouse in the vertical direction and bias is changed by moving the mouse in the horizontal direction.

4.1.4.2 Using the sliders

The sliders can be used instead of the mouse. The sliders do not give the same extreme range that the mouse button provides. There is a separate slider for contrast and for bias. Moving the slider in one direction will increase contrast or bias and moving in the opposite direction will decrease it.

4.1.5 Intensity

Rearranges the order of the colors in the colormap. Ramp is the default. Changes are applied as soon as an intensity type is selected from the drop on the control bar. Using the drop down the intensity distribution can be changed to equal, exponential, gamma, log, negative, negative log or ramp.

4.1.6 Cut Levels

Cut levels are used to set the upper and lower limits based on pixel values. There are four choices for the automatic application of cut levels:

- MinMax, %

- Set the upper and lower limits to based on the specified percentage. A histogram of the data is created and the limits are set to display the percentage, about the mean value. For minmax the percent is set to 100%.
- ZScale
 - Set the upper and lower limits base on the IRAF ZScale algorithm. ZScale parameters may be configured via the detailed cut level dialog.
- JSky
 - Set the upper and lower limits base on the JSky algorithm. This choice is particularly useful when the sky is very bright or rapidly varying (e.g. at twilight). JSky may be configured via the detailed cut level dialog.
- Mean
 - Set the upper and lower limits base on a standard deviation about the mean. Mean parameters may be configured via the detailed cut level dialog.

The automatic settings can be changed to manual and in this case the cut levels are determined by the user.

4.2 Marking images

4.2.1 Fiducial Marks

Fiducial marks can be placed on the image by right clicking on the image and choosing “Mark Fiducial Point”. Use “Clear Fiducial Points” to remove marks. Choosing this menu item will create a numbered circle around the current mouse position on the display. Any number of fiducial points can be marked.

4.2.2 Marking a location on the OA screen

A location on the OA’s UI can be highlighted by right clicking on the image on the observer’s GUI and choosing “Set Marker”. This will cause a mark point to appear in the same location on the camera image displayed on the OA’s screen. This provides an easy way to identify a point on the camera image to the OA without having to read out X,Y positions. Subsequent calls to Set Marker will remove the previous marker from the OA’s GUI and mark the new location. Use “Clear Marker” to remove a mark.

Any number of fiducial points can be set locally on the observer’s GUI, but only one location (the latest one marked) can be highlighted on the OA UI.

4.3 Saving Images

The current full frame image can be saved as a bitmap, jpeg or in FITS format. To save an image right click and select “Save as ...”. The resulting file appears in the nightly directory.

4.4 Printing Images

The current image can be printed by pressing the “Print” button on the top control bar. This is the last button on the bar. The image is printed as it appears on the screen with the compass rose

overlays, any fiducial points etc. In addition current telemetry information is also included as a footer.

4.5 Image Information

At the bottom of the image display is an image status bar.

560, 450	985.0	04:29:24.086, +00:02:20.14	67.35,0.06	1.3",-0.3"	-0.2mm,0.9mm
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Figure 4 Image status area

All regions on this control have tooltips. The data displayed in each subpanel is as follows, in Left to Right order:

- Cursor position of the mouse
- Pixel value at the mouse position
- RA, Dec at the mouse position
- Az, El at the mouse position (only valid for guider camera image)
- RA, Dec offset in arcsec between the current mouse position and current Pointing Origin
- Guider image X,Y coordinates in mm from current PO to mouse position

4.6 Pan and Magnify

There is a small drop down on the top right hand side of each display image. This can be used to toggle the appearance of the pan and magnify window.

4.6.1 Magnification

Magnification is automatic. As the mouse is moved around the main image the magnify window updates with a scaled image for that region around the mouse.

4.6.2 Panning

Panning is only valid if the image has been scaled such that its size is larger than the available screen real estate. The panning window will show what portions of the image are currently displayed in the display area by drawing a yellow box around that area. The image can be panned by selecting an area in the panner window with the left mouse and dragging the mouse in the direction of choice.

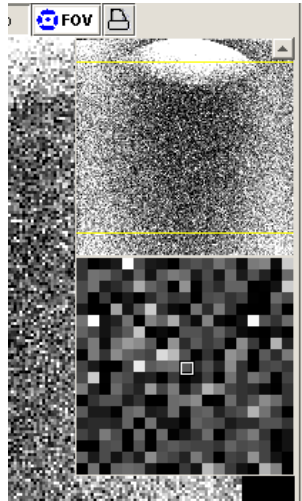
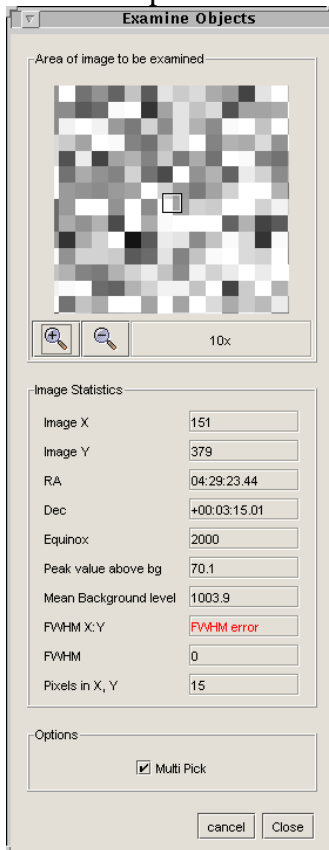


Figure 5 Pan and Magnify

4.7 Image Analysis

This is only applicable for camera images. It will not work for DSS or other externally generated images that you may have loaded into the MAGIQ display. Select Camera->Examine Objects from the top menu to bring up the “examine objects” window.



By selecting on an object in the image display the examine object window will update to display the following information:

- X,,Y position
- RA, Dec for that location
- Mean background for the region around the mouse
- Peak value above background
- FWHM

5 DSS Images

DSS images are automatically retrieved any time a target is selected from the starlist. Once a DSS image is retrieved it is cached locally. DSS images for the entire starlist can be pre-cached at the start of the evening by right clicking on the starlist and selecting “Fetch DSS and catalogs for starlist”. The default is DSS2R images.

The DSS images retrieved for use with MAGIQ have a FOV of 0.1 degrees. In addition to the standard image manipulation functions the following functions are available for DSS images.

- Overlay the guider FOV and pointing origins
- Overlay catalog information onto the DSS.
- Rotate the DSS image to a given angle
- Auto rotate the DSS image to track the guider angle

The same image display component used for camera images is used for the DSS. For details on how to adjust images see 4.1

5.1 Overlay the guider FOV and pointing origins

The last button on the top control bar of the DSS image is titled FOV and can be used to toggle the guider FOV and pointing origin overlay. The FOV box and pointing origins will track the currently selected PO.

5.2 Overlay catalog information onto the DSS.

The second last button on the top control bar of the DSS image is an icon showing a tabular list in magenta and can be used to toggle an overlay of catalog information on the DSS. The catalog information is retrieved any time a target is selected in the starlist. Catalog information is cached.

If the catalog overlay is visible it is possible to interact between the overlay on the DSS image and the catalog table. Clicking on an overlay item in the DSS will highlight that item in the catalog table. Likewise clicking on an item in the catalog table will highlight that item on the overlay by setting it yellow.

Items from the catalog are overlaid as oval shapes on the display. The radii of the ovals are scaled to the magnitude of the catalog item.

5.2.1 Displaying catalog item names

From the top level menu choose Preferences->Show GSC Names to have the name of each catalog item shown next to the item on the overlay. This is only useful for fields that are not very crowded.

5.2.2 Display a grid

From the top level menu choose Preferences->Show GSC Grid to superpose a grid as part of the overlay. This grid is presented as a 4 * 4 grid with the RA, Dec coordinates displayed at each vertex.

5.3 Rotate the DSS image to a given angle

To rotate the DSS to a given angle, enter the angle in degrees into the text box adjacent to the rotate button on the top control box. The rotate button is represented as a curving arrow. Click the button to rotate the DSS. To remove the rotation, enter 0 into the box and press rotate.

5.4 Auto rotate the DSS image to track the guider angle

To have the DSS automatically track the guider angle, click the synch button on the top control bar. This button is represented by two curving arrows that point towards each other. This is a toggle button. The same button is used to turn on and off this tracking capability.

6 User Images

All the above features applicable to DSS images can also be applied to user-supplied images.. User images are not loaded automatically but can be loaded on demand by a user through the File menu. Select File-> Load Image to bring up the file selection dialog. Choose a file and then press "Select image to load" The image will appear in the UserImage display.

The same image display components used for camera images are available for User Images. For details on how to adjust images see 4.1. For details on how to rotate images etc. see 5.3 and 5.4.

7 Catalogs

Any time a target is selected a catalog query is performed for the region surrounding the target. A variety of online and local catalogs are available which include those listed below. The GSC, SAO and HIP are archived locally. The GSC2 is the default catalog. Available catalogs are:

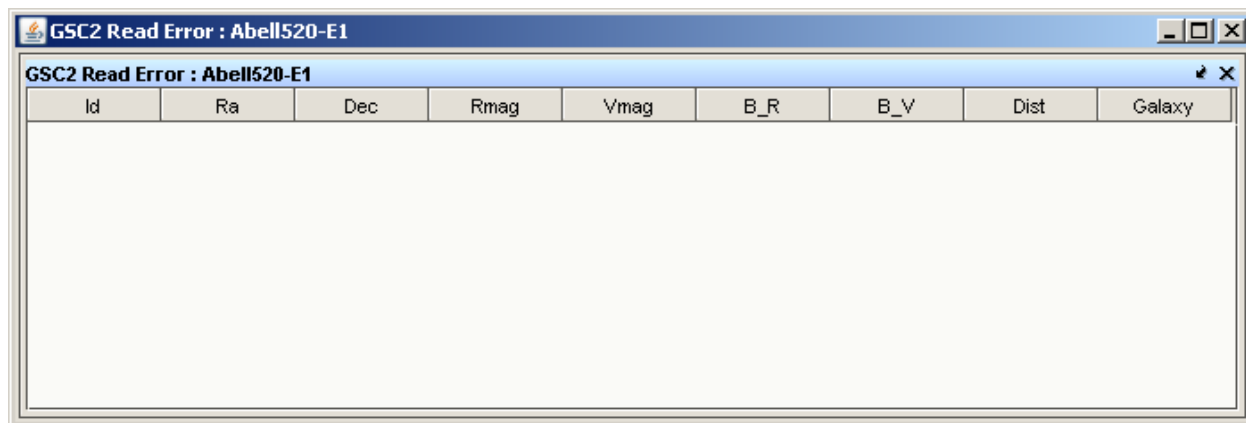
- GSC23
- Nomad
- 2Mass
- USNOB10
- VGSC2 (default)
- GSC
- SAO
- HIP

The choice of which catalog service to use is selectable from the main menu. Choose Catalogs and then the catalog name to use. The current selection is checked. If you have already selected a target and want to change the catalog for that target, then change the catalog name and refresh the target.

It is possible to specify a radius and range of magnitudes to use for the catalog query. These are available on the target panel. If you want to change the search radius and/or the vmag range after you have selected the target you should use “Refresh” to update the information.

Searching the catalog produces a table as is shown below. The catalog table has the same sorting, column reordering, filtering and highlighting capabilities as the starlist table.

Information on the objects listed in the catalog table can be overlaid onto the DSS. If the catalog overlay is visible it is possible to interact between the overlay on the DSS image and the catalog table. Clicking on an overlay item in the DSS will highlight that item in the catalog table. Likewise clicking on an item in the catalog table will highlight that item on the overlay by setting it yellow.



Id	Ra	Dec	Rmag	Vmag	B_R	B_V	Dist	Galaxy
----	----	-----	------	------	-----	-----	------	--------

Figure 6 Sample catalog Table

The first entry is always the actual primary target.

Id	The catalog name of the star
RA	The Right Ascension of the star in hours
Dec	The Declination of the star in degrees
Rmag	The R Magnitude of the target, if specified
Vmag	The V Magnitude of the target, if specified
B_R	B – R if specified
B_V	B – V if specified
Dist	The distance of the item from the target in degrees
Galaxy	If set the catalog item is no a star

8 Starlist and Target Management

It is possible to map the starlist which the OA is currently using into the observer UI so that you can easily use it to interact with the OA. Once mapped the observer can:

- Dynamically add items to the starlist
- Dynamically remove items from the starlist
- Highlight items from the starlist so that they appear highlighted on the OA UI. (useful for indicating the next target to be observed)

Index	Name	Ra/Az	Dec/El	Equinox	Mag	PMRA	PMDEC	DRA	DDEC	Rotmode	Rotdest	StarList
1	001	17:32:48.048	-04:58:17.14	2000.00	12.05	0.0000	0.000	0.0000	0.000		0.000	/kroot/starlists/laser/ags
2	002	17:38:14.217	14:45:10.63	2000.00	12.11	0.0000	0.000	0.0000	0.000		0.000	/kroot/starlists/laser/ags
3	003	17:38:30.501	34:45:12.47	2000.00	12.22	0.0000	0.000	0.0000	0.000		0.000	/kroot/starlists/laser/ags
4	004	19:38:09.764	15:02:38.64	2000.00	12.04	0.0000	0.000	0.0000	0.000		0.000	/kroot/starlists/laser/ags
5	005	20:36:43.068	-04:58:17.91	2000.00	12.04	0.0000	0.000	0.0000	0.000		0.000	/kroot/starlists/laser/ags
6	006	20:37:31.157	34:58:52.50	2000.00	12.15	0.0000	0.000	0.0000	0.000		0.000	/kroot/starlists/laser/ags
7	007	21:38:06.979	14:51:33.65	2000.00	12.23	0.0000	0.000	0.0000	0.000		0.000	/kroot/starlists/laser/ags

Figure 7 Sample Starlist table

Index	Numerical index, this is the order the item is first encountered in the starlist. If a starlist has duplicate entries the same name will appear but with different indexes.
Name	Target name
RA/Az	If the target is using FK4, FJK5 or APP then this shows the Right Ascension in hours. If it is using Mount coordinates then this is the Azimuth in degrees.
Dec/El	If the target is using FK4, FJK5 or APP then this shows the Declination in degrees. If it is using Mount coordinates then this is the Elevation in degrees.
Equinox	Equinox of target
Mag	Magnitude of the target, if specified
PMRA	RA proper motion adjustment if specified
PMDEC	Dec proper motion adjustment if specified
DRA	RA differential tracking adjustment if specified.
DDEC	Dec differential tracking adjustment if specified.
Rotmode	Rotator mode to use
Rotdest	Rotator angle to use
Starlist	The full path to the starlist

All tables in MAGIQ can be sorted, columns can be re-arranged and items can be filtered or highlighted.

8.1 Sorting a table

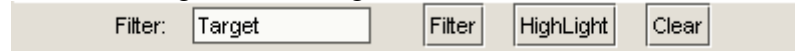
You can sort based on any of the columns in a table by clicking on the column header. Clicking once will sort in ascending order, clicking again will sort in descending order. A small arrow in the column header indicates the direction.

8.2 Arranging columns (Advanced)

To re-arrange the columns in a table simply click the column holding down the mouse and drag it left or right to the position you want, then release the mouse. Columns can also be made larger or smaller by dragging the column with the mouse.

8.3 Filtering or highlighting items (Advanced)

To enable filtering in a table, press CTRL-F while the table has focus or use the filter button that appears on the panel toolbar. It is the first button. A small dialog will appear at the bottom of the table allowing a filter string to be entered.



The filter or highlight operation is not case sensitive. Press Filter to perform the actual filtering. Press Highlight to just highlight using the filter string. For filter all the items are compared against the filter string and when applied the starlist contents will adjust to only display the items that matched the filtered set. For highlight all the items will continue to be shown but items matching the filter string will be shown in a different color.

To remove a filter or highlight; press the Clear button.

8.4 Mapping / Sharing the OA starlist

The MAGIQ server must be running and the OA must have loaded a starlist before performing this operation.

- Select "File" from top menu
- Select "Map OA Starlist"
- Targets will appear in the starlist table

You can confirm that the correct list is loaded by looking under the "StarList" column of the table. It is the last column and you may need to scroll to it.

8.5 Loading a private starlist (Advanced)

Multiple private starlist can be loaded. These provide all the same features of the main starlist but are not shared with the OA. The default directory for the starlist is /kroot/starlists. The starlist file must follow the SKY format (standard Keck format for starlists). To load one or more starlists

- Select "File" from top menu
- Select "Load Private Starlist"
- From Dialog, select starlist of choice
- Click on "Select a starlist to Open"

The new starlist will appear under a new tab, following the main starlist.

8.6 Appending to a private starlist (Advanced)

You can add/append one or more starlists together into a single starlist. This only applies to private starlists. To do so

- Select "File" from top menu
- Select "Append To Private Starlist"
- Choose the starlist to append to from the sub-menu
- From Dialog, select starlist of choice
- Click on "Select a starlist to Open"

8.7 Saving a starlist

It is possible to save a mapped or private starlist back to file by using the "Save Starlist" button on the starlist panel toolbar. It is represented by the standard save icon. Once pressed, a dialog will open allowing you to enter the directory and filename. Press "Save Starlist" on the dialog to complete the operation.

8.8 Selecting a target from the starlist

To select a target simply click on object with left mouse button. Once selected a number of things happen:

- Preview panel will update for target
- DSS image will update for target (if auto retrieval is enabled)
- Catalog info will update for target (if auto retrieval is enabled)

8.9 Target Refresh

Refresh applies to whatever target is currently selected in the table. Refresh will:

- Force a preview update
- Retrieve DSS image for this target, if not cached
- Retrieve catalog overlay information for this target, if not cached

8.10 Target Preview

The preview panel is updated automatically whenever a new target is selected in the starlist (or a target is refreshed). It is also automatically updated every 10 seconds, if "Live Preview" is enabled. The preview window display information for this target at the present time (time to limit, airmass, etc.) To get preview information for this target at some other time (i.e. what is the airmass one hour from now ?) you can uncheck "Live Preview" at the lower right of the preview window, then type in a new LST. The preview values will then be computed for the new LST.

Preview			
Tel Time to Limit: not up	Parallactic: 60.10	Rot Time to Limit: No limit	CW Lim: N.A.
Above Limit: 19:03 ST (09:39)	Airmass: n.a.	Rotpdest: -60.10 (299.90)	CCW Lim: N.A.
Below Limit: 03:21 ST (17:57)	Az: 292.84	Direction: CCW	<input checked="" type="checkbox"/> Live Preview
Est Slew Time:	El: -47.12	Rotdest: 00.00	LST: <input type="text" value="09:24:39"/>

Figure 8 Preview Panel

The fields are as follows and are applicable to the current selection:

Tel Time to Limit	Time until telescope reaches limit in hours:minutes
Above Limit	Time the target becomes visible (Blue is past, Red is future)
Below Limit	Time the target goes below limit
Est Slew Time:	Estimated time to slew to selected target from current position
Parallactic	The parallactic angle at limit
Airmass	The airmass at limit
Az	The current azimuth value for this target
El	The current elevation value for this target
Rot Time to Limit	Time until rotator reaches limit in hours:minutes
Rotpdest	Physical rotator angle at limit
Direction	The direction the limit will occur in.
Rotdest	Rotator user angle at limit
CW Lim	Value used for Clockwise rotator limit
CCW Lim	Value used for Counter Clockwise rotator limit
Live preview	If selected the current LST is used
LST	If "Live Preview" is selected this constantly updates with the current lst. If not selected then any LST can be entered here to preview for a given time. Format is hh:mm:ss

8.11 Highlight a target from starlist on the OAs screen

This feature is useful when you want to let the OA know what the next target should be or to discuss the possibility of observing a particular target in planning subsequent observations. Only one target at a time can be highlighted on the OA screen. The currently selected item will be highlighted in yellow. To do this:

- Select the object from starlist
- Press right mouse within starlist window
- Select "Highlight as next target " from popup menu

8.12 Adding a new target

Select the target tab to get a target panel which will allow you to manually enter a new target. This target can then be added to the main starlist.

The screenshot shows a 'Target' panel with the following elements:

- Target Name:** 001
- Buttons:** Get Current, Add, Resolve
- Slew Time:** unknown
- Coordinates:**
 - Ra:** 17:32:48.048
 - Dec:** -04:58:17.14
 - Equinox:** 2000.0000
 - Az:** 101.2861
 - El:** 15.5171
- Buttons:** Synch, List, +RA (0.25), +-Dec (4.0), Vmin (10), Vmax (12)
- Rotator Section:**
 - Buttons: +, -, 0.0
 - Dropdown: PA

Figure 9 Target panel

Once the information has been entered, press “Add” to add the item to the main starlist.

Note: this panel does double duty. It is also used to change the search radius and magnitude ranges for catalog retrieval. In addition the rotator angle and mode can be changed so that these are factored into preview calculations.

8.13 Removing a target

To remove a target from a starlist do the following:

- Select object from starlist
- Press right mouse within starlist window
- Select "Remove target from list" from popup menu

8.14 Resolving a target by name

To resolve an item by name using the same service; enter the target name into the target panel and press “Resolve”. The RA, Dec and Equinox fields will update.

8.15 Using the current target

To get the DSS and catalog information on where the telescope is currently pointing, press “Get Current” to retrieve the current target information and then press “add” to add it to the starlist or “List” to just retrieve the DSS and catalog information.

8.16 Fetch DSS and catalogs for starlist

This task will retrieve and cache the DSS and catalog overlay information for each item in the starlist. To fetch and cache DSS and catalog information for the starlist, right click within the starlist table and chose “Fetch DSS and catalogs for starlist”

Choosing this menu item will launch the MagiqCacheGeneraor task in the background. There is no visible cue that the retrieval is happening, though a log file called, MagiqCachegeneraor.log does get created.

8.17 Extended Previews

An extended preview can be generated for any starlist or subset of a starlist. The extended preview can be launched from the observer or OA UI or can be run as a standalone program. The user can load a starlist through the File menu. The starlist is loaded automatically when this UI is launched via a right mouse click from the main UI.

The extended preview view contains three tabs, which consist of an elevation, observation chart and tabular information. All times along the x axis can be displayed in UT, LST or HST. In the elevation plot, elevation and airmass and optionally parallactic angle are plotted over time. The user can select whether to plot elevation, angle or both together for the selected targets. Plotting elevation and parallactic angle together becomes messy very quickly if there are a large number of targets.

The observation chart shows twilight and dark time for the night and shows the timeline over which each object overlaps. For each target the maximum elevation during the night is shown and if a target's elevation comes within a certain delta of zenith it is changed to red on the chart. (Since Keck is an alt-az telescope, a small region around the zenith is not accessible.) It is possible to create multiple observation charts based on certain criteria such as elevation, amount of observable time. One can also restrict the number of items per graph. For a large starlist the observation chart will automatically create multiple plots each containing a number of objects small enough to keep the display usable. The charts can be saved as JPEG files in the nightly directory, for later use or for printing.

8.18 Immediate starlist plot

Choosing this menu item will launch the MAGIQ extended preview window. This is a separate UI that once launched can be operated independently from the main UI. Its functionality is described above.

With this option all targets in the starlist are plotted. This can produce a messy plot difficult to interpret if there are a large number of targets in the current starlist.. Once the extended preview dialog is up it is possible to manage which targets are plotted using the View->Targets menu. If you only want to plot a subset then the "Deferred starlist plot" might be the best choice.

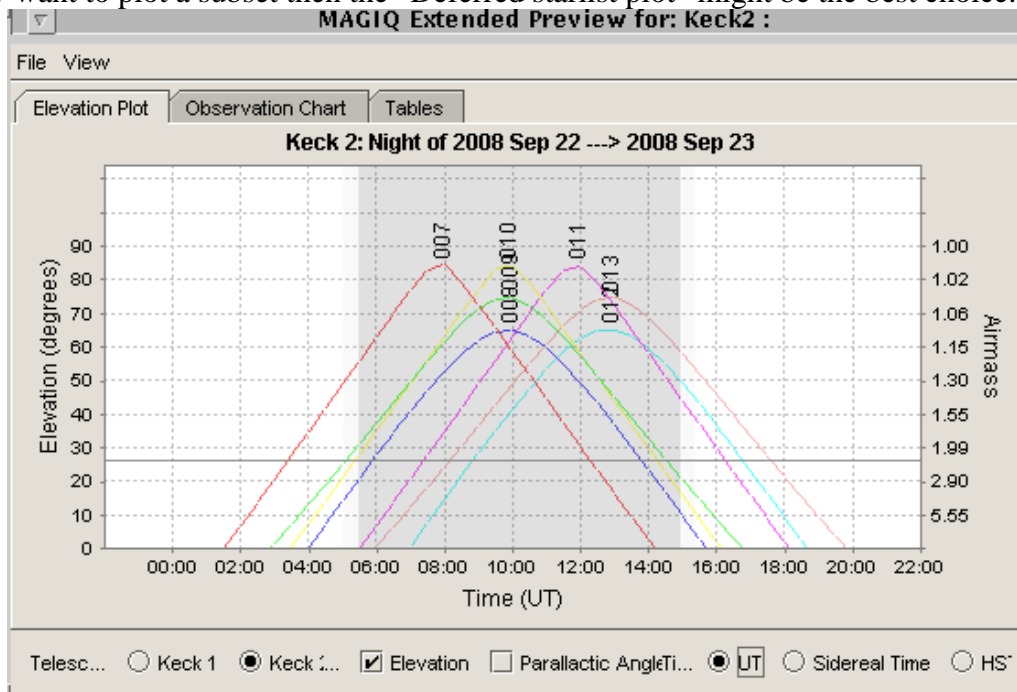


Figure 10 Extended Preview Window

8.19 Deferred starlist plot

Choosing this menu item will launch the MAGIQ extended preview window whose functionality is described above.. This is a separate UI that once launched can be operated independently from the main UI.

With this option no targets are initially plotted. Using the View->Targets menu you can select which items to plot. Options include plot all, plot none or plot selected targets from the starlist.

8.20 *Plot selected target*

This brings up the same UI and graph as above but only plots the selected target.

9 Information Panels

There are a number of UI panels that display telescope, guider and camera telemetry information in both a textual and graphical format.

9.1 Telemetry

This panel is like a mini facsum and displays information about the current target and telescope state.

Telemetry				
Telescope:	not controlling	Az: 67.35	Rotator: Unknown	TTL: not up
Instrument:	OSIRIS	El: 0.06	Sky PA: 000.00	RTTL: No limit
Target:	HORIZON STOW	Ra: 04:29:24.000	Drive: 000.00	PMRA: 0.000
Pointing Origin:	ospec	Dec: 00:02:20.40	LST: 09:24:39	PMDEC: 0.000
Diff Track:	Off	Diff Guide: Off	DRA: 0.000	DDEC: 0.000

Figure 11 Telemetry Information Panel

Telescope	Telescope state
Instrument	Current instrument
Target	Current target
Pointing Origin	Current PO
Diff Track	Shows if Differential Tracking is enabled or not
Az	Current Az
El	Current El
RA	Current RA in hours
Dec	Current Dec in degrees
Diff Guide	Shows if Differential Guiding is enabled or not (DOFFGE)
Rotator	Rotator state
Sky PA	Current Sky PA
Drive	Rotator drive position
LST	Current LST
DRA	RA differential tracking rate for current target
TTL	Telescope time to limit for current target
RTTL	Rotator time to limit for current target
PMRA	RA proper motion for current target
PMDE	DEC proper motion for current target
DDEC	DEC differential tracking rate for current target

9.2 Guider Info (Advanced)

Guider					
Camera:	acam	Guider State:	Off	Filter 1:	Unknown
Integration Time:	1.00	Differential Tracking:	Off	Filter 2:	Unknown
Binning:	BINNING_1x1	Algorithm:	Unknown	Focus:	0.00
Box Size(pixel):	(512,512)	Box Size(arcsec):	(68.61,68.61)	Timestamp:	10:05:24 AM HST
<hr/>					
FWHM (arcsec):	0.00	Sky Count:	0	SNR:	NAN
Centroid (X, Y):	(-20.15,-2.14)	Star Count:	0	Time Guiding:	20:13:26

Figure 12 Sample GuiderInfo panel

This panel provides telemetry information on the camera and guider.

- The panel provides information about the camera image and current guider state.
- Camera related information is on the top and guider information on the bottom.

9.3 Graphs

There are a number of real time graphs that display FWHM, sky and star counts, SNR and centroid X,Y information for the last ten minutes. All graphs auto scale.

To change the properties of a graph, right click on the graph. This will bring up a pop-up menu that allows you to change the X and Y axis labels, ranges, etc. (General hint: if you want to change the properties of a display window, try right-clicking on it.)



Figure 13 Sample graphs

9.3.1 Zooming a Graph

The following works when the cursor is positioned on the graph.

Zoom in by holding down the left mouse button on the area of interest and moving to the right.

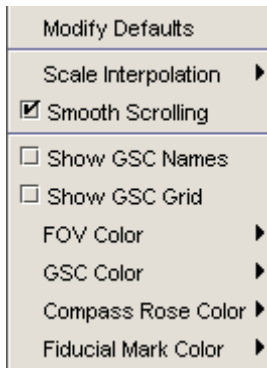
Zoom out by holding down the left mouse button and dragging it to the left.

9.3.2 Changing scale

All graphs auto scale based on the range of the dataset. It is possible to manually change the range by right clicking and using the graph properties. To manually set a range

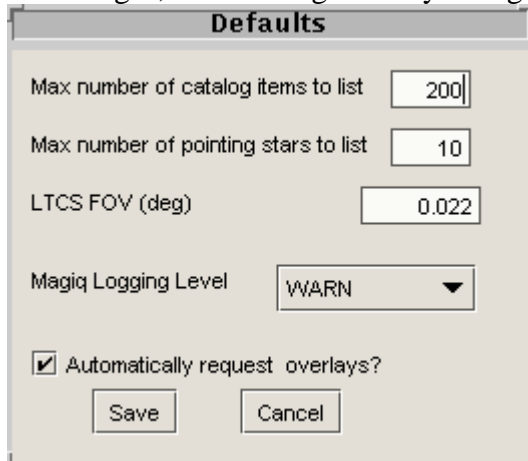
- Select the Plot tab
- Select the Range Axis
- Under Other, select Range
- Unselect “Auto adjust range” and manually enter the upper and lower range.

9.4 Preferences



9.4.1 Modify Defaults

Displays a dialog box allowing various defaults to be changed. Press Save on the dialog to allow the changes, Cancel to ignore any changes.



Default items that can be changed include:

- The maximum number of catalog items to list after a query
- The maximum number of pointing stars to list after a query
- The LTCS FOV to use in the LTCS Queries
- The logging level to use in MAGIQ, the default is WARN
- If Automatically Request Overlays is selected, which is the default, each time a new target is selected the DSS and catalog for that target will be selected. Items are automatically cached after the first query.

9.4.2 Scale Interpolation

Determines the scale interpolation to use when scaling a camera or DSS image. NEAREST is the default and fastest. Other options typically gives smoother results though that may not necessarily be the best for guider images.

9.4.3 Smooth Scrolling

When enabled the main image window continuously updates, scrolls, when the image is being panned. Enabled is the default. If the option is not set the image only updates after a pan is finished.

9.4.4 Show GSC Names

If enabled the catalog item names are displayed as part of the catalog overlay, otherwise only the catalog item markers are display.

9.4.5 Show GSC Grid

If enabled a grid is displayed over the DSS image showing the RA,Dec at each grid point.

9.4.6 FOV Color

Sets the color to use for the FOV layer.

9.4.7 GSC Color

Sets the color to use for the catalog overlay layer.

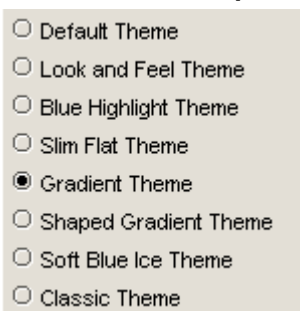
9.4.8 Compass Rose Color

Sets the color to use for the compass roses.

9.4.9 Fiducial Mark Color

Sets the color to use for fiducial point markers on the camera images.

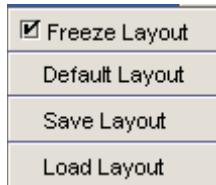
9.5 Themes (Advanced)



A screenshot of a software menu titled "9.5 Themes (Advanced)". The menu is enclosed in a light gray box and contains eight radio button options. The "Gradient Theme" option is selected, indicated by a filled black circle next to the text. The other options are unselected, indicated by empty circles. The options are: Default Theme, Look and Feel Theme, Blue Highlight Theme, Slim Flat Theme, Gradient Theme, Shaped Gradient Theme, Soft Blue Ice Theme, and Classic Theme.

This menu allows the UI to be assigned a different look and feel. Changes are minor and include background colors, tabs sizes etc.

9.6 *Layout Manager (Advanced)*



9.6.1 Freeze Layout

This is set by default. When set, the overall window can be moved and sized but individual panels are locked in place. When unselected, each of the panels can be moved around, minimized, maximized or floated.

9.6.2 Default Layout

This restores any layout to the default. This option can always be used to recover from a corrupt layout file or mistake in arranging a layout.

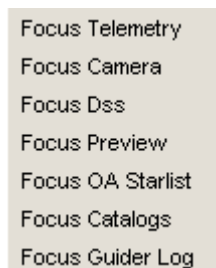
9.6.3 Save Layout

This saves the current layout to a file which can be reloaded later.

9.6.4 Load Layout

This loads a previously saved layout and re-arranges the UI based on the contents.

9.7 *Show View*



This menu gets dynamically updated. It will also show the regular panels and depending on what other panels are loaded, such as private starlist, it may also include additional views. Selecting any item in the menu causes the panel to be made visible, and brought forward into UI focus.

10 Appendix A – Brief Summary of MAGIQ Features

10.1 Starlists

Loading	
Share the OA starlist	<ul style="list-style-type: none"> • Select "File" from top menu • Select "Map OA Starlist"
Load one or more private starlist(s)	<ul style="list-style-type: none"> • Select "File" from top menu • Select "Load Private Starlist" • From Dialog, select starlist of choice • Click on "Select a starlist to Open"
Append to an already open starlist	<ul style="list-style-type: none"> • Select "File" from top menu • Select "Append To Private Starlist" • Choose the starlist to append to from the sub-menu • From Dialog, select starlist of choice • Click on "Select a starlist to Open"
StarList operations	
Select an item from a starlist	<ul style="list-style-type: none"> • Click on object with left mouse button <ul style="list-style-type: none"> • Preview panel will update for target • DSS image will update for target (if auto retrieval is enabled) • Catalog info will update for target (if auto retrieval is enabled)
Highlight a target from starlist on OAs screen	<ul style="list-style-type: none"> • Select object from starlist • Press right mouse within starlist window • Select "Highlight as next target " from popup menu
Add an item to a starlist	<ul style="list-style-type: none"> • Fill in information on Target Panel • Press the "Add" button <p>For known objects "<i>Resolve</i>" can be used to retrieve the object information via Sesame To use the current telescope target press "<i>Get Current</i>"</p>
Remove an item from a starlist	<ul style="list-style-type: none"> • Select object from starlist • Press right mouse within starlist window • Select "Remove target from list" from popup menu

Cache DSS and Catalog information for a starlist	<ul style="list-style-type: none"> • Press right mouse within starlist window • Select "Fetch DSS and catalogs for starlist " from popup menu
Plot rise times for selected object	<ul style="list-style-type: none"> • Select object from starlist • Press right mouse within starlist window • Select "Plot selected target" from popup menu <p>Graph will appear showing Airmass, elevation, parallactic angle and observable times for object</p>
Plot rise times for all objects in the starlist (deferred)	<ul style="list-style-type: none"> • Press right mouse within starlist window • Select "Deferred starlist plot" from popup menu <p>Graph will appear. No objects are visible in graph. Use View->Tragets->Add from Extended Preview UI to graph objects</p>
Plot rise times for all objects in the starlist (immediate)	<ul style="list-style-type: none"> • Press right mouse within starlist window • Select "Immediate starlist plot" from popup menu <p>Graph will appear showing Airmass, elevation, parallactic angle and observable times for all objects</p>
Filtering/HighLighting	
Show / Hide the Filter bar	<ul style="list-style-type: none"> • Toggle "Toggle List Filtering" on starlist toolbar
Filter (Display) only specific items	<ul style="list-style-type: none"> • Enter string into Filter: field on Filter Bar • Press the Filter button
Highlight specific items	<ul style="list-style-type: none"> • Enter string into Filter: field on Filter Bar • Press the Highlight button
Show all items	<ul style="list-style-type: none"> • Press the "Clear" on the Filter bar
DSS and Catalog Auto Retrieval	
Enable / Disable DSS Automatic retrieval for targets	<ul style="list-style-type: none"> • Toggle "Auto retrieval" on starlist toolbar

10.2 All Images

Zooming/Panning	
Zoom in (absolute)	<ul style="list-style-type: none"> • Use image toolbar

	<ul style="list-style-type: none"> • Press “Zoom In” button
Zoom out (absolute)	<ul style="list-style-type: none"> • Use image toolbar • Press “Zoom Out” button
Zoom to Fit (absolute)	<ul style="list-style-type: none"> • Use image toolbar • Press “Zoom to Fir” button
Zoom normal (absolute)	<ul style="list-style-type: none"> • Use image toolbar • Press “Zoom Normal” button (i.e. no Zoom)
Set zoom factor (relative)	<ul style="list-style-type: none"> • Click on image • If mouse wheel available – use wheel to change zoom • If no mouse wheel available – hold and drag middle button to change zoom
See Current Zoom and Binning	<ul style="list-style-type: none"> • Use image toolbar • Zoom and Binning appears as n x mb
Overlay Guider FOV	<ul style="list-style-type: none"> • Use image toolbar • Press “FOV” button
Adjusting Image Scaling/Colormap	
Adjust contrast/bias (DS9 style)	<ul style="list-style-type: none"> • Hold down shift button • Place cursor on image • Click and drag with RIGHT mouse • Contrast is vertical, Bias is Horizontal direction
Adjust contrast/bias	<ul style="list-style-type: none"> • Use contrast and bias slider bars
Change color	<ul style="list-style-type: none"> • Use image toolbar • Select color from “Color” dropdown <p>Grey is default</p>
Change scaling	<ul style="list-style-type: none"> • Use image toolbar • Select scale algorithm from “Scale” dropdown <p>Linear is default</p>
Change cut levels	<ul style="list-style-type: none"> • Use image toolbar • Select cut level algorithm from “Cut” dropdown <p>ZScale is default</p>
Change intensity	<ul style="list-style-type: none"> • Use image toolbar

	<ul style="list-style-type: none"> • Select intensity algorithm from “Intensity” dropdown <p>Ramp is default</p>
Restore defaults	<ul style="list-style-type: none"> • Use image toolbar • Press the “Defaults” button
Pan/Magnify	
Pan	<ul style="list-style-type: none"> • Ensure Pan/Magnify window is visible • In Pan window click on image and drag to new location • Release mouse
Magnify	<ul style="list-style-type: none"> • Ensure Pan/Magnify window is visible • Move around main image, magnified image appears in box
Image Information	
Cursor X,Y Position	<ul style="list-style-type: none"> • Place cursor on image • 1st column in status bar shows current X,Y position
Pixel Value at X,Y	<ul style="list-style-type: none"> • Place cursor on image • 2nd column in status bar shows pixel value for the current cursor position
WCS Ra, Dec	<ul style="list-style-type: none"> • Place cursor on image • 3rd column in status bar shows current Ra, Dec information for Camera Image and WCS info from DSS if available
WCS Az, El	<ul style="list-style-type: none"> • Place cursor on image • 4th column in status bar shows current Az, El information for Camera Image and WCS info from DSS if available

10.3 Camera Images

Image Operations	
Print Current Image	<ul style="list-style-type: none"> • Use image toolbar • Press “Print” button
Save Current Image	<ul style="list-style-type: none"> • Right click on image • Choose “Save Image as ...” from popup menu
Mark Fiducials	<ul style="list-style-type: none"> • Right click on image, at point of interest • Select "Mark Fiducial" • Repeat as needed

Clear Fiducials	<ul style="list-style-type: none"> • Right click on image • Select "Clear Fiducial"
Create a marker on the OA display	<ul style="list-style-type: none"> • Right click on image, at point of interest • Select "Set Marker"
Clear Marker	<ul style="list-style-type: none"> • Right click on image, at point of interest • Select "Clear Marker"
Image Statistics	
Measure centroid/size	<ul style="list-style-type: none"> • Select "Camera" from top menu • Select "Examine Objects" to get "examine objects" popup • Click on area of interest • FWHM and other information will appear in popup
Image Information	
Ra, Dec from PO	<ul style="list-style-type: none"> • Place cursor on image • 5th column in status bar shows current Ra, Dec offset from the current PO
XIM, YIM at Cursor position	<ul style="list-style-type: none"> • Place cursor on image • 5th column in status bar shows current Guider XIM, YIM at current cursor position

10.4 DSS Images

Manually Rotate Image	<ul style="list-style-type: none"> • Use image toolbar • Enter the angle in degrees to rotate • Press the "Rotate" button
Automatically Rotate Image (Track Guider)	<ul style="list-style-type: none"> • Use image toolbar • Toggle the "Track" button
Catalog overlay	<ul style="list-style-type: none"> • Use image toolbar • Toggle the "Catalog overlay" button
Show Grid with Catalog Overlay	<ul style="list-style-type: none"> • Select "Perferences" from top menu • Toggle "Show GSC Grid"
Show item names for Catalog Overlay	<ul style="list-style-type: none"> • Select "Perferences" from top menu • Toggle "Show GSC Names"
Show FITS keywords	<ul style="list-style-type: none"> • Select "DSS" from top menu • Select "Show DSS FITS Keywords"

10.5 User Images

Load User Image	<ul style="list-style-type: none">• Select "File" from top menu• Select "Load Image"• Select image of choice from dialog• Click on "Select an image to load"
Manually Rotate Image	<ul style="list-style-type: none">• Use image toolbar• Enter the angle in degrees to rotate• Press the "Rotate" button
Automatically Rotate Image (Track Guider)	<ul style="list-style-type: none">• Use image toolbar• Toggle the "Track" button
Catalog overlay	<ul style="list-style-type: none">• Use image toolbar• Toggle the "Catalog overlay" button
Show FITS keywords	<ul style="list-style-type: none">• Select "UserImage" from top menu• Select "Show UserImage FITS Keywords"

10.6 Telemetry

Telescope Telemetry	<ul style="list-style-type: none">• Use Telemetry Tab <p>Displays information on current target, current position, limits etc.</p>
Guider Textual Presentation	<ul style="list-style-type: none">• Use Guider Tab <p>Displays Guider and Camera information</p>
Guider Graphical Presentation	<ul style="list-style-type: none">• Use FWHM, Counts (Sky and Background), Centroid and SNR graphs

10.7 Layout

Enable Docking	<ul style="list-style-type: none">• Select "Layout Manager" from top menu• Toggle "Freeze Layout" so that option is not selected
Disable Docking	<ul style="list-style-type: none">• Select "Layout Manager" from top menu• Toggle "Freeze Layout" so that option is selected
Restore Default Layout	<ul style="list-style-type: none">• Select "Layout Manager" from top menu• Select "Default Layout"

Load workspace	<ul style="list-style-type: none"> • Select "Layout Manager" from top menu • Select "Load Layout" • Select Layout file from dialog • Press Open
Save workspace	<ul style="list-style-type: none"> • Arrange Layout • Select "Layout Manager" from top menu • Select "Save Layout" • Specify filename and directory in dialog • Press Save

10.8 MAGIQ Log Files

MAGIQ log files are intended for both debugging purposes (tracing the cause of errors and problems) and for archiving of sky and guider conditions. They go into the nightly directory. All log entries are time stamped in HST.

- MagiqServer.log
 - Primary log file, includes all low level actions, including DCS and guider interactions
- MAGIQ_OA_UI.log
 - Logs any errors with the U and all OA actions
- MAGIQ_Observer_UI.log
 - Logs any errors with the observer UI.

10.9 How to communicate with the OA UI

10.9.1 Use Starlist

Assumes Map OA Starlist has been performed.

To highlight a target as the next target:

- Select the target in the starlist
- Right click
- Choose "Highlight as next target" from the popup menu

10.9.2 Use Camera Image

Assumes camera images are being updated.

To highlight an area of interest on the OA UI:

- Right click on the camera image at the x,y position/on the object you want to highlight
- Choose Set Marker from the popup window

11 Appendix B – Zero Points for NIRSPEC MAGIQ Camera

Tests during the March 2008 engineering run suggest the following for the performance of the MAGIQ camera on NIRSPEC: for a star of mag 18.0 in each of V, R and I, the net DN per sec is 9,800 for the V filter, 11,800 for the R filter, and 4,500 for the I filter.

The scale of the MAGIQ guider camera on NIRSPEC is 0.20 arcsec/pixel.