StarCat

IRTF Star Catalog Application

User's Guide

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1. What is STARCAT?

The STARCAT software is a tool used to search star catalog files. Its 2 main functions are to provide Main Catalogs and manage the User List:

Main Catalog – There are numerous standard astronomical catalog available. User can specify a search coordinates and starcat will search the indicated catalogs and list the nearby stars.

User List – User can load their object list (a text file of objects) into the user list window.

Startcat can send slew request to the TCS using these catalogs lists, and query the TCS for its position for new search coordinate. These catalog lists can be viewed in a variety of formats, and sorted based on different fields. Starcat calculates the observed positional information on all listed objects. Is also display a diagram of the sky showing where the stars are located related to the IRTF's view of view.

If you have questions or comments concerning STARCAT, you may contact the author of the software via email at denault@ifa.hawaii.edu or by calling the IRTF. The starcat home page is at http://irtfweb.ifa.hawaii.edu/~tcs3/starcat/.

The current version of starcat is StarCat4

2. Setting up your user account

When STARCAT starts up, it read the file ~/.starcat-init in your home directory. Using a text edit, you can customized STARCAT using commands from Appendix A. For example, the file may contain the following instructions to set the search radius, and load the user catalog from the user's home directory.

If this file exist, STARCAT expects it to contain STARCAT commands. See the STARCAT Command Dictionary for the syntax. Using a text editor you can place instructions in this file to configure when STARCAT starts up. Here an example of a .starcat-init file:

```
guider none
mainsort Ang.Offset
catalog.clear
catalog.set nomad
SkyMap.ShowSmokey on
```

3. Starting STARCAT

STARCAT is installed in all IRTF observing workstation. Type 'starcat' on your terminal start it. Many observing desktop may have a STARCAT icon for you to use.

When starcat stars this window should appear on your screen:

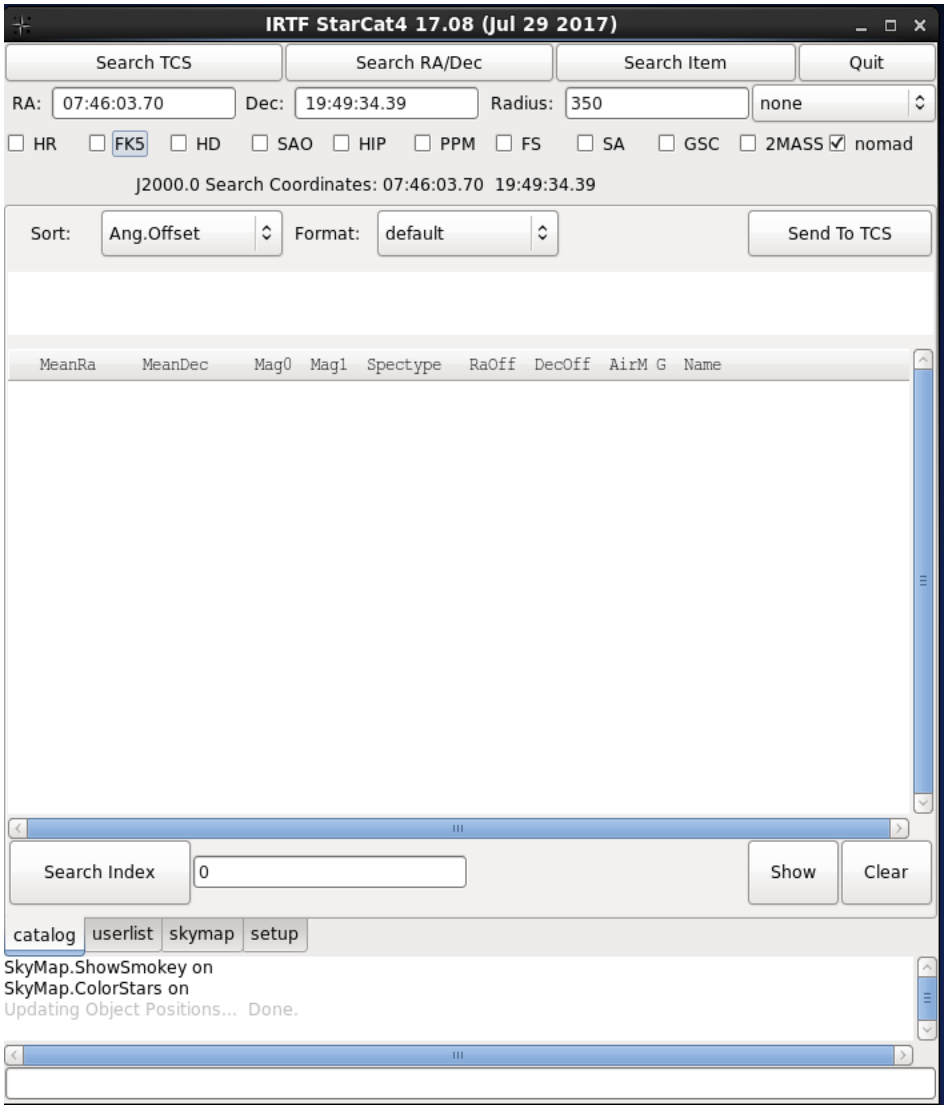
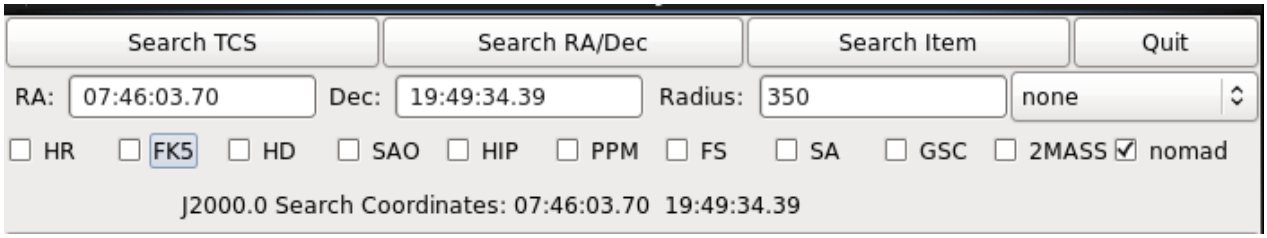


Figure 3.1 – The Base Window

4. Main Catalogs Search Options

These widgets allows you to search the Main Catalogs (HR, FK5, HD, ..) for data.



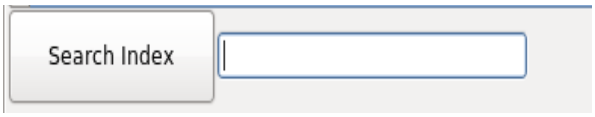
First select the catalog you wish to search, and insure the Radius is correct. You have 3 options as indicated by the 3 search buttons:

Search TCS – Starcat will query the TCS, update the RA/DEC field with the TCS's position, and perform a search on this position.

Search RA/DEC – First enter the coordinates in the RA/DEC text fields. Press this button to search the entered RA/DEC position.

Search Item - if you have catalog data loaded in the Main or User catalog list. You can highlight an entry and use that position as your search position. After highlighting a catalog entry, click the **Search Item** button.

Below the list of star is **Search Index.**



Enter the Numeric ID for the star to find a particular star, for example, to find SAO_45859 enter 45859. For SA stars, the enter 4 digit for each NNN-NNN part, ie SA-35-535 would be "00350535". GSC, 2MASS, and NOMAD are not supported.

4.1 About the Radius Parameter

Search will look for star at the FK5 J2000.0 search coordinates. Stars within the search radius will be placed in the main catalog. The Radius has 2 widget associated with it. The text field and pull down menu.

The pull down menu has selection which determine is the radius is automatically. The options are:

Off-axis – The radius is set to the field of view of the off-axis camera (350 arcseconds).

Cshell – The radius is set to the field of view of the cshell guider (90 arseconds)

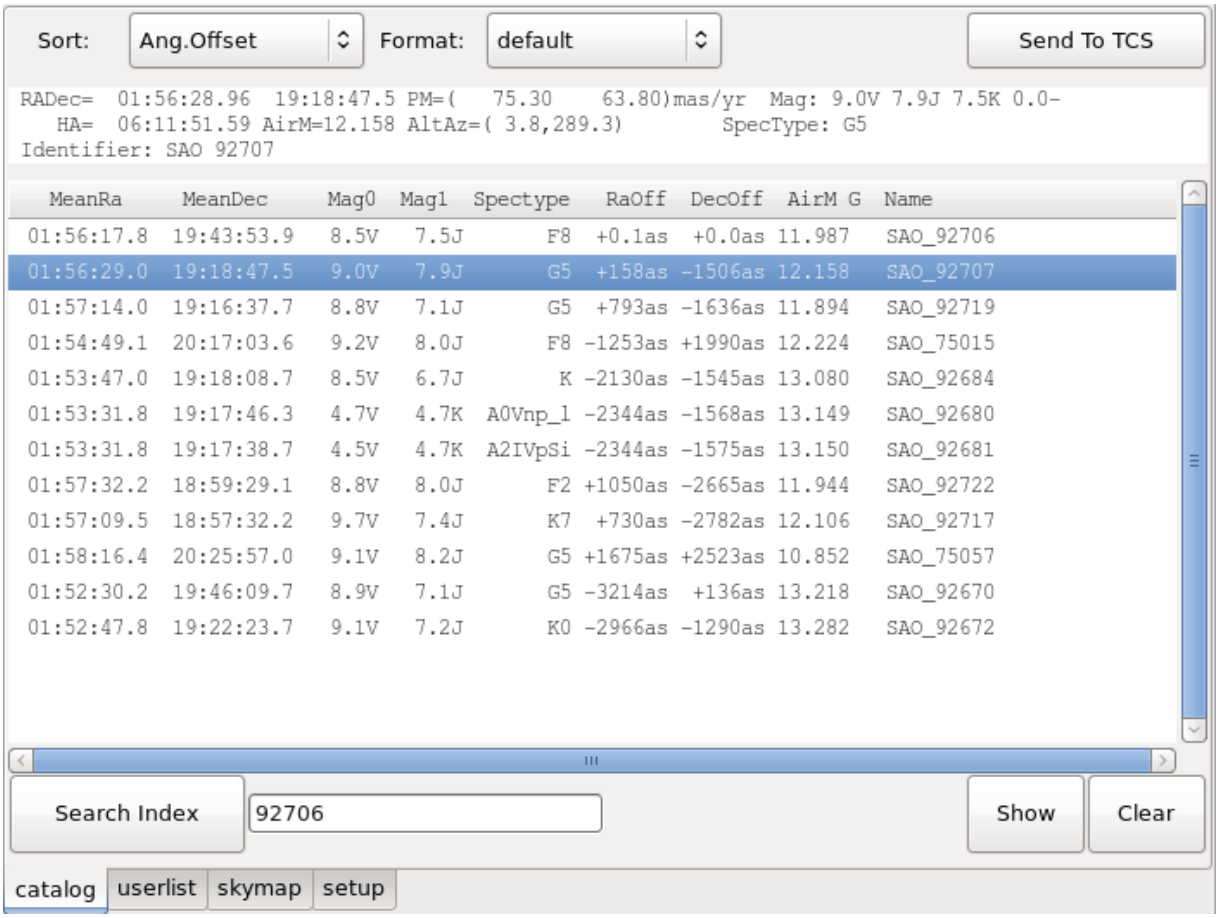
None – When set to none, the radius is set to the minimum suggest value of all the selected catalogs. The minimum values are:

HR	18000 arcseconds or 5 degs
FK5	36000 arcseconds or 10 degs
HD	2500 arcseconds, or 0.7 degs
SAO	3600 arcseconds, or 1 degs
HIP	7200 arcseconds, or 2 degs
PPM	7200 arcseconds, or 2 degs
FS	108000 arcseconds, or 30 degs

SA	36000 arcseconds, or 10 degs
GSC	540 arcseconds, or 0.15 degs
2MASS	900 arcseconds, or 0.25 degs
nomad	350 arcseconds (offaxis guider FOV).

5. Main Catalog Display options

Clicking on the **Catalog** tab will display the Main Catalog Panel.



This tab displays the search results from the main catalogs. When you select a star from the list, more detailed informtion about his object is displayed just about the list. Using you mouse you can highlight/copy information for input into other applications (ie, SIMBAD data searches).

Sort menu – Specifies the sort field for the object list.

Format menu – Specifies the text format for the object list.

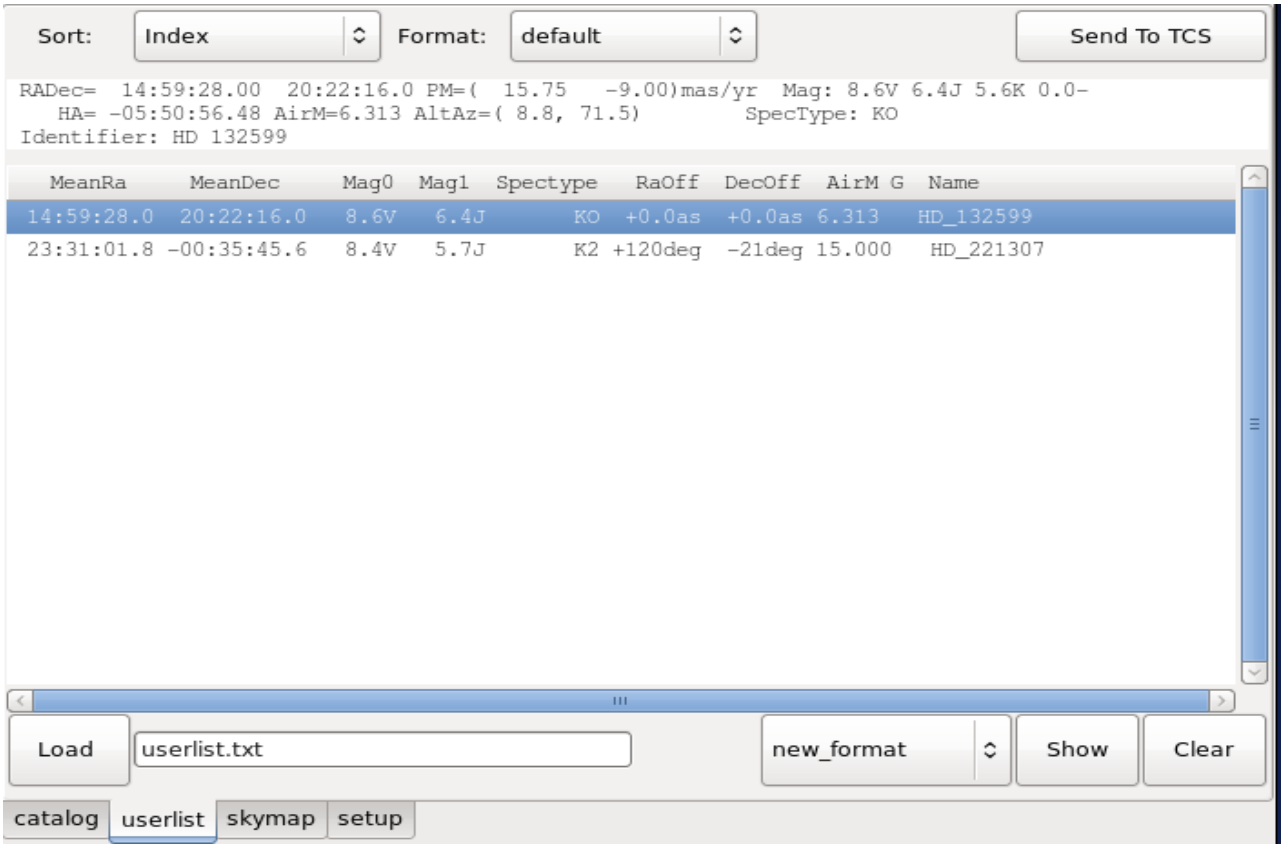
Sent To TCS button – Sends the highlighted object's coordinates to the TCS

Show button – prints the list to standard output.

Clear button – clears the object in the main catalog list.

6. User List

Clicking on the **Userlist** tab will display the User List Panel.



6.1 How to load your object list:

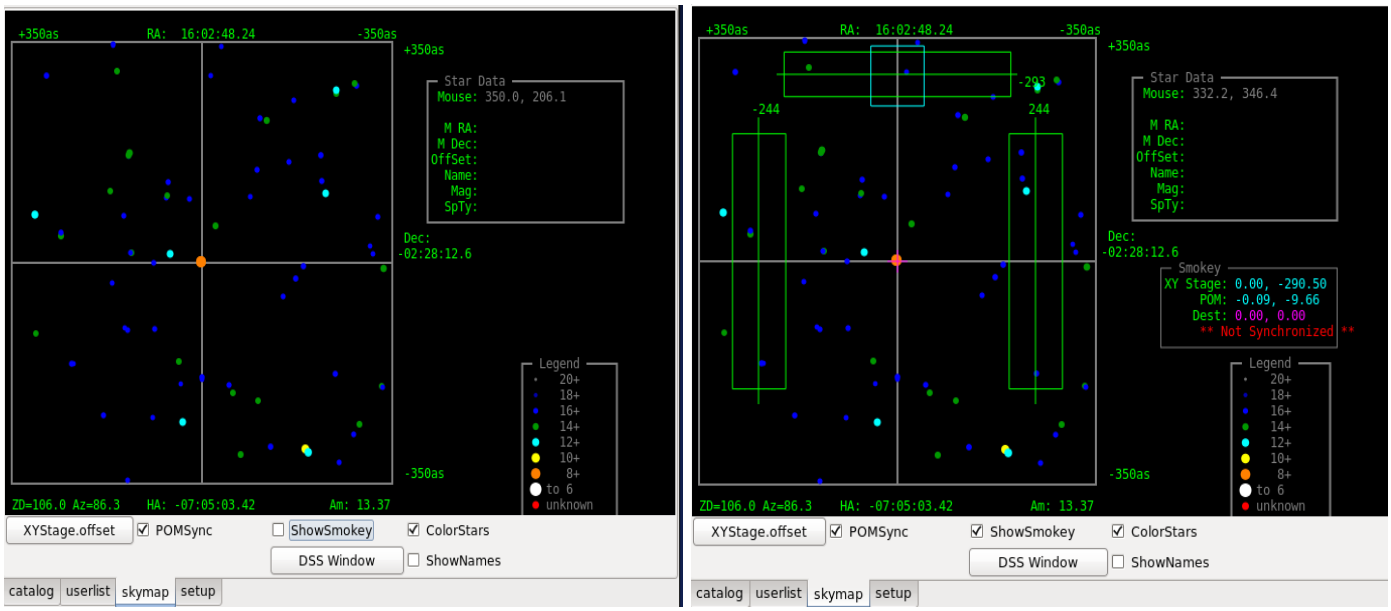
Enter the name of your user list file (the example shows userlist.txt).
Select the format you are using on the menu next to the filename text entry (new or old format).
Select the **Load** button.

6.2 Other User List functions:

Sort menu – Specifies the sort field for the object list.
Format menu – Specifies the text format for the object list.
SentToTCS button – Sends the highlighted object's coordinates to the TCS.

Show button – prints the list to standard output.
Clear button – clears the object in the main catalog list.

7. SkyMap Panel



Skymap with ShowSmokey Off and ON

Clicking on the **SkyMap** tab will present the skymap panel. The SkyMap displays a drawing of the main catalog stars centered on the search coordinates.

The Star Data box on the left will display relevant data based on the mouse cursor position. When positioned on a star, details of the star is displayed.

The **Legend** box at the left of the coordinate system displays the current magnitude legend. This legend can be used to visually estimate the magnitude of stars shown in the skymap.

ColorsStars – this checkbox switches the legend from a grayscale to a colored scale.

ShowName – When checked, the names of the stars are display in the starmap.

DSS Window – Pressing the DSS Window button will instruct stacat to download a DSS image and display in it a dialog window. This DSS FOV is fixed at 12 arcmin, it is intended to display the star within the smokey offaxis guiding area to help the TO select an offaxis guide star. *Note: It may take from 5 to 10 seconds for the DSS window to appear or update, as the image are queried from the DSS server.*

Note: Controlling the XYStage should only be done by the Telescope Operator.

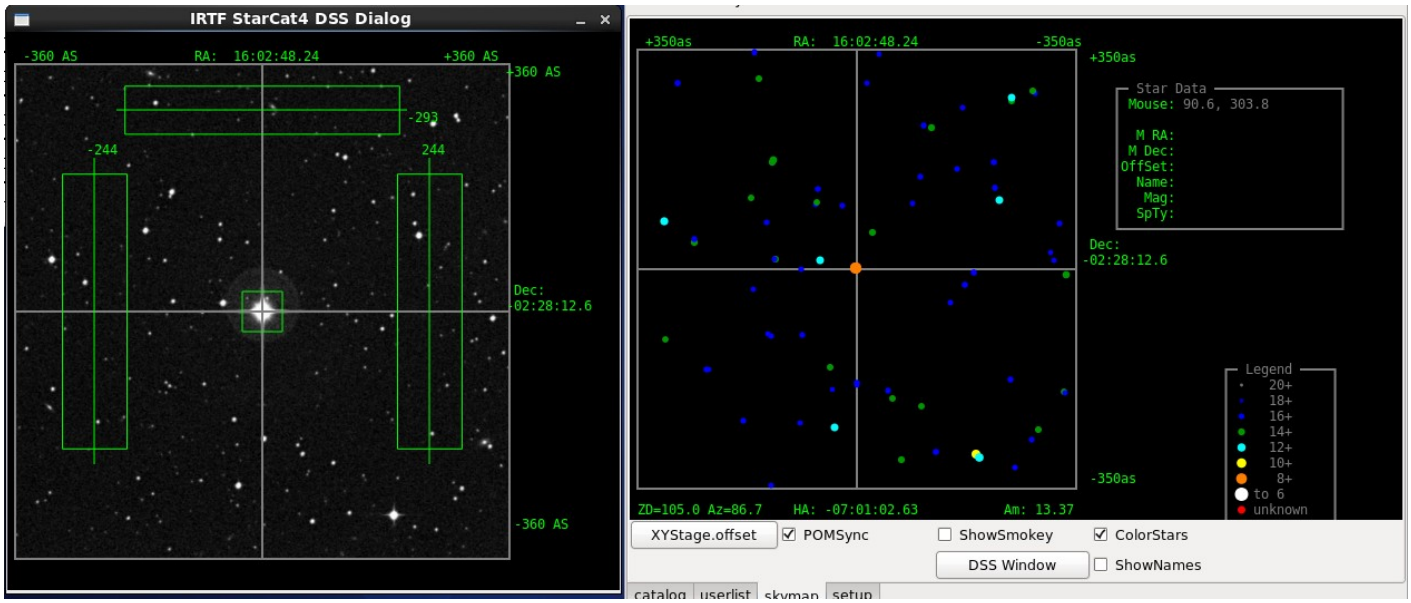
If **ShowSmokey** is enabled, the **Smokey** box (center-right) will display information relevant to the x-y stage and the POM. The **XYstage** and **POM** fields display the positions of x-y stage and POM, respectively. The cyan box show the current located of the smokey's mirror/POM. Clicking on the mouse will move the Magenta "+". This "+" show the destination for the POM with the **XYState.offset** button is pressed.

XYStage.offset – Move the x-y stage to the destination RA and DEC.

POMSync – Toggle whether the POM should sync with the XYStage when moved.

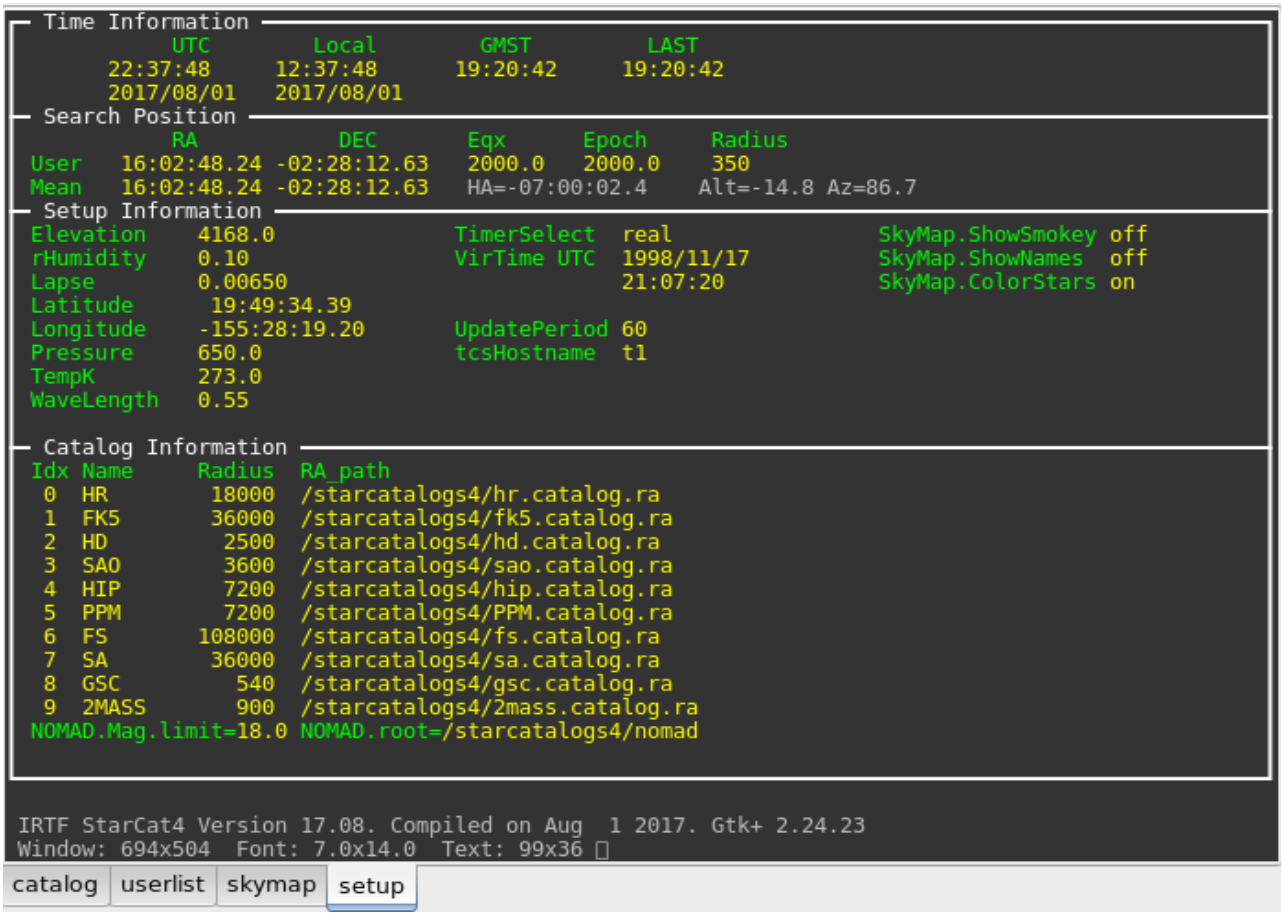
ShowSmokey – Toggle advanced Smokey controls.

Here is a screen shot of the SkyMap and DSS window.



8. Setup Panel

Clicking on the **setup** tap will present the setup panel. This panel simply displays the value of some starcat parameters and variables.



9. User List Text Format - The User List supports 2 text formats.

9.1 New_Format

This is the text file format for importing user's list. Each line describes an object. The column data is separated a white space (any combination of spaces and tabs).

Column	Name	Description
1	Index	Numeric index of catalog
2	Name	Name as a string , max 30 chars (no blanks)
3	Right Ascension	hh:mm:ss.ss
4	Declination	dd:mm:ss.ss
5	Epoch/Equinox	1950.0 assumes FK4. Otherwise FK5. Default to 2000.0
6	RA Proper Motion	s.ssss in seconds of time/year. Defaults to 0.
7	Dec Proper Motion	a.aaaa in second of arc/year. Defaults to 0
8	Spectra Type	7 chars max. Defaults to 'n/a'
9,10	Mag[0] value & type	m.mmm c. Default to '0' and '-' if not given.
10,11	Mag[1] value & type	
12,13	Mag[2] value & type	
14,15	Mag[3] value & type	

Lines beginning with '#' are comment lines.

Here is an example:

```
#
#Index Name________  ____RA_____  ____DEC____  _Epoch_ RaPM DecPM   __ST__  Magn_0   Magn_1   Mang_2   Mang_3
#
   1   IRTF-1       00:02:45.93  35:48:55.86  2000.0  0.00 -0.00   A0      7.30 V   99.90 P  0.00 x   0.00 x
   2   IRTF-2       00:15:57.26  04:15:03.75  2000.0  0.00 -0.02   A0      7.00 V   99.90 P  0.00 x   0.00 x
   3   IRTF-3       00:30:02.36 -03:57:26.35  2000.0  0.00 -0.01   K5      6.00 V   99.90 P  0.00 x   0.00 x
   4   IRTF-4       00:31:18.42 -43:36:24.78  2000.0 -0.00 -0.02   A2      7.50 V   99.90 P  0.00 x   0.00 x
```

9.2 Old_Format

This older format is the text format using by previous xstarcat and starcat version 1. Each line describes an object. The column data is separated a white space (any combination of spaces and tabs).

Column	Name	Description
1	Name	Name of object (no blanks allowed)
2	Right Ascension	hh:mm:ss.ss
3	Declination	dd:mm:ss.ss
4	RA Proper Motion	s.ssss in seconds of time/year.
5	Dec Proper Motion	a.aaaa in second of arc/year
6	Magnitude	m.mmm

7	Epoch	eeee.e . Equinox of 2000.0 is assumed.

Lines beginning with '#' are comment lines.

Here is an example:

```
#name       RA           DEC       paRA  pmDec Mag  epoch
IRTF-1  00:02:45.93  35:48:55.86  0.00   0.00 7.30 2000
IRTF-2  00:15:57.26  04:15:03.75  0.00   0.00 7.00 2000
IRTF-5  00:32:49.08  28:16:49.08  0.00   0.00 6.40 2000
IRTF-6  00:33:39.52  20:26:02.36  0.00   0.00 7.60 2000
IRTF-7  01:09:43.94  35:37:13.93  0.00   0.01 2.40 2000
```

Appendix A – Dictionary of Commands

This section describes the command set for STARCAT.

For the syntax, the following conventions are used:
`Normal Courier` fonts must be typed as showed.
`Italic Courier` fonts represent choices or values to be determined by the user.

These are further explained under the Range. Some examples:
`{off|on}` – represent a list of choice. You must select one.
`[value]` – the `[]` represent an optional parameter.

azel – Issues a LOAD RA,DEC command using observed Az El values.

Syntax	`azel` *`Az El`*
Range	*`Az – Azimuth, in degrees (N=0, E=90, S=180, w=270).`*
	`El – Elevation in degrees (0 to 90).`
Example	`AzEl 180 85.5`

Catalog.clear – Untoggles any catalog selection.

Syntax	`Catalog.Clear`
Example	`Catalog.Clear`

Catalog.set – Sets the toggle for a catalog by name.

Syntax	`Catalog.set` *`catalog_name`*
Range	*`catalog_name – can be {bsc5, fk5, gsc, irtf, sao, ukirt, hd.sao }.`*
Example	`Catalog.set fk5`

CatFile.Inx.Path

CatFile.Name

CatFile.Ra.Path

CatFile.Radius – A set of properties are associated with each catalog: Name, Default Radius, and file paths to its RA and Index sorted files. These 4 commands allow you to set these properties.

Syntax	`catfile.name` *`index name`*
	`Catfile.radius` *`index radius`*
	`Catfile.inx.path` *`index inx_file_path`*
	`Catfile.ra.path` *`index ra_file_path`*
Range	index – 0-7 (8 main catalog are supported)
	Name – name of catalog (any string).
	Radius - in arcseconds (1 to 200000)
	Inx_file_path – full pathname of index sorted catalog.
	Ra_file_path – full path name of RA sorted catalog

Example `Catfile.name 0 bsc5`
`Catfile.radius 0 27000`
`Catfile.inx.path 0 /starcatalogs2/bsc5.catalog.inx`
`Catfile.ra.path 0 /starcatalogs2/bsc5.catalog.ra`

Catalog.show – Print the catfile variable to stdout.

Syntax `Catalog.show`
Example `Catalog.show`

DSS – The DSS command invokes the download and display of the Digital Sky Survey image, and update the DSS window.

Syntax `DSS`
Example DSS

Echo – Prints the parameter string to the text feedback window.

Syntax `Echo` *`string`*
Range *`string – Any message.`*
Example `Echo Hello, can you see this message?`

Elevation – Specifies the elevation in meters above sea level of the telescope. Used to calculate airmass and observed parameters.

Syntax `Elevation` *`meters`*
Range Meters – the elevation in meters.
Example `elevation 4168`

Guider – Tells starcat what guider is used. The guider affects the default search radius.

Syntax `Guider` *`{off-axis | tip-tilt | cshell | none}`*
Range off-axis – The default range is 250.
Tip-tilt – The default range is 160.
cshell – The default range is 90.
none – The default radius is based on the catalog selection for searching.
Example `guider off-axis`

HaDec – Issues a LOAD RA,DEC command using observed Ha Dec values.

Syntax `HaDec` *`Ha Dec`*
Range *`HA – Hour Angle (units of time)`*
`Dec – Declination in degrees.`
Example `HaDec -1:00 19:50`

Lapse – Given in Kelvin per minute. Used to calculate airmass and observed parameters.

Syntax `Lapse` *`rate`*
RangeRate – rate in Kelvin/minute.

Example `lapse 0.0065`

Latitude – Specifies the latitude of the telescope. Used to calculate airmass and observed parameters.

Syntax `Latitude` *`deg:min:sec {N | S}`*

Range Deg:Min:Sec – must be 90 degrees or less north or south of the equator.

Example `latitude 19:49:34.39 N`

Load – Specifies the parameters for the search position.

Syntax `Load` *`ra dec [eqx] [epoch] [pm_ra] [pm_dec]`*

Range `ra – Right Ascension (Time format)`

`Dec – Declination (degrees)`

`Eqx – equinox. Default is 2000`

Epoch – Epoch. Default is equinox value.

`Rapm – RA proper motion. Default is 0.`

`Decpm – Dec proper motion. Default is 0.`

Example `Load 20:34:23.4 19:49:34.39`

Longitude – Specifies the longitude of the telescope. Used to calculate airmass and observed parameters.

Syntax `Longitude` *`deg:min:sec {E | W}`*

RangeDeg:Min:Sec – must be 180 degrees or less east or west of Greenwich.

Example `longitude 155:28:19.20 w`

LTOffset – Specifies the universal time to local time offset in minutes. Used to calculate airmass and observed parameters.

Syntax `LTOffset` *`value`*

RangeValue – offset in minutes (-720 to 720).

Example `ltoffset –600`

MainClear – Clears the Main catalog list from the main catalog display area.

Syntax `MainClear`

MainFormat – Specifies the data format for the main catalog.

Syntax `MainFormat` *`{ Default | Obs | Mag }`*

Range Default – The default data format

Obs – Data format highlighting observed position information.

Mag – Data format highlighting magnitude information.

Example `MainFormat Obs`

MainSearchID – Searches the selected MainCatalogs for matching index or catalog ID. Matching records are loaded into the Main Catalog List.

Syntax`MainSearchID` *`ID`*

RangeID – Numeric ID value to search for.

ExampleMainSearchID 100334

MainSearchRA – Searches the selected MainCatalogs using the search parameter (mean J2000 ra, dec, and radius). Matching records are loaded into the Main Catalog List.

Syntax `MainSearchRA`

Example `MainSearchRA`

MainSentToTCS – Issues a C.SLEW command to the TCS using the coordinates from the selected entry in the Main Catalog.

Syntax `MainSentToTCS`

Example `MainSentToTCS`

MainShow – Prints the main catalog to stdout (the terminal window).

Syntax `MainShow`

Example `MainShow`

MainSort – Indicated the sort field for the MainCatalog.

Syntax `MainSort` *{ Index | RA | Dec | Mag | Ang.Offset | RA.Offset | Dec.Offset | Airmass | Name | HA | Alt | Azi }*

Example `MainSort RA`

NewEntryPos – Loads a new search position by reading the XUI input widget for RA,DEC, Equinox, and Epoch.

Syntax `NewEntryPos`

Example `NewEntryPos`

NewEntryPos – Loads a new search position by reading the XUI input widget for RA,DEC, Equinox, and Epoch.

Syntax `NewEntryPos`

Example `NewEntryPos`

NewItemPos – Loads a new search position by reading the highlighted object the the current Catalog or UserList tab.

Syntax `NewItemPos`

Example `NewItemPos`

Nomag.mag.limit – Set the faint magnitude limit for the nomad catalog searches.

Syntax `NOMAD.Mag.Limit mag`

Range `mag – the faint magnitude limit. Range is 0 to 29.`

Example `NOMAD.Mag.Limit 18.5`

Nomag.mag.root – Tell starcat where the NOMAD catalog files are.

Syntax `NOMAD.Mag.Root dir`

Range `dir – the directory with the NOMAD files are located.`

Example `NOMAD.Mag.Root /starcatalog3/nomad`

OutTab – Select the (output) tab for the display window.

Syntax `OutTab { catalog | userlist | skymap | setup }`

Range `{catalog | userlist | skymap | setup }`

Example `OutTab catalog`

POM.getOffset – Retrieves the POM offset by querying smokey.

Syntax `POM.getoffset}`

Example `POM.getOffset`

POM.Sync – Toggle whether the POM should synchronize its position with that of the x-y stage. The synchronization occurs only after using **XYStage.offset**.

Syntax `POM.Sync {on | off}`

Range `{on|off}`

Example `POM.Sync on`

PosFromTCS – Loads a new search position by querying the TCS for its position..

Syntax `PosFromTCS`

Example `PosFromTCS`

Pressure – Specifies the atmospheric pressure at the telescope. Used to calculate airmass and observed parameters

Syntax `Pressure value`

RangeValue – pressure in mBars (200 to 2000).

Example `pressure 650`

Quit – Exits the STARCAT program.

Syntax `Quit`

Radius – Sets the search box size. The number given is the "radius" of the box.

Syntax `Radius value`

Range Value – radius in arcseconds.

Example `radius 400`

RHumidity – Specifies the relative humidity at the telescope. Used to calculate airmass and observed parameters.

Syntax `RHumidity value`

Range Value – relative humidity (0.0 to 1.0).

Example `rhumidity 0.10`

SkyMap.ColorStars – If ON uses color for display skymap stars, else a gray scale is used.

Syntax `SkyMap.ColorStars { off | on }`

Range `off – Use gray scale.`

`On – Use color scale.`

Example `SkyMap.ColorStars on`

SkyMap.showID – Indicate if the ID value should be display on the skymap display..

Syntax `SkyMap.showID { off | on }`

Range `off – Do not display ID.`

`On – Display the ID value.`

Example `SkyMap.showID on`

TCS – Sends a command to the TCS.

Syntax `TCS command`

Range Command – the TCS command to be sent.

Example `tcs 0:00:00 0:00:0 0.0000 0.000 2000.0 C.SLEW`

TCSHostname – Identifies the host used to handle communications to the TCS.

Syntax `TCSHostname host`

Range Enter a valid hostname

Example `tcshostname vtcshost`

TempK – Specifies the temperature at the telescope in Kelvin. Used to calculate airmass and observed parameters.

Syntax `TempK value`

Range Value – temperature in Kelvin (100 to 350).

Example `tempk 273.0`

UpdatePeriod– Indicate the period when the catalog observed positions are updated (using the UpdatePosition command).

Syntax `UpdatePeriod sec`

Range `sec – Update period in seconds.`

UpdatePosition – The command updates all positional information. (Automatically executed by starcat every UpdatePeriod).

Syntax `UpdatePosition`

Example `UpdatePosition`

UpdateTime – Updates the time information. This command is automatically execute every second by the starcat application.

Syntax `UpdateTime`

Example `UpdateTime`

UserClear – Clears the user's catalog list from the user catalog display area.

Syntax `UserClear`

UserFormat – Specifies the data format for the user list.

Syntax `UserFormat { Default | Obs | Mag }`

Range Default – The default data format

Obs – Data format highlighting observed position information.

Mag – Data format highlighting magnitude information.

Example `UserFormat Obs`

UserLoad – Loads the user's catalog file into the user catalog display area. Note there are 2 supported formats, see UserTextFmt.
RangeFilename – the user's catalog list file.

Syntax `UserLoad` *`filename`*

UserNewPos – Takes the coordinates from the specified user catalog display row and places the values (in J2000, current epoch) in search coordinates input fields.

Syntax `UserNewPos` *`index`*

Range Index – Row in catalog list to use as new search position (0, 1, 2,…).

Example `UserNewPos 10`

UserSentToTCS – Issues a C.SLEW command to the TCS using the coordinates from the selected entry in the UserCatalog.

Syntax `UserSentToTCS`

Example `UserSentToTCS`

UserSort – Indicated the sort field for the UserCatalog.

Syntax `UserSort` *`{ Index | RA | Dec | Mag | Ang.Offset | RA.Offset | Dec.Offset | Airmass | Name | HA | Alt | Azi }`*

Example `UserSort RA`

UserTextFmt – This parameter tell the UserLoad command the format for the text files (user list) to be loaded. Two formats are supported. See the User Guide for data format examples.

Syntax `UserTextFmt` *`{ textfmt2 | textfmt1 }`*

Range `textfmt1 – This is the old style (xstartcat and starcat v1) text format`

`Textfmt2 – starcat v2 text format.`

Example `UserTextFmt textfmt2`

Wavelength – Specifies the observed wavelength in microns. Used to calculate airmass and observed parameters.

Prompt 'Wavelength' text box on the Setup Options Page.
RangeValue – wavelength in microns (0.1 to 50.0).

Syntax `Wavelength` *`value`*

Example `wavelength 0.550`

XYStage.GetOffset – Retrieves the XY Stage position from smokey.

Syntax `XYStage.GetOffset`

Example `XYStage.GetOffset`

XYStage.Offset – Move the x-y stage to the specified RA, DEC position.

Syntax `XYStage.Offset` *`ra dec`*

Range

Example `XYStage.Offset 64.0 32.25`