

VPhot Users Guide
Version 3.2
February 2016

VPHOT Users Guide



A guide to the web hosted aperture-based photometry tool available free to all AAVSO members.

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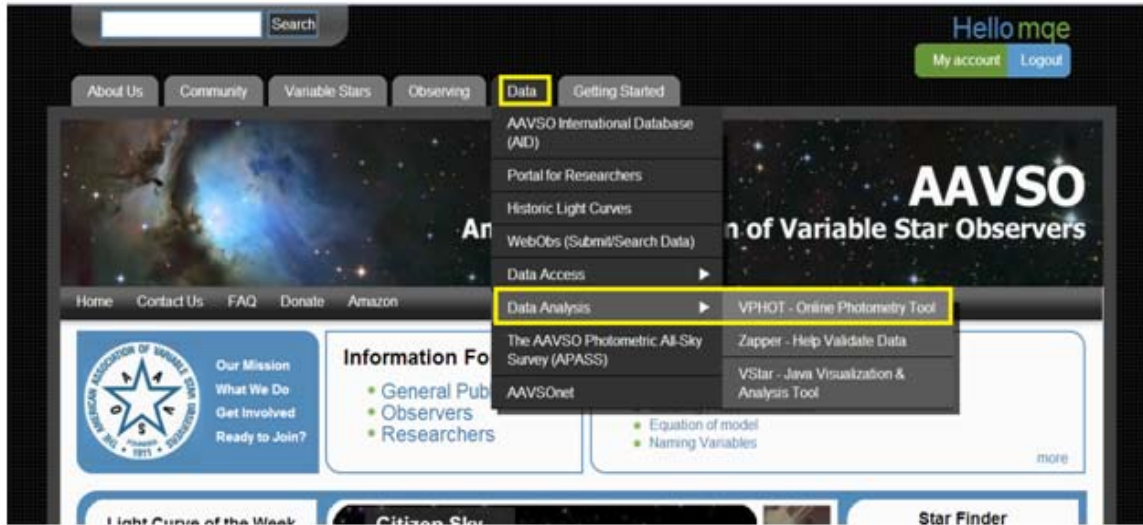
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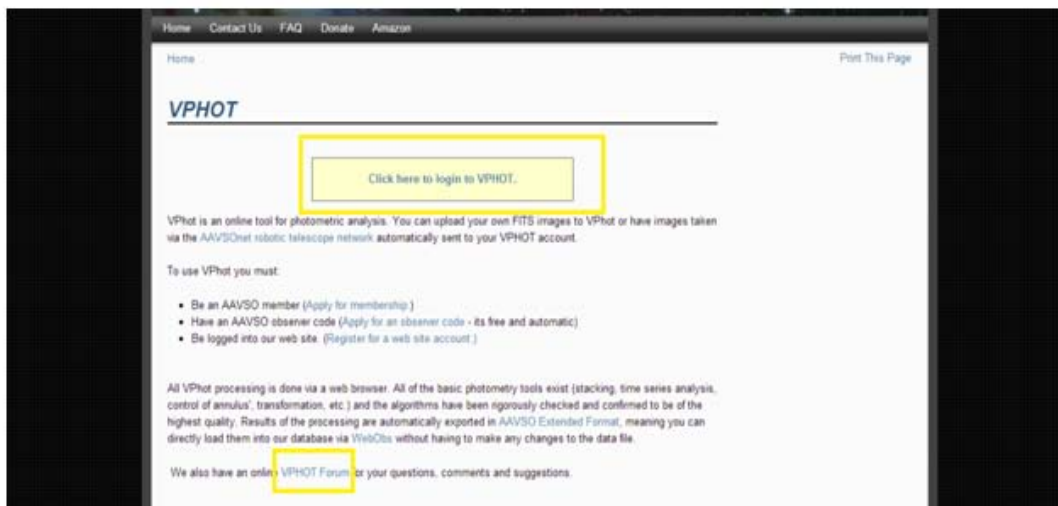
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1 ACCESSING VPHOT

To access VPHOT, sign in to AAVSO from the home page at <http://www.aavso.org/>. Select this menu item to go to the VPHOT page. Then mouse over DATA-->DATA ANALYSIS-->VPHOT-Online Photometry Tool.



Click the highlighted link “Click Here to Login to VPHOT”. Farther down the same page, note the link to the VPHOT forum, where support questions can be asked, and suggestions for improvements can be made.

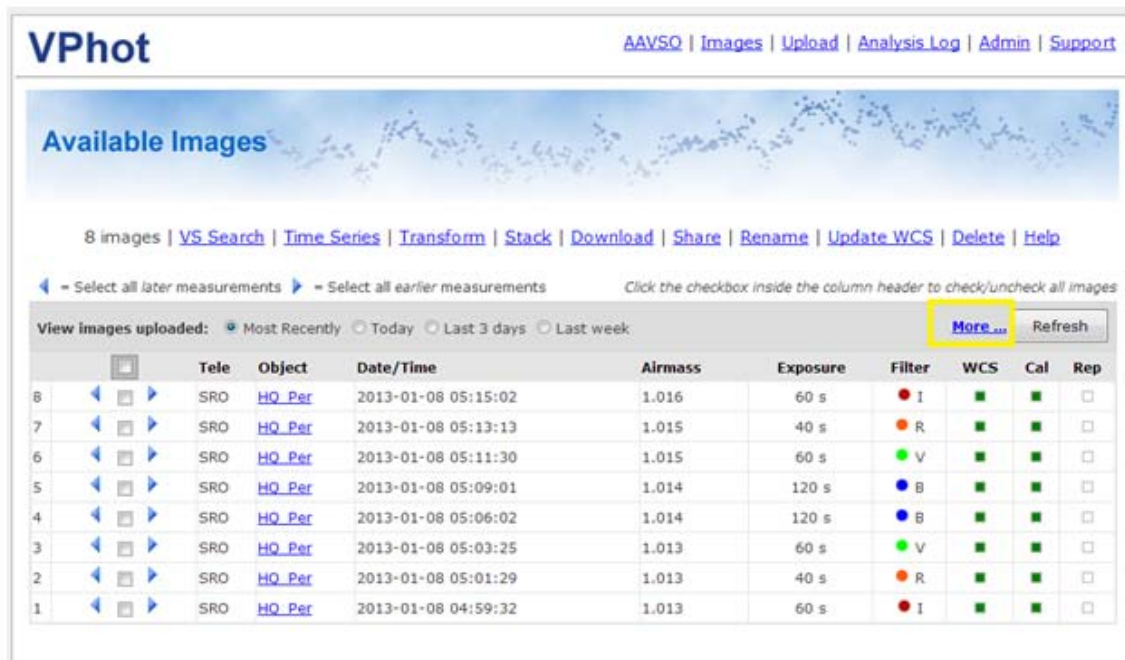


You may find it useful to bookmark this page.

After clicking the “Click Here to Log into VPHOT” link you will arrive at the “Available Images” page. You can navigate from this page to anywhere in VPHOT.

2 AVAILABLE IMAGES PAGE

This page lists all available images, most recent on top. By default, it shows the most recently uploaded images. You can also choose to view images uploaded today, the last three days or last week. If you are looking for a specific set of images, choose 'More' to use the image search tool.



The screenshot shows the VPhot interface for the 'Available Images' page. At the top, there are navigation links: AAVSO | Images | Upload | Analysis Log | Admin | Support. Below the header, there's a sub-header 'Available Images' with a decorative background. A navigation bar includes '8 images | VS Search | Time Series | Transform | Stack | Download | Share | Rename | Update WCS | Delete | Help'. Below this, there are controls for selecting measurements and a 'View images uploaded:' section with radio buttons for 'Most Recently' (selected), 'Today', 'Last 3 days', and 'Last week'. A 'More...' button is highlighted in yellow, and a 'Refresh' button is also present. The main table lists 8 images with the following data:

	Tele	Object	Date/Time	Airmass	Exposure	Filter	WCS	Cal	Rep
8	SRO	HQ_Per	2013-01-08 05:15:02	1.016	60 s	I	■	■	□
7	SRO	HQ_Per	2013-01-08 05:13:13	1.015	40 s	R	■	■	□
6	SRO	HQ_Per	2013-01-08 05:11:30	1.015	60 s	V	■	■	□
5	SRO	HQ_Per	2013-01-08 05:09:01	1.014	120 s	B	■	■	□
4	SRO	HQ_Per	2013-01-08 05:06:02	1.014	120 s	B	■	■	□
3	SRO	HQ_Per	2013-01-08 05:03:25	1.013	60 s	V	■	■	□
2	SRO	HQ_Per	2013-01-08 05:01:29	1.013	40 s	R	■	■	□
1	SRO	HQ_Per	2013-01-08 04:59:32	1.013	60 s	I	■	■	□

2.1 AVAILABLE IMAGE LIST

This list is the starting point for analysis. Several tools are available to perform various tasks on the images in the list, which are described in detail below.

2.2 LIST CONTENTS

The information in the list is extracted from the FITS headers. It contains:

- Tele: The name of the telescope system
- Object: This is the name as saved by the imaging software. Click the Object name to view and analyze this image.
- Date/Time: The observation date/time (in UT). This is the mid-point time of the exposure.
- Airmass: The airmass of the center of the image

- R.A.: The R.A. of the true center of the image (corrected by the plate solve)
- Dec: The declination of the true center of the image (corrected by the plate solve)
- Exposure: The exposure time of the image in seconds
- Filter: The name of the filter used in the exposure

WCS: Plate solving status. If OK, VPhot can import catalog data and display R.A./Dec.

= Successfully plate solved

= Not plate solved

Cal: Calibration status

= Both dark and flat fielded (and possibly bias subtracted)

= Partially calibrated. Hover the mouse over the image to view details (B = bias corrected, D = dark subtracted, F = Flat fielded)

= Not calibrated, or unknown calibration status

Rep: Report status

= Reported to the AAVSO

= Analysis created, but not yet reported

= None of the above (unknown status)

NOTE: If you return to the list after saving an analysis or reporting data you need to refresh the list in order to update the report status.

2.3 SEARCH TOOL

Date from and date to: Enter observation date to view images from a specified period only. Must be entered in the form YYMMDD. For instance, 2008-04-20 is entered as 080420. If only 'From' is specified, all images from that date until today will be listed. If only 'To' is specified, all images up to that date are listed. Both to and from imply a period.

- Target: Select a target to show images of that target only.
- Filter: Select a filter to show images of that filter only.
- System: Select a telescope to show images of that telescope only.
- Stacked: Only include stacked images
- To apply the filter, or to view new files that might have been transferred to the server since last time the list was refreshed, click the 'Refresh' button.

2.4 SHORTCUT: USING THE CHECK BOXES

In order to accomplish such tasks as deleting images, running a times series, sharing, etc. it is necessary to click the box to right of the image number for whatever images one wants to include in the task, on the Available Images page.

To select all images in the list, click the box with the grey border at the top. This will put a check mark in the boxes next to all images in the list. If images have already been selected, clicking on the box will deselect.

VPhoto [AAVSO](#) | [Images](#) | [Upload](#) | [Analysis Log](#) | [Admin](#) | [Support](#)

Available Images

54 images | [VS Search](#) | [Time Series](#) | [Transform](#) | [Stack](#) | [Download](#) | [Share](#) | [Rename](#) | [Update WCS](#) | [Delete](#) | [Help](#)

◀ = Select all later measurements ▶ = Select all earlier measurements *Click the checkbox inside the column header to check/uncheck all images*

View images uploaded: Most Recently Today Last 3 days Last week [More ...](#)

	<input checked="" type="checkbox"/>	Tele	Object	Date/Time	Airmass	Exposure	Filter	WCS	Cal	Rep
54	<input checked="" type="checkbox"/>	iT4	BL Cam	2009-12-11 09:19:07	1.407	60 s	● R	■	■	■
53	<input checked="" type="checkbox"/>	iT4	BL Cam	2009-12-11 09:17:07	1.401	60 s	● R	■	■	■
52	<input checked="" type="checkbox"/>	iT4	BL Cam	2009-12-11 09:15:07	1.396	60 s	● R	■	■	■
51	<input checked="" type="checkbox"/>	iT4	BL Cam	2009-12-11 09:13:07	1.391	60 s	● R	■	■	■
50	<input checked="" type="checkbox"/>	iT4	BL Cam	2009-12-11 09:11:08	1.386	60 s	● R	■	■	■
49	<input checked="" type="checkbox"/>	iT4	BL Cam	2009-12-11 09:09:09	1.381	60 s	● R	■	■	■
48	<input checked="" type="checkbox"/>	iT4	BL Cam	2009-12-11 09:05:11	1.371	60 s	● R	■	■	■
47	<input checked="" type="checkbox"/>	iT4	BL Cam	2009-12-11 09:03:11	1.366	60 s	● R	■	■	■

The blue arrows to the right and left of each box are used to select or deselect a range of images within the list, making it unnecessary to click many times to select a limited but large range of images.

Clicking the blue arrow to the left of an individual box will select that image and all images with a higher number than that image on the list. Clicking the arrow on the right will select that image and all the images with a lower number.

VPhoto [AAVSO](#) | [Images](#) | [Upload](#) | [Analysis Log](#) | [Admin](#) | [Support](#)

Available Images

54 images | [VS Search](#) | [Time Series](#) | [Transform](#) | [Stack](#) | [Download](#) | [Share](#) | [Rename](#) | [Update WCS](#) | [Delete](#) | [Help](#)

◀ = Select all later measurements ▶ = Select all earlier measurements *Click the checkbox inside the column header to check/uncheck all images*

View images uploaded: Most Recently Today Last 3 days Last week [More ...](#)

	<input type="checkbox"/>	Tele	Object	Date/Time	Airmass	Exposure	Filter	WCS	Cal	Rep
54	<input type="checkbox"/>	iT4	BL Cam	2009-12-11 09:19:07	1.407	60 s	● R	■	■	■
53	<input type="checkbox"/>	iT4	BL Cam	2009-12-11 09:17:07	1.401	60 s	● R	■	■	■
52	<input type="checkbox"/>	iT4	BL Cam	2009-12-11 09:15:07	1.396	60 s	● R	■	■	■
51	<input type="checkbox"/>	iT4	BL Cam	2009-12-11 09:13:07	1.391	60 s	● R	■	■	■
50	<input type="checkbox"/>	iT4	BL Cam	2009-12-11 09:11:08	1.386	60 s	● R	■	■	■
49	<input checked="" type="checkbox"/>	iT4	BL Cam	2009-12-11 09:09:09	1.381	60 s	● R	■	■	■
48	<input checked="" type="checkbox"/>	iT4	BL Cam	2009-12-11 09:05:11	1.371	60 s	● R	■	■	■
47	<input checked="" type="checkbox"/>	iT4	BL Cam	2009-12-11 09:03:11	1.366	60 s	● R	■	■	■
46	<input type="checkbox"/>	iT4	BL Cam	2009-12-11 09:01:11	1.362	60 s	● R	■	■	■

3 AVAILABLE IMAGES TOOLS - OVERVIEW

The following tools are available, which applies to all selected images in the list:

- VS Search: This tool lets you look for variable stars in a star field. The conditions are as for the time series tool. (Not currently available.)
- Time Series: This time series tool lets you analyze several images at once, for instance to create light curves of variable stars. All images selected in the list that have been plate solved will be analyzed. You can only use one filter. However, the images can be of an arbitrary time span and taken with one or several telescopes.
- Transform: Performs transformed two-filter photometry based on a predefined sequence.
- Stack: Stacks the selected images in the list. Note that all images must be of the same dimension. Select between average and median stacking. The resulting image is shown in the list with bold font. The observation date/time will be set to the mid-point of all stacked images. Before they are stacked the images are shifted in X and Y direction, but rotation is not handled.
- Download: Download all selected images. They will be zipped into a single zip archive to reduce bandwidth.
- Share: Lets you share selected images with others (shared by username).
- Rename: You can rename the telescope, object name or filter name.
- Update WCS: Allows you to edit the plate solving of an image.
- Delete: Permanently delete the selected files from the server.

3.1 VARIABLE STAR SEARCH (NOT CURRENTLY AVAILABLE)

The variable star search tool is designed to detect variability in a series of images of a given field of view. It is suited to look for new variable stars, but not transient objects like novae, supernovae, asteroids or comets. It works on a series of images of the same field of view, taken with the same filter. These are typically the same images one would take to observe a variable star over time.

Starting the Search

1. Click the 'VS Search' link on the images page.
2. Select a pre-defined sequence, or leave it at 'Auto' to let the software determine which comp star to use
3. Enter the minimum SNR a star must have to be included in the analysis. The default is 20
4. Click 'Start' to start the analysis. When done you will be presented with a list showing the top 20 candidates.

How it Works

As a part of the plate solving process all stars are measured using regular aperture photometry. The aperture is taken to be 1.2 times the average FWHM of the image, whereas the sky annulus has a radius of 2 times the aperture and a fixed width of 10 pixels.

Next the instrumental magnitudes are stored in photometry files, one file for each image.

The variable star search tool analyzes these photometry files, performing differential photometry between each star and a comparison star, and presents the resulting light curves in a list. The list is sorted according to a variability index. If there are variable stars in the field of view, those should be listed first.

The Variability Index

The variability index is pretty naive and non-scientific, but seems to work pretty well. Each star has an average SNR. In addition, the standard deviation of each star's light curve is calculated. The index is then

$$VI = \text{std} * \text{SNR}^{1/2}$$

Empirical studies have shown that the standard deviation is related to the inverse of the square root of SNR, thus the given variability index should be roughly the same for non-varying stars. Bright stars have high SNR but low std, while faint stars have low SNR but large std. The idea is that stars with a higher std than what should be expected from its SNR will get a high VI, and therefore be at the top of the list.

The Comparison Star

You can choose to select which comparison star to use, or let the program determine which star to use.

- Select star manually: Open one of the images, add a comp star and save the sequence. Note that for now only one comp star is allowed.
- Automatically: The software uses a bright star (not saturated) close to the center of the image.

NOTE: If you use the automated approach and ALL stars show similar variation, the software has probably selected a variable star as a comp star. This might happen in a series of images of a known variable where the variable is bright and close to the center of the image. If this is the case use the manual comp star approach instead.

3.2 TIME SERIES

Once the form on the 'Time Series' page has been filled and the 'Start the analysis' button has been clicked, all images in the file list are automatically analyzed.

The tool is developed with an "analyze first, check afterwards" strategy in mind. So whereas the analysis is fully automated, the results can be examined in such detail that problems should be easy to detect. Such problems can be bad tracking, intermittent clouds, hot pixels in the measurement aperture, or the software selecting the wrong star in a crowded field.

Note that the time series tool only works on plate solved images. Images that are not plate solved will be ignored.

Furthermore, a user-defined sequence is used to automatically identify stars in each image. This is easily done by opening one of the images from the file list, add the stars (manually or imported from AAVSO or file), click the 'Save Sequence' link and give it a proper name.

1. Select your sequence in the 'Sequence' drop down list (mandatory)
2. Select how the aperture radius is to be determined:
 - Automatically: If this option is selected VPhot will calculate the average FWHM for all measurements in the sequence. This average FWHM, times the given constant, is used as aperture radius for all measurement in that image. This should give optimal results by compensating for varying seeing conditions. You should try to play with the value of the constant to see which value gives the best results for your particular set of data.
 - Fixed: Applies this aperture radius to all measurements and images.
3. Enter the minimum SNR a detected star must have in order to be included in the analysis
4. Enter the search radius to be applied by the software when searching for stars in the region around the coordinates given in the sequence file
5. Click the 'Start the analysis'. Please do not navigate away from the page while the analysis runs. Depending on the image size, the number of files and the number of stars in the sequence the analysis could run for minutes.
6. Once finished the result page will be displayed.

3.3 TIME SERIES SUMMARY

The summary table lists all stars, with their respective average magnitude, standard deviation and average SNR. The magnitudes are calculated using all comp stars in an ensemble. For a single image, the target's magnitude is the average of the magnitudes based on each comp star.

Average magnitude and standard deviation for a variable star are not very interesting statistics. But for check stars, which should be constant, the average magnitude should be close to its catalog value. Also, if it is of similar magnitude of the target star, and preferably of similar color, the check star standard deviation might be reported as the estimated error of the target star. Such error estimates will contain all random error sources; also scintillation, and it might be argued to be more realistic than the SNR based error estimates of a single measurement.

The values for each comp star are calculated using the other comparison stars. That is, the comp star is treated as a check star for the purpose of calculating its magnitudes. Since each comp

should be constant with respect to time, any trends in the comp star light curves could be an indication of one or more of them being variable.

Click on the star's name to examine each star's results in detail.

3.4 TIME SERIES GRAPHS

The following graphs are shown below the summary table:

- Target/Check star light curve: Displays the light curves of all target and check stars. X-axis is JD, Y-axis is magnitude
- Comp Stars Light Curve: Displays each comp star's light curve. X-axis is JD, Y-axis is magnitude
- SNR: Displays each star's SNR for each image. X-axis is JD, Y-axis is SNR
- Airmass: airmass as a function of time. Common for all stars, as this value is taken from each image's FITS header
- FWHM: Each star's FWHM for each image. X-axis is JD, Y-axis is pixels
- Max ADU: Each star's maximum ADU value in the aperture. Values above 50 000 ADU or so indicates a saturated measurement, which should be treated with care.
- Skyglow: Average ADU in the sky annulus for each measurement. X-axis is JD, Y-axis is ADU
- Tracking error: the tracking error, in both X and Y direction, relative to the first image.

3.5 TIME SERIES TOOLS

- Binning: You can bin the measurements to reduce noise. With a bin width of N the first N measurements are averaged into a single value, then the next N measurements and so on.
- Stars to plot: You can select which stars to plot in the summary graphs.
- Ensemble: you can select which stars to include in the ensemble. For instance, if a comp star turns out to be bad for some reason you might want to exclude it from the analysis.
- Refresh: Click the 'Refresh' button to carry out changes in bin width, stars to plot or ensemble definition.
- Export: You can export the results to the AAVSO extended format, or to a user-defined format. Click the links above the toolbar.

3.6 TRANSFORMED COLOR PHOTOMETRY

VPhot lets you do transformed photometry of stars on images taken with two different filters. You can choose to report one or both of the resulting measurements to the AAVSO.

To be able to do this the transformation coefficients of the telescope have to be known. For common scopes this is usually the case. To be able to transform images from your own telescope you will need to determine the transformation coefficients yourself. For instance, if your target is to be measured in B and V, the coefficients needed are T_{BV} , T_B and T_V . These can be

determined by observing a field with standard stars and plotting b-v against B-V, B-b against B-V and V-v against B-V.

If these coefficients are registered in the system they will be used by default. If not, they need to be provided by the user. To register them permanently in the system please enter the information in the telescope information pages under the Admin menu.

Furthermore, you specify the sequence used to capture the measurements from both images, and the aperture to use. You can also specify the minimum SNR a comp star must have in order to be included in the analysis. Only those comp stars that are identifiable in both images, and that have catalog photometry for the relevant filters, are used.

When you click 'Show Report', both images are analyzed gathering instrumental magnitudes for stars in the sequence, and the report is displayed.

3.7 STACKING IMAGES

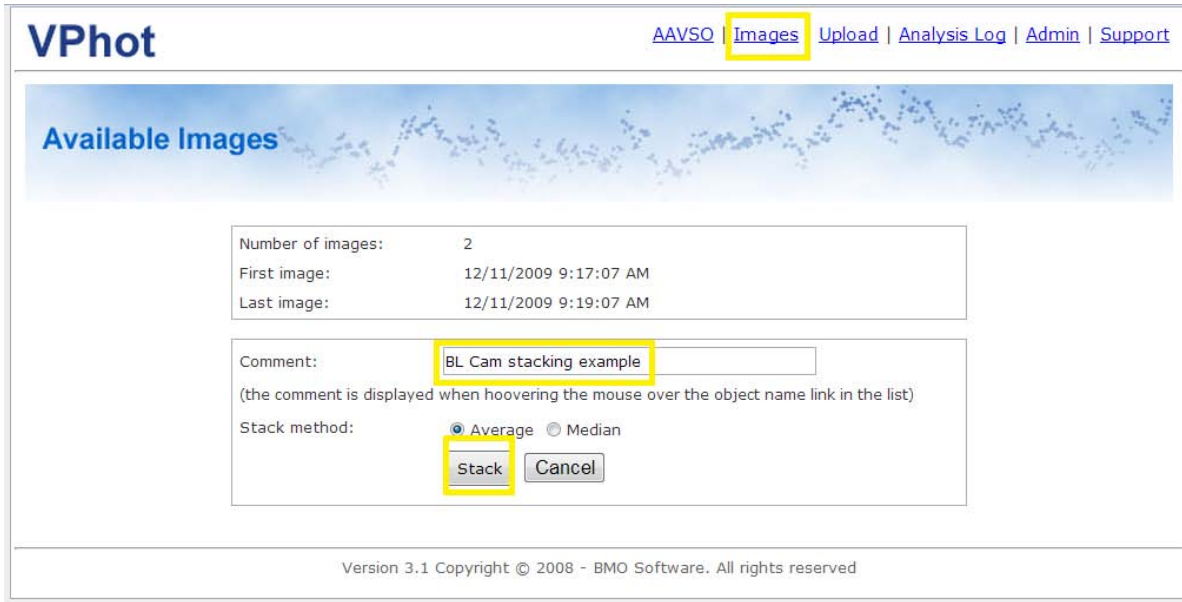
"Stacking" in photometry is a way to add together the light from more than one image into a single image.

To stack more than one image taken in a series, choose from the list which images to include in the stacking process. Then click "Stack" link.

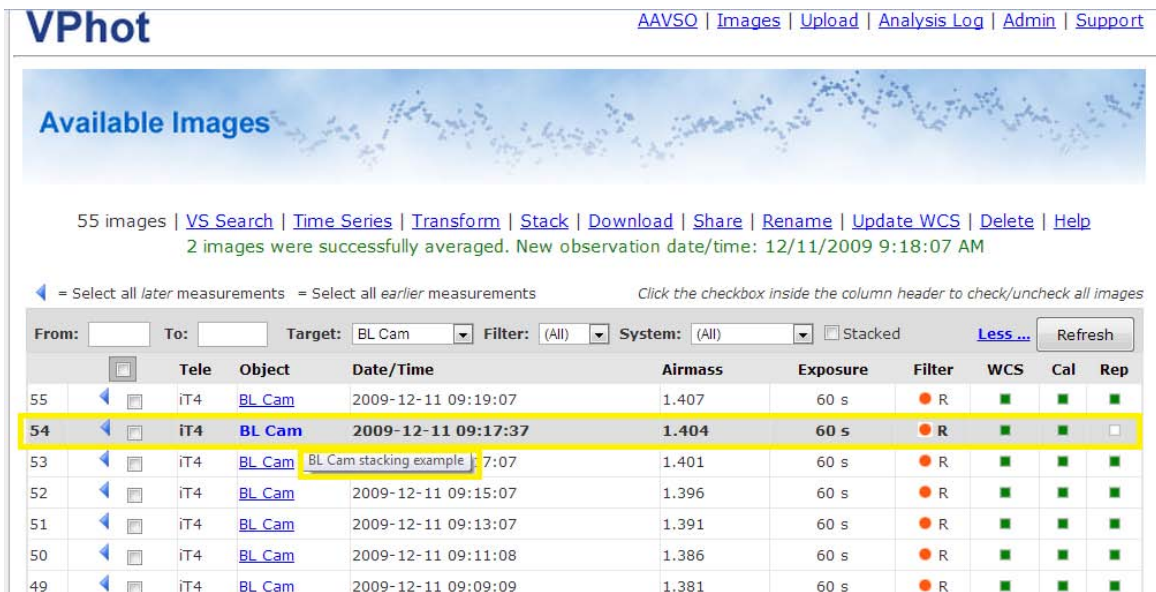
The screenshot shows the VPhot web interface. At the top, there are navigation links: AAVSO | Images | Upload | Analysis Log | Admin | Support. Below this is a header for 'Available Images' with a star field background. A navigation bar contains links: 54 images | VS Search | Time Series | Transform | Stack | Download | Share | Rename | Update WCS | Delete | Help. The 'Stack' link is highlighted with a yellow box. Below the navigation bar, there are controls for selecting images: a left arrow for 'later measurements', a right arrow for 'earlier measurements', and a checkbox for 'Stacked'. A table of images is displayed with columns: From, To, Target, Filter, System, Stacked, Less..., and Refresh. The table has columns: Tele, Object, Date/Time, Airmass, Exposure, Filter, WCS, Cal, and Rep. The first four rows of the table are highlighted in grey. The checkboxes for the first two rows (54 and 53) are highlighted with yellow boxes.

From:	To:	Target:	Filter:	System:	Stacked	Less ...	Refresh
54		BL Cam	(All)	(All)	<input type="checkbox"/>		
53		BL Cam	(All)	(All)	<input checked="" type="checkbox"/>		
52		BL Cam	(All)	(All)	<input type="checkbox"/>		
51		BL Cam	(All)	(All)	<input type="checkbox"/>		

Enter any notes or comments you may desire, choose either "average" or "mean" method of stacking, then click "stack".



The stacked image will appear in between the originals in bold face type. Any comments you add will be visible when you mouse over the object name link from the list.



3.8 SHARE IMAGES WITH OTHER VPHOT USERS

To put images from your VPHOT account into someone else's VPHOT account, click the "Share" link after selecting which images to send from the list....

	Tele	Object	Date/Time	Airmass	Exposure	Filter	WCS	Cal	Rep
54	iT4	BL Cam	2009-12-11 09:19:07	1.407	60 s	R	■	■	■
53	iT4	BL Cam	2009-12-11 09:17:07	1.401	60 s	R	■	■	■
52	iT4	BL Cam	2009-12-11 09:15:07	1.396	60 s	R	■	■	■
51	iT4	BL Cam	2009-12-11 09:13:07	1.391	60 s	R	■	■	■

...then enter that individual's observer code, and click "OK". Click the "Images" link to return to the previous page. Note that the individual with whom you wish to share must be a registered VPHOT user.

Please enter the user name of those with whom to share the images. If more than one user, separate with a comma.

mqe OK Cancel

The following will be shared:
BL Cam taken at 2009-12-11 09:19:07

Version 3.1 Copyright © 2008 - BMO Software. All rights reserved

4 INDIVIDUAL IMAGE PAGE

The main area of this page shows the center region of the image. Note that it is a highly compressed jpg image, so its quality does not necessarily reflect the quality of the raw image. In the zoom and pan control to the lower left of the screen you can see what portion of the image is currently displayed.

4.1 INTERACTING WITH THE IMAGE

- Pan: Click and drag in the image, or click and drag on the zoom and pan control.
- Zoom in: Double click in the image to zoom in on that region, or click the Zoom In link below the zoom and pan window.
- Zoom out: Click the Zoom Out link below the zoom and pan window. You can zoom out to display the whole image at once.
- Measure: Click on a star to select and measure it.

Next and previous image arrow: All images are given a number in the file list to make it easier to keep track of what image is currently being analyzed. This number is shown in the upper left corner. You can easily move to the previous or next image by clicking the arrows. Any stars that have been selected will be applied to the new image.

Load sequence: The Load Sequence combo lists all previously defined sequences and is typically used when repeatedly analyzing the same field. When a sequence is selected, the image is searched for matching stars and measured if found.

Measurement list: As stars are selected, either manually by clicking in the image or automatically by loading a sequence or importing data from a catalog, the star is added to the measurement list to the left of the image. The list displays the star's name, its FWHM and its SNR. Click the name link to view details. Click the cross icon to delete the measurement.

4.2 INDIVIDUAL IMAGE DETAILS

An image centered on the selected star is displayed, along with essential information about the measurement

- Star Profile: Plots the average ADU at a given distance, in pixels, from the centroid. That is, the average value on a circle around the centroid
- Effect of Signal Circle Radius: Plots the SNR of the measurement against increasing signal circle radius, and instrumental magnitude vs. signal circle radius. The radius at max SNR might be taken as the optimal setting. The instrumental magnitude plot should level off as the effect of varying signal circle radius becomes negligible
- ADU-Readings: Show the ADU readings of the aperture in a tabular format

View and edit measurement info:

To view information for a particular star, click on or hover the mouse pointer over the aperture (see Setting below for more info on choosing preferred method). This will pop up a window with information relevant for that measurement, such as SNR, instrumental magnitude, calculated centroid etc. It also lets you:

- Change name
- Change type of measurement (target, moving target, comp or check star)
- Enter/change magnitudes for comp and check stars
- Enter/change color index for targets stars

- Change the settings for the sky annulus (applies only to this star)
- Delete the measurement

At any time, you can save a sequence for later use. You accomplish this by clicking the 'Save sequence' link and type in a name. Note that if a sequence with that name already exists, it will generally be overwritten. Depending on the changes, you may need to provide a new name.

Measurements can be of the following types:

- Target: Used to measure the star's brightness. Targets will be measured and reports can be generated.
- Moving targets: Used to measure an asteroid in a set of images. VPhot will track the target from image to image, unless it passes close to a bright star. Note that this feature is so far pretty simple, and you might have various kinds of problems trying to create an asteroid light curve.
- Comparison star: Star with known (or fixed) magnitude used to compare the brightness of target stars.
- Check star: Used as a quality control measurement.

View photometry report: Click this button when done. Note that you must have selected at least one star. If you want to measure magnitudes, you need at least one comp star with pre-defined photometry relevant to the filter with which the image was taken.

Saving your photometry: Click on "Keep This" in the top menu and your data will be saved to the current analysis log. You can add as many results as you wish and submit them together as one file to the AAVSO through WebObs.

4.3 CATALOGS

Certain catalogs can automatically be searched to import data. Note that this option is only available for images that have been successfully plate solved.

- AAVSO comp stars: Click this link to import data from the AAVSO comparison star database. The database is searched centered on the RA / Dec coordinates of the image, in a radius given by the telescope system's FOV. Only stars with SNR above the minimum limit are included (this limit is defined in the settings tool, see below). Stars that might be saturated (that is, have max ADU in the aperture above 50,000) are disabled, and displayed in gray. They can be activated on the report page.
- AAVSO chart and sequence: Selecting one of these will open a new browser window with the output from the AAVSO Variable Star Plotter.
- Load AAVSO Standard Stars: This will allow you to load standard stars for determining transformation coefficients.
- GCVS: Stars from the General Catalog of Variable Stars will be imported. If the difference between the catalog position of a star and its estimated position is more than 5 arc sec, it will not be included in the analysis, but marked with a red circle. It is then up to the analyst to identify and select the appropriate star.

- VSX: The International Variable Star Index maintained by the AAVSO.
- SIMBAD: This will import all data from SIMBAD (from various catalogs). The stars will not be added to the measurement list, they will merely be marked with red squares. These squares link to SIMBAD, and clicking on them will open SIMBAD in a new browser window. This information can be used for manual entry of a comp star.

5 INDIVIDUAL IMAGE - TOOLS

5.1 APERTURE AND SKY ANNULUS

- Aperture radius: Specify the aperture radius in pixels. This will be applied to all measured stars.
- Radius of inner sky annulus circle: The default radius in pixels to be applied to all new measurements added.
- Width of sky annulus: The default width in pixels to be applied to all new measurements added.
- Click Apply to update and save the settings.

5.2 IMAGE DISPLAY

The graph shows the image histogram (the distribution of number of CCD pixels with a given ADU). By changing the low threshold, you say that pixels with ADU less than the threshold shall be displayed as white, and for the high threshold, that pixels with ADU greater than this limit shall be displayed as black. Click Apply to update the display of the image.

5.3 MEASURE PA AND SEP

Used to calculate the position angle and separation between two stars (typically for double star work). Select the primary and secondary stars, and click Calculate to view PA and SEP.

5.4 SETTINGS

- Only import stars with SNR >: The minimum signal-to-noise ratio a star must have to be included in the analysis when importing data from file or catalogs.
- Search radius in pixels: The region of the image being searched for a local maximum (that is, a star). In the case of a click in the image, the region is centered on the click. In case of automated import of star data, the region is centered on the coordinates of the star. Default is 5 pixels.
- Show measurement info: Choose how the measurement info box appears. 'On click' means that you have to click a star to display information, 'On mouse over' means that the information appears when the cursor touches the star.
- Click Save to store the settings. They will be remembered and used next time you visit the page.

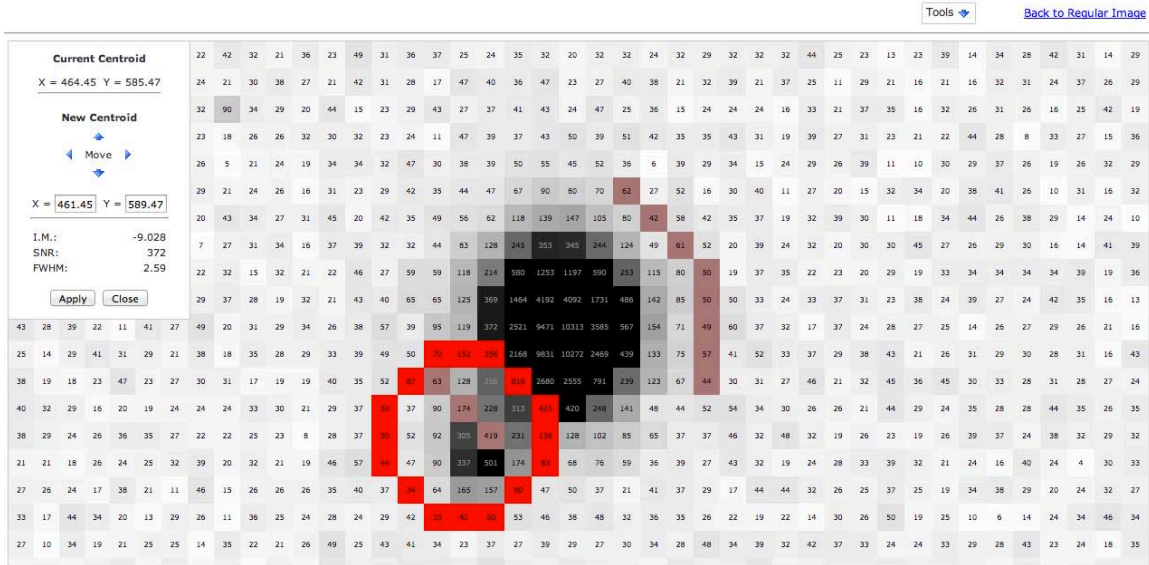
5.5 FITS HEADER

Click this link to view the full FITS header of the image.

Note: To navigate back a page in VPHOT, it is best to use a link to do so where it exists. Although using your browser's "Back" button will often accomplish the same thing, it will sometimes lead to a dead page.

5.6 PIXEL/ADU MODE

In regular mode stars are selected when the image is clicked. When the image is clicked in Pixel / ADU mode a new screen appears that displays each pixel with its ADU value in a region around the clicked position. This is useful for inspecting the image in more detail. Furthermore, if a measurement is clicked the aperture is displayed as a red circle. One can adjust the position of the centroid manually by selecting it, and clicking the arrows to move it.



Please note that a centroid will usually be determined to sub-pixel accuracy by the software. So it should NOT be changed except in special cases, such as for very close stars where the centroid might be influenced by its neighbor. Also, note that because of sub-pixel centroids the visual representation might be inaccurate (most likely if the centroid falls between two pixels).

One can also adjust image display and aperture settings when in pixel/ADU mode.

6 UPLOADING IMAGES

6.1 UPLOAD WIZARD

If you are new to VPhot, or if your FITS header does not comply with the FITS header requirements, use this wizard to upload your images.

6.2 QUICK UPLOAD

If you are familiar with VPhot, know how to upload and know that your FITS headers comply with the requirements - go here to upload your images with as few clicks as possible. If you are uncertain, you should use the wizard.

6.3 VIEW SERVER PROCESSING QUEUE

Click here to see how far your images have come in the processing queue.

6.4 VIEW PROCESSED IMAGES

Click here to see if your images processed properly. If you have uploaded a large number of images only the 1000 most recent ones are shown.

7 ANALYSIS LOG

Analyses you have saved will be listed here (note that time series are automatically saved when completed). You can pick up any analysis where you left it, and you can report several analyses at a time. It might also be useful for comparing the effect of various parameter settings in your analysis.

By default, the most recent analyses are listed, ordered by the time the analysis was saved. You can also choose to only view analyses from the current session, from today or the complete log.

You can also choose between two different views:

As Images

Each analysis is displayed as a thumbnail image. Time series shows the target light curves, while single image analysis are shown as a clipping of the image, centered on the target, and the sequence displayed. Click on the thumbnails to open the reports.

As a List

The analyses are grouped by date, and listed chronologically showing the target star estimated magnitude and error, or in the case of time series, the standard deviation of the check star (which is a good indicator of the quality of the time series data).

You can select one or more analyses to include in AAVSO reports. Note that time series cannot be included in a batch of reports. You will have to open the report and submit it from there.

You can also delete analyses by checking them and clicking 'Delete'.

8 ADMINISTRATION

8.1 SEQUENCES

View, edit and upload sequences in text format.

Sequences are files that define the position of target stars, comparison stars and check stars, their sky annulus settings and (optionally) magnitudes for any band of the comparison stars.

Sequences will typically be created while analyzing an image, by selecting stars in the field and giving them names and magnitudes, or by first importing from AAVSO and GCVS, and then saving the sequence.

However, advanced users familiar with the file format can create their own sequence files, upload them here and apply them when analyzing images.

8.2 LIST CONTENTS

File Name: The name of the sequence file. Click the link to view the file.

Creation Date: The date the sequence was created or uploaded

Edit: Click the link to edit the file

Delete: Click the delete symbol to permanently delete the file

8.3 TOOLS

You can upload new files by clicking the 'Choose File' button and selecting the file to upload. Then click the 'Upload' button.

To use the sequence:

Start analyzing an image

In the toolbar above the image, there is a drop-down list under the 'Load Sequence' heading

All your sequences will be shown in this list

Select your sequence of choice, and stars will automatically be added to the analysis.

Note that the image has to be plate solved before a sequence can be used. This will usually be the case since VPhot tries to plate solve all images

If no stars are imported, check 1) that your file is correct and 2) check the FITS header to see that the telescope pointed where it was supposed to be.

8.4 TELESCOPE SETUP

Lets you administer your private telescope setup if you want to upload images to VPhot.

You can see all common telescopes in this list, as well as your own scope(s). A common scope is one that is publically available, such as scopes from AAVSONet or iTelescope. If you create your own telescope setup, only you will see it in this list.

Click on a link in the display name column to edit the setup. Note that you can view details of common scopes, but not edit them.

8.5 IMAGE TRANSFER (CONNECT ACCOUNTS)

If you have accounts from other online telescope providers other than the AAVSONet, such as iTelescope, you can associate those accounts with your AAVSO account here.

VPhot can only be accessed from within the AAVSO web site. This means that all your images must be associated with your AAVSO account. If you have other accounts, for instance with iTelescope, you can transfer those images to your AAVSO account using the tool on this page. Enter the user name and password of the other account, and click 'Transfer' to associate those images to your AAVSO account (note that you have to do this only once).

All transfers are logged for the records.

9 TUTORIALS

9.1 LOADING IMAGES

When first arriving at the "Available Image Page" after logging in, your most recent day's images will be visible in your list. To find other images, click the "More" link to bring up a drop down menu of filter options for sorting the images in your list.

VPhot [AAVSO](#) | [Images](#) | [Upload](#) | [Analysis Log](#) | [Admin](#) | [Support](#)

Available Images

8 images | [VS Search](#) | [Time Series](#) | [Transform](#) | [Stack](#) | [Download](#) | [Share](#) | [Rename](#) | [Update WCS](#) | [Delete](#) | [Help](#)

◀ = Select all later measurements ▶ = Select all earlier measurements *Click the checkbox inside the column header to check/uncheck all images*

View images uploaded: Most Recently Today Last 3 days Last week More... Refresh

	<input type="checkbox"/>	Tele	Object	Date/Time	Airmass	Exposure	Filter	WCS	Cal	Rep
8	◀ <input type="checkbox"/> ▶	SRO	HQ_Per	2013-01-08 05:15:02	1.016	60 s	● I	■	■	<input type="checkbox"/>
7	◀ <input type="checkbox"/> ▶	SRO	HQ_Per	2013-01-08 05:13:13	1.015	40 s	● R	■	■	<input type="checkbox"/>
6	◀ <input type="checkbox"/> ▶	SRO	HQ_Per	2013-01-08 05:11:30	1.015	60 s	● V	■	■	<input type="checkbox"/>
5	◀ <input type="checkbox"/> ▶	SRO	HQ_Per	2013-01-08 05:09:01	1.014	120 s	● B	■	■	<input type="checkbox"/>
4	◀ <input type="checkbox"/> ▶	SRO	HQ_Per	2013-01-08 05:06:02	1.014	120 s	● B	■	■	<input type="checkbox"/>
3	◀ <input type="checkbox"/> ▶	SRO	HQ_Per	2013-01-08 05:03:25	1.013	60 s	● V	■	■	<input type="checkbox"/>
2	◀ <input type="checkbox"/> ▶	SRO	HQ_Per	2013-01-08 05:01:29	1.013	40 s	● R	■	■	<input type="checkbox"/>
1	◀ <input type="checkbox"/> ▶	SRO	HQ_Per	2013-01-08 04:59:32	1.013	60 s	● I	■	■	<input type="checkbox"/>

For example, to list all images for

Target: BL CAM

Filter: R

Telescope: iT4

Date: 11Dec2009

Mouse over and left click the drop down arrow next to the target box to select and sort your list by target name.

Available Images

8 images | [VS Search](#) | [Time Series](#) | [Transform](#) | [Stack](#) | [Download](#) | [Share](#) | [Rename](#) | [Update WCS](#) | [Delete](#) | [Help](#)

◀ Select all later measurements ▶ Select all earlier measurements Click the checkbox inside the column header to check/uncheck all images

From: [] To: [] Target: BL Cam Filter: (All) System: (All) Stacked Less... Refresh

	Tele	Object	Airmass	Exposure	Filter	WCS	Cal	Rep
8	SRO	HQ_Per	1.016	60 s	I	■	■	□
7	SRO	HQ_Per	1.015	40 s	R	■	■	□
6	SRO	HQ_Per	1.015	60 s	V	■	■	□
5	SRO	HQ_Per	1.014	120 s	B	■	■	□
4	SRO	HQ_Per	1.014	120 s	B	■	■	□
3	SRO	HQ_Per	1.013	60 s	V	■	■	□
2	SRO	HQ_Per	1.013	40 s	R	■	■	□
1	SRO	HQ_Per	1.013	60 s	I	■	■	□

Open the drop down box next to FILTER to show to select and sort the image list by filter type.

Available Images

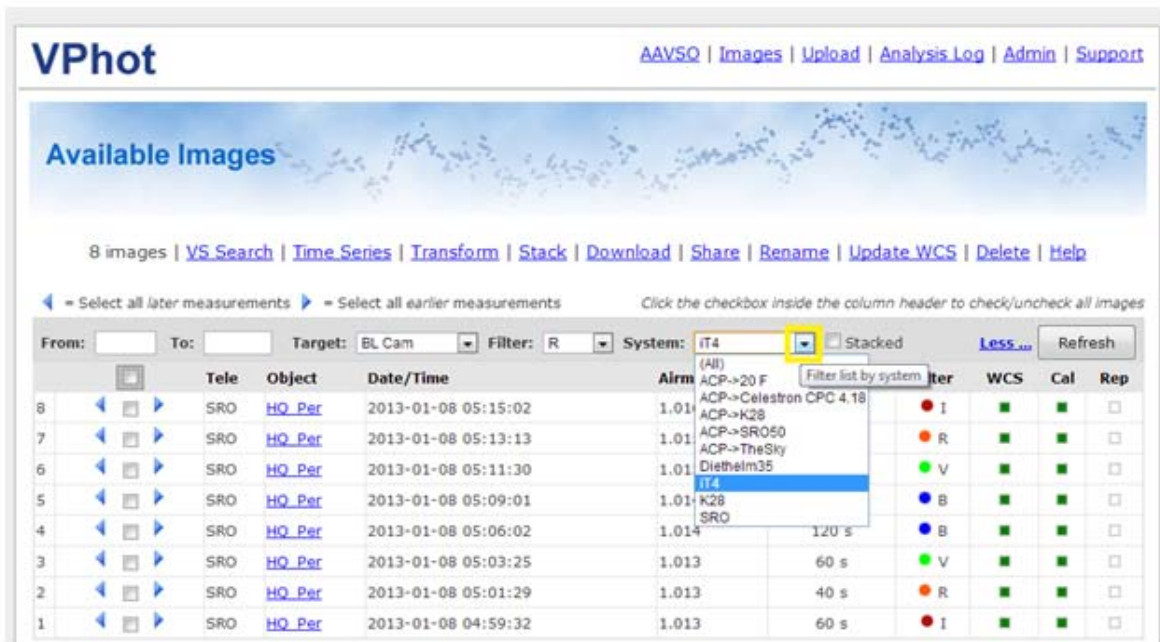
8 images | [VS Search](#) | [Time Series](#) | [Transform](#) | [Stack](#) | [Download](#) | [Share](#) | [Rename](#) | [Update WCS](#) | [Delete](#) | [Help](#)

◀ Select all later measurements ▶ Select all earlier measurements Click the checkbox inside the column header to check/uncheck all images

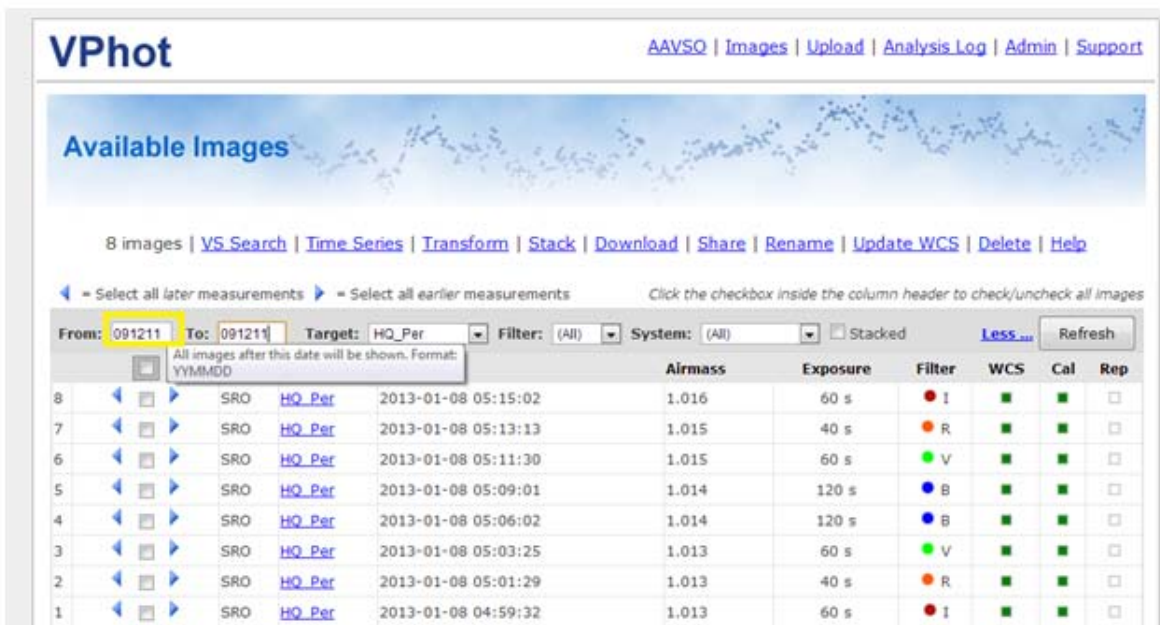
From: [] To: [] Target: BL Cam Filter: R System: (All) Stacked Less... Refresh

	Tele	Object	Date/Time	Exposure	Filter	WCS	Cal	Rep
8	SRO	HQ_Per	2013-01-08 05:15:02	60 s	I	■	■	□
7	SRO	HQ_Per	2013-01-08 05:13:13	40 s	R	■	■	□
6	SRO	HQ_Per	2013-01-08 05:11:30	60 s	V	■	■	□
5	SRO	HQ_Per	2013-01-08 05:09:01	120 s	B	■	■	□
4	SRO	HQ_Per	2013-01-08 05:06:02	120 s	B	■	■	□
3	SRO	HQ_Per	2013-01-08 05:03:25	60 s	V	■	■	□
2	SRO	HQ_Per	2013-01-08 05:01:29	40 s	R	■	■	□
1	SRO	HQ_Per	2013-01-08 04:59:32	60 s	I	■	■	□

Open the drop down box next to SYSTEM to select and sort the image list by equipment type.



Mouse over the "From" and "To" boxes and enter the date in the format indicated.



Then click the "Refresh" button.

The screenshot shows the VPhot interface with the 'Available Images' section. At the top, there are navigation links: AAVSO | Images | Upload | Analysis Log | Admin | Support. Below this is a header for 'Available Images' with a star field background. A sub-header indicates '8 images' and provides links for VS Search, Time Series, Transform, Stack, Download, Share, Rename, Update WCS, Delete, and Help. Below the sub-header are navigation arrows and a note: 'Click the checkbox inside the column header to check/uncheck all images'. The main table has the following columns: From, To, Target, Filter, System, Stacked, Less..., and Refresh. The table itself has columns: Tele, Object, Date/Time, Airmass, Exposure, Filter, WCS, Cal, and Rep. The 'Tele' and 'Object' headers are highlighted in yellow. The table contains 8 rows of data for images taken on 2013-01-08.

From:	To:	Target:	Filter:	System:	Stacked	Less...	Refresh		
<input type="checkbox"/>	Tele	Object	Date/Time	Airmass	Exposure	Filter	WCS	Cal	Rep
8	SRO	HQ_Per	2013-01-08 05:15:02	1.016	60 s	I	■	■	<input type="checkbox"/>
7	SRO	HQ_Per	2013-01-08 05:13:13	1.015	40 s	R	■	■	<input type="checkbox"/>
6	SRO	HQ_Per	2013-01-08 05:11:30	1.015	60 s	V	■	■	<input type="checkbox"/>
5	SRO	HQ_Per	2013-01-08 05:09:01	1.014	120 s	B	■	■	<input type="checkbox"/>
4	SRO	HQ_Per	2013-01-08 05:06:02	1.014	120 s	B	■	■	<input type="checkbox"/>
3	SRO	HQ_Per	2013-01-08 05:03:25	1.013	60 s	V	■	■	<input type="checkbox"/>
2	SRO	HQ_Per	2013-01-08 05:01:29	1.013	40 s	R	■	■	<input type="checkbox"/>
1	SRO	HQ_Per	2013-01-08 04:59:32	1.013	60 s	I	■	■	<input type="checkbox"/>

The highlighted column titles are described briefly below the image, and in more detail at the “Help” link for this page.

The screenshot shows the VPhot interface with the 'Available Images' section. At the top, there are navigation links: AAVSO | Images | Upload | Analysis Log | Admin | Support. Below this is a header for 'Available Images' with a star field background. A sub-header indicates '54 images' and provides links for VS Search, Time Series, Transform, Stack, Download, Share, Rename, Update WCS, Delete, and Help. Below the sub-header are navigation arrows and a note: 'Click the checkbox inside the column header to check/uncheck all images'. The main table has the following columns: From, To, Target, Filter, System, Stacked, Less..., and Refresh. The table itself has columns: Tele, Object, Date/Time, Airmass, Exposure, Filter, WCS, Cal, and Rep. The 'Tele' and 'Object' headers are highlighted in yellow. The table contains 6 rows of data for images taken on 2009-12-11.

From:	To:	Target:	Filter:	System:	Stacked	Less...	Refresh		
<input type="checkbox"/>	Tele	Object	Date/Time	Airmass	Exposure	Filter	WCS	Cal	Rep
54	IT4	BL_Cam	2009-12-11 09:19:07	1.407	60 s	R	■	■	<input type="checkbox"/>
53	IT4	BL_Cam	2009-12-11 09:17:07	1.401	60 s	R	■	■	<input type="checkbox"/>
52	IT4	BL_Cam	2009-12-11 09:15:07	1.396	60 s	R	■	■	<input type="checkbox"/>
51	IT4	BL_Cam	2009-12-11 09:13:07	1.391	60 s	R	■	■	<input type="checkbox"/>
50	IT4	BL_Cam	2009-12-11 09:11:08	1.386	60 s	R	■	■	<input type="checkbox"/>
49	IT4	BL_Cam	2009-12-11 09:09:09	1.381	60 s	R	■	■	<input type="checkbox"/>

Tele--The name of the instrument on which the image was taken.

Object--Name of the image and a hyperlink to the Image Analysis Page. The name is taken from what advanced users will recognize as the FITS header for the image file that was sent from the telescope. This can be whatever name you choose to call the image.

<http://en.wikipedia.org/wiki/FITS>

Date/ Time-- given in UTC, otherwise known as GMT or Zulu.

Airmass -- Airmass provides an indication of the deterioration of the observed image as regards the direct effects of spectral absorption, scattering and reduced brightness, as well as atmospheric turbulence.

The larger the number, the more atmosphere was traversed by the light in the image at the time of exposure before reaching the instrument. The lower the air mass, the better.

Exposure-number of seconds during which the instrument collected photons.

Filter--The Filter color / type used.

WCS and Cal--VPHOT, and the robotic system it is associated with, arrange for your images to be calibrated and plate solved before arriving in your image list. Your own system may require an action on your part to conduct such calibration and plate solution. In very general terms, if both the Plate Solve and Calibration boxes are green, this indicates that the image was properly processed. Another color indicates there were issues.

WCS--a green box indicates that the image was successfully plate solved; a red box indicates that it was not plate solved.

Cal--Calibration status. A green box indicates the image was successfully calibrated. Red and Yellow boxes indicate there were issues which should be checked. Go to the "help" link for this page for more details.

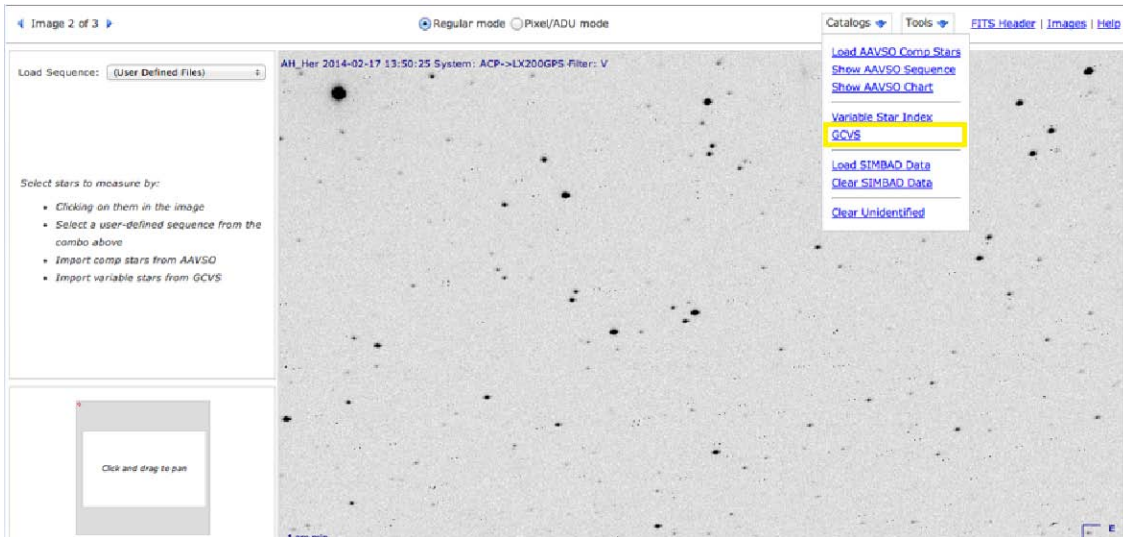
Rep--A green box indicates that the image was analyzed and the results reported to AAVSO. A yellow box indicates that the imaged was analyzed only. No color indicates status unknown.

9.2 LOADING VARIABLE STARS ONTO IMAGES

Once you have an image showing in the display area you can find the known variables residing in your images. Certain catalogs can automatically be searched to import data. (Note that this option is only available for images that have been successfully plate solved.) The catalogs we will be concerned with in this tutorial are the GCVS and VSX catalogs.

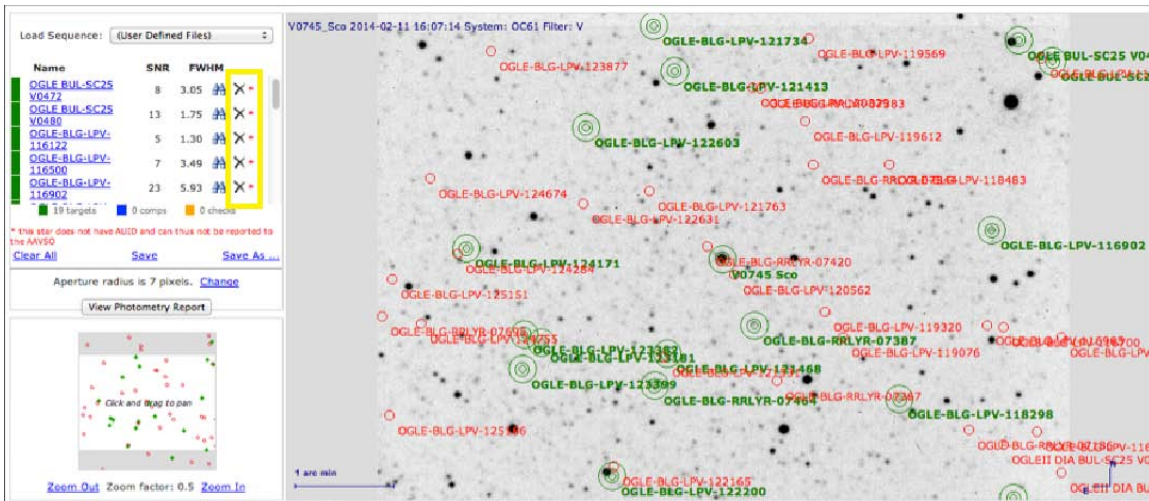
First, mouse over the catalog arrow to display the drop down menu. Select GCVS and left click. Stars listed in the General Catalogue of Variable Stars will be displayed with green annuli around them. If the star is present in the field but too faint to be detected in your image, its location will be marked by a single red circle. You can remove these red circles by clicking on "Clear Unidentified" in the catalog drop down menu.

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February 2016



In crowded Milky Way fields clicking on GCVS may result in dozens of variable stars being marked on the image. You can deselect any faint or unwanted variables one at a time in the target star box on the left. Do this by clicking the 'x' to the right of the star name.

The same holds true for displaying known variable stars listed in VSX. First, mouse over the catalog arrow to display the drop down menu. Select Variable Star Index and left click. Stars listed in the Variable Star Index will be displayed with green annuli around them.



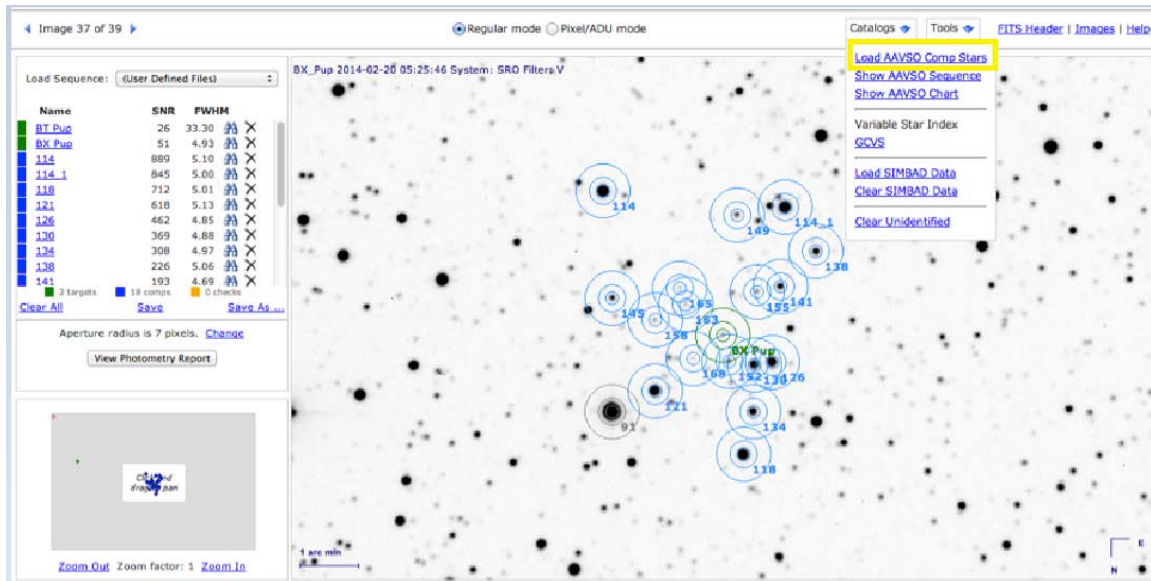
In crowded Milky Way fields clicking on VSX may result in dozens or hundreds of variable stars being marked on the image! You can deselect any faint or unwanted variables one at a time in the target star box on the left. Do this by clicking the 'x' to the right of the star name.

It is not advisable to report data on every variable marked in your images by the software. We suggest you only report data on stars that are the primary targets of your investigation. Many of the OGLE, 2MASS and other variables from survey data are faint and may not be properly

identified by the software. If you are going to report data on secondary targets do the research and be certain you have identified the proper star in the image. When in doubt, leave it out.

9.3 SELECTING, SAVING AND LOADING SEQUENCES

To perform photometry on an image you need to display a sequence of comparison stars. VPHOT will download all the comparison stars from the AAVSO Comp Star Database when you mouse over 'catalogs' and click on "[Load AAVSO Comp Stars](#)".



Not all comp stars are created equally, and you may not need all the comp stars that load onto your image, so how do you select which ones to use?

First, any comp stars that are displayed in gray should be eliminated. The gray color indicates they are saturated in the image displayed on screen. They may not be saturated in other images of the same field in other filters or exposure times.

Second, you can display the sequence information and determine the source of the color magnitude data by mousing over catalog and clicking on "Show AAVSO sequence". The photometry table from the chart plotter, VSP, will open in another window. In order of preference, select or eliminate comp stars based on these guidelines.

- For naked eye stars use GCPD when available or Tycho 2 magnitudes.
- For magnitude 7-10.5V or so, depending on the associated errors, use Tycho 2 magnitudes.
- Bright Star Monitor (BSM) magnitudes and colors can also be used from mag 7 to about 12.5V.
For magnitudes 10.5-16V use USNO Henden or SRO magnitudes, if available.
- You may also use calibrated magnitudes and colors from APASS, or other AAVSONet telescopes when available. These are all quality data.

- Other magnitude sources are a stopgap measure for now, and will eventually be replaced. These include ASAS3 photometry and a handful of other sources. As a last option, you can use TASS V mags from about 10 to 13V, but these are just placeholders until reliable CCD photometry becomes available. Try everything else first. Do not trust TASS V or Ic magnitudes.

To remove a star from the sequence, click on the x to the right of the star name or label. To assign a star as a check star, click on the star on the image and a box will display. Select the radio button for Check star and click "Update" and then "Save" the sequence.

Another useful way to check comp stars is available in the photometry tool in VPHOT.

To the left of the image, click on "View Photometry Report". At the bottom of the resulting page you will see a table of comp stars. Those highlighted in dark red are giving results that disagree more significantly from the average and may be considered less accurate. This does not mean the photometry is bad, they may just be too faint to use for the exposure time in your image, or other factors may come in to play. Deselect these stars in the table and click on "refresh" above and see what your results look like. Chances are the error reported in the target star result will be improved substantially. You can continue this process until it becomes a point of diminishing returns (your reported error will never be better than the SNR error reported in the Target Star Estimates report), or use the first result to guide your list of acceptable comparison stars.

When you have arrived at the result you want to keep, return to the image display page, delete the stars you have eliminated, and in the sequence block click "Save as..." Then name the sequence in the box provided and click save again.

16 Comparison Stars [Toggle Active](#)

Star	IM	SNR	X	Y	Skv	Air	B-V	V-mag	Target estimate	Active
114	-8.844	889	1 399.269	880.133	111	1.789	0.056	11.428	15.911	<input checked="" type="checkbox"/>
118	-8.392	712	1 554.955	1 172.238	111	1.789	1.005	11.823	15.855	<input checked="" type="checkbox"/>
121	-8.145	618	1 456.504	1 101.602	119	1.789	1.128	12.072	15.857	<input checked="" type="checkbox"/>
126	-7.601	462	1 586.654	1 069.830	109	1.789	0.281	12.627	15.868	<input checked="" type="checkbox"/>
130	-7.236	369	1 567.126	1 072.852	114	1.789	0.693	12.982	15.858	<input checked="" type="checkbox"/>
134	-6.828	308	1 565.537	1 124.535	111	1.789	0.368	13.397	15.865	<input checked="" type="checkbox"/>
138	-6.378	226	1 635.482	947.218	109	1.789	0.551	13.848	15.866	<input checked="" type="checkbox"/>
141	-6.112	193	1 596.009	985.974	110	1.789	0.395	14.099	15.851	<input checked="" type="checkbox"/>
145	-5.668	135	1 409.484	998.862	111	1.789	0.454	14.542	15.849	<input checked="" type="checkbox"/>
149	-5.312	104	1 547.560	906.834	110	1.789	0.437	14.899	15.851	<input checked="" type="checkbox"/>
152	-5.058	77	1 538.812	1 069.170	108	1.789	0.353	15.163	15.860	<input checked="" type="checkbox"/>
155	-4.688	63	1 569.946	991.842	108	1.789	0.650	15.532	15.859	<input checked="" type="checkbox"/>
158	-4.315	46	1 456.517	1 023.407	112	1.789	0.737	15.816	15.770	<input checked="" type="checkbox"/>
163	-3.983	39	1 490.930	1 005.944	106	1.789	0.595	16.322	15.945	<input checked="" type="checkbox"/>
165	-3.658	27	1 484.290	988.154	111	1.789	0.774	16.478	15.775	<input checked="" type="checkbox"/>
168	-3.451	21	1 499.067	1 065.918	109	1.789	0.804	16.784	15.874	<input checked="" type="checkbox"/>

9.4 APERTURE PHOTOMETRY- SINGLE IMAGES

To perform aperture photometry, you need to identify a target (or multiple targets), and comparison stars. For this exercise we will assume this is a field you have observed before and have a pre-selected sequence stored in your VPHOT account.

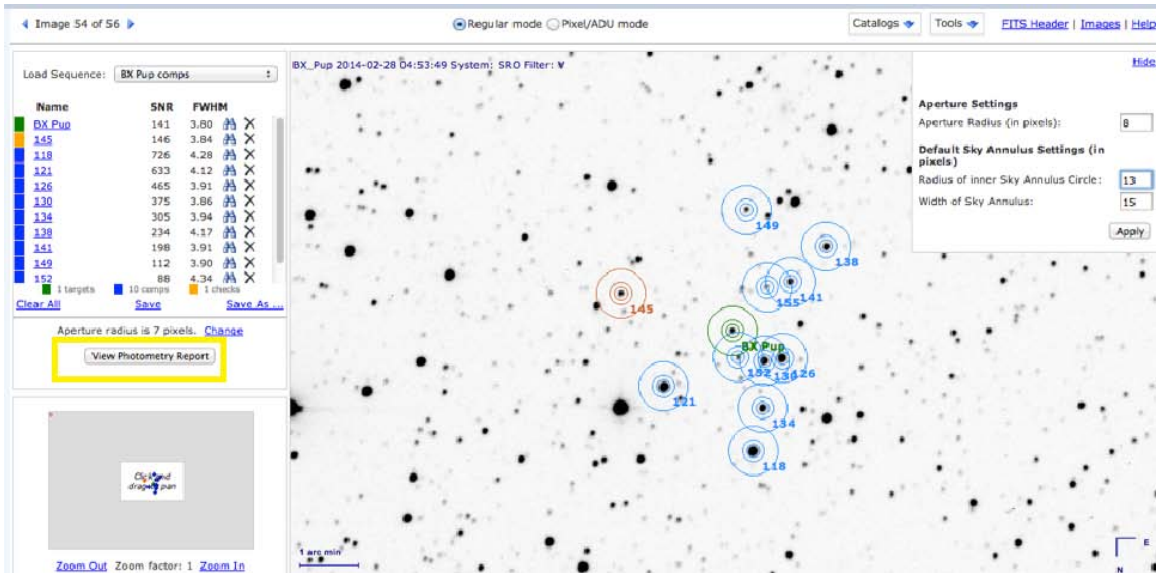
Load the image and then select your sequence from the drop down list in the upper left corner of the image display window.

The screenshot shows the VPhot software interface. At the top, it indicates 'Image 54 of 56' and 'Regular mode'. The main display area shows a star field with several stars circled in blue and labeled with numbers (118, 121, 134, 138, 141, 145, 149, 152, 155, 158, 163, 165). A 'Measure' box is visible over one of the stars, showing coordinates: X: 1345.9, Y: 880, RA: 07:56:28, Dec: -24:21:21. The left sidebar contains a 'Load Sequences' dropdown menu set to 'BK Pup comps', a table of star names, SNR, and FWHM, and a 'View Photometry Report' button. The bottom left shows a zoom control with 'Zoom factor: 1'.

Examine the image to be sure your apertures are encircling the target and comparison stars properly. At this point you may want to adjust the sizes of the annuli in your frame. The rule of thumb is to use 2x the full width half maximum (FWHM) as the inner annulus. If you look at the sequence table in the upper left corner, you will see a column labeled FWHM. In this example the FWHM of the target and comp stars is between 3.9 and 4.2 pixels on average. So you should set your annulus to 8 pixels. The Measurement Details page for each comp shows a Star Profile and Effect of Signal Circle graph which help make a decision on the aperture size for the image.

Under the table you'll see the line "Aperture radius is X pixels. [Change.](#) "

To change the size of the aperture, click [Change](#). A box will appear in the upper right corner of the image. You can adjust the size of all three annuli by typing in the values in the drop down box and clicking "Apply." Click on "Hide" to make the drop down box disappear.



To measure the target, click on "View Photometry Report". You may want to try to improve your results by eliminating a few selected comp stars. When you are happy with your results click on [Keep this](#). Your observation will be stored in the Analysis Log.

Single Image Photometry

[Keep this](#)

[Back to Image](#) | [Comp Data to Excel](#) | [Download](#) | [AAVSO Report](#) | [Help](#)

Target Star Estimates

Aperture radius: <input type="text" value="8"/>	<input type="checkbox"/> Transform	<input type="button" value="Refresh"/>					
Target	Mag	Err	Std	Err(SNR)	SNR	Sky	<*
141 (14.131)	14.150	0.014	0.012	0.007	164	37	
R CrB	14.618	0.015	0.012	0.009	115	37	<input type="checkbox"/>

* - report the target as fainter than the limiting magnitude of 17.264

Image summary

Object:	R_CrB	Date/Time:	2014-03-06 11:19:02
JD:	2456722.97155	Decimal Date:	2014-03-06.47155
R.A.:	15:48:33.33	Dec:	28:09:31.87
Exp.time:	120 s	Filter:	V
Airmass:	1.0238	Calibration:	BDF
Telescope:	SRO		
Filename:	635297283196996250-stacked.fts		

[View full FITS header](#)

9.5 REPORTING IMAGE ANALYSES FROM THE ANALYSIS LOG

Click on '[Analysis Log](#)' to access your saved observations.

	<input type="checkbox"/>	Tele	Object	Date/Time	Airmass	Exposure	Filter	WCS	Cal	Rep
34	<input type="checkbox"/>	SRO	R_CrB	2014-03-06 11:32:11	1.014	120 s	● I	■	■	<input type="checkbox"/>
33	<input type="checkbox"/>	SRO	R_CrB	2014-03-06 11:27:48	1.017	90 s	SR	■	■	<input type="checkbox"/>
32	<input type="checkbox"/>	SRO	R_CrB	2014-03-06 11:25:17	1.019	120 s	● V	■	■	<input type="checkbox"/>
31	<input type="checkbox"/>	SRO	R_CrB	2014-03-06 11:21:24	1.021	240 s	● B	■	■	<input type="checkbox"/>
30	<input type="checkbox"/>	SRO	R_CrB	2014-03-06 11:18:45	1.024	120 s	● I	■	■	■
29	<input type="checkbox"/>	SRO	R_CrB	2014-03-06 11:18:02	1.024	120 s	● V	■	■	■
28	<input type="checkbox"/>	SRO	R_CrB	2014-03-06 11:17:04	1.023	240 s	● B	■	■	■
27	<input type="checkbox"/>	SRO	R_CrB	2014-03-06 11:16:44	1.025	240 s	● B	■	■	<input type="checkbox"/>
26	<input type="checkbox"/>	SRO	R_CrB	2014-03-06 11:12:47	1.029	120 s	● V	■	■	<input type="checkbox"/>
25	<input type="checkbox"/>	SRO	R_CrB	2014-03-06 11:10:04	1.032	90 s	SR	■	■	<input type="checkbox"/>
24	<input type="checkbox"/>	SRO	R_CrB	2014-03-06 11:07:20	1.034	120 s	● I	■	■	<input type="checkbox"/>
23	<input type="checkbox"/>	SRO	BX Pup	2014-03-06 04:35:10	1.790	180 s	● V	■	■	<input type="checkbox"/>

You will see something like this. The default view is to display thumbnails. You can also choose to view them as a list of files.

VPhot [AAVSO](#) | [Images](#) | [Upload](#) | [Analysis Log](#) | [Admin](#) | [Support](#)

Analysis Log

[Select All](#) | [Create AAVSO Report](#) | [Delete](#) | [Help](#)

View: Most recent Current Session Today Complete Log | View as: Thumbnails

<input type="checkbox"/> R_CrB 3/6/2014 7:02:48 PM B-mag: 15.436, Err: 0.018	<input type="checkbox"/> R_CrB 3/6/2014 7:01:26 PM V-mag: 14.632, Err: 0.015	<input type="checkbox"/> R_CrB 3/6/2014 6:59:35 PM I-mag: 13.511, Err: 0.017	<input type="checkbox"/> R_CrB 3/6/2014 6:58:15 PM B-mag: 15.375, Err: 0.014
<input type="checkbox"/> R_CrB 3/6/2014 6:57:12 PM V-mag: 14.618, Err: 0.015	<input type="checkbox"/> R_CrB 3/6/2014 6:56:03 PM I-mag: 13.484, Err: 0.034	<input type="checkbox"/> CW_Mon 3/6/2014 6:54:52 PM V-mag: 16.924, Err: 0.100	<input type="checkbox"/> BX_Pup 3/6/2014 6:53:40 PM V-mag: 14.955, Err: 0.014

You can navigate and choose which images you want to display in the analysis log by choosing Most Recent, Current Session, Today, Complete Log, or you can filter by Target, Filter, etc., by clicking on “[More...](#)”

Hit “Refresh” and your new selections will be shown.

VPhot [AAVSO](#) | [Images](#) | [Upload](#) | [Analysis Log](#) | [Admin](#) | [Support](#)

Analysis Log

[Select All](#) | [Create AAVSO Report](#) | [Delete](#) | [Help](#)

From: To: Target: (All)

Filter: (All) Type: (All) View as: Thumbnails

<input type="checkbox"/> R_CrB 3/6/2014 7:02:48 PM B-mag: 15.436, Err: 0.018	<input type="checkbox"/> R_CrB 3/6/2014 7:01:26 PM V-mag: 14.632, Err: 0.015	<input type="checkbox"/> R_CrB 3/6/2014 6:59:35 PM I-mag: 13.511, Err: 0.017	<input type="checkbox"/> R_CrB 3/6/2014 6:58:15 PM B-mag: 15.375, Err: 0.014

To create a report to submit to the AAVSO select the images you want to include or click “[Select All](#).” Then click “[Create AAVSO Report](#).” Note that you cannot select a time series for reporting except by opening the time series separately to report.

Fill in the form, and click the button to create the report. If you want to exclude one or more observations, such as in a multicolor analysis where the same observation is used to derive transformed magnitudes for more than one filter, remove the check in the 'Include' column for those stars.

Note that if you are reporting several reports in one and supply a comment and/or group, that information will apply to all observations.

When you click the button, a text file is created. This is the report you send to AAVSO. Save the file on your hard drive, and go to the AAVSO web site to upload the file. Use the “Open WebObs” link at the bottom of the report page to quickly open the upload page on the AAVSO site.

Go to the WebObs Upload File page <http://www.aavso.org/webobs/file>

Select the file from your hard drive and click “Upload File”.

A list of your observations will be displayed.

Examine it for accuracy and if it is correct, click “Submit Observations”.

The screenshot shows the AAVSO website interface. At the top, there is a navigation bar with buttons for 'About Us', 'Community', 'Variable Stars', 'Observing', 'Data', and 'Getting Started'. Below this is a header banner with the AAVSO logo and the text 'American Association of Variable Star Observers'. A secondary navigation bar contains links for 'Home', 'Contact Us', 'FAQ', 'Donate', and 'Amazon'. The main content area is titled 'Upload a File of Observations' and contains the following text: 'Upload a *Visual or Extended* format file of observations. The program will read the first parameter, #TYPE=, to determine which format the file is in. The file must be formatted according to either the AAVSO Visual Format or the AAVSO Extended Format. Visit our page Software that exports AAVSO formats for help with formatting.' Below this text is a 'Filename:' label, a 'Choose File' button (highlighted with a yellow box), and the text 'No file chosen'. A note below the button states: 'Click "Browse" to select a file to upload. The maximum file size per upload is 40 MB.' At the bottom of the form is an 'Upload file' button. On the right side, there is a 'WebObs Menu' sidebar with a list of links: 'Main WebObs Page', 'Submit an Observation', 'Upload a File', and 'Search for Observations'. Below the menu is a 'Popular Web Tools' section.

9.6 TIME SERIES PHOTOMETRY

In order to perform time series analysis, you must have two or more calibrated and plate solved images of the same target, taken with the same filter. You must also have a pre-selected sequence that includes at least one comp star and one check star.

VPhot [AAVSO](#) | [Images](#) | [Upload](#) | [Analysis Log](#) | [Admin](#) | [Support](#)

Available Images

14 images | [VS Search](#) | [Time Series](#) | [Transform](#) | [Stack](#) | [Download](#) | [Share](#) | [Rename](#) | [Update WCS](#) | [Delete](#) | [Help](#)

◀ = Select all later measurements ▶ = Select all earlier measurements *Click the checkbox inside the column header to check/uncheck all images*

From: To: Target: Filter: System: Stacked [Less ...](#)

	<input type="checkbox"/>	Tele	Object	Date/Time	Airmass	Exposure	Filter	WCS	Cal	Rep
14	◀ <input type="checkbox"/> ▶	SRO	BX_Pup	2014-03-06 04:29:05	1.788	180 s	● V	■	■	■
13	◀ <input type="checkbox"/> ▶	SRO	BX_Pup	2014-03-05 04:32:15	1.787	180 s	● V	■	■	■
12	◀ <input type="checkbox"/> ▶	SRO	BX_Pup	2014-02-28 04:52:19	1.788	180 s	● V	■	■	■
11	◀ <input type="checkbox"/> ▶	SRO	BX_Pup	2014-02-27 04:55:44	1.787	180 s	● V	■	■	■
10	◀ <input type="checkbox"/> ▶	SRO	BX_Pup	2014-02-20 05:24:16	1.789	180 s	● V	■	■	■
9	◀ <input type="checkbox"/> ▶	SRO	BX_Pup	2014-02-19 05:23:30	1.787	180 s	● V	■	■	■
8	◀ <input type="checkbox"/> ▶	SRO	BX_Pup	2014-02-16 05:40:26	1.789	180 s	● V	■	■	■
7	◀ <input type="checkbox"/> ▶	SRO	BX_Pup	2014-02-12 05:51:21	1.788	180 s	● V	■	■	■
6	◀ <input type="checkbox"/> ▶	SRO	BX_Pup	2014-02-10 06:03:47	1.788	180 s	● V	■	■	■
5	◀ <input type="checkbox"/> ▶	SRO	BX_Pup	2014-02-09 06:07:27	1.788	180 s	● V	■	■	■
4	◀ <input type="checkbox"/> ▶	SRO	BX_Pup	2014-02-08 06:11:14	1.788	180 s	● V	■	■	■
3	◀ <input type="checkbox"/> ▶	SRO	BX_Pup	2014-02-06 06:19:29	1.788	180 s	● V	■	■	■
2	◀ <input type="checkbox"/> ▶	SRO	BX_Pup	2014-02-05 06:23:46	1.789	180 s	● V	■	■	■
1	◀ <input type="checkbox"/> ▶	SRO	BX_Pup	2014-01-30 06:48:03	1.789	180 s	● V	■	■	■

Select the images you want to analyze or check the select all box, and then click [Time Series](#) in the menu above.

The screenshot shows the 'Available Images' interface. At the top, there is a header 'Available Images' with a decorative background. Below it, a navigation bar contains '14 images | [VS Search](#) | **[Time Series](#)** | [Transform](#) | [Stack](#) | [Download](#) | [Share](#) | [Rename](#) | [Update WCS](#) | [Delete](#) | [Help](#)'. Below the navigation bar, there are controls for selecting measurements: 'Select all later measurements' and 'Select all earlier measurements'. A note says 'Click the checkbox inside the column header to check/uncheck all images'. Below this is a filter section with 'From: [] To: [] Target: BX_Pup Filter: (All) System: SRO Stacked [] Less... Refresh'. The main part of the interface is a table with 14 rows of image data. The first row is highlighted, and its first checkbox is checked. The table columns are: ID, Selection, Tele, Object, Date/Time, Airmass, Exposure, Filter, WCS, Cal, and Rep.

		Tele	Object	Date/Time	Airmass	Exposure	Filter	WCS	Cal	Rep
14	<input checked="" type="checkbox"/>	SRO	BX_Pup	2014-03-06 04:29:05	1.788	180 s	● V	■	■	■
13	<input checked="" type="checkbox"/>	SRO	BX_Pup	2014-03-05 04:32:15	1.787	180 s	● V	■	■	■
12	<input checked="" type="checkbox"/>	SRO	BX_Pup	2014-02-28 04:52:19	1.788	180 s	● V	■	■	■
11	<input checked="" type="checkbox"/>	SRO	BX_Pup	2014-02-27 04:55:44	1.787	180 s	● V	■	■	■
10	<input checked="" type="checkbox"/>	SRO	BX_Pup	2014-02-20 05:24:16	1.789	180 s	● V	■	■	■
9	<input checked="" type="checkbox"/>	SRO	BX_Pup	2014-02-19 05:23:30	1.787	180 s	● V	■	■	■
8	<input checked="" type="checkbox"/>	SRO	BX_Pup	2014-02-16 05:40:26	1.789	180 s	● V	■	■	■
7	<input checked="" type="checkbox"/>	SRO	BX_Pup	2014-02-12 05:51:21	1.788	180 s	● V	■	■	■
6	<input checked="" type="checkbox"/>	SRO	BX_Pup	2014-02-10 06:03:47	1.788	180 s	● V	■	■	■
5	<input checked="" type="checkbox"/>	SRO	BX_Pup	2014-02-09 06:07:27	1.788	180 s	● V	■	■	■
4	<input checked="" type="checkbox"/>	SRO	BX_Pup	2014-02-08 06:11:14	1.788	180 s	● V	■	■	■
3	<input checked="" type="checkbox"/>	SRO	BX_Pup	2014-02-06 06:19:29	1.788	180 s	● V	■	■	■
2	<input checked="" type="checkbox"/>	SRO	BX_Pup	2014-02-05 06:23:46	1.789	180 s	● V	■	■	■
1	<input checked="" type="checkbox"/>	SRO	BX_Pup	2014-01-30 06:48:03	1.789	180 s	● V	■	■	■

Select a sequence from the drop down menu.

Set the FWHM. Default is 1.5 x FWHM.

Or Set the fixed radius of the aperture.

Set the minimum SNR. (Images where the target is less than this value will not be included in the results.)

Set the search radius and initial FWHM.

Click "Start the Analysis".

Time Series

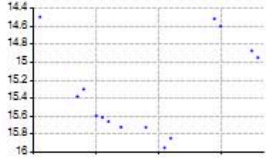
Target name:	BX_Pup
First image:	2456687.78337
Last image:	2456722.68686
Number of images:	14

Sequence:	BX Pup comps	
Aperture:	<input checked="" type="radio"/> Automatic, with radius	<input type="text" value="2.0"/> times FWHM
	<input type="radio"/> Fixed, with radius	<input type="text" value="5.0"/> pixels
Min. SNR:	<input type="text" value="5"/>	
Search radius:	<input type="text" value="5"/> pixels	
Initial FWHM	<input type="text" value="5"/> pixels	
	Help	
	<input type="button" value="Start the analysis"/>	

Once the analysis is complete, click on [Continue to the result page.](#)

VPhot [AAVSO](#) | [Images](#) | [Upload](#) | [Analysis Log](#) | [Admin](#) | [Support](#)

Time Series



The analysis is complete.

Please note that time series analysis is automatically stored in the analysis log, and can be viewed at any time via the 'View Log' link.

[Continue to the result page](#)

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To generate a report to submit to the AAVSO, click on [Create AAVSO Report.](#)

The screenshot shows the 'Time Series' interface with a navigation bar containing 'General Export', 'Create AAVSO Report' (highlighted in yellow), and 'Help'. Below the navigation bar is a control panel with 'Bins: 1', 'Sequence: V', 'Stars to plot: ...', 'Ensemble: ...', and a 'Refresh' button. The main content is a table with the following data:

	Average	Min	Max	Std	Avg. SNR
Targets					
■ BX Pup	15.301	14.493	15.951	0.517	86
Check stars					
■ 145 (14.542)	14.542	14.527	14.631	0.026	133
Comparison stars					
■ 118 (11.823)	11.830	11.824	11.835	0.003	630
■ 121 (12.072)	12.075	12.071	12.081	0.003	552
■ 126 (12.627)	12.634	12.628	12.645	0.005	408
■ 130 (12.982)	12.984	12.975	12.999	0.006	329
■ 134 (13.397)	13.395	13.385	13.404	0.006	272
■ 138 (13.848)	13.855	13.840	13.870	0.008	207
■ 141 (14.099)	14.094	14.083	14.106	0.006	182
■ 149 (14.899)	14.886	14.765	14.921	0.039	106
■ 152 (15.163)	15.162	15.124	15.187	0.017	87
■ 155 (15.532)	15.526	15.484	15.666	0.044	67

Fill in the form, and click the button to create the report. The default values should be OK, but can be changed if needed.

You can select between two types of error reporting: 1) Individual is the SNR-based measurement error of the target (varies from image to image), or 2) a fixed user-specified error which applies to all images.

When you click the “Create Report File” button, a text file is created. This is the report you send to AAVSO. Save the file on your hard drive, go to the AAVSO web site and log on to WebObs to upload the file.

The screenshot shows the 'Create AAVSO Report' interface, which is a form for generating a report. It includes fields for 'Your Observer Code', 'Error estimate', 'Notes', and 'Group identifier', along with a 'Create Report File' button and a link to 'Open WebObs (AAVSO)'.

Fill in the form, and click the button to create the report. The default values should be OK, but can be changed if needed.

You can select between two types of error reporting: 1) Individual is the SNR-based measurement error of the target (varies from image to image), or 2) a fixed user-specified error which applies to all images.

When you click the button, a text file is created. This is the report you send to AAVSO. Save the file on your hard drive, go to the AAVSO web site and log on to WebObs to upload the file.

Your Observer Code:

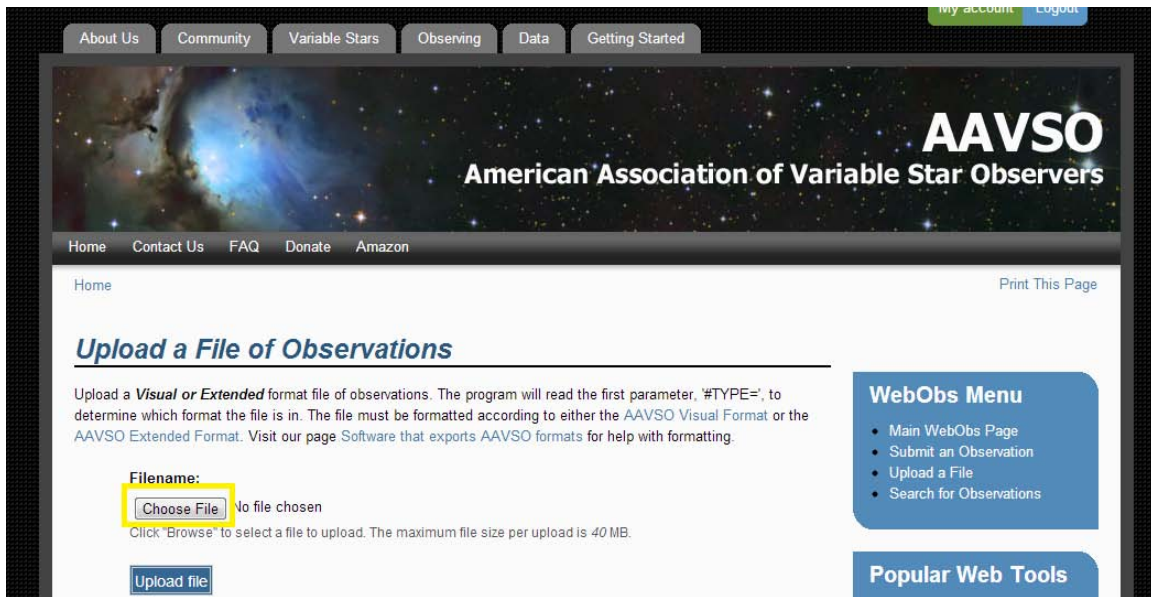
Error estimate:

Notes:

Group identifier: (integer)

[Open WebObs \(AAVSO\)](#)

There is a short cut link to WebObs on this form that will open a new window in your browser at the WebObs 'upload a file' page. <http://www.aavso.org/webobs/file>



Select the file from your hard drive and click “Upload File”.

A list of your observations will be displayed.

Examine it for accuracy and if it is correct, click “Submit Observations”.

9.7 REPORTING TRANSFORMED DATA

VPhot lets you do transformed photometry of stars on images taken with two different filters. You can choose to report one or both of the resulting measurements to the AAVSO.

To be able to do this the transformation coefficients of the telescope have to be known. VPhot does not calculate transformation coefficients. To be able to transform images from your own telescope you will need to determine the transformation coefficients yourself.

For example, if your target is to be measured in B and V, the coefficients needed are TBV, TB and TV. These can be determined by observing a field with standard stars and plotting b-v against B-V, B-b against B-V and V-v against B-V.

If these coefficients are registered in the system, they will be used by default. If not, they need to be provided by the user. To register them permanently in the system please enter the information in the telescope information pages under the Admin menu.

To begin, select two images of the same field taken in different colors, such as V and B. Then select [Transform](#).

Available Images

135 images | [VS Search](#) | [Time Series](#) | [Transform](#) | [Stack](#) | [Download](#) | [Share](#) | [Rename](#) | [Update WCS](#) | [Delete](#) | [Help](#)

◀ = Select all later measurements ▶ = Select all earlier measurements Click the checkbox inside the column header to check/uncheck all images

From: To: Target: R_CrB Filter: (All) System: SRO Stacked [Less ...](#) Refresh

	<input type="checkbox"/>	Tele	Object	Date/Time	Airmass	Exposure	Filter	WCS	Cal	Rep
135	<input type="checkbox"/>	SRO	R_CrB	2014-03-07 11:22:03	1.018	120 s	I	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
134	<input type="checkbox"/>	SRO	R_CrB	2014-03-07 11:19:21	1.020	90 s	SR	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
133	<input type="checkbox"/>	SRO	R_CrB	2014-03-07 11:15:13	1.023	120 s	V	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
132	<input type="checkbox"/>	SRO	R_CrB	2014-03-07 11:11:14	1.026	240 s	B	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
131	<input type="checkbox"/>	SRO	R_CrB	2014-03-07 11:08:30	1.030	120 s	I	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
130	<input checked="" type="checkbox"/>	SRO	R_CrB	2014-03-07 11:07:48	1.029	120 s	V	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
129	<input checked="" type="checkbox"/>	SRO	R_CrB	2014-03-07 11:06:49	1.028	240 s	B	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
128	<input type="checkbox"/>	SRO	R_CrB	2014-03-07 11:06:25	1.030	240 s	B	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
127	<input type="checkbox"/>	SRO	R_CrB	2014-03-07 11:02:23	1.035	120 s	V	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

Specify the sequence used to capture the measurements from both images, and the aperture to use. You can also specify the minimum SNR a comp star must have in order to be included in the analysis. Only those comp stars that are identifiable in both images, and that have catalog photometry for the relevant filters, are used.

VPhot [AAVSO](#) | [Images](#) | [Upload](#) | [Analysis Log](#) | [Admin](#) | [Support](#)

Color Photometry

Target Name: R_CrB
 Color Index: B - V
 Sequence: R CrB V band seq

T_{BV} =
 T_V =

Aperture: Automatic, with radius times FWHM
 Fixed, with radius pixels

Min. SNR:
 Search radius: pixels
 Initial FWHM: pixels

[Help](#)

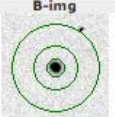
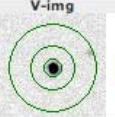
When you click 'Show Report', both images are analyzed gathering instrumental magnitudes for stars in the sequence, and the report is displayed.

Color Photometry

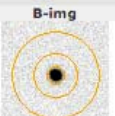
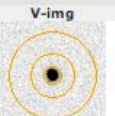
[Keep this](#) | [Show B-image](#) | [Show V-image](#) | [AAVSO Report](#) | [Help](#)

Observation date B:	2014-03-07 11:08:49	Observation date V:	2014-03-07 11:08:48
JD B:	2456723.96446	JD V:	2456723.96444
FWHM B: 4.444	FWHM V: 3.549	Average FWHM: 3.996	Aperture: 5.995 pix

Target Star Details

Name	Results			Details				
	B*	V*	(B - V)*	B-img	V-img	Err	Std	SNR
R CrB	15.362	14.606	0.755			B: 0.023	0.019	93
						V: 0.024	0.021	132

Check Star Details

Name	Results			Details				
	B*	V*	(B - V)*	B-img	V-img	Err	Std	SNR
141	14.715	14.150	0.565			B: 0.021	0.019	145
	(14.691)	(14.131)	(0.560)			V: 0.022	0.021	181

You can select [Keep this](#), which will save the result to the analysis log, or [AAVSO Report](#), which will create a report form.

Fill in the form, and click the button to create the report. If you want to exclude one or more observations, such as in a multicolor analysis where the same observation is used to derive transformed magnitudes for more than one filter, remove the check in the 'Include' column for those stars.

Note that if you are reporting several reports in one and supply a comment and/or group, that information will apply to all observations.

When you click the button, a text file is created. This is the report you send to AAVSO. Save the file on your hard drive, go to the AAVSO web site to upload the file.

9.8 USING VPHOT AND TG TO GENERATE TRANSFORMATION COEFFICIENTS

It is strongly urged that all AAVSO observers submit target magnitudes that have been transformed to the standard system (e.g., BVRI). In order to do that it is necessary to generate transformation coefficients and apply them to multi-filter observations.

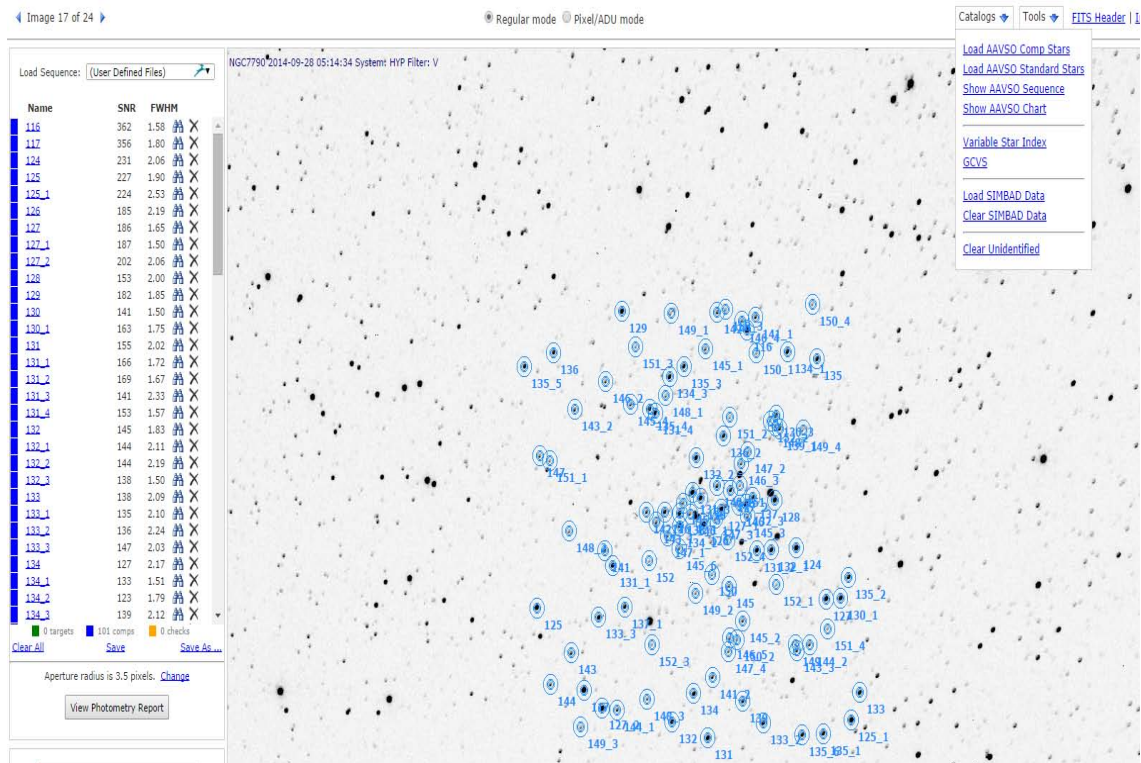
Although it is possible to create transformation coefficients by using spreadsheets, it is much more efficient to use both VPhot and TG (Transformation Generator, Gordon Myers, 2015) to carry out this task. This tutorial explains how to do this. It does require you to install TG, which is found at this link (<https://www.aavso.org/tg>), on your computer.

9.8.1 Image Standard Fields

Currently three standard fields, with accurate photometry, have been selected for this effort (M67, NGC7790 and M11). Image one of these fields near the meridian and collect images in the filters that you have. You need at least two filters to transform data. It is recommended that you take them in the following series order or subset: IIRRVVBBUUUUBBVVRRII to minimize problems with extinction. Use image durations appropriate to your system (e.g., B 90s, V 60s, R 45s; I 30s). Calibrate your images (BDF) and subsequently upload these images to VPhot.

9.8.2 Measure Instrumental Magnitudes

It is recommended that you stack each filter pair to improve SNR. Open a stacked filter. In Catalog, “Load AAVSO Standard Stars”. Confirm that the apertures are appropriate for your image. Note that some adjacent stars may overlap your apertures. If this happens, adjust the apertures as appropriate and save the comp stars in a sequence for your system. You may delete some comp stars that are poorly resolved in your images, although this is not critical at this step. Use this sequence for all images.



No targets or check stars are required. Click the “View Photometry Report” button. On the Single Image Photometry page, note the presence of a table of Instrumental Magnitudes (IM) for as many as 100 comps. Click “Download” in the top toolbar. Save the comp magnitude text

file on your computer with an appropriate name perhaps including system name, date, filter, replicate or other parameters you desire (e.g., MyScope 140928 V1.txt).

Repeat this process for all stacked images in all filters.

The screenshot shows the VPhot web interface. At the top, there are navigation links: [AAVSO](#) | [Images](#) | [Upload](#) | [Analysis Log](#) | [Admin](#) | [Support](#). The main heading is "Single Image Photometry". Below it, there are links: [Keep this](#) | [Back to Image](#) | [Comp Data to Excel](#) | [Download](#) | [AAVSO](#).

The "Target Star Estimates" section shows an aperture radius of 3.5 and a "Transform" checkbox. A note below states: "report the target as fainter than the limiting magnitude of 16.494 THERE ARE NO TARGETS".

The "Image summary" section provides the following details:

- Object: NGC7790
- JD: 2456928.71845
- R.A.: 23:58:24.56
- Exp.time: 60 s
- Airmass: 1.0694
- Telescope: HYP
- Filename: 635475493985375803-stacked.fits
- Date/Time: 2014-09-23
- Decimal Date: 2014-09-23
- Dec: 61:12:39.1
- Filter: V
- Calibration: BDF

The "77 Comparison Stars" table is partially visible below:

Star	IM	SNR	X	Y	Sky	Air	B-V	V-mag	Target estimate	Active
116	-7.585	362	810.646	339.769	259	1.070	0.566	11.652	19.237	<input checked="" type="checkbox"/>
124	-6.743	239	879.250	560.172	257	1.069	0.537	12.488	19.231	<input checked="" type="checkbox"/>
125	-6.706	233	515.774	620.496	256	1.069	1.742	12.591	19.297	<input checked="" type="checkbox"/>
127	-6.469	204	607.441	722.182	258	1.069	0.455	12.769	19.238	<input checked="" type="checkbox"/>
129	-6.336	185	634.960	321.085	257	1.070	1.301	12.951	19.287	<input checked="" type="checkbox"/>
130	-6.139	158	941.622	610.725	256	1.069	0.663	13.094	19.233	<input checked="" type="checkbox"/>
130_1	-6.221	151	745.031	509.570	262	1.069	0.391	13.041	19.262	<input checked="" type="checkbox"/>

The "Save As" dialog box is open, showing the file name "HYP 140928 V1.txt" and "Save as type: Text Document". The file is being saved in the "Documents library" folder.

9.8.3 Generate Transformation Coefficients with TG

Open TG and select a Telescope. You create a new Telescope by "Add Scope". Select the Standard Field. Select VPhot and enter an SNR = 20 to start. Click "Select Files" and highlight all the applicable IM file pairs that you saved on your computer. If you have five filters, you will have ten txt files. If these files appear in the "Current File" window, proceed by clicking "Calculate Transform Set". A table of your coefficients will appear. Click the first coefficient and a graph will appear. Some data points may appear quite far from the linear regression best fit line. You should initially click on these discrepant points to remove them from the analysis, at which point they will turn red. Generally, remove only those points that exceed three standard deviations from the trend line. Note the value of the coefficient and the error and r^2 values. Try to improve the coefficients without removing data points that are not really outliers. Save your transformation coefficients on your computer with the "Save Transform Set". Continue to experiment with TG to increase your understanding of the program, increase your efficiency with this process and improve your coefficients.

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 Version 3.2
 February 2016

