

Introduction to Catalogs_Plugin v1.00a

19 Nov 2021

This document is a short introduction to Catalogs_Plugin, a Java-based plugin for AstrolmageJ to query on-line photometry databases. The output is an AstrolmageJ-compatible radec file to overlay apertures on plate-solved images.

Version 1.00a supports the VSP and APASS9 on-line catalogs as listed below

Version 1.00b: saves both selected and de-selected table records to radec file

Version 1.00c: adds option to download DSS fits file from the SkyView server for the current query parameters

Version 1.0d: plots target object altitude over 24 hr at geographic location specified in Coordinates Converter dialog. The object visibility plotter is based on the ING StarAlt program.

Version 1.0e: added a second plot to track object visibility, similar to ING StarTrack function. User selected table sort and DSS download options can now be saved to the properties file.

Note: some screenshots are from earlier versions.

Links:

AstrolmageJ:	https://www.astro.louisville.edu/software/astroimagej/
Variable Star Plotter:	https://app.aavso.org/vsp/
VizieR: (APASS9 catalog)	http://cdsarc.u-strasbg.fr/doc/asu-summary.htm
Isaac Newton Group of Telescopes	http://catserver.ing.iac.es/staralt/index.php

Run plugin from AstrolmageJ toolbar

From the AstrolmageJ toolbar, select Plugins | Catalog Plugin to open the following form:

The screenshot shows the 'Catalogs Plugin ONEJAR-1.00e' window. On the left is a sidebar with buttons: 'SIMBAD Query' (highlighted), 'Save Query Data', 'Run Catalog Query', 'Import RaDec File', 'Save RaDec File', 'Update Table', 'Clear', 'Close', 'Visibility Plots'. The main area is divided into sections: 'Catalog Query settings' (ObjectID: wasp 12, RA: 06:30:32.80, Dec: +29:40:20.27, Fov: 60.0, Limit: 15.0, Catalog: VSP, Filter: V, Save DSS Fits File checked), 'SIMBAD Data' (ObjectID: WASP-12, RA: 06:30:32.80, DEC: +29:40:20.27, Filter Mag: MagB: 12.14, MagV: 11.57, MagR: ., MagI: .), 'Set Mag Limits' (Upper: 0, Nominal: 10, Lower: 0, Apply mag limits checked), 'Ascending Sort' (Distance selected, Delta MagI unselected, Nobs (APASS) 1), 'Record counts' (Total 0, Filtered 0, Selected 0), 'Starting Night' (19 November 2021), 'Civil Solar Times' (Sunset: 17:27, Twi End: 18:55, Twi Start: 05:57, Sunrise: 07:29), 'Geographic Location and UTC Offset' (Lon: -85:31:42.51, Lat: +38:20:41.25, Alt: 229, UTC offset: -5.0). A status bar at the bottom says 'Simbad query successful for ObjectID: wasp 12'. On the right is a table with columns: Ap, ObjectID, Ra2000, Dec2000, Mag, Mag Err, Mag diff, Dist, Nobs, USE.

User interface after SIMBAD query on wasp 12

Note: the plugin runs as a modal dialog and must be closed to access other AIJ software.

SIMBAD Query – runs an object name-based query on Simbad on-line database. If a match is found, populates SIMBAD Data section as shown for WASP-12. In this example, no data was returned for R and I magnitude bands.

Save Query Data – saves current Catalog Query settings to disk plus Save DSS and Ascending Sort selections. Reloads saved data and settings when plugin is closed and re-opened

Run Catalog Query – runs an on-line query on the selected catalog (APASS9) with user parameters specified in Catalog Query settings section. The results of a successful query are tabulated on the right of the form, shown in the next section. Currently limited to 1500 records.

If selected, downloads a DSS fits file for the current query parameters

Import RaDec File – reads and displays radec file data.

Close – closes plugin, any unsaved data will be lost.

Visibility Plots – plots target object altitude and track coordinates at Geographic Location for selected Starting Night.

Run an on-line catalog query:

The figure shows the interface after downloading data from the APASS9 catalog. All 70 records matching the specified query parameters are tabulated, sorted by increasing radial distance from the object star.

The screenshot shows the 'Catalogs Plugin ONEJAR-1.00a' window. On the left, there are buttons for 'SIMBAD Query', 'Save Query Data', 'Run Catalog Query', 'Import RaDec File', and 'Save RaDec File'. Below these are input fields for 'ObjectID' (wasp 12), 'RA' (06:30:32.80), 'Dec' (+29:40:20.27), 'Fov' (10.0 arcmin), 'Limit' (15.0 mag), and 'Catalog' (APASS). There are also filters for 'Filter: SR' and 'Filter Mag'. At the bottom left, there are buttons for 'Update Table', 'Clear', and 'Close', along with 'Total records: 70' and 'Filtered records: 70'. The main area displays a table of 70 records with columns: Ap, ObjectID, Ra2000, Dec2000, Mag, Mag Err, Mag dIff, Dist, Nobs, and USE. The first two records are highlighted in green and red respectively.

Ap	ObjectID	Ra2000	Dec2000	Mag	Mag Err	Mag dIff	Dist	Nobs	USE
T01	wasp 12	06:30:32.80	+29:40:20.27	11.500	0.000	0.000	0.00	1	<input checked="" type="checkbox"/>
C02	06303279+29402033	06:30:32.79	+29:40:20.33	11.415	0.070	-0.085	0.00	4	<input checked="" type="checkbox"/>
C03	06303272+29400556	06:30:32.72	+29:40:05.56	15.175	0.083	3.675	0.99	4	<input checked="" type="checkbox"/>
C04	06303103+29411843	06:30:31.03	+29:41:18.43	14.716	0.090	3.216	1.04	4	<input checked="" type="checkbox"/>
C05	06302810+29400084	06:30:28.10	+29:40:00.84	15.839	0.122	4.339	1.07	3	<input checked="" type="checkbox"/>
C06	06304003+29413214	06:30:40.03	+29:41:32.14	15.262	0.075	3.762	1.97	3	<input checked="" type="checkbox"/>
C07	06303766+29420086	06:30:37.66	+29:42:00.86	15.711	0.000	4.211	1.98	2	<input checked="" type="checkbox"/>
C08	06303481+29382199	06:30:34.81	+29:38:21.99	16.046	0.008	4.546	2.02	2	<input checked="" type="checkbox"/>
C09	06303188+29422730	06:30:31.88	+29:42:27.30	11.983	0.081	0.483	2.13	4	<input checked="" type="checkbox"/>
C10	06304243+29410531	06:30:42.43	+29:41:05.31	15.278	0.099	3.778	2.22	4	<input checked="" type="checkbox"/>
C11	06302377+29391223	06:30:23.77	+29:39:12.23	13.973	0.064	2.473	2.27	4	<input checked="" type="checkbox"/>
C12	06302522+29384115	06:30:25.22	+29:38:41.15	14.998	0.037	3.498	2.33	4	<input checked="" type="checkbox"/>
C13	06303847+29422159	06:30:38.47	+29:42:21.59	15.978	0.071	4.478	2.37	2	<input checked="" type="checkbox"/>
C14	06302618+29382110	06:30:26.18	+29:38:21.10	14.947	0.083	3.447	2.45	4	<input checked="" type="checkbox"/>
C15	06303632+29375820	06:30:36.32	+29:37:58.20	12.963	0.074	1.463	2.49	4	<input checked="" type="checkbox"/>
C16	06303223+29373473	06:30:32.23	+29:37:34.73	13.006	0.064	1.506	2.76	4	<input checked="" type="checkbox"/>
C17	06302282+29383368	06:30:22.82	+29:38:33.68	14.619	0.092	3.119	2.80	4	<input checked="" type="checkbox"/>
C18	06304613+29392873	06:30:46.13	+29:39:28.73	15.002	0.038	3.502	3.02	4	<input checked="" type="checkbox"/>
C19	06303981+29374055	06:30:39.81	+29:37:40.55	10.203	0.076	-1.297	3.07	4	<input checked="" type="checkbox"/>
C20	06304486+29383724	06:30:44.86	+29:38:37.24	15.386	0.113	3.886	3.13	2	<input checked="" type="checkbox"/>
C21	06304305+29423509	06:30:43.05	+29:42:35.09	15.131	0.101	3.631	3.16	4	<input checked="" type="checkbox"/>
C22	06304323+29375376	06:30:43.23	+29:37:53.76	13.641	0.071	2.141	3.33	4	<input checked="" type="checkbox"/>
C23	06301809+29391979	06:30:18.09	+29:39:19.79	13.914	0.077	2.414	3.35	4	<input checked="" type="checkbox"/>
C24	06302442+29372911	06:30:24.42	+29:37:29.11	13.335	0.076	1.835	3.38	4	<input checked="" type="checkbox"/>
C25	06301861+29414715	06:30:18.61	+29:41:47.15	15.568	0.129	4.068	3.41	2	<input checked="" type="checkbox"/>
C26	06304827+29393591	06:30:48.27	+29:39:35.91	11.381	0.058	-0.119	3.44	5	<input checked="" type="checkbox"/>
C27	06304647+29383043	06:30:46.47	+29:38:30.43	14.135	0.058	2.635	3.49	5	<input checked="" type="checkbox"/>
C28	06304824+29412601	06:30:48.24	+29:41:26.01	15.723	0.125	4.223	3.53	3	<input checked="" type="checkbox"/>
C29	06302382+29431858	06:30:23.82	+29:43:18.58	15.767	0.120	4.267	3.55	2	<input checked="" type="checkbox"/>
C30	06303980+29370443	06:30:39.80	+29:37:04.43	14.625	0.037	3.125	3.60	4	<input checked="" type="checkbox"/>
C31	06302051+29424838	06:30:20.51	+29:42:48.38	15.906	0.000	4.406	3.63	2	<input checked="" type="checkbox"/>
C32	06303876+29434608	06:30:38.76	+29:43:46.08	15.503	0.000	4.003	3.67	2	<input checked="" type="checkbox"/>
C33	06302240+29371700	06:30:22.40	+29:37:17.00	15.473	0.069	3.973	3.80	4	<input checked="" type="checkbox"/>
C34	06304828+29421207	06:30:48.28	+29:42:12.07	16.272	0.164	4.772	3.84	2	<input checked="" type="checkbox"/>

User interface after Run Catalog Query

Ap – lists AstrolmageJ aperture id

ObjectID – catalog object identifier.

Since records are not named in the APASS database, the plugin creates a unique identifier formatted HHMMSSSS±DDMMSSSS, as below for Ap C02

Ap	ObjectID	Ra2000	Dec2000
T01	wasp 12	06:30:32.80	+29:40:20.27
C02	06303279+29402033	06:30:32.79	+29:40:20.33

Ra200, Dec2000 – object coordinates

Mag, Mag Err – catalog magnitude values for selected filter band

Mag diff – difference between Catalog and Nominal magnitudes

Dist – radial distance (arcmin) to T01 object; by default, records are sorted by increasing radial distance.

Nobs – number of observations for each record (APASS)

USE – user selects or de-selects record to export to radec file.

Import RaDec File – over-writes current data with radec file data set.

Save RaDecFile – saves selected table data to AstrolmageJ-compatible file
<ObjectID>.<filter>.<fov>.radec.txt

Update Table – see below

Clear – clears table data

Apply user-selected filters and sort order:

The tabulated record count is reduced to 10 records after applying the following filters:

Nominal (target) mag set to 11.5 mag

Mag range: 11.5 ± 1.5

Minimum number of observations: 3

Sort by: |Delta Mag|, i.e., by the absolute difference in comparison and nominal mag.

The screenshot shows the 'Catalogs Plugin ONEJAR-1.00a' window. On the left, there are buttons for 'SIMBAD Query', 'Save Query Data', 'Run Catalog Query', 'Import RaDec File', and 'Save RaDec File'. Below these are 'Update Table', 'Clear', and 'Close' buttons. The 'Catalog Query settings' section includes fields for 'ObjectID' (wasp 12), 'RA' (06:30:32.80), 'Dec' (+29:40:20.27), 'Fov' (10.0 arcmin), 'Limit' (15.0 mag), 'Catalog' (APASS), and 'Filter' (SR). The 'SIMBAD Data' section shows 'ObjectID: WASP-12', 'RA: 06:30:32.80', and 'DEC: +29:40:20.27'. The 'Filter Mag' section shows 'MagB: 12.14', 'MagV: 11.57', and 'MagI: .'. The 'Set Mag Limits' section shows 'Upper: 1.5', 'Nominal: 11.5', and 'Lower: -1.5'. The 'Ascending Sort' section shows 'Distance' and 'Delta Mag' (selected). The 'Nobs (APASS)' section shows '3'. The 'Total records: 70' and 'Filtered records: 10' are displayed at the bottom left. The table on the right has columns: Ap, ObjectID, Ra2000, Dec2000, Mag, Mag Err, Mag diff, Dist, Nobs, and USE. The table contains 10 records, with the first two (T01 and C02) highlighted in blue. The 'USE' column has checkboxes for each record.

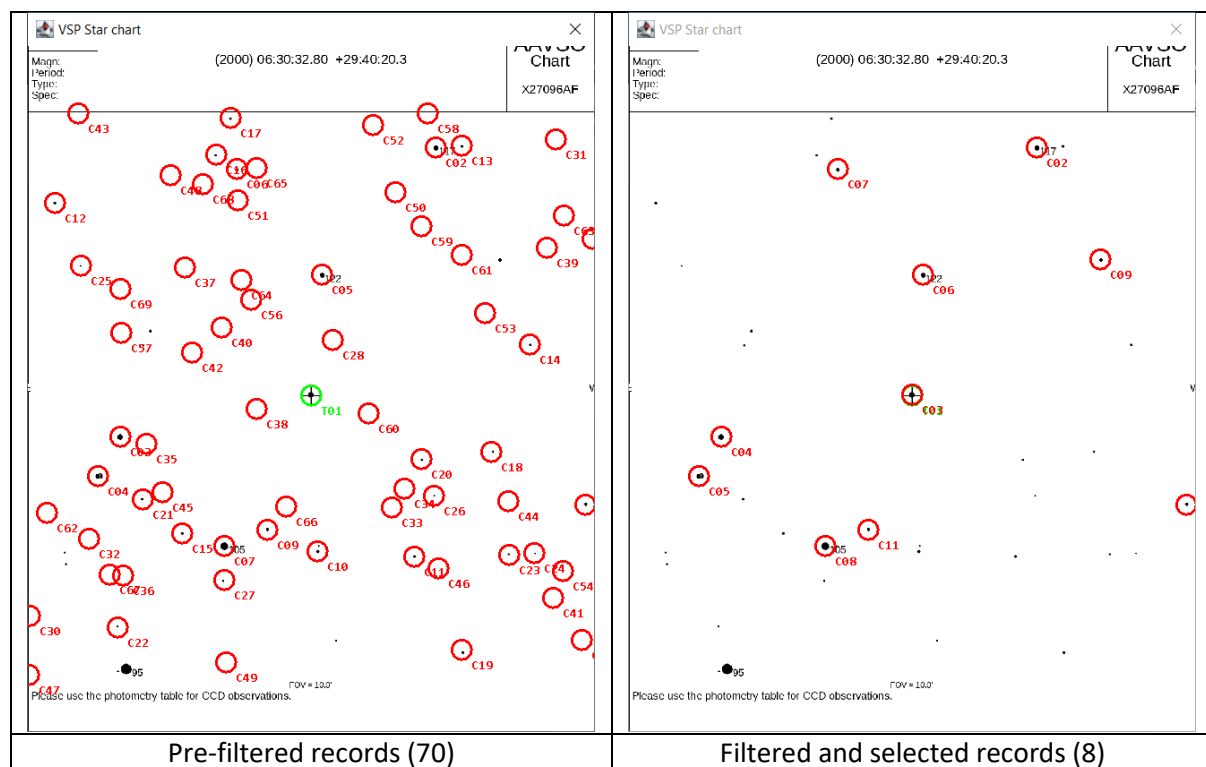
Ap	ObjectID	Ra2000	Dec2000	Mag	Mag Err	Mag diff	Dist	Nobs	USE
T01	wasp 12	06:30:32.80	+29:40:20.27	11.500	0.000	0.000	0.00	1	<input checked="" type="checkbox"/>
C02	06302262+29444221	06:30:22.62	+29:44:42.21	11.554	0.080	0.054	4.89	4	<input checked="" type="checkbox"/>
	06303279+29402033	06:30:32.79	+29:40:20.33	11.415	0.070	-0.085	6.00	4	<input checked="" type="checkbox"/>
C03	06304827+29393591	06:30:48.27	+29:39:35.91	11.381	0.058	-0.119	3.44	5	<input checked="" type="checkbox"/>
C04	06305007+29385436	06:30:50.07	+29:38:54.36	11.773	0.060	0.273	4.02	5	<input checked="" type="checkbox"/>
C05	06303188+29422730	06:30:31.88	+29:42:27.30	11.983	0.081	0.483	2.13	4	<input checked="" type="checkbox"/>
C06	06303881+29441895	06:30:38.81	+29:44:18.95	12.661	0.073	1.161	4.19	4	<input checked="" type="checkbox"/>
C07	06303981+29374055	06:30:39.81	+29:37:40.55	10.203	0.076	-1.297	3.07	4	<input checked="" type="checkbox"/>
	06301744+29424376	06:30:17.44	+29:42:43.76	12.850	0.087	1.350	4.11	4	<input type="checkbox"/>
C08	06301050+29382465	06:30:10.50	+29:38:24.65	12.945	0.073	1.445	5.21	4	<input checked="" type="checkbox"/>
C09	06303632+29375820	06:30:36.32	+29:37:58.20	12.963	0.074	1.463	2.49	4	<input checked="" type="checkbox"/>

User interface after applying magnitude and Nobs filters

Update Table – applies selected sort order, magnitude and Nobs filter, selecting 10 of 70 records in this example.

USE – the figure shows two de-selected records with Ap column automatically entries updated accordingly.

VSP Chart



The left figure shows VSP chart opened after running a catalog query and the right figure after applying filter and user selections.

Save Radec File - saves the right-hand data set to a text file: wasp_12.SR.010.radec.txt

Example workflow

Open Catalogs_Plugin, enter ObjectId and run SIMBAD query to download coordinates and available magnitude data.

Input other Catalog Query settings and enter an estimate Nominal magnitude for this object, e.g., based on SIMBAD magnitude for that filter band.

Run Catalog Query to download all records matching query parameters. Set magnitude and Nobs (APASS catalog) filters and run Update as necessary until roughly 10 table records are displayed.

Review table and chart data to select or de-select table records. For example, in the filtered chart above, de-select C03 (overlaps target object) and (optionally) de-select the object at right edge of FOV.

Save chart data to radec file – the software automatically assigns filename with query-based format in radec subfolder.

Close Catalogs_Plugin, open a plate-solved image in AIJ image viewer, then import and over-layer apertures (File | Import Apertures from RA/DEC list ..., navigate to and select radec file).

Option: to change selected aperture, re-open Catalogs_Plugin, run Import Radec File and open saved radec file to import table records. De-select any unwanted apertures and save changes.

Note: Save RaDec File over-writes without warning any radec file for the same query settings.

Download Deep Sky Survey (DSS) Fits file option (v1.0c):

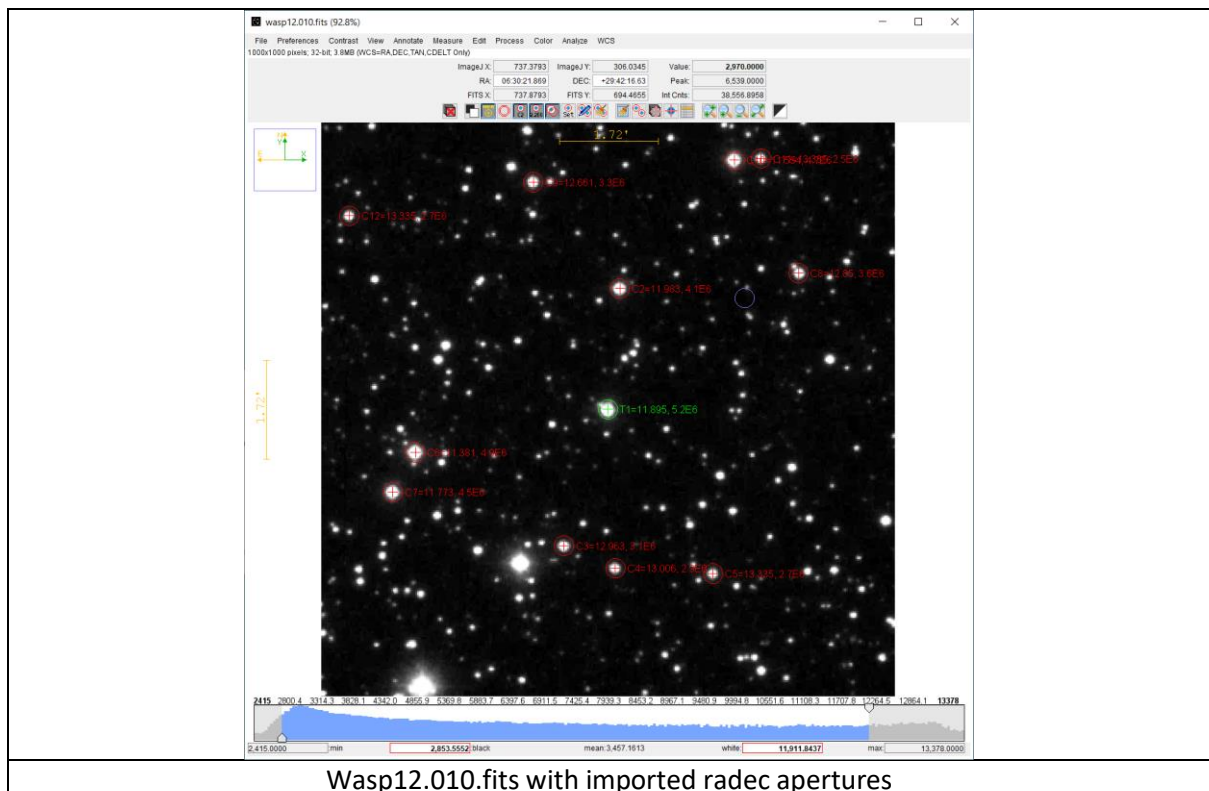
Run an on-line query or import radec file data as above to populate the catalog table.

<div>SIMBAD Query</div> <div>Save Query Data</div> <div>Run Catalog Query</div> <div>Import RaDec File</div> <div>Save RaDec File</div>	Catalog Query settings
	ObjectID: <input type="text" value="wasp12"/>
	RA: <input type="text" value="06:30:32.80"/> HH:MM:SS.SS
	Dec: <input type="text" value="+29:40:20.27"/> ±DD:MM:SS.SS
	Fov: <input type="text" value="10.0"/> arcmin
Limit: <input type="text" value="15.0"/> mag	
Catalog: <input type="text" value="APASS"/>	
Filter: <input type="text" value="SR"/>	
<input checked="" type="checkbox"/> Save DSS Fits File	

Save DSS checkbox (v1.0c)

Select Save DSS Fits File checkbox and click Save Radec File to download and save a fits file, filename format: <objectId>.<fov>.fits in the dss folder (wasp12.010.fits in this example).

Close the Catalogs_Plugin, open wasp12.010.fits in AIJ and import radec apertures as below



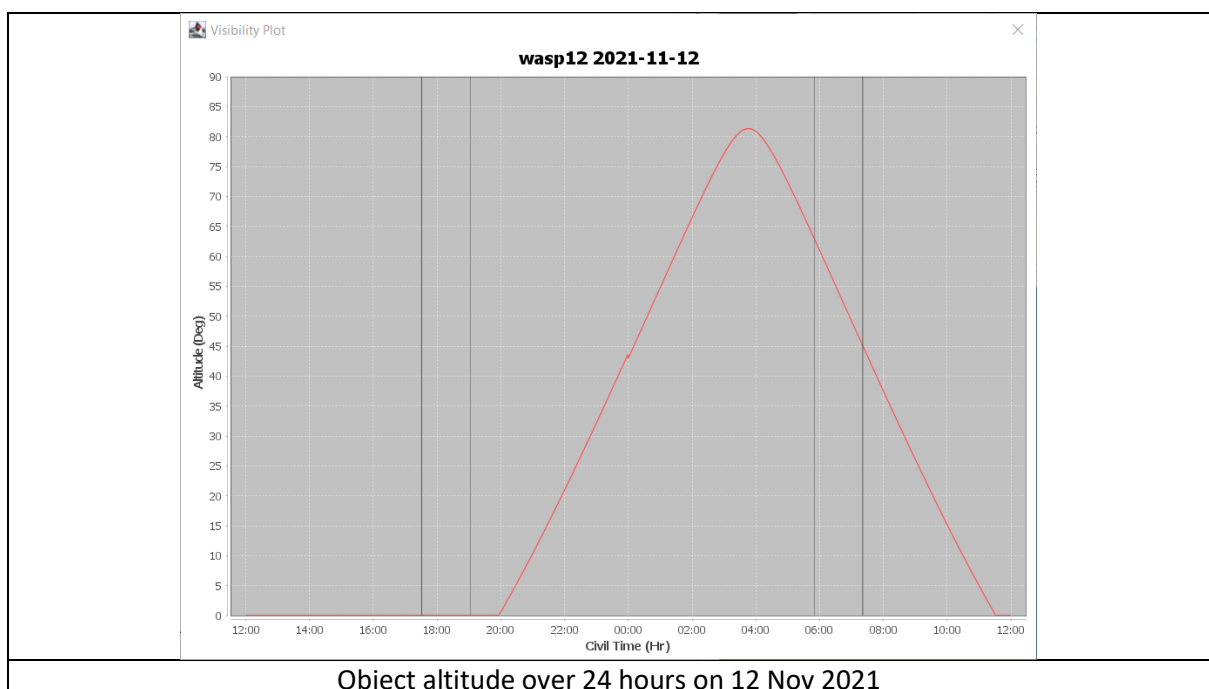
Plot target object altitude over 24-hour period (v1.0d)

Version 1.0d with Plot Altitude control

Geographic location and UTC offsets are imported from the Coordinates Converter dialog, saved in AIJ_Prefs.TXT file. In this case, the observing site is Moore Observatory and UTC offset is -5 hour (EST). The date picker automatically opens with today's date (November 12, 2021).

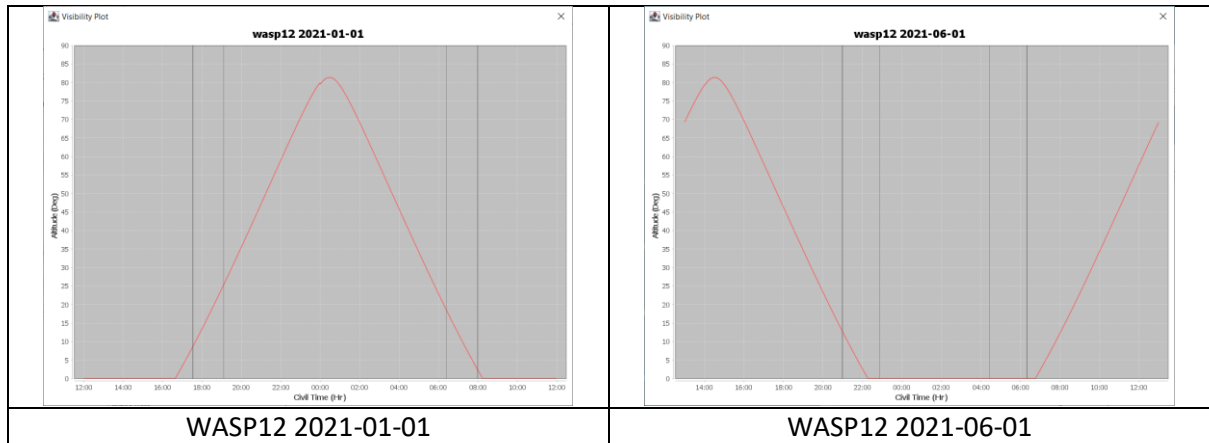
Civil Solar Times section shows Starting Night sunset and twilight end times, and twilight start and sunrise times for the next day (Nov 13). These times automatically update when the user selects another date.

Click [Plot Altitude] to open a new Visibility chart



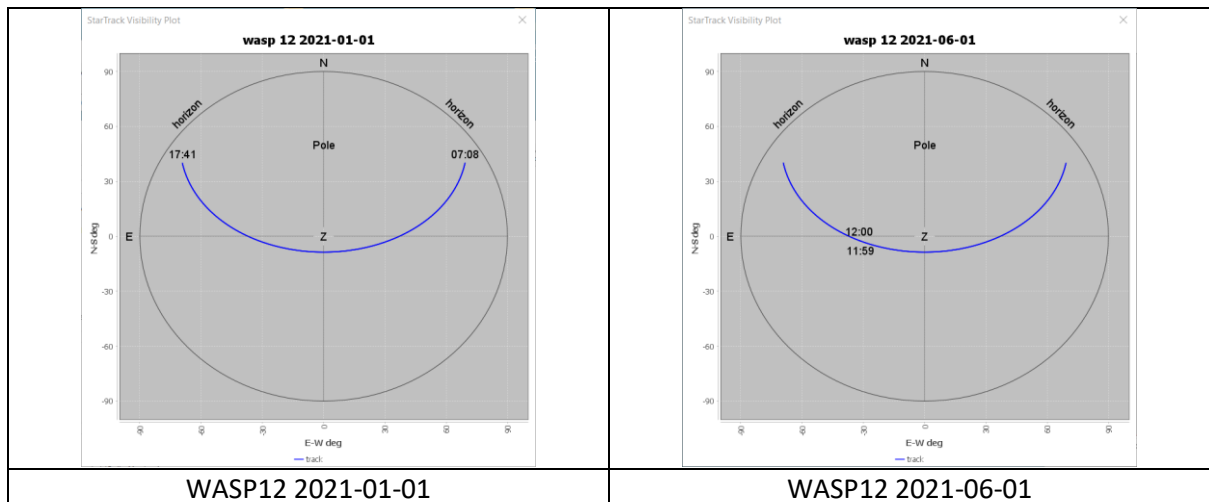
The red line plots target object altitude against local time (EST), and clips to 1 when object goes below the horizon. The outer vertical lines mark sunset and sunrise, the inner lines mark twilight end and start times.

Example January and June plots for WASP12:



Track target object in sky for altitudes over 10° (v1.0e).

In version 1.0e, the [Plot Altitude] button is renamed [Visibility Plot]. Clicking this button creates a second plot of the target object position in the sky over altitudes above 10°.



StarTrack plots for the same dates. The minimum 10° altitude is reached at 17:41 on the 2021-01-01 track, and ends at 07:08 on the next day. Timings on the June plot are plot start (12:00) and end (11:59) times.

Save user settings (v1.0e)

The [Save Query Data] function also saves current Save DSS Fits and Ascending Sort states.

Example: deselect the DSS Save option and select the |Delta Mag| Sort option. Click [Save Query Data], close and reopen the plugin to confirm saved changes.

Notes

Main reference for astronomical calculations: *Practical Astronomy with your Calculator or Spreadsheet*, 4th ed. P. Duffett-Smith, J. Zwart.

JFreeChart graphing software: <https://www.jfree.org/jfreechart/> LGPL licence.

Date picker control: <https://github.com/LGoodDatePicker/LGoodDatePicker> MIT licence.

ING Object Visibility functions *not* implemented in v1.0d include plotting moon altitude and Startrack plotting object altitude-azimuth over the observing night.