

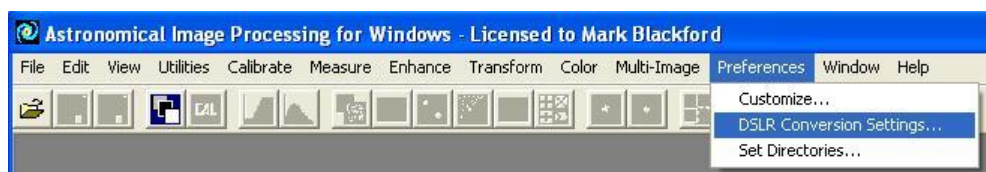
AIP4Win (Version 2.4.8) Calibration and Photometry Tutorial

AIP4Win only works on one colour channel at a time (the two green channels are combined into one image though). The following instructions show the steps for creating master files and processing green channel images only. The process needs to be repeated if red and blue channels are also required.

Currently AIP4Win does not correctly open .CR2 files from Canon 1100D cameras. These first have to be converted to .dng files with Adobe DNG Converter. See Step 5.10 for instruction on how to use Adobe DNG Converter. To be safe, I'd recommend converting all .CR2 files to .dng before using AIP4Win.

1. RAW image conversion

Select DSLR Conversion Settings Preferences:



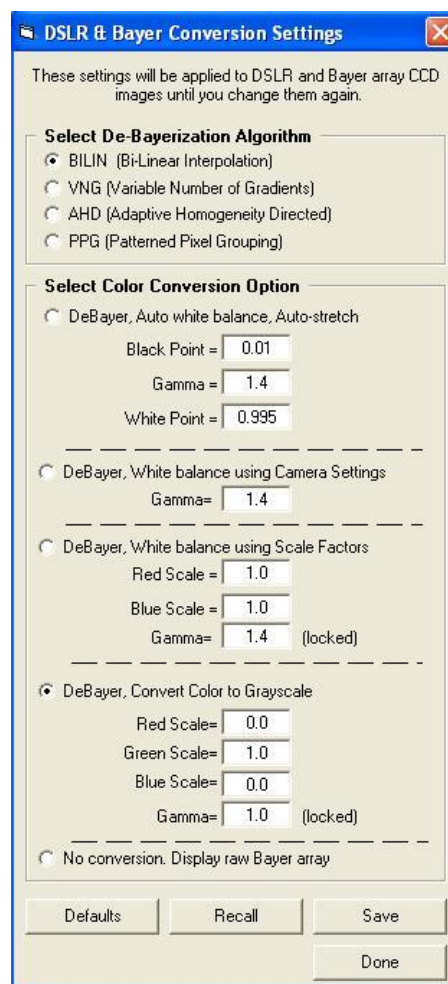
Select BILIN for the De-Bayerization Algorithm (other options are not suitable for photometry).

Select DeBayer, Convert Color to Grayscale with parameters shown at right for the green channel image.

For red channel set Red Scale = 1.0 and others to 0.0

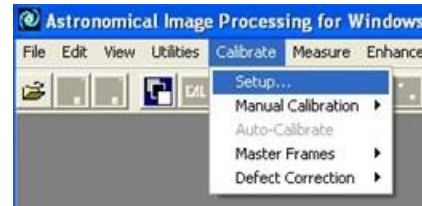
For blue channel set Blue Scale = 1.0 and others to 0.0.

Click the Save button then click the Done button.



2. Calibration setup to make master frames

The next step is to select Setup under the Calibrate menu.



3. Select Advanced under Calibration Protocol

3.1 Select Bias tab

Select Use Bias Frame

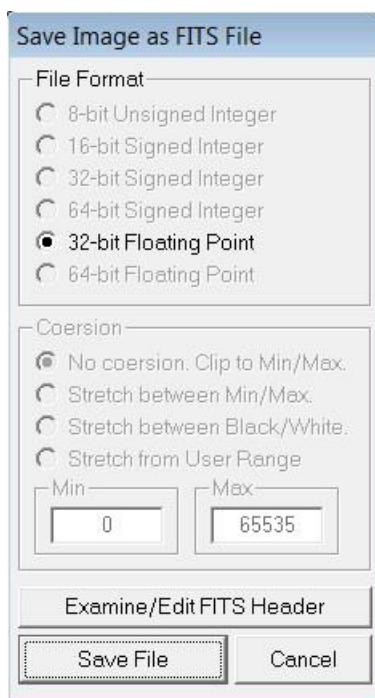
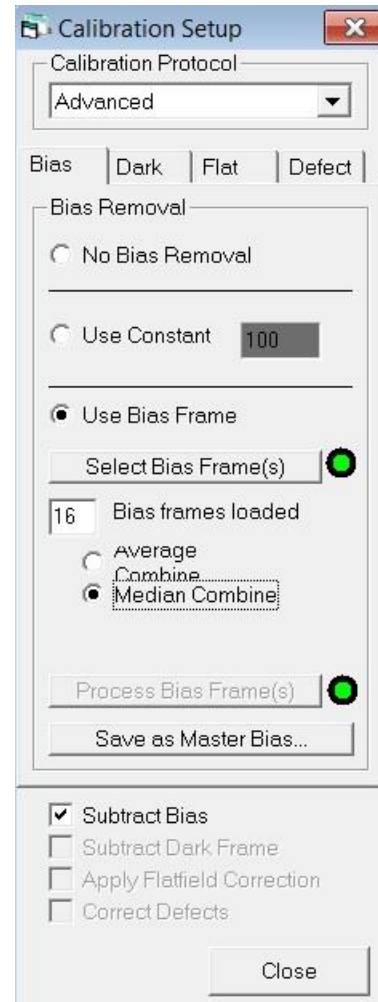
Click on Select Bias Frame(s) button, navigate to the bias images and select digital camera files from drop down list at lower right.

Select Median Combine

Click Process Bias Frame(s) button and wait until finished

Click Save as Master Bias.. button and save in an appropriate place with a suitable name, e.g. "AIP4Win master bias green"

Use default .fits settings each time you save



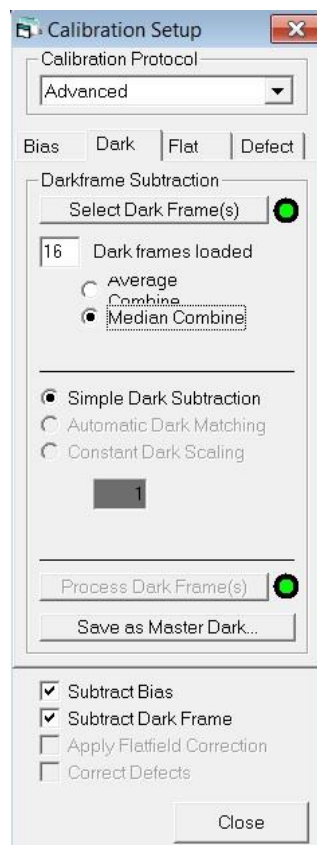
3.2 Select Dark tab

Click on Select Dark Frame(s) button, navigate to the dark images and select them

Select Median Combine

Click Process Dark Frame(s) button and wait until finished

Click Save as Master Dark.. button and save in an appropriate place with a suitable name, e.g. "AIP4Win master dark green"



3.3 Select Flat tab

Click on Select Flat Frame(s) button, navigate to the flat images and select them

Select Median Combine

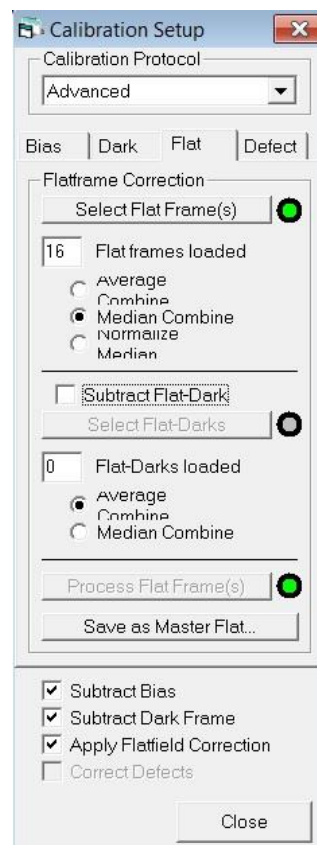
Do not check Subtract Flat-Dark

Click Process Flat Frame(s) button and wait until finished

Click Save as Master Flat.. button and save in an appropriate place with a suitable name, e.g. "AIP4Win master flat green"

Ensure Subtract Bias, Subtract Dark Frame and Apply Flat field Correction check boxes at the bottom are all selected, and Correct Defects is greyed out and not selected.

Close the Calibration Setup window, the setup will be remembered and used by AIP4Win until the program is closed.



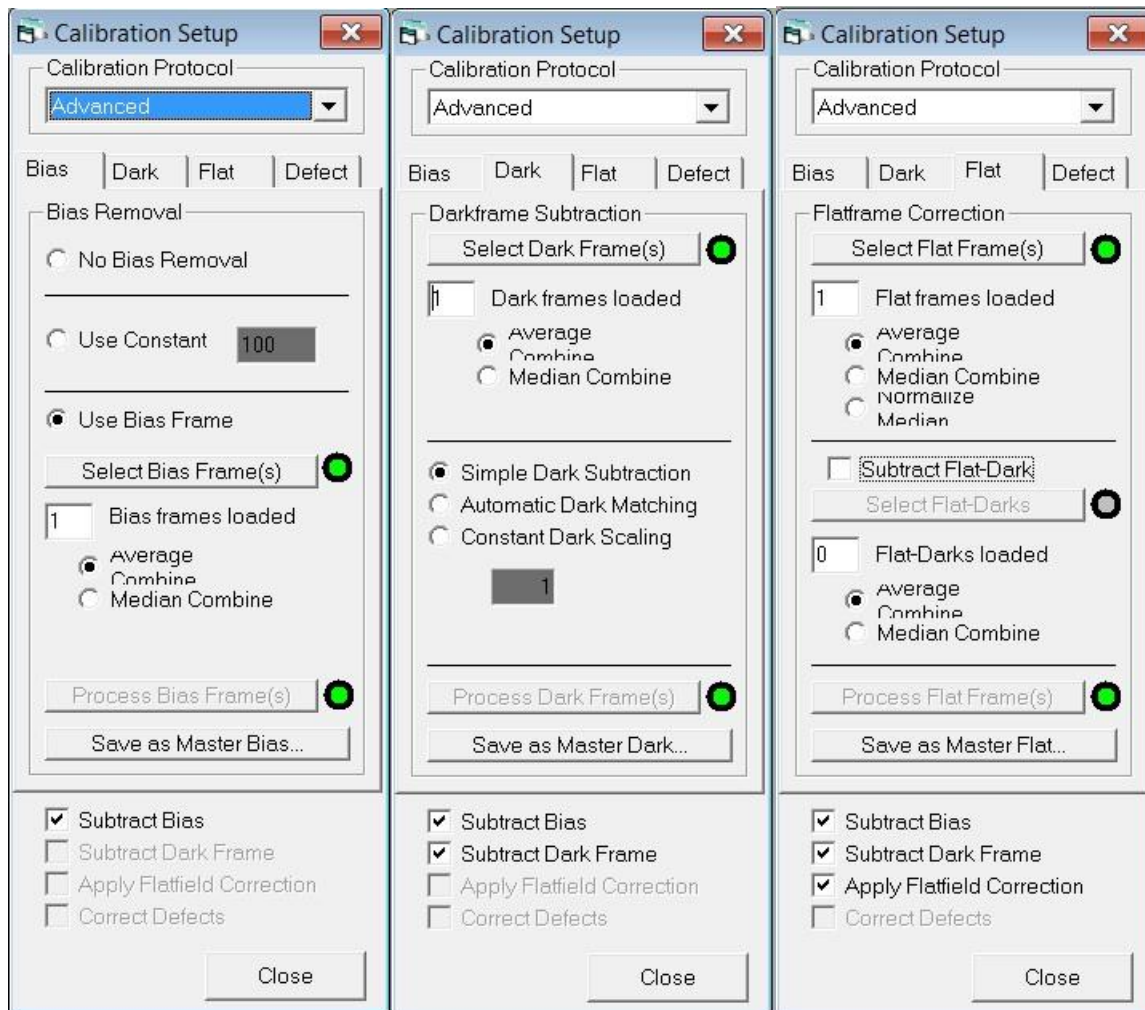
4. Calibration setup using master frames

Once you've saved master calibration frames the Calibration Setup can be configured to use them instead of the individual bias, dark and flat frames.

Follow steps 3.1, 3.2 and 3.3 except:

- 1) Select the relevant master frame instead of the individual frames
- 2) It doesn't matter if average or median combine is selected
- 3) There is no need to save the master frames again

The Calibration Setup tabs will look like this:

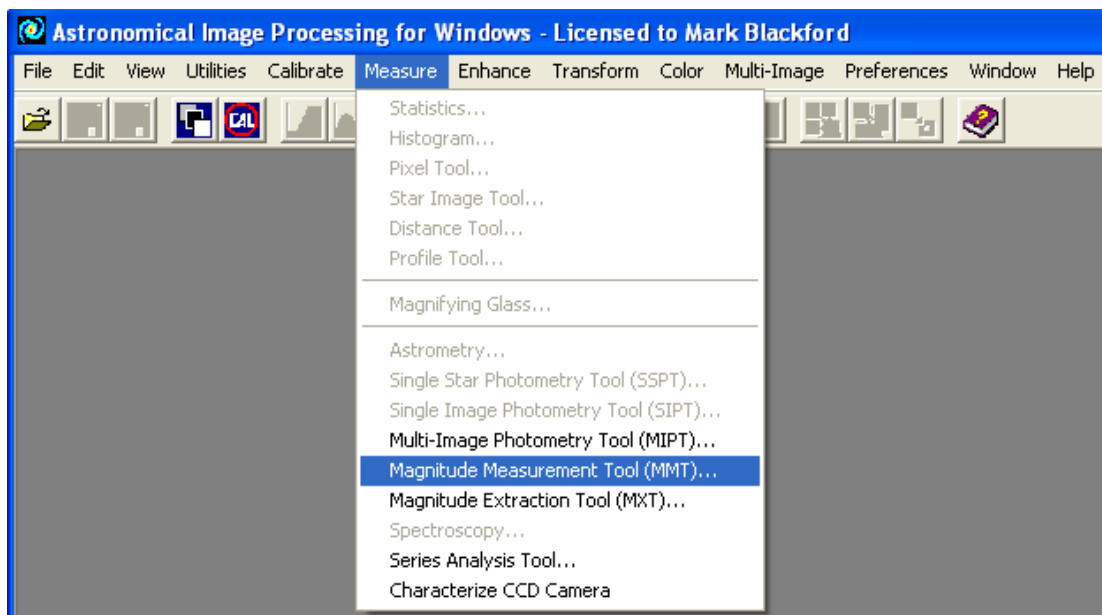


Ensure Subtract Bias, Subtract Dark Frame and Apply Flat field Correction check boxes at the bottom are all selected, and Correct Defects is greyed out and not selected.

Close the Calibration Setup window, the setup will be remembered and used by AIP4Win until the program is closed.

5. Magnitude Measurement Tool

AIP4WIN version 2.4.8 includes a very useful tool for automating the process of calibrating and measuring a series of images to get a variety of statistics and produce reports in several formats. It is called the Magnitude Measurement Tool (MMT) and is selected under the Measure menu:



We'll use MMT to extract target, check and comparison star instrumental magnitudes from each image.

5.1 MMT Observer tab

 The screenshot shows the "Magnitude Measurement Tool v2.4.8" window with the "Observer" tab selected. The tab has sub-tabs: Observer, Instruments, Images, Aperture, Stars, Report, and Execute. The "Observer" sub-tab is active, showing the title "OBSERVER = MGB CH UT.MMT0". Below this are several input fields with labels and instructions:

- BMGA: Observer ID Code assigned by AAVSO, or the name of the observer.
- Chester Hill, NSW: Geographic location of the observer or observatory.
- 151 00 00.00: Observer's longitude (West longitude is NEGATIVE; that includes the USA)
- 33 53 28.0: Observer's latitude (Southern hemisphere is NEGATIVE)
- UTC: Time Zone saved in the FITS header of your images.
- 0.00: Clock Correction as true-log [seconds]

 At the bottom of the form are three buttons: "Recall...", "Save as...", and "Clear". Below the form is a label "Verify your personal observer information...".

Information entered in this tab is used in the reports and to calculate Julian date and airmass. Set the Time Zone to UTC to avoid confusion with local time zones and daylight savings.

5.2 MMT Instruments tab

Magnitude Measurement Tool v2.4.8

Observer Instruments Images Aperture Stars Report Execute

INSTRUMENTS = 1100D 200mm Canon.MMTI

CANON 200MM F2.8 Telescope

72.0 Telescope Aperture [mm]

0.0% Central Obscuration [Percent]

200.0 Focal Length [mm]

1 Number of Filters

TG List of Filters

Recall... Save as... Clear

CANON 1100D CCD Camera

4290 X-axis Pixel Count

2856 Y-axis Pixel Count

0.0051 X-axis Pixel Size [mm]

0.0051 Y-axis Pixel Size [mm]

0.840 Gain [electrons/adu]

7.000 R.O. Noise [electrons rms]

1.00 Dark Current [electrons/pixel/sec]

Verify your telescope and CCD information...

Information entered in this tab defines the imaging system used. The gain, read out noise and dark current values are not important and those shown are arbitrary values. You could determine these values by testing your camera as per Appendix A of the AAVSO DSLR Observing Manual.

5.3 MMT Images tab

Magnitude Measurement Tool v2.4.8

Observer Instruments Images Aperture Stars Report Execute

SELECT IMAGES...

☒ Disk Files ☐ On-Screen Images

Select DISK FILES...

Select Disk Files

☒ Sort file list alphabetically

☒ Calibrate files when opening

Pick an Image for Star Selection

IMG_0001.dng

IMG_0002.dng

IMG_0003.dng

IMG_0004.dng

IMG_0005.dng

IMG_0006.dng

IMG_0007.dng

IMG_0008.dng

IMG_0009.dng

IMG_0010.dng

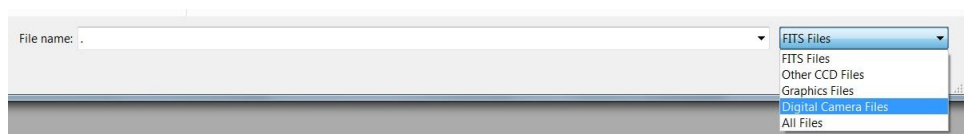
Images In Queue = 10

Select Sort file list alphabetically

If processing un-calibrated images select Calibrate files when opening.

If processing images made in Step 5.4 or Step 5.5 DO NOT select Calibrate file when opening.

Click on Select Disk Files then navigate to, and select, your images. You need to select your file type from the drop down list:



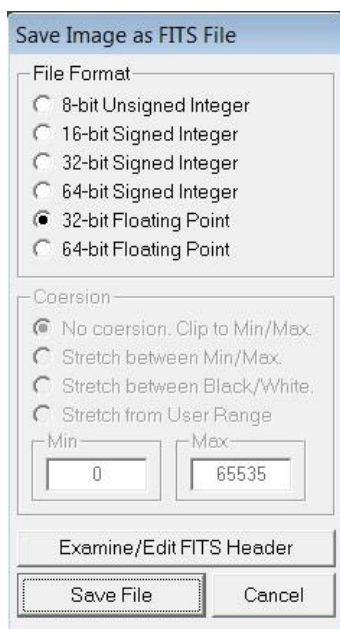
5.4 Calibrating, color extracting images and saving as FITS files with MMT (Optional)

Go to Step 5.6 if you do not want to save calibrated color extracted images as FITS files.

MMT can be used to calibrate and extract a single color channel from science images which can be saved for later stacking or measuring. The procedure is not automated and can be tedious if many science images need to be processed.

In the MMT Images tab select the first file in the list window, then click Pick an Image for Star Selection to open it. The displayed image has been calibrated and the color channel (selected at Step 1) has been extracted.

To save this image choose Save As FITS from the File menu, navigate to the appropriate folder, enter an appropriate name (e.g. IMG_0001 MMT.fits), then click the Save button. The following window appears:



Select the 32-bit Floating Point option then click Save File button.

Close the image, select the next image in the list window and repeat the process until all images have been calibrate, color extracted and saved as FITS files.

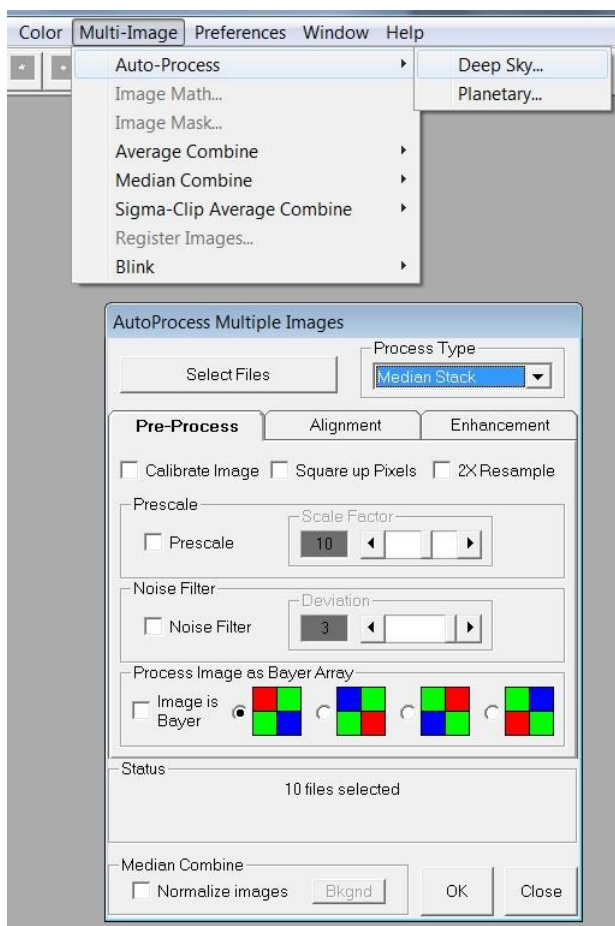
These images can be used in Step 5.3 instead of the un-calibrated frames.

5.5 Stacking images (Optional)

Go to Step 5.6 if you do not want to stack images.

The FITS images saved in Step 5.4 can be combined into a single large stack or several smaller stacks. Here we will demonstrate the process by making a single stack from the 10 individual calibrated and color extracted images.

Select Multi-image/Auto-Process/Deep Sky to open the AutoProcess Multiple Images window:



Click on Select Files button and select the images saved at Step 5.4.

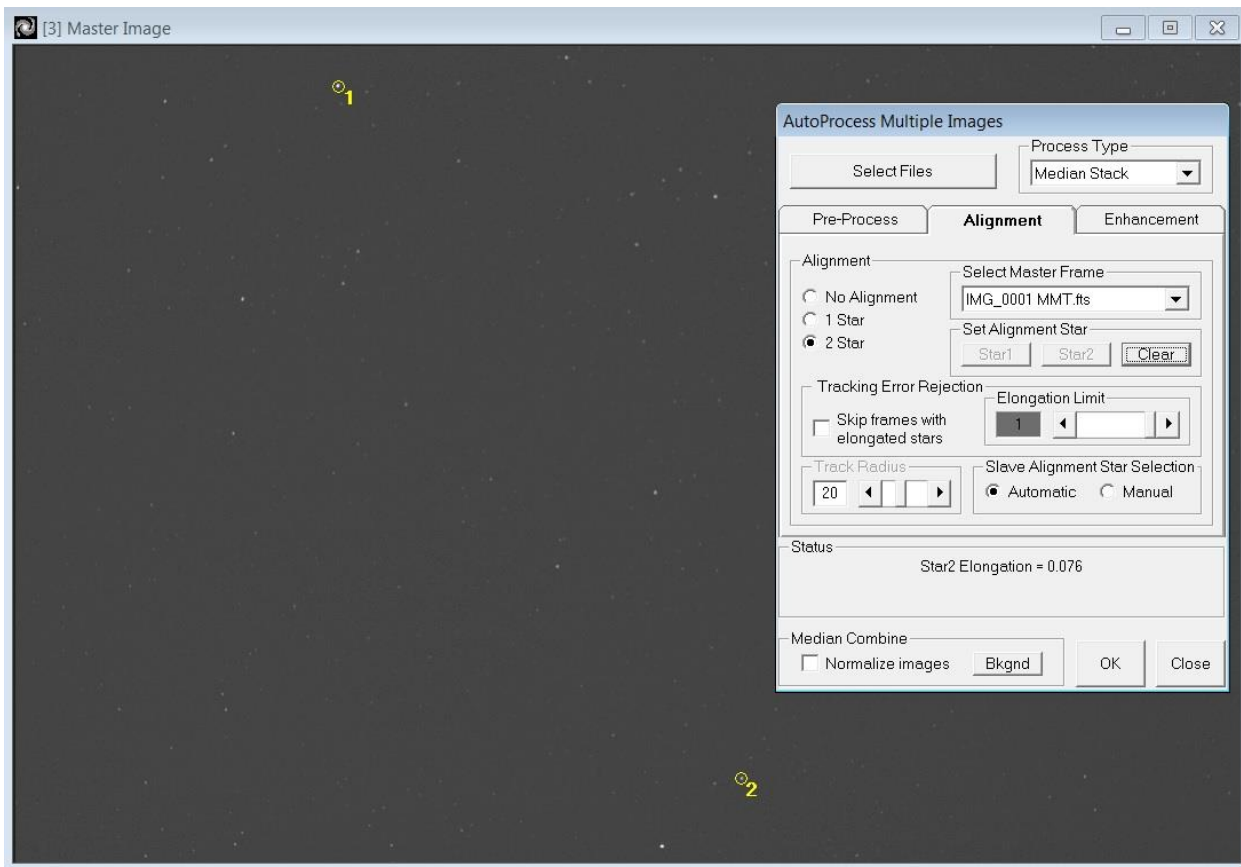
Select Median Stack from Process Type list.

Do not select any of the other check boxes in the Pre-Process tab.

Click on the Alignment tab and in the Select Master Frame list select the first image to display it.

Select the 2 Star option under Alignment and set the Track Radius value to 20 using the slider and/or arrow buttons.

Select the alignment stars by single left click on a star image near one side then click on Star1 button; a label will appear next to the star image. Then single left click on a second star image near the opposite side and then click on Star2 button. See image next page.



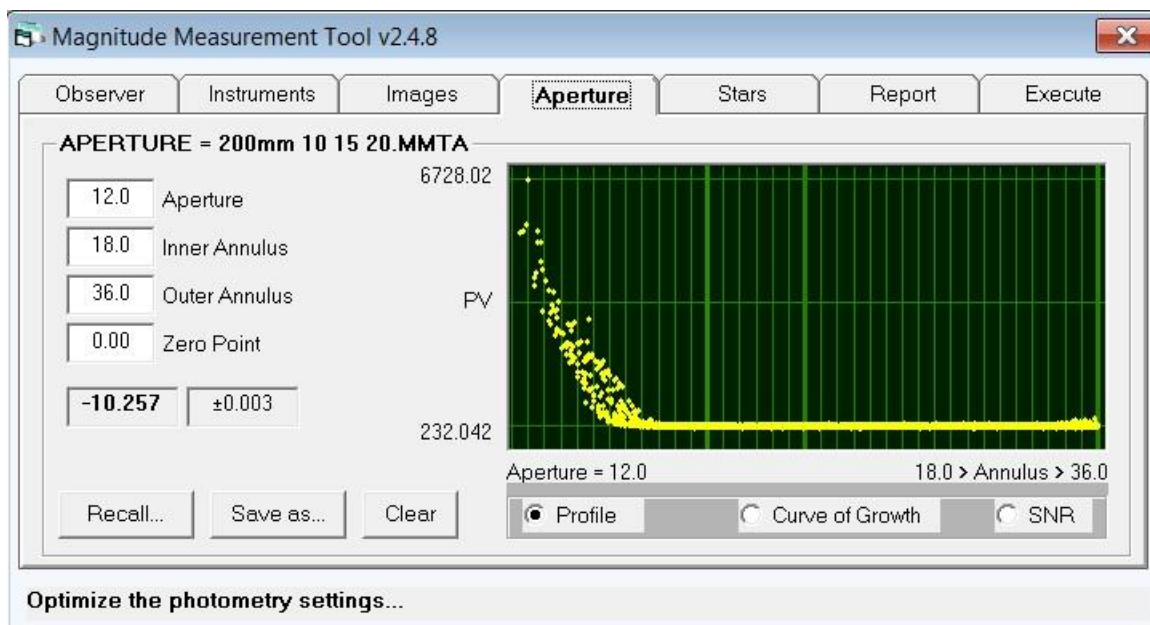
Now click on OK button to start aligning and stacking. This may take several minutes.

Save the resulting image as a FITS file with an appropriate name (e.g. median stk MMT calib.fits).

This stacked image can be used in Step 5.3 instead of individual frames.

5.6. MMT Aperture tab

This is where you select the size of the aperture and annulus for aperture photometry. The aperture should be large enough to include virtually all light from the star as shown below. The annulus should not be too large or background stars may be included. Set the Zero Point value to zero.

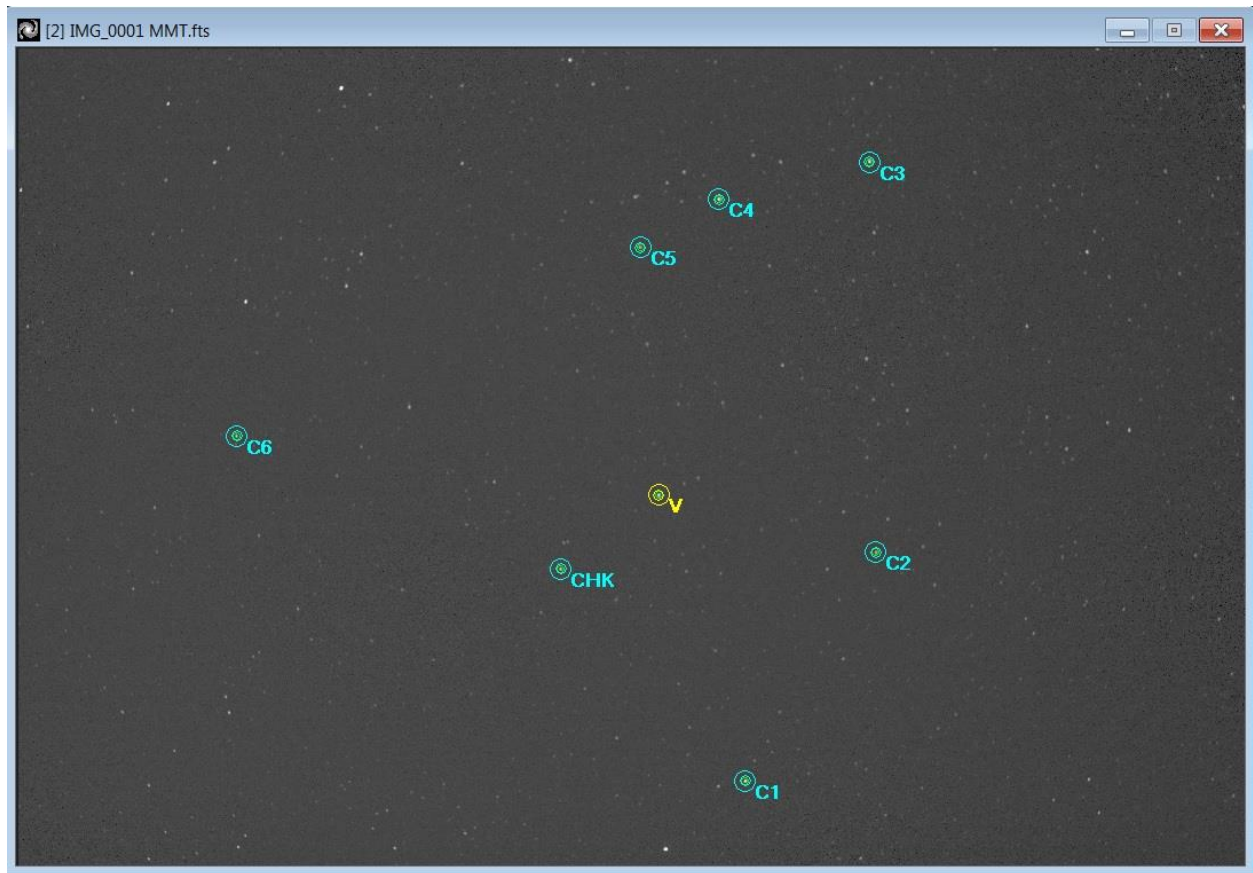


5.7 MMT Stars tab

This is where information about the target and comparison stars is entered. If you only want instrumental magnitudes you can leave the RA and DEC coordinate and magnitude fields as shown below. See instruction of creating a .STAR file below.

The screenshot shows the 'Stars' tab of the 'Magnitude Measurement Tool v2.4.8'. The 'STAR DATA = U AQL.STAR' header is visible. The 'Target = Variable star' section shows coordinates: V, U AQL, 00 00 00.00, +00 00 00.0. The 'Star 1 of 7' section shows: C1, C1, 00 00 00.00, +00 00 00.0. The 'Filter 1 of 1' section shows: TG, 0.000, ± 0.000. The 'Chart' section shows: 1000AAA. The status bar at the bottom says 'Select the variable star...'.

Now click on the star image of the Target = Variable star, three rings will be drawn around the image with the letter “V”. Now click on each of the comparison stars in the correct order, and finally click on the check star.



In the image above the star labeled “V” is U Aql. A check star and six comparison stars have been also been selected.

If you want accurate airmass calculated then carefully enter RA and DEC coordinates. See instruction of creating a .STAR file below.

How to create a new .STAR file.

NOTE: You must press the ENTER key after editing any section, otherwise a warning message will be displayed.

1. Make sure **Enable Star Editing** is checked.
2. Select **Stars** tab, click on **Create New** button
3. A window will pop up asking for number of comp stars. For example, put in 7 (6 comps and 1 check star. The last comp star in AIP4Win is the check star). Click **OK**
4. A window will pop up asking number of filters. Put in 1. A window will pop up asking you to clear all the current star data. Click **OK**
5. Under **Target**, edit StarName appropriately
6. Under **Star 1 of 7**, you will see C1 and CompName. Enter C1 for CompName. Enter an appropriate name (e.g. V) next to **Filter**.
7. Click on the down arrow to get to C2, enter C2 for CompName. Do this up to C6. When you get to C7, enter CHK for C7.
8. Magnitudes don't have to be entered since we are obtaining instrumental magnitudes.
9. Uncheck **Enable Star Editing** box when finished.
10. Click on **Save as...** button to save a file that can be recalled next time you analyse images of this field.

5.8 MMT Report tab

Magnitude Measurement Tool v2.4.8

Observer Instruments Images Aperture Stars **Report** Execute

Select Report Type

- ☐ AAVSO Format
- ☐ CBA Format Report
- ☐ VSS Format Report
- ☐ Standard Magnitudes
- ☒ Instrumental Magnitudes
- ☐ Raw Star Measurements
- ☐ Photometric Data Dump
- ☐ Astrometry Report

Instrumental Magnitudes

- ☒ One Image ☐ One Star
- ☒ JD ☐ HJD
- ☒ Each Image ☐ Each Star
- ☐ Normal (3:5) ☒ Extra (4:6)

Each line in report contains...

Date type to be used in report

Airmass to be reported for...

Decimal places (Mag:Date)

Column Delimiter

- ☐ Semicolon
- ☐ Comma
- ☐ Space
- ☒ Tab

Choose the output format report that you want...

A number of report formats are available. Use the Instrumental Magnitudes report to extract the data needed for input to the DSLR photometry analysis spreadsheet.

5.9 MMT Execute tab

Magnitude Measurement Tool v2.4.8

Observer Instruments Images Aperture Stars Report **Execute**

Guiding Properties

- ☐ No guide star. Re-center; follow.
- ☐ Guide star offset; re-center; follow.
- ☒ Guide star offset; re-center; no follow.
- ☐ Guide star offset; no re-center; no follow.

50.0 Guide star search radius [pixels].

1.0 Guide star change threshold [mags].

10 V,C1,..Cn Search Radius [pixels] R

0.0 Pause time after each image [sec]. S

Auxiliary Functions

Display Time Series Light Curve

Output Another Report using Same Data

Reset Magnitude Measurement Tool

Clear current images and star selections to prepare the MMT for new images and new stars.

Reset

Run Photometry

Select a Guide star and run photometry...

I've found the above settings work well for measuring my images. You might want to experiment to see what works best for you. When you change any field you have to press the ENTER key on your keyboard

Now click on a star in the image to be the guide star. It could be one of the stars already selected or another one so long as it is well separated from nearby stars and reasonably bright (but not saturated).



The final step is to click on the Run Photometry button to start the measurement process which takes a couple of minutes for 10 images on my computer. The data is written to the AIP DataLog window and needs to be saved as a text file for importing later into the spreadsheet. Use a file name that lets you clearly identify the date of observations, target stars and which colour channel was analysed, e.g. “140813 U Aql green.txt”.

If required, repeat the process for the other two colour channels. Remember to change the “DeBayer, Convert Color to Grayscale” Scale parameters appropriately for the colour channel (Step 1 above). You will end up with three text file, e.g.:

“140813 U Aql green.txt”

“140813 U Aql red.txt”

“140813 U Aql blue.txt”

Now that we have the data for the three colour channels we have finished with AIP4WIN and move on to the Excel spreadsheets for data reduction. These spreadsheets are described in another document.

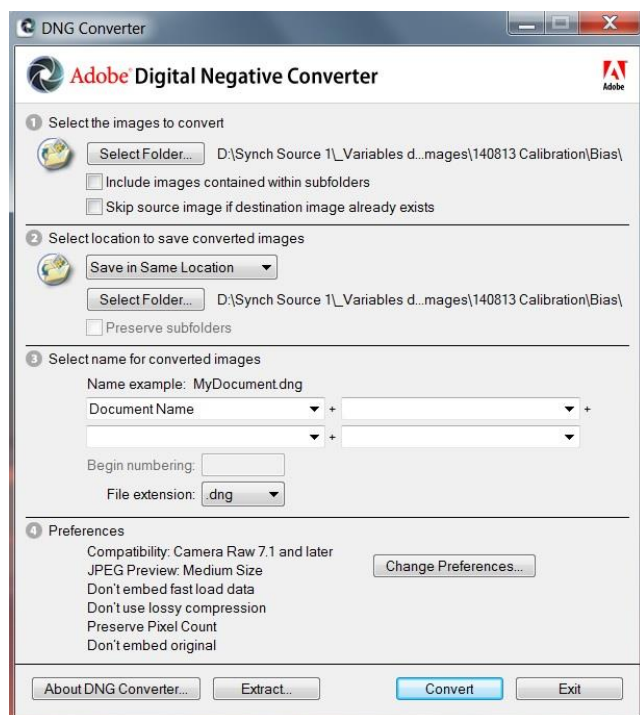
5.10 Using Adobe DNG Converter

First download and install the latest Adobe DNG Converter from:

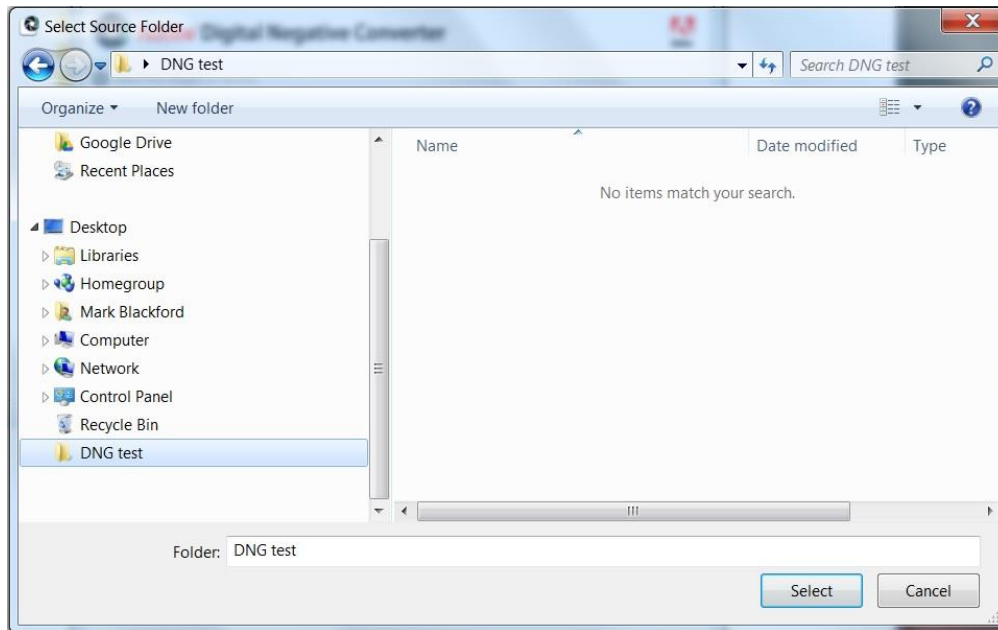
<https://www.adobe.com/support/downloads/product.jsp?product=106&platform=Windows>

The following instructions show how I use the Adobe DNG Converter program (version 9.6.0.625).

Launch the program. The following window should appear:



Section 1. Click Select Folder button and navigate to folder containing .CR2 files you want to convert. Then click on that folder in the left pane of the DNG Converter window.



The images won't be listed in the right pane when you select the folder. Click on Select button at bottom right.

Section 2. Select Save in Same Location

Section 3. Select Document Name in first drop down list, leave others empty. Select .dng file extension.

Section 4. Set preferences to those shown in the first image above

Click Convert button and wait for processing to complete. Check the folder to make sure the .dng files are actually there.

A screen capture from AIP4Win 2.4.8 on the next page shows a .CR2 bias frame captured on my Canon 1100D (left image) and the .dng file (right image) made from it. Only the center part of the .CR2 image is visible, this is why Canon 1100D images have to be converted to .dng files before they can be processed in AIP4Win.

