DEF Shifter imports the image file to detect the differential flexure and focus. It supports the fits file and JPEG file. The format of fits file should be INT16 monochrome.

Actually correct the differential flexure execute by DEF Guider software. Focus correction does motor Focuser control software on the market. Because of this software use the astigmatism method, it can't detect the focus if the imaging scope without astigmatism.

Web page: http://exogalaxy.com (Japanese and English)

Enquiries: From the above home page or email to g-log@exogalaxy.com

Features:

- ➢ Finding the differential flexure from the star image
- ➢ Finding the focus by the astigmatism method from the star image. There are no interrupt your exposure time.

1. Installing/ Uninstalling the DEF Shifter program

When the Zip file is extracted, the following files are created.

    def-shifter.exe

    DEF-Shifter_Manual_JPN.pdf

    DEF-Shifter_Manual_ENG.pdf (This file)

    hspcv.dll

   hspext.dll

    tw_Lang_ENG.txt

    tw_Lang_JPN.txt

There is no installation program.   The registry is not used at all.   Just store all the above files in a single folder.   The instruction manual (PDF files) does not have to be in the same folder to launch the program. You can store the above files in any folder but do not put a space character within the folder name.   Just double click "def-shifter.exe" to launch the program.   When the DEF Shifter program is executed for the first time, the configuration file, "def-shifter.ini" is automatically created in the same folder. To uninstall the DEF Shifter program, just delete all the above files in the folder.

2. Mounting the Imaging Camera

The camera must be mounted so that the horizontal and vertical lines of the camera are parallel to RA and DEC movement. If the Imaging camera is mounted improperly (angled), the program cannot correct the differential flexure. It does not have to be very accurate but it should be more or less within 5 degrees range. See the pictures below for mounting the imaging camera.
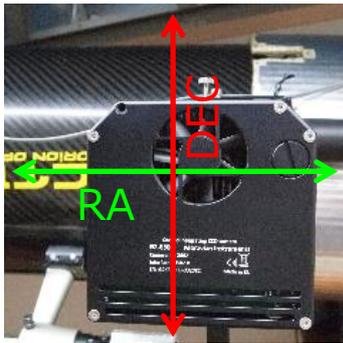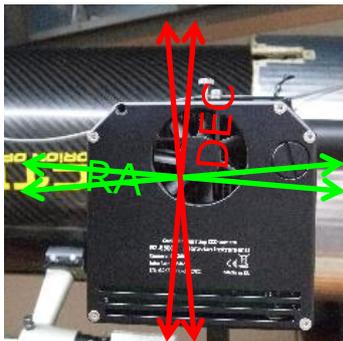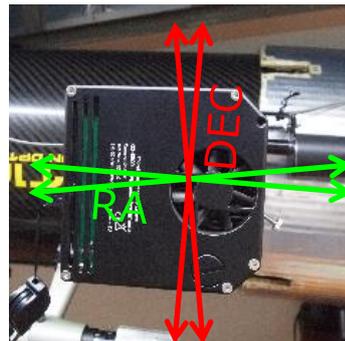

OK
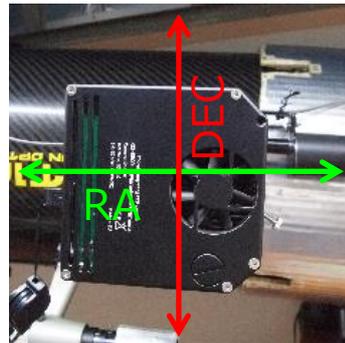
OK
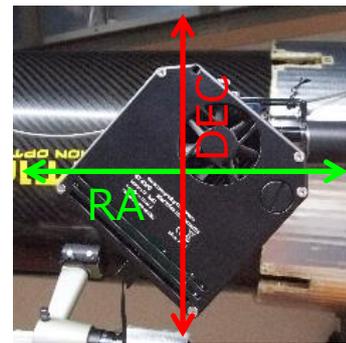
Inappropriate

OK

OK

3. Differential flexure correcting procedure

Here is a brief procedure of setting up this program.

For the detailed explanations, please refer to the chapter 5 and 6.

1) Launch the DEF Guider program
2) Configure the imaging scope and imaging camera in the calibration window of DEF Guider
3) Launch the DEF Shifter program
4) Provision the folder name of FITS/JPEG image files
5) Start exposing
6) Set the screen stretch to find the good star image after read the first image file.

4. Focusing procedure

Here is a brief procedure of focusing. For the detailed explanations, please refer to the chapter 5. If you don't want to use Differential flexure correcting, just launch this program (no launch the DEF Guider).

1) Launch the DEF Shifter program
2) Launch the motor focuser program
3) Provision the motor focuser
4) Start exposing

5. Explanation of the main window

When the DEF Shifter program is launched, the following window should appear.
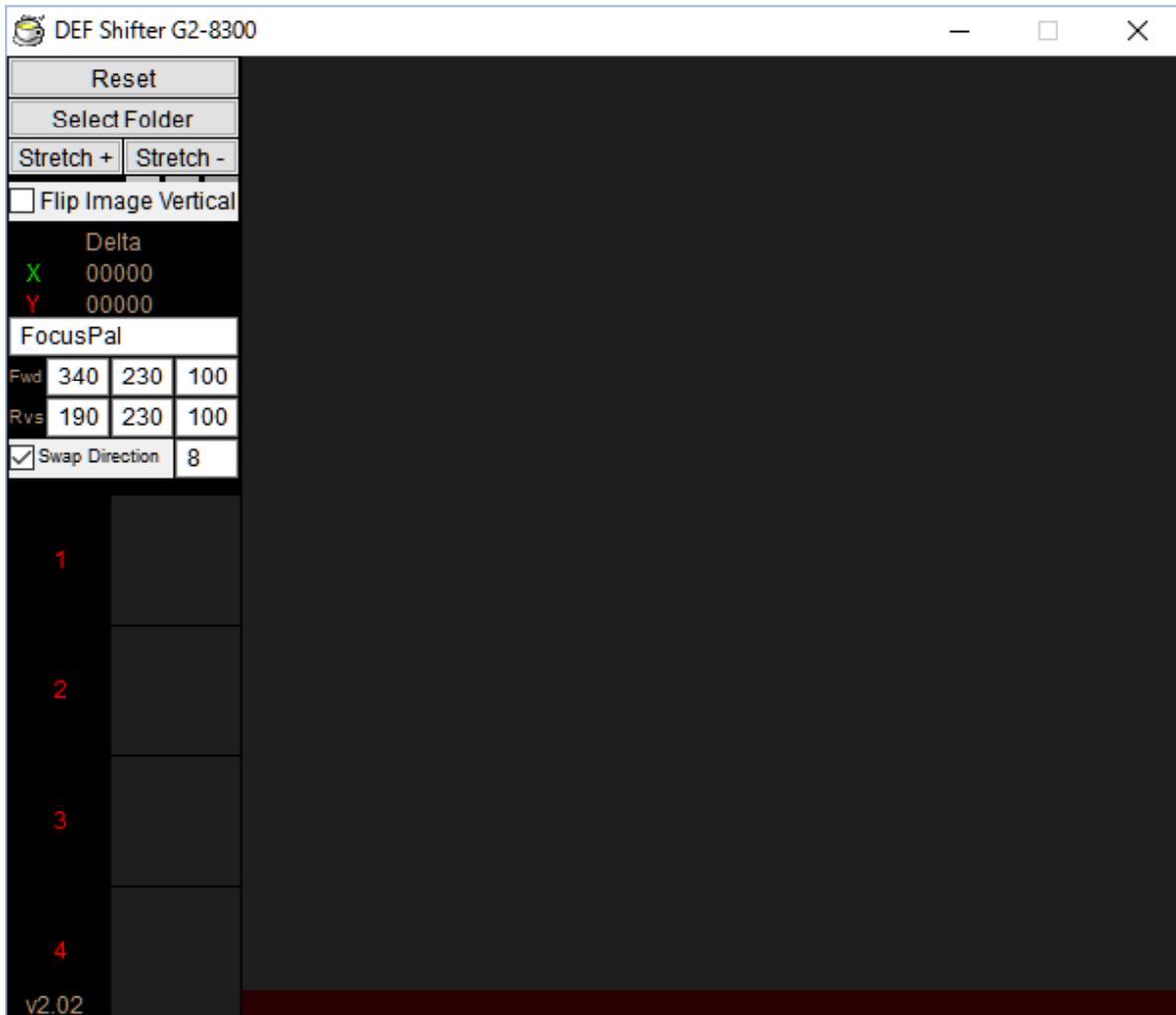
The configuration value of the underlined items will be stored to the configuration file when you exit the program. For your convenience, the DEF Shifter program will load the default values if "def-shifter.ini" file cannot be found.

Reset   Reset the detection value of differential flexure and focus. Please do reset

                after flip the German equatorial mount (GEM) east and west.

|	
<u>Select Folder</u>	Provision the folder name that the imaging software saving the image files. This program watches the fits, fit, fts, jpg and jpeg files in the provisioned folder. Then it is automatically load the latest image file. The folder name is shown in the title bar.
Stretch+/Stretch-	The screen stretch is automatically done. You can adjust the screen stretch value by using these buttons. Please manual correction when this software selects the double star. If it uses a double star, focusing is not work correctly. You can disable the focus feature by deleting the focuser program name.
Flip image vertical	Display the captured image upside down.
Delta	The detection value of differential flexure. The unit is 1000x pixels. 100 equal 0.1 pixels. DEF Shifter sends this value to DEF Guider.
<u>FocusPal</u>	This is a name of motor focuser program. It is shown in the title bar of focuser window. DEF Shifter searches focuser program by this program name. Focusing is not done when it can't find the focuser program. You can disable the focus feature by deleting the focuser program name.
<u>Fwd/Rvs</u>	These are the coordinates of the point of the Forward and Reverse button of the focuser window and the motor time (msec). Please check the position of these buttons. Alt + Print Screen can capture the focuser window, then past it to the picture editor software. Fwd 340 230 100 means X=340, Y=230, motor time=100msec.
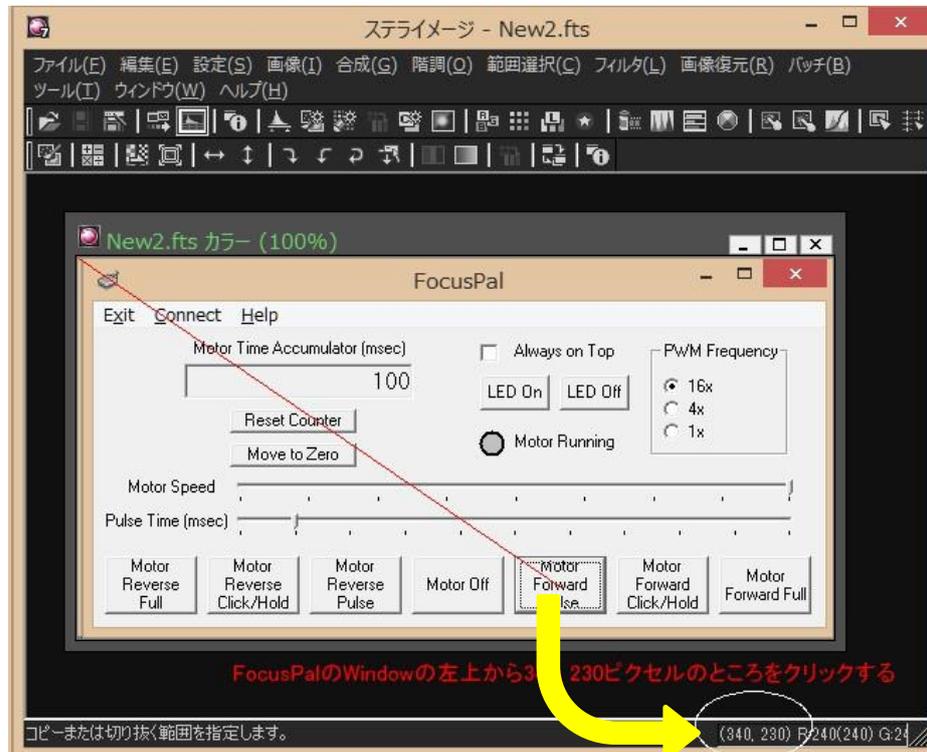
This software pushes the focuser button once an image. So please adjust motor time to your equipment.

Swap Direction   Check box is off: Click forward button when the focus value is plus.

Check box is on: Click forward button when the focus value is minus.

Number box   Reduce the extra focus correction due to measurement error. If you set it 8, focus correction is not executed when focus detection value is +8 through -8.

1-4   Enlarged Guide Star Display. Find the guide star from the four corners of the screen. Dark yellow is the area that has not been found guide star.

1		3
2		4

4-digit number is a number of focus. 0000 is in focus. In the case of out-of-focus, all numbers will be positive or negative value. In the case of positive and negative mix, star image becomes elliptical due to factors other than the out-of-focus. This software shows FWD or RVS When you do focus correction. It is no able to detect in focus or out-of-focus in the following cases.
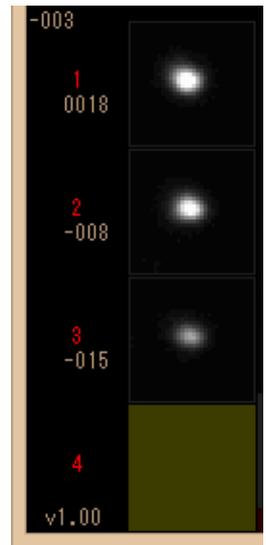
1. Guide star is found only one
2. Guide star is found only two. These are in area (1 and 4) or (2 and 3).

6. Explanation of the Calibration window

When you click the Calibration button, the windows in left side will appear.
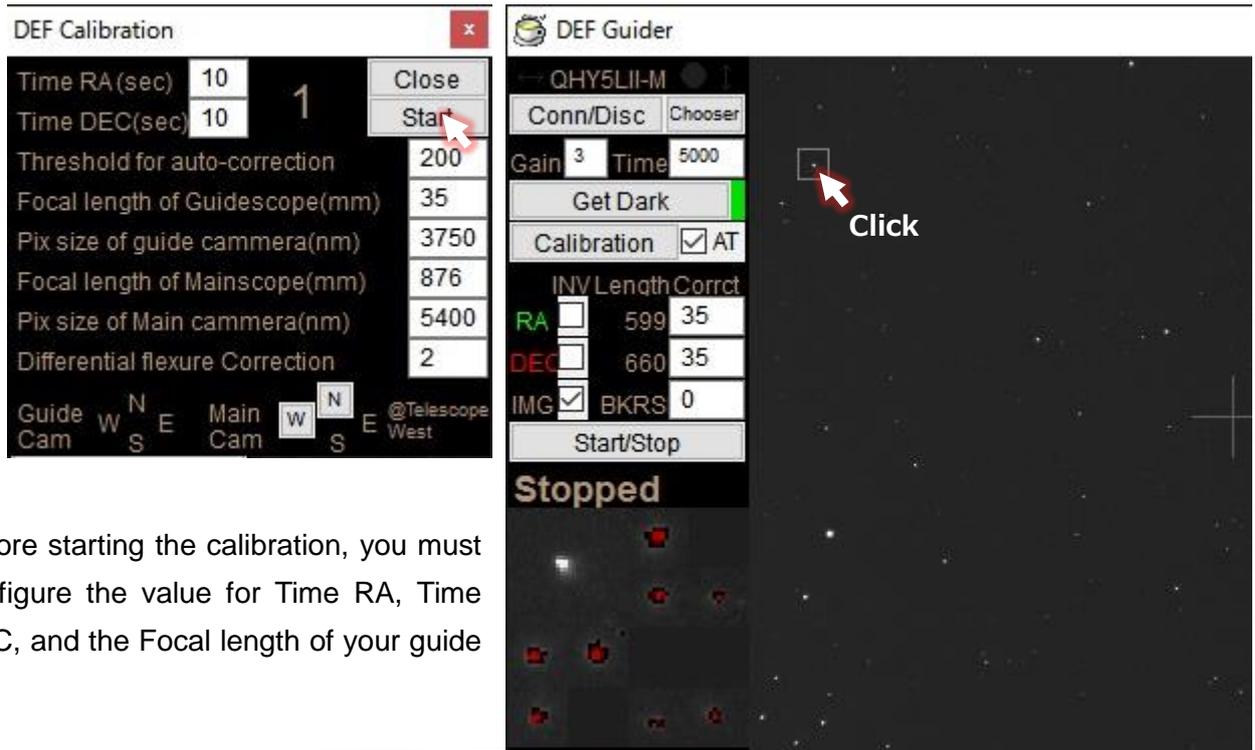
Before starting the calibration, you must configure the value for Time RA, Time DEC, and the Focal length of your guide

scope.　To begin the calibration, there are 2 methods to start the calibration.

Method 1:　Click the Start button in the DEF Guider Calibration window.　<--- Try this method first.

Method 2:　Click a guide star in the DEF Guider main window.　<--- If the program does not start calibrating.

The enlarged target guide star appears on left top of the guide stars area during the calibration. The calibration of DEF Guider is performed only RA+ direction and DEC+ direction.　After the calibration is ended, this window closes automatically.

　　*The detailed instructions of Calibration procedure

　　Method #1: When you click the "Start" button

　　1.　Uncheck the RA INV, DEC INV, and AT checkboxes.

　　2.　Click the "Start" button in the Calibration window.

　　　　- The program searches a target guide star automatically for the calibration and a square box will appears for the target star to be used for the calibration.　Then, the calibration starts.

　　　　-　If there would be more than 2 stars in the square box, the calibration cannot be performed correctly.　In this case, perform the calibration again or try another method described in #2 below.

　　　　-　While calibrating, a large number will appear as "1" -> "3" -> "4" -> "5" -> "6" in order on upper left window.　If the number goes back to "1" while calibrating, the calibration is incomplete.　In this case, try the followings.

　　　　　　- Click the "Start" button again.　The program may select another star that is used for the calibration.　Let it calibrate again to see whether the calibration can be done.

　　　　　　-　Decrease the time in "Time RA (sec)" and "Time DEC (sec)" from 5 seconds (default) to 4 seconds or less.　(If the focal length of the guide telescope is long, adjust the duration so that the target star does not move out from the square box.) Or increase the time 6 seconds or more (If the focal length of the guide telescope is short and the target star does not move enough.)

　　　　　　- Adjust the guide star detection pixel values from 4, 7, 40, 70 (default) to 4, 8, 40, 80 so that the threshold value difference can be expanded.

　　　　　　- Select another star for the calibration manually as described in method #2.

　　3.　After "1" to "6" appears using this method and the calibration is successful, Click the "Guide Start/Stop" button to start autoguiding.

　　Method #2: Selecting a target star for the calibration in the main window

　　1.　Uncheck the RA INV, DEC INV, and AT checkboxes.

　　2.　Click (Single click) a star once that is relatively dark. (It barely shows as a white dot on the

screen.)

   - A red square box will appear and then the calibration starts automatically.

   - While calibrating, a large progress number appears on left top window. The number increases in order, such as "1" -> "2" -> "3" -> "4" -> "5" -> "6". If the number returns to "1" before reaching "6", the calibration is incomplete. Select another star which is relatively dark to calibrate again. Adjust the time in "Time RA (sec)" and "Time DEC (sec)" or the guide star detection pixel values as described in the Method #1.

3. After the progress number reaches "6" and the calibration is successful, click the "Start/Stop" button to start autoguiding.

The explanation of the Calibration window display and configuration items:

The configuration value of the <u>underlined items</u> will be stored to the file.

For your information, the program recovers all default values when the file, "def-guider.ini" is deleted.

|	
<u>Time RA (sec)</u>	The calibration time for the RA direction. The unit is in second. Adjust this value so that a target star moves several pixels when the guide telescope is pointing around the celestial equator. If the focal length of the guide scope is long, the target guide star may travel a long distance. In this case, decrease the guide speed of your equatorial mount to X 0.25 or less.
<u>Time DEC (sec)</u>	The calibration time for the DEC direction. The unit is in second. Adjust this value so that a target star moves several pixels.
A large number "1"	This is the calibration progress indicator.

                                 1: Ready to start the calibration

                                 2: Clicked a guide star – Only show when using Method #2

                                 3: Found the guide star

                                 4: Calibrating RA side

                                 5: Calibrating DEC side

                                 6: Finished calibration

Note: This indicator will back to 1 when you lost the guide star while calibration.
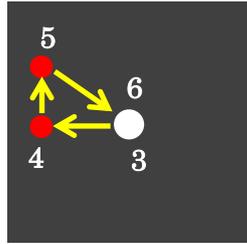
Example of calibration was successful.
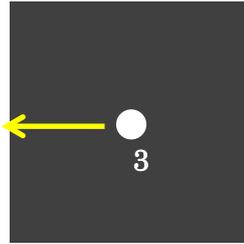
Case you have lost the guide star. Guide star goes out of measurement area.

Close	Click to close the Calibration window. If you click "X" in this window, the main window also closes and the DEF Guider program ends. So, please remember this in your mind before you click "X" in this window.
Start	Click to start the calibration. A target calibration star is also automatically selected.
Threshold for auto-correction	Adjust this value to configure the ratio of the correction compensation sensitivity. The unit is in percent (%). The program accumulates 30 guide error values in the past and if these values exceed this threshold value (%), it corrects the mount movement. So, less this value is, more sensitive the mount movement is to correct the mount movement. Adjust this value as you are actually guiding a star with the automatic correction. If the program is too aggressive to correct the mount movement, uncheck the Automatic correction and then perform the calibration again.
Focal length of Guidescope (mm)	Specify the focal length of your guide telescope in millimeter. More than 1 must be specified.
Pix size of guide camera (nm)	Specify the pixel pitch value in nanometer. The pixel size of QHY5L-II is 3750nm (3.75um).

The parameters below are flax ration correction that is used in conjunction with the DEF Shifter program.   These parameters are not used for the DEF Guider autoguiding program.

|	
Focal length of Mainscope (mm)	Specify the focal length of your main scope in millimeter. More than 1 must be specified.
Pix size of Main camera (nm)	Imaging Camera Pixel pitch (nm). Specify the value in nanometer.
Differential flexure Correction	The numbers of pixel to correct per correction. The unit is in 1/1000 pixel. The default value is 2. If the excessive correction is performed, set this value to 1. If the loose correction is performed, set this value to 3.
Guide Cam	From the result of calibration, it shows the direction of East, West,

	South and North of the vertical/horizontal screen*1. If no calibration has been performed yet, "-" appears.
<u>Main Cam</u>	Set the direction of the imaging camera picture to East, West, South and North, which is displayed by the DEF Shifter program.*1 Every time you click the button on left side, the display changes N, E, S and W. Select the direction of the left side of the screen. Then if you click the button on top, the screen flips (upside down). Set the screen direction using these buttons. If no calibration has been performed yet, "-" appears.

*1:   If you are using a German equatorial mount, this screen should be shown as Telescope West (Your telescope is pointing to East sky). If the calibration was performed while "Telescope East", the screen does not appear properly. So, to adjust the position of your guide camera and main camera, you must perform the calibration using Telescope West.   After you calibrate the mount as Telescope West and then you can move the telescope to Telescope East, the screen shows properly and you do not have to re-adjust the directions of screen.   If you are using a fork-type equatorial mount, the proper screen display should appear regardless of the direction.

Here is a screen shot while the DEF Guider is guiding.   The guide stars have white cross markings.   The numbers in red represents the position of the enlarged display boxes (Lower left. 16 boxes)
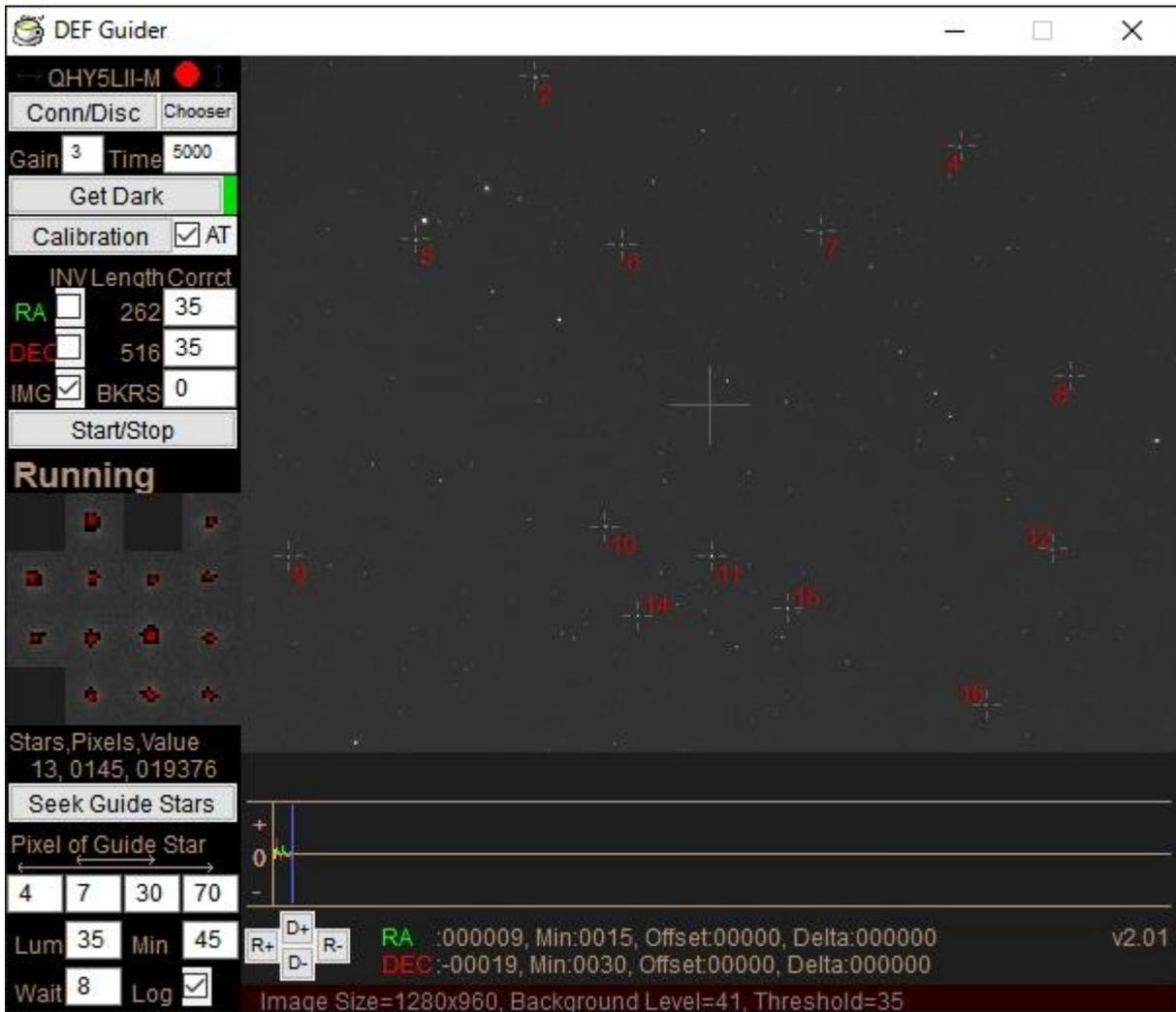
7. Multiple Language Display capability

    You can customize almost all text messages in the DEF Shifter windows to any language by changing messages in the language file. 2 standard sample language files are provided. Japanese and English language files (Standard files).

    tw_Lang_ENG.txt

    tw_Lang_JPN.txt

    When the DEF Shifter is launched, the program picks up either of these files. The target language file can be changed by specifying the first line of the "def-shifter.ini" file.

    When the DEF Shifter program is launch for the first time and the language environment of your PC is Japanese, the program automatically select the Japanese language file. If the language environment of your PC is other than Japanese, the program will show the messages in English. If a language file that is specified in "def-shifter.ini" cannot be found, all the messages will be in English. The English file, "tw_Lang_ENG.txt" is not necessary to show the messages in English.

How to create a language file:

Place a desired message to the right of the "=" (equal) character.   If no "=" (equal) character is found in the line,   the line is considered as commentary line. A space character before and after the configured value will be removed automatically.   In the case of MS Gothic character, there is a space between MS and Gothic but this is not removed.   The following examples are all the same.

font=MS Gothic

font   =   MS Gothic

 font = MS Gothic

If there are more than 1 of the "=" (equal) characters in a line, the parameter may not be properly configured.

As the following example shows, it will be "QHY5" and "=connection" will be ignored.

s_conn_cam = QHY5=connection

Remarks (comments) cannot be appended to the line with the configured value.   The following example will be handled as MS Gothic // font configuration

font=MS Gothic // font configuration

There are 4 different font sizes are used, S, M, L and XL.   These sizes can be configured in the language file.

The following example shows S-size characters.   An M-sized character can be also configured.

Please use the following examples if you would like to change the size or font of the messages that appears in the window.

The size of the characters in red rectangular cannot be changed.   (The type of font can be configured.)   The font of the window title depends on the configuration of your windows control panel.
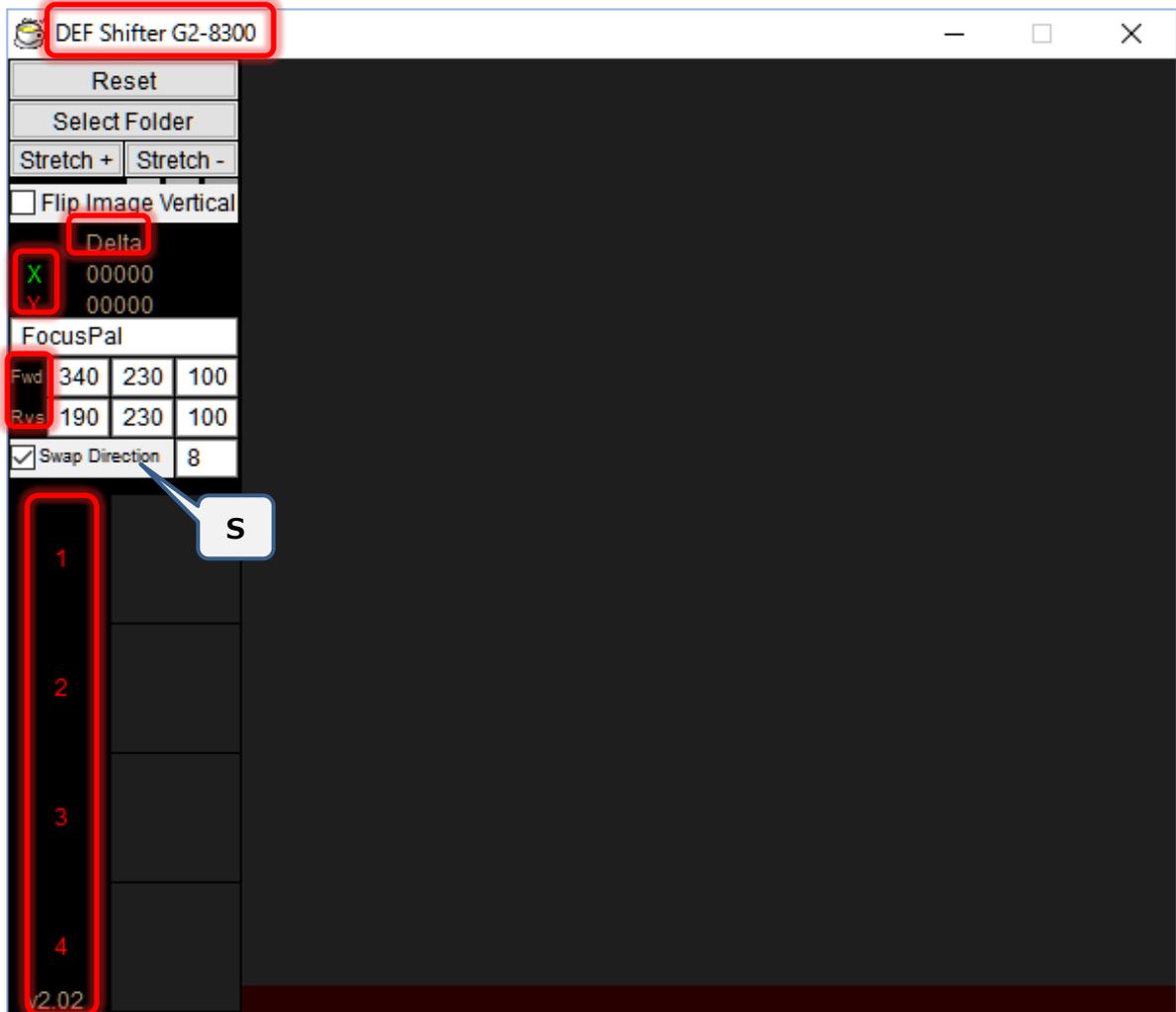
8. Known issues and these workaround

　・　When the motor focuser there is the mouse cursor to other than Display, which is displayed in a multi-Display environment, it is not click on the button of the motor focuser. -> Please move the mouse cursor to Display the motor focuser is displayed.

9. DEF Shifter 2

Two DEF Shifter can be run on one PC. If you launch the DEF Shifter again when one DEF Shifter is running, DEF Shifter 2 will be run on your PC. A new configuration file is automatically created for DEF Shifter 2 in the same folder. The file name is def-shifter2.ini. DEF Shifter 2 is link-up with DEF Guider 2.

Acknowledgment:

I would like to thank Nam-san for improving this software and the description of the instruction manual.

DEF Shifter release note:

v2.05	Dec. 31, 2018	Support DEF Shifter 2
		The click button is change from right click to left click
v2.04	skip	
v2.03	Feb. 13, 2016	Fix problem, the FITS file with odd number of width pixel is not read
v2.02	Jan. 2, 2016	Save window position
v2.01	Nov. 29, 2015	Name change Tawami3 to DEF Shifter
v2.00	Jul. 3, 2015	Support multiple FITS header
		Support JPEG file
v1.00	Jan. 22, 2015	Initial release.

Copyright and license notices:

The DEF Shifter program is copyrighted by Tsutomu Chikazawa.

The DEF Shifter program is written in Hot Soup Processor Version 3.4.

Also, the following HSP expansion plug-ins are used.

      hspext.dll

      hspcv.dll

      llmod3/llmod3.hsp

      llmod3/input.hsp

The DEF Shifter program may be distributed/transferred freely.　However, OpenCV library (1.0), included in HSPCV is licensed by BSD.　So, if you wish to distribute/transfer the program, you must indicate the copyright notices for the following libraries.

If you distribute those libraries along with the DEF Guider program and this instruction manual, this problem can be avoided.

OpenCV library (1.0), included in HSPCV is copyrighted by Intel Corporation.

Open Source Computer Vision Library

Copyright (C) 2000-2006, Intel Corporation, all rights reserved.

Libjpeg library in OpenCV library(1.0) is copyrighted by IJG.

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The following xml files are developed by Mr. Rainer Lienhart.
haarcascade_frontalface_default.xml
haarcascade_frontalface_alt.xml
haarcascade_frontalface_alt2.xml

HSPCV.DLL
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