Reduction Group Generator Application

Overview

TheSky has the capability to perform full noise reduction on a light frame image. The user can apply reduction groups to individual images, to a folder of images, or automatically to each image when acquired. TheSky User Guide describes Image Reduction (starting on page 621). The feature requires the user to manually create lists of files in reduction groups, consisting of any number of bias, dark, and flat-field frames. As a rule, each group is appropriate for a specific exposure (darks and flats) and filter (flats). If the user is imaging at more than one or two exposures and filters, then the combinations proliferate rapidly. Manual configuration of these groups is slow and agonizingly tedious, especially with multiple dark exposure times. This utility fixes that by doing the configuration automatically, producing Image Calibration Groups that adhere to a specified naming convention. When imaging, the user can select the desired reduction group either manually in the Camera "Take Photo" window or programmatically using the ccdsoftCamera.ReductionGroupName method.

The THESKY Image Calibration Library

Note: This summary description assumes the reader is at least some familiarity with manual configuration of Image Calibration Libraries in THESKY.

The THESKY Image Calibration Library is organized into "Groups". Each Group is applied as a whole for image reduction. Groups are further divided into sets of Bias Frames, Dark Frames, Dark Frames for Flats Only, and Flat Frames. During reduction, THESKY will combine (once) the frames in each of these sets to produce master frame for that set. These master frames are then used for reduction of light frames.

When a user chooses the "Full Calibration" option for "Reduction" in the camera or autoguider set up window, a drop-down box appears from which one of the preconfigured Image Calibration Library Groups can be selected. Upon imaging, the master frames from this Group will be applied to reduce the image (noise).

For each Group, the following rules apply:

1. All images to be reduced by a given Group are of the same binning, exposure, filter and temperature.
2. All reduction frames (bias, dark, flat) are taken at the same camera temperature as the images.
3. All reduction frames within each set (bias, dark, dark for flat, flat) have the same exposure, temperature, binning and filter, if applicable.
4. All Bias Frames are 0 seconds duration.
5. All Dark Frames are of the same exposure time as the images to be reduced
6. All Flat Frames are of the same filter as the images to be reduced.
7. All Dark Frames for Flats Only are of the same duration as the Flat Frames.

Once the user has manually created Image Calibration Library Groups and populated them with file-paths to the reduction frames, these lists are stored as a record in the TheSky AppSettings.ini file. This file with its Image Calibration Library definitions is loaded when TheSky is launched.

The Reduction Group Generator

This applet takes a heap of bias, dark and flat frame files and sorts out all combinations of binning, temperature, exposure and filter. The user may image and name the FITS files as they please as the program extracts this information from the FITS header The only requirement is that all bias, darks and flats images to be grouped reside in the same directory tree. The user is given the opportunity to select a specific binning and temperature as found in the heap. The program then builds an exhaustive set of groups based on the following rules:

1. Flat files are separated into sets of the same filter (and appropriate temperature and binning).
2. Dark files are separated into sets of the same exposure (and appropriate temperature and binning).
3. Groups are created for each combination of a set of Flats (by filter) and set of Darks (by exposure).
4. For each group, the Dark Frames for Flats Only, is populated with a Dark set of the same exposure as the respective Flat set.

5. Every group gets all Bias files of appropriate temperature and binning.

Once the definition of these Groups is complete, a new record is formed and substituted for the existing record in the AppSettings.ini file.

Note that all FITS files in that directory tree will be surveyed for grouping so the directory tree should not contain functional duplicates, e.g. dark files of different dates.

Each group produced for the calibration library will have a name assigned according to the following convention:

B<b>_T<t>_E<e>_F<f>

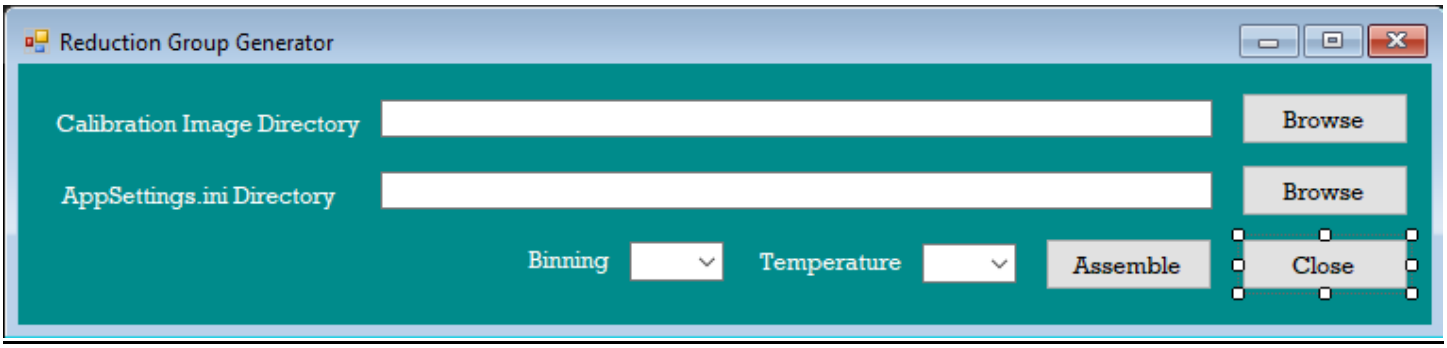
Where

<*b*> = binning: “1X1”, “2X2”, etc
<*t*> = integer temperature in Centigrade: “x”
<*e*> = exposure in seconds: “e.eee”
<*f*> = filter name: “C”, “R”, “B”, “V”, etc

Examples

“B1x1_T-20_E35.0_FC”
“B2x2_T-10_E180.0_FRed”

Controls and Commands



Calibration Image Directory Browse: The directory containing all reduction FITS files.

AppSettings.ini Directory Browse: The directory containing the TheSky “ApplicationSettings.ini” file -- either “C:\Users\...\Documents\Software Bisque\TheSky Professional Edition 64” or “C:\Users\...\Documents\Software Bisque\TheSky Professional Edition”.

Binning: Selection from available binnings in Calibration Image Directory tree.

Temperature: Selection from available temperatures in Calibration Image Directory tree.

Assemble: Organize lists of bias, darks and flats, then modify AppSettings.ini formulate the calibration image libraries accordingly.

Close: Closes the program.

Structure

TBD

Operation

The program assumes that the user will enter all fields sequentially from top to bottom.

Upon selection of a Calibration Image Directory, that directory and all sub-directories will be surveyed for FITS image files.

For each file, FITS header data is collected into an XML-based catalog with fields for IMAGETYPE (Light, Dark, Bias or Flat), FILTER (user-defined names), SET-TEMP (degrees), EXPTIME (seconds), XBINNING (1,2,etc) and YBINNING (1,2,etc).

Binning and Temperature lists are populated from the catalog and default to the first entry.

Requirements

Reduction Group Generator is a Windows Forms executable, written in Visual C#. The app requires TheSky Professional or Imaging Edition (Build 13210 or later). The application runs as an uncertified, standalone application under Windows 10/11.

Installation

The source code for this application is available on GitHub under rrskybox/ReductionGroupGenerator. The One-Click installation package is available in the “publish” directory. To install, download “ReductionGroupGenerator.zip” and extract. Then run "setup.exe". Upon completion, an application icon will have been added to the start menu under "TSXToolKit" with the name "Reduction Group Generator". This application can be pinned to the Start if desired.

Support

This application was written for the public domain and as such is unsupported. The developer would happily entertain questions or suggestion and may update the application occasionally as time permits. Otherwise, the developer wishes you his best and hopes everything works out but recommends learning Visual C# (it's not hard and the tools are free from Microsoft) if you find a problem or want to add features. The source is supplied as a Visual Studio 2019 project on GitHub.

I should also note that the structure and format of the AppSettings.ini configuration file is clearly proprietary, i.e. subject to change without notice or apologies. But, I will try to keep the app up with the current build, if possible and as time permits.

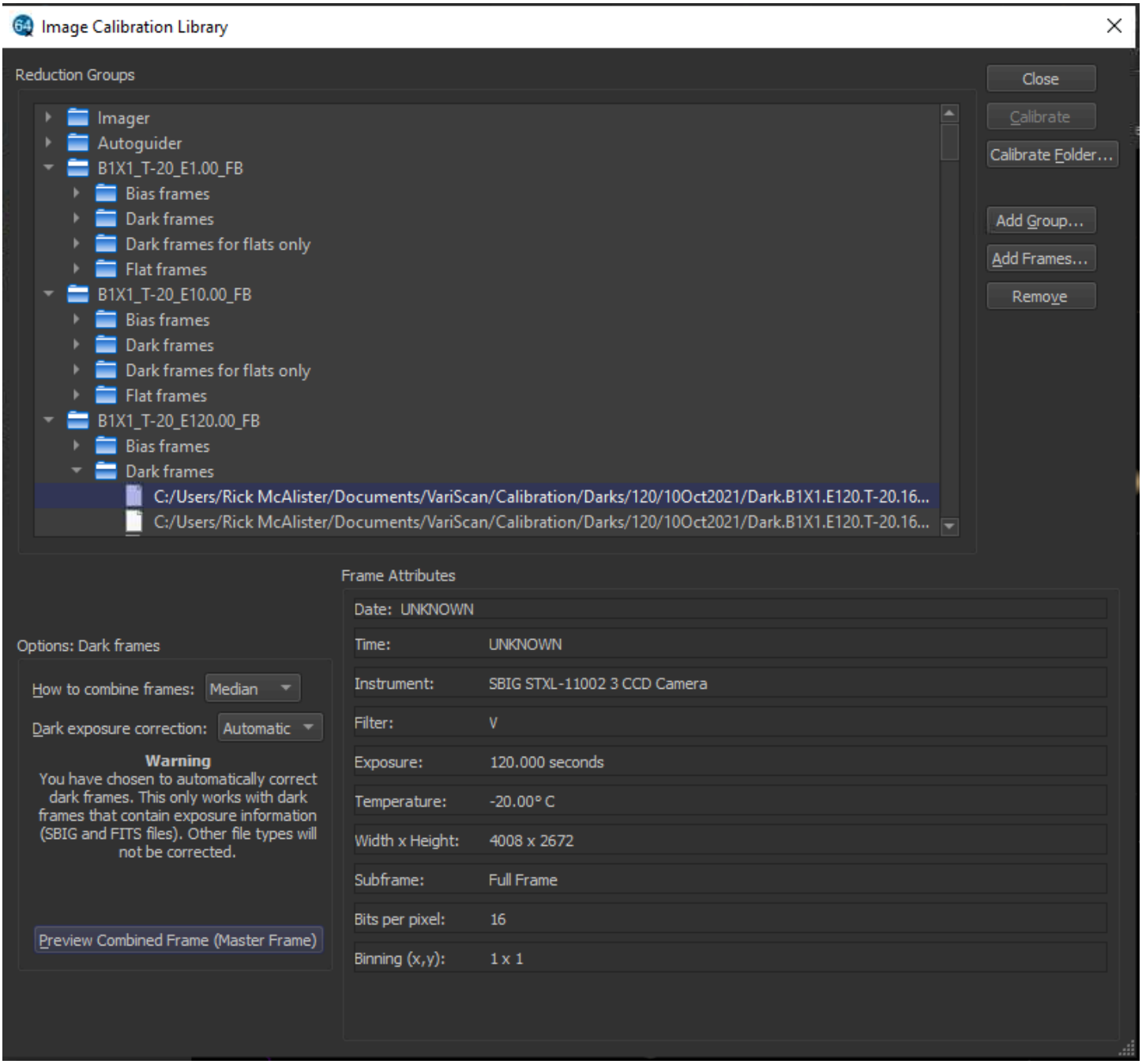


Image Calibration Library
Reduction Groups
Imager
Autoguider
B1X1_T-20_E1.00_FB
Bias frames
Dark frames
Dark frames for flats only
Flat frames
B1X1_T-20_E10.00_FB
Bias frames
Dark frames
Dark frames for flats only
Flat frames
B1X1_T-20_E120.00_FB
Bias frames
Dark frames
C:/Users/Rick McAlister/Documents/VariScan/Calibration/Darks/120/10Oct2021/Dark.B1X1.E120.T-20.16...
C:/Users/Rick McAlister/Documents/VariScan/Calibration/Darks/120/10Oct2021/Dark.B1X1.E120.T-20.16...
Close
Calibrate
Calibrate Folder...
Add Group...
Add Frames...
Remove
Frame Attributes
Date: UNKNOWN
Time: UNKNOWN
Instrument: SBIG STXL-11002 3 CCD Camera
Filter: V
Exposure: 120.000 seconds
Temperature: -20.00° C
Width x Height: 4008 x 2672
Subframe: Full Frame
Bits per pixel: 16
Binning (x,y): 1 x 1
Options: Dark frames
How to combine frames: Median
Dark exposure correction: Automatic
Warning
You have chosen to automatically correct dark frames. This only works with dark frames that contain exposure information (SBIG and FITS files). Other file types will not be corrected.
Preview Combined Frame (Master Frame)