Astrophotography Techniques: Solar Eclipse Timelapse Video

Process Flow

1. Obtain Images → 2. Sort Images → 3. Process Images → 4. Create Timelapse
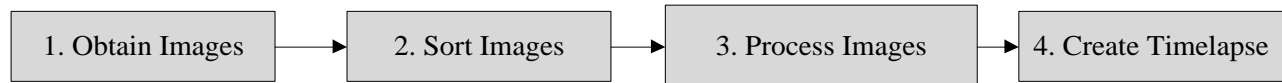
Summary

This document will provide an overview of the techniques used to photograph a solar eclipse and generate a time-lapse video of the event.

Capturing The Eclipse

For this event cameras are attached too two telescopes. Questar 3.5" with Canon 5D MIV camera and Lunt LS60THA Pressure Tuned Telescope with Canon 60Da camera. During Totality, solar filter on Questar is removed to capture associated objects including Diamond Ring, Baileys Beads, Solar Corona.

Equipment

- iOptron iEQ45 – A German Equatorial Telescope Mount
- Questar Duplex 3.5"
    - o Filter: Full aperture filter (PN: 19261)
    - o Camera Coupling Set (PN: 13075)
    - o Camera: Canon EOS 5D MIV
- Lunt LS60THA
    - o Camera: Canon EOS 60Da
    - o Intervalometer: Canon tc-80n3

Camera Setup

- **Questar/5D MIV Setup** – Since the 5D MIV is a full frame sensor, providing a larger field of view, it was selected to be paired with the Questar so that during totality the solar filter could be removed and much of the solar corona could be captured
    - o Camera Settings - With solar filter:
        - Optimal ISO: **100**
        - Optional Shutter Speed: **1/200** second
        - Exposure Bracketing: 1/200, 1/400, 1/100
        - Intervalometer: 15 seconds interval, for endurance of eclipse
    - o Totality Camera Settings – With solar filter removed
        - Diamond ring: 100 ISO, 1/400 sec
        - Corona: 200 ISO, 1/8 sec
        - Prominences: 200 ISO, 1/125 sec
        - Saved files: both CR2 and high resolution JPG files saved for each image

- **Lunt/60Da Setup** – Since this telescope is unable to capture the suns corona, and the 60Da is a good match for this telescope since it is not a full framed camera, thus providing a larger image of the suns disk. Exposure bracketing is critical if post processing of prominences and sun features on the disk are desired since these features require different exposures to be captured.
  - Camera Settings:
    - Optimal ISO: **250**
    - Optional Shutter Speed: **1/160** second
    - Exposure Bracketing: 1/160, 1/250, 1/100
    - Intervalometer: 15 seconds interval, for endurance of eclipse
    - Saved files: both CR2 and high resolution JPG files saved for each image

Photographing the event

Both setups were configured to take photo 3 photos every 15 seconds bracketed for regular, under and over exposed photos (see setup above) over the entire eclipse event. The Lunt setup remained untouched during totality, while the solar filter on the Questar was removed just prior to, after, and during totality to capture optical events that is only visible with the solar filter removed. There were close to 2,000 photographs taken on each camera.

Sorting Photos

After the event photos were organized in the following directories. Note only JPG files will actually be utilized in generating the time-lapse. CR2 files can be used for creating individual images for printing.

- 01 Questar with 5D MIV
  - 01 Pre Totality
  - 02 Totality
  - 03 Post Totality
- 02 Lunt with 60Da
  - 01 Pre Totality
  - 02 Totality
  - 03 Post Totality

Once source photos have been organized. A new directory is created to contain the images that will be utilized for creating the timelapse:

- 01 Questar with 5D MIV
  - **11 For Video** – This is where all of the individual source frames for creating the timelapse will be placed.
    - 01_StartAndEnd – Duplicate images of initial image of sun and totality will be placed here to allow the viewer to see. For this project I have generated 30 duplicates of each photo. After duplicates have been made copies are placed in the [11 For Video] directory.
    - 02_Totality – Since totality is so short, I made 5 copies of each totality photo to allow the viewer to see the event.
- 02 Lunt with 60Da
  - **11 For Video** – This is where all of the individual source frames for creating the timelapse will be placed.
    - 01_StartAndEnd – Duplicate images of initial image of sun and totality will be placed here to allow the viewer to see. For this project I have generated 30 duplicates of each photo. After duplicates have been made copies are placed in the [11 For Video] directory.
    - 02_Totality – Since totality is so short, I made 5 copies of each totality photo to allow the viewer to see the event. After duplicates have been made copies are placed in the [11 For Video] directory.

Software

- Planetary Imaging Pre Processor (PIPP) – Windows application used to take source JPG photos, process them and generate time-lapse file.
- VLC media player – Media player used to convert timelapse avi file to mp4 format.

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Creating TimeLapse with PIPP

Now that each of the individual frames that will make up the timelapse have been stored in the 11 For Video directory, we can use the PIPP program to generate the timelapse video in avi format. The settings for both the Lunt and the Questar setup are Identical except where noted

PIPP Settings

- **Questar with 5D MIV**
    - Source Files tab
        - Add all images from [01 Questar with 5D MIV\11 For Video] directory.
        - Join Mode: Selected
        - Optimise Options For: Solar/Lunar Full Disk
    - Input Options tab
        - Binning Type: 2x2
        - Binning Calculation: Average Of Pixels
    - Processing Options tab
        - Gain To Apply To Each Frame Before Processing: 1.0
        - Gamma Correct Value: 0.8
        - Monochrome Conversion
            - Convert Colour To Monochrome: Selected
            - Use RG & B Channels
        - Histogram Equalisation
            - Stretch Histogram White Point To: 85 %
            - Set Histogram Black Point to 05: Selected
            - Equalise R, G and B Channels Individually: Selected
        - Flip and Rotate | Flip Vertically: Selected (Lunt only)
        - Frame Stabilisation Mode: Object/Planetary
        - Cropping
            - Enable Cropping: Selected
            - Crop Width: 1500
            - Crop Height: 1500
    - Animation Options tab
        - Forward Play | Play All Frames In Forward Order: Selected
    - Output Options tab
        - Output Format: AVI
        - AVI File Options
            - AVI Codec: DIB (RAW Uncompressed)
            - Framerate To Use Otherwise: 15
    - Do Processing tab
        - Open Output Folder When Complete: Selected
        - Select [Start Processing] button when ready to generate timelapse

Once completed, the TimeLapse avi file should be generated.

Convert Timelapse from AVI to MP4 with VLC

Conversion of the AVI format to MP4 can be performed in the VLC program:

- {VLC Application}
    - | Media | Convert / Save | → {Open Media}
    - {Open Media}
        - File Selection | Add → Select AVI file
        - Select [Convert] button → {Convert}
    - {Convert}
        - Profile: Video – H.264 + MP3 (MP4)
        - Destination File: Set destination path and file name.
        - Select [Start] button
- Done

Comments/Thoughts

Timelapse is a bit jittery need to determine if we can adjust for this using VirtualDub with MSU Deflicker plug-in or some other software.