IOTA/ES Workshop

QHY 174M GPS

2020 February 29
Archenhold-Sternwarte Berlin

Local Organising Team: Konrad Guhl, Christian Weber, Nikolai Wünsche | all IOTA/ES

Agenda

11.00 Welcome

Part 1: Introduction to basic use

11.10 Presentation and live demonstration

12.00 Workshop on your own computer

13.00 Lunch break

Part 2: Introduction to advanced use

13.30 Presentation and live demonstration

14.15 Workshop on your own computer

15.45 Wrap up and outlook

16.00 End of workshop

IOTA/ES Workshop

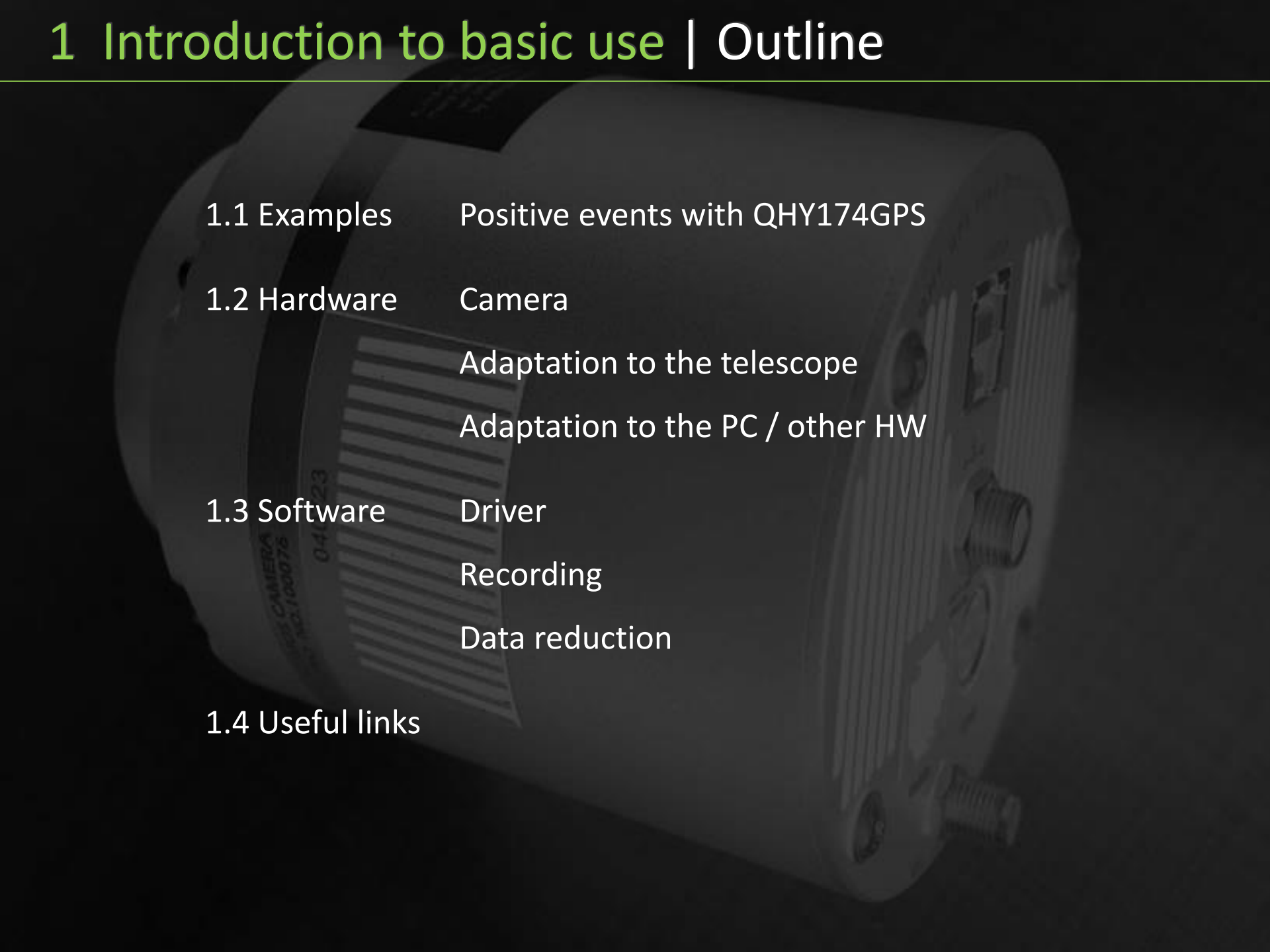
QHY 174M GPS

1 Introduction to Basic Use

2020 February 29
Archenhold-Sternwarte Berlin

Christian Weber | IOTA/ES

1 Introduction to basic use | Outline



1.1 Examples — Positive events with QHY174GPS

1.2 Hardware — Camera

Adaptation to the telescope

Adaptation to the PC / other HW

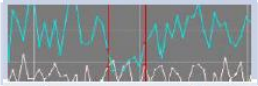
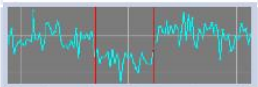
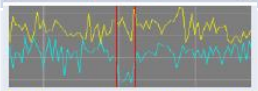
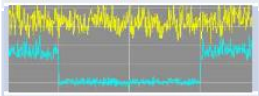
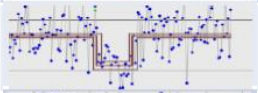
1.3 Software — Driver

Recording

Data reduction

1.4 Useful links

1.1 Examples: Pos. events w. QHY174GPS | Chr. Weber

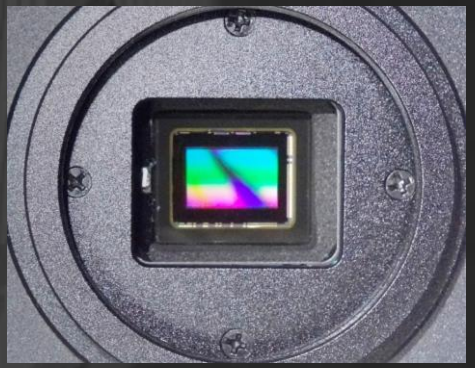
Asteroid	2019 (UT)	Star	Star (m)	Dur. (s)	Drp. (m)	Scp. (“)	Exp. (ms)	Gain	Offs.	ROI	T (°C)	USB Tr.	SC 3.2...	Data Reduction
(308) Polyxo	13 May; 01:36:15	4UC-402-056901	13.0	12.7	0.3	6 M	250	460	50	640 x 480	13	4	5994	
(734) Benda	14 Sep; 03:09:08	TYC 1891-01348-1	11.4	2.8	4.2	6 M	150	450	0	800 x 600	-25	4	6086	
(675) Ludmilla	14 Sep; 21:52:57	4UC-597-007906	11.9	11.1	0.7	6 M	300	480	0	640 x 480	-20	0	6086	
(3200) Phaethon	15 Oct; 19:46:28	4UC-707-014626	11.3	0.2	5.6	10 M	40	480	0	480 x 300	-12	4	6109	
(87) Sylvia	29 Oct; 23:39:33	TYC 1932-00469-1	10.1	23	3.3	6 M	75	460	400	480 x 300	-20	4	6109	
(140) Siwa	18 Nov; 21:50:48	4UC-550-012450	13.3	8.4	0.7	6 M	275	460	264	640 x 480	-20	4	6109	
(786) Bredichina	05 Dec; 00:13:13	4UC-562-024846	13.5	7.4	1.1	10 M	250	470	228	480 x 300	-31	4	6109	

System:
- Intel i7 2.2GHz
- Total Physical Memory 16.3GB
- Available Physical Memory 11.6GB
- Operating System: MS W7 Home Premium
- OS is 64bit, SharpCap is 32bit; SSD

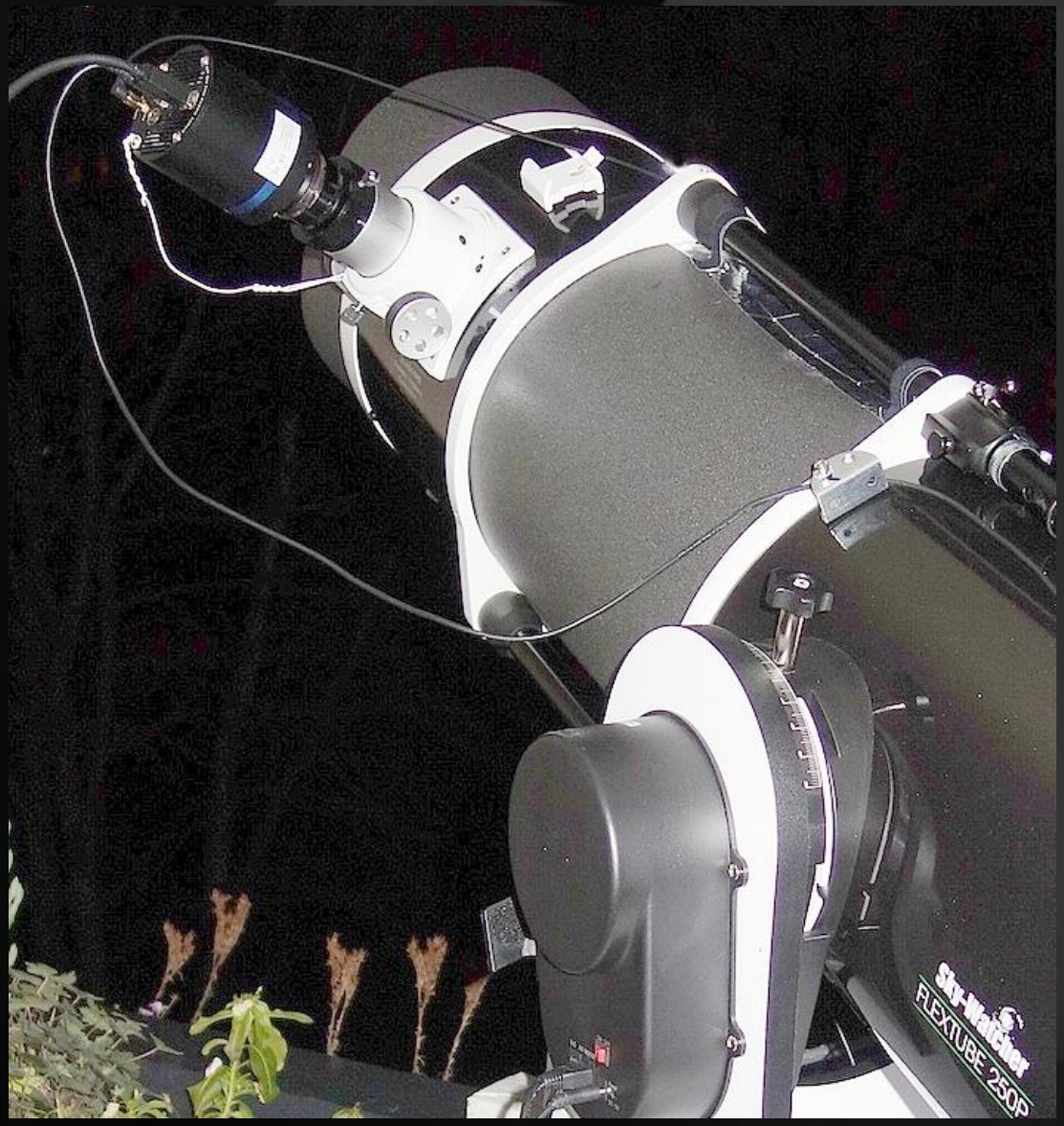
Almost everything in these presentations is done with this system

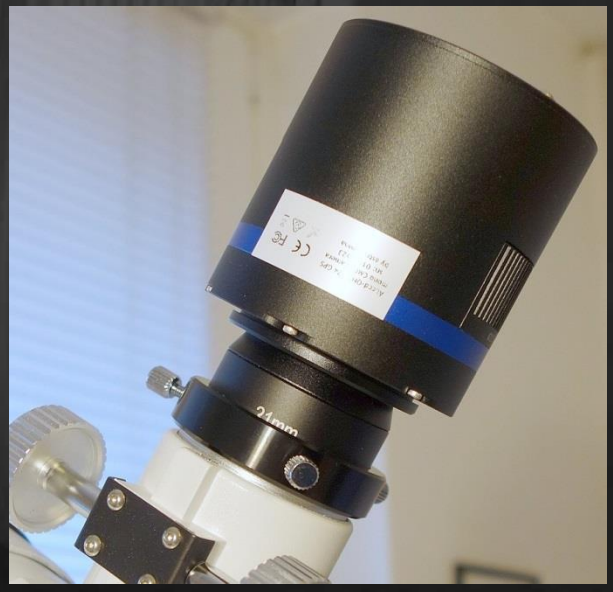
SC settings for all:
- Format: SER
- Resolution: 16bit
- Binning: 1x1
- LED-Calibr.: CSP=0, CEP=1000 (= no calibration)
- SC free version, 32bit

1.2 Hardware | Camera



1.2 Hardware | Adaptation to the telescope





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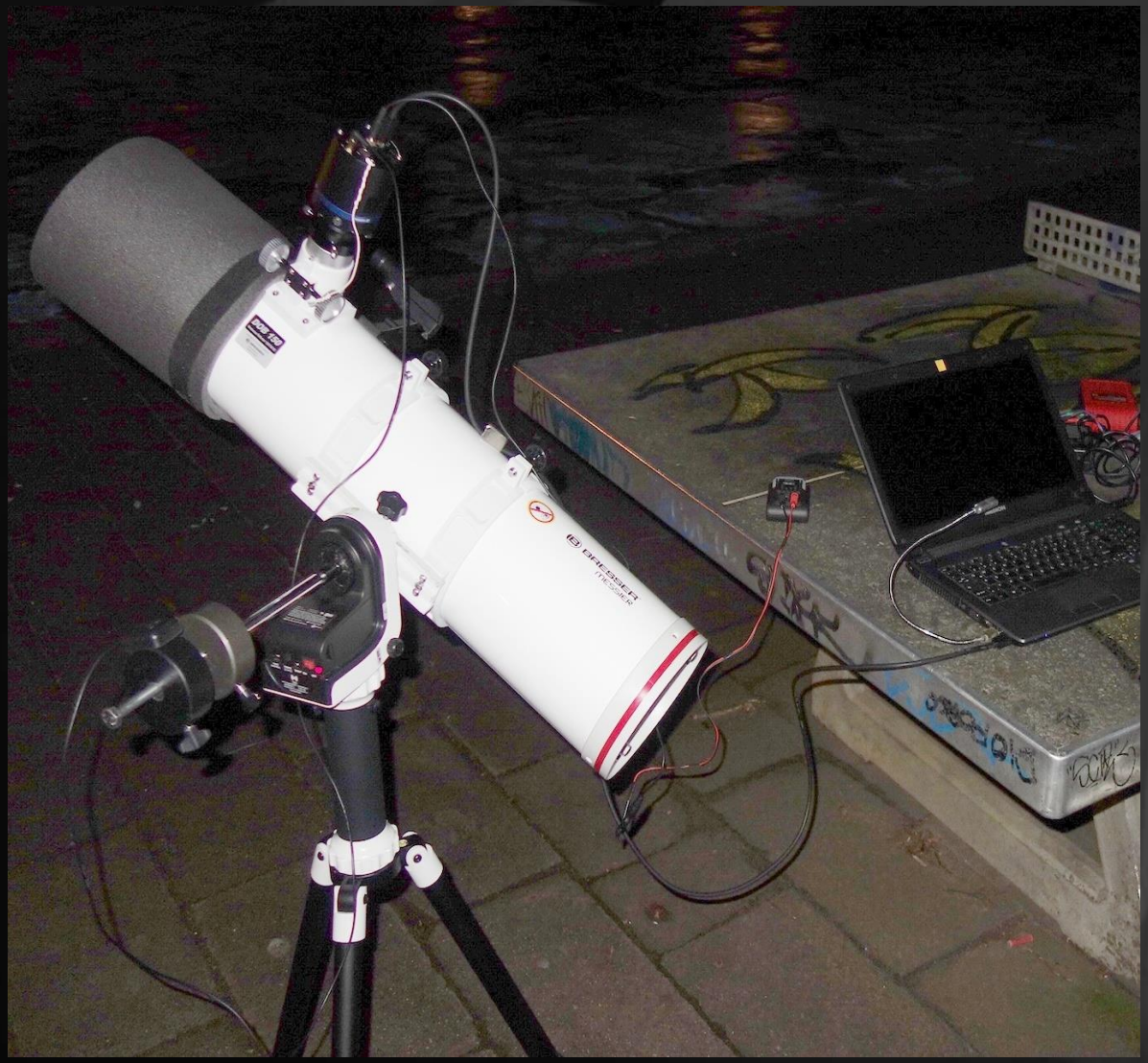
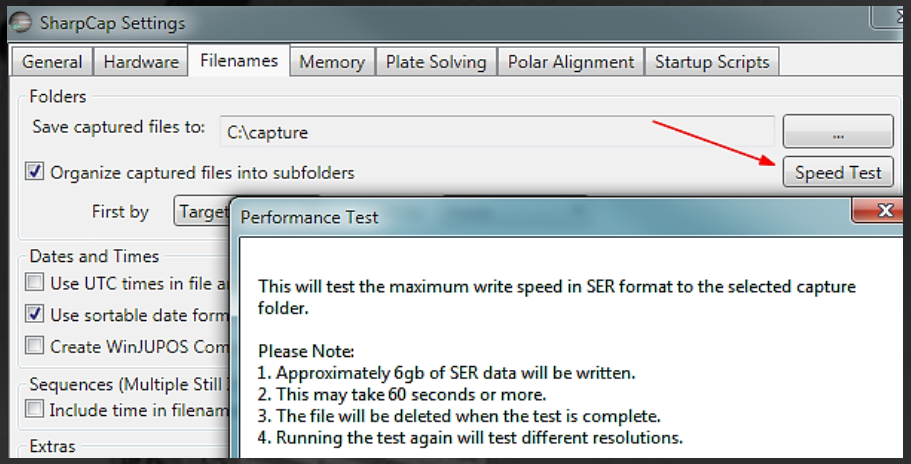
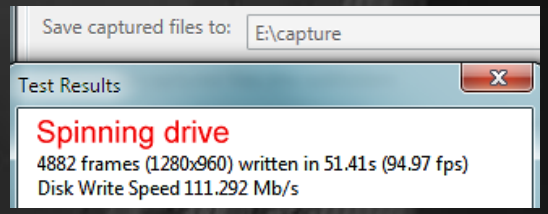
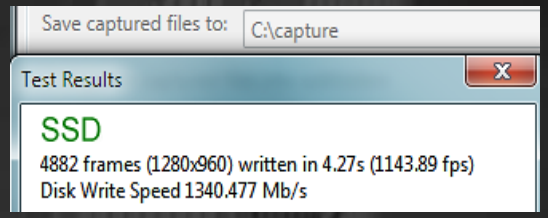


1.2 Hardware | Adaptation to the PC / other HW

PC: Check / disable all for occultation recording *not required* SW / services …,
Check / avoid carefully *(MS) updates* (especially W10!), provide enough *RAM*,
Record on a (dedicated) *SSD*; work with *administrator rights*







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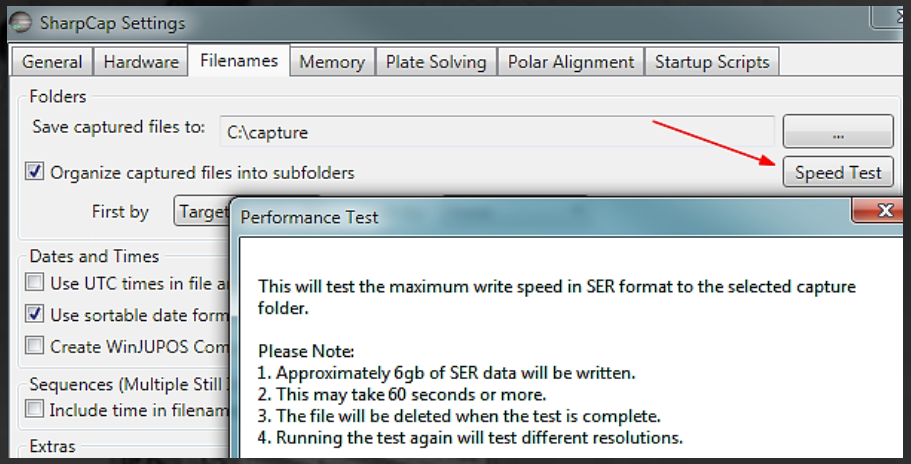

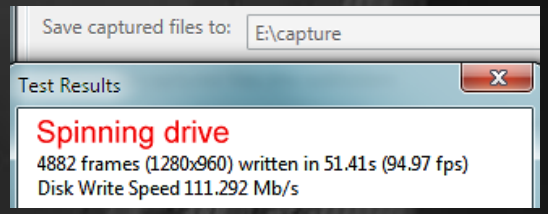

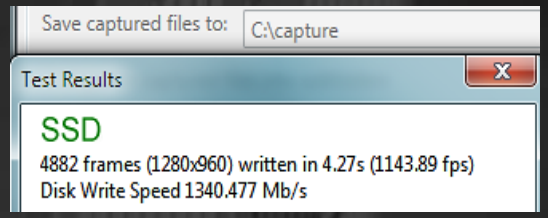

USB: *Real USB-3 connection,* original cable, high quality cables, < 2-3m,
Powered high quality hubs *can* work,
Check *PC's USB-powering* (System control / Energy options …),
In case of USB problems: https://forums.sharpcap.co.uk/viewtopic.php?f=18&t=349

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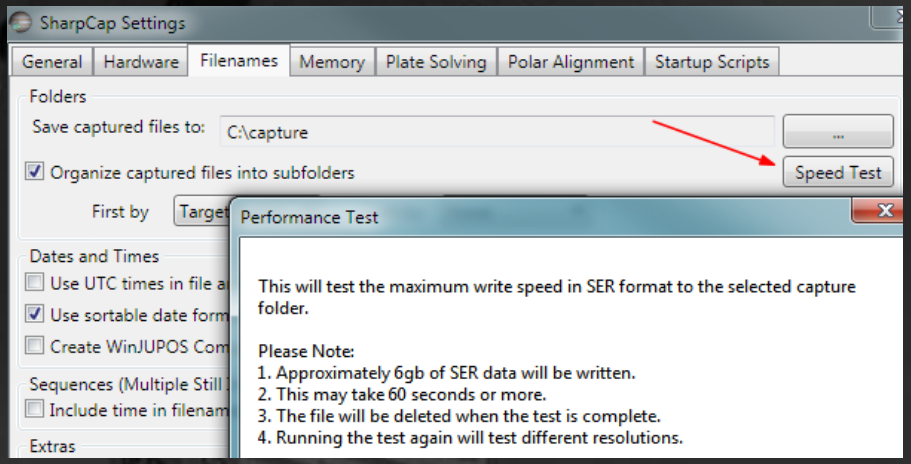

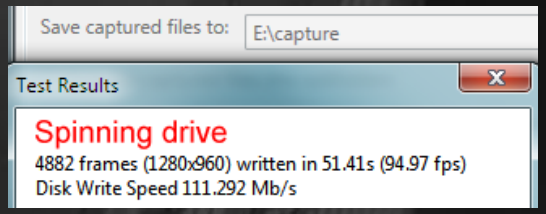

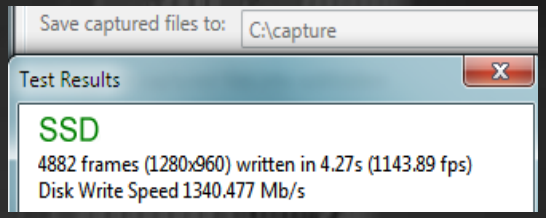

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Check *PC's USB-powering* (System control / Energy options …),
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12V: *Only* for cooling required, cooling recommended - at least for the actual event,
Up to 3A required!,
Cool down / up *slowly* (planned SC-feature),
So far no optical window dew problem - window is *heated*

1.2 Hardware | Adaptation to the PC / other HW

Antenna: Needs *free sight* to the sky, for timing tests GPS required – indoor with extension cables

For extension cables look for: „Eightwood SMA Kabel SMA Male auf SMA Bulkhead Jack Pigtail Kabel RG174 16.5ft" (Amazon)

https://de.aliexpress.com/item/32796598520.html

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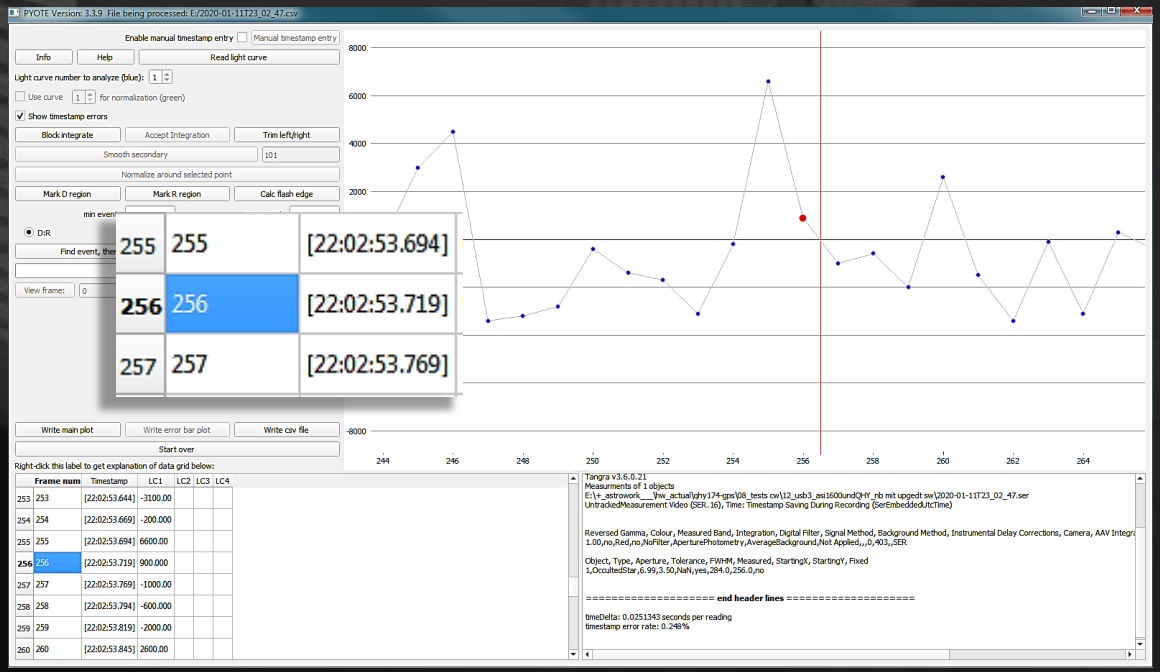
Event: Make a *test record* immediately before the event. This should also include a quick reduction (Tangra). Look for *dropped frames* and *timing inaccuracies*. Adapt the HW settings.

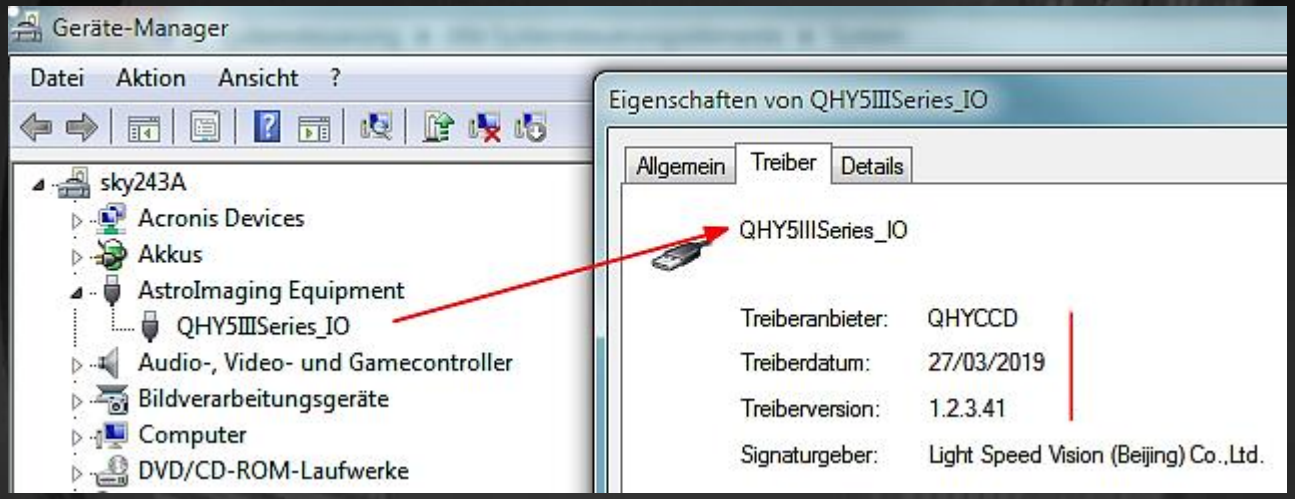


TANGRA > PyOTE found dropped frame
(see part 2)

1.3 Software | Driver

QHY Driver: Only 1 driver for all QHY-cameras: „QHY5IIISeriesDriver“:
https://www.qhyccd.com/file/repository/latestSoftAndDirver/Driver/QHY5IIISeriesDriverLatestEdition.zip

As of 2020 Feb 11: QHY5IIISeriesDriver200203win7.exe



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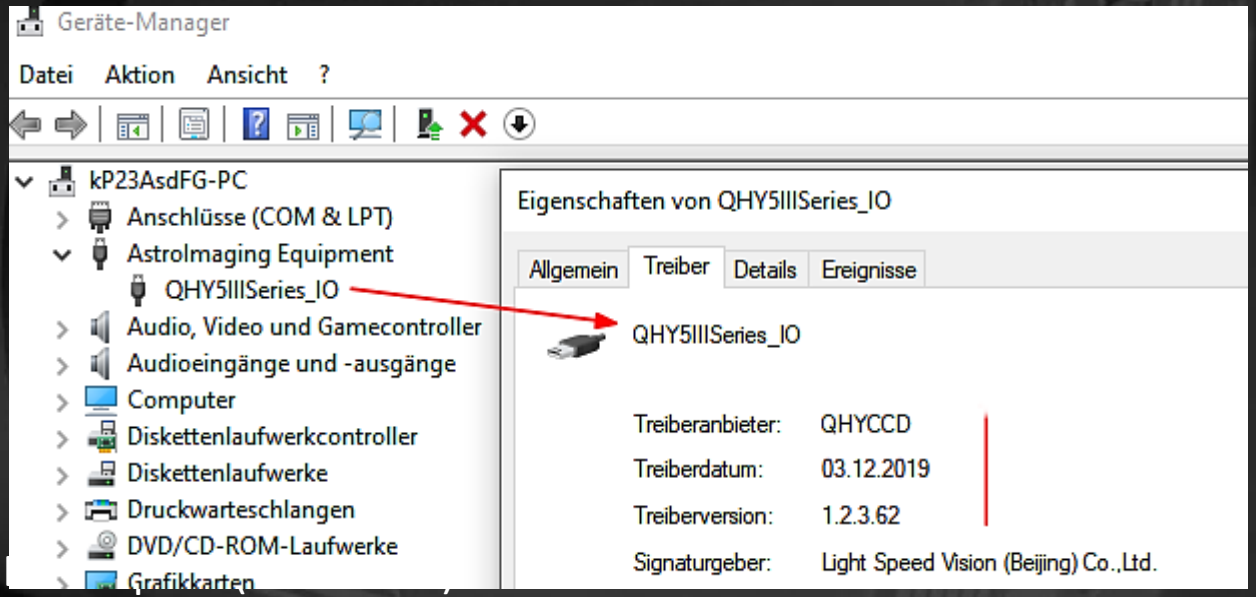
https://www.qhyccd.com/file/repository/latestSoftAndDirver/Driver/QHY5IIISeriesDriverLatestEdition.zip

As of 2020 Feb 11: QHY5IIISeriesDriver200203win10.exe

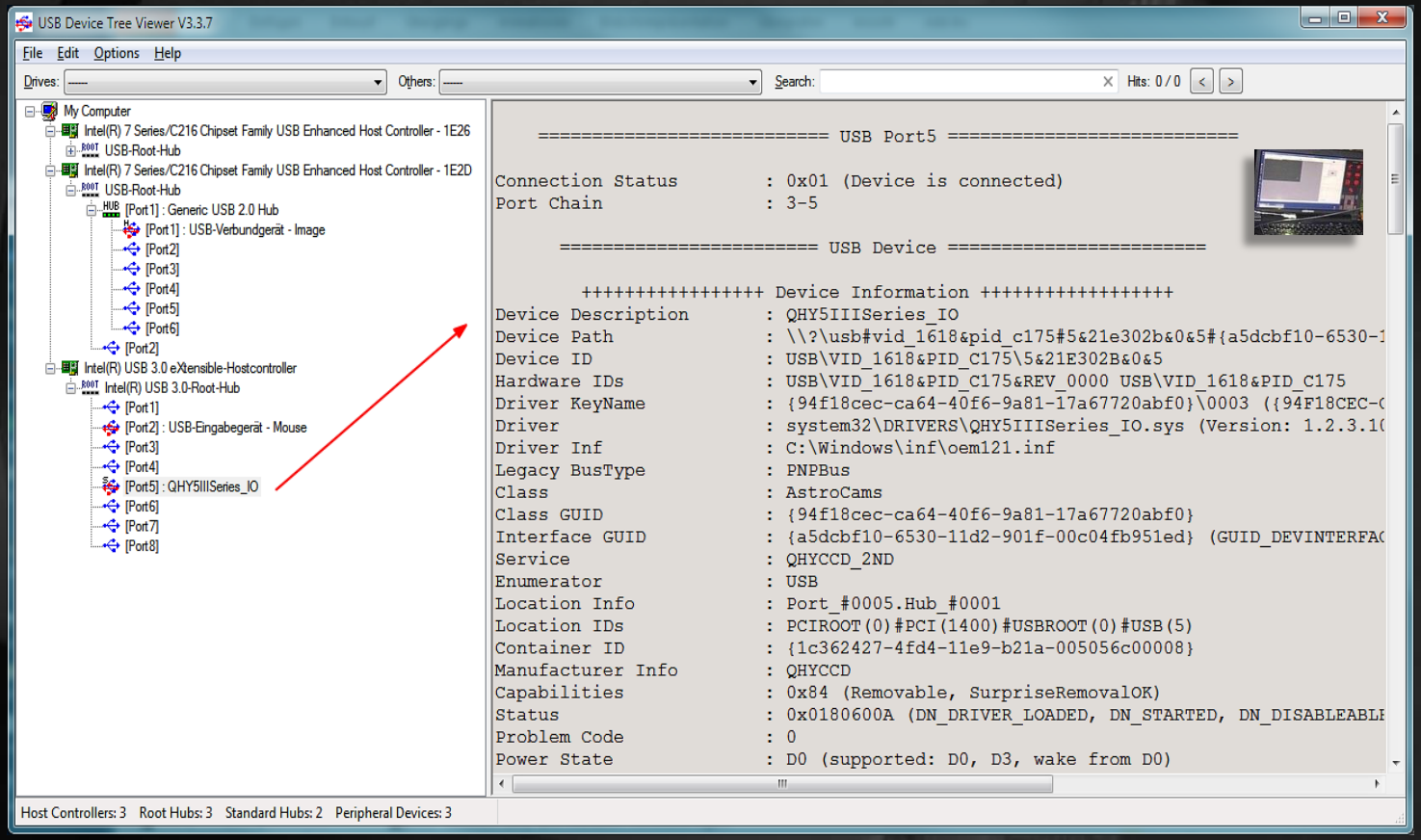


c:\Program Files (x86)\QHYCCD\QHY5IIISeriesDriver\

Driver history /old versions:
https://www.qhyccd.com/index.php?m=content&c=index&a=show&catid=141&id=62

1.3 Software | Driver

QHY Driver: USB Tree Viewer:
https://www.uwe-sieber.de/usbtreeview.html



1.3 Software | Recording

Rec. SW:

At the moment, *SharpCap* is the only software that fulfills all the requirements of occultation work. SC supports all functions of the camera.
https://www.sharpcap.co.uk/sharpcap/downloads

SC 3.2… for W7 – W10, 32 bit version (also for 64 bit OS)

Pro version (12.00 EUR p. a.) recommended (among others: Extended Memory Support, Preprocessing, Scripting …)

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Install:

You *can* overinstall… (the personal SC settings will remain)

To be safe: Backup your personal settings (see next page)

Uninstall the old version

(Optionally) clean the registry:

HKEY_CURRENT_USER\SOFTWARE\RWG\SharpCap

1.3 Software | Recording

SharpCap paths (W7-64 bit):

Program:	C:\Program Files (x86)\SharpCap 3.2\
Capt. profiles:	C:\Documents and Settings\Administrator\AppData\Roaming\SharpCap\CaptureProfiles\
SC logfiles:	C:\Documents and Settings\Administrator\Local Settings\SharpCap\logs\
Captures:	Chosen capture folder according to SC settings
GPS logfiles:	1 layer above capture folder
Optional: plate solved frames	C:\Documents and Settings\Administrator\AppData\Local\Temp\

1.3 Software | Recording

SharpCap basic settings:

SharpCap Settings

General | Hardware | Filenames | Memory | Plate Solving | Polar Alignment | Startup Scripts

Startup

- [ ] Show tips when SharpCap starts
- [ ] Automatically connect to camera when SharpCap starts
- [ ] Automatically restore camera settings

Shutdown

Confirm Shutdown: When a Camera is Open

Display

- [ ] Display in night vision colours (Dark Colour Scheme)
- [ ] Prevent Screen and Computer from powering down when using SharpCap

Auto Stretch Intensity

Saving

- [x] Save capture settings file alongside each capture
- [ ] Start cameras with 'Auto' output format (for supported cameras)
- [ ] Save 10/12/14 bit images in FITS files without scaling to 16 bit.
  [Advanced use for Photometry only. Altair, QHY, ZWO cameras only. Read Documentation.]
- [ ] Compress TIFF files (smaller files, will not open in some software - e.g. PIPP)

Preferred Video Format: SER

Preferred Still Format: FITS

Saved Target Names:
Moon
CW
Mars
Jupiter
Saturn

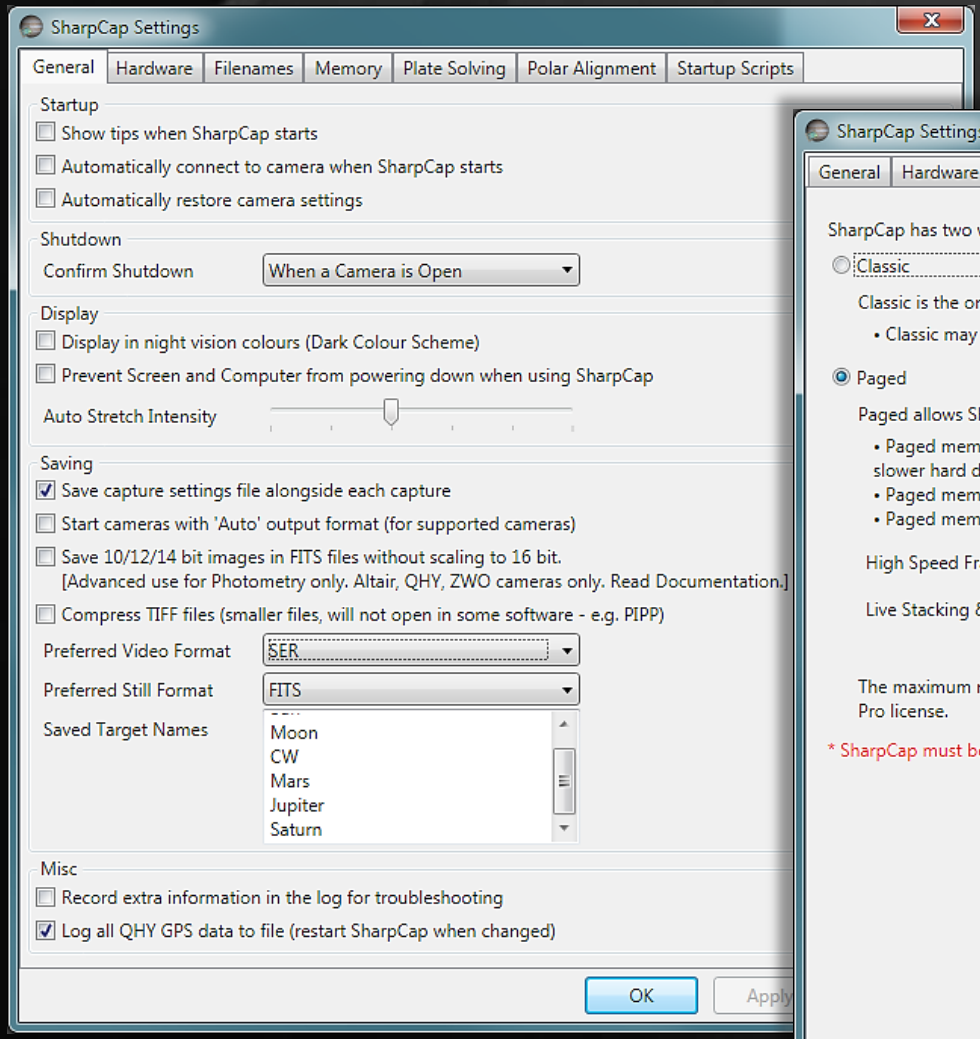
Misc

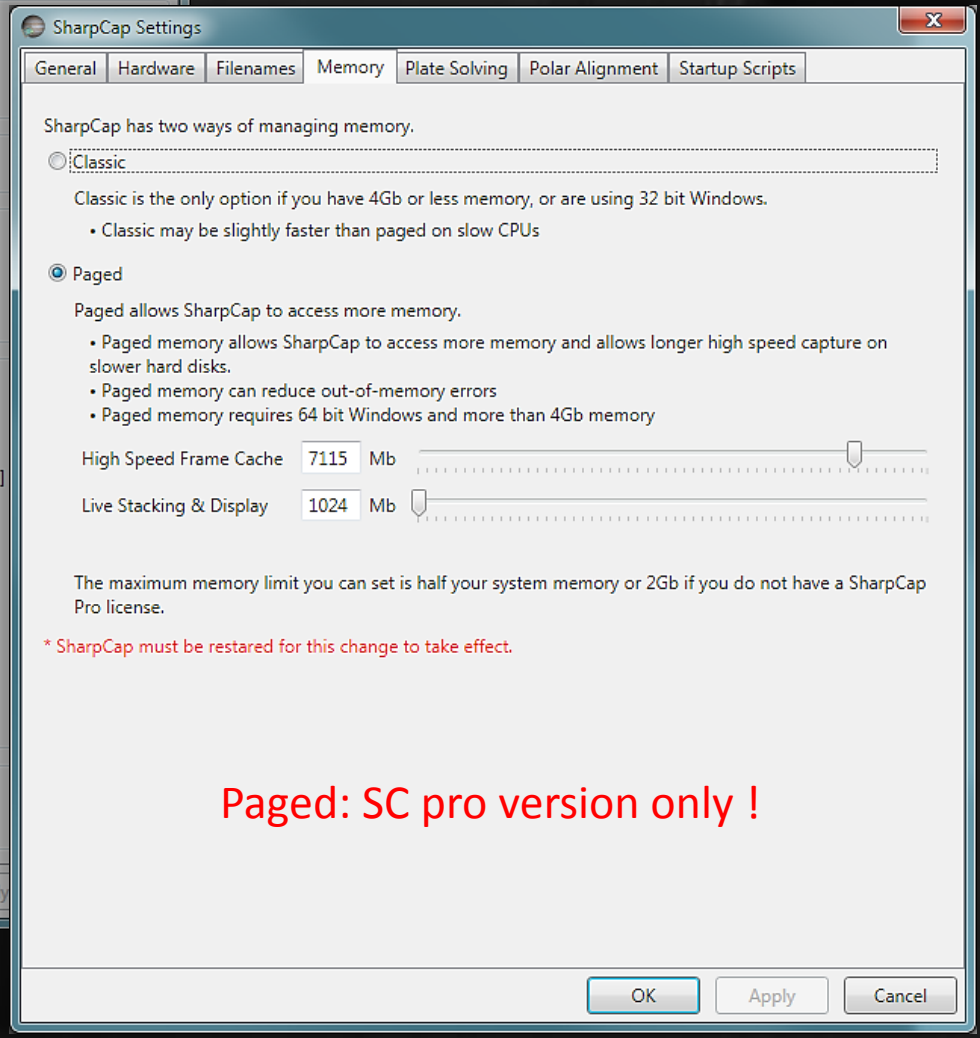
- [ ] Record extra information in the log for troubleshooting
- [x] Log all QHY GPS data to file (restart SharpCap when changed)

OK | Apply | Cancel

1.3 Software | Recording

SharpCap basic settings:





1.3 Software | Recording

SharpCap basic settings:

SharpCap Pro (v3.2.6226) - QHY174M - C:\capture

File Cameras Options Capture Tools Scripting Help

Start Capture | Quick Capture | Stop Capture | Pause | Snapshot | Live Stack | Target Name: | FX: None

2020 02 12 20:40:07:3162825

GPS Status

```
Status     : Locked
Sequence # : 3410
Latitude   : 52.5
Longitude  : 13.4
Start      : 2020-02-12T20:40:07.0000000Z
Start (us) : 316282.5
End        : 2020-02-12T20:40:07.0000000Z
End   (us) : 416370.3
Now        : 2020-02-12T20:40:07.0000000Z
Now   (us) : 416370.3
PPS Counter: 9999993
Exp. (us)  : 100087.8
Sys Clock  : 0.014s behind GPS
System/GPS offset stable for : 0:00:49
```

Once the GPS has a status of 'Locked' you can set the system time to the GPS time.

To set the system time you must run SharpCap as Administrator.

Choose a short exposure and high frame rate to ensure an accurate sync.

Set PC Time to GPS Time

Camera Control Panel

QHY-SC-DEFAULT

Load | Save | Save As... | Manage...

Capture Format and Area

Colour Space	MONO16
Capture Area	640x480
Binning	1x1
Output Format	SER file (*.ser) Auto
ROI Selection	Pan: 1280 Tilt: 360

Camera Controls

Exposure	100 ms LX Mode
Quick Picks	Auto
Gain	480
Frame Rate Limit	Maximum
Amp Noise Reduction	Off Auto
Offset	0
USB Traffic	5
Enable Live Broadcast	Off
Force Still Mode	Off

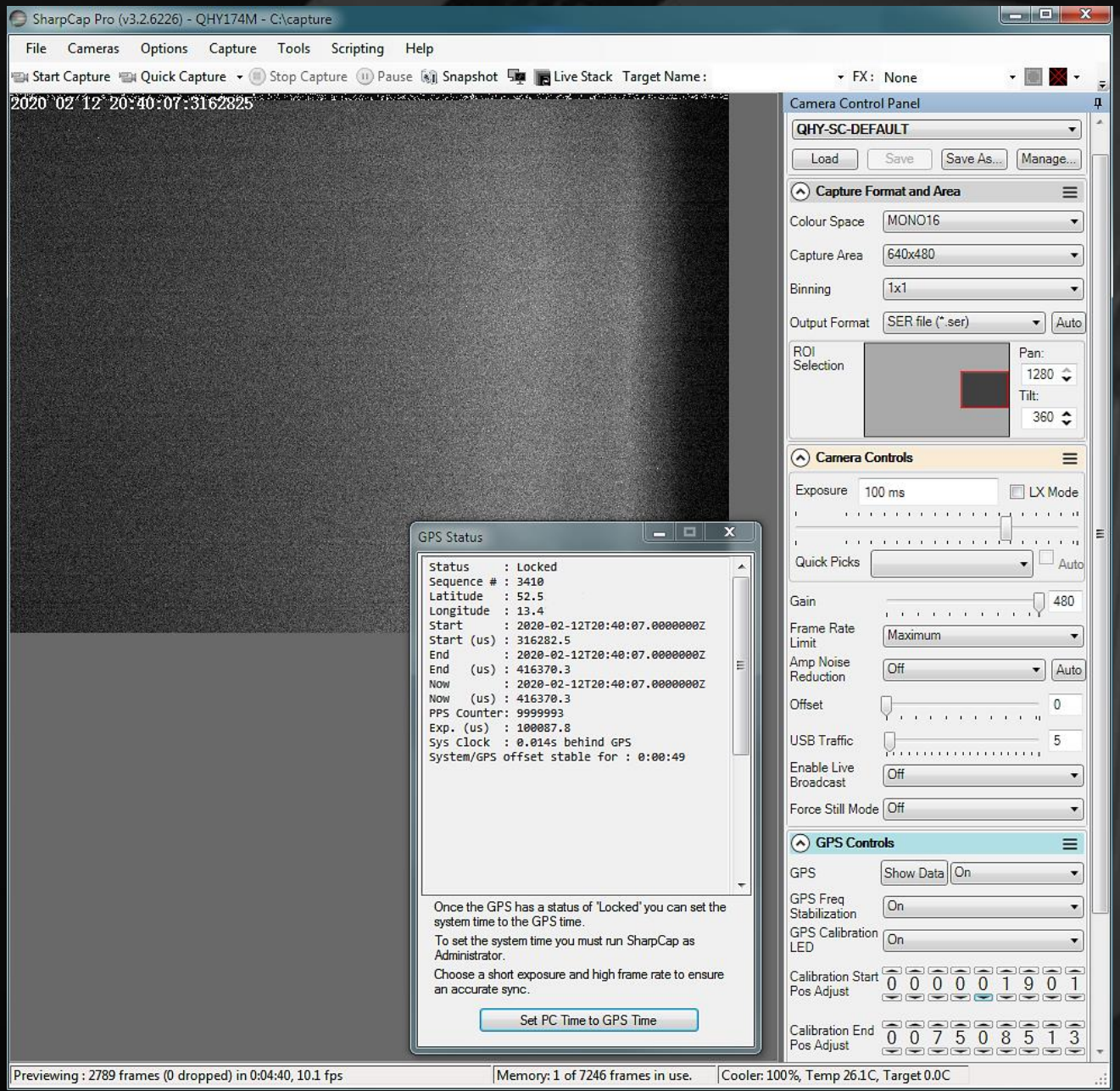
GPS Controls

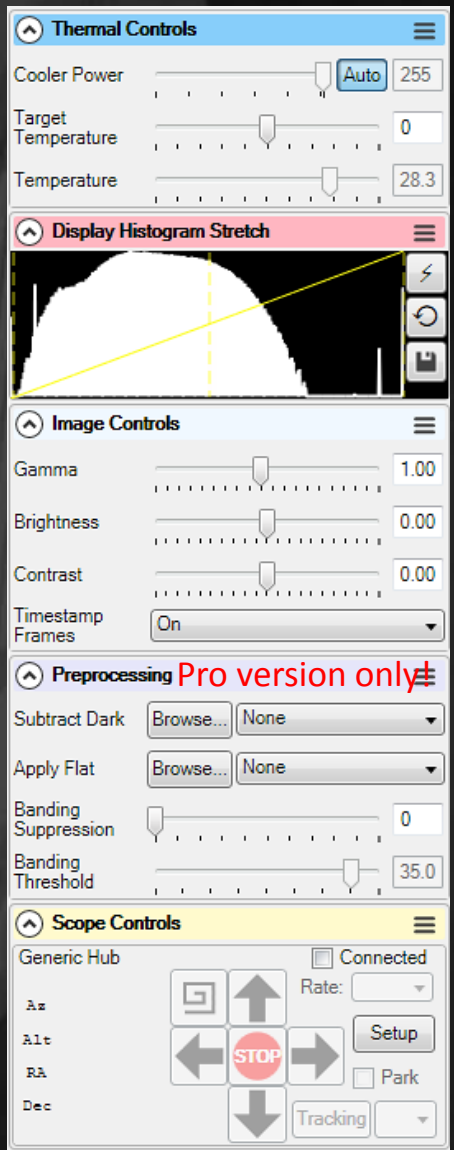
GPS	Show Data On
GPS Freq Stabilization	On
GPS Calibration LED	On
Calibration Start Pos Adjust	0 0 0 0 0 1 9 0 1
Calibration End Pos Adjust	0 0 7 5 0 8 5 1 3

Previewing : 2789 frames (0 dropped) in 0:04:40, 10.1 fps | Memory: 1 of 7246 frames in use. | Cooler: 100%, Temp 26.1C, Target 0.0C

1.3 Software | Recording

SharpCap basic settings:





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Start Capture | Quick Capture | Stop Capture | Pause | Snapshot | Live Stack | Target Name: | FX: None

2020 02 12 20:40:07:3162825

Lister - [C:\Dokumente und Einstel...

Datei Bearbeiten Optionen Hilfe 94 %

Capture Profile

```
Output Format=SER file (*.ser)
Binning=1x1
Capture Area=640x480
Colour Space=MONO16
Pan=1280
Tilt=360
Force Still Mode=Off
Enable Live Broadcast=Off
USB Traffic=5
Offset=289
Amp Noise Reduction=Off
Frame Rate Limit=Maximum
Gain=480
Exposure=100
Calibration End Pos Adjust=7508513
Calibration Start Pos Adjust=1901
GPS Calibration LED=On
GPS Freq Stabilization=On
GPS=On
Timestamp Frames=On
Contrast=0
Brightness=0
Gamma=1
Temperature=31.7
Target Temperature=0
Cooler Power=255(Auto)
Banding Threshold=35
Banding Suppression=0
Apply Flat=None
Subtract Dark=None
#Black Point
Display Black Point=0
#MidTone Point
Display MidTone Point=0.5
#White Point
Display White Point=1
```

GPS Status

```
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Camera Control Panel

QHY-SC-DEFAULT

Load | Save | Save As... | Manage...

Capture Format and Area

Colour Space: MONO16

Capture Area: 640x480

Binning: 1x1

Output Format: SER file (*.ser) | Auto

ROI Selection | Pan: 1280 | Tilt: 360

Camera Controls

Exposure: 100 ms | LX Mode

Quick Picks | Auto

Gain: 480

Frame Rate Limit: Maximum

Amp Noise Reduction: Off | Auto

Offset: 0

USB Traffic: 5

Enable Live Broadcast: Off

Force Still Mode: Off

GPS Controls

GPS: Show Data | On

GPS Freq Stabilization: On

GPS Calibration LED: On

Calibration Start Pos Adjust: 0 0 0 0 0 1 9 0 1

Calibration End Pos Adjust: 0 0 7 5 0 8 5 1 3

Fits-Header

FITS-Header

```
SIMPLE  =                    T / C# FITS: 02/12/2020 21:58:23
BITPIX  =                   16
NAXIS   =                    2 / Dimensionality
NAXIS1  =                  640
NAXIS2  =                  480
GPS_Long=     13.4   83333333 / Longitude
GPS_SFlg=                   51 / StartFlag
GPS_ST  = '2020-02-12T20:58:23.0000000Z' / StartShutterTime
GPS_SU  =               443406 / StartShutterMicroSeconds
GPS_EFlg=                   51 / EndFlag
GPS_ET  = '2020-02-12T20:58:23.0000000Z' / EndShutterTime
GPS_EU  =             543494.1 / EndShutterMicroSeconds
GPS_NFlg=                   51 / NowFlag
GPS_NU  =               543494 / NowShutterMicroSeconds
GPS_Lat =      52.5   96666667 / Latitude
GPS_PPSC=            9999995 / PPSCounter
GPS_Stat= 'Locked  '           / GPS Status
GPS_ExpU=            100088.1 / Exposure (microseconds)
GPS_DSYS=          -0.0430033 / System clock - GPS clock offset (s)
GPS_DSTB=                1145 / Time offset stable for (s)
GAIN    =                 480 /
GPS_NT  = '2020-02-12T20:58:23.0000000Z' / NowShutterTime
GPS_H   =                 256 / Height
GPS_Tmp$=                   3 / TempSequenceNum
BLKLEVEL=                 289 /
EXTEND  =                   T / Extensions are permitted
BZERO   =               32768 /
BSCALE  =                   1 /
EXPTIME =                 0.1 /
XPIXSZ  =       5.8600001335144 /
YPIXSZ  =       5.8600001335144 /
XBINNING=                   1 /
GPS_W   =                 656 / Width
YBINNING=                   1 /
SWCREATE= 'SharpCap'           / v3.2.6226.0, 32 bit
DATE-OBS= '2020-02-12T20:58:23.4434060' / GPS:Start Exposure
DATE-END= '2020-02-12T20:58:23.5004908' / System Clock:Frame Received
GPSSTAT = 'Locked  '           /
OBSLAT  =     52.5   96666667 / From GPS
OBSLONG =     13.4   83333333 / From GPS
GPS_Seq#=                14355 / Sequence Number
CCD-TEMP=                 30.3 /
INSTRUME= 'QHY174M '           /
END
```

Previewing : 2789 frames (0 dropped) in 0:04:40, 10.1 fps | Memory: 1 of 7246 frames in use. | Cooler: 100%, Temp 26.1C, Target 0.0C

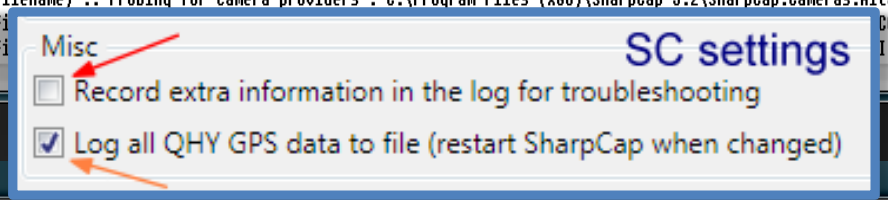
1.3 Software | Recording

Lister - [C:\Dokumente und Einstellungen\Administrator\Lokale Einstellungen\SharpCap\logs\Log_2020-02-12T21_33_52-10872.log]

Datei Bearbeiten Optionen Hilfe 6 %

```
Info:   21:33:52.1207880 Thread:#1 SharpCap.Program.Main() :: Starting...
Info:   21:33:52.2897977 Thread:#1 SharpCap.Program.SetupNBUG() :: Setting up bug reporting.
Info:   21:33:52.3518012 Thread:#1 SharpCap.LogSystemInfo.Run() :: Starting thread to log system info
Info:   21:33:52.3618018 Thread:LogInfo Thread#9 SharpCap.LogSystemInfo.ThreadProc() :: SharpCap Version 3.2.6226.0
Info:   21:33:52.3628018 Thread:LogInfo Thread#9 SharpCap.LogSystemInfo.ThreadProc() :: GC Memory 116Mb
Info:   21:33:52.3638019 Thread:LogInfo Thread#9 SharpCap.LogSystemInfo.ThreadProc() :: Process Memory 150Mb
Info:   21:33:52.3648019 Thread:LogInfo Thread#9 SharpCap.LogSystemInfo.ThreadProc() :: Total Physical Memory 16278Mb
Info:   21:33:52.3648019 Thread:LogInfo Thread#9 SharpCap.LogSystemInfo.ThreadProc() :: Available Physical Memory 4745Mb
Info:   21:33:52.4368061 Thread:#1 SharpCap.Program.RunApp(Boolean showSplash) :: Setting up application
Info:   21:33:52.4418063 Thread:#1 SharpCap.Program.RunApp(Boolean showSplash) :: Initializing WPF
Debug:  21:33:52.4928093 Thread:#1 SharpCap.UI.SharpCapForm..ctor() :: Started
Info:   21:33:52.5248111 Thread:LogInfo Thread#9 SharpCap.LogSystemInfo.ThreadProc() :: Operating System : Microsoft Windows 7 Home Premium
Info:   21:33:52.5258112 Thread:LogInfo Thread#9 SharpCap.LogSystemInfo.ThreadProc() :: Full OS Version 6.1.7601
Info:   21:33:52.5258112 Thread:LogInfo Thread#9 SharpCap.LogSystemInfo.ThreadProc() :: OS is 64 bit, SharpCap is 32 bit.
Info:   21:33:52.5468124 Thread:#1 SharpCap.MultiCaptureProvider.AddProvider() :: Added device enumerator of type BaslerDeviceEnumerator
Info:   21:33:52.5468124 Thread:#1 SharpCap.MultiCaptureProvider.AddProvider() :: Added device enumerator of type QHYDeviceEnumerator
Info:   21:33:52.5468124 Thread:#1 SharpCap.MultiCaptureProvider.AddProvider() :: Added device enumerator of type ASIDeviceEnumerator
Info:   21:33:52.5478124 Thread:#1 SharpCap.MultiCaptureProvider.AddProvider() :: Added device enumerator of type AltairDeviceEnumerator
Info:   21:33:52.5798142 Thread:#1 SharpCap.MultiCaptureProvider.AddProvider() :: Added device enumerator of type PointGreyDeviceEnumerator
Info:   21:33:52.5798142 Thread:#1 SharpCap.MultiCaptureProvider.AddProvider() :: Added device enumerator of type SxDeviceEnumerator
Info:   21:33:52.5858146 Thread:#1 SharpCap.Base.InterfaceFactory`2.ScanDll(String filename) :: Probing for camera providers : C:\Program Files (x86)\SharpCap 3.2\SharpCap.Cameras.Altair.dll
Info:   21:33:52.5868146 Thread:#1 SharpCap.Base.InterfaceFactory`2.ScanDll(String fi                                                                                                    COMCamera.dll
Info:   21:33:52.5878147 Thread:#1 SharpCap.Base.InterfaceFactory`2.ScanDll(String fi                                                                                                    I.dll
```

SC log file



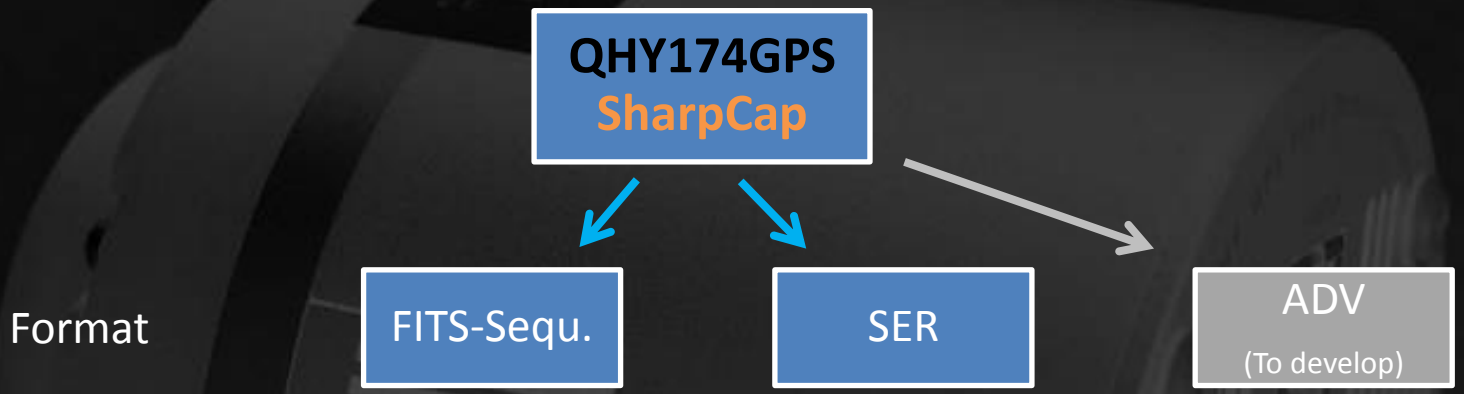
Lister - [C:\capture\GPSLog_2020-02-12T20_34_32-10872.log]

Datei Bearbeiten Optionen Hilfe

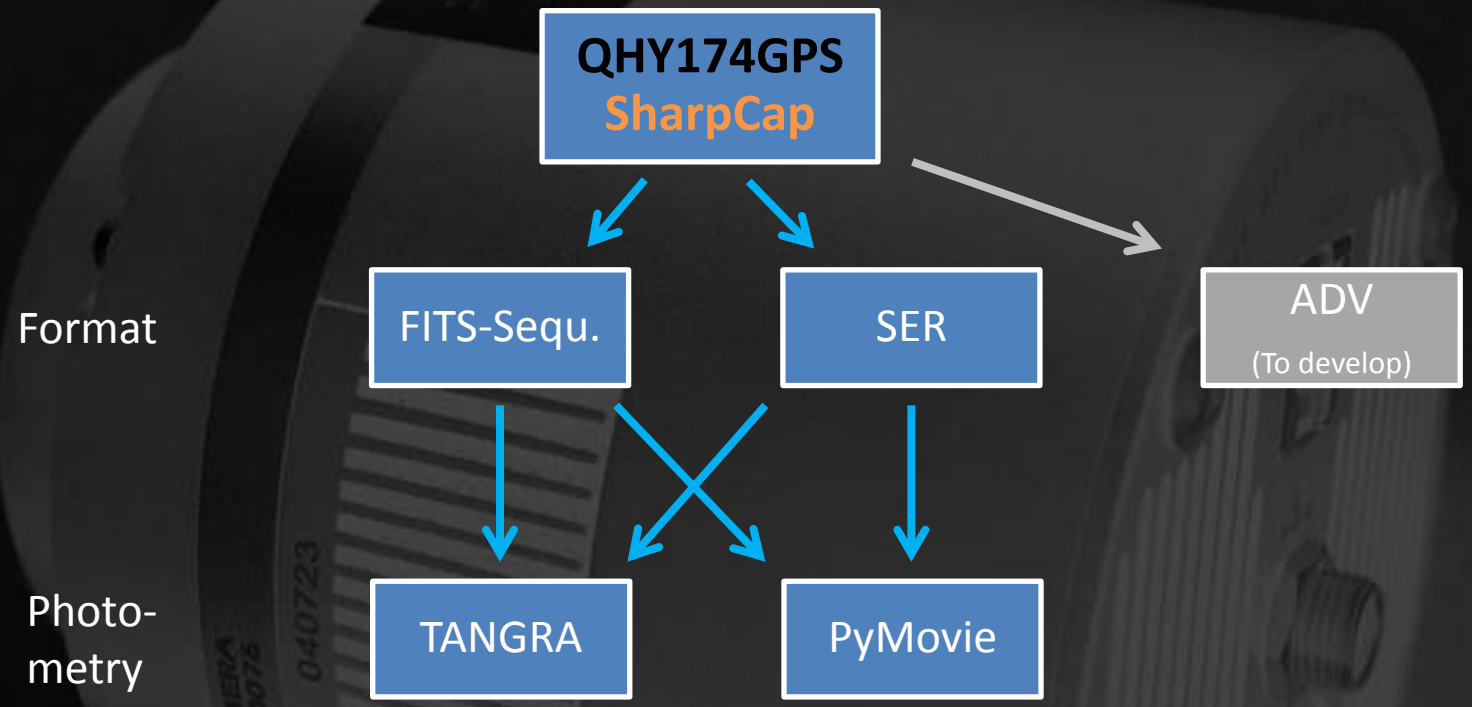
```
System Time (UTC), Status, Sequence Num, GPS Start Frame Time, GPS End Frame Time, Lat, Long, RAW Lat, RAW Long, System-GPS (s), NumSats, Altitude, FixTime, FixQuality, HDop, RawData
2020-02-12T20:34:32.3760[illegible]Z, BadData, 0, 1995-10-10T00:00:00.0000000Z, 1995-10-10T00:00:00.0000000Z, 0.0000000, 0.0000000, 0, 0, 768256472.35
2020-02-12T20:34:32.553[illegible]062Z, PartialData, 25, 2020-02-12T20:34:32.5503724Z, 2020-02-12T20:34:32.6503259Z, 0.0000000, 0.0000000, 0, 0, -0.10
2020-02-12T20:34:32.7551124Z, PartialData, 27, 2020-02-12T20:34:32.7506674Z, 2020-02-12T20:34:32.8506210Z, 0.0000000, 0.0000000, 0, 0, -0.10
2020-02-12T20:34:32.8571180Z, PartialData, 28, 2020-02-12T20:34:32.8508149Z, 2020-02-12T20:34:32.9507685Z, 0.0000000, 0.0000000, 0, 0, -0.09
2020-02-12T20:34:33.0541292Z, PartialData, 30, 2020-02-12T20:34:33.0510598Z, 2020-02-12T20:34:33.1510134Z, 0.0000000, 0.0000000, 0, 0, -0.10
2020-02-12T20:34:33.2531406Z, PartialData, 32, 2020-02-12T20:34:33.2513549Z, 2020-02-12T20:34:33.3513084Z, 0.0000000, 0.0000000, 0, 0, -0.10
2020-02-12T20:34:33.3531463Z, PartialData, 33, 2020-02-12T20:34:33.3515024Z, 2020-02-12T20:34:33.4514559Z, 0.0000000, 0.0000000, 0, 0, -0.10
2020-02-12T20:34:33.4541521Z, PartialData, 34, 2020-02-12T20:34:33.4516499Z, 2020-02-12T20:34:33.5516034Z, 0.0000000, 0.0000000, 0, 0, -0.10
2020-02-12T20:34:33.555[illegible]792Z, PartialData, 35, 2020-02-12T20:34:33.5517974Z, 2020-02-12T20:34:33.6517509Z, 0.0000000, 0.0000000, 0, 0, -0.10
2020-02-12T20:34:33.757169[illegible]Z, Locked, 37, 2020-02-12T20:34:33.7520924Z, 2020-02-12T20:34:33.8520459Z, 52.5  2978, 13.4  9400, 523  7787, 132  764, -0.10
2020-02-12T20:34:33.9541807Z, Locked, 39, 2020-02-12T20:34:33.9523874Z, 2020-02-12T20:34:34.0522908Z, 52.5  .978, 13.4  0400, 523  7787, 132  764, -0.10
```

GPS log file

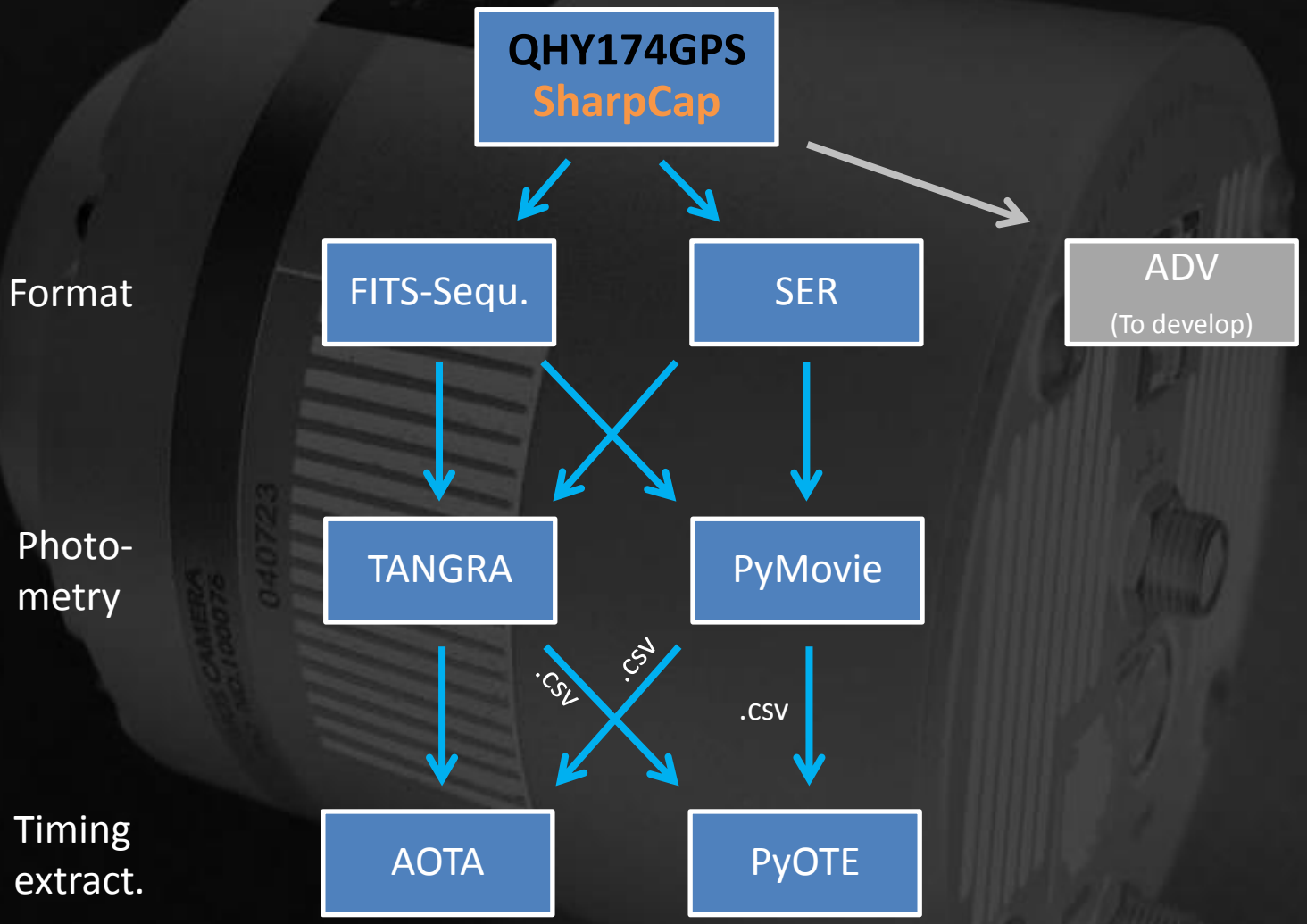
1.3 Software | Data reduction



1.3 Software | Data reduction



1.3 Software | Data reduction



No camera delays to consider

1.4 Useful links

SER-Player	https://sites.google.com/site/astropipp/ser-player#downloads
FitsWork	https://www.fitswork.de/software/
Skychart / CDC	https://sourceforge.net/projects/skychart/
PyMovie	http://occultations.org/observing/software/pymovie/
PyOTE	http://occultations.org/observing/software/ote/
SEXTA	https://www.kuriwaobservatory.com/SEXTA/SEXTA.html
	https://arxiv.org/abs/1503.05705
SC Forum	https://forums.sharpcap.co.uk/index.php
ADV format	https://forums.sharpcap.co.uk/viewtopic.php?f=8&t=2237
ASCOM	https://ascom-standards.org/

Many thanks to:

Robin Glover	For providing and continuous development of SharpCap
Hristo Pavlov	Developer of TANGRA
Dave Herald	Developer of Occult / AOTA
Bob Anderson	Developer of PyMovie, PyOTE
Th. Midavaine	For providing a SEXTA device (developed by Tony Barry and Dave Gault)
IOTA/ES	For providing a QHY174GPS test model

Colleagues of the worldwide community for suggestions and valuable discussions

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Thank You