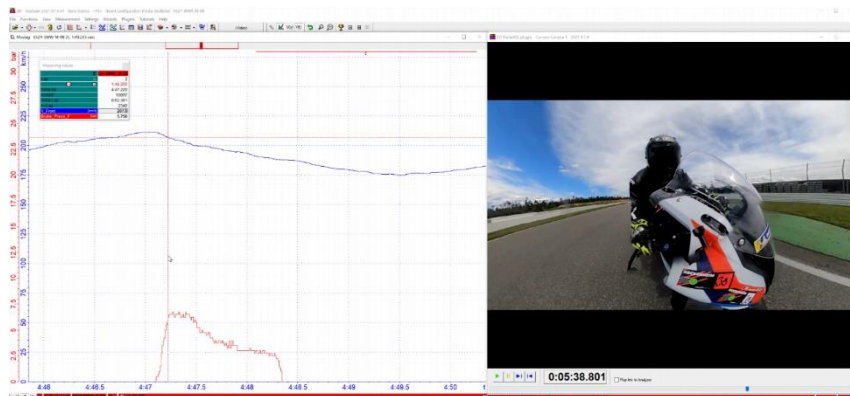


- English -



GoPro® AutoSync

Manual

1 Revision History

Revision	Description	Release Date	Author
0	Initial Release	2020-07-24	FS
1	Expansion new GoPro® cameras	2021-02-14	FS
2	Compatibility GoPro® Hero 10	2021-09-15	FS
3	Improvement “Add videos to multiple videos”	2022-01-14	FS
4			

Revision 0:

Initial Release

Revision 1:

Expansion of *GoPro® AutoSync* feature with the GoPro® Hero 9 and GoPro® MAX cameras. Also, the use of GoPro® MAX 360° videos is possible now (chapter 9.2)!

Revision 2:

Expansion of *GoPro® AutoSync* feature with the GoPro® Hero 10.

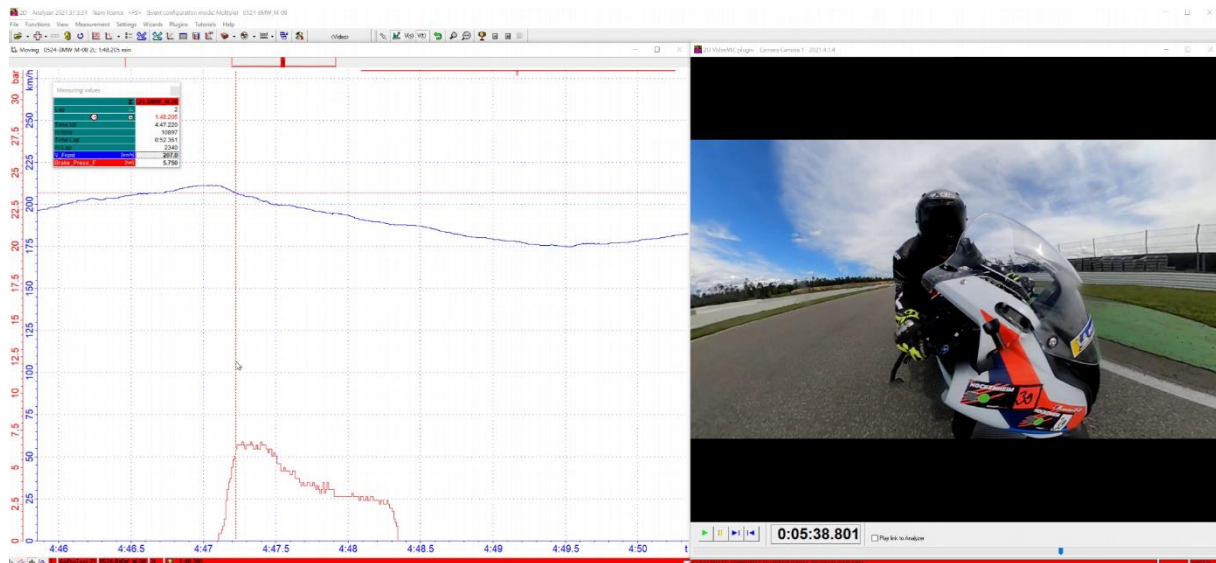
Revision 3:

Description of new toolbar button to easily attach videos to multiple measurements (5.1).

2 Table of contents

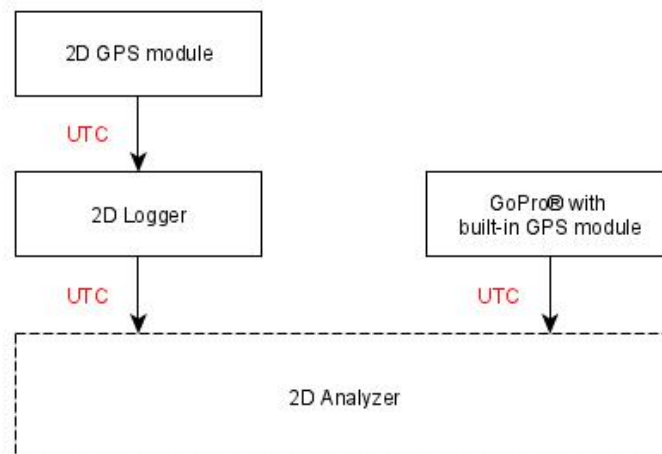
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3 Description



(click [here](#) to open demo video)

Automatically link a video to a measurement by calculating the video offset from the GPS time stamps of a 2D GPS module and the GPS time stamps of the GoPro® to extend the measurement data by an audiovisual component with frame by frame analysis!



- GPS-channels provided by GPS2CAN or serial GPS are required to use the *GoPro® AutoSync* feature!
- Ensure to record the GPS-channels, especially #SSHH, #HHMM and #MMDD



- At the moment, the software is able to process twelve videos each from four cameras! If you want to use more cameras, please contact 2D Datarecording via our website!

With different license levels, videos from a different amount of GoPro®'s can be synchronized to a measurement. With license level *TEAM* four GoPro®'s with each 16 videos can be synchronized.



- Detailed information about licenses can be at <http://2d-datarecording.com/downloads/manuals/>

4 Preparations

4.1 Important instructions

Since the alignment accuracy of the GoPro® video for the 2D measurement data depends to a large extent on the GPS reception of all devices, it is important to ensure that all devices involved have received very good GPS at least at the start of the measurement!



- Only if all preparation steps are carried out conscientiously, an alignment accuracy of far less than 1 second can be achieved!

4.2 GoPro®

4.2.1 GoPro® Quik software

If the GoPro® Quik software is installed on your computer, please ensure that this software does not start automatically when a data carrier with GoPro® content is inserted. With a special setting, this software would automatically delete the content after importing.

4.2.2 GoPro Player

The GoPro® Player is only required if GoPro® MAX 360° videos must be edited!

Click [here](#) to download GoPro® Player.

4.2.3 Hardware

In the following you will find a list that shows with which GoPro® the automatic synchronization works. Ensure that your camera is updated to the latest firmware!

Hero® 5	Black		2016
	Session		2016
Hero® 6	Black		2017
	Fusion		2017
	HERO		2018
Hero® 7	White		2018
	Silver		2018
	Black		2018
Hero® 8	Black		2019
MAX®			2019
Hero® 9	Black		2020
Hero® 10	Black		2021



- Please familiarize yourself with the use of the GoPro®, especially with the video settings, as well as the activation of the GPS and display of a GPS connection of the camera.

No GPS-connection



GPS-connection



- With **GoPro® AutoSync** toolchain is also possible to process 360° of the GoPro® MAX! Please see respective chapter 9.2 in appendix.
- HERO-mode videos from GoPro® MAX are processed normally

4.3 2D-Datarecording modules

GoPro® videos can only be automatically synchronized to measurements that use a GPS module. It does not matter whether a GPS2CAN receiver or a serial GPS receiver is used.



- Ensure to record the GPS-channels, especially #SSHH, #HHMM and #V_Sat are important!
- When using a 2D GPS module, it is important that the module has received GPS reception for at least 13 minutes, at best 26 minutes, before a measurement, to receive the latest GPS-Almanac data and thus the alignment accuracy can be guaranteed.
- During this time, the measurement system must only be switched on, no active record is required.

4.4 Computer

4.4.1 VLC-Player

To play the videos via the Analyzer's plugins, the VLC Player must be installed in its 32-Bit-Windows version.

Click [here](#) to download the VLC-Player!



- 32-Bit-Windows version must be used!
- Select "Windows" at dropdown menu for downloading 32-Bit-Windows version!
- Please ensure that VLC-Player is always updated to its latest version!

4.4.2 HEVC-Codec

Certain resolution and framerate combinations lead to a HEVC-coded video. For more information please see:

Click [here](#) for additional information about HEVC-codec!



- Please ensure if your computer can display HEVC-coded videos!
- Follow the instructions of the GoPro® camera!

5 How to automatically attach videos



- Do not import the measurement and the videos at the same time! Import one behind the other. The order you do that is not important!
- The videos must be on a data carrier called "2D-Stick" or on a stick of any name with a directory "DCIM"!
- Make sure only videos from the respective event are on your data carrier



- The following instructions are also available as YouTube tutorial:
Click [here](#) for link to the YouTube tutorial!
- When using GoPro® MAX 360° videos, before automatically synchronizing videos, please see chapter 9.2.

1. Insert the USB stick with the measurement as usual with *WinARace* open with the correctly selected event and have the measurement automatically downloaded into the selected event.
2. If a data carrier with videos is connected to the PC and *WinARace* is open **or** if a data carrier with videos is already connected and *WinARace* is then started, the videos are automatically copied to the current event in the folder *Videos*.

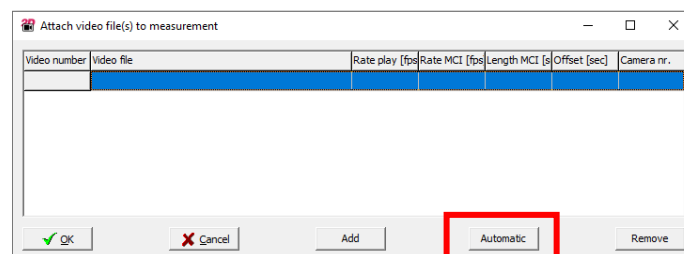


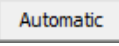
- Only videos that are not already in the *Videos* event folder are copied!
- When copying, information about length, framerate, timestamps (SecondOfDay → SOD) and camera are extracted automatically from the videos and stored in *AvailableVideos.ini*. This ini-file can be found inside the respective event folder inside the folder *Videos* (<EventDir>\Videos) and can be opened with a text editor.
- The video files are also renamed in the *Video* event folder (<EventDir>\Videos) according to the following schema:

GoPro®-Videos with enabled GPS	SerialNumberGoPro®_TimestampRecording.mp4
GoPro®-Videos with disabled GPS	SerialNumberGoPro®_TimestampCopyingToPC.mp4
Other Videos	000000_TimestampCopyingToPC.Datatype

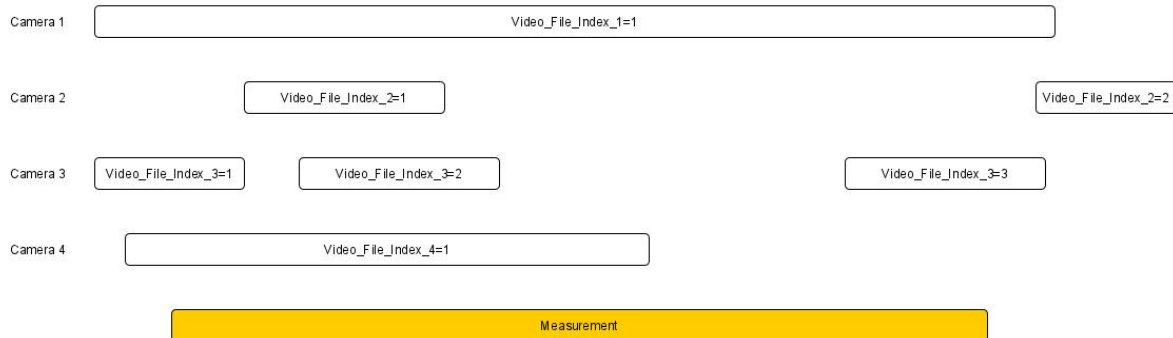
3. Open *WinARace* and select the measurement to which you want to attach the videos

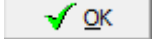
4. Click on  in Toolbar to open *VideoCMDLine.exe*



By clicking  all GoPro® videos are automatically attached that correspond to the measurement. The offset is calculated automatically for the respective videos.

In the following figure you can see that all videos except Camera 2 video 2 (Video_File_Index_2=2) would coincide in time with the measurement and therefore all but Camera 2 video 2 would be attached.



By clicking  the videos are attached successfully to the measurement and video channels are created according to the following pattern:



- A video_file_index channel is created for each camera, showing which video of the camera is currently active
- Only one video_time channel is created for each camera. Channel Video_Time_3 contains the Video_Times of all videos of camera 3

5.1 Attach videos to multiple measurements

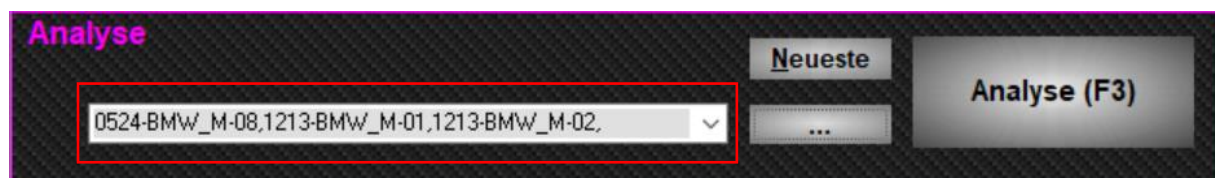
With the previous description videos can be synchronized to one, selected measurement only.


Because often videos must be synchronized to multiple measurements since Race2022 a new WinARace toolbar button was implemented.

By clicking on toolbar button



for all in WinARace currently selected measurements videos are synchronized.



- By clicking on  multiple measurements can be selected via holding [CTRL]-key and selection measurements.

6 Assign camera name



For a better allocation of the cameras, a camera name can be set individually via entries in the event.ini in the respective event directory.

[Cameras]

Camera1=C3331350490577

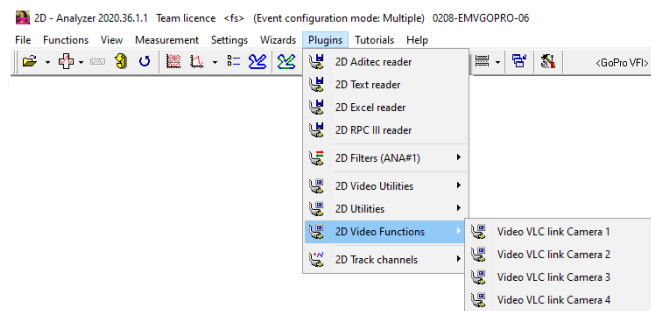
Name1=Chest

7 Open Plugins

Open *Analyzer* with the desired videos and then the *Plugins* which can be found under *Plugins* → *2D Video Functions* and then *Video VLC link Camera*.



- If a camera name was assigned the respective camera name is shown



8 Evaluation

The alignment accuracy strongly depends on the conscientious execution of the steps described in the section *Preparations*. The processing time of the camera used also plays a role.



- If the video offset must be adjusted manually, please click [here](#) for link to 2D YouTube tutorial!

9 Appendix

9.1 Possible setup



Due to the temporal assignment of the videos to the measured data, the following scenario is possible:

- Rider 1 has installed a 2D logger on his motorcycle and is wearing a camera with chest strap
 - Rider 2 films with a camera on the helmet Rider 1 from behind
 - Camera 3 was set up stationary in corner 5
 - Camera 4 is attached to a drone and films from a bird's eye view
- ⇒ During evaluation, the driver can then access videos from 4 different perspectives in addition to the 2D measurement data and thus improve his performance with the various tools of the 2D Datarecording software.



- At the moment, the software is able to process twelve videos each from four cameras! If you want to use more cameras, please contact 2D Datarecording via our website!
- By using GoPro® MAX camera, with one camera different perspectives of one rider can be achieved, when e.g., creating multiple videos with different views from only one 360-file! **If required, please contact 2D Datarecording via our website!**

9.2 GoPro® MAX 360° Videos

In comparison to other GoPro® cameras, the GoPro® MAX is saving its 360° videos in 360-format on SD-card.

Since January 2021, the 2D GoPro® AutoSync feature is also able to handle videos in 360-format!



- Videos in 360 format can be played by the VLC player but cannot be used in any meaningful way. After editing with GoPro Player the videos are exported as mp4-files

When inserting an SD card with videos in 360 format into a computer, these videos are treated completely like mp4 files, i.e. when copying from the SD card into the video event folder (<EventDir>\Videos), GPS timestamps are also extracted and saved in *AvailableVideos.ini*. In addition, the copied 360 files are renamed according to the previously described pattern with camera serial number and time information.

Before using the 360-videos in 2D-Analyzer, the renamed 360-files must be opened and edited in GoPro® Player where the desired views can be chosen! More information about editing in GoPro® Player can be found [here](#).



- **After editing the video, the file must be exported to the video event folder (<EventDir>\Videos) with the same name as the respective 360 file was called!**

Afterwards, the mp4 file can be used like any other GoPro® video in chapter 5, but steps 1 and 2 must not be carried out.

9.3 Interpretation of the AvailableVideo.ini entries

[490577_20200407113745.MP4]	[754000_20200502133702.MP4]	[490577_20200407103406.MP4]	[490577_20200511135013.MP4]	Filename
FrameRate=119.880	FrameRate=119.880	FrameRate=119.880	FrameRate=119.880	Video-framerate
Length=9.902	Length=294.127	Length=6.807	Length=10.093	Length of video
Model=HERO8 Black	Model=HERO5 Black	Model=HERO8 Black	Model=HERO8 Black	Camera-model
Version=HD8.01.01.60.00	Version=HD5.02.02.70.00	Version=HD8.01.01.60.00	Version=HD8.01.01.60.00	Camera-firmware
Serial=C3331350490577	Serial=C3161325754000	Serial=C3331350490577	Serial=C3331350490577	Serialnumber of camera
Copy_Date_UTC=20200511	Copy_Date_UTC=20200511	Copy_Date_UTC=20200511	Copy_Date_UTC=20200511	Time when video was copied to PC
Copy_Time_UTC=13:49:53	Copy_Time_UTC=13:49:08	Copy_Time_UTC=13:50:11	Copy_Time_UTC=13:50:13	Date when video was copied to PC
GPS_SOD=41865.714	GPS_SOD=49022.140	GPS_SOD=38046.515	GPS_SOD=0	GPS-Time in SOD-format
GPS_Time=11:37:45.714	GPS_Time=13:37:02.140	GPS_Time=10:34:06.515		GPS-Time
GPS_Date=20200407	GPS_Date=20200502	GPS_Date=20200407		GPS-Date
Precision=9999	Precision=493	Precision=220		Precision-value
ExtrapolDiff=0	ExtrapolDiff=54.002	ExtrapolDiff=0		Time after precision became smaller than limit value
First latitude=49.003264	First latitude=49.003264	First latitude=49.003264		First Latitude
First longitude=8.461552	First longitude=8.461552	First longitude=8.461552		First Longitude
This combination indicates that the GPS was on (Precision entry), but the camera had no GPS reception during the whole video (Precision=9999 & ExtrapolDiff=0)	This combination indicates that the GPS was switched on (Precision entry), but the video started with bad GPS reception, which was then getting better (Precision=493) after 54.002 seconds (ExtrapolDiff=54.002)	This combination indicates that the GPS was switched on (Precision entry), the camera had good GPS reception (Precision=220) from the first sample (ExtrapolDiff=0)	This combination indicates that the camera's GPS was off (GPS_SOD=0)	Interpretation

9.4 Dashware Data overlay

The software Dashware can be used in conjunction with the 2D software to create a measurement data overlay. The recorded data is displayed during the video using various, freely configurable display options.

Due to the improved usability of the Dashware feature and the automatic synchronization of GoPro videos in the 2D software, only the channels need to be selected and a toolbar button pressed to export the measurement data. Only the part of the measurement data that actually corresponds to the video is then exported to a csv file. This csv file is then loaded together with the video in the Dashware software.



[Link to Youtube video](#)



- Detailed information about *Dashware Data overlay* can be at <http://2d-datarecording.com/downloads/manuals/>