TECH NOTE #072:: Integration of Video Signals in catman AP

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Abstract

This Tech Note explains the basics of video recording in catman AP and describes the related workflow from the configuration of the video cameras to the post processing of the recorded measurement and video data.

Picture source: Logitech.com; axis.com

Intro

In many Test & Measurement applications cameras are integrated in measurement projects beside analog and digital sensor data.

Important things to know before using the video recording functionality of catman

Before starting to work with video/audio capture, it is important to understand a few basic terms and concepts.
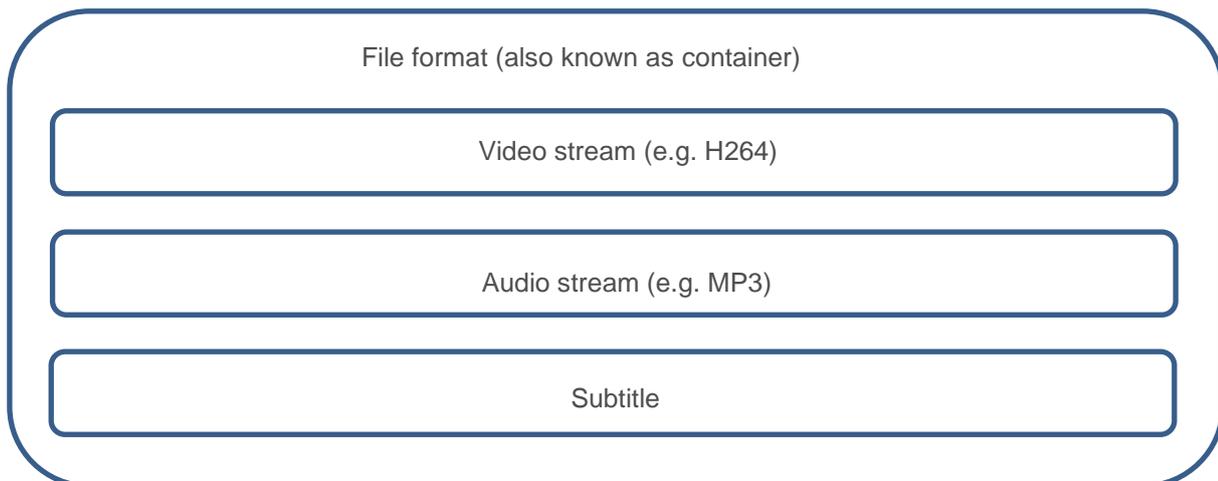
File format

The file format (also known as container) describes how the different elements of data are being stored in the multimedia file. Effectively, the container may not only have one video stream to store but can also have one or more audio streams (e.g. languages for a DVD), subtitles and so on.

There are many different containers and each has its own features: some can only store audio stream data and some do not support every video stream format, etc. The most famous containers are AVI, MKV, WAV, FLV, QuickTime and MP4, etc…

Important note: catman currently only supports the AVI file format.

Video stream

The video stream represents the video data that are stored in the container. Those data can be compressed or not. In catman, the format of the video stream depends on the selected compression. If you are not using any extra compression, then the format of the video stream will be determined by the selected hardware format (video stream format delivered by the camera). Note that the hardware format can already be a compressed video format (see the Logitech C920 which can deliver a compressed H264 video format) but is in general a raw video format (RGB24, YUV2, etc…).

Audio stream

As for the video stream, the audio stream may be compressed or not. The format of the audio stream will also depend on the compression used or on the hardware format if you don't use an extra compression.

Subtitle: catman does not store subtitles in the container.

Impact of the video/audio capture on PC performance

Capturing video streams can have a significant impact on CPU performance and disk operations. Since video capture runs in parallel to the catman data recording process, it is desirable to keep the additional load due to video capture as low as possible.

The CPU is mostly concerned with the compression of the video stream. Depending on the Codec (column "Video compression in PC" in catman), the video resolution and the frame rate (FPS), compression can use a vast amount of CPU speed. In the worst case CPU power might not be sufficient and frames will be dropped. In addition to video compression the video stream must of course be written to disk and these disk write operations may also consume a significant amount of time. Depending on resolution and frame rate, the amount of data which needs to be written can be very large. For example capturing in HD resolution (1920x1080) at 30FPS without compression would result in 186 MB/s. This makes clear why the use of compression is very important.

The following hints will help you to avoid problems caused by high video capture workload:

- Use the lowest resolution still acceptable (usually 640 x 480)
- Use the lowest frame rate acceptable (in many cases 10 fps is sufficient)
- If possible, use hardware compression on the camera itself (column "Hardware format"). Some cameras like Logitech C920 are able to deliver a compressed MJPEG or H264 stream.

Observe however that for the live display in catman the precompressed stream has to be de-compressed, which also consumes CPU power. Thus, if video throughput performance is at a premium, do not use live video displays in catman.

- Use a fast SSD disk for video storage
- Do not store video data on the same disk as is used for the catman temporary data store
- Do not use the operating system disk (usually C:/ for video storage)
- If video throughput performance is at a premium, do not use live video displays in catman
- By all means do a test capture (ribbon tab "Video") before you use the camera in a real DAQ job. This gives you a good feedback on CPU load and disk throughput and (by doing a replay) ensures that the selected encoder works with your camera.

Specifications

For the integration of video signals into the data acquisition catman AP is required. To activate the camera features launch catman and select "Options" in the startup screen. On the following screen select "General" and activate the EasyVideo option in the group "Program functions".

catman allows the integration of up to 4 video cameras. As a prerequisite, the camera must support DirectShow of Windows, i.e. there must be drivers which are compatible with WDM (Windows Driver Model) or VfW (Video for Windows). This is the case for the following cameras.

The following cameras have been tested in combination with catman:

Vendor	Type	Technology	Tested cameras	Comment
Logitech	C series	USB	C920	
Axis	All Ethernet network cameras	Ethernet	M7011, Dome Q7035-E	Installation of Axis Streaming Assistant necessary

Note: Only the camera types listed in the column "Tested cameras" have been tested. Many other types should work according to the specification but have not been tested explicitly! (Allied Vision (Ethernet, Basler (Ethernet)…)

Recommended settings in catman

Before explaining the setup parameters in detail the following table shows you a set of parameters which will usually give good results with most cameras:

Configuration option	Recommended Setting
Video compression in PC	Microsoft Windows Media Video 9
Hardware format	YUV2
File format	AVI
Resolution	640x480
Frames/s (Fps)	15

Parameters in detail:

1. Select the video camera from the dropdown list of video cameras connected to the computer. Activate the live display of the camera.

2. Select a video compression from the dropdown list of all codecs installed on the PC (recommended to reduce the video file size).

Not all codecs can be combined with all video cameras. If the live display disappears, select a different video codec. General recommendation: Windows Media Video 9 VCM (can be downloaded from http://www.microsoft.com/en-us/download/details.aspx?id=6191).

3. The hardware format determines how the camera delivers the video data. Usually this is an uncompressed format but cameras like the Logitech C920 also provide compressed formats like MJPEG or H264. If you select a compressed camera format make sure that the video compression (see preceding parameter) is set to none. Even non-compressed hardware formats like YUV2 or RGB have a slight influence on compression: YUV2 reduces the size by about 20% compared to RGB.

4. The file format (i.e. the format of the container file that contains the video stream) cannot be changed as catman only supports AVI. This is a container file format that is compatible with most video stream formats.

5. The options in the dropdown list are provided by the camera. Be aware that high resolutions may slow down the computer.
6.
7. The options in the dropdown list are provided by catman. Most USB cameras are limited to 20 or 30 fps. The fps actually provided by the camera can be determined during the following test recording. Be aware that high sample rates may slow down the computer.

Some exemplary measurement data is provided to give an impression on how to choose the resolution and frame rate of the recording. In the example, one camera is connected and the recommended "Microsoft Windows Media Video 9" codec is used for video compression.

Resolution	Fps	File size with compression	File size without compression
640x480	15	1.4 MB/min	551.0 MB/min
640x480	30	1.9 MB/min	1.0 GB/min
1280x960	7.5 (30)	2.1 MB/min	1.1 GB/min
1280x960	7.5 (15)	2.6 MB/min	1.1 GB/min
1280x960	7.5 (120)	2.5 MB/min	1.1 GB/min
1024x576	10 (15)	1.3 MB/min	696.4 MB/min

DAQ Job Configuration

Video capture is linked to a catman DAQ job or a Recorder job. In the "DAQ job configuration" window select the start mode and the stop mode of the video recording for each active video camera:
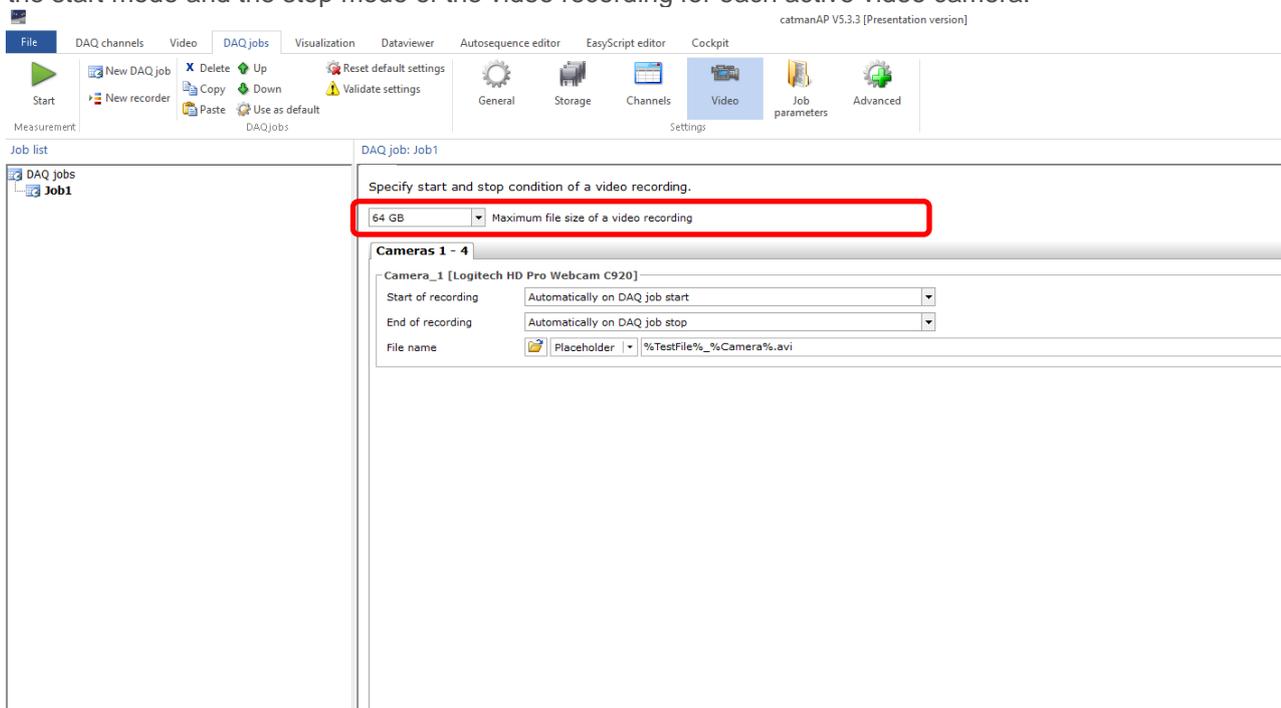
The following start modes are available:
- Automatic on DAQ job or DAQ recorder start

- Automatic on start trigger: video recording starts together with triggered data recording. This option is not available for recorders.

- By event monitoring or script: video recording starts based on its own event condition or based on a script command. This option is not available for recorders.

If necessary, modify the default name of the video file
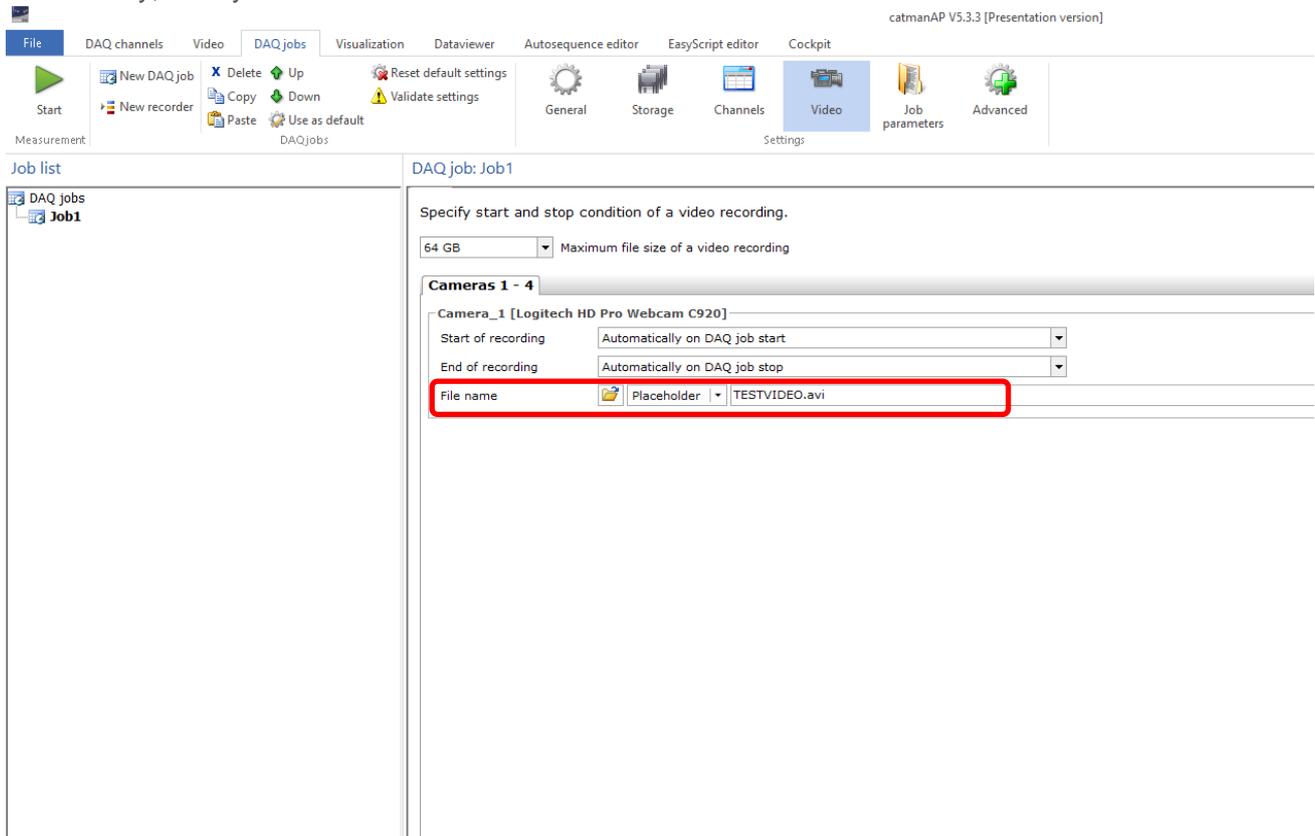
By default, the video file is stored in the same folder as the measurement data. Also, the file name is identical, except for an additional suffix "_Camera_1" and a different file extension (.avi).

To configure an event based video capture, open the "Limit values and event monitoring" in the catman channel ribbon tab. ribbon tab):
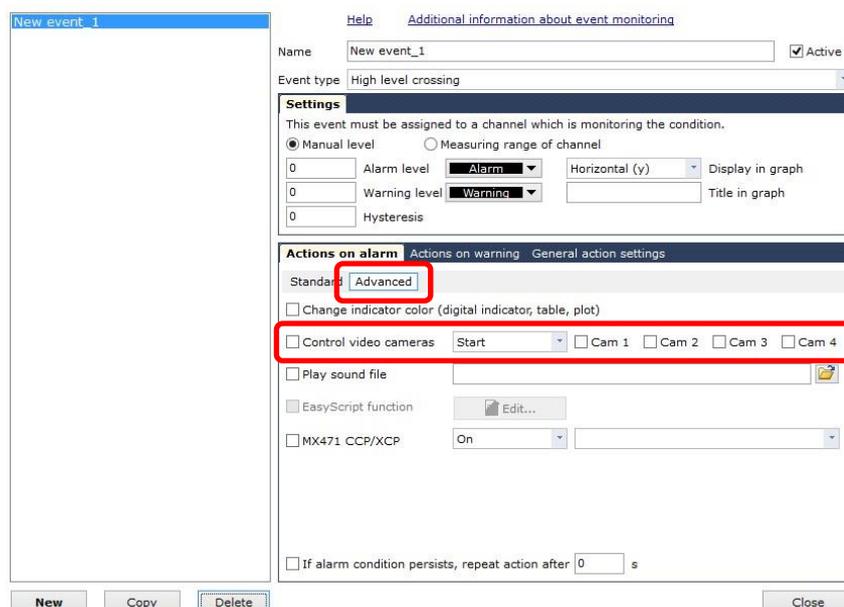
In contrast to video capture linked to a DAQ or recorder job, event based video caption also supports the capture of single still images (JPEG files).

In a next step add a Video Camera Display (one per camera) to your real-time visualization:
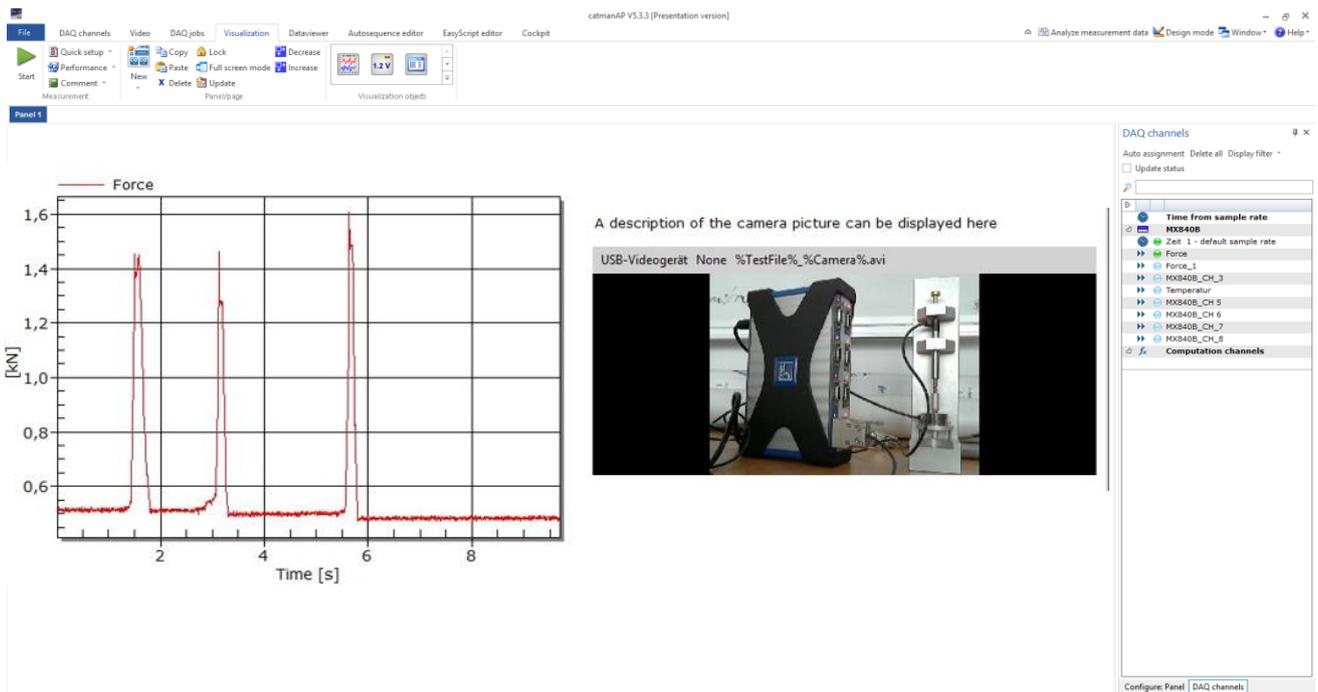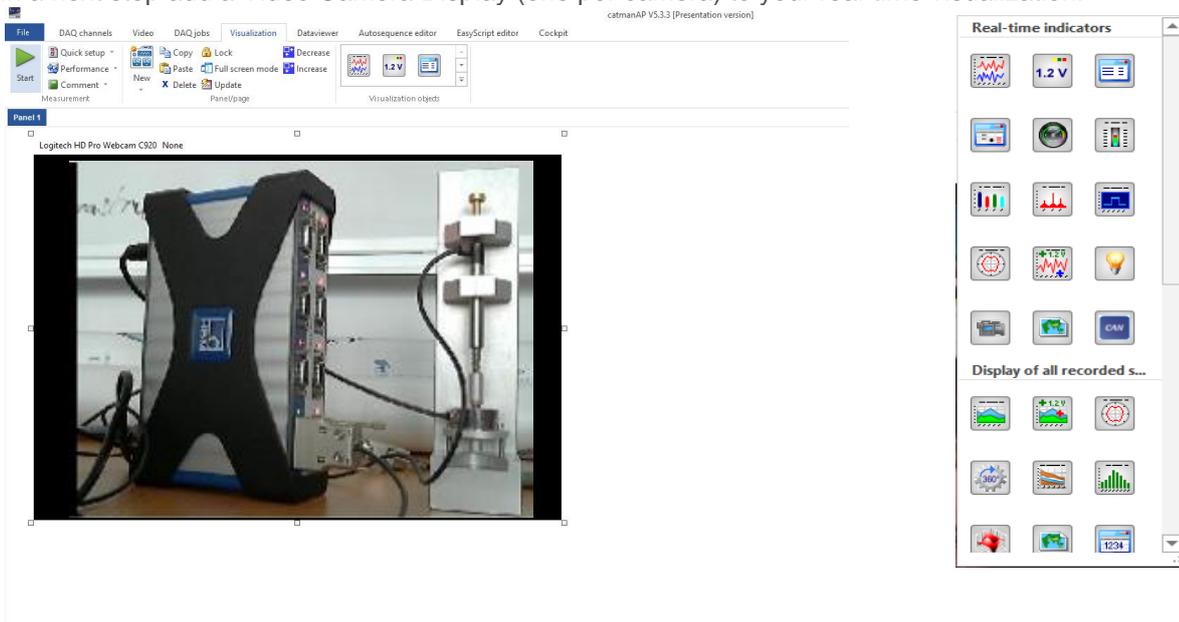
Stop the data acquisition and save the measurement data. The video data are then also saved automatically:
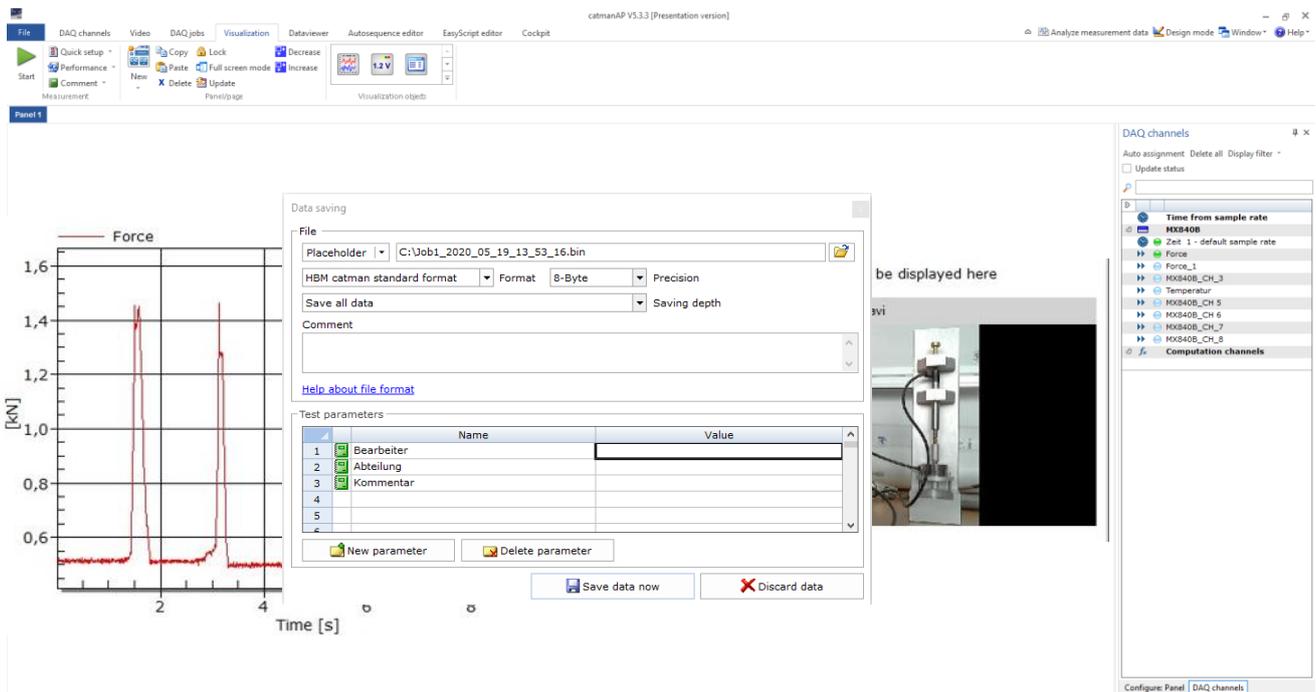
Data Review and Analysis

In the analysis mode, add the visualization object "Video playback". Open the video file from the measurement job to be analyzed by simply dragging the "Video file from camera …" test parameter from the analysis project into the video display window. Alternatively you may also browse for video files via the … button of the video player config window.
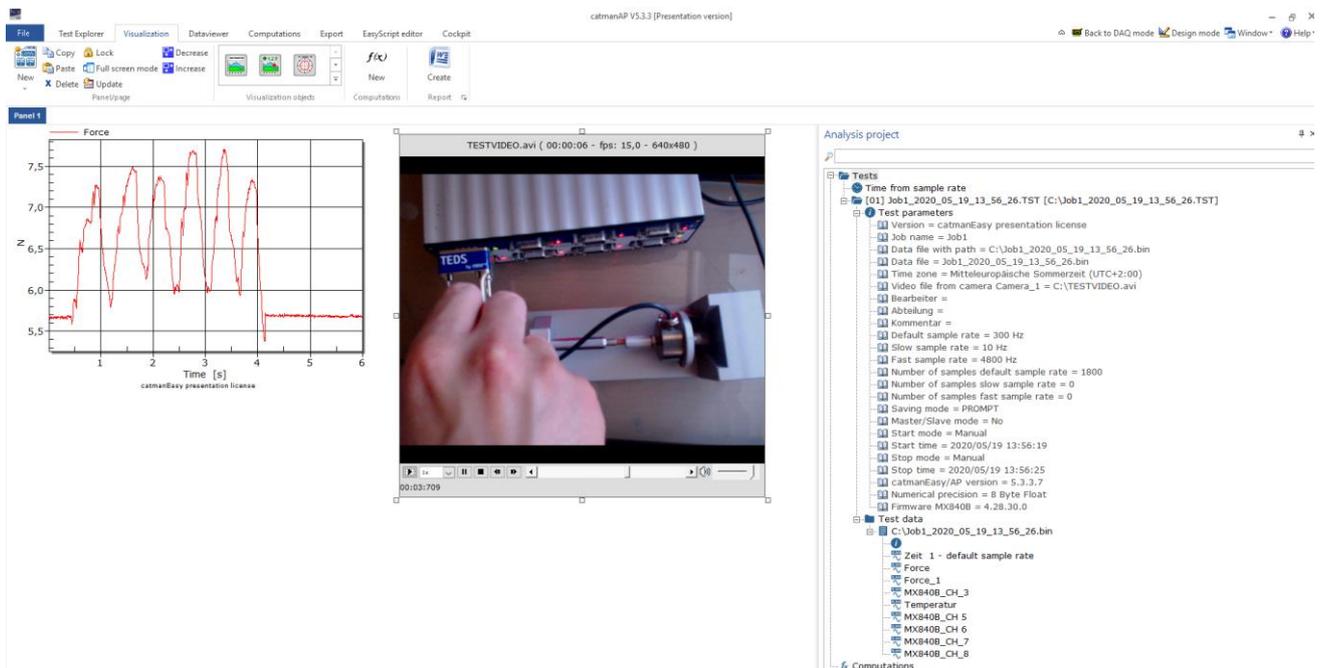
Push playback to review the video and measurement data in parallel. Select the cursor tool to synchronize the video playback with graphs or other numerical indicators.
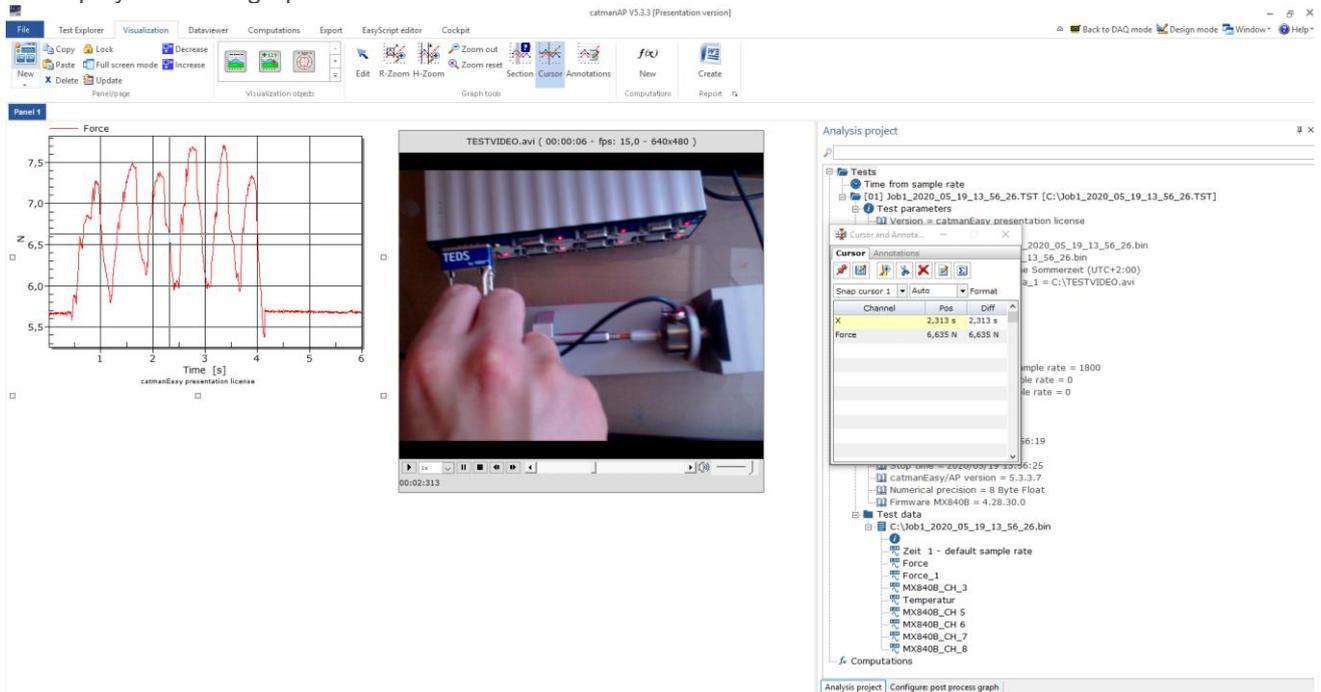
Since the video capture is not hardware-synched with the DAQ hardware you may observe a time lag when comparing the video image with the DAQ data. The "Offset" parameter in the video config dialog allows you to correct this time difference.

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