

BalanceLab 3 Camera Setup Guide



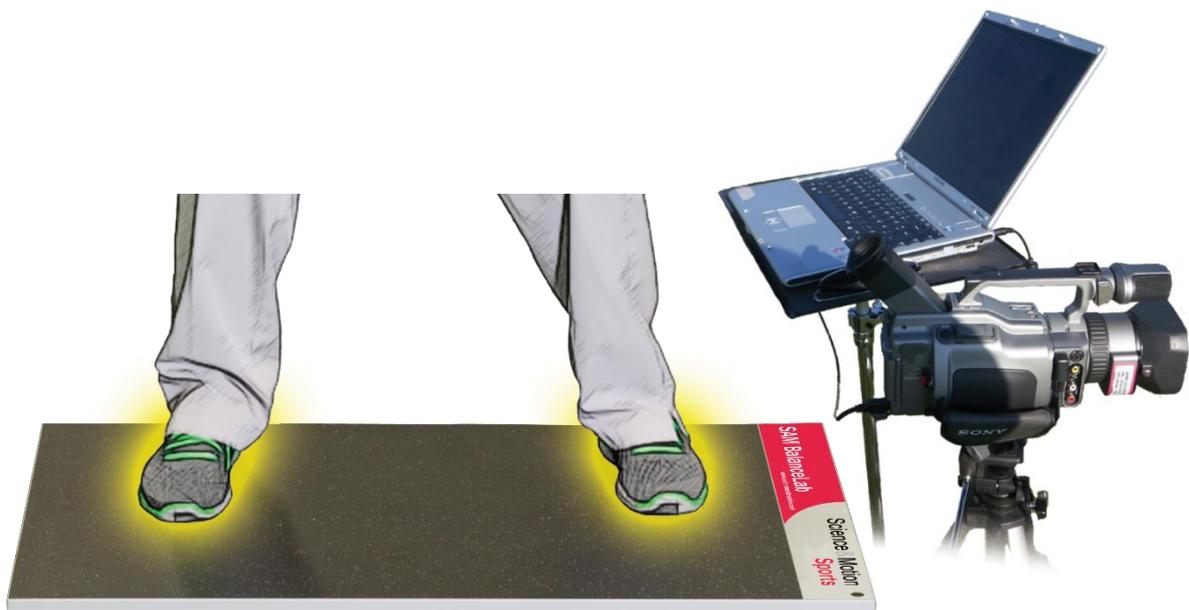
This Camera Setup Guide describes the installation and operation of a camera together with the SAM BalanceLab system.

Any camera that is Windows compatible or provides a Windows driver (Direct Show) and all IDS USB cameras can be operated with the system. The camera must be able to deliver a live stream.



Be sure to have the SAM BalanceLab 3 software installed and running before starting to connect a camera to the system!

Please follow this guide step by step to get your camera connected and record your first video with the SAM BalanceLab software.



1. Prepare Camera Installation



For the connection of your camera to the computer you will need a data link cable. Depending on your camera this can be a Firewire cable, a USB cable or a Network cable (for Gigabit-Ethernet cameras).

For Mini-DV cameras this will be a Firewire cable, for most web cameras or other cameras a USB cable.

Some industry cameras (like Basler) provide **Windows DirectShow** drivers for their Gigabit Ethernet (GIGE) cameras, so these cameras also might work with the BalanceLab 3 software.



The camera and the cables are NOT included in the SAM BalanceLab package, so be sure to have the right cable available before continuing with the installation.

Connect your camera to the PC / Laptop

Connect your camera to the computer. There are different interfaces available depending on the camera you use. The most common are:

- Firewire (also known as IEEE 1394)
- USB 2 / USB 3
- Network (Gigabit Ethernet)
- IDS camera family (can be provided by Science&Motion Sports)



Please refer to the original documentation of your camera on how to install and connect the camera to a Windows computer. The camera has to be completely installed before you can continue with the next steps!

2. Software Settings

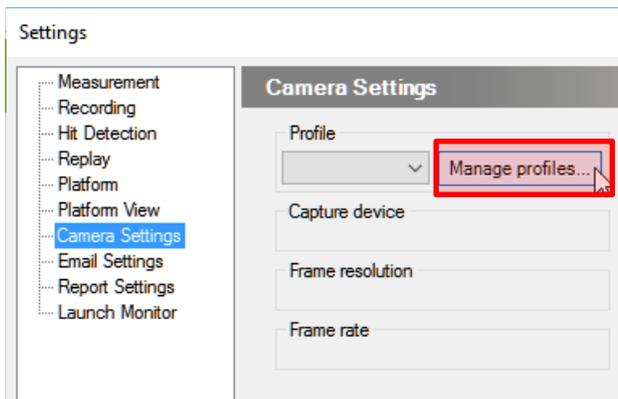


Be sure that you have installed your camera software and that the camera is connected to your computer before you start the settings process.



1. Start the SAM BalanceLab 3 software

Start "SAM BalanceLab 3" via the desktop icon which was created during the software installation. You can also start the software through the Windows start menu under "Programs" and "SAM BalanceLab 3".

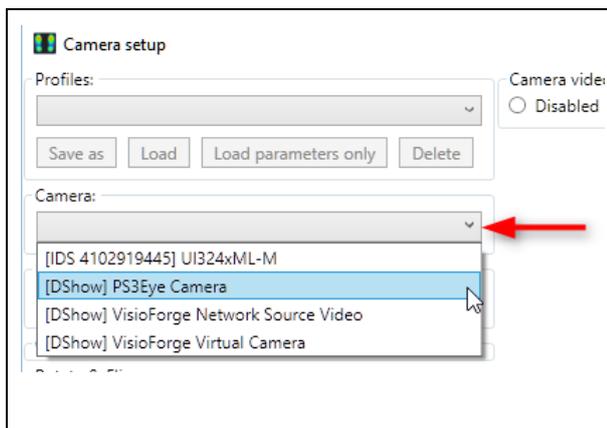


2. Camera setup

A new feature of BalanceLab 3 are camera *profiles*. A camera can be configured and settings can be stored inside a *profile*. This makes it possible to configure multiple or different cameras and then easily select one of them when a recording is done. A profile can even be loaded after a recording is started.

To configure a camera open the program settings and then select "Camera Settings". Then press the "Manage profiles..." button.

2.1 Configure a new camera



To configure a new camera select the desired camera from the list.

The list should show all cameras that are connected and have a valid Windows "Direct Show" driver. Additionally all IDS uEye cameras are listed.

Depending on the type of the connected cameras the configuration window may look different.

Software Settings

If you want to use a "IDS uEye" camera please continue reading with chapter [2.1.2](#)

If you want to use a general USB camera (Webcam or DirectShow compatible camera, no IDS uEye camera), then please continue reading here: [2.1.1](#)

2.1.1 Configuring a standard Webcam or generic DirectShow connected camera

In this example we use a Microsoft Cinema Series Webcam.

The configuration windows will look like follows:

The screenshot shows a camera configuration window with the following settings and callouts:

- Camera settings:**
 - Pixel format: YUY2
 - Resolution: 640 × 480 (Callout: Video size / resolution)
 - Frame rate:
 - Minimum: 15.000 fps
 - Maximum: 30.000 fps
 - Desired: 30.000 fps (Callout: Desired frame rate (FPS))
 - Reported: 30.000 fps
 - Exposure: 1.95 ms (Callout: Exposure time (not available for all cameras))
 - Show camera-dependent configuration dialog... (Callout: Additional settings (availability depending on camera type))
- (Note: Device-dependent configuration can not be stored in profiles.)
- Rotate & Flip:**
 - 0° (selected), 90°, 180°, 270°, H, V (Callout: Picture orientation)
- Video quality:**
 - Slider from 1% to 100% with a value of 60.00 (Callout: Video quality (compression factor, recommended: 60%))
- Time offset to force plate data (ms):** 0
- Dropped frames:** 0 fps (compression) (Callout: Number of missed frames in the last second)
- Actual frame rate achieved:** 30.057 frames per second (Callout: Real actual frame rate (if lower than desired a performance problem can be the reason))

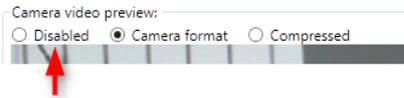
If you change values you will see the result in the live image window on the right.

Software Settings

The following table will give you detailed information on all adjustable parameters:

Parameter	Description
Pixel format	The cameras deliver the pictures in different pixel formats. If you see a live picture without errors you don't need to change anything on the default setting. If the picture looks strange you can try other pixel formats if available.
Resolution	This is the picture size of the video. For BalanceLab a medium resolution is recommended, e.g. 640x480. The higher the resolution is the more CPU performance and also disk space is needed. So please be careful with high resolution settings here.
Frame rate	Most webcams only allow framerates of 30 FPS. Some more special cameras also allow higher framerates. You can enter a higher value here and the camera will be set to the maximum framerate. At the bottom of this window you can check if the desired framerate can be achieved, please see "Actual frame rate achieved".
Exposure	If this parameter is available (depends on the camera) you can adjust the exposure time. A smaller exposure time makes your video more crisp especially for the moving club. But the lower the framerate is the more light you will need. So this parameter is very much dependent on your environment conditions.
Show camera dependent configuration	Some cameras offer additional settings like: Exposure time, gain, Color Balance, etc. The settings can only be done in a camera specific driver software, which will be opened by pressing this button. The BalanceLab software does not have direct control of these parameters, however, you can try to optimize settings here for specific cameras.
Rotate & Flip	Allows to rotate or flip the image. If the camera shows a wrong image orientation you can correct this here, e.g. switch to portrait mode from landscape.
Video quality	All pictures of the video will be compressed before saved to the disk.

Software Settings

	<p>A higher quality setting will produce bigger files. The mechanism is identical to the JPG compression. A quality level of 60% is recommended to achieve a good compression level.</p>
Time offset to force plate data (ms)	<p>This value allows to perfectly synchronize the camera and force plate data streams. Depending on the used camera model there can be a small offset. Go to "4. Synchronizing the camera..." to get a full description how to execute the synchronization.</p>
Dropped frames	<p>The number of dropped (missing) frames in the last second of recording. If this value is not zero frames are missed. This may show a problem with the camera or a problem with system or USB performance.</p>
Actual frame rate achieved	<p>This is the "real" framerate of the pictures coming in from the camera. If this value is differing from the "desired frame rate" setting by more than 2 frames permanently there is something wrong. Either frames are dropped (please check the display for the dropped frames) or there is a general performance problem. Try to lower the "desired frame rate" and check if the problem is still showing up for lower frame rates.</p>
Processor load	<p>Shows the current CPU usage. If this value is above 50% please switch off the preview live display:</p>  <p>Then check if the value is still higher than 50%. If so you may reduce frame rate or video resolution to save some CPU power.</p>

If you press the "Close" button or leave the configuration window the actual configuration will be set.

It is recommended to create profiles for all configurations that you may want to use again in future. See [chapter 2](#) to learn how to do this.

Software Settings

2.1.2 Configuring a standard Webcam or generic DirectShow connected camera

In this example we use the USB 3.0 camera IDS UI-3240 LE.

The configuration windows will look like follows:

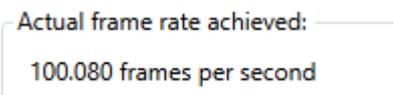
The screenshot shows a camera configuration window with various settings and callouts:

- Pixel format:** BGR8Packed (Image format delivered by camera)
- Binning:** 1 (Factor to skip lines in the video)
- Cropped width:** 800 (Width / height of the video in pixels)
- Cropped height:** 600 (Width / height of the video in pixels)
- Pixel clock:** 7 MHz to 86 MHz, currently 84.00 (Transfer bandwidth, is limited by USB connection speed)
- Frame rate:** Minimum: 0.953 fps, Maximum: 100.084 fps, Desired: 100.084 fps (Desired frame rate (fps))
- Exposure:** 0.01 ms to 9.98 ms, currently 0.04 (Exposure time in ms)
- Capture buffer:** 2 frames to 100 frames, currently 10
- Gain:** 0 % to 100 %, currently 100 (Camera gain to increase brightness)
- Auto gain:** Enabled (Auto gain settings to auto-adjust brightness to environment)
- Analog gain boost:** Enabled
- Rotate & Flip:** 0° 90° 180° 270° H V (Rotate / flip image for Portrait or landscape mode)
- Video quality:** 1 % to 100 %, currently 60.00 (Compression quality (JPEG factor))
- Time offset to force plate data (ms):** 0
- Dropped frames:** 0 fps (capturing) 0 fps (compression) (Number of lost frames in the last second)
- Actual frame rate achieved:** 100.084 frames per second (Real actual framerate – if lower than desired a performance problem can be the reason)
- Processor load:** 15 %
- Close** button

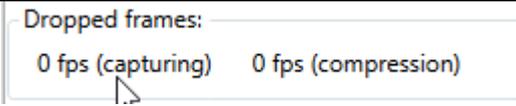
If you change values you will see the result in the live image window on the right.

Software Settings

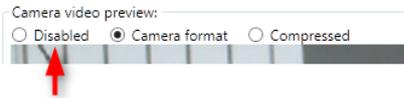
The following table will give you detailed information on all adjustable parameters:

Parameter	Description
Pixel format	<p>The cameras deliver the pictures in different pixel formats. If you see a live picture without errors you don't need to change anything on the default setting.</p> <p>For a grey camera you should select "Mono8".</p> <p>For color camera setting should be "BGR8Packed".</p>
Binning	<p>Binning factor removes rows and columns from the camera picture without changing the view.</p> <p>For a binning of 1 all lines of the camera will be used, for a binning of 2 every second line will be skipped. So the vertical and horizontal resolution will be half of what is defined under "Resolution". This makes sense if you have performance problems or want smaller video files.</p>
Resolution	<p>This is the picture size of the video. For BalanceLab a medium resolution is recommended, e.g. 640x480.</p> <p>The higher the resolution is the more CPU performance and also disk space is needed. So please be careful with high resolution settings here. A double resolution will increase storage size of the picture by 400%.</p>
Frame rate	<p>The maximum frame rate you can achieve with IDS cameras is dependent on the camera model and the USB connection speed.</p> <p>If you want to check out the maximum framerate you can achieve for a given resolution do the following:</p> <ol style="list-style-type: none">increase the Pixel Clock value to max. valueyou will then see a maximum framerate displayed in the "Frame rate" box. Set the value in the "Desired" field to this maximum value (or higher) and press "Apply"now check the value at the bottom of the window for "Actual frame rate achieved". This will show you the real frame rate in live mode: if this value is ok also check for dropped frames:

Software Settings

	 <p>This value should be 0 for both capturing and compression. If it is not 0 frames are lost due to performance problems. Please refer to the "Dropped Frames" section below in this table for possible solutions.</p>
Exposure	<p>This parameter allows to set the exposure time for the camera. A smaller exposure time makes your video more crisp especially for the moving club. The downside of a small exposure time is that you will need more light. So you need to play with the values for exposure time and camera gain (see below) to find a good setting for your environment.</p> <div style="background-color: #f0f0f0; padding: 5px; border: 1px solid #ccc;">  <p>The Iris setting on the optics will also have a big influence on brightness and depth of field of the pictures.</p> </div>
Capture buffer	<p>Number of frames buffered by the computer. If there is a performance problem (dropped frames) you can try to increase this value. Normally it should be left on the default value of 10.</p>
Gain / Auto gain / gain boost	<p>The camera gain will increase the brightness of the pictures. This can be helpful for low light conditions or if you want to achieve a low exposure time to get more crisp pictures for moving objects. Increased gain will lead to more pixel noise in the pictures, but this may be more acceptable than pictures that are too dark or blurry. Best way to find a good compromise between all settings is to play with the gain/auto gain/gain boost in combination with exposure settings until you get a satisfactory picture.</p> <div style="background-color: #f0f0f0; padding: 5px; border: 1px solid #ccc;">  <p>The Iris setting on the optics will also have a big influence on brightness and depth of field of the pictures.</p> </div>
Rotate & Flip	<p>Allows to rotate or flip the image. If the camera shows a wrong image orientation you can correct this here, e.g. switch to portrait mode from landscape.</p>
Video quality	<p>All pictures of the video will be compressed before saved to the disk.</p>

Software Settings

	A higher quality setting will produce bigger files. The mechanism is identical to the JPG compression. A quality level of 50-60% is recommended to achieve a good compression level.
Time offset to force plate data (ms)	This value allows to perfectly synchronize the camera and force plate data streams. Depending on the used camera model there can be a small offset. Go to " 4. Synchronizing the camera... " to get a full description how to execute the synchronization.
Dropped frames	The number of dropped (missing) frames in the last second of recording. If this value is not zero frames are missed. This may show a problem with the camera or a problem with system or USB performance.
Actual frame rate achieved	This is the "real" framerate of the pictures coming in from the camera. If this value is differing from the "desired frame rate" setting by more than 2 frames permanently there is something wrong. Either frames are dropped (please check the display for the dropped frames) or there is a general performance problem. Try to lower the "desired frame rate" and check if the problem is still showing up for lower frame rates.
Processor load	Shows the current CPU usage. If this value is above 50% please switch off the preview live display:  Then check if the value is still higher than 50%. If so you may reduce frame rate or video resolution to save some CPU power.

If you press the "Close" button or leave the configuration window the actual configuration will be set.

It is recommended to create and save profiles for all configurations that you may want to use again in future. Go to [chapter 3](#) to learn how to do this.

3. Saving camera settings to Profiles or exporting to files

There are two ways to save specific camera settings for later use.

a) Profiles

This are complete parameter sets for a specific camera. They only can be used for this unique camera that is connected during configuration.

Basically this is the way to store configuration sets for a specific camera.

Multiple profiles allow to easily switch between different parameter sets, e.g. one for indoor use and one for outdoor.



A profile will load the camera and also the settings.

Camera setup

Profiles:

The screenshot shows a software interface titled 'Camera setup'. Under the 'Profiles:' label, there is a text input field. Below the input field are four buttons: 'Save as', 'Load', 'Load parameters only', and 'Delete'. A red arrow points to the 'Save as' button.

To save the current configuration set into a profile press the "Save as" button in the "Profiles" section.

You will be asked for a name for the new profile, please choose a name that includes the camera model and a short description of the main properties.

E.g. "IDS-cam1-medium resolution-high gain" or "IDS-cam2-highres-outdoors".

To load a profile press the "Load" button and select the desired profile from the list.

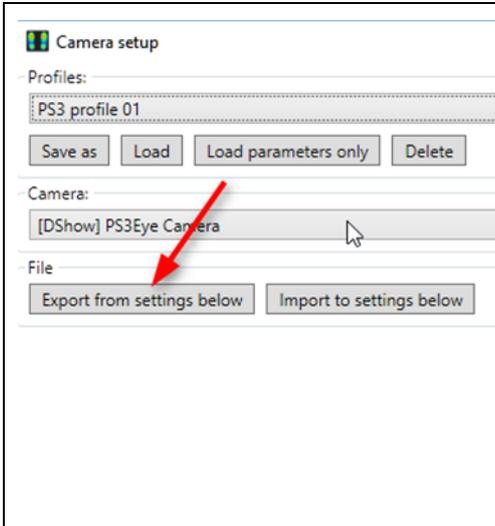
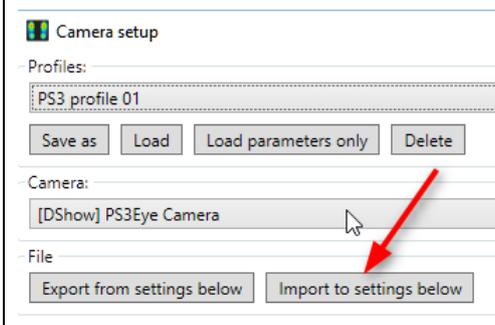


You can also load camera profiles when you are in the recording window.

You have the option to load all available profiles to quickly switch between different pre-configured cameras or settings.

The camera that is linked to the profile must be connected, otherwise the profile cannot be loaded.

b) Export of parameters to file

 <p>The screenshot shows the 'Camera setup' window. Under the 'Profiles' section, 'PS3 profile 01' is selected. Below that are buttons for 'Save as', 'Load', 'Load parameters only', and 'Delete'. Under the 'Camera' section, '[DShow] PS3Eye Camera' is selected. Under the 'File' section, the 'Export from settings below' button is highlighted with a red arrow pointing to it.</p>	<p>These export files are not exclusive for a specific camera.</p> <p>Example: You have multiple cameras of same type and want to transfer a configuration from one camera to another.</p> <p>This can be done by pressing the button "Export from settings below".</p> <p>All current settings will be saved to a file. It is helpful to use a meaningful name.</p> <p>If you want to transfer the settings to another camera then:</p> <p>a) select the other camera</p>
 <p>The screenshot shows the 'Camera setup' window. Under the 'Profiles' section, 'PS3 profile 01' is selected. Below that are buttons for 'Save as', 'Load', 'Load parameters only', and 'Delete'. Under the 'Camera' section, '[DShow] PS3Eye Camera' is selected. Under the 'File' section, the 'Import to settings below' button is highlighted with a red arrow pointing to it.</p>	<p>b) press the button "Import to settings below"</p> <p>Select the file you want to load.</p> <p>c) Check the settings and if everything is OK then save the current configuration to a new profile for this camera.</p> <p>The profile will then be available to use in the recording screen.</p>

4. Synchronizing the camera with the pressure plate data

For each camera model it is necessary to synchronize the video to the recorded pressure data. A full golf swing is a very fast movement and it is very important to have synchronized data, otherwise you may see the moment of impact in the video, but the pressure data has an offset of some milliseconds and does not exactly belong to this time.

In worst case this could lead to wrong readings of data.

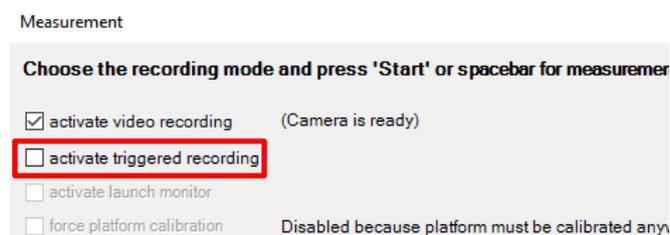
To synchronize video and pressure data you need to do a recording where an event is visible in both the video and the pressure data.

As an example this can be:

- a) standing on the pressure plate with one foot only and then shortly push down the second foot.
- b) take a golf club and hold it above the surface with the grip side down. While the recording is running, shortly push the club down and hit the surface of the plate with the grip end.

The video camera has to be placed in a way that you can exactly identify the moment when the objects (foot or club) hit the surface. This has to be clearly visible in the video.

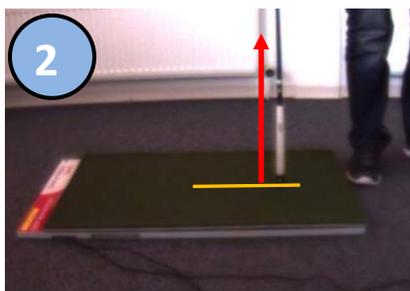
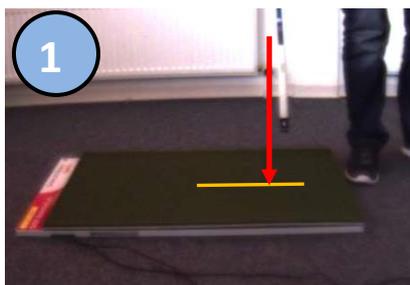
Following is a step by step description of the complete synchronizing process.



1. Start a measurement in the BalanceLab software. Be sure to uncheck the "activate triggered recording" box in the startup window.

2. Adjust the camera so that the BalanceLab surface is visible in the view.
3. Take a golf club and hold it upside down with grip showing to the ground.
4. Start recording.

Synchronizing the camera with the pressure plate data

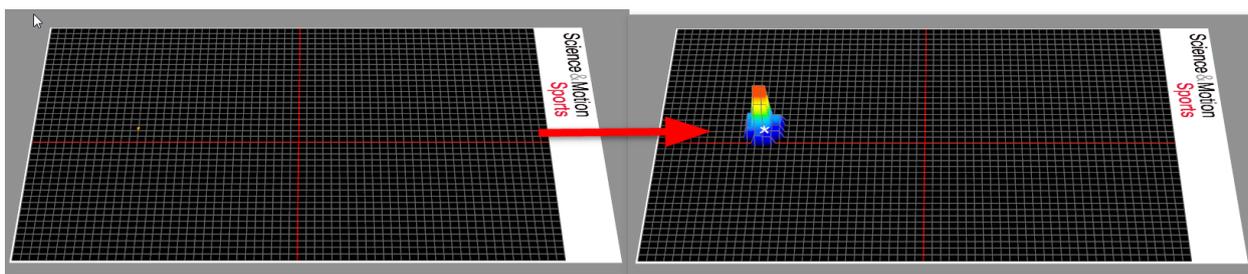


5. During the recording is running push down the club shortly to the BalanceLab surface and directly pull it up again (see pictures on the left).
6. Save the recording and close the measurement screen.

7. Open the recording in the Replay

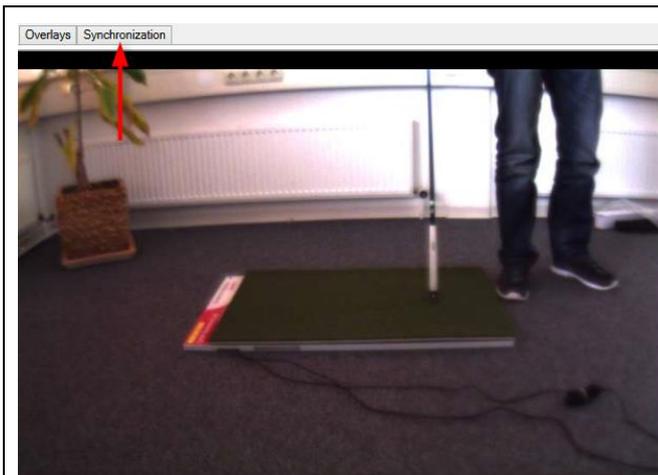
8. Navigate forward to the position where the contact is visible for the first time.

Confirm this by going back and forth step by step and stay on the first position where the contact appears.



Stay on this position.

Synchronizing the camera with the pressure plate data



9. In the video window press on the button "Synchronization":



10. Use the arrow button left of the navigation slider to go back some frames in the video until the golf club is up in the air before touching the surface.



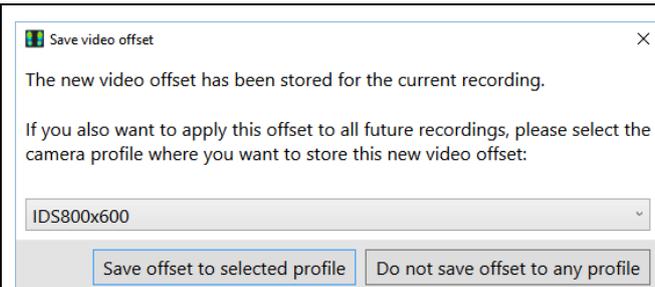
Please note: You need to use the mouse and click on the arrow buttons. Do not use the arrow keys of the keyboard!
This navigation only happens in the video, the position in the pressure display will not change.

11. Now click on the arrow button right of the navigation bar to move forward step by step in the video. Do this until you see the first frame where the club touches the surface.
Stay on this frame.



12. Now you see the offset between force data and video data in milliseconds.

Synchronizing the camera with the pressure plate data



13. If everything looks fine save this offset setting by clicking the "Save new offset" button.

Now the video offset is set for the current record. If you also want to use this offset for all future recordings with the same camera profile then press the "Save offset to selected profile".

If you only want to set the offset for the actual record then press "Do not save offset to any profile".



To be sure that the data is synchronised it is recommended to repeat the process of detecting the offset.

The offset should be in range of one video image, for a normal camera this would be If you change your video equipment you have to repeat the complete offset correction process! The settings are only valid for the camera used during this correction process.