ERGONEERS
FROM SCIENCE TO INNOVATION

HOW TO…

CREATE A GAZE VECTOR WITH A DIKABLIS EYE TRACKER IN QTM?

Last Modified: 11/2017

SUMMARY

The data of Motion Capture Systems can be enriched by adding a gaze vector to the head segments of a moving body to follow the gaze of the subject, while it is performing tasks, like arranging objects or doing sports.

EQUIPMENT

Hardware Requirements

Motion capture with Oqus cams	Eye Tracking with Dikablis	Other
MoCap Laptop	D-Lab Laptop	Network Switch for LAN connection
3 Qualisys Cameras (Oqus or Miqus)	Dikablis Eye Tracker	2 network cables
Calibration kit (T-Wand & L-Frame)	Dikablis USB Cable	
Network / Power Cables for the single cameras	Power Supply	
Network Cable to connect Cam 1 to switch		
Power supply for Cameras		
Min. 5 Qualisys Markers		

You can find more specifications on hardware requirements for the D-Lab Laptop here. Please contact Support@qualisys.com for more details on the Qualisys requirements to hardware.

Software Requirements

D-Lab 3.45 with Eye Tracking Head Mounted license. Download the latest D-Lab version.

Qualisys Track Manager (Min. QTM 2.14) including Eye-Tracker Plugin. QTM requires a valid license key. To check your actual license in QTM, go to Help → About Qualisys Track Manage and click on licenses.

HARDWARE SETUP

In case you are an experienced user of QTM and Qualisys you can set up and calibrate the Camera System like usual or refer to QTM Manuel – System Hardware for setting up Miqus Cameras. Afterwards go on with #Step 2 and concentrate on steps with 👁. They are related to the Eye Tracking.

#Step 1: Cabling for Oqus Camera System

Install the Opus cameras in a half circle facing a volume. Connect the first camera with one of the associated double-cables to the second camera. Repeat this for the second to the third and so on until all cameras are connected in a chain. Please refer to the QTM-Manual or to the Qualisys Support for detailed information.
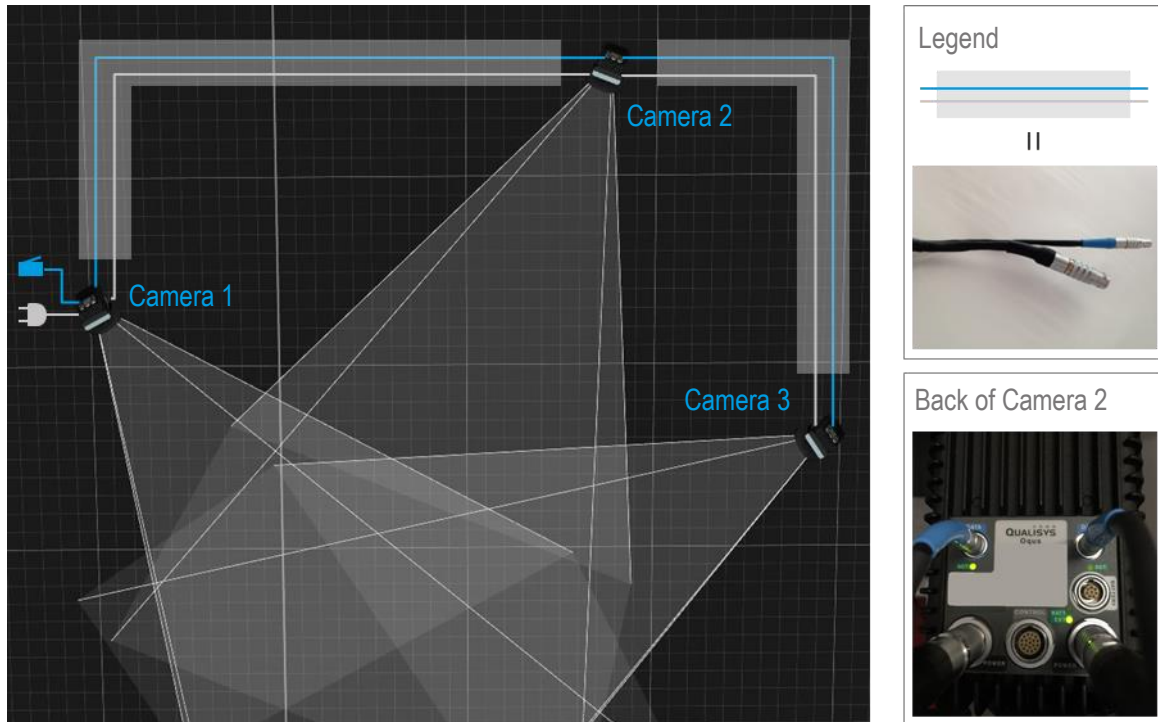

Connect Camera 1 and both laptops to the Network Switch. Use the Qualisys Network-Cable to connect the first camera to the switch. Use common network cables to connect the two laptops to the switch.

#Step 2: Connect Dikablis Eye Tracker 👁

Option 1: Connect the cable bounded Dikablis Eye Tracker. First connect the Dikablis Eye Tracker to the Laptop via USB Cable. Afterwards connect the Power Supply to the Connector Box. The eye data of Dikablis left eye camera is transmitted to QTM via network connection.
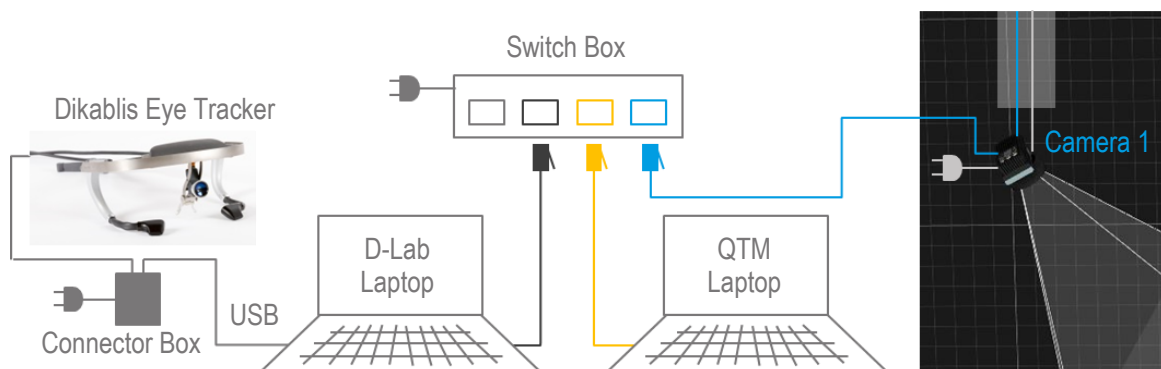
Option 2: Set up the Dikablis Professional Wireless. Prepare the backpack according to the Dikablis Professional Wireless Quick Start Guide and set up the D-Link router. The eye data of Dikablis left eye camera is transmitted to the D-Lab Laptop via Wi-Fi and is forwarded to QTM via network connection.
NOTE: Make sure you connect the Dikablis Eye Tracker to battery after starting D-Lab Mini.
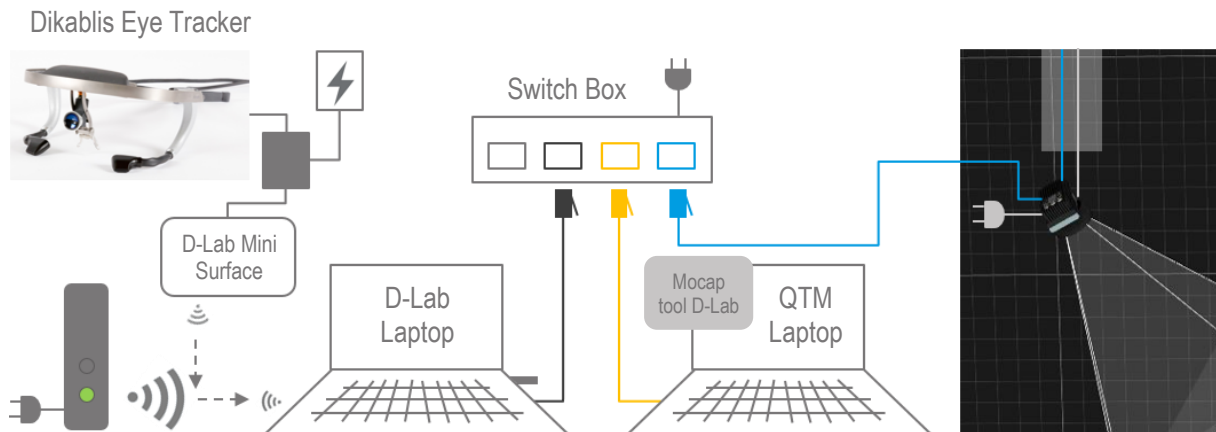
#Step 3: Enable the devices to communicate ⊚

Set IP addresses for LAN adapter. Set the computers to the following static IP address to connect them in a Local area Network (Microsoft help). Do not change the IP address of the tablet or any Wi-Fi adapter.

- E.g. D-Lab Laptop IP: **192.168.10.80** (Submask: 255.255.255.128)
- QTM Laptop IP: **192.168.10.1** (Default if using Qualisys DHCP Server)

Turn of Windows firewall. To learn more about how to deactivate the Windows firewall follow this link.

Deactivate Anti-Virus Software. How to deactivate an Anti-Virus Software depends on the manufacturer. Please refer to their websites or manuals.

Test communication with ping. Open Command Prompt and type the command "ping" followed by the IP address of the other laptop.

#Step 4: Prepare the Dikablis Head unit with Markers ⊚

Attach Markers. In order to define the Dikablis Eye Tracker as a Rigid Body that can be tracked in QTM, you have to attach at least four reflective Qualisys Markers to the Frame of the Dikablis Eye Tracker. NOTE: Make sure the Markers do NOT form a symmetric object.
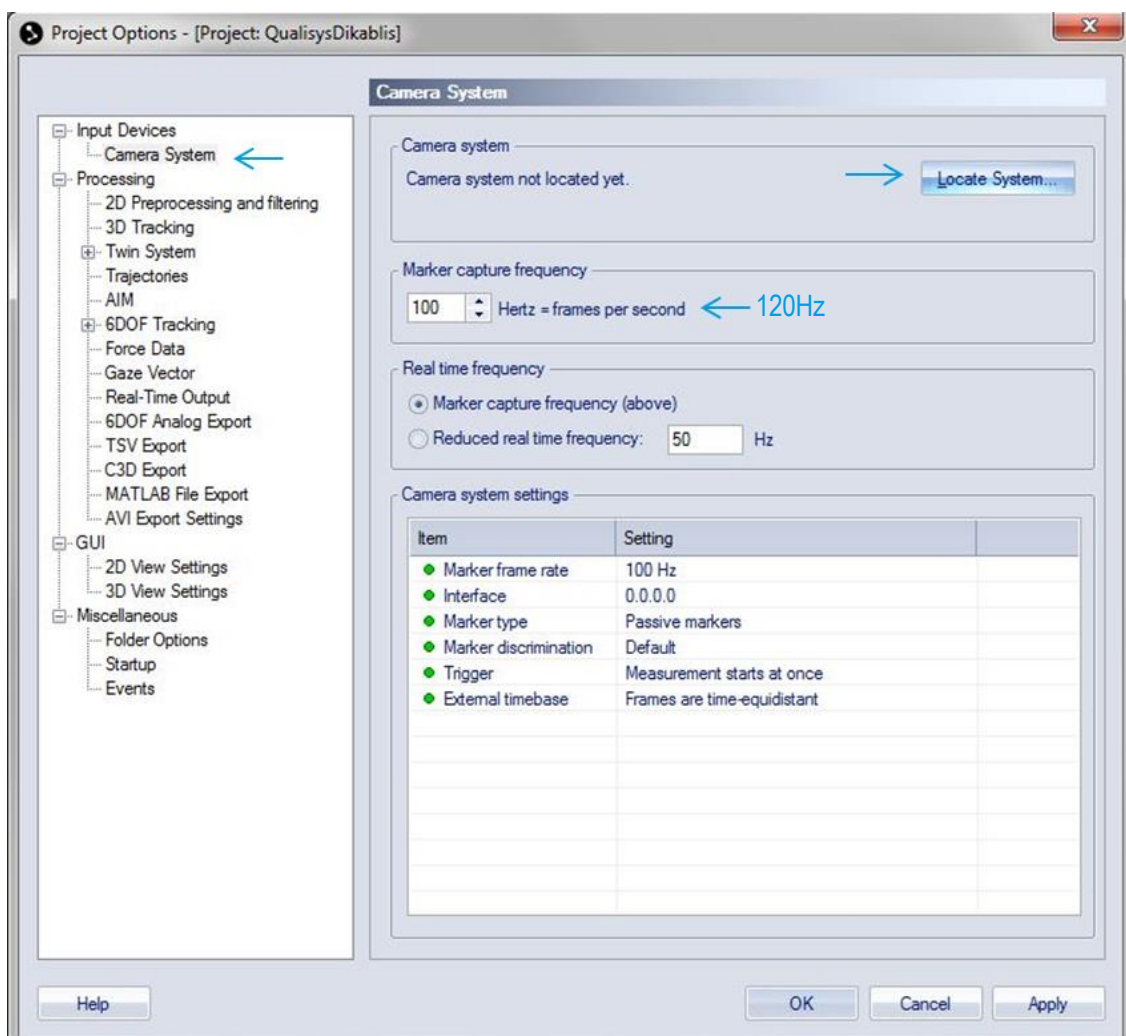
CALIBRATE CAMERA SYSTEM IN QTM

Please be aware, that this is just a short description how to proceed to test the Dikablis Eye-Tracker in QTM. The following description does not replace the Qualisys Manual in any way. For detailed information regarding the Setup of the Qualisys system, please refer to the QTM Manual or to the Qualisys Support.

#Step 5: Camera Location and Settings

Start Qualisys DHCP Server. Follow the wizard to connect the cameras to the QTM Laptop and establish a Local Area Network. NOTE: If the cameras have already been connected to the QTM Laptop, DHCP Server will not start again.

Open QTM. Create a new project and give it a name.

Locate cameras. Go to the Project Options by clicking ⚙ in the toolbar or via the menu Tools. Select Input Devices → Camera System and click Locate System. Change Marker Capture Frequency to 120Hz.

Choose Calibration Type. Go to Input Devices → Camera System → Calibration in the Project options and select the type of your wand kit. Insert the exact wand length (mm). You will find the exact wand length in your Wand kit. For the 300mm kit it is 299.3mm. Confirm with Apply and OK.
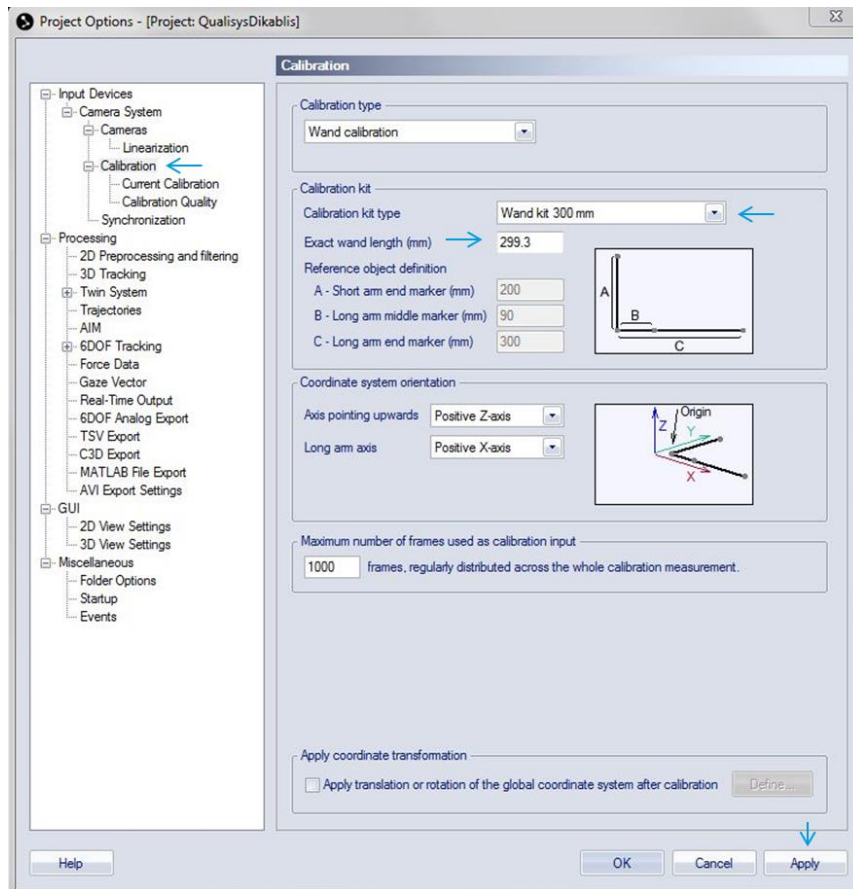
#Step 6: Adjust Camera Position

Place L-Frame in volume. To define the camera position, place the L-Frame in the volume.

Open a New File ▯ **.** Check in 2D view if all four markers of the L-Frame are visible in each camera. Adjust angle of cameras, focus and aperture so the markers are bright and in focus.
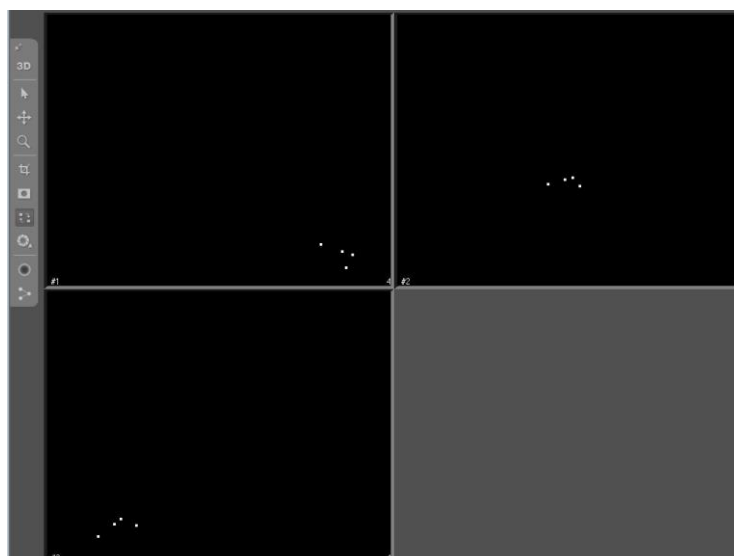
#Step 7: Calibrate camera system using the Wand

Mask disturbing reflections (optional). Before calibration use the Marker Mask Tool ⬜ in the vertical toolbar to mask reflections. For a good calibration, only the four markers of the L-Frame should be visible as bright dots in the 2D View.

Start Calibration process. Click on Calibrate ⬛ in the top toolbar and choose a calibration time between 10 and 20s and optional a delay time until the calibration starts.
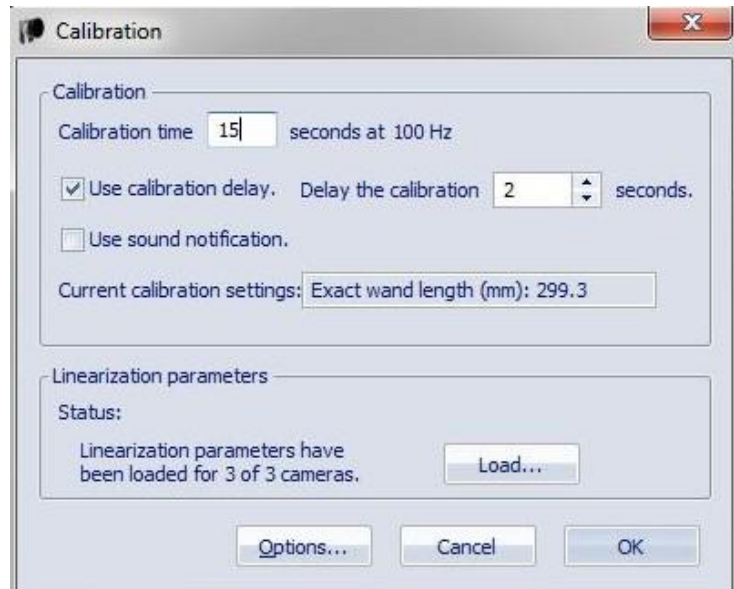
Move Wand in volume. Click OK and move the Wand through the Tracking Volume in all three directions in space.

Review calibration results. Recommended Values are >1000 points per camera, Avg. residual ~ 1mm and standard deviation of wand length ~1mm. Confirm the calibration if it is sufficient or do another calibration. After a successful calibration, the Icon on the right bottom turns green ⬛ and the screen turns blank.

Change to 3D view. Open a New File and change to 3D view (vertical toolbar). The markers of the L-Frame will appear as red dots in a coordinate System.

CONNECT D-LAB AND QTM 👁

#Step 8: D-Lab Settings 👁

Start D-Lab Mini in case you use Dikablis Professional Wireless. Connect Dikablis to battery and press the button on the battery.
NOTE: Make sure the Tablet and the D-Lab Laptop are connected to Dikablis-Wireless Network.

Start D-Lab. Click on ⬛ to open D-Lab and create a project.
NOTE: Make sure to plug in the Dongle with your license. The connected Dikablis Eye Tracker shows up automatically in the Recording Device Window.

Open a Relay. Go to the Screen Layout Tab and click on 📡 to open a Relay-Window. An empty Relay opens in the visualization area of D-Lab. It transmits chosen data to the network via TCP/IP.

Insert Eye Tracking Data to Relay. Drag and drop the whole Dikablis Professional Eye Tracker from the Recording Device Window to the relay.

Adjust settings of Relay. Open the setting of the relay with the small arrow on the lower left corner of Relay visualization and choose the IP of the D-Lab Laptop (192.168.10.100) and note the Port-Number (default: 9015).
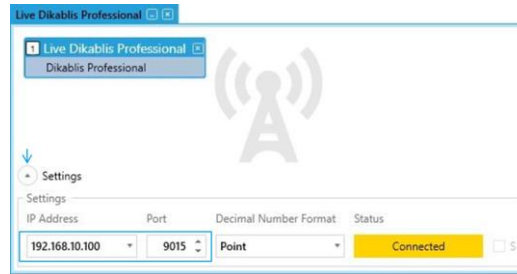
#Step 9: D-Lab Mocap Tool settings 👁

Copy D-Lab Mocap Tool from the D-Lab directory on D-Lab PC to QTM laptop. Copy C:\Program\D-Lab\D-Lab.Mocap.exe and C:\Programme\D-Lab\D-Lab.Mocap.exe.config to a folder on the QTM laptop.

Adjust sending frequency of D-Lab Mocap Tool. Go to the D-Lab directory (default: C:\Program\D-Lab\Mocap Tool), open „D-Lab.Mocap.exe.config" with an editor (e.g. Notepad++) and change the number in line 29 to the frequency you need. In case there is more than one open relay, also change the D-Lab Port written in Relay. Save the file.

Recommended frequencies depending on Dikablis Version:

- **Dikablis Professional Cable:**   60Hz
- **Dikablis Professional Wireless:** 30Hz
- **Dikablis Essential:**   50Hz

NOTE: Cameras configuration of Dikablis Essential should be 50Hz which is the default setting. Please check this with Camlab Application if this configuration has been changed.

Start „D-Lab.Mocap.exe" as <u>administrator</u>. After starting the .exe, a small window displays the settings in the configuration file. Check if they fit to your equipment.

NOTE: Do **NOT** close this window but minimize it. If you close this window no data transmission will be possible.
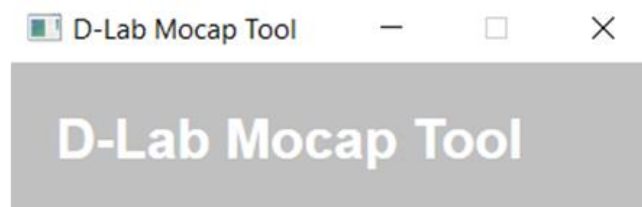
#Step 10: Add Dikablis Eye Tracker Device in QTM 👁

Add an Input Device. Go back to the QTM-Computer. Open the Project Options → Input Device and click Add Device and select the Dikablis Eye Tracker. The Eye Tracker will appear in the List. Mark the Dikablis Device and it shows up in the Index. Please note, that this step only can be executed if you have a license for the QTM Eye-Tracking-Plugin. Please refer to Qualisys to obtain this license.
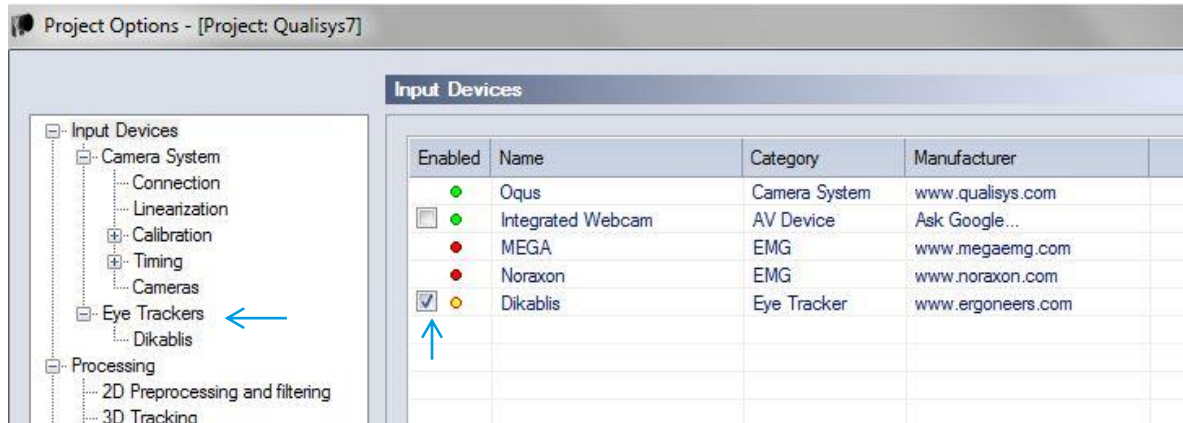
Set up connection to D-Lab. Select Dikablis in the Index. Insert the Mocap IP-Address which is shown in the D-Lab Mocap Tool Relay (e.g. 192.168.10.1 and the Port 2001). NOTE: The IP address and port are very likely different then in the example.

Test the connection. Press the Test connection in QTM and confirm with OK if D-Lab streams Data at 60/50/30Hz.
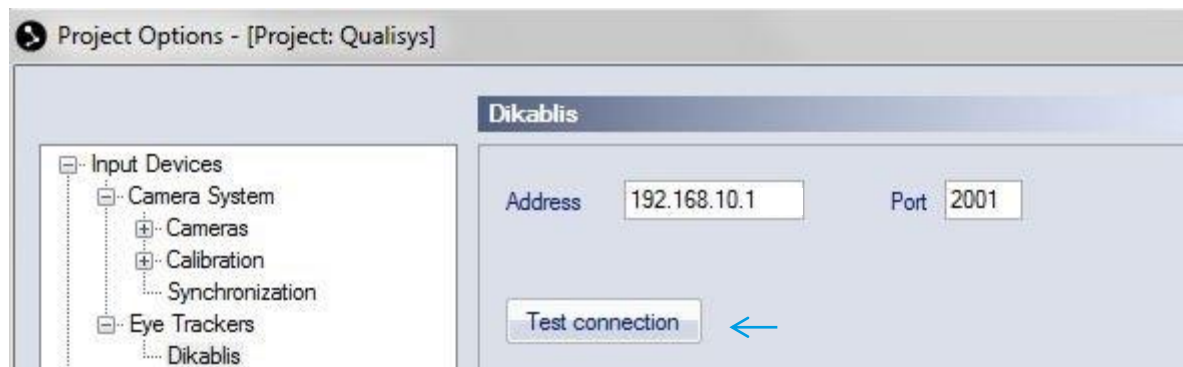
### #Step 11: Acquire a Rigid Body for the Eye Tracker in QTM 👁

🎓 ADVANCED USERS: Please stick to this method to define the Dikablis Eye Tracker as rigid body. If you like to define a 6DoF Body with a capture, you should do this before adding the new Input Device Dikablis Eye Tracker. Otherwise you might face connection problems.

Place Dikablis Eye Tracker in Volume. Each marker should be visible by at least two cameras. They should be securely fixed in position, so the shape they form will not change with movements of the head during measurement. This is important to guarantee constant rigid body tracking.

Open a New File 📄 .

Enable Calculation of 6DOF and Gaze Vector. Go to the Project Options → Processing and check the options Calculate 6DOF and Calculate Gaze Vector.
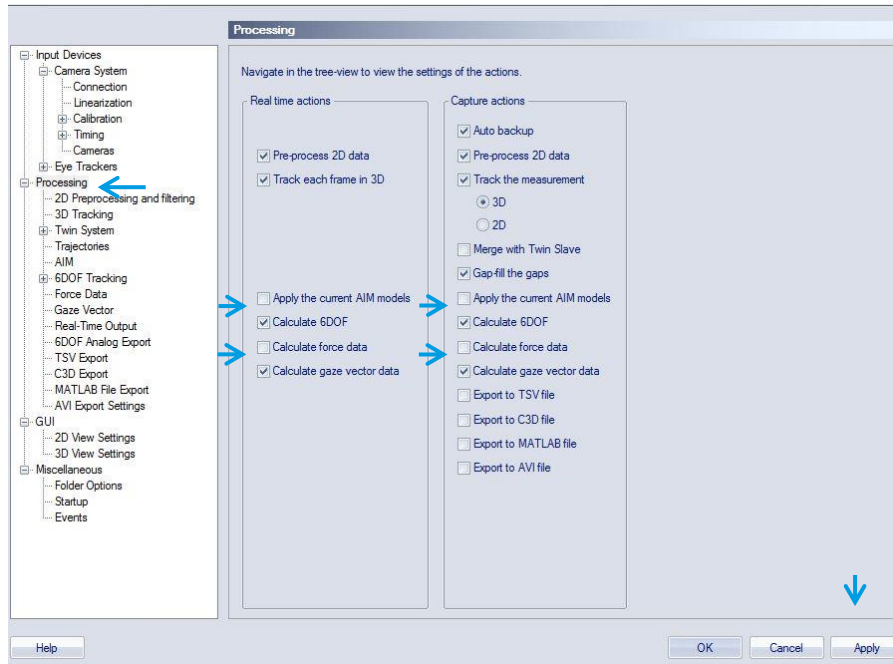

Acquire a Rigid Body. To calculate the Rigid Body go to Project Options → Processing → 6DOF Tracking and click Acquire Body. Label it for example with Head. NOTE: Make sure a new file is still open and the Dikablis Eye Tracker with Markers is visible in the cameras.
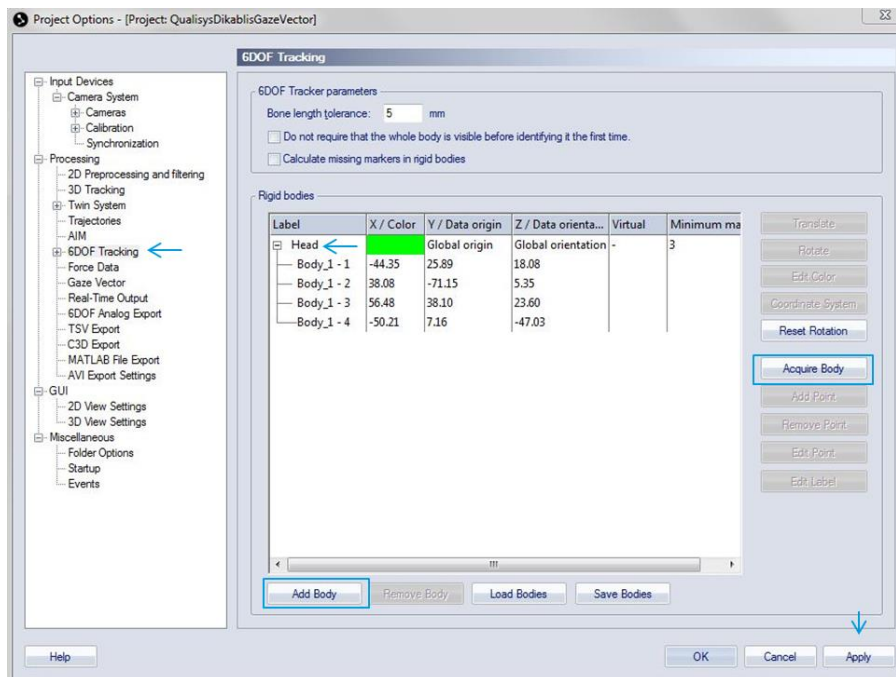
#Step 12: Gaze Vector for Head Body 👁

Add a Gaze Vector to the Rigid Body. Go to Project Options → Processing → Gaze Vector and add one. Select Dikablis for Eye Tracker and the Label of your Rigid Body.
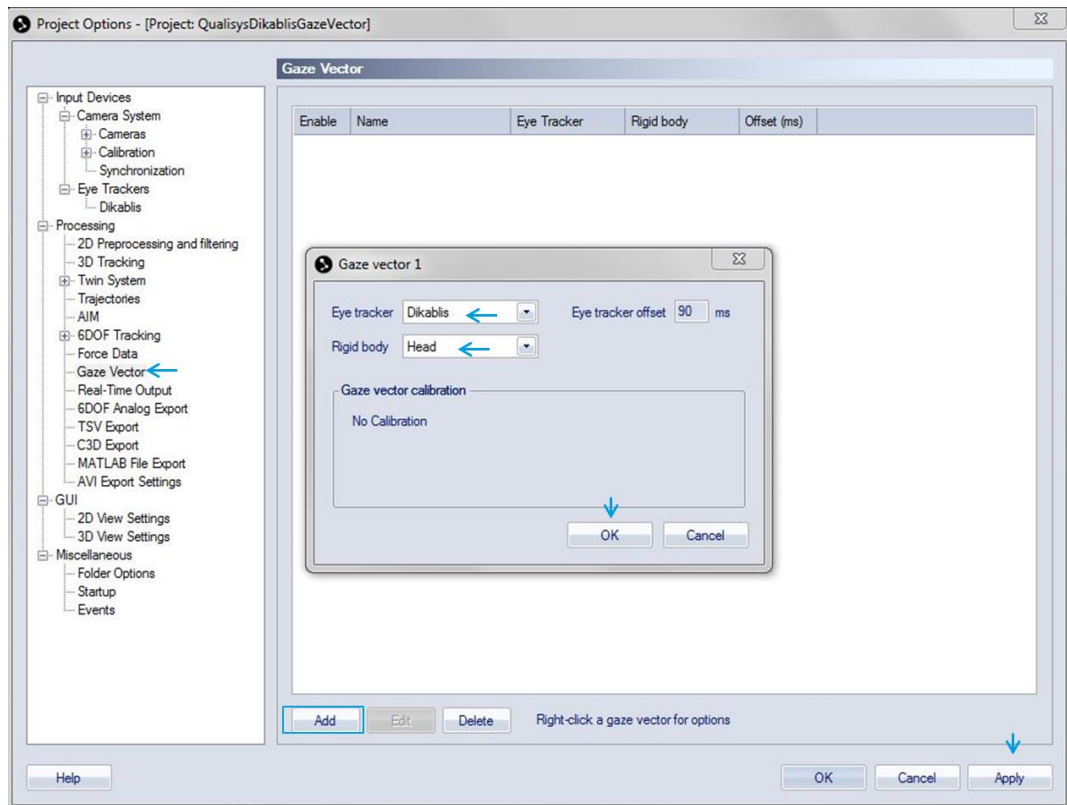
Start a Capture. You start capturing by pressing 🔴 in the horizontal toolbar and select a capture time (e.g. 3 for the first capture). If the Rigid body was recognized correctly the markers should appear in green and were bound with lines.
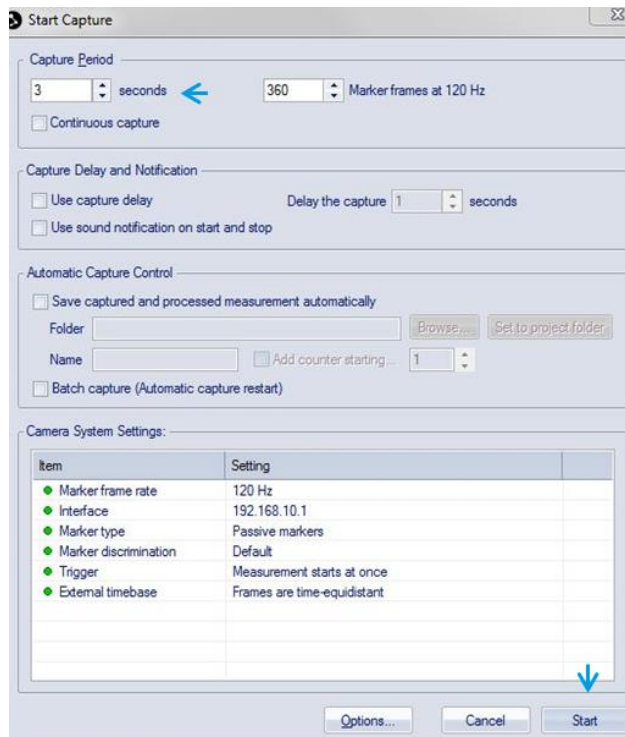
Tracked 6DOF Body Head successfully
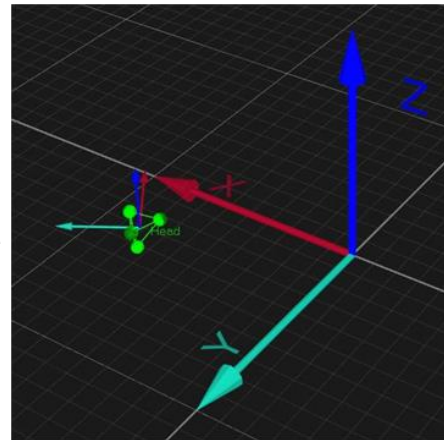
#Step 13: Put on the Dikablis Eye Tracker 👁

Put on Dikablis Eye Tracker. The Eye Tracker should be well positioned on the subjects head. Use the Nose Piece and the strap to secure it comfortably on its head.
NOTE: Be careful with the Marker structure and do not change the position of the markers after it was defined in QTM as Rigid Body.

Adjust the left Eye Camera. Open an Eye Tracker visualization 👁 in D-Lab (Screen Layout Tab) and drag and drop Dikablis Eye Tracker to this window. Select the left eye image on the top left to see the eye video with the crosshair. Adjust the positon of the Eye Camera by carefully bending the camera arm until the eye is horizontally aligned and centered in the video.
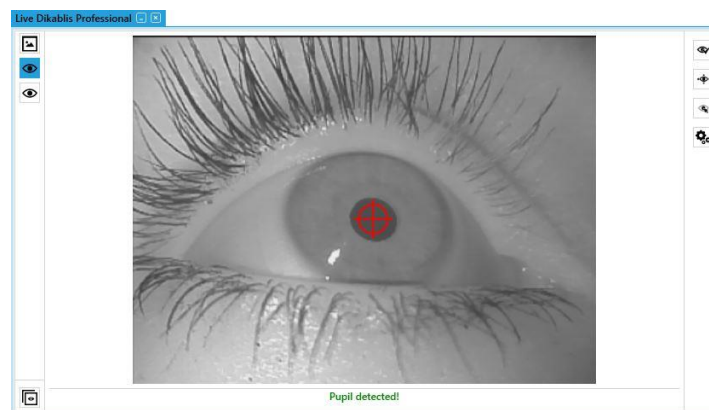
Review Pupil Detection. Ask the subject to do some gaze movement and review the pupil detection of the left eye. The better the pupil detection in D-Lab is the higher the accuracy of the gaze vector in QTM. NOTE: In case you have bad detection, use the calibration wizard to mask e.g. dark eye lashes.
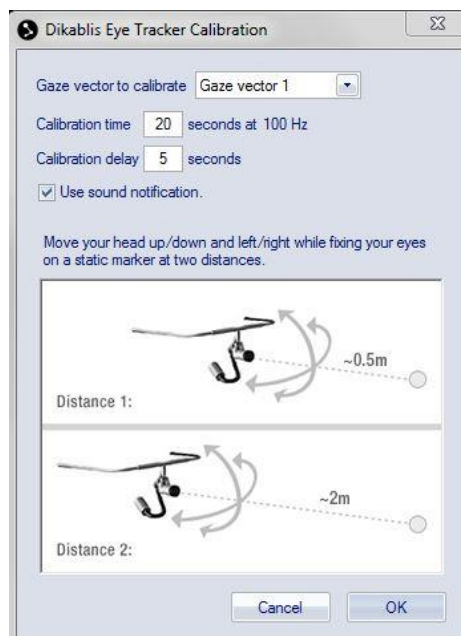
#Step 14: Calibrate the Gaze vector in QTM 👁

Place a Marker in the volume. The single Marker should be positioned on head level to allow more comfortable head position during calibration. Make sure the Marker is visible in at least three cameras.
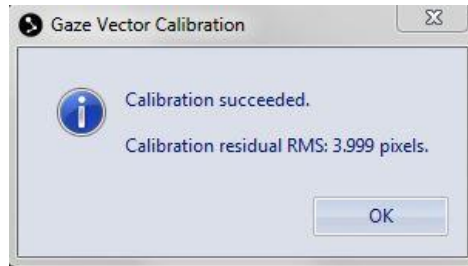

Open a New File 📄 **.**

Start the Gaze Vector Calibration. Go to Capture → Calibrate Gaze Vector and a calibration dialogue opens.


Choose a calibration time. Recommended calibration time is between 10-20s. Optional you can also choose a calibration delay, which means the calibration starts x seconds after you press ok.

Subject performs calibrations movements. To calibrate the Gaze Vector the subject has to look at the single static marker at two different distances (0.5m and 2m) and move the head in circles while fixating the static marker. It the calibration succeeded the Calibration residual RMS is displayed.

Review Gaze Vectors Origin and Residual. Go to Project Options → Processing → Gaze Vector and double click on the gaze vector.
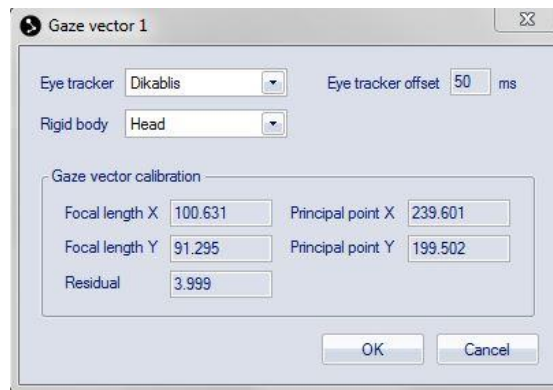

FIRST CAPTURE OF BODY MOTION AND GAZE

Open a New File 📄 **.** If you like QTM to calculate the Gaze Vector in real time review this option in the Project Options → Processing and check the in the options for real time calculation.

Do a capture 🔴**.** The subject with the Dikablis Eye Tracker can fix again the single marker or and moving around to see if the calibration of the gaze vector is precise.

Replay of capture. To replay and analyse your capture you can use the player in the menu bar. The gaze vector will be printed as arrow (default: yellow, 1000mm).
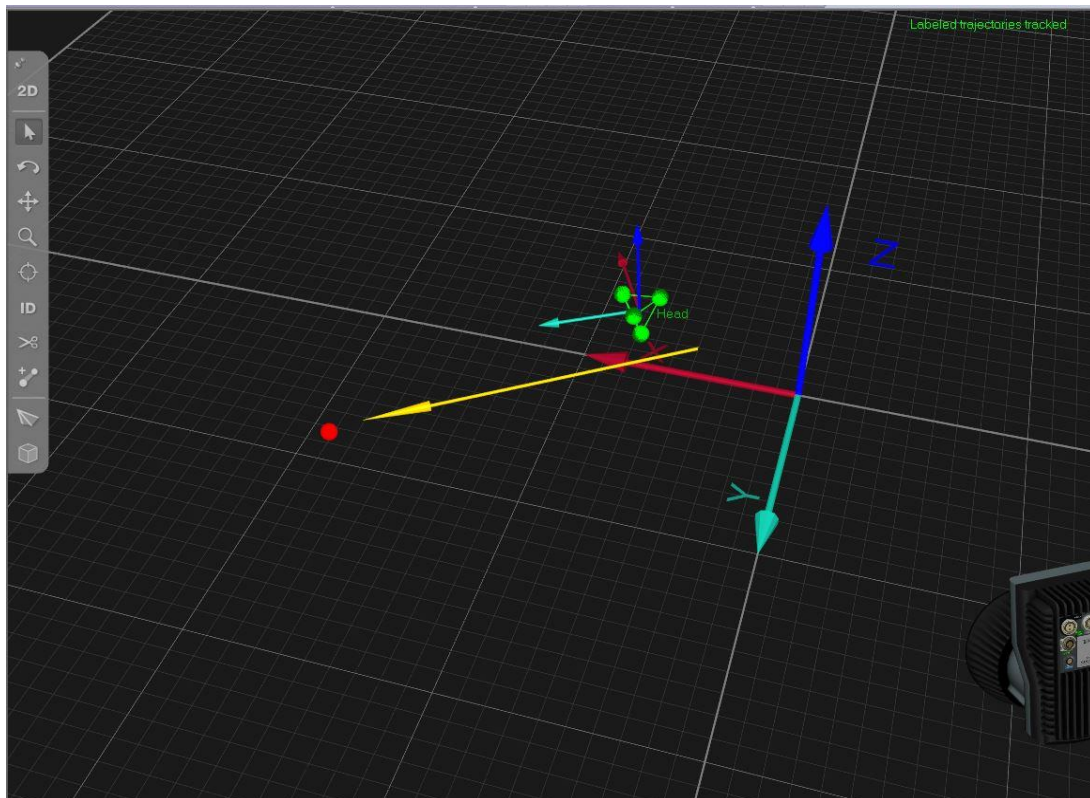
Change appearance of gaze vector. Go to Project Options → GUI → 3D View Settings and change the colour or length of the gaze vector.

Review or analyse gaze vector data. Go to View → Info Data 1-3 and the Info Data Window opens. Right click to the window and select Display Gaze Vector Data. You can export the gaze vector data to all application Qualisys supports. You also can get access to the pupil position data that has been send by D-Lab by selectin Display Eye Tracker Data.

GET HELP

You can find answers to your questions, as well as instructions and troubleshooting information, on the Ergoneers FAQ (http://www.ergoneers.com/faq) or via the QTM-Online Help → Help Topics in QTM.

In case of other questions regarding the Ergoneers Product Family (Dikablis, D-Lab), please refer to support@ergoneers.com.

For questions and information about QTM or the Qualisys Hardware, please refer to the Qualisys Manual, Online Help or the Qualisys Support (support@qualisys.com).