

GCT 2.1 | Manual

CD40201

R04 / 2022-04-27

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1 Introduction

1.1 What is GCT v2.1

The GenICam Control Tool (GCT) permits to communicate with cameras which fulfil the GenICam standards. The tool allows to set-up a camera, browse and adjust parameters, perform camera calibration tasks and visualize and analyze acquired images. GCTv2.1 is the successor product of GCT v1.x. It uses the transport layer interface and provides more features.

1.2 Installation of GCT v2.1

The installation program can be downloaded from <https://www.chromasens.de/gct2-current>

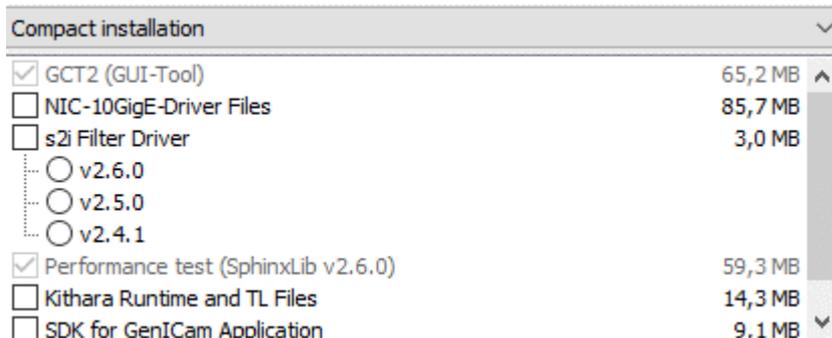
GCT v2.1 does not require the installation or uninstallation of GCT v1.x. Both can exist parallely on the PC. If GCT v2.x was already installed before, an information will indicate you to overwrite the previous version of v2.x.

GCT2 is a GenICam-based camera tool. It can be used with compatible TL producers (*.cti).

GCT2 only supports cameras manufactured by the TKH Vision group.

The transport layer for the different interfaces (1GigE, 10GigE, CoaXPress) are provided by the GCT installer.

There are six components for the installation:



Depending on the kind of interface, different components of the installation are needed.

For detailed information about the components, you need to install, refer to:

- chapter 3 for installation with Kithara transport layer,
- chapter 4 for installation for 10GigE interface without Kithara, or
- chapter 5 for installation with CoaXPress interface.

The operation of GCT is always the same regardless of the interface.

1.3 System Requirements

Hardware requirements:

- A TKH Vision GenICam-standard camera
- Intel Core i7 or higher
- 16GB RAM or higher
- Min. PCIe 3.0 lane with min. 8 lanes to install your frame grabber or network card

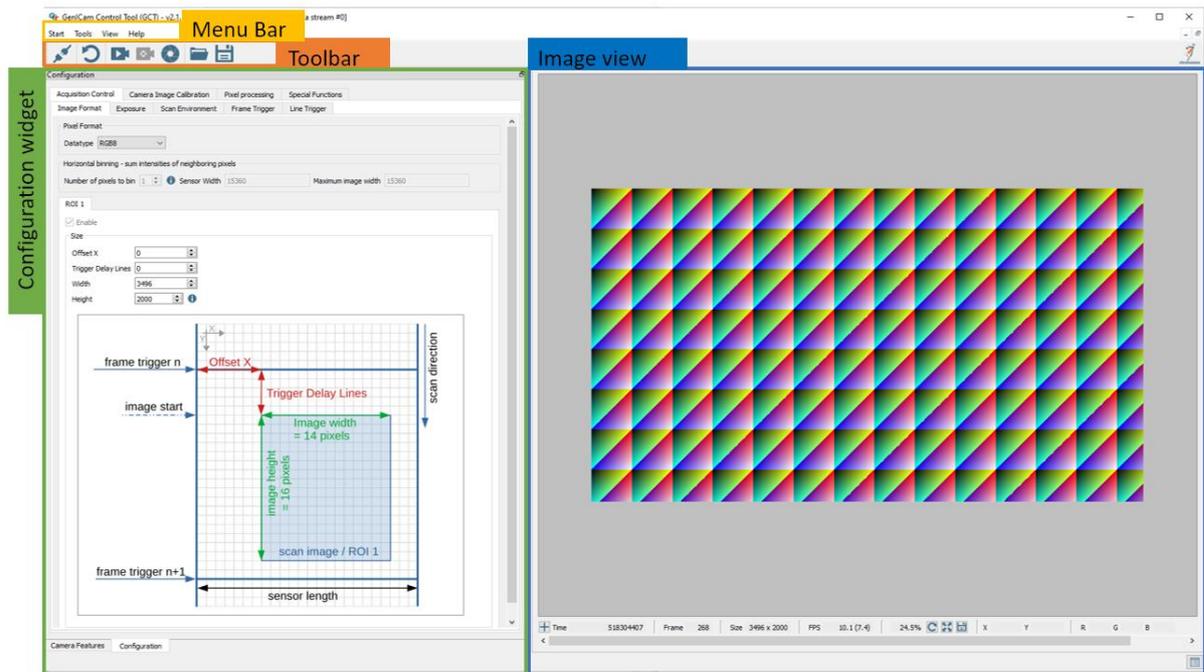
Software requirements:

- Win10 x64 bit operating system
- Driver for 10-Gigabit Ethernet network interface card or frame grabber software

2 GCT v2.1

2.1 GCT user interface

The software provides different panel elements, they can be placed, resized, and docked freely within GCT window. The GCT user interface starts after the connection with a camera with the following setup. The window contains four main areas. The Menu bar widget for general access, the Toolbar widget for fast access to the most common functions, the image view widget where the image and all relevant information's are displayed and the configuration widget for the camera configuration.



2.1.1 Menu Bar

The **Start Menu** offers the following functions:

- **Connect/Disconnect:** Opens device discovery widget or disconnect the camera, see 2.2.
- **Start Grabbing:** Starts continues image grabbing.
- **Device description:** Load and save xml file from the camera.
- **Settings:** GCT setting options, see 2.11
- **Exit:** Close GCT window.

The **Tools Menu** offers the following functions

- **Calibration:** Opens a camera calibration dialog, see 2.8.
- **Maintenance Mode:** Only for experts.
- **Up/Download:** Opens a Up/Download dialog, see 2.7.
- **Register Editor:** Only for experts.
- **Kithara Configurator:** Opens the Kithara Network Configurator, see 3

The **View Menu** offers the following functions

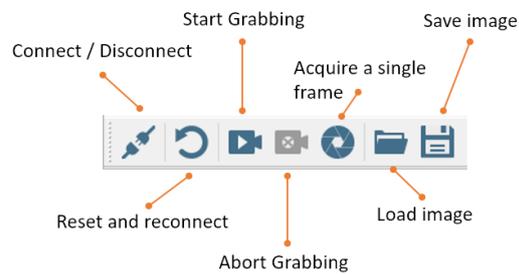
- **Default view:** Set the GCT view to default.
- **Camera Configurations:** Shows the configuration panel in the configuration widget.
- **Message Log:** Display the Message Log under the Image view.
- **Refresh Feature Tree:** Refreshes the feature tree

The **Help Menu** offers the following functions

- **About:** General Information's about GCT
- **Open GCT Manual:** Opens the GCT Manual
- **System Information:** Generates a System information report
- **Search for GCT Update:** Search for GCT updates

2.1.2 Toolbar widget

The Toolbar widget contains the following icons and their functions.



The **Toolbar** widget offers the following button functions:

- **Connect/Disconnect:** Opens device discovery widget or disconnect the camera, see 2.2.
- **Reset and reconnect:** Resets the camera and reconnect.
- **Start Grabbing:** Starts continues image grabbing, see 2.4.
- **Abort Grabbing:** Stops the image acquisition.
- **Acquire a single frame:** Acquires a single frame.
- **Load image:** Load an image from disk, see 2.6.
- **Save image:** Save image to disk, see 2.6.

2.1.3 Configuration widget

The Configuration widget provides two panels, Camera features which is the Genlcam parameter tree and the configuration panel which is a graphical representation of the Genlcam parameter tree.

The following image shows the configuration panel of the configuration widget. The panel contains a tab view, from which four main categories can be selected. Each tab contains another tab view with subcategories. The content in each sub tab view is scrollable.

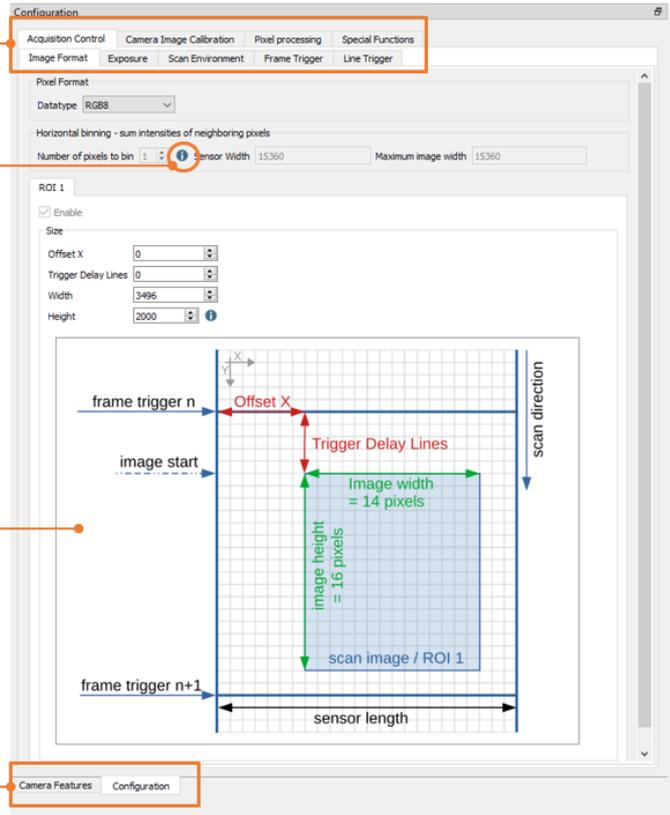
An Info box or tooltip is shown when hovering over a parameter input field or the blue information icon.

Tab view with four main categories

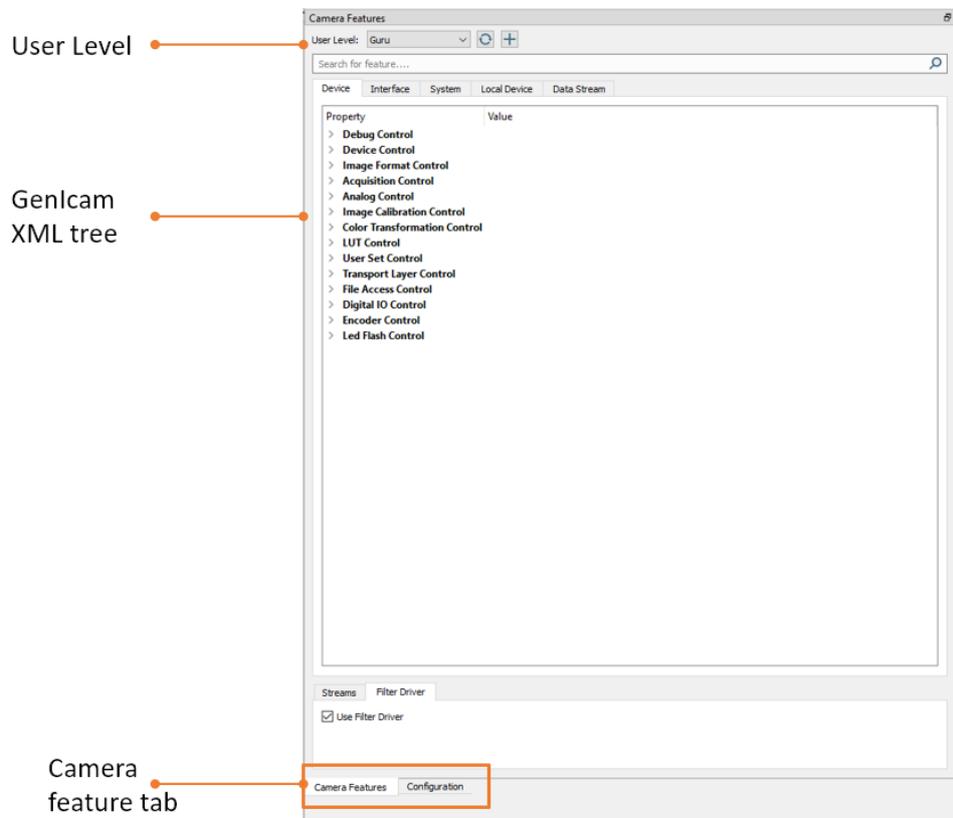
Additional information

Explanation picture

Configuration Tab

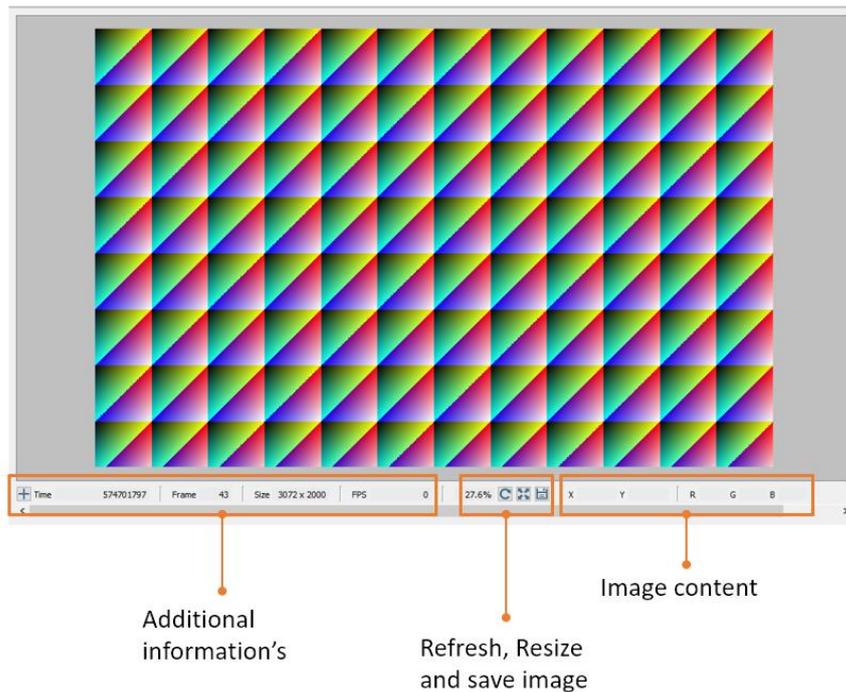


The Camera Features tab contains the GenIcam parameter tree, the user setup level and an extra panel to set up the filter driver.



2.1.4 Image view widget

The image view widget shows the current image view and additional image and stream relevant information's.



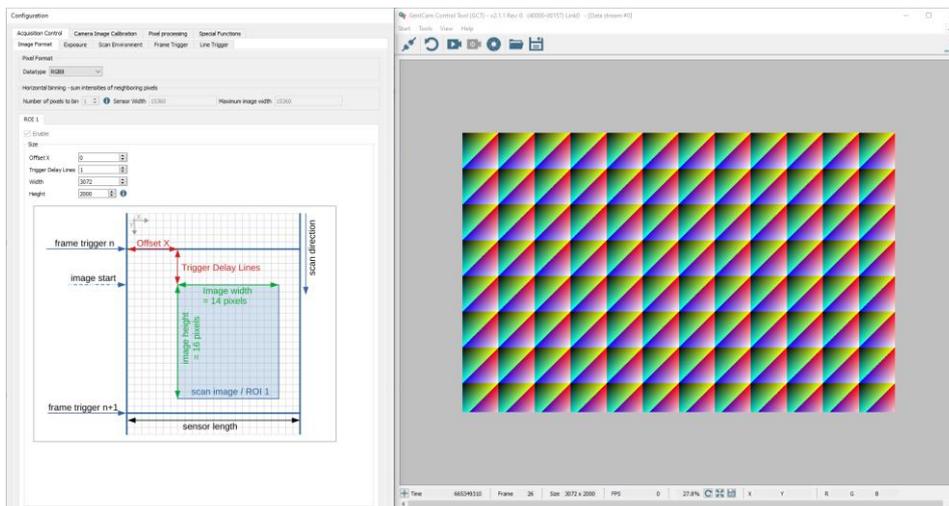
Mouse operations on the image

During or after image acquisition, you can work on the image as follows.

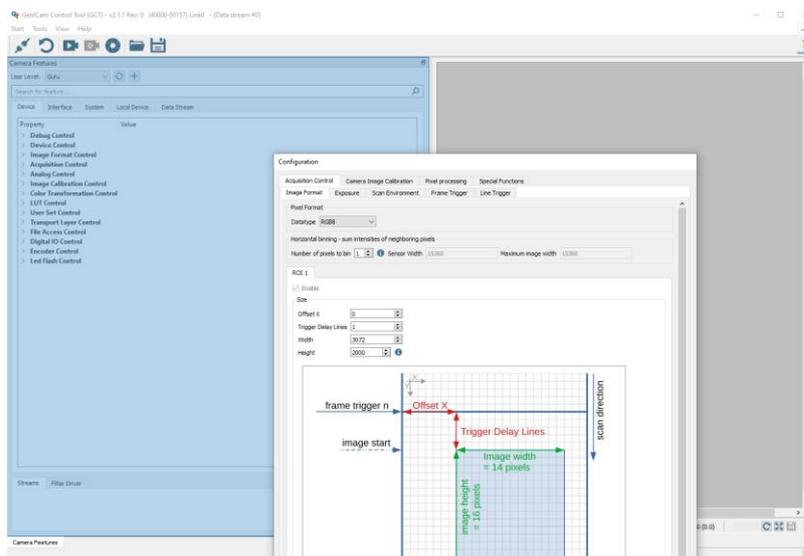
Function	Operation
Zoom in (factor x 1.05)	Mouse wheel forward
Zoom out (factor * 0.95)	Mouse wheel backward
Move image	Move mouse while holding left mouse button pressed
Reset image to original size	Click 
Expand image to full display area	Click 
Read RGB value as 8bit	Move mouse onto the image

2.1.5 Arrange / Rearrange widgets

The software provides different widget elements, they can be placed, resized, and docked freely within GCT window. If you are using two monitors you can place, for example, the configuration widget on the second screen and the image view widget on the first screen.



If you want to dock the widget again, drag the widget to the area where you want it, it will create a blue marked region in the target area. Once the desired position is indicated by the blue area, the widget can be dragged.



2.2 Connecting and disconnecting the camera

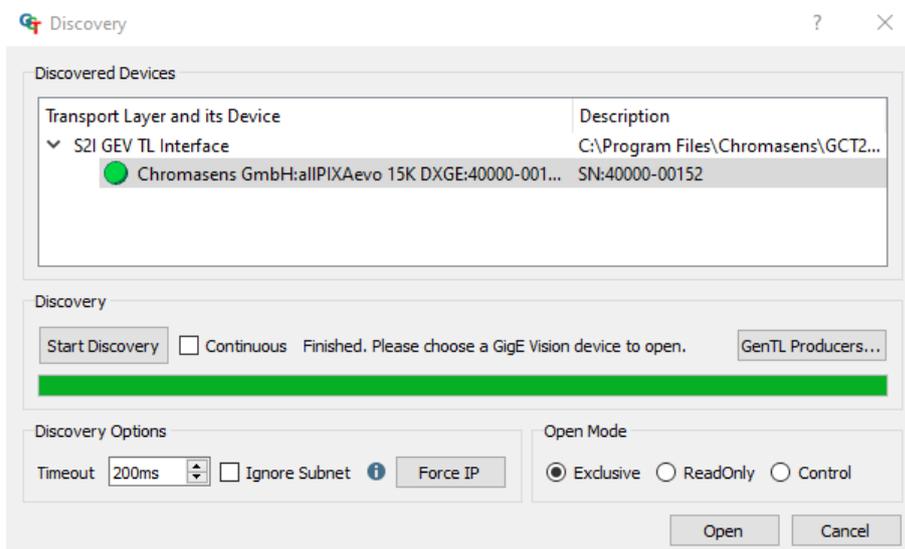
To be able to access the camera, GCT needs to create a connection to the camera and to download an XML file that specifies the camera interface.

To connect the camera:

1. Switch on the camera. Initialization can take up to about 40 seconds.
2. Start GCT.
3. On the toolbar click **Run device discovery** .

The **Discovery** dialog box opens and in the **Discovered Devices** list shows information about the detected camera. If the camera is not found, wait a few seconds, and then click **Start Discovery**.

4. In the **Discovered Devices** list, select the camera, and then click **Open**. GCT now downloads the file with the camera interface specification, which takes a few seconds. Afterward, the **Discovery** dialog box is closed, and the available camera parameters are shown in a tree structure on the left side.



The camera discovery is controlled by several parameters and options, which can be modified if necessary:

Parameter	Default value	Description
Timeout	200 msec	If no camera can be found in the specified time, the discovery process stops and the dialog shows “No GigE Vision device has been found.” This value can be adjusted.
Continuous	Disabled	If you select this check box, the discovery process is repeated until you stop it.
Open Mode	Exclusive	Specifies how the camera should be opened.
GenTL Producersr	The producer(.cti) files present in the “GENICAM_GENTL64_PATH” folders will be listed and selected	Producer file, which should be used to detect and communicate with the camera.

To disconnect the camera

After the camera is connected, the **Discovery** button is replaced by a **Disconnect**  button. Click this button to unlink the connection. If you want to disconnect the camera while it is grabbing images, it is recommended to stop the grabbing process completely before you click **Disconnect**. The disconnection progress may take several seconds, due to the cleanup of generated temporary data in background.

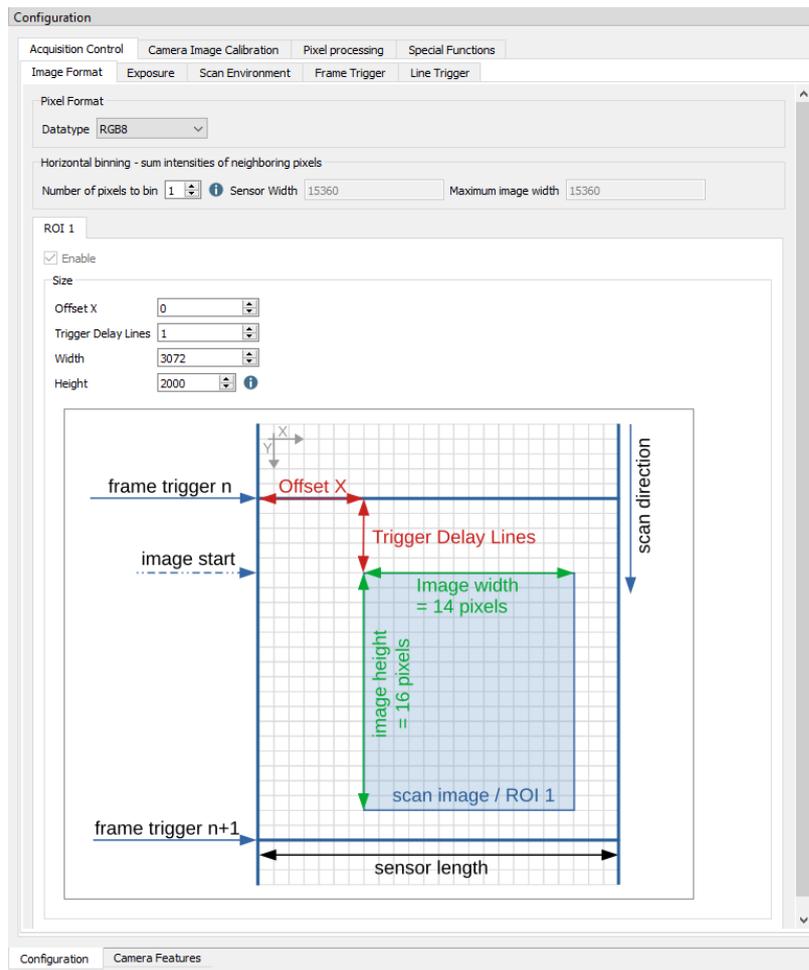
2.3 Modifying features

GCT allowed to modify the features in two different ways. On the one hand, the configuration panel makes setting functions more convenient, special views show a set of related functions on which you can easily change these parameters. On the other hand, the camera feature panel allowed to edit the parameter in the XML-Tree

2.3.1 In the Configuration panel

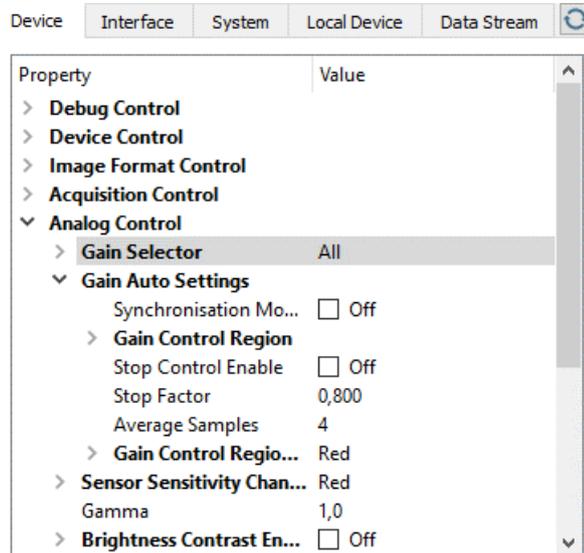
The view consists of four main tabs **Acquisition Control**, **Camera Image Calibration**, **Pixel Processing** and **Special functions**. Each tab shows several subtabs.

The Acquisition Control tab, for example, show five subtabs, which permit to specify many features such as image format and trigger settings: Features can easily edit in the GUI elements. Some features also have additional explanation pictures.

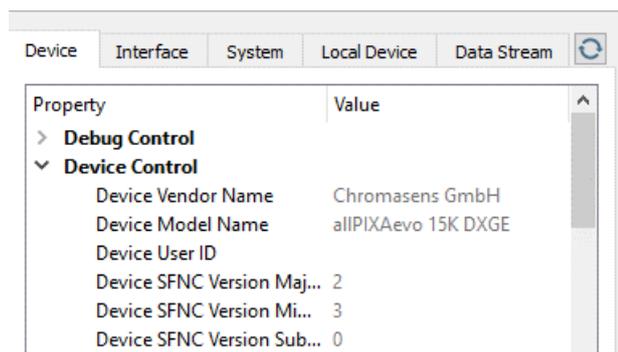


2.3.2 In the Camera feature panel (XML-Tree)

On the left side of the GCT window, features and their values are shown in a tree structure organized in feature groups. To show the features of a feature group, click on the arrow preceding the group name.



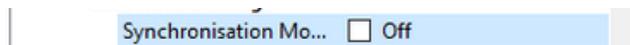
Some features are read-only. Their values are shown in gray color in the feature tree:



Some features cannot be modified during grabbing. Therefore, their values are also shown in gray during grabbing.

How values are changed, depends on the data type of the feature:

- For binary features, select or clear the shown check box.



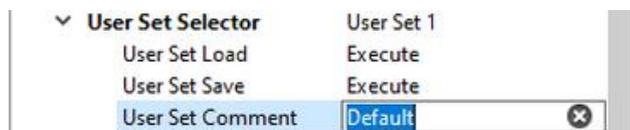
- For numerical values, click on the value. A box and a slider appear that permit to modify the value:



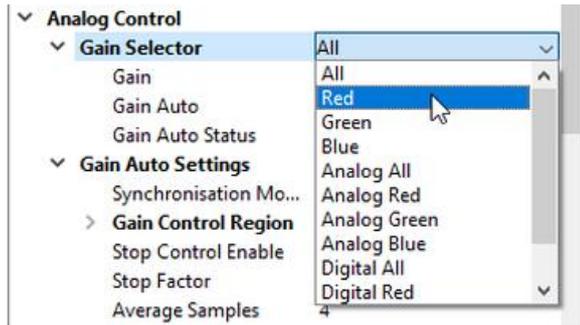
- For hexadecimal values, click on the value. A box appears that permits to modify the value:



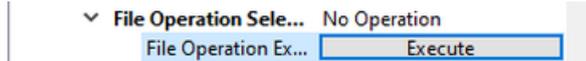
- For features containing text, a text box appears, at which you can edit the value:



- For the feature type enumeration, a value list appears. Click again on the value to open the list, and then click the desired value:



- For command features, an **Execute** button appears:



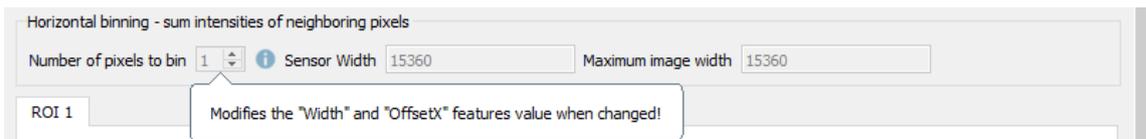
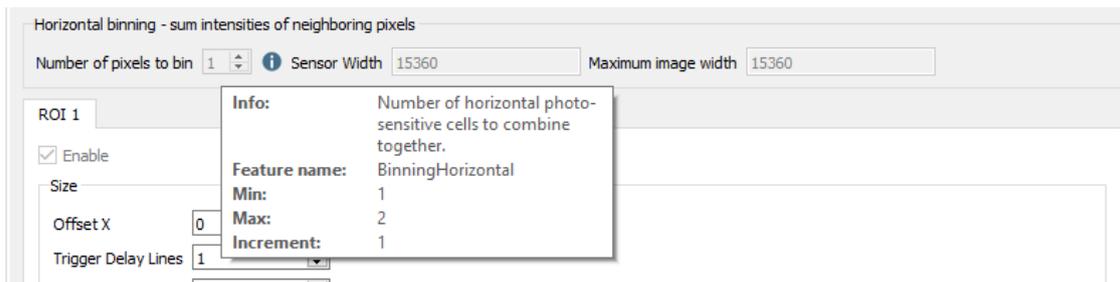
To execute the function, click **Execute**.

2.4 Showing feature details

Feature details can be displayed in the configuration panel and in the camera feature panel.

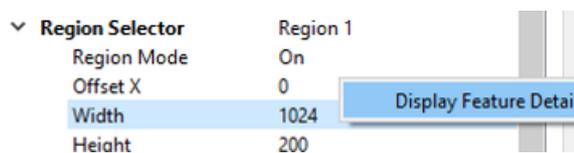
2.4.1 In the Configuration panel

In the configuration panel, the information is displayed when you move the mouse pointer over the parameter input field or the blue information icon.



2.4.2 In the Camera feature panel

To show feature details, double-click the feature name or right-click the feature and then click **Display Feature Detail**:



A message box then shows information about type, access, and values:



2.5 Grabbing images

To start grabbing, click **Start grabbing**  on the toolbar. To stop grabbing, click **Stop grabbing**  on the toolbar.

The grabbing process continues to grab images (frame) from the camera repeatedly. If only a single frame should be grabbed, click **Acquire a single frame**  on the toolbar.

Because the filter driver can improve data processing, it should be enabled for capturing of large images.

2.6 Saving/Loading an image

GCT permits to save the currently acquired image as a BMP or TIFF file, and to load such files.

Saving an image

To save an acquired image:

1. If GCT is grabbing images continuously, stop image acquisition.
2. On the toolbar click **Save currently displayed image** .

For a typical RGB8 or Mono8 format, the image can be saved as BMP file. For formats such as Mono10, Mono12 or RGB10p32, it can be saved as TIFF file. Each color value of each channel is then scaled from 10 or 12 to 16bit in the TIFF file.



Loading an image from disk

Previously saved images can be loaded back into GCT.

To load an image:

1. On the toolbar, click **Load image** .
2. On the file dialog box, click the desired file type in the list, to display the respective images:



3. Select a file, and then click **Open**.

Each opened image is displayed in a separate **Static Image** tab. The images can be viewed with mouse actions, as described in section 0. The 16bit TIFF images are currently displayed as 8Bit image, so the RGB values are scaled to 0-255.

2.7 Update/Download

Firmware files, as well as user sets and other file types, can be downloaded from the camera and saved to a file on the PC or vice versa. Supported file types and extensions depend on the camera type.

2.7.1 Uploading files to the camera

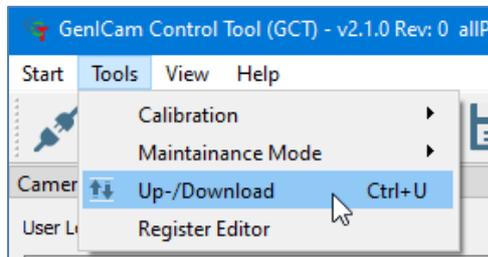
You can restore user settings, calibration files and other file types previously downloaded from the camera. For downloading files from the camera, see section 0

For installing firmware files see section 2.7.1

If you need to upload special files to the camera, contact support first.

To upload files to the camera (only for Chromasens cameras):

1. On the **Tools** menu, click **Up-/Download**, or use hotkey **Ctrl+U**.

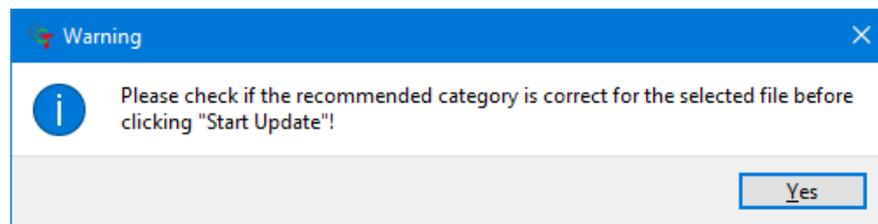


The **Update/Download** dialog box opens.

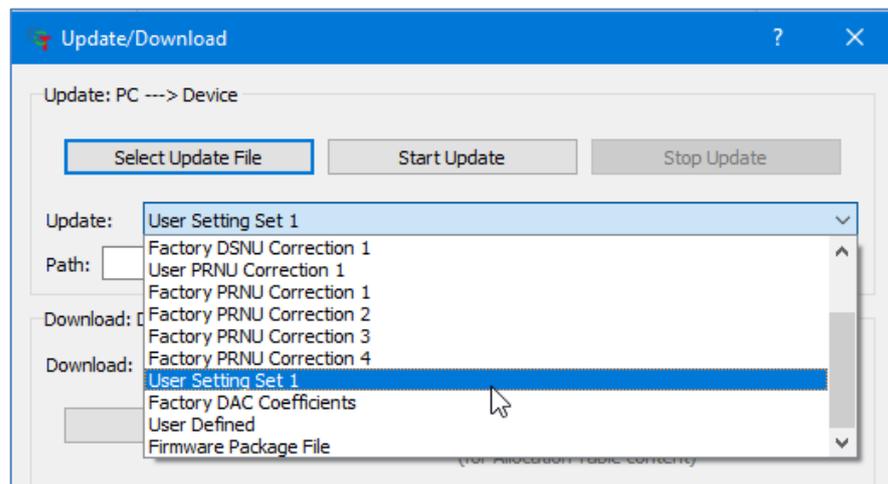
2. Click **Select Update File**. A file dialog box opens.

Select the file you want to upload and then click **Open**.

GCT shows a warning message:

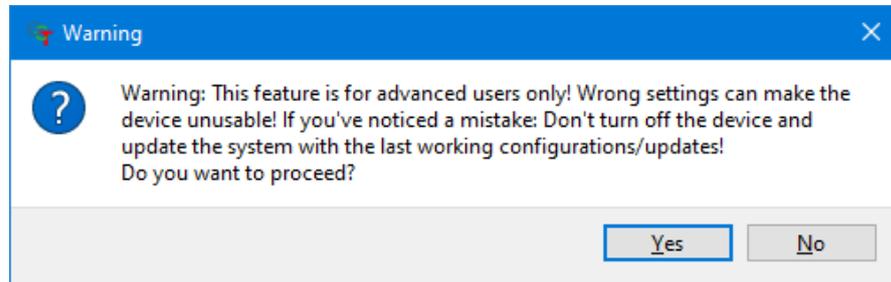


Select the correct file type for the file you want to upload.



3. Click **Start Update**.

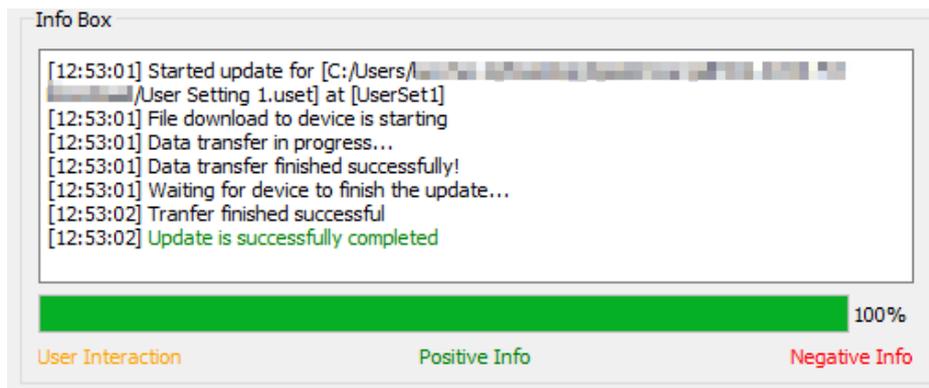
GTC shows another warning message:



 Make sure that the appropriate file type is selected before you proceed. Selecting the wrong file type might damage the camera!

Click **Yes** to start the upload process or **No** to cancel the upload.

4. During upload a progress bar is shown. Wait until the file has been uploaded completely.
5. Check the text in the Info Box: If the update was successful, it contains a green confirmation message "Update is successfully completed"



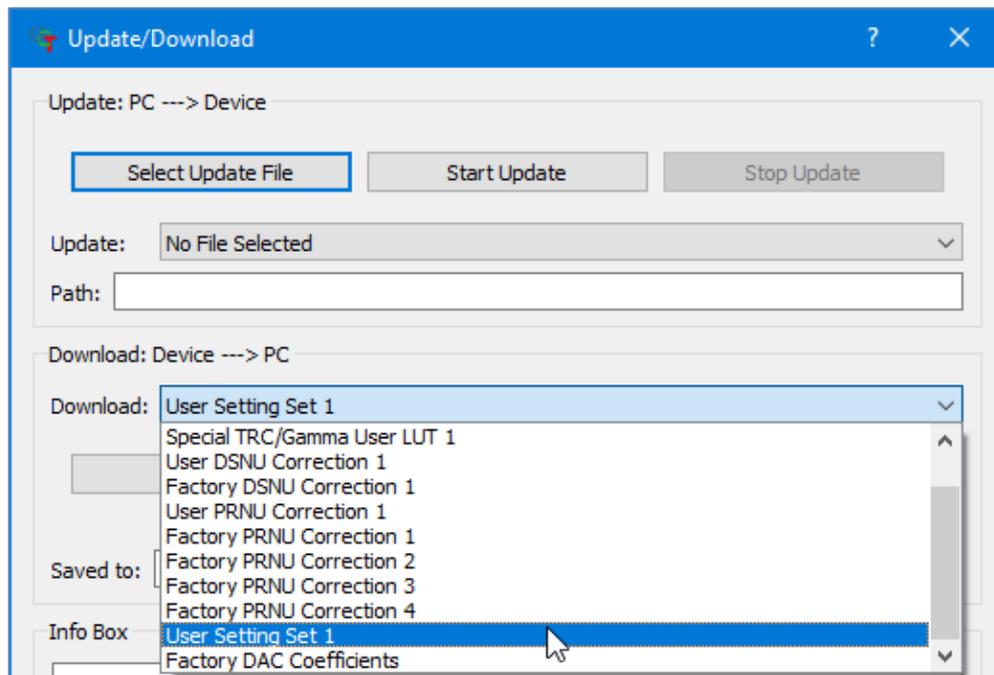
 If the update was not successful, **do not switch off the camera**, but try to restore the previous state by uploading the correct file for the previously selected file type.

2.7.2 Downloading files from the camera to the PC

Firmware files, as well as user sets and other file types, can be downloaded from the camera to the PC and saved to a file.

To download a file from the camera:

1. Start GCT and connect the camera.
2. On the **Tools** menu click **Up-/Download**.
The **Update/Download** dialog box opens.
3. In the **Download** list, click the desired file type.



4. Click **Download to**. A file dialog box opens.
5. Select a folder, enter a file name and extension (e.g. **.bin** for firmware files or **.uset** for user settings), and then click **Save**.

2.7.3 Updating the firmware

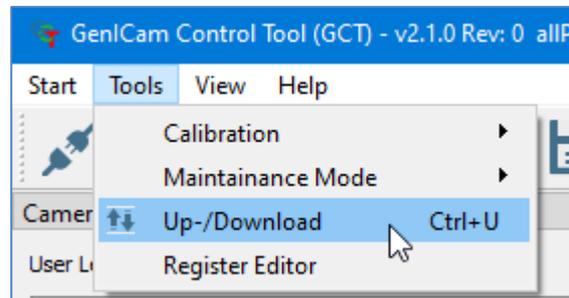
Before you begin:

1. Download firmware from the Chromasens website or use the firmware file provided by Chromasens.
2. Start GCT and connect the camera.
3. Note the **Device Package Version** and/or **Device Firmware version** of the currently installed firmware displayed in the **Device Control** feature group.

Device Package Version	1.52.7
Device Package Description	allPIXAevo-a15-dxge-fw-package
Device Package Consistency	<input type="checkbox"/> Off
Device Firmware Version	4.0.8

To update the camera firmware (only for Chromasens cameras):

1. On the **Tools** menu, click **Up-/Download**, or use hotkey **Ctrl+U**.

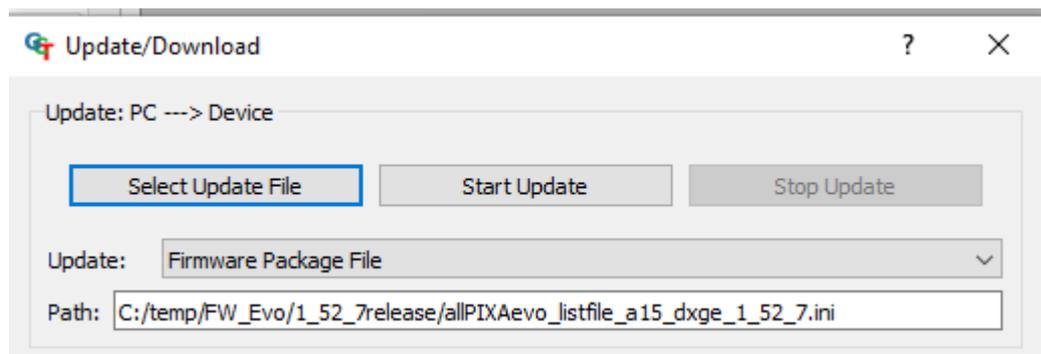


The **Update/Download** dialog box opens.

2. Click **Select Update File**. A file dialog box opens.

Select the firmware file¹ or packages you want to install and then click **Open**.

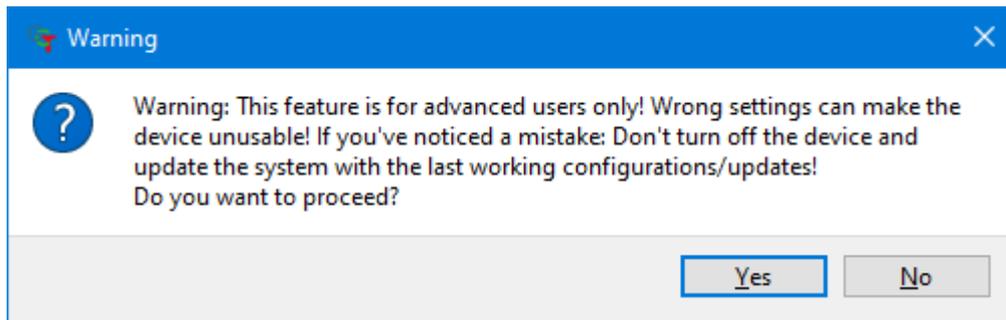
GCT shows a warning message and selects the appropriate file type **Firmware** in the **Update** list.



3. Click **Start Update**.

¹ For allPIXA SWIR cameras, the firmware file has the following name **allPIXASWIR....bin**. For allPIXA EVO camera the firmware file has the following name **allPIXAevo_listfile....ini**.

GCT shows another warning message:

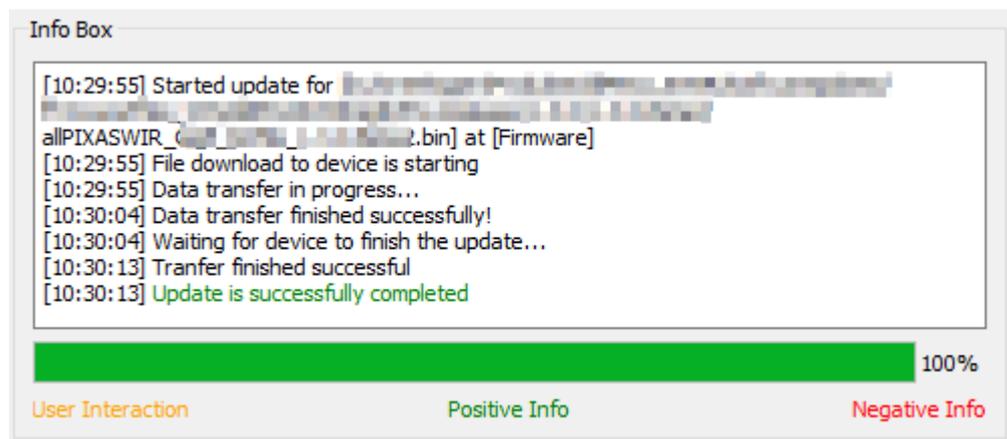


 Make sure that the appropriate firmware file and file type is selected before you proceed. Selecting the wrong file or type might damage the camera!

4. On the appearing warning message, click **Yes** to start the update process or **No** to cancel the firmware update.

Depending on the file size, firmware upload may take a few seconds up to several minutes.

5. During upload a progress bar is shown. Wait until the firmware has been uploaded completely.
6. Check the text in the Info Box: If the update was successful, it contains a green confirmation message "Update is successfully completed"



 If the update was not successful, **do not switch off the camera**, but upload the respective firmware file again or upload a previous version.

7. If the upload has been completed successfully, close the **Update/Download** dialog box, disconnect the camera, turn it off and after a few seconds turn it on again.

This is necessary to complete the firmware update!

8. Reconnect the camera.
9. Check **Device Package Version** and **Device Firmware version** in the **Device Control** feature group to make sure that the camera successfully booted with the new firmware.

Device Package Version	1.52.7
Device Package Description	allPIXAevo-a15-dxge-fw-package
Device Package Consistency	<input type="checkbox"/> Off
Device Firmware Version	4.0.8

2.8 Camera calibration

2.8.1 Creating a black-reference (DSNU)

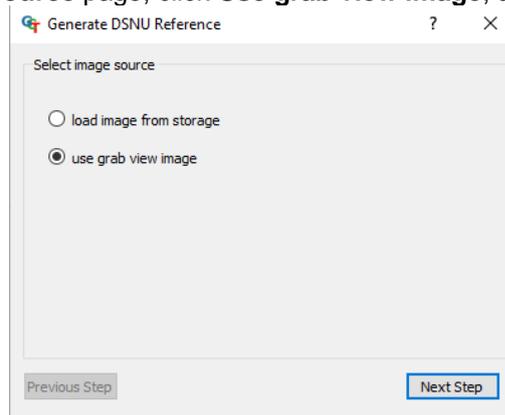
To create a black-reference:

1. Switch off illumination and cover the lens with a black or dark piece of cardboard or plastic so that there is no light on the sensor. Check that the piece covers the whole lens.
2. Prepare an image with GCT. Either click the **Acquire a single frame**  on the toolbar, or click **Start grabbing** , wait until an image is shown and then click **Stop grabbing** .
3. On the **Tools** menu, select **Calibration**, and then click **Generate DSNU Reference**.

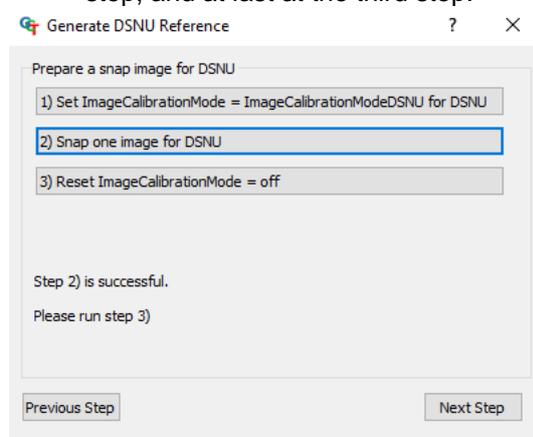


The **Create DSNU Reference** wizard opens.

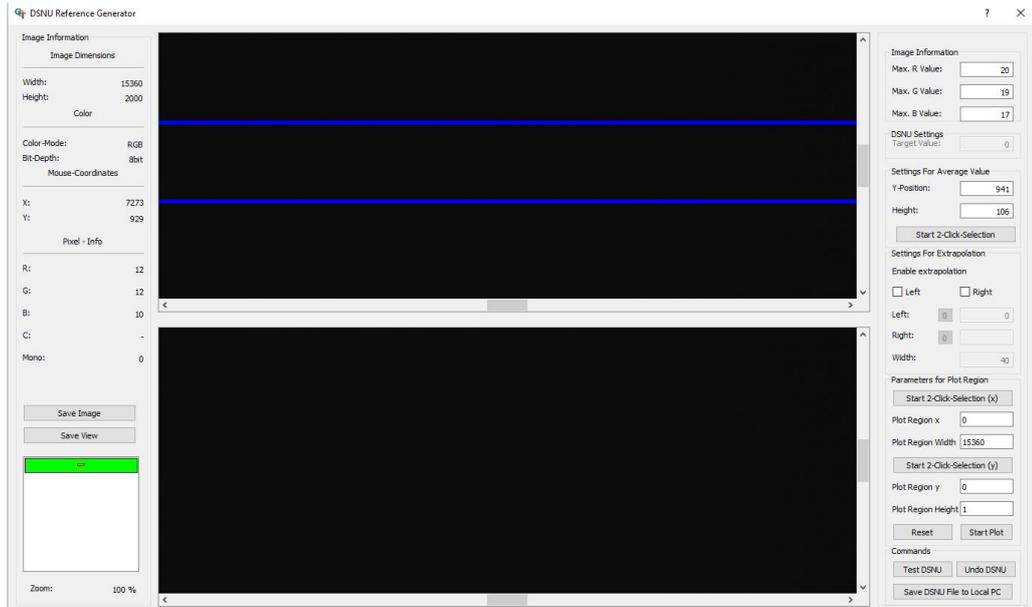
4. On the **Select image source** page, click **Use grab view image**, and then click **Next Step**.



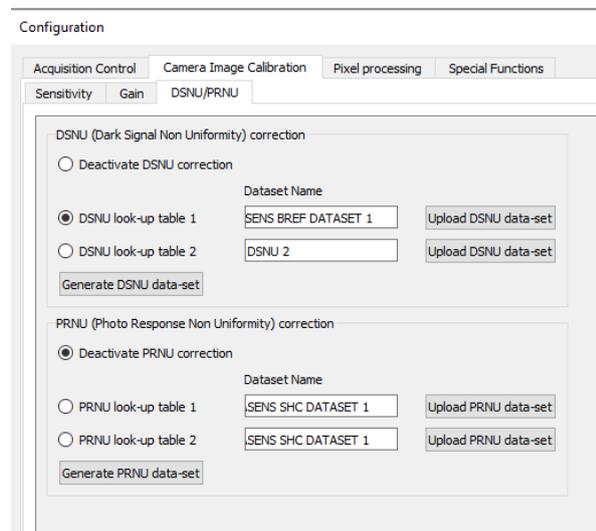
5. On the next page, click at the first step (**1) Set ImageCalibrationMode...**), then at the second step, and at last at the third step.



6. If all three steps were reported as successful, click **Next Step**. The **DSNU Reference Generator** window opens and shows the grabbed image in expected image calibration mode.



7. In the **Settings for Average Value**, enter values for **Y-Position** and **Height** to specify the area to be used for reference generation, or click **Start 2-Click-Selection** and click start and end position on the image.
8. To create and save the reference data, click **Save DSNU File to Local PC**, specify folder and file name in the appearing file dialog box, and then click **Save** and close the wizard.
9. If you are using the configuration panel to load and activate the DSNU, you can skip the next steps. Therefore, click **Upload DSNU data-set** and load the xx.dsnu data file. After loading the data-set you can activate the **DSNU look-up table x**.



10. On the **Tools** menu click **Up-/Download**, and in the **Update/Download** dialog box click **Select Update File**. A file dialog box opens.
11. Select the DSNU file, and then click **Open**. GCT selects the appropriate file type in the **Update** list. If the file type is correct, confirm the appearing warning message.
12. Click **Start Update**, wait until the file has been uploaded completely, and then close the dialog box.
13. To activate DSNU, click the **LUT Control** feature group,

14. Click **LUT Selector** and click the respective DSNU LUT in the value list:



15. At the **LUT Enable** feature, select the check box.

To create a dark-reference from an existing image file:

1. Perform steps 1 to 3 of the above procedure.
2. On the **Select image source** page, click **Load image from storage**, and then click **Next Step**.
3. Click **Choose BMP or TIFF File** on the following page and open the desired image file in the appearing file dialog box.
4. Specify a pixel offset, and then click **Next Step**.
5. Continue with step 7 of the above procedure.

NOTE: Make sure that the used image has been grabbed with active image calibration mode for DSNU, so that all gains and other LUTs are adjusted to fit the calibration.

NOTE: While **Image Calibration Control** is active, the temporarily modified features are locked and cannot be modified until the feature is set to **Off**.
Currently, the input image (regardless of whether acquired directly with the grabbing process or loaded from PC) will be converted to 8 bit and then used to calculate the DSNU reference.

2.8.2 Creating a shading reference (PRNU)

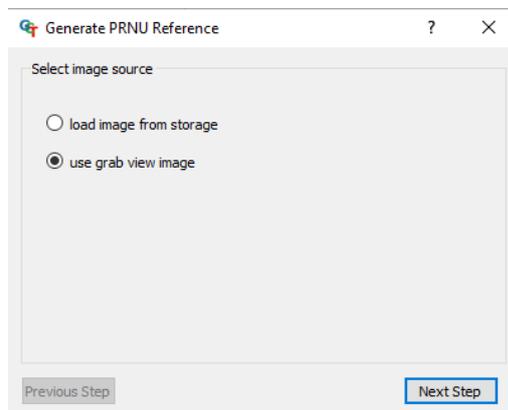
To create a shading reference:

1. Check lighting and focusing.
2. Disable continuous white-control and save the parameters to the camera.
3. If possible, prepare a moving white target. If you use a stationary target, place the target a bit out of focus, to reduce the effect of dust or scratches on the calibration result.
4. Prepare an image with GCT. Either click the **Acquire a single frame**  on the toolbar, or click **Start grabbing** , wait until an image is shown, and then click **Stop grabbing** .
5. On the **Tools** menu, select **Flat-Field Correction References**, and then click **Generate PRNU Reference**.

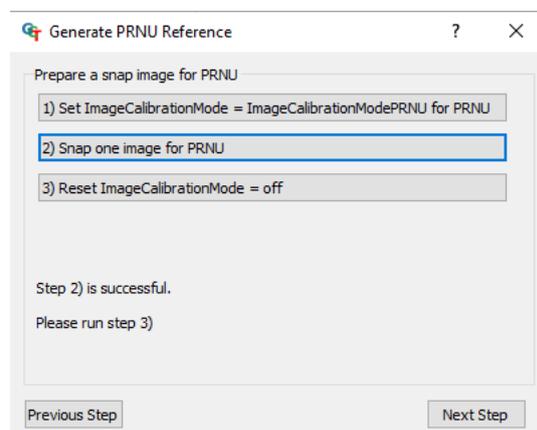


The **Create PRNU Reference** wizard opens.

6. On the **Select image source** page, click **Use grab view image**, and then click **Next Step**.

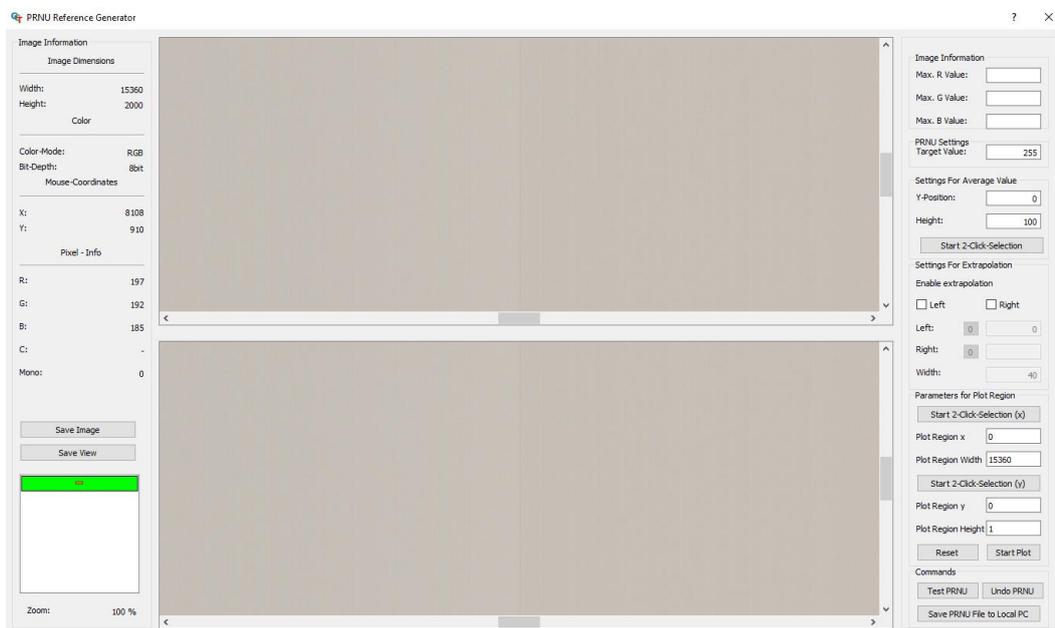


7. On the next page, click at the first step (1) **Set ImageCalibrationMode...**, then at the second step, and at last at the third step.



- If all three steps were reported as successful, click **Next Step**. The **DSNU Reference Generator** window opens and shows the grabbed image.

On the next page, shading parameters must be specified in the **PRNU Settings** area on the right side:



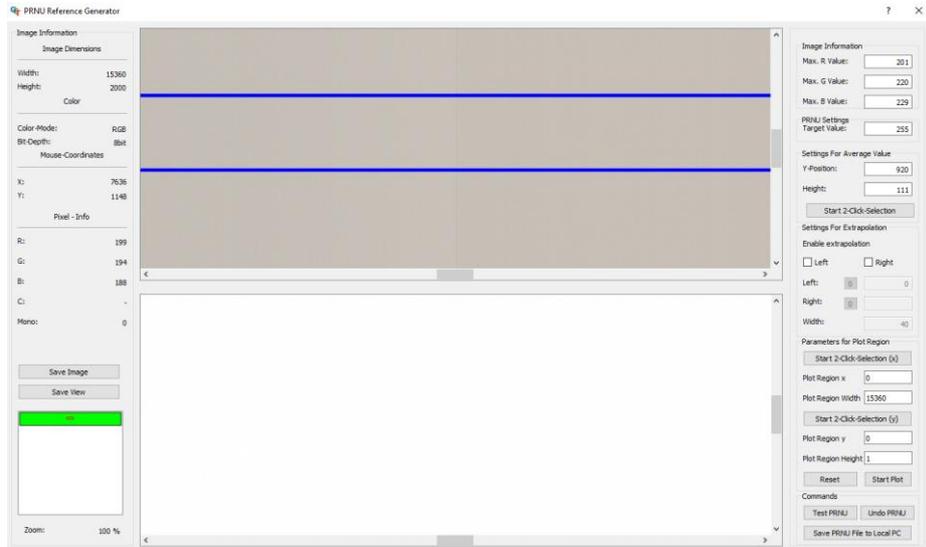
- Specify the target value for white, and the area that should be used to create the shading data:

Target Value: Target value of white after the shading reference has been applied. The default target is 255, to obtain the full range of the camera (8bit 255). The adjustment of Brightness should be performed in the next step with brightness and contrast, which can be found in the **Analog Control** feature group. .If necessary, the target value can be set to a smaller value.

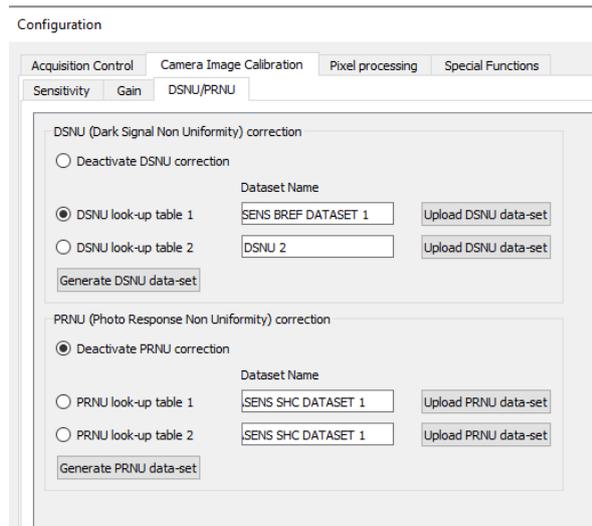
Y-Position, Height: Start and height of the area used to generate shading data. If you specify 100 and 300 as values, 200 lines starting at line 101 are used. Enter values into the boxes, or click **Start 2-Click-Selection**, and then click on the start and end position of the desired area on the image. The specified area is then marked with green color.
- If the image has black borders on the left/right side, specify an area for extrapolation:

For extrapolation on the left side, select the **Left** check box, for the right side, the **Right** check box. In the **Left** and **Right** boxes, enter the start positions of the areas used for extrapolation, and in the **Width** box the width of the areas.

Start and end position of the areas are marked with red color on the image.
- To show the result of the shading correction with the specified parameters, click **Test PRNU**.



12. To save the shading reference data, click **Save PRNU File to Local PC**, specify folder and file name in the appearing file dialog box, and then click **Save** and close the wizard.
13. If you are using the configuration panel to load and activate the PRNU, you can skip the next steps and go to step 20. Therefore, click **Upload PRNU data-set** and load the xx.prunu data file. After loading the data-set you can activate the **PRNU look-up table x**.



14. On the **Tools** menu click **Up-/Download**, and in the **Update/Download** dialog box lick **Select Update File**. A file dialog box opens.
15. Select the PRNU file, and then click **Open**. GCT selects the appropriate file type in the **Update** list. If the file type is correct, confirm the appearing warning message.
16. Click **Start Update**, wait until the file has been uploaded completely, and then close the dialog box.
17. To activate PRNU, click the **LUT Control** feature group.
18. Click **LUT Selector** and click the respective PRNU LUT in the value list.



19. Click **LUT Enable** and select the check box.
20. At the **Analog Control** feature group, adjust **Brightness** and **Contrast** to reach a value of about 220-230 in the image (8bit), for example with a brightness value of about 0.9.

To create a shading reference from an existing image file:

- Perform the steps of the above procedure, but click **Load image from storage** in step 6, click **Next Step**, click **Choose BMP or TIFF File** on the following page, and open the desired image file in the appearing file dialog box.

NOTE: Make sure that the used image has been grabbed with active image calibration mode for PRNU, so that all gains and other LUTs are adjusted to fit the calibration.

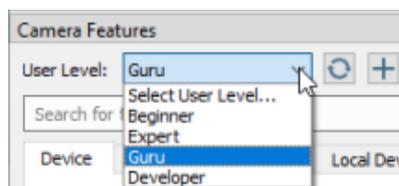
NOTE: While **Image Calibration Control** is active, the temporarily modified features are locked and cannot be modified until the feature is set to **Off**.
Currently, the input image (regardless of whether acquired directly with the grabbing process or loaded from PC) is converted to 8 bit and then used for calculating the PRNU reference

2.9 User level

Each camera contains an XML file specifying the available camera features, When GCT connects to the camera, it loads the XML file and shows the features as a tree structure.

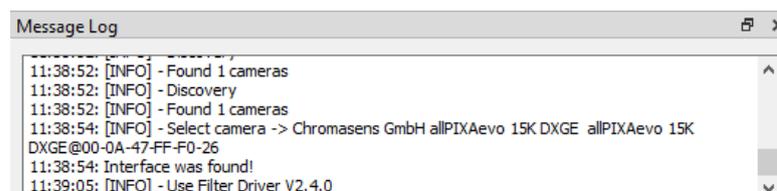
Each feature has a visibility level. While all features are displayed for user level **Developer**, many advanced features are hidden for user level **Beginner**.

The User Level is shown above the feature area. To modify the user level, click the displayed User Level, and then click the desired level:



2.10 Show message log

To show the message log, click **Message Log** on the **View** menu or click **Show message log window**  in the bottom right corner of the GCT window. A **Message Log** area is then shown below the image area:

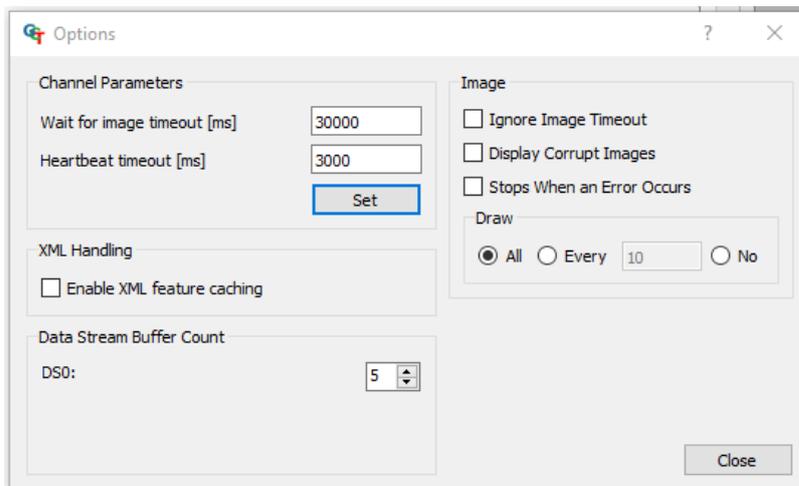


To copy messages to the clipboard, mark the messages, right-click on the selected messages, and then click **Copy** on the appearing context menu.

To copy all present messages, right-click on the **Message Log** area, click **Select All** on the appearing context menu, and then press **Ctrl+C**.

2.11 GCT Options

To open the **Options** dialog box, click **Settings** on the **Start** menu.



Option name	Default value	Description
Wait for image timeout	30000	If the next image is not received after the specified time, then it will send a timeout. The value can be modified. When GCT is restarted, it is set back to 30000.
Heartbeat timeout	3000	Read the value of GevHeartbeatTimeout from the camera (control channel).
Data Stream Buffer Count	5	Specifies the number of buffers used for each stream. The value should be at least 2 or 3.
Ignore Image Timeout	Not selected	Can be selected if the acquisition process should continue despite timeout error.
Display Corrupt Image	Not selected	Can be selected if an image should be displayed despite missing data
Stops If an Error Occurs	Not selected	
Draw	All	Can be set to display every x frames, or to shut off display to reduce CPU usage.
Enable XML feature caching	Not selected	So that the actual value is retrieved directly from the camera, instead of from a cached register.

The options (except **Wait for image timeout** and **Heartbeat timeout**) are saved in `GCC.ini` in a user-specific folder:

`C:\Users\USER_SPECIFIC_FOLDER\Documents\Chromasens\GCT2\GCC.ini.`

3 10 GigE interface with Kithara real time solution

3.1 Introduction of Kithara RealTime

Kithara Software was developed by the company Kithara. The real-time solution of Kithara is a comprehensive system library, which combines industrial automation, machine vision, hardware drivers and communication seamlessly, while being completely flexible and modular at the same time. In nearly any conceivable industrial application, Kithara RealTime can provide fast image capturing with the GigE Vision standard and can achieve a high real-time performance. Running Kithara RealTime requires dedicated CPU cores. On those reserved cores, the real-time system is booted, which, from here on, functions just like a separate RTOS while Windows retains its full operability on the remaining CPU cores. From this point on, Windows and the real-time system run simultaneously and parallel to each other on the same computer, without one restricting the other.

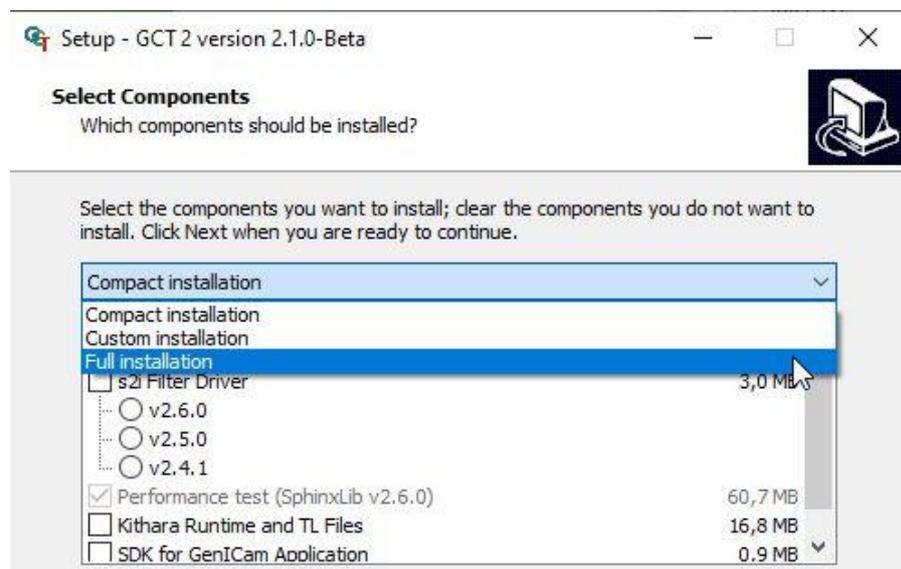
3.2 Licensing

A valid software license including a USB dongle is required to use the Kithara transport layer. Please contact Chromasens about information on licensing options:

<https://www.chromasens.de/en/distribution/contact>

3.3 Installing the Kithara Transport Layer

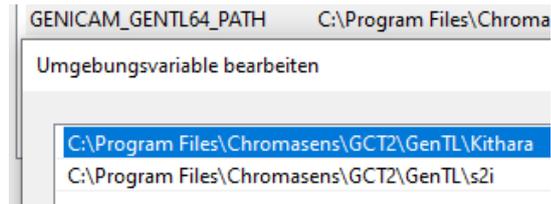
The Kithara transport layer permits to communicate with GigE cameras based on the Kithara software. If Kithara should be used, all components shown on the **Select Components** dialog box must be installed. Therefore, click **Compact installation** to open the installation mode list, and then click **Full installation**:



After the installation of the Kithara transport layer, the Windows system is configured to suit Kithara, and the transport layer file `ls_tl_gev_kithara.cti` and its library file `gevKithara_kernel.dll` are placed in the default folder:

`C:\Program Files\Chromasens\GCT2\GenTL\Kithara.`

After the installation of this component, the system environment variable `GENICAM_GENTL64_PATH` is expanded with the transport layer folder from Kithara and from s2i.



Kithara locates and uses the existing network adapters. This can be configured during the installation of GCT in the Kithara configurator dialog if the component **Kithara transport layer** was selected. You can also skip the Kithara configurator dialog during the GCT installation and start the configurator dialog later in GCT. For more information of the Kithara configuration dialog, refer to the next section.

After the Kithara transport layer has been installed, you must restart the PC.

3.4 System Configuration for Kithara

If the Kithara transport layer is being installed, some system parameters are also configured for the Kithara application, and you must restart the PC after installation has finished.

While you do not need to change the configuration manually, it could still be useful to take a look at the Kithara-related configurations.

3.4.1 Kithara Configurator

If the **Kithara transport layer** check box has been selected during installation of GCT, the **Kithara Configurator** is started during installation. Alternatively, you can start it later by clicking **Kithara Configurator** on the **Tools** menu of GCT.

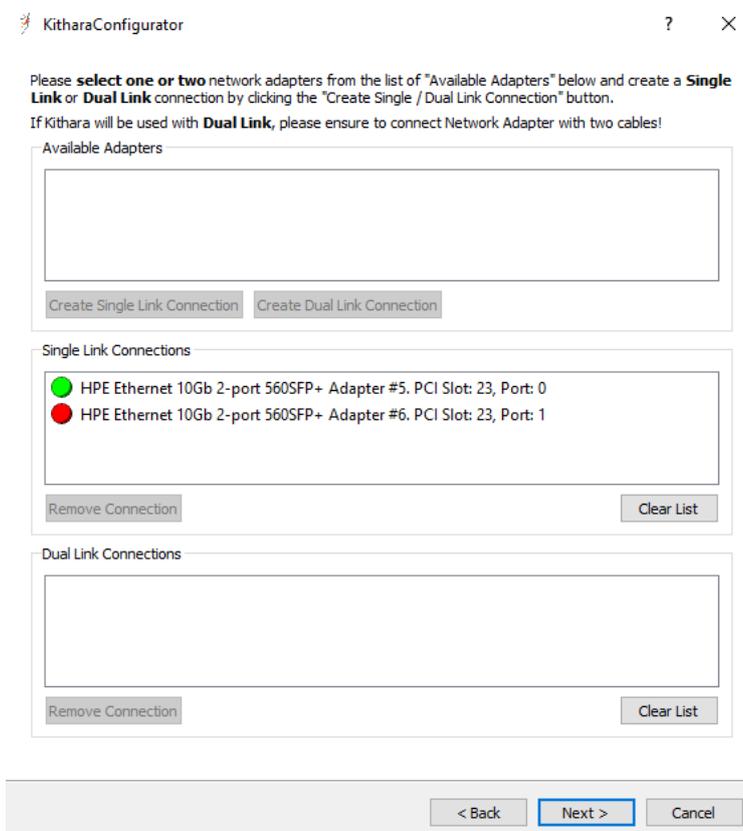
The configurator adds a file `kithara_config.txt` to the folder `C:\Users\Public\Documents\Chromasens\GCT2`, which contains the hardware IDs of the network adapters on which Kithara will be executed. Without this file, the Kithara transport layer is not able to detect the devices in GCT. The Kithara Configurator also adds the dedicated CPU cores for Kithara (refer to section 12.4.2) and disables Hyper-Threading (refer to section 12.4.3). The Kithara Configurator will prompt the system to reboot to update the changes.

To configure the system with the Kithara Configurator:

1. On the **Introduction** page, click **Next**.

On the next page the current internet adapters are listed. Adapters that are connected and in use are shown as active; adapters that are not connected or at which the device is switched off are shown as inactive.

2. If Kithara is going to be used with a single cable connection, select the corresponding adapter port in the adapter list, click **Single Link**, and then click **Next**.



3. If Kithara is going to be used with two cables (which connect two dual ports of the same network adapter), select any one of the two adapter ports in the adapter list, click **Dual Link**, and then click **Next**.



**IMPORTANT
NOTE**

The Kithara configuration can currently be executed once before the first use of Kithara. After Kithara has been used at least once, the configured adapter port(s) are dedicated to Kithara and cannot be used from within Windows unless the driver is set back manually. In the Windows Device Manager the network adapters can be found in the **Kithara System Device** section. If the cable connection for Kithara is changed, it is required to reset the network adapter driver to the original Windows network adapter driver (so that the device can be found under Windows) and rerun the Kithara Configurator.

3.4.2 Reserve dedicated CPU cores for Kithara

If the Kithara transport layer is installed during the GCT installation, two cores of the multicore processor are automatically reserved for the Kithara real-time applications, while Windows and the remaining programs are restricted to the remaining processor cores.

If GCT is uninstalled, the reserved processor cores are freed automatically.

For more information about CPU reservation, refer to:
<https://kithara.com/en/docs/krts:tutorial:setupdedicated>.

3.4.3 Disabling hyperthreading

If the processor supports hyperthreading, do not split a physical core between Windows and Kithara to maximize runtime efficiency. If the Kithara transport layer is installed during installation of GCT, the two following commands are executed during the installation in background using Powershell:

```
bcdedit /set hypervisorlaunchtype off
```

```
Disable-WindowsOptionalFeature -Online -FeatureName Microsoft-Hyper-V-All -NoRestart
```

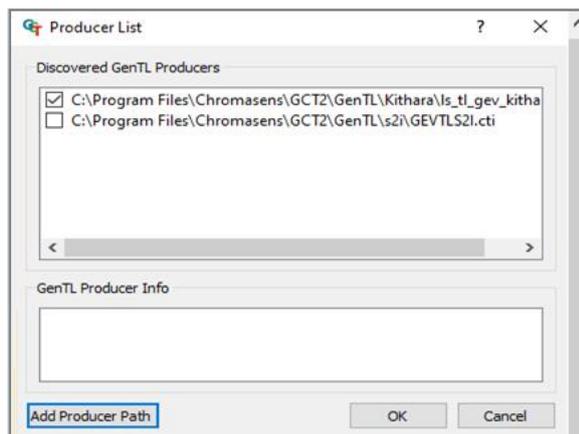
3.5 Using the Kithara Transport Layer

1. Plug in the license USB dongle before using the Kithara Transport Layer.
2. When you start GCT, the first step is to detect the camera. The Kithara TL can be used like any other producer but requires the system to be configured properly. The configuration is done automatically during the installation of GCT. For more information, see sections 3.3 and 3.4.

3.5.1 GCC.ini content of Kithara Producer

During the first discovery process after installation, GCT fetches the paths from the system environment variable `GENICAM_GENTL64_PATH` and searches for `.cti` files in each of those folders. If `cti` transport layer files are found and can be parsed, the camera can be detected with the corresponding transport layer. This may take several minutes during the first discovery process.

When you click **Select TL Producer**, the found files are shown:



To enable use of the Kithara transport layer, select the check box of the file `ls_tl_gev_kithara.cti`, clear the check box of the default file `GEVTLs2I.cti`, and then click **OK**. The discovery process is then started using the Kithara transport layer.

If the discovery process has already been executed, the content of producer path, producer filename, and selected producer for the discovery are already adjusted automatically in the file `GCC.ini`. Therefore, if the discovery has already been executed, the file `GCC.ini` could look as follows in the block of `[DefaultProducers]`.

```
[DefaultProducers]
ProducerList=C:\\Program Files\\Chromasens\\GCT2\\GenTL\\Kithara\\ls_tl_gev_kithara.cti, C:\\Program Files\\Chromasens\\GCT2\\GenTL\\s2i\\GEVTLs2I.cti
AdditionalSearchPath=C:\\Program Files\\Chromasens\\GCT2\\GenTL\\s2i
SelectedProducerList=C:\\Program Files\\Chromasens\\GCT2\\GenTL\\Kithara\\ls_tl_gev_kithara.cti
```

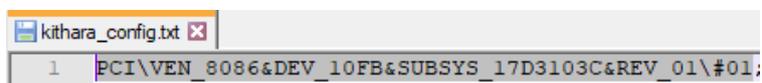
- `ProducerList` contains the found `cti` transport layer files.
- `AdditionalSearchPath` contains the additional search paths for `cti` files, which can be added by clicking **Add Producer Path**.
- `SelectedProducerList` contains the `cti` transport layer files which are selected to be applied for the discovery process.

3.5.2 Kithara_config.txt

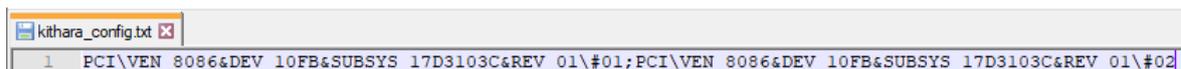
The file `kithara_config.txt` in the folder

`C:\Users\Public\Documents\Chromasens\GCT2` is created by using the Kithara Configurator (see section 3.4.1).

If only a single link is used with Kithara, this file contains the hardware ID of the chosen connection as single entry:

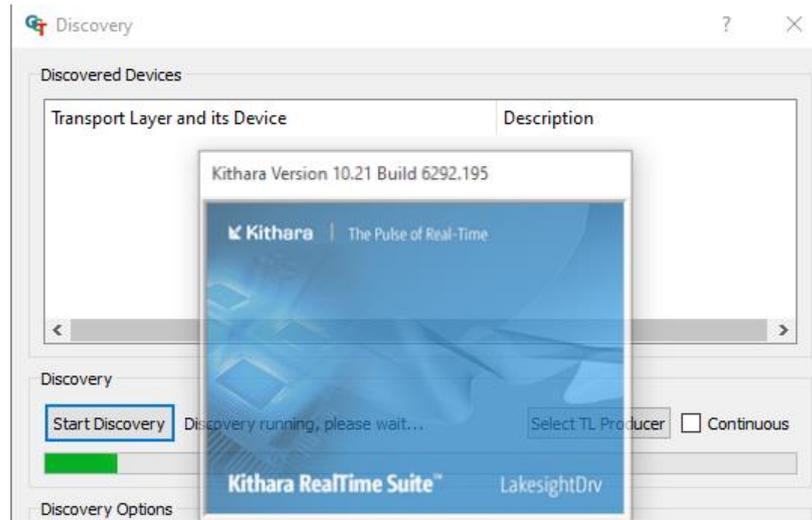


If dual link is used with Kithara, this file contains two items from the dual connections, separated by a semicolon:



3.5.3 Camera discovery with the Kithara Transport Layer

If the Kithara transport layer file `ls_tl_gev_kithara.cti` has been selected in the **Select TL Producer** dialog box, and the file `kithara_config.txt` in the folder `C:\Users\Public\Documents\Chromasens\GCT2` has been configured, a blue Kithara window may appear for some seconds during the first camera discovery with Kithara TL.:



3.5.4 Resetting network adapter driver back to Windows driver

After discovering the camera with the Kithara transport layer file, the corresponding network adapter connections are assigned to the Kithara driver and can no longer be found in the list of normal network adapters in the Windows Device Manager.

As shown in the following screenshot of the Windows Device Manager, the two entries of the dual port HP network adapter (**HPE Ethernet 10Gb 2-port 560SFP**) are not available in the **Network adapters** list. Instead, they are present in the **Kithara System Devices** list with the name **Kithara RealTime -PCI Intel 10 GbE Network Controller**.



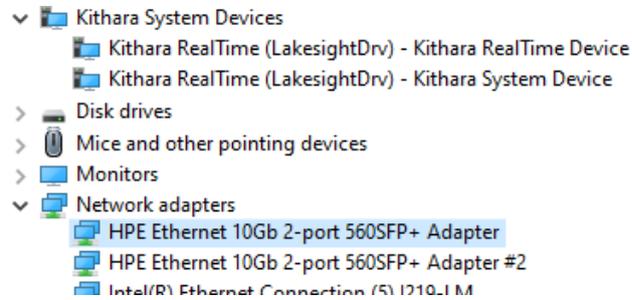
It is not an issue if the camera is always only to be used with the Kithara transport layer. But if the adapter should be used outside the Kithara application, the adapter driver must be set back to the original Windows driver, so that it can again be available for other windows applications.

To reset a Kithara RealTime PCI network controller:

1. On the Windows **Settings** window, click **Network & Internet** and on the next window click **Change adapter options**.
2. Right-click one of the **Kithara RealTime PCI** network controllers, and then click **Properties**.
3. Click **Configure** and on the next dialog box click the **Drivers** tab.
4. Click **Update Driver**.
5. Click **Search driver on my PC** and then click **Select available drivers from a list of my PC**.
6. Select the suitable adapter driver and then click **Continue**.

7. Delete the Kithara config file `Kithara.config.txt` in the folder `C:\Users\Public\GCT2\Kithara`. Otherwise, it could happen that the wrong configuration file is loaded during a renewed Kithara configuration.

After these steps, the adapter (**HPE Ethernet 10Gb 2-port 560SFP** in this example) is removed from **Kithara System Devices**, and is again available in the **Network adapters** list:



3.6 Performance Test with Kithara

When the Kithara transport layer is installed, a separate performance program is copied to the folder: C:\Users\Public\Documents\Chromasens\GCT2\performanceTest\withKithara.

To run the performance test with Kithara, a Kithara-specific dongle representing the license must be plugged in an USB slot. If this dongle has not been delivered yet by Chromasens, contact sales or support.

The performance test program with Kithara is independent of GCT. It can be started directly without any configuring.

The program has the following parameters:

- start_line_time: Start value of camera acquisition line time in microseconds.
- stop_line_time: End value of camera acquisition line time in microseconds.
- line_time_step_width: Time step from **start_line_time** to **stop_line_time** in microseconds.
- iteration_time: Test duration of each line time in seconds (integer).
- width: Image width in pixels. If this parameter is not set, the current width is used.
- height: Image height in pixels. If this parameter is not set, the current height is used.
- rgb10: Format flag. If 0, the format RGB8 (each pixel has 24 bit) is used for image acquisition. If 1, RGB10p32 (each pixel has 32 bits) is used instead. In case of RGB10p32, the camera transfers 33.3% more image data.

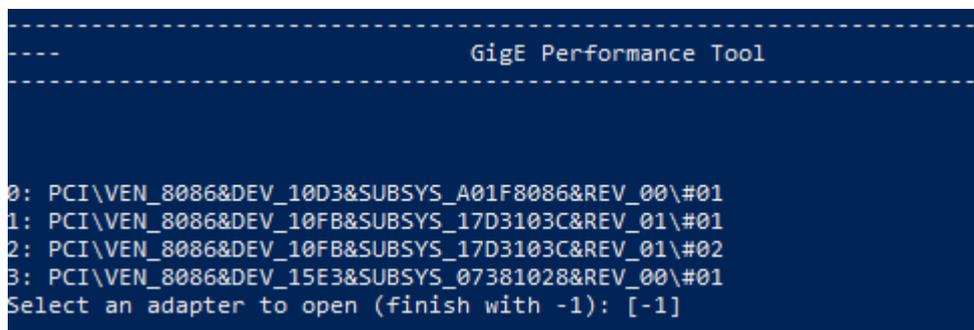
Example of a command line:

```
PerformanceTest.exe start_line_time 30.0 stop_line_time 40.0
line_time_step_width 5.0 iteration_time 60 rgb10 1
```

This means, the camera uses RGB10p32 as image format, starts with an acquisition line time of 30.0 microseconds (us), stops after 40.0us, and the step is 5.0us. With each acquisition line time, the test of each different line time will take 60 seconds. The running program can be stopped by pressing any key.

When the performance program is started, Kithara searches all available ports of the PC. If the camera is connected with a single cable, the corresponding index must be entered as shown below. If the camera is connected to a dual port network adapter with two GigE-cables, the indices of both ports must be entered.

In the example shown below, a dual port network adapter occupies two ports with the same identifier PCI\VEN_8086&DEV_10FB&SUBSYS_17D3103C&REV_01. The ports differ from each other only by the ending #01 or #02:



```
----- GigE Performance Tool -----
0: PCI\VEN_8086&DEV_10D3&SUBSYS_A01F8086&REV_00\#01
1: PCI\VEN_8086&DEV_10FB&SUBSYS_17D3103C&REV_01\#01
2: PCI\VEN_8086&DEV_10FB&SUBSYS_17D3103C&REV_01\#02
3: PCI\VEN_8086&DEV_15E3&SUBSYS_07381028&REV_00\#01
Select an adapter to open (finish with -1): [-1]
```

So, if a camera is connected to both ports of this network adapter, then index 1 and 2 must be both selected to start acquisition.

```
----- GigE Performance Tool -----
0: PCI\VEN_8086&DEV_10D3&SUBSYS_A01F8086&REV_00\#01
1: PCI\VEN_8086&DEV_10FB&SUBSYS_17D3103C&REV_01\#01
2: PCI\VEN_8086&DEV_10FB&SUBSYS_17D3103C&REV_01\#02
3: PCI\VEN_8086&DEV_15E3&SUBSYS_07381028&REV_00\#01
Select an adapter to open (finish with -1): [-1] 1
Select an adapter to open (finish with -1): [-1] 2
Select an adapter to open (finish with -1): [-1]

The following cameras have been found:
0: Chromasens-Camera Chromasens GmbH [00:0A:47:FF:F0:2A][40000-00157]
Packet size: 8240.
Width: 10240
Height: 1024
PixelFormat: RGB10p32
Line time min: 17.452 (from feat. param: 17.452)
Using 18.0000 us line time
```

3.7 Troubleshooting Kithara Transport Layer

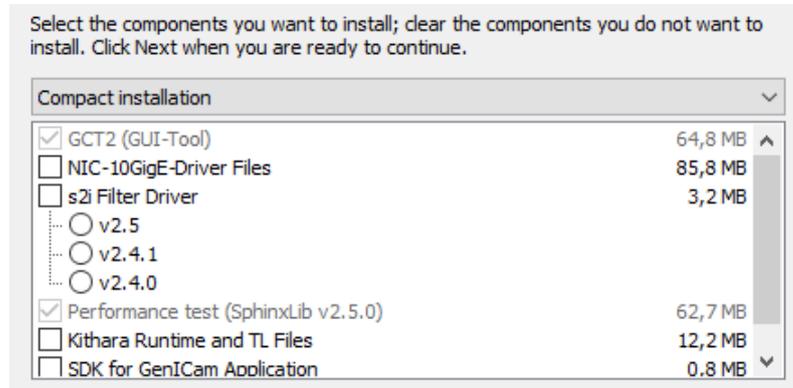
3.7.1 No camera is found during discovery

Make sure that the license USB dongle is plugged in. Also make sure to configure the Kithara transport layer before use by following the steps described in the section 3.4.

3.7.2 Discovery takes a long time to finish

It may happen that the discovery takes a long time to finish its process without detecting the camera, even though the system is configured properly. In such cases, restart the system and try again. If the Kithara Transport layer is used to detect the camera, run the Kithara Configurator application again to set all the Kithara-related parameters correctly.

4 10GigE Connection without Kithara real time solution with Sphinx Lib



There are six components for the installation.

1. The first component is GCT and it is a mandatory part.
2. The second component (NIC-10GigE-Driver-Files) copies the installer program for the driver files of the Intel-supported GigE network adapters (for example HPE Ethernet 10Gb 2-port 560SFP+ Adapter) to the PC. If your network adapter meets the criterion, you can select this component.
3. If the third component (s2i Filter Driver) is selected, the filter driver batch of the selected version is copied to the PC. If no filter driver is installed, or an older version is installed, you can select this component. If the one of the listed versions of the s2i filter driver file is already installed, you don't need to select it.
4. Performance test provides a batch file that permits to test the image data transfer.
5. Kithara Runtime and transport layer files. Select this component for installation only if the Kithara Realtime should be applied to the camera. For more information about Kithara, refer to chapter 2.11.
6. SDK for GenICam Application. If this component is selected, the corresponding headers, library files, documents and sample code of SDK are installed.

For the components NIC-10GigE-Driver Files and s2i Filter Driver, the required installation files are copied by default to the folder C:\Program Files\Chromasens\GCT\drivers if the respective component is selected.

The s2i filter driver is normally installed automatically if the component is selected. To change/uninstall the s2i filter manually later or to install the NIC-10GigE driver, you must start the respective batch- or exe-file in its subfolder and reboot the PC as needed. In addition, a change in the BIOS settings is needed before the very first installation of s2i filter driver, as described in section 4.2.

4.1 System Requirements

Hardware requirements:

- A GenICam-standard camera
- 10-Gigabit Ethernet network interface card (also known as 10Gb NIC)
- 10-Gigabit fiber optical cable with LC/SFP+ connector and 2 transceivers SR 850nm SFP+.
- Intel Core i7 or higher
- 16GB RAM or higher

Software requirements:

- Win10 x64 bit operating system
- Driver for 10-Gigabit Ethernet network interface card

4.2 Setup of the 10-GigE adapter

4.2.1 General preparation

If the component **s2i Filter Driver** is selected during installation, it is installed automatically from the installer. If you want to change the filter driver manually afterwards, refer to section **Fehler! Verweisquelle konnte nicht gefunden werden.**

Installing the s2i filter driver

To be able to apply the s2i filter driver in GCT, at least version 2.4.0 of the filter driver must be installed (V2.5 is recommended). The batch files for installation and removal can be found in the folder:

`C:\Program Files\Chromasens\GCT\drivers\s2iFilterDriver.`

If an older version is installed, for example V2.1.4, it should be updated.

To remove an older version of the s2i filter driver:

1. Run the batch file `UninstallFilterDriver.bat`.
2. Reboot the PC.
3. In the folder `C:\windows\system32\drivers` remove the file `s2iGEVFilter.sys` if it is still present.

To install the s2i filter driver:

1. Run the batch file `InstallFilterDriver.bat` as administrator.
2. Reboot the PC.

For more information, refer to the instruction `HowTo_Install_Driver_Windows.pdf` in the folder `C:\Program Files\Chromasens\GCT\drivers\s2iFilterDriver.`

Disabling Secure Boot

Secure Boot must be disabled in the BIOS settings. To access the BIOS settings, you must press the BIOS key of your PC, while the PC is starting. The BIOS key could be **F10**, **F2**, **F12**, **F1**, or **DEL**, depending on the manufacturer of the mainboard.

Connecting the camera

Connect the required Gigabit Ethernet cable(s) to the network adapter. If a teaming should be configured, you should connect both cables to the network adapter and then power up the connected camera.

4.2.2 Setup for adapters supported by Intel driver under Windows 10 64-bit

If the following conditions are fulfilled, the setup can be performed using a Powershell script as described below:

- 10-GigE adapter supported by an Intel driver, for example HPE Ethernet 10Gb 2-port 560SFP+.
- Windows 10 64-bit

Otherwise, the setup of the network adapter must be performed as described in section 4.2.3.

To setup the adapter using the Powershell script:

1. Install the intel driver for 10-GigE network adapter manually.

By default, the network adapter driver can be found in the folder
 C:\Program Files\Chromasens\GCT\drivers\NIC-10GigE\Win10
 if the option **NIC-10GigE-Driver Files** was checked during GCT installation. The newest driver version can be also downloaded from the Intel website under <https://downloadcenter.intel.com/de/download/25016/Intel-Network-Adapter-Driver-for-Windows-10>.

Double-click the executable network adapter driver to run its installation.

2. Start Windows PowerShell as administrator. Windows 10 comes with a Cortana search box in the taskbar. Just type `powershell` in the search box. Right-click on **Windows PowerShell** on the results, select **Run as administrator**, and confirm with **Yes**. Then type the following row in the PowerShell console window to run the PowerShell script `config10GigE.ps1`:

```
C:\Users\Public\Documents\Chromasens\GCT\config10GigE.ps1
```

3. According to displayed hint, enter **y** or **n**, to setup for each adapter connection.

```
PS C:\users\Public\Documents\Chromasens\gct> .\config10GigE.ps1
This program configures the 10 GigE network connections.
A teaming can be created optionally if the network interface card is supported by intel driver.
=====
Start IntelNetCmdlets...
IntelNetCmdlets is started.
=====
Detecting existing teaming group(s)
Found following teaming group(s). If you want to setup network interface card for evo-camera, it is recommended to remove existing teaming group.

TeamName       : Gruppe: LAG
TeamMembers    : {HPE Ethernet 10Gb 2-port 560SFP+ Adapter #2, HPE Ethernet 10Gb 2-port 560SFP+ Adapter}
TeamMode       : StaticLinkAggregation
PrimaryAdapter : NotSet
SecondaryAdapter : NotSet

=====
Do you want to remove Gruppe: LAG which contains HPE Ethernet 10Gb 2-port 560SFP+ Adapter #2 HPE Ethernet 10Gb 2-port 560SFP+ Adapter ?
[y/n] Please enter the key 'y' for 'yes', or 'n' for 'no'.
```

If a teaming group (link aggregation) exists already, you must remove it first before starting a new setup. In this case, enter **y**.

```

2 10 Gigabit Ethernet connection(s) are found.

InterfaceDescription                               Name           Speed  Index
-----
HPE Ethernet 10Gb 2-port 560SFP+ Adapter         Ethernet 3 10000000000  0
HPE Ethernet 10Gb 2-port 560SFP+ Adapter #2     Ethernet 4 10000000000  1

=====
Do you want to setup for Ethernet 3 ?
[y/n] Please enter the key 'y' for 'yes', or 'n' for 'no'.

Do you want to setup for Ethernet 4 ?
[y/n] Please enter the key 'y' for 'yes', or 'n' for 'no'.

```

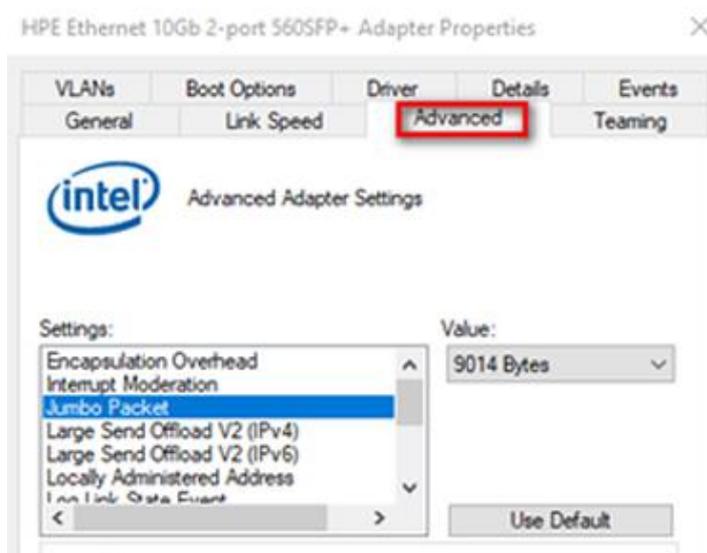
The 10-GigE adapter connections will be listed. If only a single connection will be used, then chose this connection to perform the setup.

4.2.3 Setup for adapters not supported by Intel driver or under Win 7 64-bit

In contrast to section 4.2.2, this section is now oriented to the network adapters, which are not supported by Intel, or the operating system is Win7 x64. Setup depends on the adapter manufacturer. Normally you need to install the driver of your own 10-GigE adapter first, then set parameters with proper values manually, and create a teaming group if necessary. The GUI of setup can vary from adapter to adapter. The following setup is just an example.

To setup the adapter manually:

1. On the Windows **Start** menu, click **Settings**.
2. In the **Settings** window, click **Network & Internet**, and then click **Change adapter options**. The **Network Connections** window opens.
3. Right-click one ethernet connection of the Gigabit Ethernet network card, and then click **Properties**. The **Properties** dialog box opens.
4. Click **Configure**, and then click the **Advanced** tab. The available parameters may vary and are depending on the adapter.



5. Set proper values for the relevant parameters:

Attribute name (English)	Attribute name (German)	Value
Interrupt Moderation	Interrupt-Drosselung	Enabled
Jumbo packet	Jumbo Packet	9014 Byte
Large-Send-Offload V2(IPv4)	Large-Send-Offload V2(IPv4)	Enabled
Large-Send-Offload V2(IPv6)	Large-Send-Offload V2(IPv6)	Enabled
Direct Cache Access	Direct Cache Access	Enabled
Receive Buffers	Empfangspuffer	Max (e.g. 4096)
Flow control	Flusssteuerung	Disabled
Interrupt Moderation Rate	Interrupt-Drosselungsrate	Adaptive
Low Latency Interrupts	Low Latency Interrupts(LLIs)	Disabled
Transmit Buffers	Übertragungspuffer	Max (e.g.16384)
Rx and Tx from Offloading Options	Rx und Tx von Offload-Optionen	Enabled
Receive Side Scaling	RSS (Empfangsseitige Skalierung)	Enabled
RSS queues	RSS-Warteschlangen	2
Log Link State Event	Verbindungsereignis protokollieren	disabled

6. In the Network Connections window, for both 10-GigE network adapter connections, right-click it, click **Properties**, click the **Network** tab, and only enable **s2i GigE-Vision Filter Driver** and **Internet protocol version 4 (TCP/IPv4)**.

5 CoaXPress interface

GCT2 supports the CoaXPress interface as well.

To use the CoaXPress interface with GCT2, please follow the installation instructions above for GCT2. You'll not need to select the drivers for 10GigE in the download as well as the Kithara transport layer during the installation.

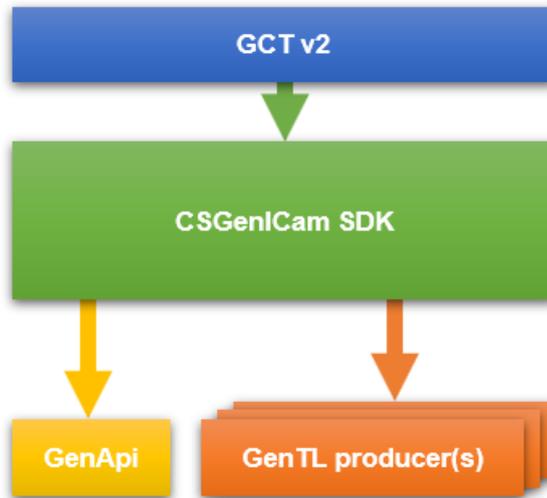
For the Driver of the CoaXPress Framegrabber as well as the transport layer, please follow the instructions of the grabbers manufacturer.

In GCT2 you have to select the GenTL Producer of the frame grabber at the Discovery instead of the S2i or the Kithara one.

Note: tested grabbers: Euresys and Matrox.

6 SDK – CSGenICam

The Chromasens GenICam SDK is an optional part of the GCT software package. It can be seen as an abstraction layer above the GenICam GenApi and GenTL interfaces, as shown in graphic below:



It permits to write applications against the CSGenICam interface. The CSGenICam interface provides a set of convenience functions and additional functionalities specific to Chromasens cameras. As an example, it adds functions that permit to perform file transfers from/to the device. It has a slightly simplified interface when compared to the more abstract GenApi and GenTL producer libraries.

For more information on how to use the SDK, including a complete API reference, refer to the SDK documentation.

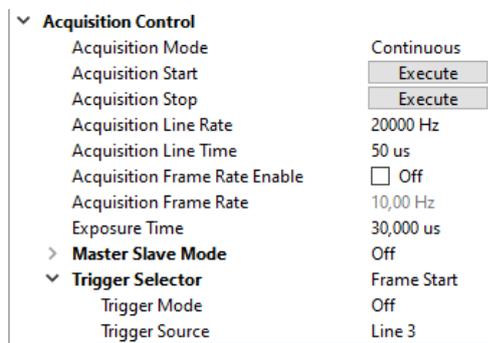
7 Troubleshooting

7.1 Possible reasons for GEV_TIMEOUT_ERROR

Sometimes during image grabbing, there comes no image from the camera, and the message log shows GEV_TIMEOUT_ERROR in the bottom area. This can be caused by following reasons.

7.1.1 Trigger mode not set correctly

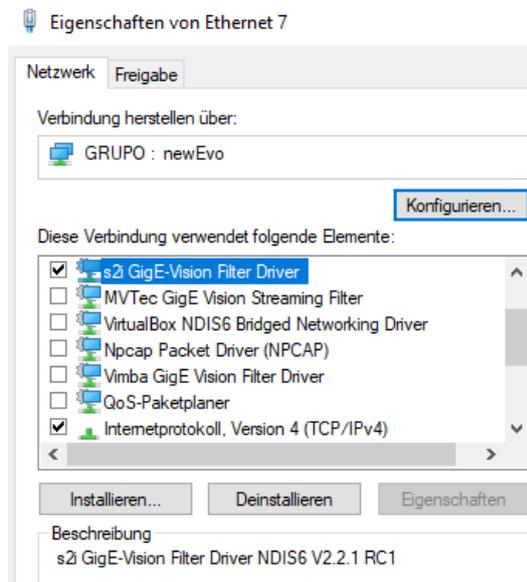
Trigger source: If there is no explicit trigger available and the camera should run in “free-running” mode, but the value of trigger source does not correspond to this mode, then GCT will return “GEV_TIMEOUT_ERROR” and cannot grab images.



7.1.2 Filter driver not installed properly (only for 10GiGE without Kithara)

GCT can use the filter driver developed by s2i. If the filter driver should be used for the grabbing process, it must be installed and enabled correctly beforehand in the adapter settings.

To check the adapter settings, go to **Start** menu -> **Settings** -> **Network & Internet**. On the **Settings** window, click **Change adapter options**. A new dialog box opens with a list of network connections. Right-click the corresponding GigE Ethernet connection for the camera and then click choose **Properties**. If a teaming group is used, then right-click the teaming group and choose its attributes. Ensure that **s2i GigE-Vision Filter Driver** is selected and that the version is correct.



7.1.3 “Secure Boot” not disabled in BIOS settings (only for 10GiGEwithout Kithara)

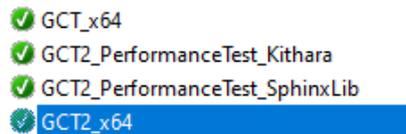
If the filter driver is installed properly and can also be detected, but “GEV_STATUS_DRIVER_READ_ERROR” appears during grabbing, it could be due to **Secure Boot** in the BIOS settings. In this case refer to section 4.2.1.

7.1.4 Firewall is not completely allowed for GCT

Data transfer between camera and PC requires firewall allowance. Normally, the firewall rule is exclusively allowed for GCT automatically after installation.

To verify the firewall rule:

1. On the Window **Start** menu, click **Settings-> Update & Security -> Windows Security -> Firewall & network protection**.
2. Click **Advanced settings** and highlight **Inbound Rules** in the left panel.
3. Find the rule name **GCT2_x64**, open its properties, and ensure that the firewall rule is allowed for all types: **domain, private, and public**.



7.1.5 Reboot

If GEV_TIMEOUT_ERROR occurs only if the filter driver is activated, you can reboot your PC to resolve unknown conflicts in the hardware.

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