GCT 2.3 | Manual

CD40201

R06 / 2022-12-08

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1 Introduction

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. GCTv2.2 is the successor product of GCT v1.x. It uses the transport layer interface and provides more features.

The following graphic shows an overview of the connection between the GCT software and the camera. The host software uses the CSGenICam SDK to connect to the camera. Regarding the GenICam GenTL standard, the software and your program are interface independent. The only difference is that the appropriate transport layer should be used for each interface type. This means if you are using a GigE camera, you need a network adapter and the s2i or Kithara transport layer, if you want to use a CoaXPress camera you need a frame grabber and the CoaXPress transport layer (delivered from the frame grabber vendor).
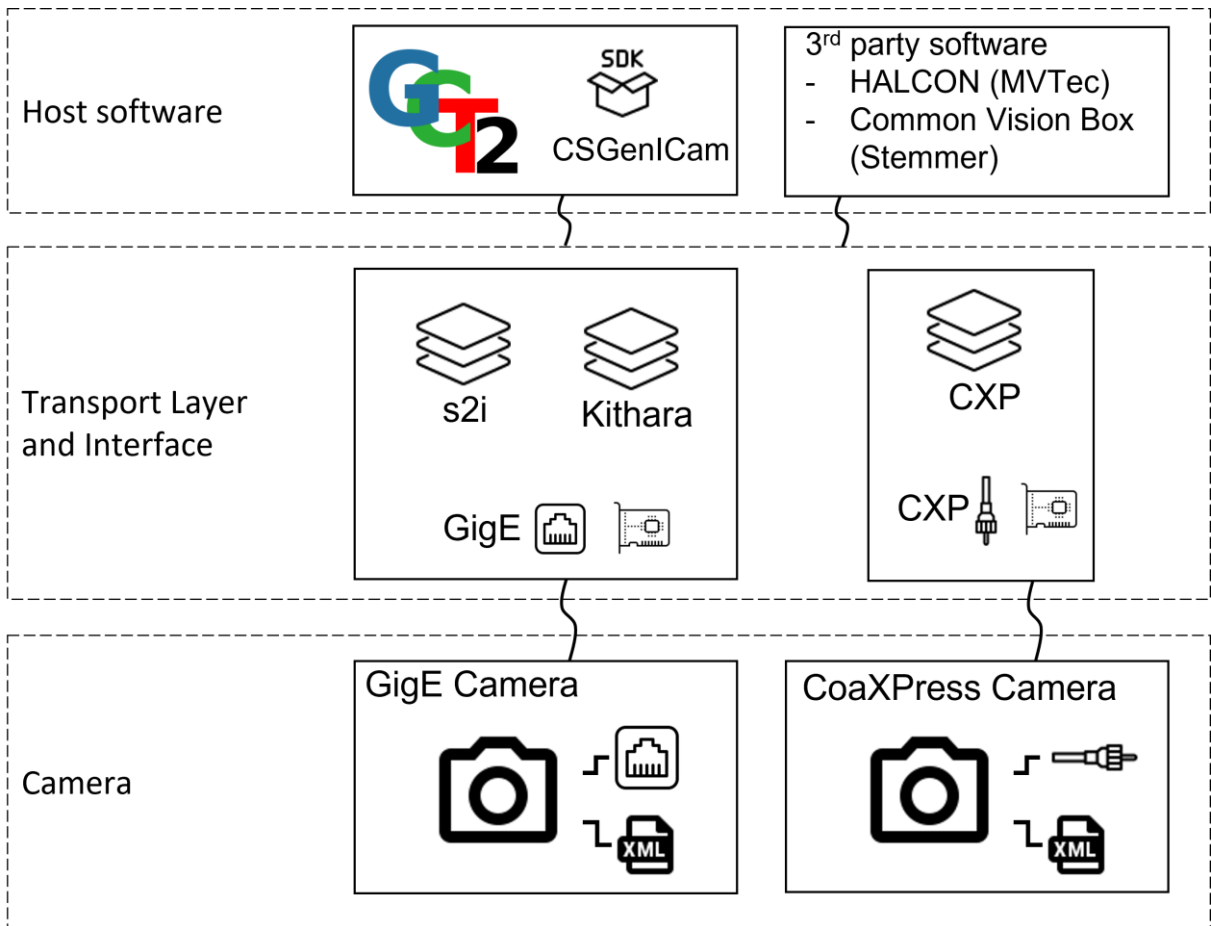
1.1 About Chromasens

The name of our company, Chromasens, is a combination of 'Chroma' which means color, and 'Sens' which stands for sensor technology.

Chromasens designs, develops, and produces high-quality and user-friendly products:

- Line scan cameras

- Camera systems

- Camera illumination systems

- Image acquisition systems

- Image processing solutions

Today, Chromasens GmbH is experiencing steady growth and is continually penetrating new sales markets around the globe. The company's technologies are used, for example, in products and for applications such as book and document scanners, sorting systems and inspection systems for quality assurance monitoring.

Customers from all over the world of a wide range of industrial sectors have placed their trust in the experience of Chromasens in the field of industrial image processing.

1.1.1 Contact information

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1.1.2 Support

Should you ever have problems with the GCT2 that you cannot solve by yourself, please look into this manual for additional information, check the troubleshooting chapter 6 contact your local distributor, or send us an e-mail.

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HP: http://www.chromasens.de/en/support/support/support

Visit our website at http://www.chromasens.de which features detailed information on our company and products.

1.2 Conventions used in this manual

1.2.1 Symbols

!	**Warning** **Failure to follow the procedure described in this manual may result in damage to the hardware.**

!	**Caution** **Failure to follow the procedure described in this manual may impair the functionality of the device.**

💡	Indicates a helpful tip.

🌐	More detailed information can be retrieved online.

1.2.2 List of abbreviations

| Abbreviation	Meaning	Explanation
CXP	CoaXPress	CoaXPress (CXP) is interface for communication between the camera and the PC. http://www.coaxpress.com/
cmd	Command prompt	Windows Command-line interpreter
DSNU	Dark signal non-uniformity	Irregularity in the dark image
GCT	GenICam Control Tool	Chromasens Software to communicate with cameras which fulfil the GenICam standards.
GenICam	Generic interface to cameras	Generic programming interface for industrial cameras administered by the European Machine Vision Association www.emva.org
GenApi	GenICam module	GenICam module defining the XML Schema which is used to describe register maps. https://www.emva.org/standards-technology/genicam/introduction-new/
GenTL	Generic Transport Layer	Generic Transport Layer interface https://www.emva.org/standards-technology/genicam/introduction-new/
GigE	Gigabit Ethernet	Enables easy connection of industrial cameras to by using the Gigabit Ethernet standard.
PRNU	Photo response non-uniformity	Difference in sensitivity of the individual pixels
ROI	Region of interest	-
SDK	Software development kit	It is a collection of software development tools in one installable package
SFNC	Standard Feature Naming Convention	Document of the GenICam standard, which provides feature names for common camera features.
TL	Transport Layer	
XML	Extensible Markup Language	It is a markup language and file format for storing, transmitting, and reconstructing arbitrary data.

1.3 Installation of GCT v2.3

GCT v2.2 does not require the installation or uninstallation of GCT v1.x. Both can exist parallelly on the PC. If GCT v2.x was already installed before, an information will indicate you to overwrite the previous version of v2.x.

The transport layer for the GigE interfaces is provided by the GCT installer. For other interfaces, such as CoaXPress, the transport layer is provided by the frame grabber vendor. The operation of GCT is always the same regardless of the interface.

After you have downloaded the installation program from our homepage https://chromasens.de/en/software , the installation can be started. Therefore, execute the GCT_win65_v2.X.X.exe file and following the next steps:

1. Select your language

2. The second window shows important information's about the GCT version

3. Select the destination where you want to install GCT2

4. Select the components for installation, you have the following options:

   a. Compact installation, only the mandatory parts are installed (recommended for CoaXPress Interface)

   b. Custom installation, you can select the components to install (for GigE interfaces without Kithara, you can select s2i Filter driver)

   c. Full installation, install all components (recommended for GigE interface with Kithara)
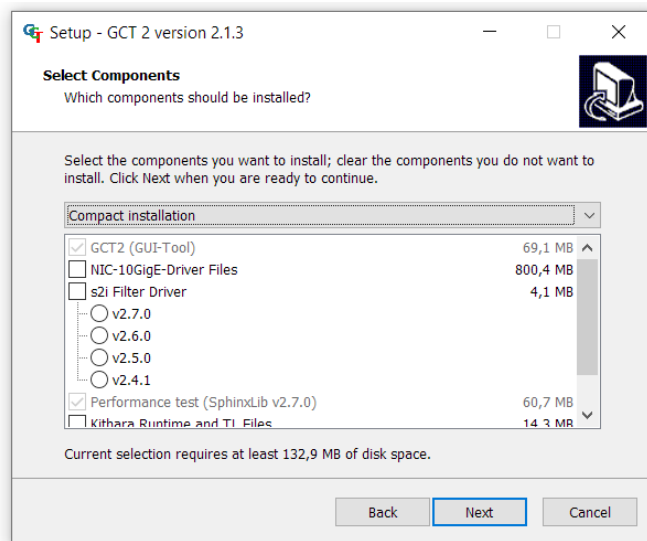
5. The components are:

   a. The first component is GCT and it is a mandatory part.

   b. 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. It will be installed during the installation.

   c. 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.

   d. Performance test provides a batch file that permits to test the image data transfer for GigE cameras.

e. Kithara Runtime and transport layer files. Select this component for installation only if the Kithara Realtime should be applied to the camera(for 10GigE cameras only).

f. SDK for GenICam Application. If this component is selected, the corresponding headers, library files, documents and sample code of SDK are installed.

6. Select Start Menu Folder

7. Select Additional Task

    a. Create a desktop shortcut

    b. Create a Quick Launch shortcut

8. Start the installation

    a. If the `NIC-10GigE-Driver-Files` filter driver is selected the installer automatically setup your environment by running a batch script, for more information please refer to chapter 1.3.1.

    b. If Kithara runtime is selected the Kithara configurator starts automatically, please refer to the chapter 1.3.2.

    c. If s2i filter driver is selected a batch script (if available, deinstall the old version) install the `s2i Filter Driver`, please follow the instructions in the chapter 1.3.3.
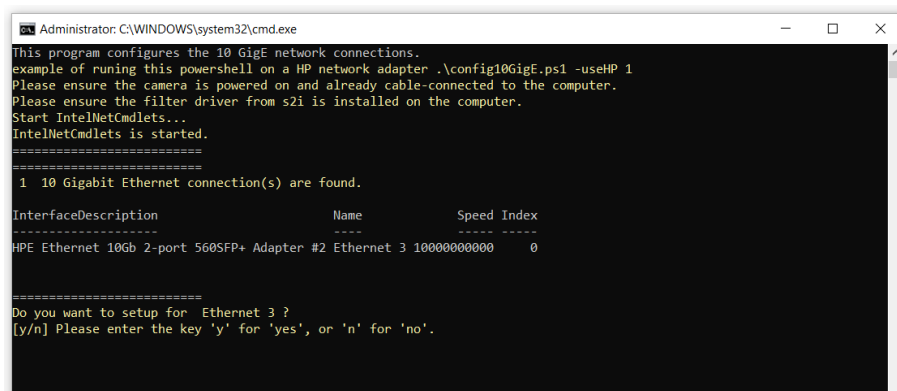
9. Restart the PC

1.3.1 Installation of NIC-10GigE-Driver Files

The `NIC-10GigE-Driver Files` are installed automatically during the installation. The following requirements must be fulfilled to use the `NIC-10GigE-Driver`:

- 10-GigE adapter supported by an Intel driver, for example HPE Ethernet 10Gb 2-port 560SFP+.
- Camera must be connected to the PC
- Windows 10 64-bit

The during the GCT installation the command line (cmd) of windows executes the `NIC-10GigE-Driver Files.` The executable scan your system to the available network adapter's which are connected to your camera. The window lists all available ethernet adapters and you can configure the network adapter by entering a **y** into the script.

If you have two adapters the script asks you also for the second one.

After the configuration of the network parameter the scrip can help you to set a static IP Address of the network adapter. If you have a default installation you can disagree by entering **n** into the window. If you want to set a static IP Address of your network, you can answer with **y**

1.3.2 Installation of 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.

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`. Also, 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. For more information of the Kithara configuration dialog, refer to the section 3.3.2.

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

1.3.3 Installation of s2i filter driver and Transport Layer

The `s2i Filter Driver` installed automatically during the installation. In addition, a change in the BIOS settings is needed before the very first installation of s2i filter driver, as described below.

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. Now you can disable the secure boot of your system.

1.4 System Requirements

Hardware requirements:

- 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 v2.2

This chapter should give you an overview of how to use GCT, it is independent of your hardware.

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 successful connection with your camera. 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.
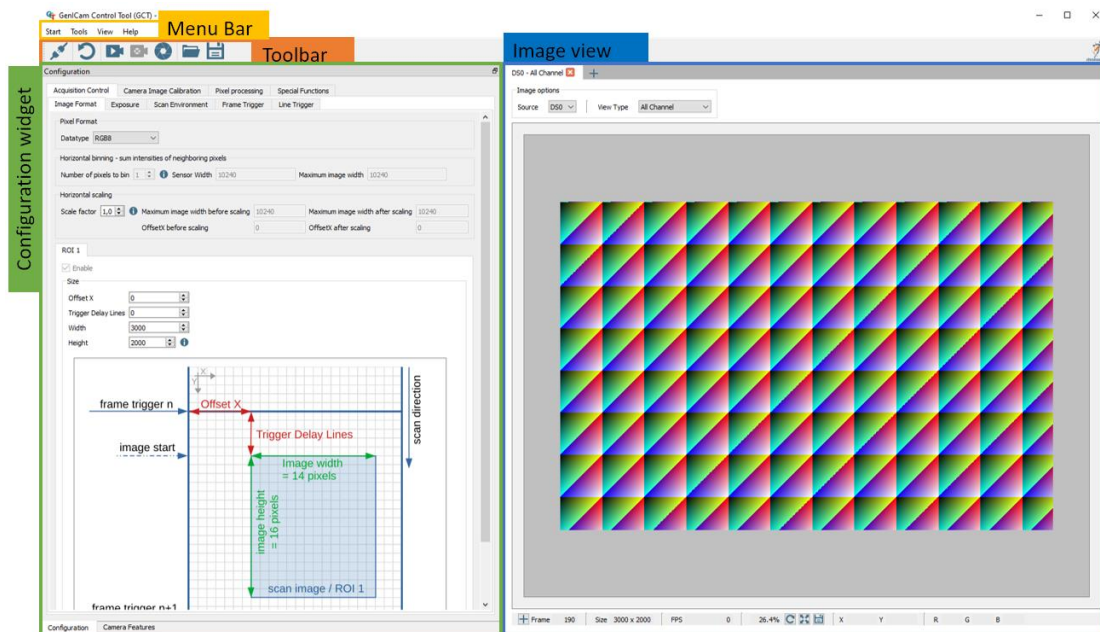
2.1.1 Menu Bar

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 3.3.2.

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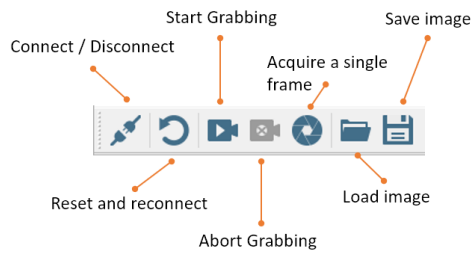
The **Toolbar** widget offers the following button functions:

- **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 2.5.
- **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 GenIcam parameter tree and the configuration panel which is a graphical representation of the GenIcam 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.
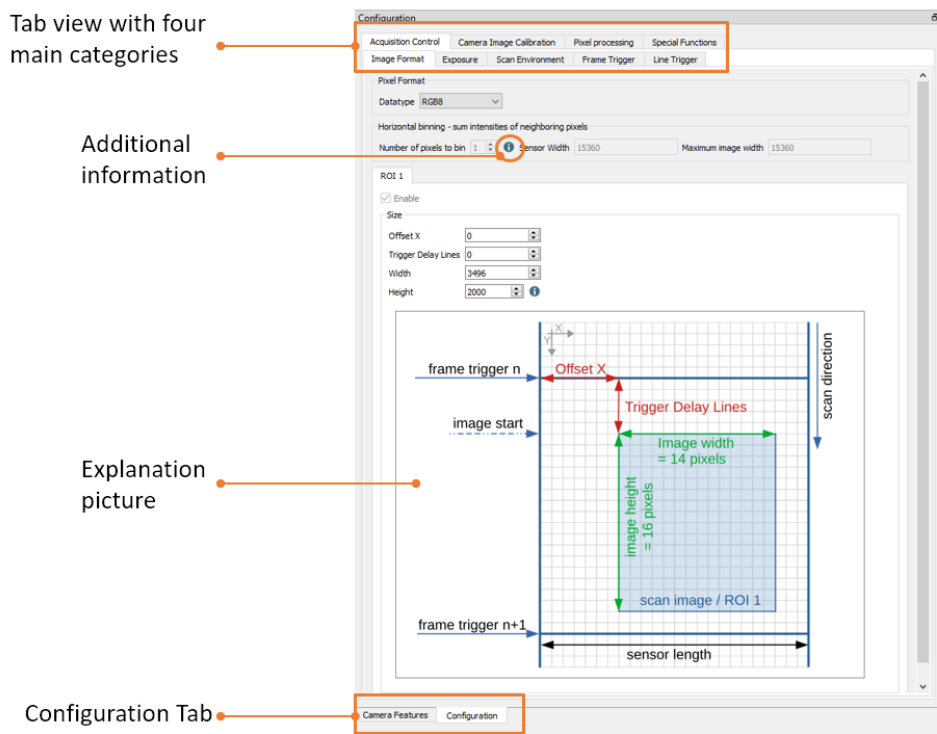
The Camera Features tab contains the GenIcam parameter tree, the user setup level and an extra panel to set up the filter driver.
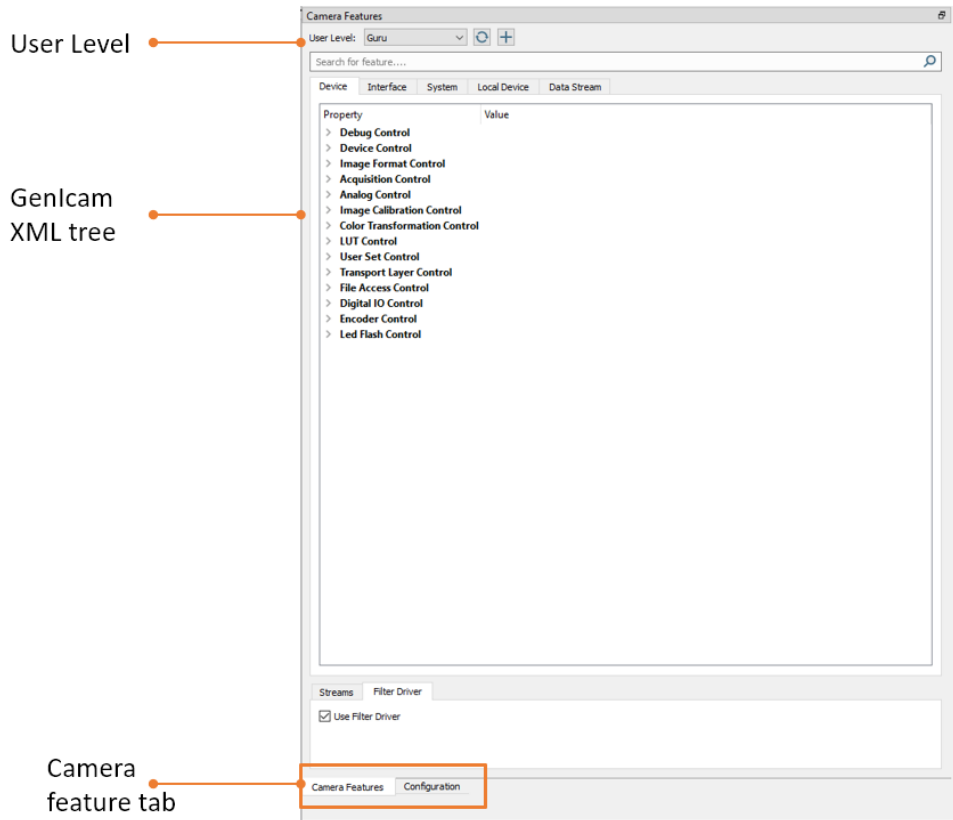
2.1.4 Image view widget

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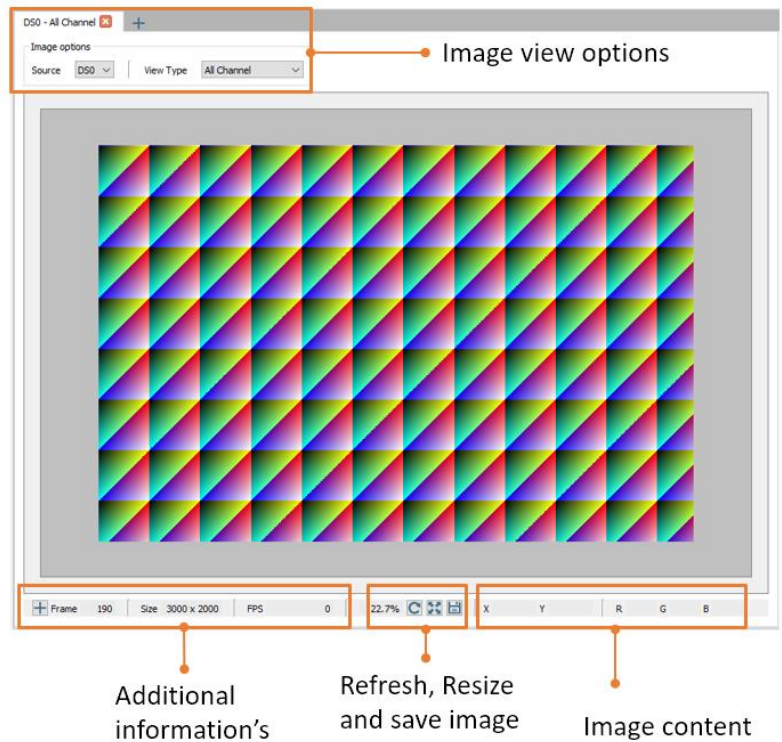
Mouse operations on the image

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 Line plot view

GCT2 can display a horizontal line plot in the image view widget. To add this feature, add a new tab, therefore press the plus on the top. A popup window will be open, please select under the "View Type" the "Horizontal Line plot.
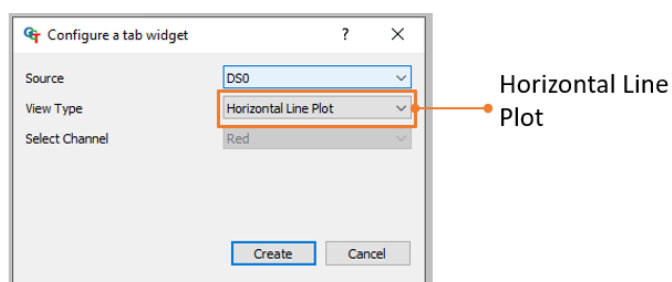
After this configuration a new window will open as shown in the following figure.
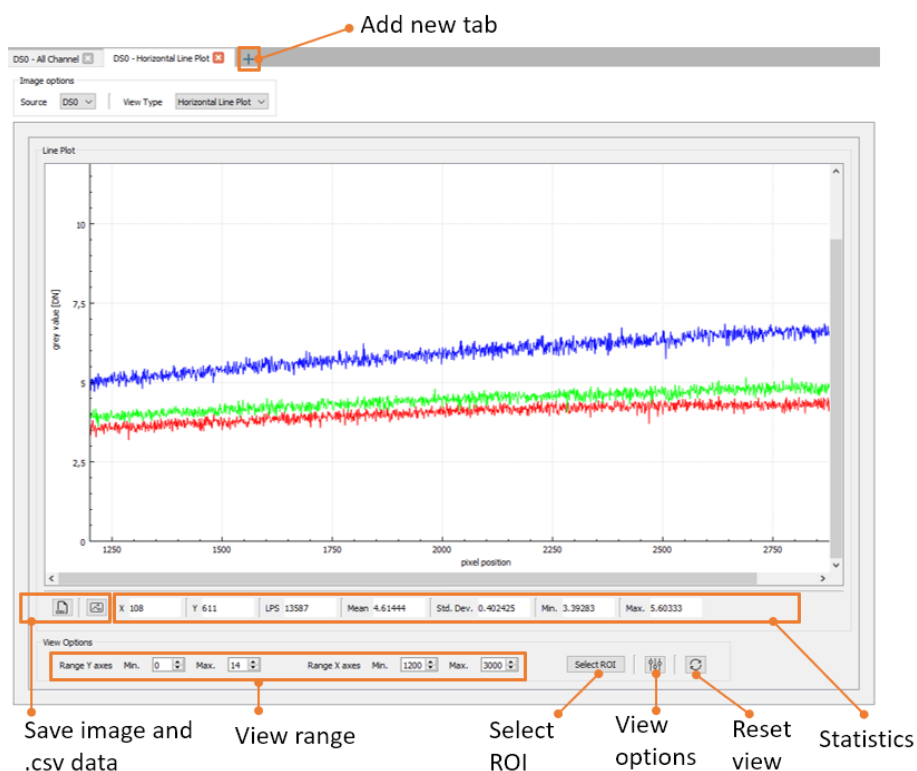
2.1.6 Histogram view

GCT2 can display a histogram of in image content in the image view widget. To add this feature, add a new tab, therefore press the plus on the top. A popup window will be open, please select under the "View Type" the "Horizontal Line plot.
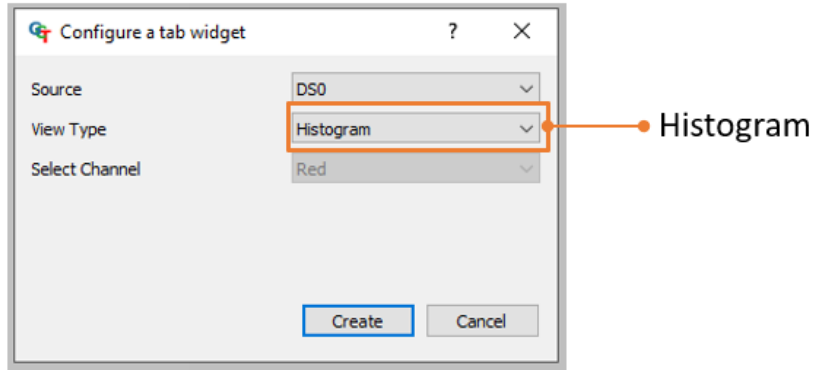
After this configuration a new window will open as shown in the following figure.

2.1.7 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.
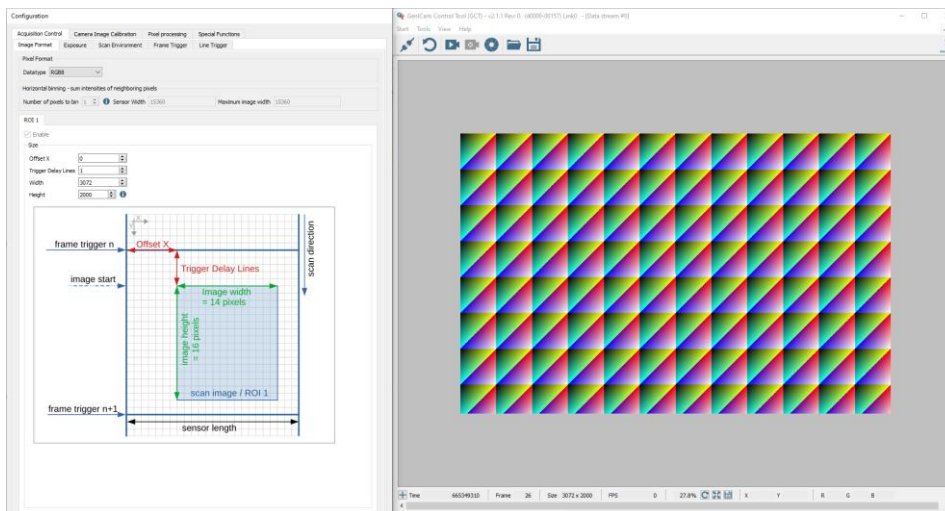
If you want to dock the widget again, drag the widget to the area where you want it, it will create a blue marked region in the target area. Once the desired position is indicated by the blue area, the widget can be dragged.
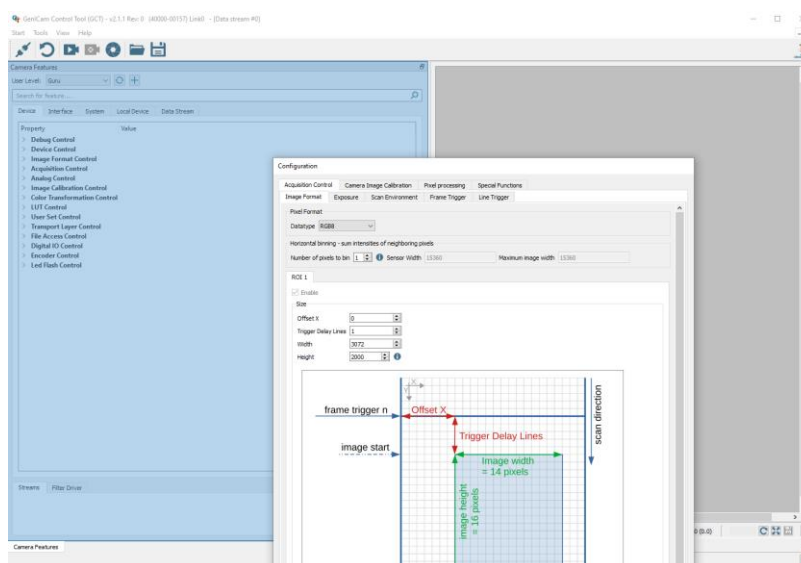
2.2 Connecting and disconnecting the camera

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.

2.2.1 Connecting

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 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**.

1. In the **Discovered Devices** list, select the camera, and 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 the configuration widget.

2. If the **Discovered Devices** shows no camera, and if you have a GigE camera, please follow the instructions of chapter 3.1.
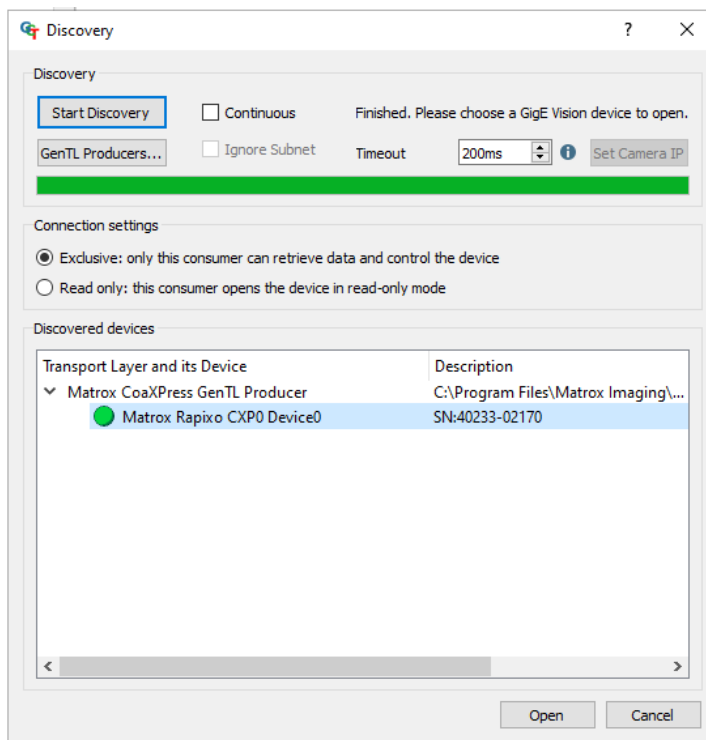
The camera discovery is controlled by several parameters and options, which can be modified if necessary:

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 Producers	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.

2.2.2 Disconnecting

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.

2.2.3 Connecting two cameras with one PC

The latest GCT2 version does not have support for multiple cameras in one GCT2 instance. To connect more than one camera to the PC, you need to open two instances (windows) to connect the camera to a PC.

If you connect two cameras to the PC and open a new instance of GCT2, you can select one camera and connect it to the GCT2 instance. Both cameras are visible in the Discovery window. With a second GCT2 instance, you can connect the second camera.
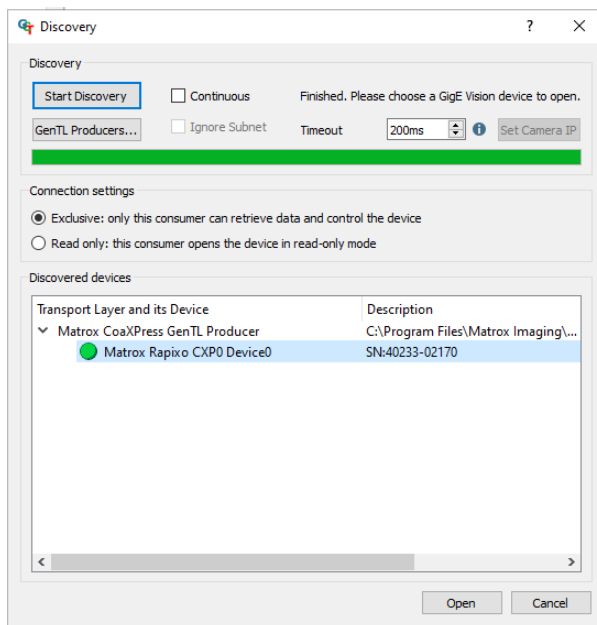
2.2.4 Edit Transport Layer

The Transport Layer (TL) is used to refer to the interface such GigE (Kithara or s2i) or CoaXPress.

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.

If it is required to change the TL you can change it in the **Discovery dialog** window, as shown in the previous chapter. To change the TL press the **GenTL Producers** button, a Producer List shows the available TL, as shown in the image below.
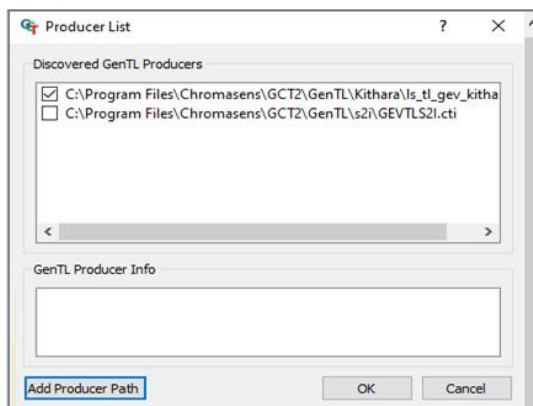
To enable or disable a Transport layer, select the certain file, for example `ls_tL_gev_kithara.cti` or `GEVTLS2I.cti` and click or clear the bock. The discovery process is then started using the certain Transport layer. We recommend enabling only one transport layer.

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 Contro**l, **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. Some features also have additional explanation pictures.
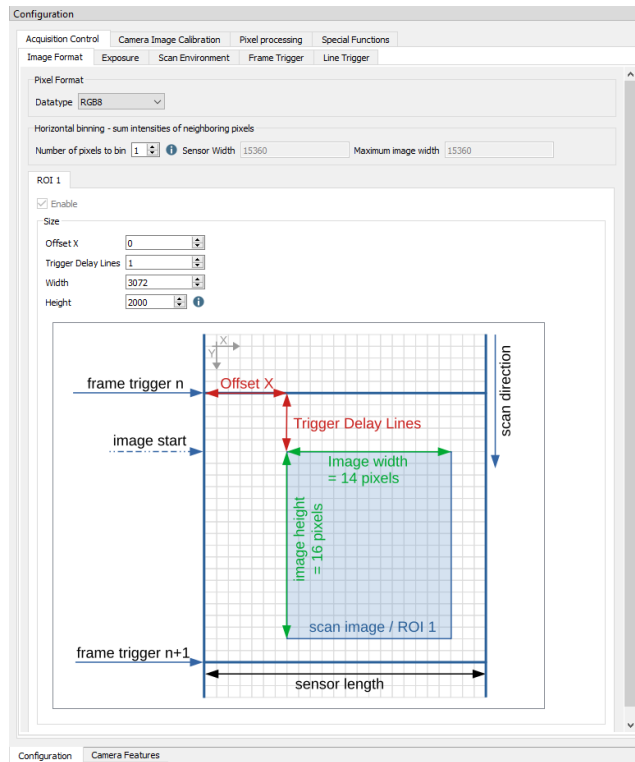
2.3.2 In the Camera feature panel (XML-Tree)

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.
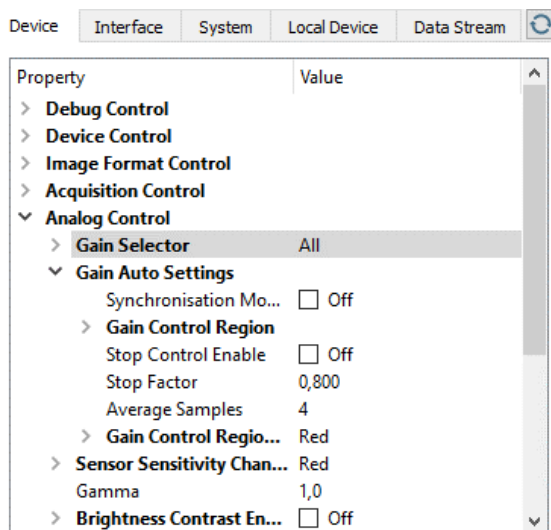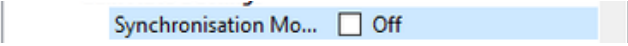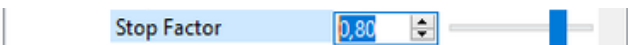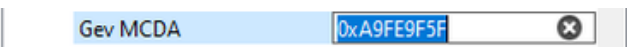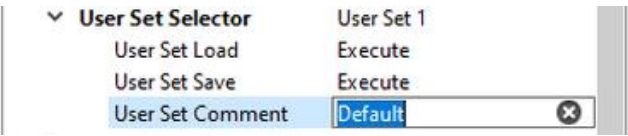
Some features are read-only. Their values are shown in gray color in the feature tree:
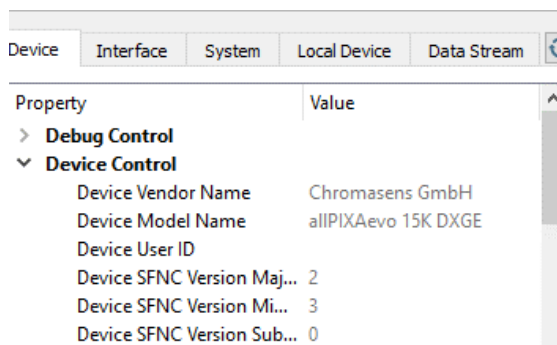
Some features cannot be modified during grabbing. Therefore, their values are also shown in gray during grabbing.

How values can be 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:
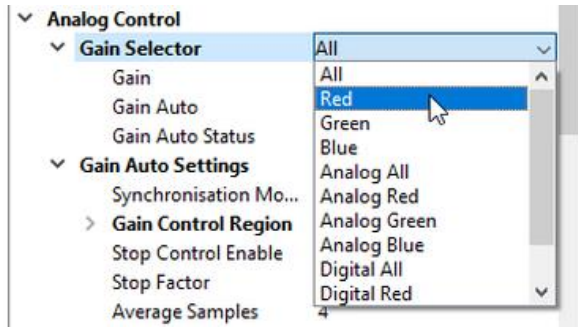
- For command features, an **Execute** button appears:
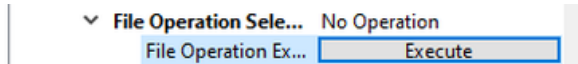
To execute the function, click **Execute**.

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.
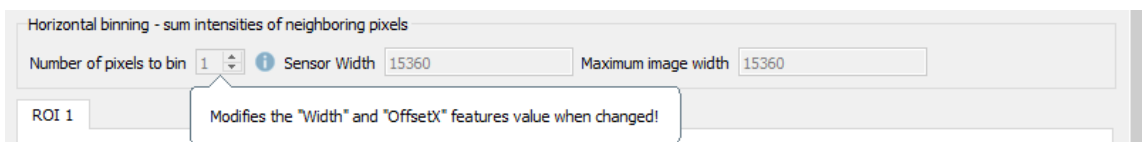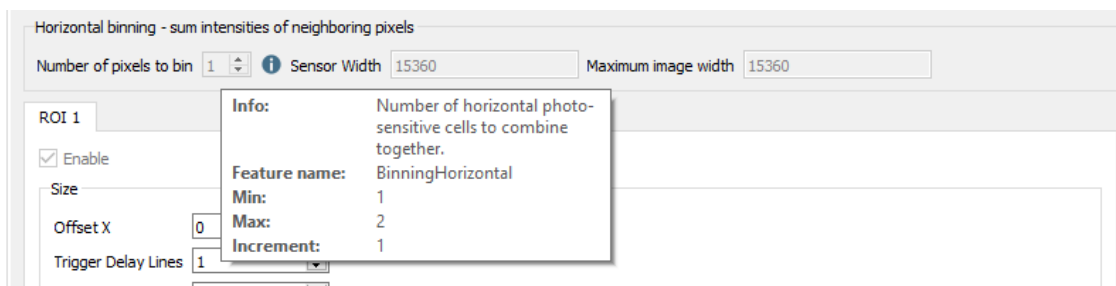
2.4.2 In the Camera feature panel

To show feature details, double-click the feature name or right-click the feature and then click **Display Feature Detail**:
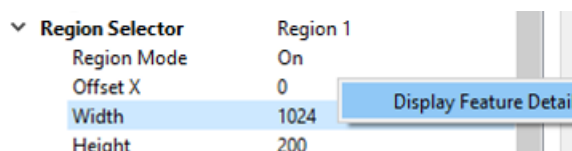
A message box then shows information about type, access, and values:

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.

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.

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.

BMP Files (*.bmp)	⌄
BMP Files (*.bmp)	
TIFF Files (*.tiff *.tif)	
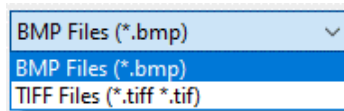
To load an image:

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:

BMP Files (*.bmp)	⌄
BMP Files (*.bmp)	
TIFF Files (*.tiff *.tif)	
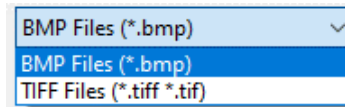
3. Select a file, and then click **Open**.

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 Up-/Download

The Up-/Download dialog allows you to Upload files from the PC to the Camera, for example Camera Package files, as well as user sets. You can also Download files from the camera to the PC. 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 which are previously downloaded from the camera. For installing firmware files (Camera Package file) see section 2.7.3.

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

1. On the **Tools** menu, click **Up-/Download**, or use hotkey **Ctrl+U**.
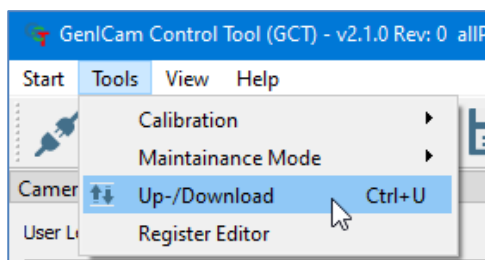
   The **Update/Download** dialog box opens.

2. Click **Select Update File**. A file dialog box opens.
   Select the file you want to upload and then click **Ope**n.
   GCT shows a warning message.
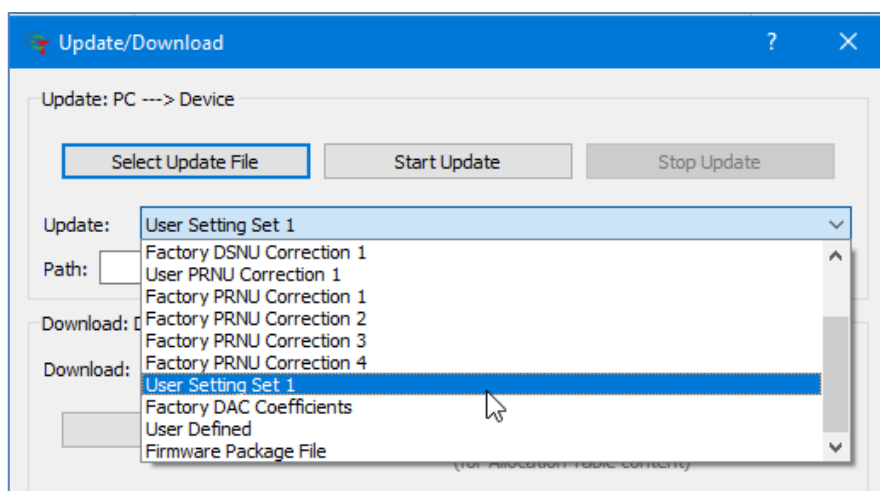
3. Select the correct file type for the file you want to upload.
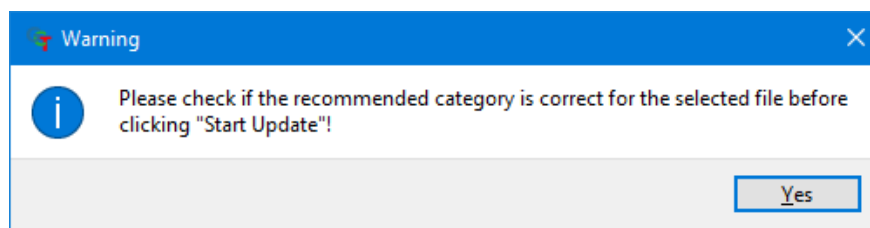
4. Click **Start Update**.

GCT2 shows another warning message:
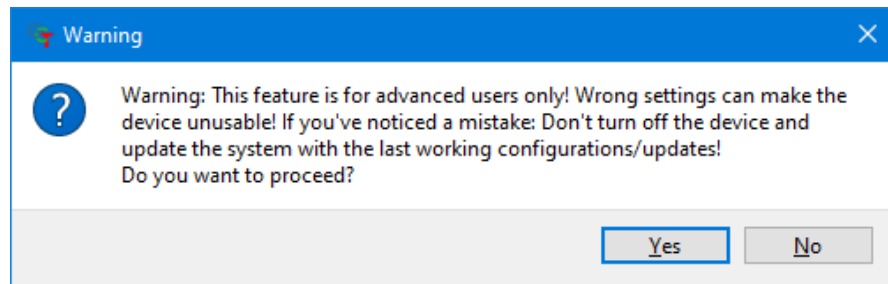
Click **Yes** to start the upload process or **No** to cancel the upload.

> ⚠ **Make sure that the appropriate file type is selected before you proceed.**

5. During upload a progress bar is shown. Wait until the file 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"
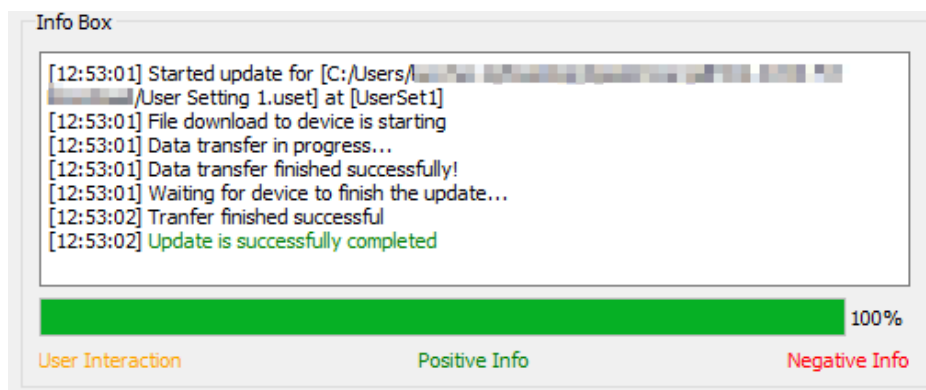
> ⚠ **If the update was not successful, _do not switch off the camera_, but try to restore the previous state by uploading the correct file for the previously selected file type.**

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.
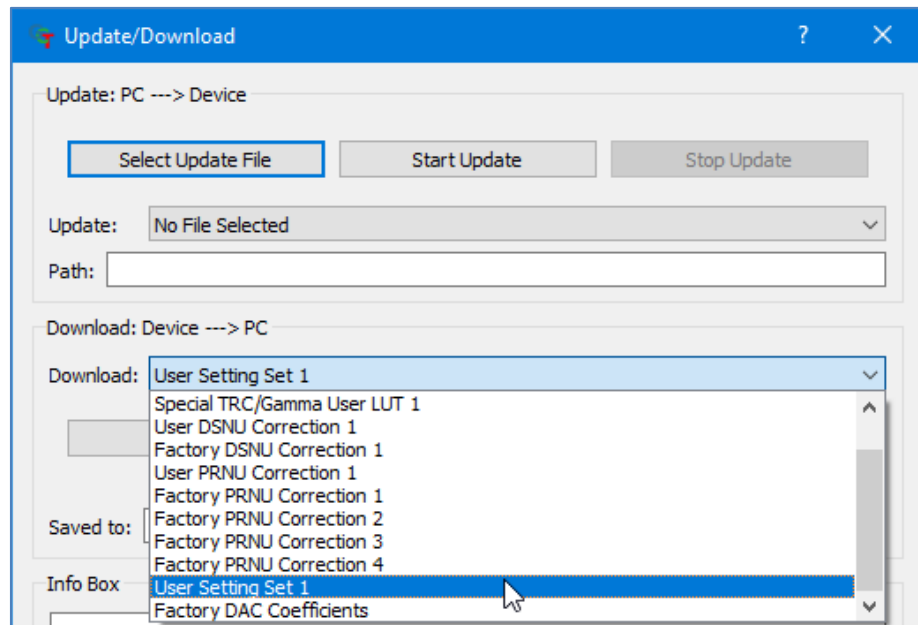
4. Click **Download to**. A file dialog box opens.

5. Select a folder, enter a file name and extension, 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.

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

4. On the **Tools** menu, click **Up-/Download**, or use hotkey **Ctrl+U**.
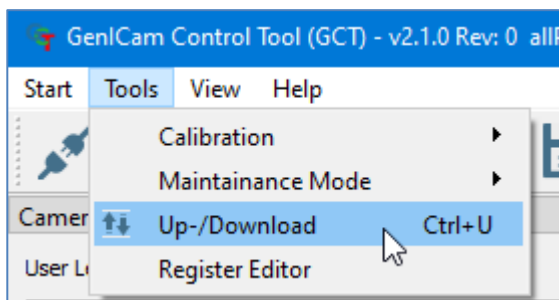
The **Update/Download** dialog box opens.

5. Click **Select Update File**. A file dialog box opens.
Select the firmware file[1] or packages you want to install and then click **Ope**n. GCT shows a warning message an selects the appropriate file type **Firmware** in the **Update** list.
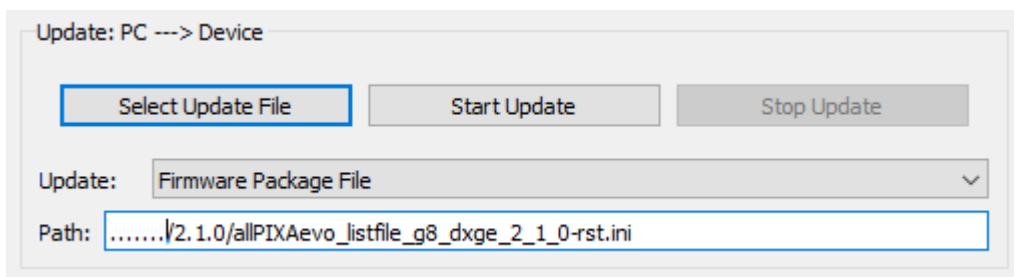
6. Click Start Update.
GCT shows another warning message:

---

[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**.

⚠️ **Make sure that the appropriate file type is selected before you proceed.**

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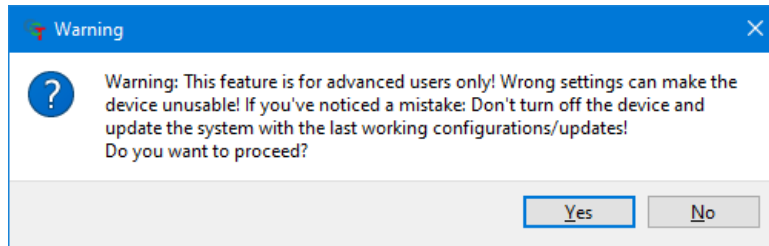
7. On the appearing warning message, click **Yes** to start the update process or **No** to cancel the firmware update.

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

8. During upload a progress bar is shown. Wait until the firmware has been uploaded completely.

9. 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.**

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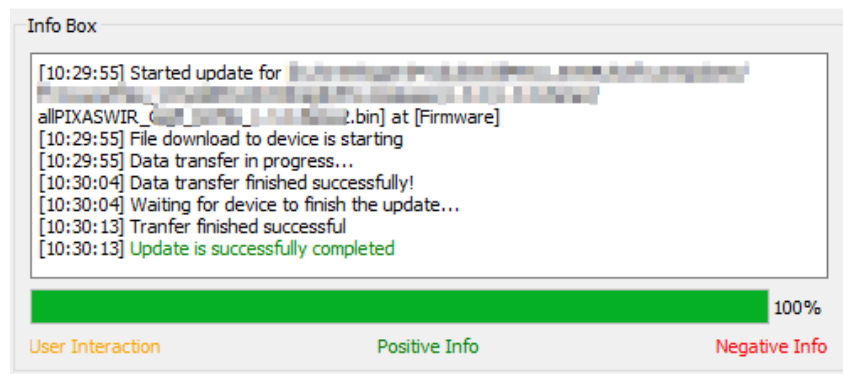
10. If the upload has been completed successfully, close the **Update/Download** dialog box, disconnect the camera, turn it off and after a few seconds turn it on again.

    This is necessary to complete the firmware update!

11. Reconnect the camera.

12. 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.

2.8 Camera calibration

2.8.1 Creating a black-reference (DSNU)

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**.
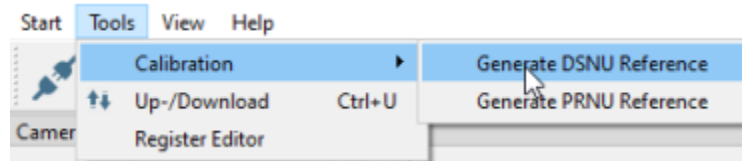
The **Create DSNU Reference** wizard opens.

4. On the Select image source page, click Use grab view image, and then click Next Step.
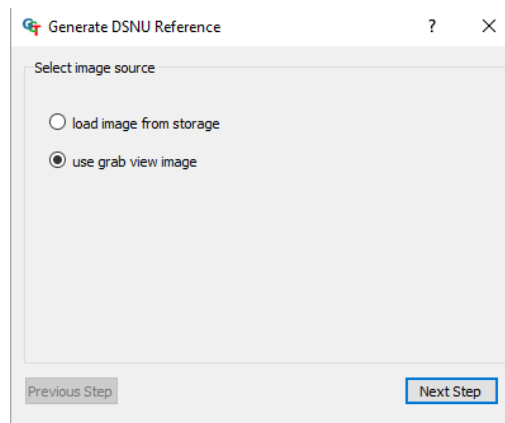
5. On the next page, click at the first step (**1) Set ImageCalibrationMode…**), then at the second step, and at last at the third step.
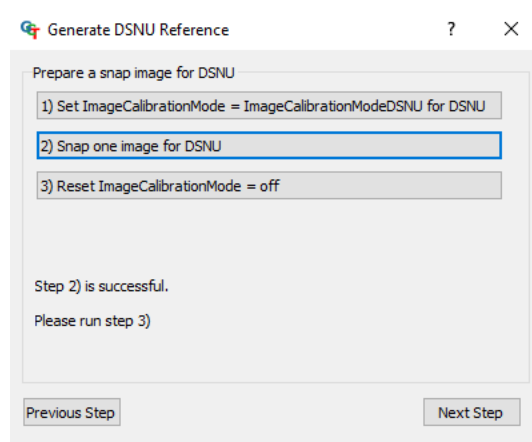
6. If all three steps were reported as successful, click **Next Step**. The **DSNU Reference Generator** window opens and shows the grabbed image in expected image calibration mode.
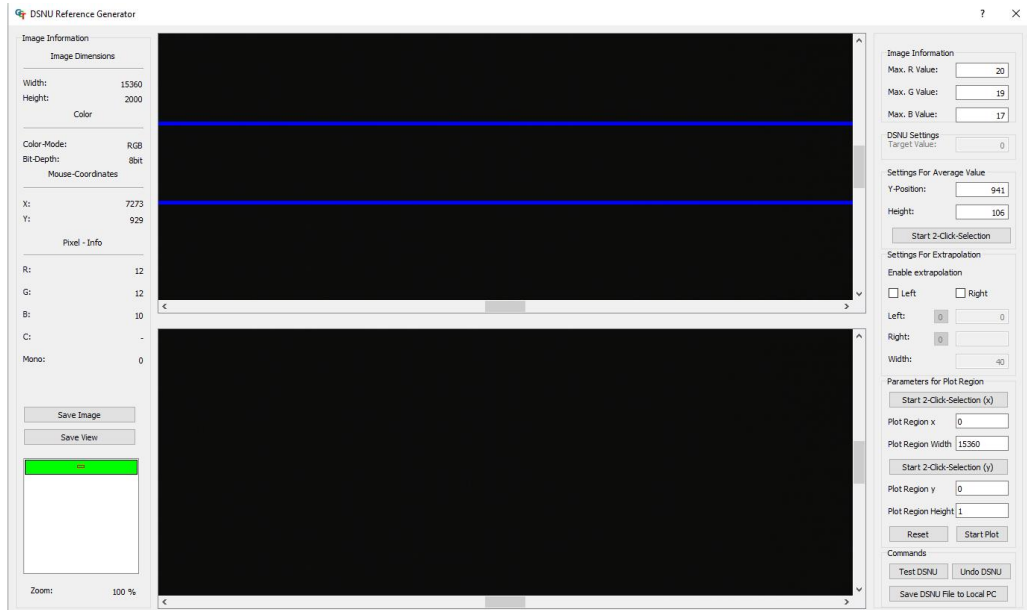
7. In the **Settings for Average Value**, enter values for **Y-Position** and **Height** to specify the area to be used for reference generation, or click **Start 2-Click-Selection** and click start and end position on the image.

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. Just, 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**.
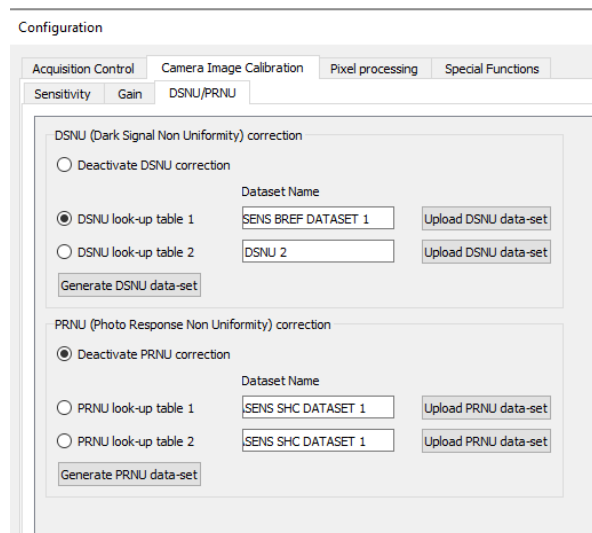
10. On the **Tools** menu click **Up-/Download,** and in the **Update/Download** dialog box click **Select Update File**. A file dialog box opens.

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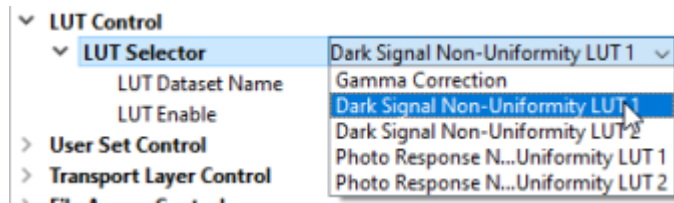
15. At the **LUT Enable** feature, select the check box.

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.

> 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.
>
> 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)

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**.
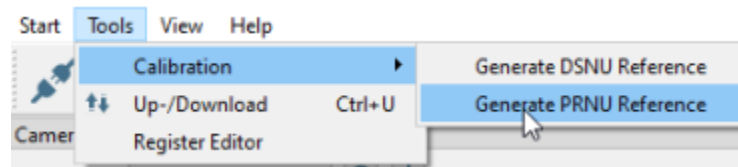
   The **Create PRNU Reference** wizard opens.

6. On the **Select image source** page, click **Use grab view image**, and then click **Next Step**.
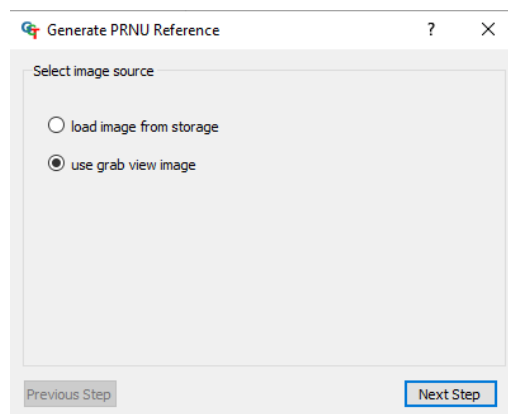
7. On the next page, click at the first step (**1) Set ImageCalibrationMode…**), then at the second step, and at last at the third step.
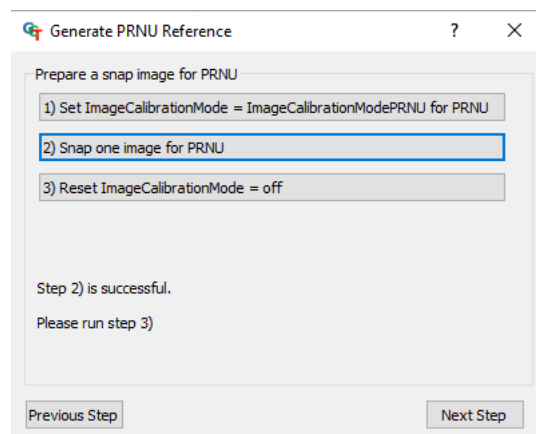
8. If all three steps were reported as successful, click **Next Step**. The **DSNU Reference Generator** window opens and shows the grabbed image.

On the next page, shading parameters must be specified in the **PRNU Settings** area on the right side:
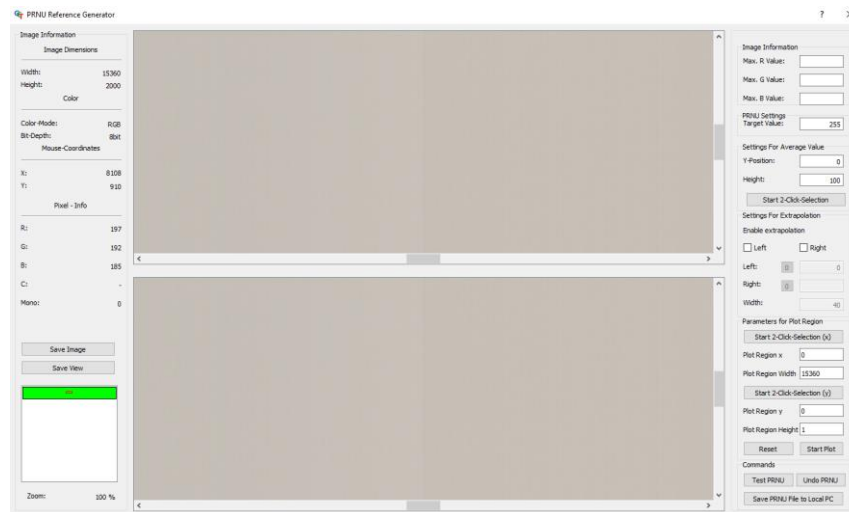
9. Specify the target value for white, and the area that should be used to create the shading data:

    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.

10. 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.

11. To show the result of the shading correction with the specified parameters, click **Test PRNU**.
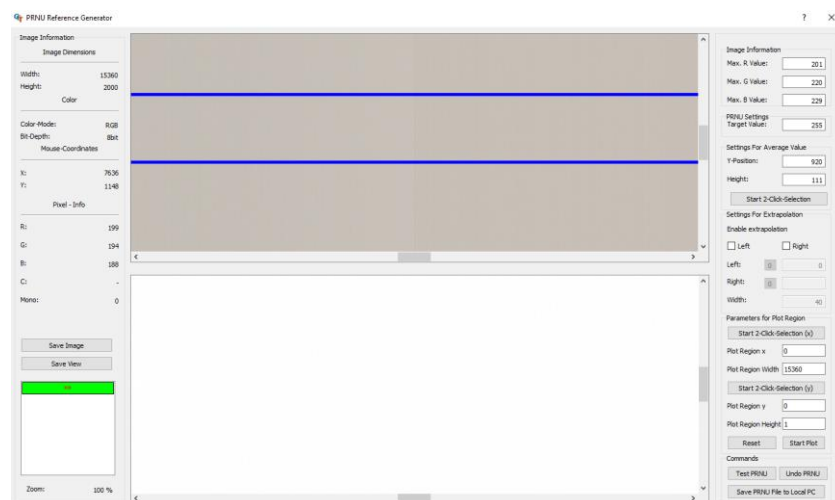
12. To save the shading reference data, click **Save PRNU File to Local PC**, specify folder and file name in the appearing file dialog box, and then click **Save** and close the wizard.

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. Just, click **Upload PRNU data-set** and load the xx.prnu data file. After loading the data-set you can activate the **PRNU look-up table x**.
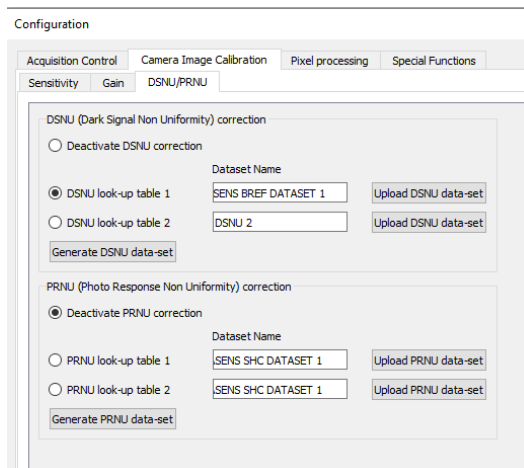
14. On the **Tools** menu click **Up-/Download,** and in the **Update/Download** dialog box lick **Select Update File**. A file dialog box opens.

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.

> ⓘ 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.
>
> 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:
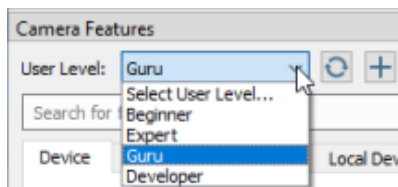
2.10 Show message log

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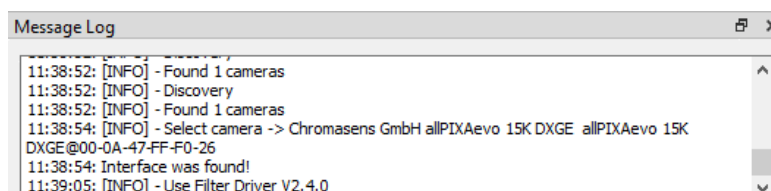
To copy messages to the clipboard, mark the messages, right-click on the selected messages, and then click **Copy** on the appearing context menu.

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 Settings and configuration files

2.11.1 GCT Options

To open the **Options** dialog box, click **Settings** on the **Start** menu.
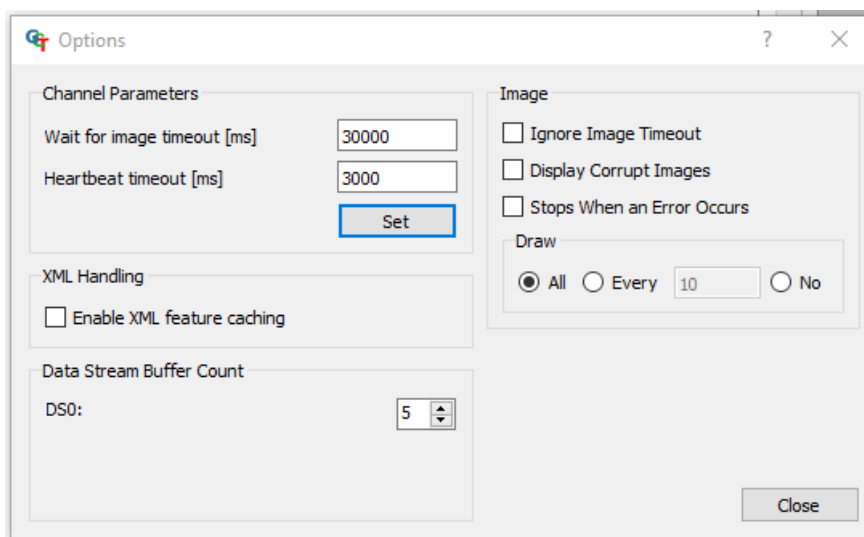
Option name	Default value	Description
Wait for image timeout	30000	If the next image is not received after the specified time, then it will send a timeout. The value can be modified. When GCT is restarted, it is set back to 30000.
Heartbeat timeout	3000	Read the value of **GevHeartbeatTimeout** from 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`

2.11.2 GCC.ini file

The GCC.ini file, which is located under *C:\Users\Public\Documents\Chromasens\GCT2,* including the content of producer path, producer filename, and selected producer for the discovery are already adjusted automatically in the file `GCC.ini`. file. 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 GigE Interface

GCT offers two different configurations of the GigE interface Transport Layer to connect and configure a TKH vision group camera. The 10 GigE real time solution with the Kithara Transport Layer and the 10 GigE with the s2i Transport Layer.

We recommend using the Kithara real-time solution for any real-time application. In some cases, it is also possible to use the s2i Transport Layer, but only for single link connections. For dual link connections the use of the Kithara Transport Layer is recommended.

> ⓘ Packets lost can occur without the Kithara real time kernel solution even with large receive buffers in combination with different Hardware components

3.1 Configure the network adapter

To connect GCT to the camera, you may need to adjust the properties of the network adapter. There are basically three methods to configure the IP address and subnet mask of your PC and camera:

- Use **LLA** (link-local address) autoconfiguration, this is per default always enabled.
- Use a **DHCP server** to configure the network settings of PC and camera, in the default factory setting it is enabled.
- Use manually assigned **persistent IP** address and subnet masks for camera and network adapter, in the default factory setting it is disabled.

In typical installations, the camera is connected directly to the network adapter of the PC with the DHCP sever configuration.

If the camera does not show up in the GCT discovery window, activate the **Ignore Subnet** check box in the **Discovery Options** window. If the camera now shows up but cannot be connected (**Open** button is disabled), you can set the camera IP address manually. To do this, click the **Set Camera IP** button. A new window will open, as shown below. This window displays your network adapters and their IP addresses. Select the network adapter the camera is connected to, and the program will assign an IP address to the camera. If this is correct, you can click **Save Configuration**. Please press the **Start Detection** button again. Now you should be able to connect your camera to GCT2.
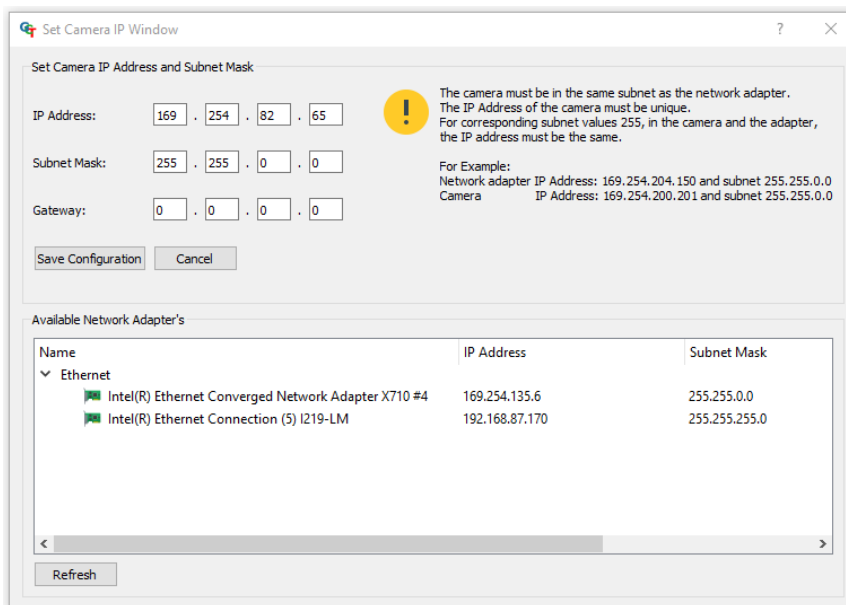
To change the IP address configuration of the camera please follow the instructions below.

3.1.1 DHCP server configuration

The **DHCP server** configuration tries to assign different IP addresses from the Link-Local-Block (169.254.x.x) to both the camera and network adapter automatically and set the subnet mask of both devices to 255.255.0.0.

This implies that feature **Current IP Configuration Persistent IP** is switched off in the camera. This feature can be found in the **GigE Vision** subcategory of the **Transport Layer Control** feature group and is off in delivery condition:
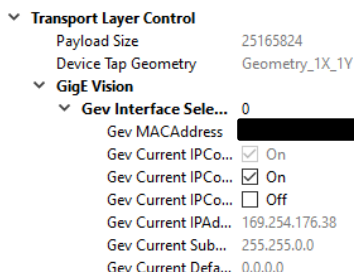
Also, the TCP/IPv4 properties of your network adapter must be configured to obtain the IP address automatically as shown below:
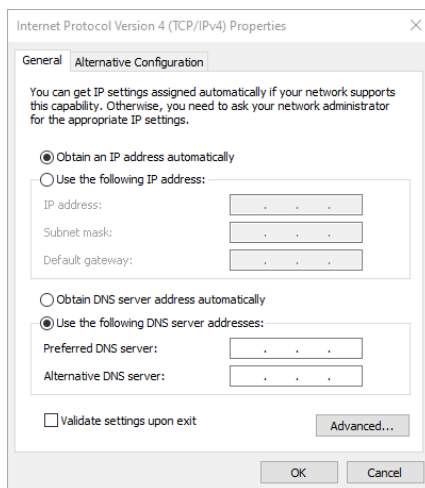
To check the TCP/IPv4 properties of your network adapter:

1. Open Windows **Settings,** click **Network & Internet**, and then **Ethernet.**

2. Click Change adapter options.

3. Right-click the Ethernet adapter that will be used to connect the camera, and then click **Properties**. The **Ethernet Properties** dialog box is displayed.

4. On the Networking tab select the Internet Protocol Version 4 item and then click Properties. The Internet Protocol Version 4 Properties dialog box is displayed.

5. Make sure that the **Obtain an IP address automatically** check box is selected.

3.1.2 Persistent IP Address configuration

The persistent IP address implies that that the feature **Current IP Configuration Persistent IP** is switched **on** in the camera. This feature can be found in the **GigE Vision** subcategory of the **Transport Layer Control** feature group and is off in delivery condition.

```
∨ Transport Layer Control
      Payload Size                                 25165824
      Device Tap Geometry                          Geometry_1X_1Y
  ∨ GigE Vision
      ∨ Gev Interface Selector                     0
          Gev MACAddress                           ▮▮▮▮▮▮▮▮▮
          Gev Current IPConfiguration LLA          ☑ On
          Gev Current IPConfiguration DHCP         ☐ Off
          Gev Current IPConfiguration Persistent IP ☑ On
          Gev Current IPAddress                    192.168.100.10
          Gev Current Subnet Mask                  255.255.255.0
          Gev Current Default Gateway              0.0.0.0
          Gev Persistent IPAddress                 169.168.100.10
          Gev Persistent Subnet Mask               255.255.255.0
          Gev Persistent Default Gateway           169.254.100.1
```

To use this configuration the TCP/IPv4 properties of your network adapter must be configured as shown in the figure below (configure IP address and subnet mask manually):

1. In Windows **Settings** click **Network & Internet**, and then **Ethernet**

2. Click Change adapter options.

3. Right-click the Ethernet adapter that will be used to connect the camera, and then click **Properties**. The **Ethernet Properties** dialog box is displayed.

4. On the Networking tab select the Internet Protocol Version 4 item and then click Properties. The Internet Protocol Version 4 Properties dialog box is displayed:
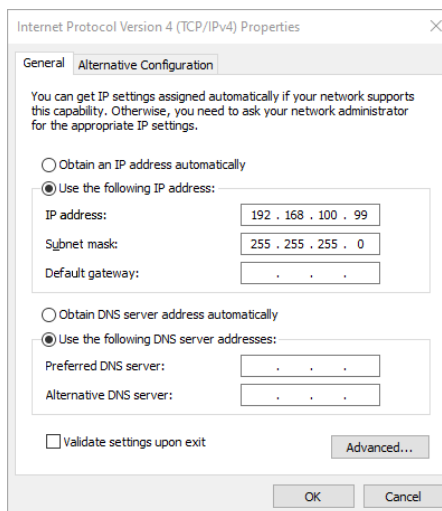
5. Click **Use the following IP address**.

6. In the **IP address** field of the Network adapter specify an address that differs from the IP address of the camera only in the last field. When the camera IP address shown in the GCT discovery window is 192.168.100.10, you can set the IP address of the network adapter e.g. to 192.168.100.99.

7. At **Subnet mask** enter 255.255.255.0.

8. Close the properties dialog boxes by clicking **OK**.

9. Again click **Camera Discovery** in GCT.

    Now you should be able to open the camera in GCT.

3.2 Tested Network adapters and Transceivers

The following network adapters are tested with GCT2. The results are shown in the following table.

Vendor Name	Type	Result	S2i TL	Kithara TL
HPE	HPE Ethernet 10Gb 2-port 560SFP+ Adapter	Fully functional	X	X
HPE *	HPE Ethernet 10Gb 2-port 562SFP+ Adapter	Only with Kithara		X
Intel *	Intel® Ethernet-Converged-Network-Adapter X710	Only with Kithara		X
Myricom	Myricom 2x 10GbE SFP+ low-profile NIC	Only with s2i	X	
Myricom	Myricom 1x 10GbE SFP+ low-profile NIC	Only with s2i	X	
Mellanox	NVIDIA Mellanox MCX512A-ACAT ConnectX®-5 EN Network adapter	Only with s2i	X	

The following transceivers are tested with the allPIXA evo camera and the network adaptes.

Vendor Name	Type	Comment	Camera side	Network adapter side
Finisar	FTLX8574D3BCL Class 1 21CFR1040:10		X	X
FS	SFP-10GSR-85		X	X
FS	Intel E10GSFPSRX Compatible 10GBASE-SR SFP+ 850nm 300m DOM Duplex LC MMF Transceiver Module	Recommended for Network adapter which are market with *		X

> ⚠ If you are using a the s2i Transport Layer it is required to configure the network adapter properly. The **HPE Ethernet 10Gb 2-port 560SFP+ Adapter** is configured during the installation procedure. For another network adapter a manual configuration is required, see chapter 3.4.4.
>
> * Some manufacturers encode their cards. Those cards can only be used with the appropriate transceivers.
> Example: intel X710 chipsets only work with intel or intel configured transceivers

3.3 10 GigE interface with Kithara real time solution

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 real-time can provide fast image capturing with the GigE Vision standard and can achieve a high performance. Running Kithara real-time 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.

3.3.1 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

3.3.2 Kithara Configurator

During the full installation of GCT, the **Kithara Configurator** is started automatically. Alternatively, you can start it later by clicking **Kithara Configurator** on the **Tools** menu of GCT.

To configure the system with the Kithara Configurator:

1. Plug in the license USB dongle before using the Kithara Transport Layer.

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

    On this 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.

3. If Kithara is going to be used with a single cable connection, select the corresponding adapter port in the adapter list, click **Create Single Link Connection**, and then click **Next**.
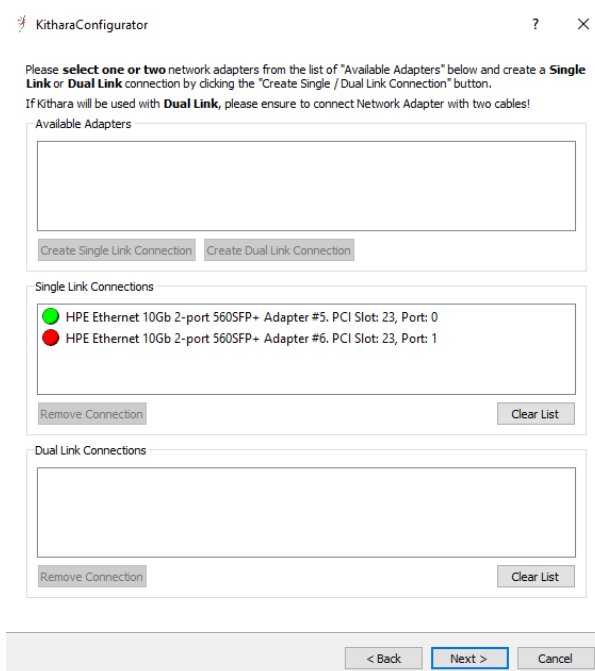
4. If Kithara is going to be used with two cables (which connect two dual ports of the same network adapter), select the two adapter ports in the adapter list, click **Dual Link**, and then click **Next**.

If you want to operate more than two single link cameras with one Kithara license, you have to assign one additional CPU core to Kithara for each additional camera. E.g. if you want to use four cameras and have Kithara already installed (two cores are already preserved for Kithara) You have to add two more CPU cores to Kithara. For details of implementation please contact Chromasens support.

Pay attention: Make sure that your PC offers enough 8lane PCIe 3.1 slots to cope with the data transmission of two cameras! For more information see the manual of our PC (Mainboard)

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 3.3.8) and disables Hyper-Threading (refer to section 3.3.7). The Kithara Configurator will prompt the system to reboot to update the changes.

> 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.

3.3.3 Camera connection with Kithara Transport Layer

After the full installation the camera connection is working with the Kithara Transport Layer. To connect the camera, proceed as follows:

1. Make sure that the license USB dongle is plugged in before using the Kithara Transport Layer.

2. Make sure that you configure the Kithara Transport Layer properly. The configuration is done automatically during the installation of GCT. For more information, see sections 3.3.2.

3. When you start GCT, the first step is to detect the camera. The Kithara TL can be used like any other producer.

> 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

3.3.4 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. Run the Kithara Configuration 3.3.2 and remove the single or dual link connection from the list. Therefore, select the connection and press the **Remove connection** button.

2. On the Windows **Settings** window, click **Network & Internet** and on the next window click **Change adapter options**.

3. Right-click one of the **Kithara RealTime PCI** network controllers, and then click **Properties**.

4. Click **Configure** and on the next dialog box click the **Drivers** tab.

5. Click **Update Driver**.

6. Click **Search driver on my PC** and then click **Select available drivers from a list of my PC**.

7. Select the suitable adapter driver and then click **Continue**.

8. After the reset the Network adapter configuration must change by following the steps in chapter 3.4.3 or 3.4.4.

9. 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:
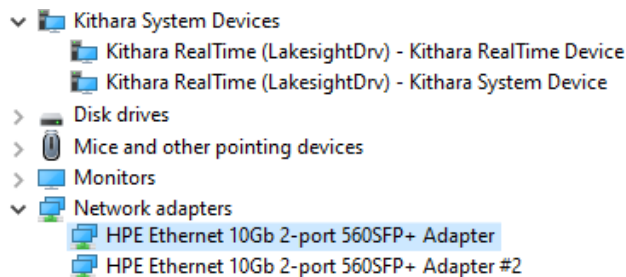
3.3.5 Performance Test with Kithara

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.
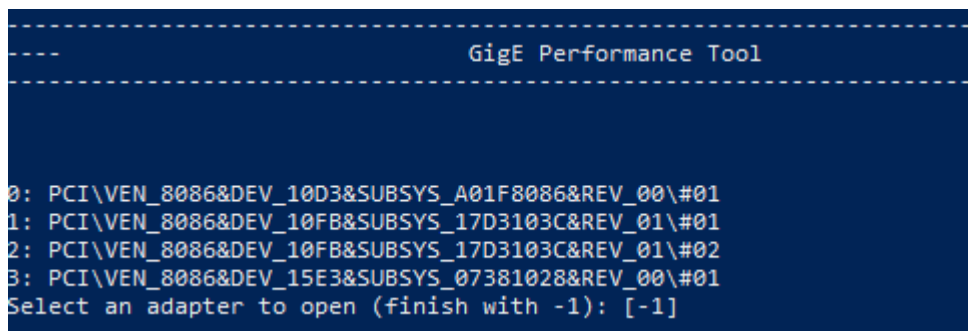
Example of a command line:

```
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:

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
```
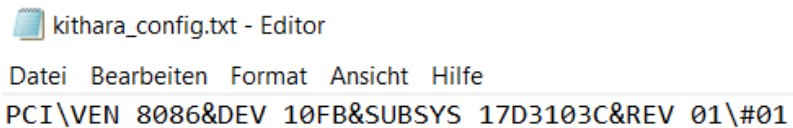
3.3.6 Kithara_config.txt file

The `kithara_config.txt` contains the hardware ID of the network adapters and the configuration whether it is a single or dual connection. The file is created executing the **Kithara Configurator 3.3.2.** The file is in the folder `C:\Users\Public\Documents\Chromasens\GCT2`

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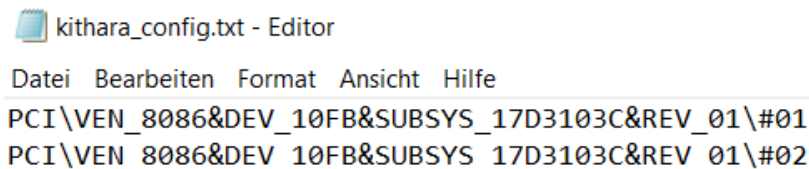
If dual link is used with Kithara, this file contains two items from the dual connections:

3.3.7 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
```

3.3.8 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.

https://kithara.com/en/docs/krts:tutorial:setupdedicated.

3.4 10 GigE Connection with s2i Transport Layer

The s2i transport layer does not require an additional license dongle.

3.4.1 Filter driver

The s2i transport layer offers the usage of a filter driver. A filter driver is used to get the UDP-image-data packets before the operating system is accessing them. This leads to a drastically improved error rate and decreases the number of lost packets drastically. To configure the filter driver, go to the **Configuration widget** and select the **Camera Features** tab, here you can check and uncheck the filter driver.

3.4.2 Manual installation and deinstallation of s2i Filter Driver

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, please follow the instructions below.

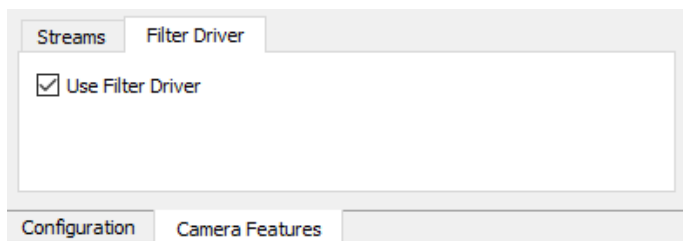To be able to apply the s2i filter driver in GCT, at least version 2.4.1 of the filter driver must be installed (V2.7.0 is recommended). The batch files for installation and removal can be found in the folder: `C:\Program Files\Chromasens\GCT2\drivers\s2iFilterDriver`.

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\GCT2\drivers\s2iFilterDriver`.

To remove an older version of the s2i filter driver:

3. Run the batch file `UninstallFilterDriver.bat`.

4. Reboot the PC.

5. In the folder `C:\windows\system32\drivers` remove the file `s2iGEVFilter.sys` if it is still present.

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

This setup is only needed if you do not have selected the `NIC-10GigE-Driver Files` during the installation procedure 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+.
- Camera must be connected to the PC
- Windows 10 64-bit

Otherwise, the setup of the network adapter must be performed as described in section 3.4.4.

To setup the adapter using the Powershell script:

1. Install the intel driver for 10-GigE network adapter <u>manually</u>.

   By default, the network adapter driver can be found in the folder
   `C:\Program Files\Chromasens\GCT2\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.

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

3. 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

   C:\Users\Public\Documents\Chromasens\GCT2\config10GigE.ps1

4. According to displayed hint, enter **y** or **n**, to setup for each adapter connection. The 10-GigE adapter connections will be listed. If only a single connection will be used, then chose this connection to perform the setup.

   ```
   PS C:\WINDOWS\system32> C:\Users\Public\Documents\Chromasens\GCT2\config10GigE.ps1
   This program configures the 10 GigE network connections.
   example of runing this powershell on a HP network adapter .\config10GigE.ps1 -useHP 1
   Please ensure the camera is powered on and already cable-connected to the computer.
   Please ensure the filter driver from s2i is installed on the computer.
   Start IntelNetCmdlets...
   IntelNetCmdlets is started.
   ==========================
   ==========================
    1  10 Gigabit Ethernet connection(s) are found.

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


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

5. After the configuration of the network parameter the scrip can help you to set a static IP Address of the network adapter. If you have a default installation you can disagree by entering **n** into the window. If you want to set a static IP Address of your network, you can answer with **y**.

   ```
   ==========================
   Do you still want to set IP address for a single connection?
   Please ensure the single connection is not used in any existing teaming group.
   [y/n] Please enter the key 'y' for 'yes', or 'n' for 'no'.
   ```

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

In contrast to section 3.4.3, 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. 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	Empfangsbuffer	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)**.

4 CoaXPress interface

GCT2 supports the CoaXPress (CXP) interface as well. To use the CoaXPess interface with GCT2, please follow the installation instructions above for GCT2. For the driver of the CoaXPress frame grabber as well as the transport layer, please follow the instructions of the grabbers manufacturer.

Note: The power over CXP option is set in the frame grabber configuration.

4.1 Tested frame grabbers

The following CXP frame grabbers are tested with GCT2. The results are shown in the following table.

Manufacturer	Type	Result	Comment
Euresys	CoaxLink Quad CXP12	Fully functional	
Matrox	Matrox Rapixo CXP Quad	Known Bugs	Updating the image width causes a GCT crash, a restart of GCT is necessary No support of RGBa8 images
Basler	CXP-12 Interface Card 4C	Fully functional	
Bitflow		Fully functional	

4.2 Connection two cameras with one Frame grabber

If you want to use two cameras with one frame grabber, you may have to configure the frame grabber (see frame grabber manual). Once it is configured correctly, you can connect the cameras as described in chapter 2.2.3.

4.3 Configure CXP version

The data transfer rate depends on the configured CXP standard version. This option can be set with the parameter "Cxp version used" as shown in the following figure. We recommend using the version CSP_Version_2_0. The CSP standard 1.0 supports a data rate of 6.26 Gbps, the CXP standard 2.0 supports a data rate of 12.5 Gbps per cxp cable.
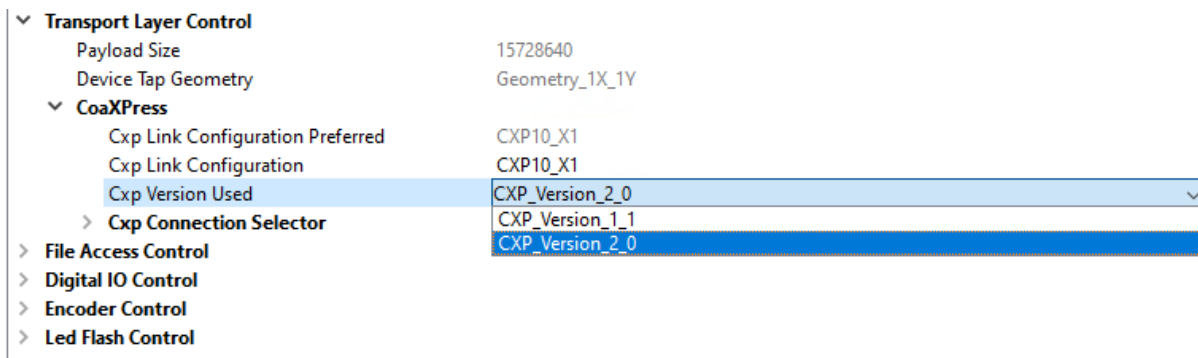
4.4 Link configuration

The link configuration defines how many CoaXPress cables are connected to the camera and the data transfer rate. The number of connected CoaXPress cables are assigned with the Xn. For example, a X2 means that two cables are connected to the camera. The data transfer rate per connected cable is defined with the first number in the selectable cxp link configuration CXPt_Xn.

The following table shows the link configuration parameters and there corresponding data rate (for CXP Version 2.0). The data rate refers to one connected CXP cable X1. The data rate increases with additional connected CXP cable. CXP12_X2, for example, has a data rate of 25 Gbps.

Link configuration	Data rate per link Xn in Gbps
CXP1_Xn	1.25
CXP2_Xn	2.50
CXP3_Xn	3.125
CXP5_Xn	5.00
CXP6_Xn	6.25
CXP10_Xn	10.00
CXP12_Xn	12.5

5 SDK – CSGenICam

The Chromasens GenICam SDK (CSGenICam 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:
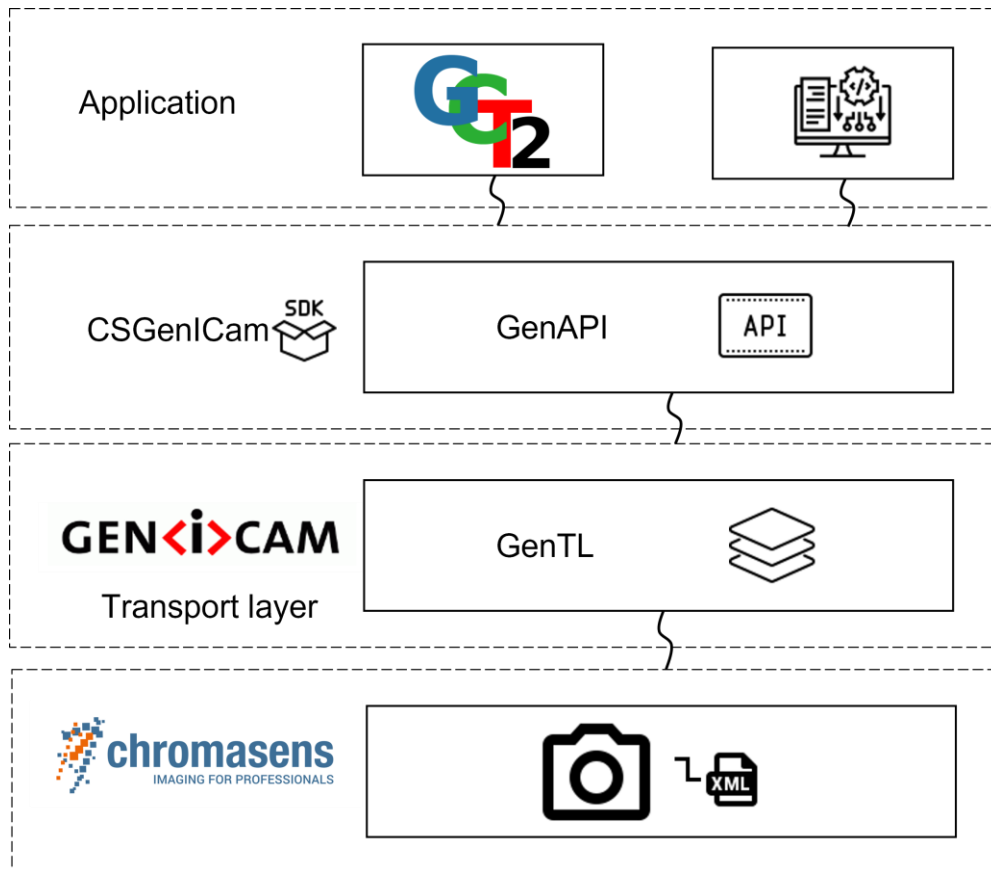
It permits to write applications against the CSGenICam interface. The CSGenICam interface provides a set of convenience functions and additional functionalities specific to Chromasens cameras. As an example, it adds functions that permit to perform file transfers from/to the device. It has a slightly 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.

https://chromasens.de/de/software

6 Troubleshooting

6.1 Troubleshooting with GigE Interface

6.1.1 No camera if found during discovery

In the case you cannot find a camera in the device discovery, you may have to check you IP address configuration of you network adapters. Therefore, please follow the descriptions in chapter 3.1.

6.2 Troubleshooting Kithara Transport Layer

6.2.1 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 2.2.4.

6.2.2 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.

6.3 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.

### 6.3.1 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.

6.3.2 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.
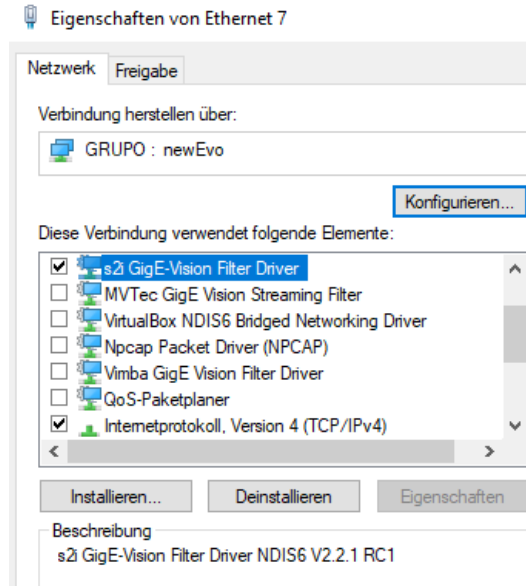
6.3.3 "Secure Boot" not disabled in BIOS settings (only for 10GiGEwithout Kithara)

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 3.4.2.

6.3.4 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**.
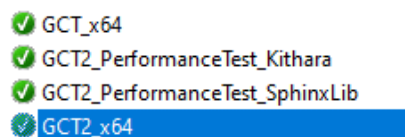
6.3.5 Reboot

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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