Vision Point Application Simulation Mode
User Guide

January 2023 - Rev 6.3.0

KAYA INSTRUMENTS

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1 Revision History

Version	Date	Notes
4.0	04/2017	Application release 4.1 - Initial Release
4.1	12/2017	Application release 4.1 - Triggering additional parameters were added
4.2	04/2017	Application release 4.2 - Added troubleshooting section
4.3	09/2018	Application release 4.3 - Review and minor corrections
4.4	01/2019	Application release 4.4 - Review and minor corrections
5.0	03/2019	Application release 2019.1/API 5.0 - Toolbar description modifications - Review and minor corrections
5.0.1	05/2019	Application release 2019.1/API 5.0.1 - Added “Grabber Links” parameter to indicate the device link connection - Indication message about Camera connection loss - Camera re-detection retains open cameras
5.1	07/2019	Application release 2019.2/API 5.1 - Added “Color Histogram” - picture color segmentation
5.1 (patch)	12/2019	Application release 2019.2/API 5.1 (Service pack 9) - Review and minor corrections in system requirements section
5.2	06/2020	Application release 2020.1/API 5.2 - All figures were updated - Document rearrangement - CoaXPress 2.0 standard correction
5.3	08/2020	Application release 2020.2/API 5.3 - Minor corrections in system requirements section
5.4	12/2020	Application release 2020.3/API 5.4 - Review and minor corrections
5.4 (patch)	04/2021	Application release 2020.3/API 5.4 (Service pack 1) - Review and minor corrections
6.0	09/2021	Application release 2021.1/API 6.0 - New “Dark Field” and “Flat Field” correction features section - New “Grid Lines” features section - Updated Important Notes and Limitations section - Added CXP2 Heartbeats indication section

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6.1	04/2022	Application release 2022.1/API 6.1 - Search option added to 'Camera' tab - Code samples added to 'Camera' tab
6.2	09/2022	Application release 2022.2/API 6.2 - Review and minor corrections
6.2 (patch)	11/2022	Application release 2022.2/API 6.2 (Service pack 1) - Minor fixes and improvements
6.3.0	01/2023	Application release 2023.1/API 6.3.0 - Figure update - Updated system requirements section - Updated Important Notes and Limitations section - Document rearrangement and description fixes

Table 1 – Revision History

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2 Figures and Tables

2.1 List of Figures

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2.2 List of Tables

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3 Introduction

3.1 Safety Precautions

Please take the time to read through the precautions listed below to avoid preventable and unnecessary injuries and damage to you, other personnel, or property. Read these safety instructions carefully before your first use of the product, as these precautions contain safety instructions that must be observed. Be sure to follow this manual to prevent misuse of the product.

⚠ Caution! Read carefully and do not disregard these instructions.
In the event of a failure, disconnect the power supply Disconnect the power supply immediately and contact our sales personnel for repair. Continuing to use the product in this state may result in a fire or electric shock.
If an unpleasant smell or smoking occurs, disconnect the power supply. Disconnect the power supply immediately! Continuing to use the product in this state may result in a fire or electric shock. After verifying that no smoking is observed, contact our sales personnel for repair.
Do not disassemble, repair or modify the product. Such actions may result in a fire or electric shock due to a circuit shortage or heat generation. Contact our sales personnel before inspection, modification, or repair.
Do not place the product on unstable surfaces. Otherwise, it may drop or fall, resulting in injury to persons or the camera.
Do not use the product if dropped or damaged. Otherwise, a fire or electric shock may occur.
Do not touch the product with metallic objects. Otherwise, a fire or electric shock may occur.
Do not place the product in dusty or humid environments, nor where water may splash. Otherwise, a fire or electric shock may occur.
Do not wet the product or touch it with wet hands. Otherwise, the product may fail or cause a fire, smoking, or electric shock.
Do not touch the gold-plated sections of the connectors on the product. Otherwise, the surface of the connector may be contaminated by sweat or skin oil, resulting in contact failure of a connector, malfunction, fire, or electric shock due to static electricity discharge.
Do not use or place the product in the following locations. ▪ Unventilated areas such as closets or bookshelves ▪ Near oils, smoke, or steam ▪ Next to heat sources ▪ A car with closed doors where the temperature can become hot ▪ Static electricity replete locations ▪ Near water or chemicals Otherwise, a fire, electric shock, accident, or deformation may occur due to a short circuit or heat generation.
Do not place heavy objects on the product. Otherwise, the product may be damaged.
Be sure to discharge static electricity from the body before touching any sensitive electronic components. The electronic circuits in your computer and the circuits on the cameras and the hardware boards are sensitive to static electricity and surges. Improper handling may seriously damage the circuits. In addition, do not let your clothing come in contact with the circuit boards or components. Otherwise, the product may be damaged.

3.2 Disclaimer

KAYA Instruments assumes no responsibility for any damage that may ensue by using this product for any purpose other than intended, as previously stated. Without detracting what was previously written, please be advised that the company takes no responsibility for any damages caused by:

- Earthquake, thunder strike, natural disasters, a fire caused by usage beyond our control, willful and/or accidental misuse and/or use under other abnormal and/or unreasonable conditions
- Secondary damages caused by the use of this product or its unusable state (business interruption or others)
- Use of this product in any manner that contradicts this manual or malfunctions due to connection to other devices.
- Damage to this product that is out of our control or failure due to modification.
- Accidents and/or third parties that may be involved.

Additionally, KAYA Instruments assumes no responsibility or liability for:

- Erasure or corruption of data caused by the use of this product
- Any consequences or other abnormalities following the use of this product

3.3 Overview

The ***Chameleon*** is the industry's first ***Camera Simulator*** supporting CoaXPress standard. This simulator can generate video streams and test patterns of up to 4 CoaXPress links in single, dual, and quad modes. Each link supports standard CoaXPress bitrates up to 12.5 Gbps. This product is ideally suited for developing industrial, defense, and aerospace Machine Vision Systems and applications. The Chameleon can easily transmit generic test patterns, customer's specific pre-processed data, or custom video streams on the CoaXPress links. It also provides GPIO for machine control signals, such as triggers, exposure control, and general I/O, which can be simulated with the video streams. The simulator enables the run time transition of the video streams directly from computer memory, enabling almost unlimited simulation time.
The principle of the simulator operation can be seen in Figure 1.

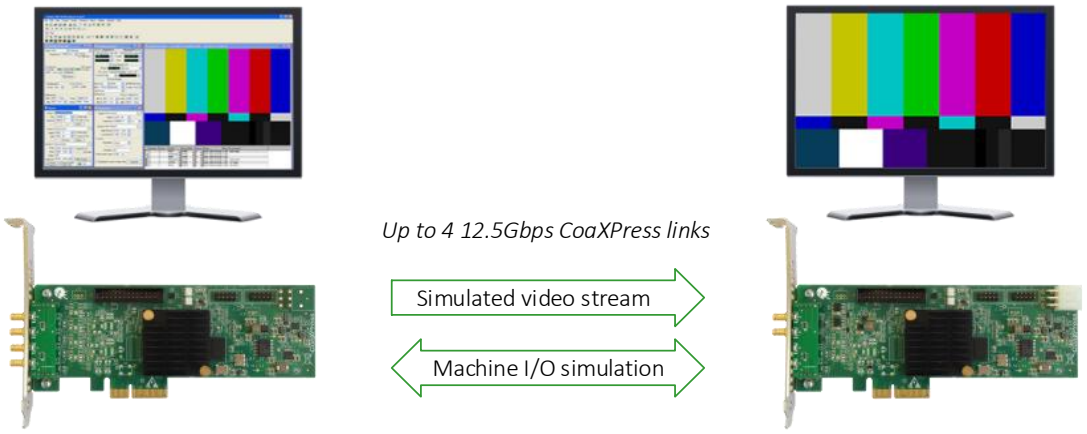

Figure 1 – Chameleon system structure

KAYA Vision Point App is a high-level windows application that provides an interactive and highly configurable camera simulation interface for the Chameleon camera simulators, allowing:

- Video stream generation
- Triggered simulation of a video stream
- Configuration of camera parameters
- Saving generated pictures to file
- Saving camera configuration to file
- Loading camera configuration from file

Please refer to the **KAYA Vision Point Application for Acquisition Mode User Guide** document for Frame Grabber mode.

For other KAYA products, such as cameras, range extenders, etc. please refer to respective documentation in our website: http://www.kayainstruments.com

3.4 System Requirements

To run the Vision Point App, a PC with the following is required:

- Intel x64 processor or compatible
- At least 4 GB of system memory
- One of the following operating systems:
  - Windows 10 64 bit OS
  - Ubuntu 18.04 / 20.04 64 bit OS
- Hard drive with 400 MB of free space
- At least one of KAYA Instruments Frame Grabber boards installed
- Internet connection

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3.5 Important Notes and Limitations

1. Windows 7 is no longer supported (since version 2020.1, API 5.2)
2. Vision Point 2019.1 is the last version to support Windows 7 OS. We encourage our customers to switch to Windows 10 OS to support our latest updates and hotfixes
3. For Windows OS to support the latest version of Vision Point, please make sure your Windows is up to date, and all the latest updates and hotfixes are installed
   a. If your computer hardware does not support Windows 7 latest updates, please consider using the Vision Point 4.4 software version.
   b. To downgrade the Vision Point application from version 2019.1 to 4.4, please refer to the "Vision_Point_Software_Installation_Guide" document, troubleshooting section.
4. Inserting and/or removing KAYA PCI devices requires a reboot of the computer or restart of the "KAYA Instruments" service. After that, one may use Vision Point Application or open API examples with KAYA devices.
5. KAYA's API should **NOT** be used from the **DllMain** function on Windows OS. There are significant limitations on what **you** can safely do at a DLL entry point. See General Best Practices for specific Windows APIs that are unsafe to call in DllMain. If you need anything but the simplest initialization, do that with the initialization function for the DLL. You can require applications to call the initialization function after DllMain has run and before they call any other functions in the DLL.
6. Starting from software version **2023.1** Chameleon Simulator device must be updated to firmware version 5.x or higher.

> **!** **Starting from software version 2023.1 Chameleon Simulator device must be updated to firmware version 5.x or higher**

4 Vision Point App Components

The Vision Point App main window with all of its components is shown in the following image.

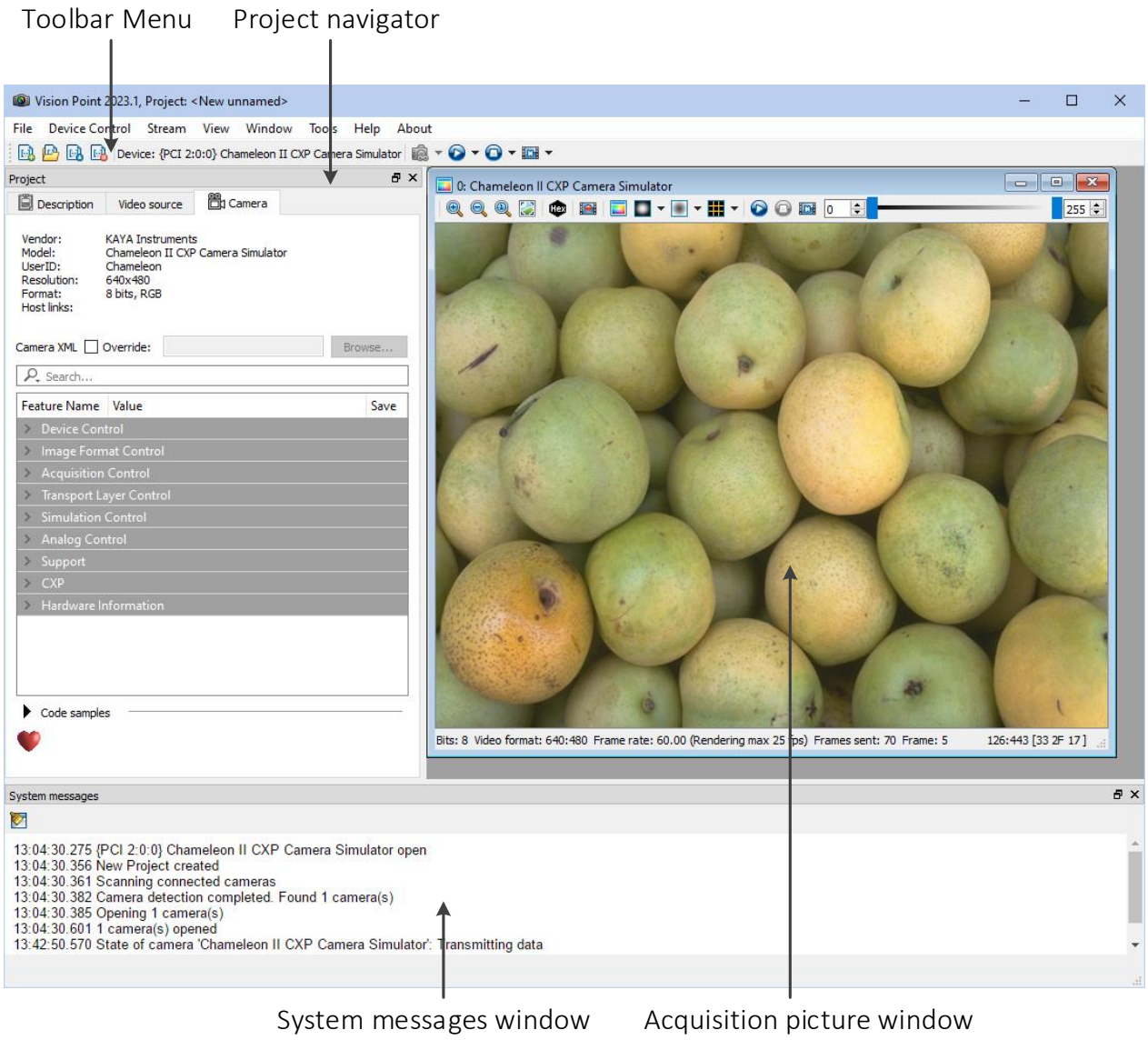

Figure 2 – Vision Point app main window

4.1 Main Toolbar Menu

The Toolbar Menu includes project operation buttons, hardware selection, and stream acquisition control buttons. The Toolbar Menu is shown below and includes the following components:

1. "New Project" button to create a new project from scratch.
2. "Open Project" button to open an existing project or example.
3. "Save Project" button to save the opened project and all of its configurations.
4. "Close Project" button.
5. Display of the previously selected device.
6. "Start" button to simulate continuous stream.
7. "Stop" button to stop the generation of continuous stream.
8. "Single Grab" button to grab one frame at a time (arrow to simulate 1 frame on a specific camera).

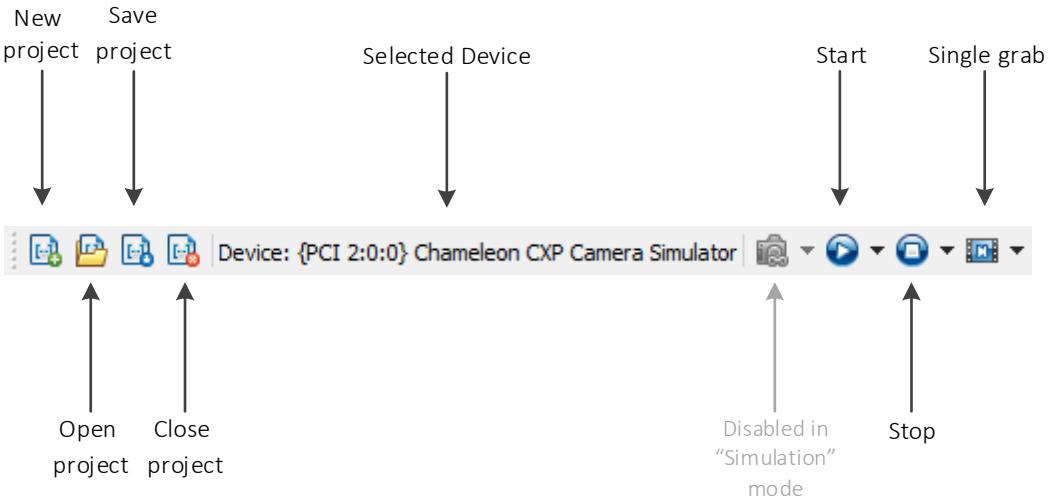

Figure 3 – Main toolbar menu

4.2 Project Navigator

The project navigator allows configuring and controlling a simulated camera via standard Gen<i>Cam interface. It includes several tabs:

1. The Description tab is used to specify the project name and description, as shown in Figure 4.
2. The Video Source tab is used to specify and configure a video source for the current project, see Figure 5.
3. The Camera tab enables configuring the camera Gen<i>Cam parameters listed in the camera XML file. An external XML file may be loaded in the absence of a native one from the camera. The camera tab is shown in Figure 6.

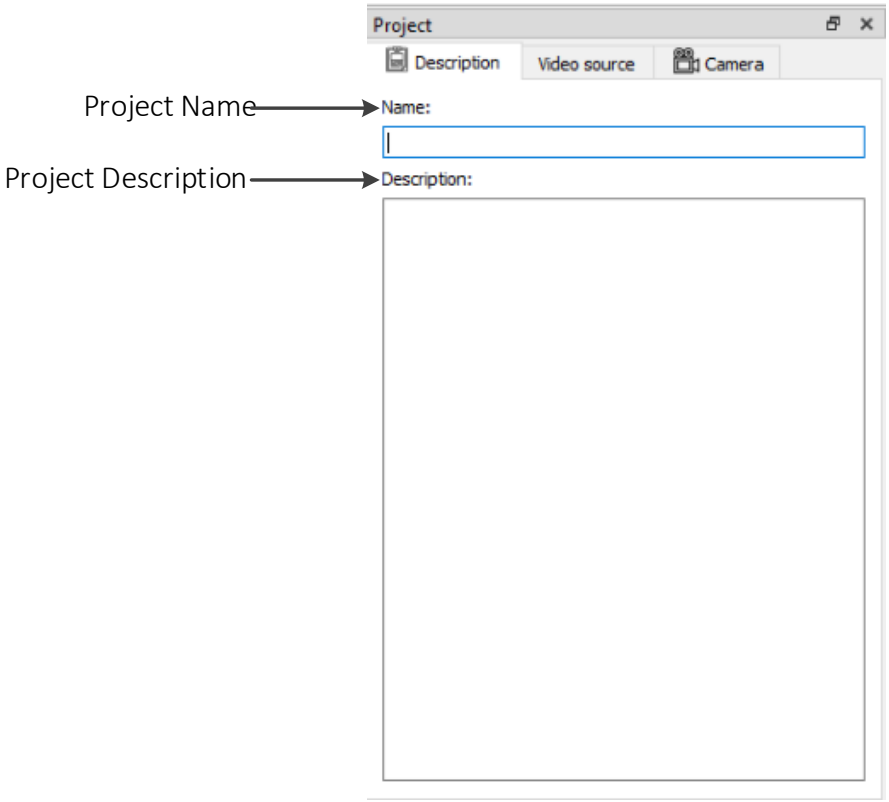

Figure 4 – Project description tab

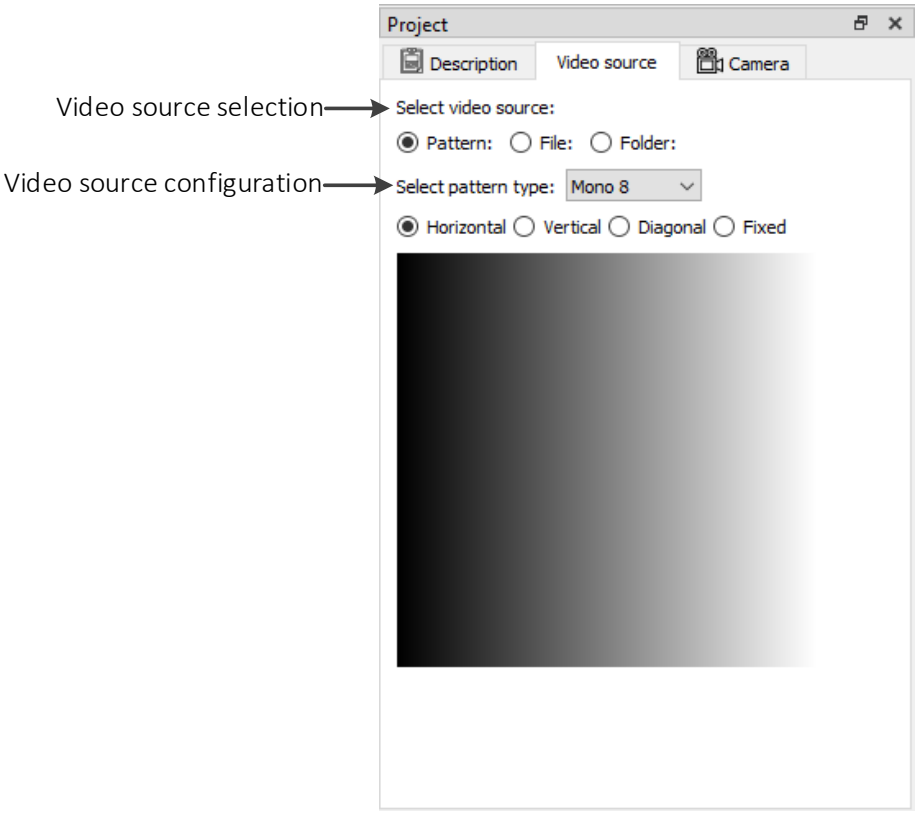

Figure 5 – Video source tab

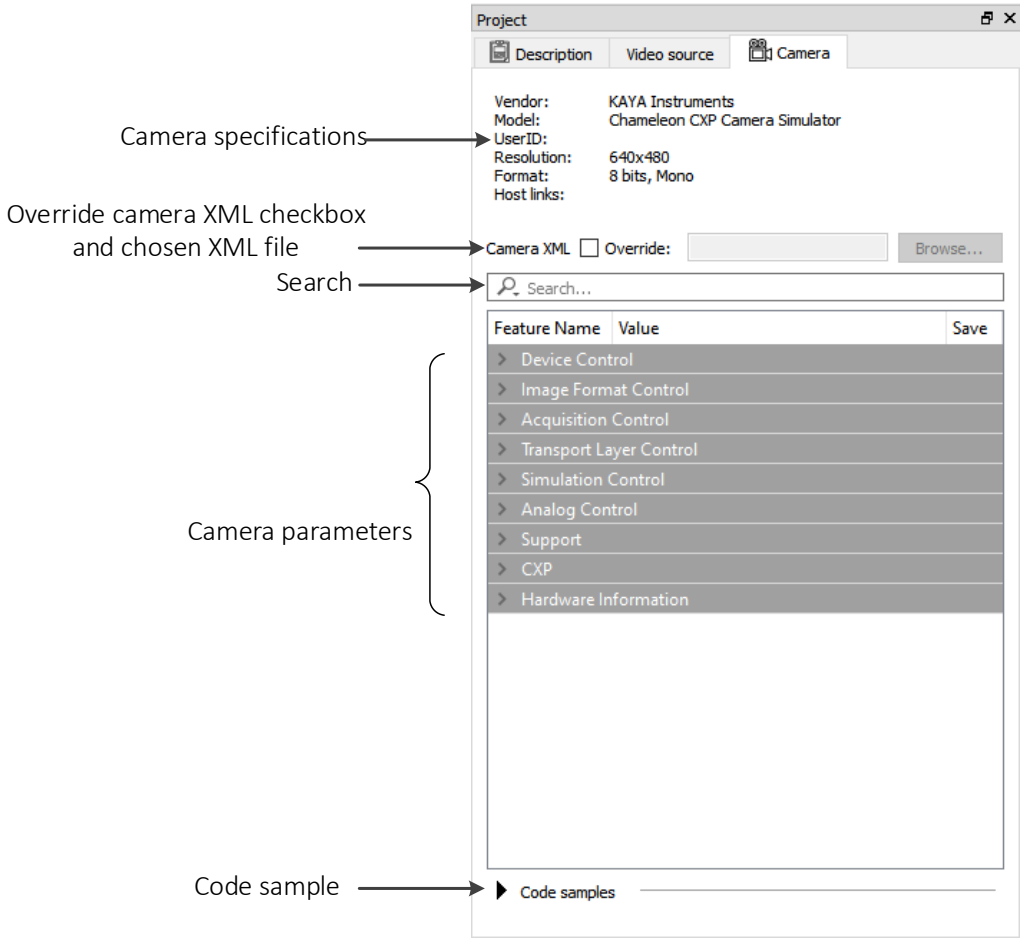

Figure 6 – Camera navigator tab

4.3 System Messages Window

The system messages window displays general, run-time informational, and error messages regarding the state of stream grabbing and changes to various components. If it is not needed, the message window can be hidden/shown via the View tab of the Vision Point App menu bar. The system messages window is shown in the image below.

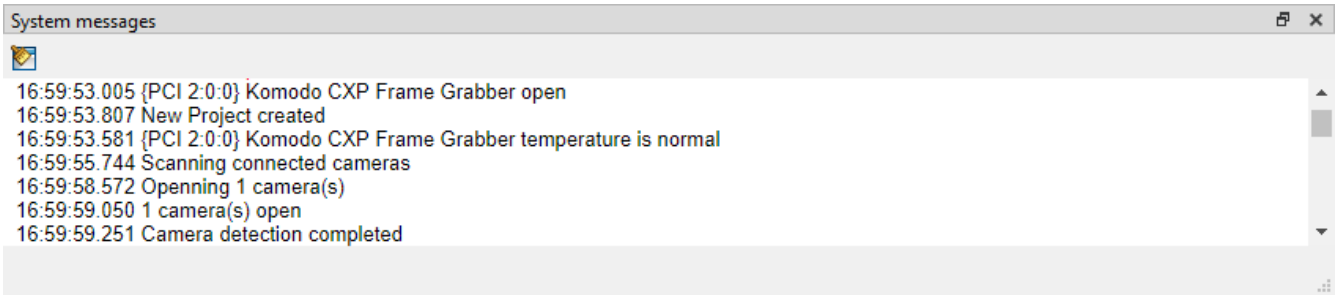

Figure 7 – System messages window

The system message window displays run-time information and error messages regarding the state of stream-grabbing and changes to various components. Click on the  button to clear the Messages Window.

4.4 Simulated Picture Window

The simulated picture window displays the last frame that has been generated. Information on frame rate and image format can be found at the bottom of the picture window. The picture window can be seen in Figure 8.

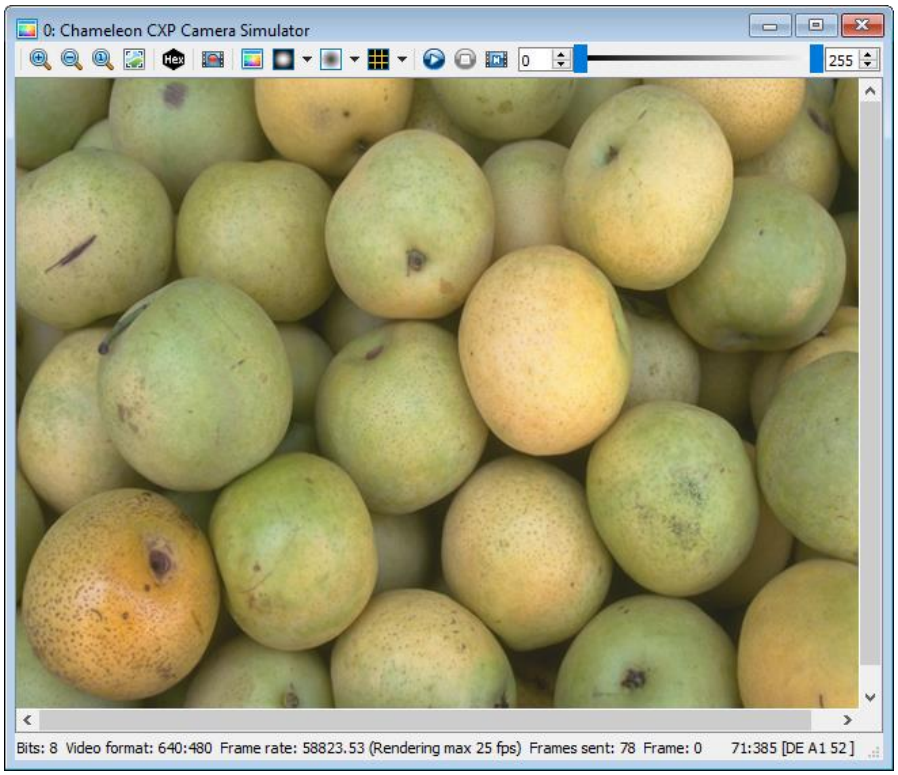

Figure 8 – Picture window

4.4.1 Picture Window Summary

The Picture summary display toolbar is shown in Figure 9 and includes the following components:

1. Image format
2. Resolution of the image
3. Frame rate
4. Number of generated frames
5. Current frame number
6. Pixel value - location of the mouse cursor in x∶y [R G B]

Figure 9 – Picture window summary display toolbar

In addition to the image dimension control buttons in the picture window toolbar, two features are available:

1. Moving picture – by holding the left mouse button and moving the mouse.
2. Zooming IN/OUT using scroll mouse button – by moving the mouse cursor on top of the image and use scroll button.

5 Vision Point App Basics

5.1 Using Vision Point App

This section describes the basic setup for connecting and configuring the Frame Grabber and connected cameras. The basic steps include:

1. Selecting a grabber board
2. Opening, creating and closing a project
3. Updating the firmware
4. Adjusting the grabber parameters
5. Scanning and adjusting the camera parameters
6. Starting an image acquisition

5.2 Selecting a Simulator Board

A Vision Point App requires selecting a single KAYA Chameleon Simulator target board among the available boards or running in demo mode with no hardware connection. Different boards may include different feature sets.
The target board is selected from the combo box and is only available when it's not mounted to any active project; in that case, the active project should be closed first. To select a target board:

- Click the ▼ button of the grabber selection combo box located on the Toolbar Menu
- When the list of available target boards opens, select the required board/demo mode from the list
- Click "Create new project" to create a new project from scratch or "Open existing project..." to open an existing one

The selection example is shown in the following figure.

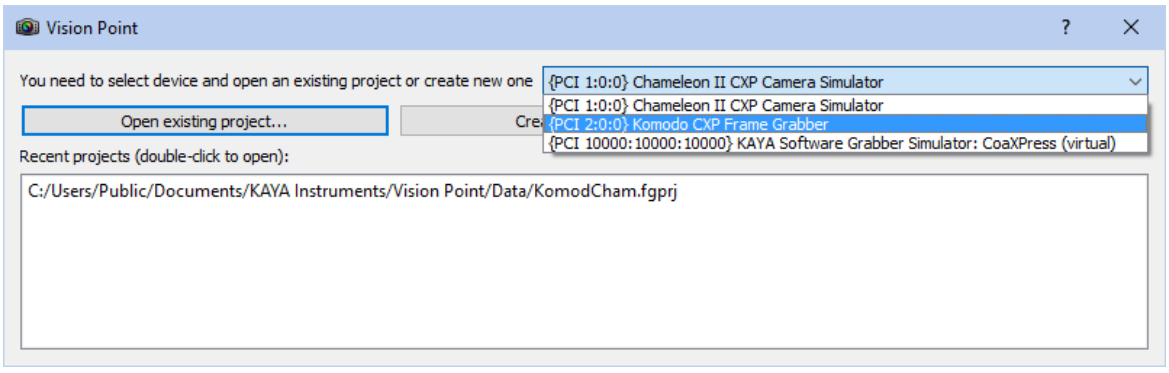

Figure 10 – Selecting the Frame Grabber

5.3 Creating a New Project File

After a target board is selected, a new project can be opened.
To create a new project file, choose one of the options:

- Click "Create New Project" button located on the application start dialog
- Use the  button located on the Toolbar menu
- Click "New Project" located under "File" menu

5.4 Open a Project File

To open a project file, choose one of the options:

- Click "Open Existing Project" button located on the application start dialog
- Use the  button located on the Toolbar menu
- Click "Open Project" located under "File" menu

Select the desired project file (file extension .fgprj). Upon project load, the corresponding parameters for the Frame Grabber and Camera would be retrieved. See section 5.12.6 to define the parameters that would be set upon a project load.

NOTE: *Please pay attention that if a project file is loaded with a different camera than the original one, it may cause some values not to be set and may alter the desired operation of the chosen camera.*

After selecting a new/existing project, a connection becomes locked for the chosen device, and you can start working with it. To connect to a different Frame Grabber, a new instance of the application should be opened.

5.5 Saving a Project

To save a project file, choose one of the options:

- Click "Save" or "Save As…" located under the "File" menu
- Use the  button located on the Toolbar menu

5.6 Closing a Project

To close an opened project use choose one of the options:

- Click "Close" located under the "File" menu
- Use the  button on the Toolbar Menu button

Closing a project disconnects it from the previously connected Frame Grabber. Now you can connect to a new Frame Grabber using either the "New Project" or "Open Project" option or connect to the same device.

NOTE: *Closing the project window using the X button simply closes it without closing the project itself. Display options can be found under the "View" menu.*

5.7 Selecting a Video Source

The next step before starting the simulation is to select the correct video source. It could be one of the following:

- Pattern
- An image file
- A directory containing several files of a specific type.

To select and configure the desired video source, use the "Video source" tab in the project navigator window as described in the following sections.

5.7.1 Pattern Source

A pattern source generates a static pre-defined pattern. A pattern type – format, bitness, and direction should be specified in the "Select pattern type" combo box, as shown in Figure 11. Several patterns can be selected, described in Table 2.

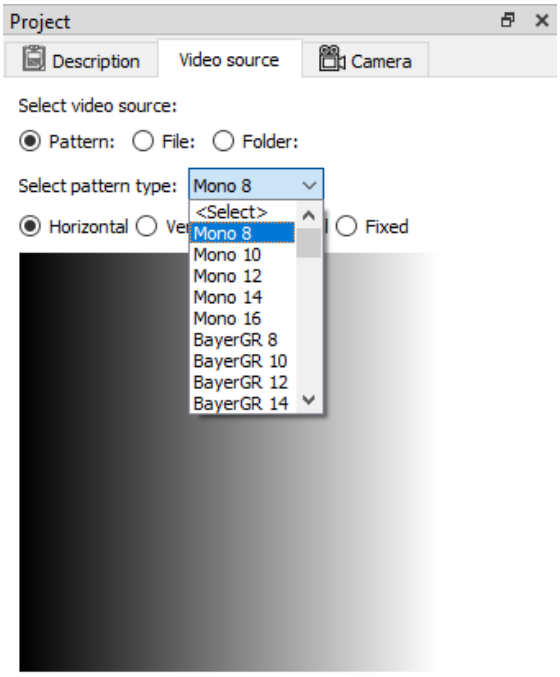

Figure 11 – Selecting pattern type

Pattern type	Bitness
Mono	8/10/12/14/16
BayerGR	8/10/12/14/16
BayerRG	8/10/12/14/16
BayerGB	8/10/12/14/16
BayerBG	8/10/12/14/16
RGB	8/10/12/14/16
RGBA	8/10/12/14/16

Table 2 – Pattern type available values

The different available patterns are:

1. Horizontal ramp – a grayscale horizontal gradient as shown in Figure 12:

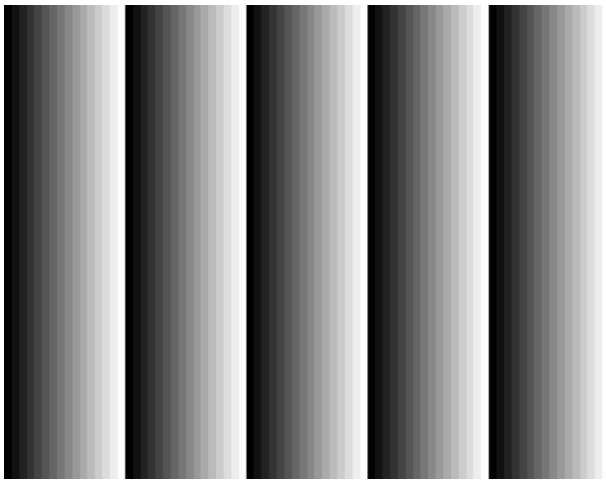

Figure 12 – Horizontal pattern

2. Vertical ramp – a grayscale vertical gradient as shown in Figure 13

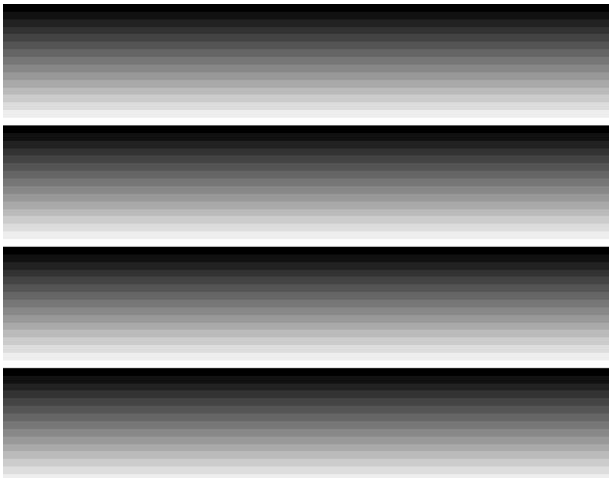

Figure 13 – Vertical pattern

3. Diagonal ramp – a grayscale diagonal gradient as shown in Figure 14.

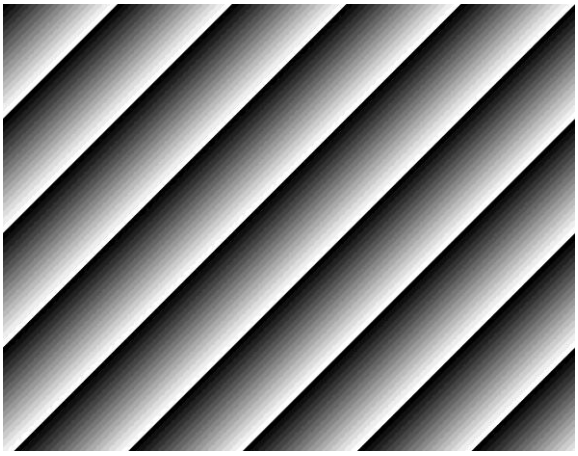

Figure 14 – Diagonal pattern

In case an RGB/RGBA format is chosen, a combo box would appear, allowing the user to switch to the following color patterns:

1. Horizontal color ramp – horizontal gradient of several color stripes, as shown in Figure 15.

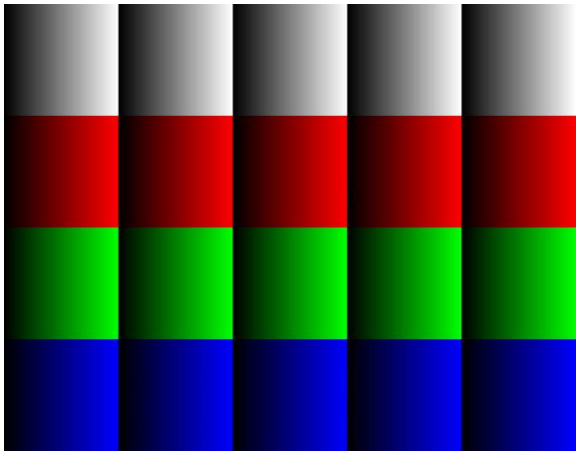

Figure 15 – Horizontal color pattern

2. Vertical color ramp – vertical gradient of several color stripes, as shown in Figure 16.

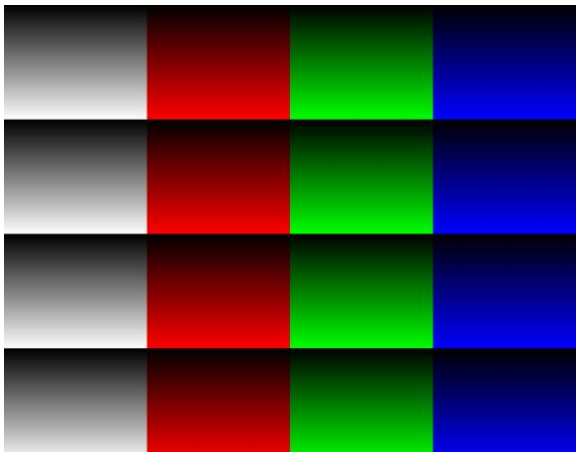

Figure 16 – Vertical color pattern

3. Diagonal color ramp – diagonal gradient of several color stripes as shown in Figure 17.

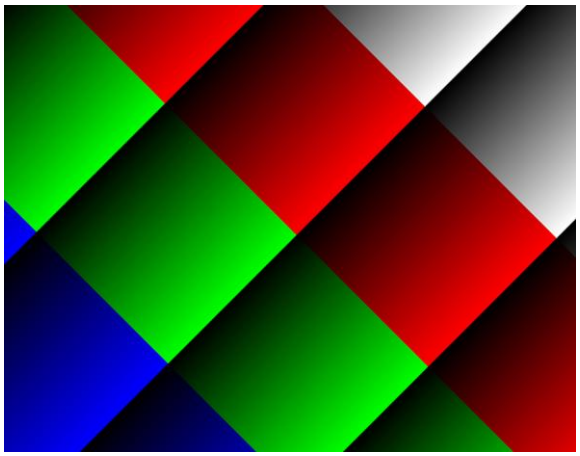

Figure 17 – Diagonal color pattern

A combo box for RGB/RGBA format allows switching to the color patterns, as shown in the image below.

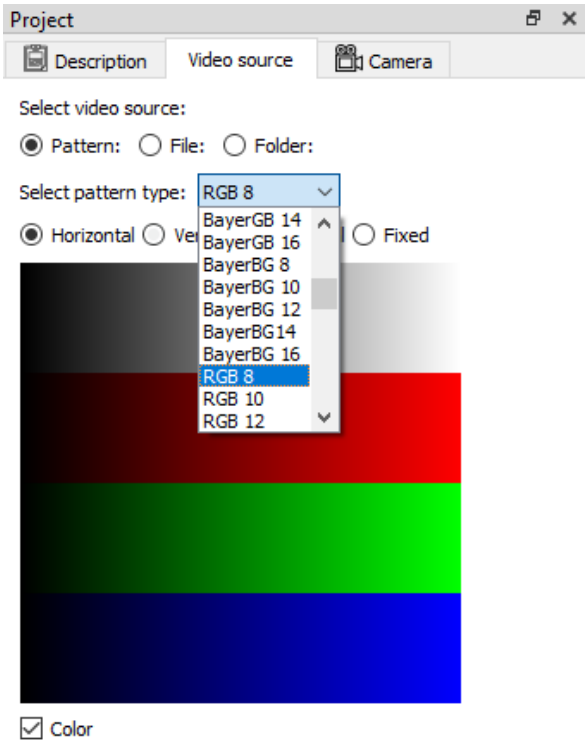

Figure 18 – Selecting a color pattern

4. Fixed – Fixed color filling of the entire frame.

   If a Fixed Pattern type is selected, color configuration controls are enabled, as shown in Figure 19. There are few methods to select the desired color:

   - The numeral values of individual colors can be modified.
   - The scales on the right may be used by dragging individual colors until the desired result is achieved.
   - The interactive color pane can be moved on the circular axle and the square shade pane to select the desired color.

   - The “Pick” button may be clicked to activate the color sampling tool (resembles the Eyedropper tool in Photoshop). Once the button is clicked, the following cursor selection would determine the color.
   - The HEX value can be modified directly if a color value is known. The “Hex” value represents a combined color value that consists of all the color planes. Each color is represented by 2 bytes (16 bits) in the Hex value LSB aligned. The first color plane is on the left side of the value. For example for an RGB 10 bits format with R=255, G=1, B=512 the hex value will be #00FF00010200.

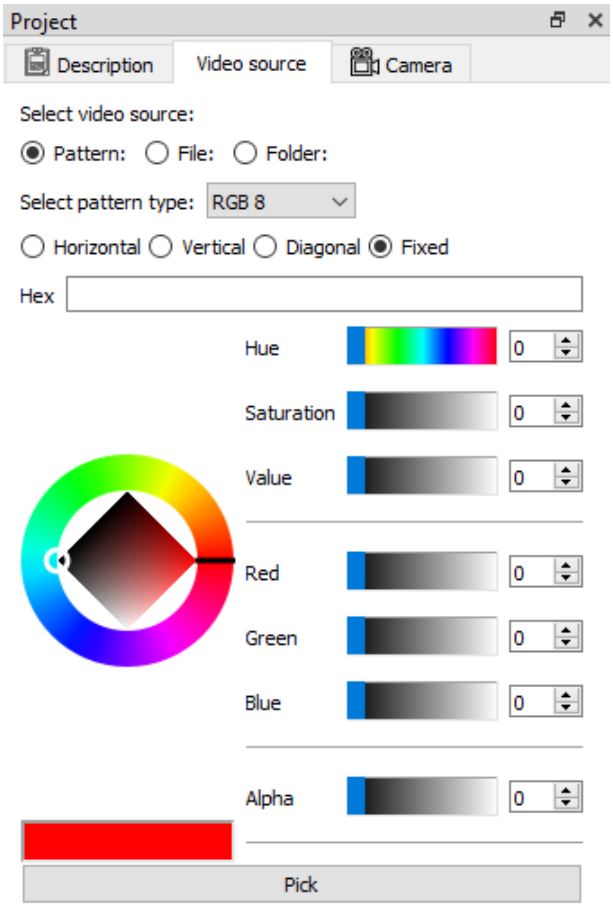

Figure 19 – Fixed color pattern

5.7.2 Folder Source

If a folder source is selected, the type and number of frames to be loaded must be specified. Only the files of the selected type would be loaded in an alphabetical order (as they are located in the folder). If there are more frames in the files than the maximum number specified, the simulator would load the maximum number of frames ignoring the rest. If there are fewer frames in files, the last frame is multiplied until the maximum number of frames is mounted.

The rules that apply to the single file also apply to the folder source. For the RAW files, the number of frames in each file in the folder can vary.

5.7.3 File Source

The Vision Point App supports BMP, PNG, TIFF, and RAW image formats. When a file source is selected, the Vision Point App loads an image from a single file. Please refer to
Table 3 for the supported image formats that can be stored in each file type.

	RAW	BMP	TIFF	PNG
Mono/ Bayer 8 bit	✓	✓	✓	✓
Mono/ Bayer 10-16 bit	✓	✗	✓	✓

RGB 8 bit	✓	✓	✓	✓
RGB 10-16 bit	✓	×	✓	✓
RGBA 8 bit	✓	×	✓	✓
RGBA 10-16 bit	✓	×	✓	✓
YCbCr 8 bit	✓	×	×	×
YCbCr 10-16 bit	✓	×	×	×
YUV 8 bit	✓	×	×	×
YUV 10-16 bit	✓	×	×	×

Table 3 – Supported image formats

Remarks:

1. If the source file resolution, color format, or bit-width of BMP, TIFF, and PNG files do not match the selected camera parameters, it would be rescaled automatically to match the camera. An appropriate message would appear in the log for this case.
2. The 8-bit formats are stored on a single-byte basis, while 10, 12, 14, and 16-bit ones are stored on a two-byte basis LSB aligned.
3. The RAW files must match the camera parameters; otherwise, they won't be loaded correctly.

RAW files are files that contain only the bitmap data of an image with no header. The RAW file must be structured as follows:

- No header or Metadata is to be a part of the file.
- The upper-Left pixel has to be located first in the file.
- All the pixels in the RAW file should be packed, and no intra-pixel and intra-line alignment allowed.
- For multi-byte color data, the byte-order is "Little Endian," i.e., LSB goes first.
- A RAW file can contain more than one frame. Only full frames would be taken from a RAW file, i.e., if there is a partial frame at the end of the file, it would be ignored.

5.8 Code Sample

This additional tool allows the user to understand better the parameter configuration and command execution related to the Chameleon device. A "Code sample" window can be exposed for each parameter by pressing on the ▶ button, showing a short description of the currently chosen command and a setter/getter function calls (if available). This feature can be found in the Camera tab, and an example of its usage is shown in the image below.

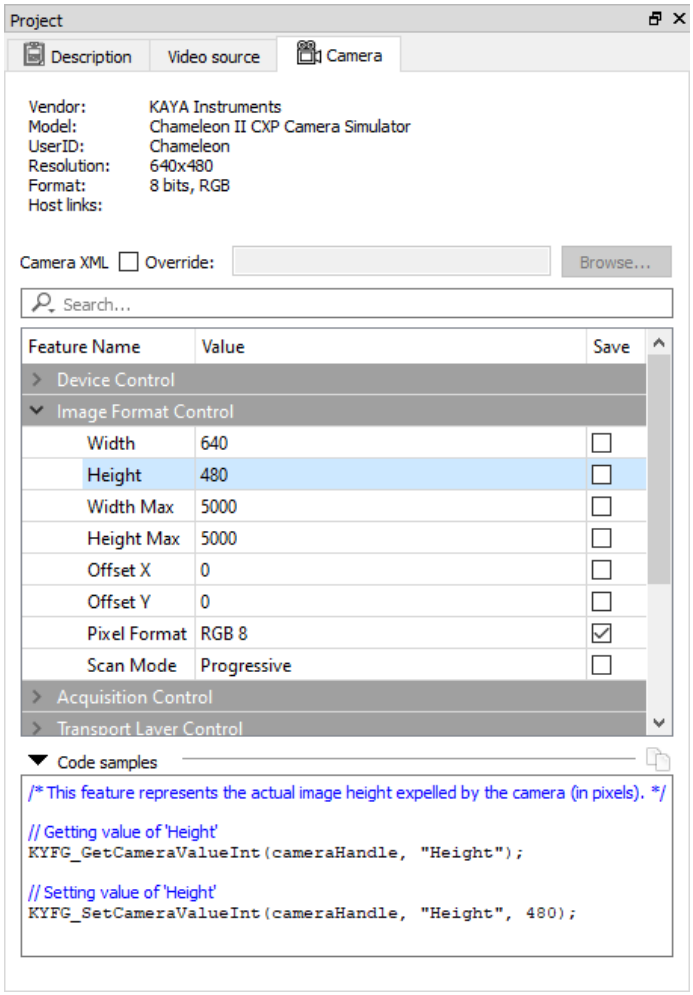

Figure 20 – Code sample

5.9 Adjusting Camera Parameters

The camera configuration contains many parameters. Some of the parameters are standard CoaXPress defines, some are camera dependent, and some affect the image type and geometry. Before starting the simulation, camera parameters have to be configured to match the simulated camera requirements. The parameters can be configured under the "Camera" tab in the project dialog, as shown in Figure 21. Camera XML is loaded automatically when the Simulator board is chosen. To override the provided camera XML, please refer to the next section.

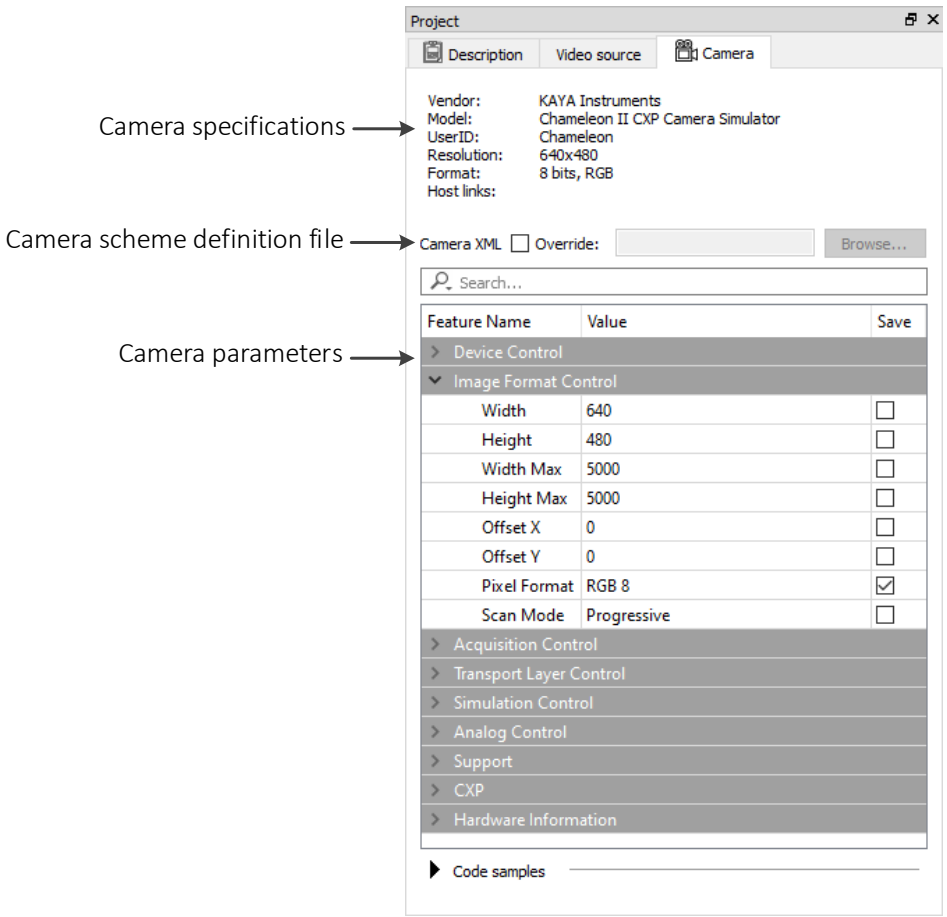

Figure 21 – Adjusting camera parameters

Several properties directly affect the simulation. These parameters must be configured before starting the simulation. The mandatory parameters are described in Table 4.

Category	Property	Description
Image Format Control	Width	This property defines the frame width in pixels
Image Format Control	Height	This property defines the frame height in pixels
Image Format Control	Offset X	This property defines the horizontal offset of the frame within ROI in pixels
Image Format Control	Offset Y	This property defines the vertical offset of the frame within ROI in pixels
Image Format Control	Pixel Format	This property defines the image's pixel format as specified in section 10.4.1.1 of the CoaXPress 2.0 standard.
Acquisition Control	Acquisition Mode	This property defines the acquisition mode of the camera; it can be "Continuous," "SingleFrame," or "MultiFrame." In "Continues" mode, the simulation continues running until a stop command is issued. In

		"SingleFrame" mode, a single frame is sent. In "MultiFrame" mode, the number of frames defined in the "Acquisition Frame Count" field is sent.
Acquisition Control	Acquisition Frame Rate	Defines the frame rate for frame scan cameras. The units are frames per second.
Acquisition Control	Acquisition Line Rate	Defines the line rate for line scan cameras. The units are lines per second.
Acquisition Control	Acquisition Frame Count	Defines the number of frames to be simulated. Used only if the "MultiFrame" value is chosen in the "AcquisitionMode" enumeration field
Simulation Control	Trigger Mode	"Free Running" for internal timing and "Triggered" for external triggered timing. In "Free Running" mode, frames/lines are sent according to "Acquisition Frame Rate"/"Acquisition Line Rate property". In "Triggered" mode, a new line/frame is sent upon hardware/software trigger.
Simulation Control	Trigger Source	Selects a source for the trigger. The sources are described in Table 6.

Table 4 – Mandatory camera properties

NOTE: *The "Image Format Control" properties can also be modified from the Frame Grabber according to Gen<i>Cam protocol. Such changes are only allowed when the simulation is stopped.*

The other properties in the list do not affect the type and geometry of the image. They are either standard CoaXPress properties or custom properties related to a specific camera. For more information regarding the CoaXPress standard properties, please refer to CoaXPress standard, Gen<i>Cam standard, and specific camera documentation.

5.9.1 Override Camera XML File

To override the camera's native XML file, check the "Override Camera schema definition with file" option, located in the "Camera" tab, then a legitimate XML file should be selected, as shown in Figure 22. If not checked, a native camera XML file would be used.

WARNING: *Override XML would reset all previous parameters to their default values. The user is responsible for resetting all needed parameters after XML is re-loaded.*

Figure 22 – Override camera native XML file

5.10 CXP2 Heartbeats generation

CoaXPress 2 support was introduced in the 2021.1 software release, including CXP2 tagged command packets, generate, CXP2 heartbeats and Events. These feature are available for the Chameleon II device and located under the 'CXP' tab in project window, 'Camera' tab. When CXP2.0 version is used, a heart image indication will appear at the bottom of project window as shown in the following figure:

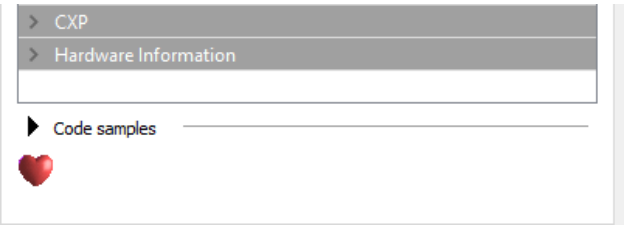

Figure 23 – heartbeats indication

The following firmware versions are required for CoaXPress 2 support.

Hardware device	Firmware version	Details
Chameleon II Camera Simulator	5.x.x	CXP2 support

Table 5 – CXP2 firmware release notes 2021.1

5.11 Firmware Update

After creating a project, a firmware update option is available. The "Firmware update..." option can be found under the "Grabber Control" category, as shown in Figure 24. For more detailed information, please refer to section 12.1.

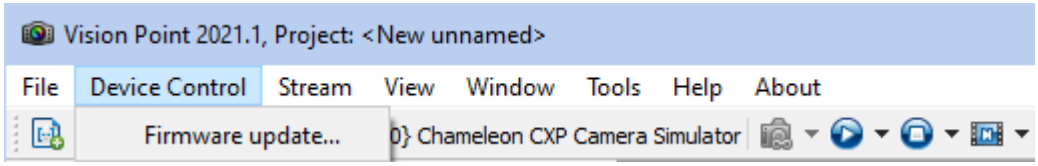

Figure 24 – Firmware update

5.12 Controlling Simulation

After a camera was selected and configured, the stream generation can commence.
There are several ways for controlling the simulation:

- Using the Toolbar Menu buttons and the Picture window buttons
- Using the "Acquisition Start" and "Acquisition Stop" commands from the Frame Grabber.

NOTE: *A project must be loaded, and a video source must be selected to start the simulation. Once a simulation is started, a window with the currently transmitted frame is shown. See section 4.4*

5.12.1 Controlling Simulation from Toolbar Menu and Picture Window Menu

To start the generation from the main Toolbar Menu, press the button.
To stop the acquisition from the main Toolbar Menu, press the button.
The same commands can be performed from the picture window after it was initiated.

- Start Acquisition to issue the "AcquisitionStart" command.
- Stop Acquisition to issue the "AcquisitionStop" command.

5.12.2 Controlling the Simulation from the Frame Grabber

Different Frame Grabbers have different approaches to starting an acquisition. On several models, the "Acquisition Start" / "Acquisition Stop" commands are automatically written to the camera when Frame Grabber starts the acquisition, while on others, it's needed to manually issue Gen<i>Cam command or direct write to the camera register. Please refer to your Frame Grabber manual for more detailed information.

5.12.3 Controlling Simulation from the Picture Window

The picture window toolbar includes stream simulated and image dimensions control buttons. After the stream generation commenced, controlling the generation and replaying frames can be made using the picture window toolbar. The picture window toolbar is shown in Figure 25 and includes the following components:

1. Zoom in button to zoom in on the image.
2. Zoom out button to zoom out the image.
3. Zoom 1:1 button to reset the image size.
4. Fit to window button to fit the image to the current window size.
5. Hex view of the picture.
6. Simulation / **Replay Mode** button to switch between live acquisition and replaying frames. Additional icons will appear. See section 5.12.4.
7. Color Histogram button allows showing/hiding color segmentation of the currently displayed image. See section 5.12.5.
8. Dark field correction See section 5.12.6.1
9. Flat field correction See section 5.12.6.2
10. Grid Lines See section 5.12.7
11. Start button to start Continuous simulation of stream of a specific camera.
12. Stop button to stop simulation of stream of a specific camera.

13. Single grab button to simulate one frame at a time of a specific camera.
14. Color level threshold bar - Adjust image level in a range of specified minimum and maximum threshold pixel values.
15. Minimum threshold pixel value.
16. Maximum threshold pixel value.

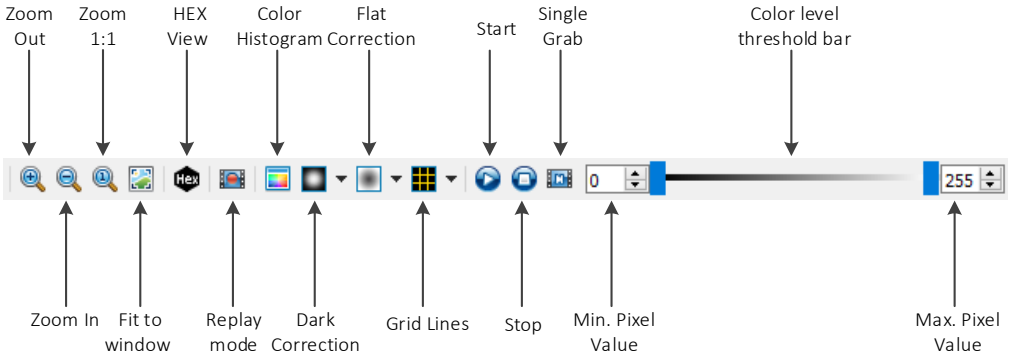

Figure 25 – Picture window toolbar

5.12.4 Replay Mode from the Picture Window Toolbar

After the stream generation commenced, frame replying can be controlled via the picture window toolbar. When Replay Mode for a specific camera is enabled, additional icons will appear in the picture window toolbar, as shown in Figure 26:

1. "Play" button to play the simulated stream
2. "Stop" button to stop the simulated stream
3. "Show Previous" Frame" button to show the previous simulated frame
4. "Show Next Frame" button to show the next simulated frame
5. "Jump to start" button to go to the first simulated frame
6. "Jump to end" button to go to the last simulated frame
7. "Looping ON/ OFF" button to play/stop the broadcasted frames in a loop
8. Buffer continuation bar
9. Frame rate window shows the current frame rate

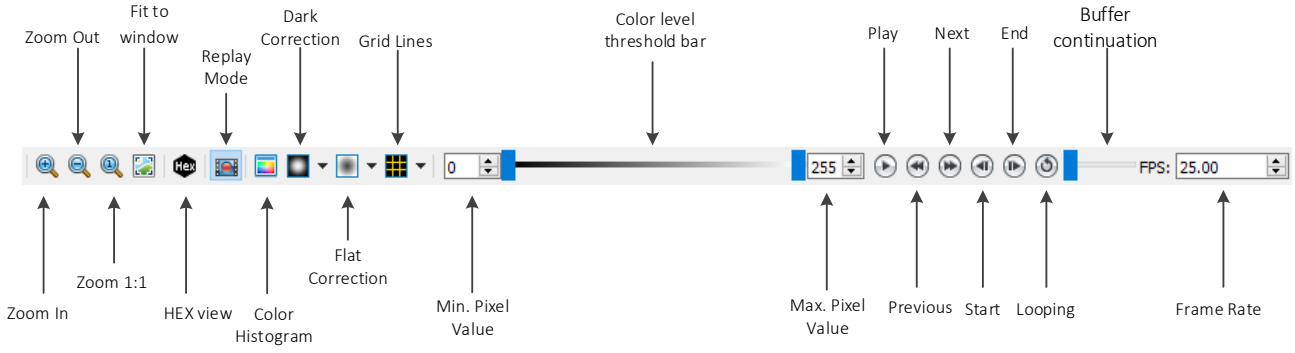

Figure 26 – Replay mode additional toolbar

5.12.5 Color Histogram

When the Color Histogram button is pressed, an additional display window appears, showing the color segmentation histogram of a picture from which it was triggered. In different camera configurations, the histogram is displayed in one of the following modes:

- For Mono pixel format cameras configuration, a single channel histogram is displayed.
- If the cameras were configured to an RGB mode, three histograms would be displayed, showing the color segmentation for each color (red, green, blue). An example is shown in Figure 27.

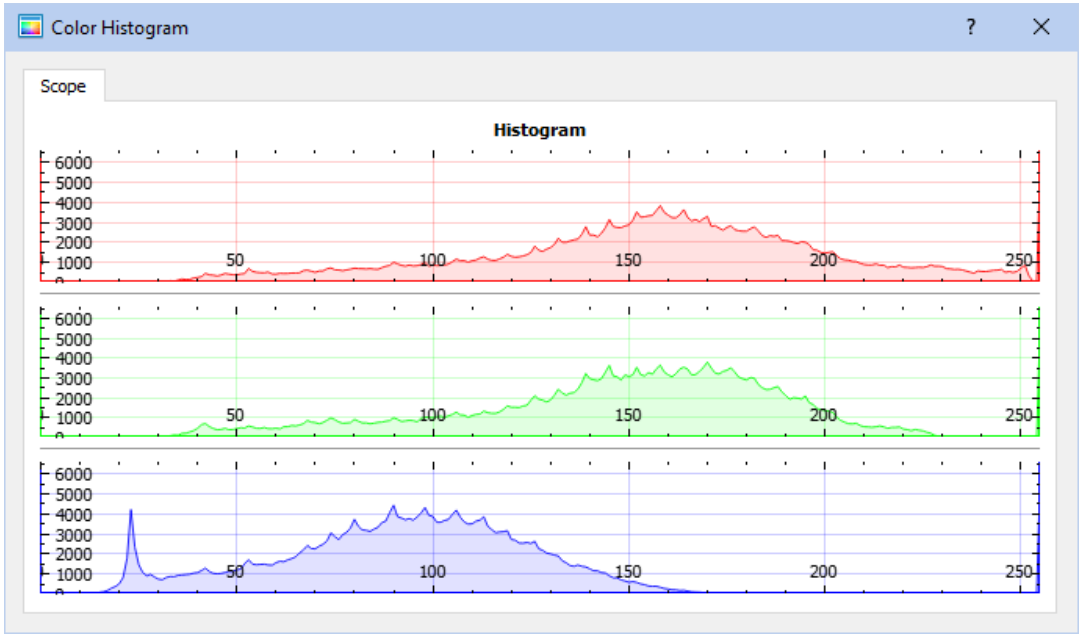

Figure 27 – Color Histogram window

5.12.6 Field Correction

The Flat-field and Dark-field corrections can be used to improve the image's quality by removing artifacts caused by fixed-pattern noise and variations in the pixel-to-pixel sensitivity of the detector.

Two pictures should be taken to perform Dark/Flat field corrections: One with the lens closed (offset should be boosted) or completely removed from the camera and covered with a solid cap, and one with **uniform** illumination of around 40% of the sensor's pixels (dark and bright photos, one of each).

The operator is per pixel and defined according to the following formula:

$$\overline{P(x,y)} = Gain(x,y)[P(x,y)-P_{dark}(x,y)]$$

Where P(x,y) is the pixel at the offset, X is horizontal, and Y is vertical. $P_{dark}(x,y)$ is the offset of the pixel at offset X in horizontal and Y in vertical that was measured during the calibration stage. Gain(x,y) is the gain of the pixel at offset X (horizontal) and Y (vertical) that was measured during the calibration stage. This correction is valid for the specific camera settings and conditions (gain, exposure time, temperature, etc.) which were selected during the calibration process.

5.12.6.1 Dark Field Calibration Process

The dark field correction is the easiest one to calibrate. It only requires a reference image to be recorded without illumination on the image sensor. Follow these steps to perform the dark field calibration process:

1. For this calibration, all light should be blocked from the sensor, which can be achieved by removing the lens and covering the lens mount with a solid cap [(1)]
2. After covering the sensor, start the camera's stream [(2)]
3. Select the "Calibrate dark field" option located under the ▾ button of the dark field icon in the picture window toolbar
4. Stop the camera's stream
5. Enable the dark field correction [(3)]
6. Restart the camera's stream
7. Save and load dark field calibration options are available after performing the calibration process. A single uncompressed .TIFF file is created upon the "Save dark field correction" operation
8. The load option requires a single uncompressed .TIFF file. Make sure to use the same camera settings with which the loaded calibration was performed

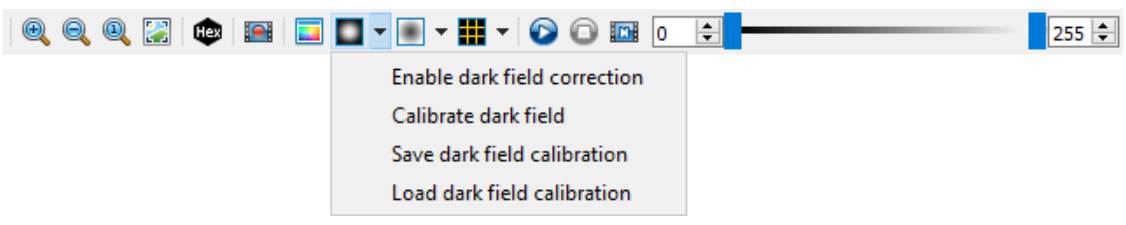

Figure 28 – Dark field calibration actions

5.12.6.2 Flat Field Calibration Process

The choice of which light intensity to use for the bright field calibration requires a little bit more thought. If you perform the calibration with a light intensity too close to camera saturation, you might compensate the camera too much and introduce more PRNU for low light intensities. If you use low-intensity light, the differences in photo response might be too small to calibrate the image properly. Generally, a light intensity that gives a signal somewhere around 40% of the sensor's full scale should give the optimal result. Follow these steps to perform a flat field calibration process:

1. Prepare light source. Uniform light should be applied across the sensor, which can be achieved by removing the lens and setting a uniform light source, such as diffused light or integrating sphere, in front of the camera
2. Perform dark field calibration or load dark field reference image (1)
3. After setting the uniform light source, start the camera's stream (2)
4. Select the "Calibrate flat field" option located under the ▾ button of the flat field icon in the picture window toolbar
5. Stop camera's stream
6. Enable the flat filed correction (3)
7. Start camera's stream
8. Save and load flat field calibration options are available after performing the calibration process
9. A single uncompressed .TIFF file is created upon the "Save flat field correction" operation
10. The load option requires a single uncompressed .TIFF file. Make sure to use the same camera settings with which the loaded calibration was performed

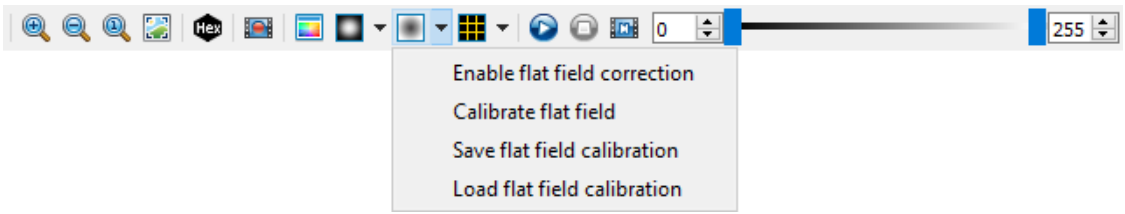

Figure 29 – Flat field calibration actions

Remarks:

1. The Flat field calibration should be performed **after** the Dark field calibration has already been performed for the exact camera settings
2. To summarize, reference images have to be recorded in dark and in a bright field depending on the flat field correction variant. Ensure the sensor is really dark when performing a dark field calibration, and perform a bright field calibration in a light intensity range of around 40% of the sensor's full scale
3. Errors might show when a sudden peak in intensity is present in the reference scene as the correction is a low-frequency correction
4. There might be limits to the absolute difference that you can correct. The correction is often achieved by applying a gain per pixel or pixel segment. If the available gain is insufficient to correct the difference between the weakest and brightest illuminated pixel segment, a flat field cannot be achieved
5. The PRNU and DSNU are valid for specific camera settings and conditions, such as exposure time, gain, temperature, number of active fiber links, etc., which were selected during the calibration process. If the above conditions might change during camera operation, it is advised to pre-calibrate the system on several conditions and save them as different images. Load the previously calibrated images if the conditions have been changed

5.12.7Grid Lines

The Grid Lines feature allows to overlay the image with one of several grid patterns to ease orientation. Centering the image on a target object is easily achieved using the grid in real-time.

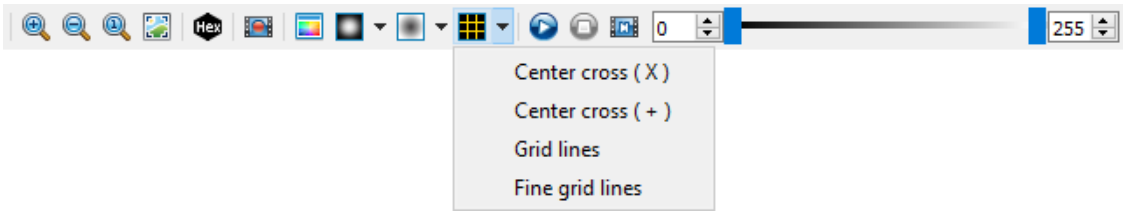

Figure 30 – Grid lines actions

There are four possible patterns:

- Center Cross (X) – see Figure 31 (A)
- Center Cross (+) – see Figure 31 (B)
- Grid lines – see Figure 31 (C)
- Fine grid lines – see Figure 31 (D)

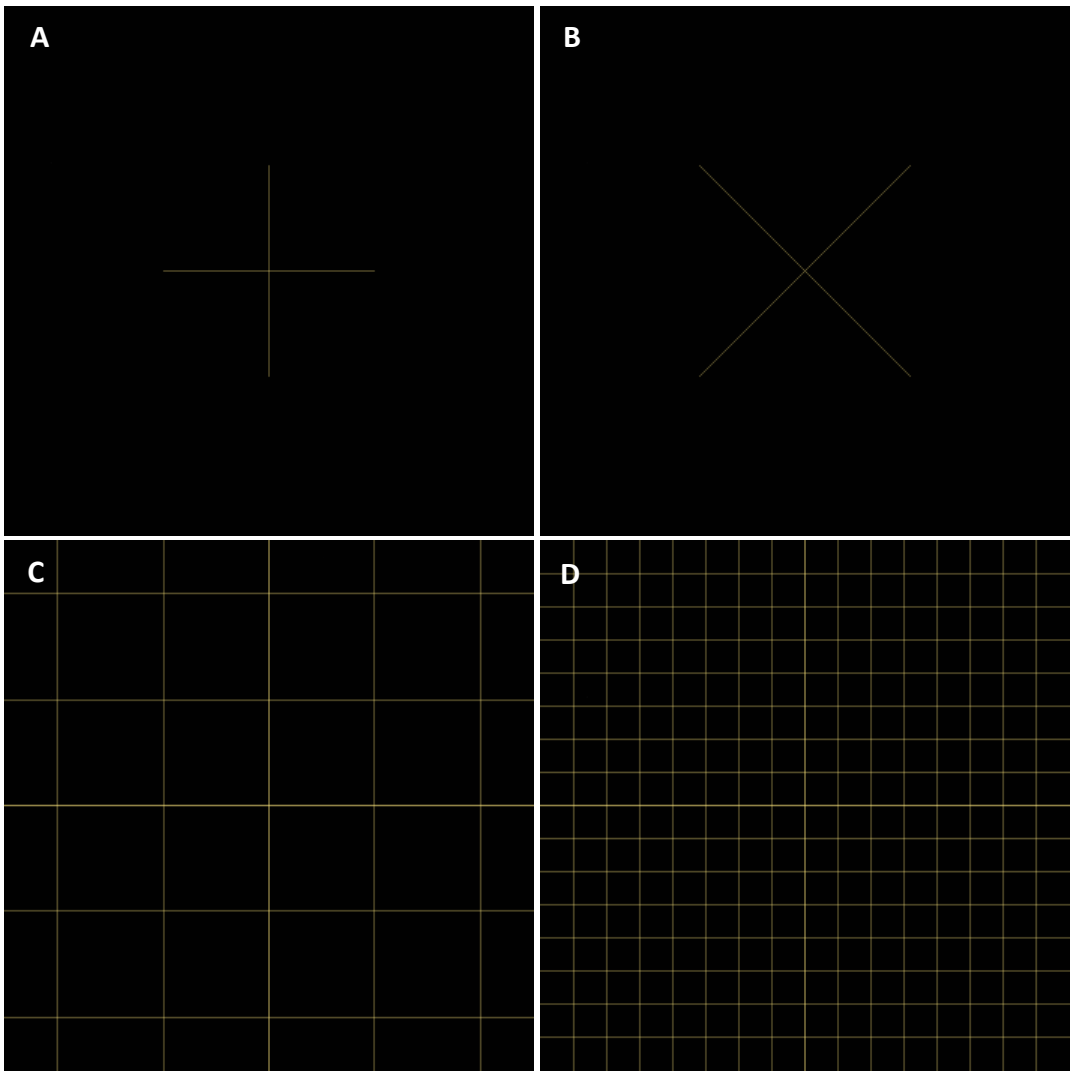

Figure 31 – Grid lines patterns

6 Save Operation

6.1 Saving the Frame Grabber/Camera Parameters

To save a specific Frame Grabber or camera parameter, check the "Save" checkbox, located to the right of each field. Only selected parameters would be saved and retrieved upon load.

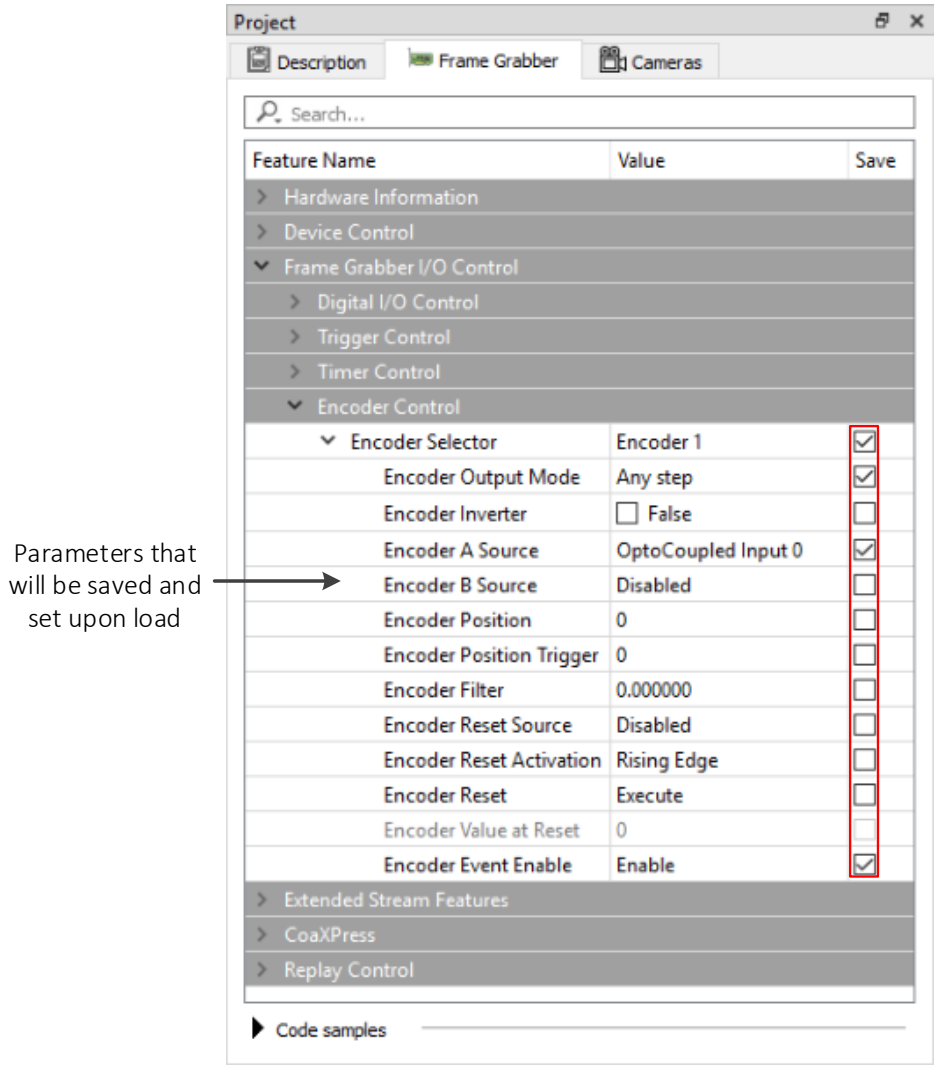

Figure 32 – Saving grabber configurations

6.2 Saving a Project

To save a project file, use the toolbar button or click "Save" or "Save As..." in the "File" menu.

6.3 Saving a Captured Image

To save a captured image, open the "Stream" menu and click the "Save Picture…" option. This option opens a save dialog, where you should choose the image format, destination folder, and file name. Click "Save" to save the image currently captured in the "Picture Window". During .tiff saving operation the user may choose whether the image would be shifted or not. The following options are available:

- ".BMP" – Windows Bitmap
- ".PNG" – Portable Network Graphics
- ".TIFF (LSB)" – Uncompressed tiff file containing complete video captured in allocated buffers. This option saves the actual values and is better tor processing.
- ".TIFF (MSB)" – Shifted uncompressed tiff file containing complete video captured in allocated buffers. This option saves a shifted image and is better for visualiziation.

Example: Saving a 10-bit image, pixel values of 1-1024, will save 16-bit values. A black image (left) shows the case of saving an image as ".TIFF (LSB)". Horizontal pattern (right) displays the shifted image saved as ".TIFF (MSB)".

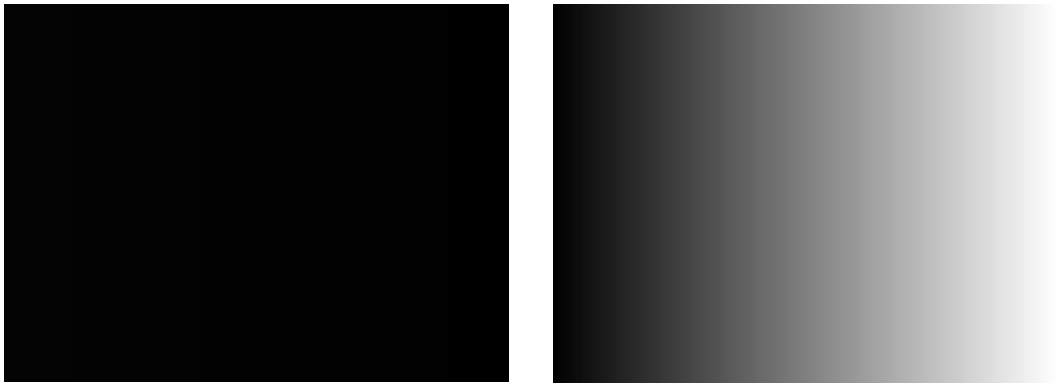

Figure 33 – Saving .tiff 10 bit image LSB (left) vs. MSB (right)

6.4 Saving a RAW Image

To save captured image as raw data, open the "Stream" menu and click the "Save raw file…" option. This opens a save dialog, where you should choose the destination folder and file name. Click "Save" to save the image currently captured in the "Picture Window" as raw data without scaling or reordering. The following options are available:

- "Single .RAW file" – Single uncompressed raw file containing complete video captured in allocated buffers
- "Multiple .RAW files" – Series of uncompressed raw files, one per each captured frame in allocated buffers

NOTE: *If the debayering format transformation is enabled, set the "PixelFormat" parameter value to "RGBxx" so the saved images will be as bayer format raw data.*

6.5 Saving Video Buffer

Open the "File" menu and click the "Save video buffer..." option to save a video stream. This opens a save dialog, where you should choose the destination folder, file name, and output format. Click "Save" to save the currently captured video in the "Picture Window".

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Available file output formats:

- ".AVI" – uncompressed MPEG output file
- "Single .RAW file" – Single uncompressed raw file containing complete video captured in allocated buffers
- "Multiple .RAW files" – Series of uncompressed raw files, one per each captured frame in allocated buffers
- "Single .TIFF file (LSB)" – Single uncompressed tiff file containing complete video captured in allocated buffers
- "Single .TIFF file (MSB)" – Single shifted uncompressed tiff file containing complete video captured in allocated buffers. See figure Figure 33.
- "Multiple .TIFF files (LSB)" – Series of uncompressed tiff files, one per each captured frame in allocated buffers
- "Multiple .TIFF files (MSB)" – Series of shifted uncompressed tiff files, one per each captured frame in allocated buffers. See figure Figure 33.

7 Working in Trigger Mode

Several applications require a triggered frame/line output. In these applications, a simulator waits for a trigger event before sending a new line/frame. In frame scan cameras, each trigger event results in a full-frame output. In line-scan cameras, each trigger event results in full line output. The following steps should be taken to configure the simulator in triggered mode, as shown in Figure 34.

1. Open the “Camera” tab in the project window
2. Under the “Simulation Control” category, open the “Triggered Control” category
3. Set "Trigger Mode” to Triggered
4. Set “Trigger Source” To “Camera Trigger”
5. Set “Trigger Activation” To the required edge
6. Set “Trigger Delay” according to your requirements
7. Detect the camera simulator
8. Note: A re-detection or refresh should follow any configuration change on the camera side.
9. Configure triggering in the Frame Grabber and start acquisition

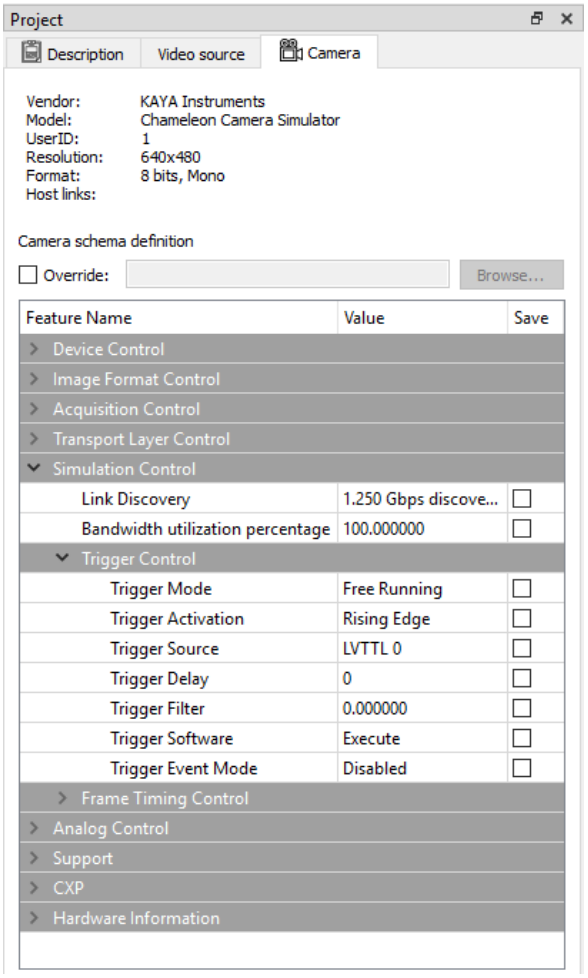

Figure 34 – Trigger control

The trigger event can be generated by:

- Software trigger by pressing the  in the Toolbar Menu or clicking the "Trigger" from the "Simulator Control" menu. It overrides the external trigger.
- An external trigger that is received from GPIO or CoaXPress link. The available sources for the trigger are described in Table 6.

Simulation Trigger Source	Description
Logic 0	Fixed Logical 0
Isolated Input 0	Isolated Input 0 from an external connector
Isolated Input 1	Isolated Input 1 from an external connector
Isolated Input 2	Isolated Input 2 from an external connector
Isolated Input 3	Isolated Input 3 from an external connector
LVDS Input 0	LVDS Input 0 from an external connector
LVDS Input 1	LVDS Input 1 from an external connector
LVDS Input 2	LVDS Input 2 from an external connector
LVDS Input 3	LVDS Input 3 from an external connector
TTL Input 0	TTL Input 0 from an external connector
TTL Input 1	TTL Input 1 from an external connector
TTL Input 2	TTL Input 2 from an external connector
TTL Input 3	TTL Input 3 from an external connector
TTL Input 4	TTL Input 4 from an external connector
TTL Input 5	TTL Input 5 from an external connector
TTL Input 6	TTL Input 6 from an external connector
TTL Input 7	TTL Input 7 from an external connector
LVTTL Input 0	LVTTL Input 0 from an external connector
LVTTL Input 1	LVTTL Input 1 from an external connector
LVTTL Input 2	LVTTL Input 2 from an external connector
LVTTL Input 3	LVTTL Input 3 from an external connector
CXP Trigger	Trigger Input from CoaXPress Link
CXP GPIO 0	GPIO Input 0 from CoaXPress Link
CXP GPIO 1	GPIO Input 1 from CoaXPress Link
CXP GPIO 2	GPIO Input 2 from CoaXPress Link
CXP GPIO 3	GPIO Input 3 from CoaXPress Link
Logic 1	Fixed Logical 1

Table 6 – Trigger source available configurations

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8 Video Readout Timing

The sensor timing is controlled according to the waveform below:

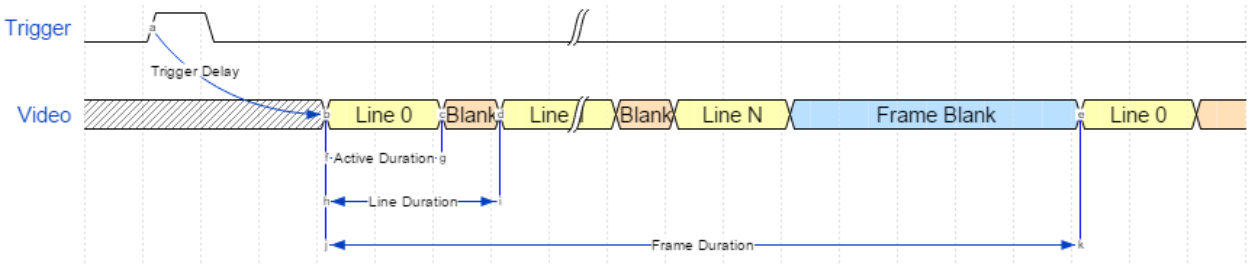

Figure 35 – Sensor timing diagram

9 Creating a Project From Scratch

To simulate a custom camera, a new project has to be created. The following components are required:

- Gen<i>Cam XML file from the camera you wish to simulate
- Required values for the properties described in the XML file

Remarks:

1. The custom XML file size limitation is 1 MByte. If your file is heavier, it has to be compressed to a ZIP file.
2. The user address space on the KAYA simulators is 510 Mbytes in size (Not including the XML file) and spans from 0x6000 to 0x1FEFFC00. Any other addresses out of this range are ignored.

To start a new design:

1. Create a new project file by choosing one of the options:
   - Click the "Create new project" button located on the application start dialog
   - Use the button located on the Toolbar menu
   - Click "New Project" located under the "File" menu
2. A project window shown in Figure 36 will be opened.

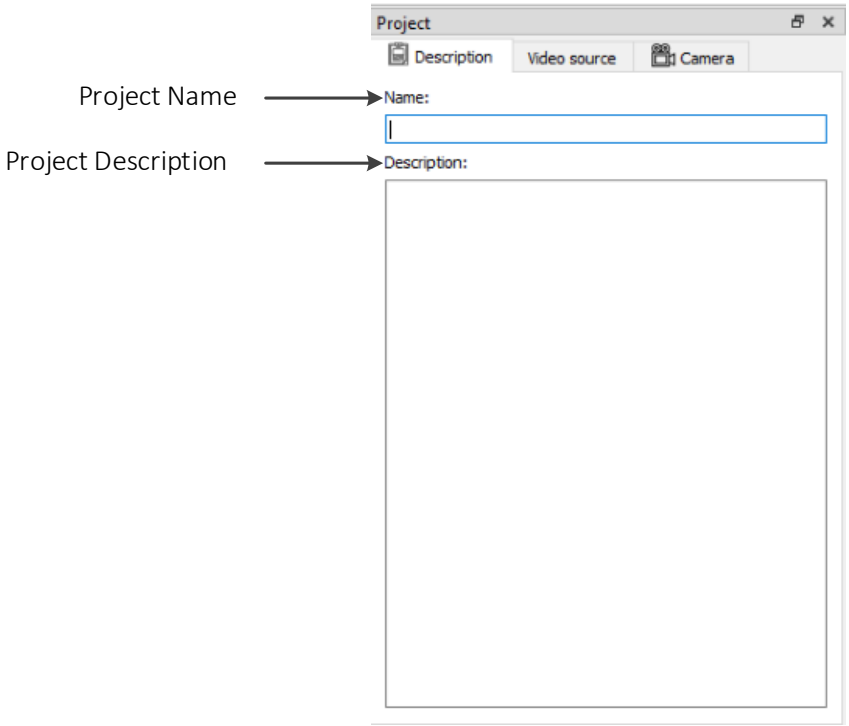

Figure 36 – New project window

3. (Optional) Write a project name and description under the "Description" tab.
4. Switch to the Video source tab, specify the desirable video settings and source, as shown in section 5.7, and save the project.
5. Switch to the "Camera" tab and specify the custom Gen<i>Cam XML file in the Camera scheme definition.

6. (Optional) Choose the Override option and Browse the desirable XML as shown in Figure 37. The latter holds all the camera parameters values.

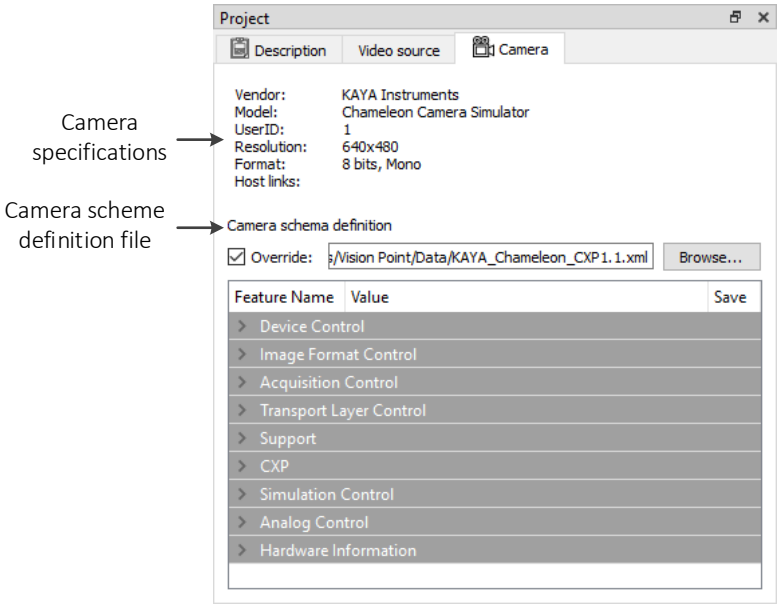

Figure 37 – New project camera parameters

If an XML file was specified, camera properties would be displayed and loaded with default values, as shown in
Figure 38. If the XML file doesn't load correctly, an error probably exists in the chosen file. In this case the XML file structure must be repaired, or another XML file is to be loaded

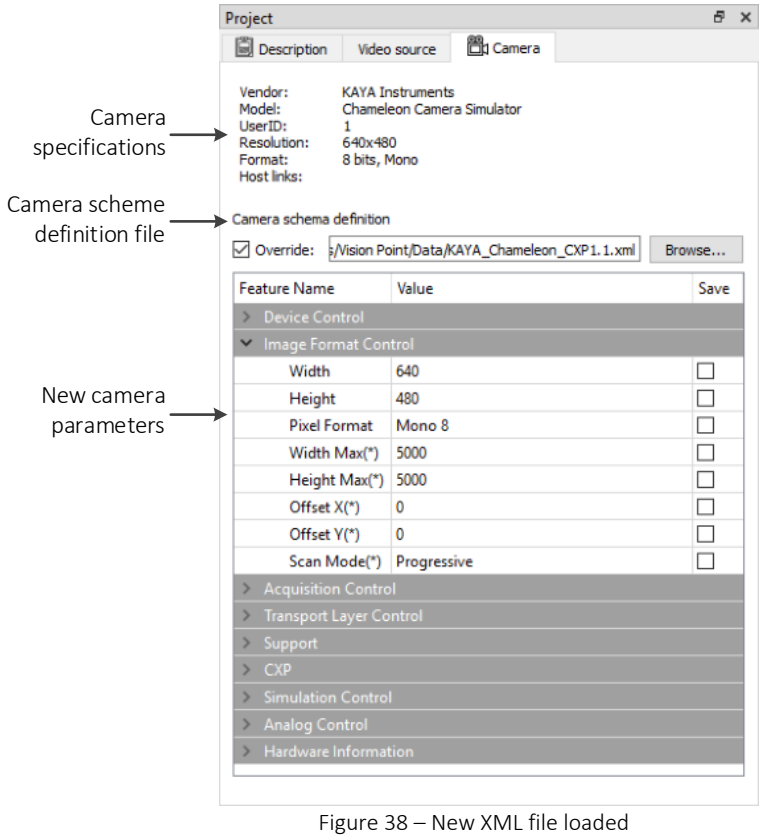

Figure 38 – New XML file loaded

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7. At this stage, each property's value has to be specified to match the simulated camera settings by filling the values manually.
8. Now a simulation can be started for the custom camera.

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10 Example Project

Vision Point Application provides an example project, located in *Examples\Vision Point\Data* under users Documentation. The parameters of the example are:

- Width: 640
- Height: 480
- Frame rate: 60 fps
- Pixel Format: Mono 10 bit per pixel
- Acquisition mode: Continuous
- Video source: Horizontal ramp pattern

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11 References

- CoaXPress 2.0 standard (http://jiia.org/en/standard_dl/CoaXPress-wg/)
- Gen<i>cam standard (http://www.emva.org/cms/index.php?idcat=47)
- Vision Point Software Installation Guide
- Chameleon HW and Installation Guide
- Vision Point API Data Book

12 Troubleshooting

12.1 Updating KAYA PCI Device Firmware Using Vision Point Application

To update the firmware of a KAYA Instrument's PCI device, an "XXX_XX.bin" file is required, when the "XXX" is the board name and "XX" is the desired firmware number.

1. In the Toolbar Menu, under the Device Control tab, chose the "Firmware update" option. A new window would open, displaying the current device firmware version.
2. Click the "Browse…" button, as shown in Figure 39, and select the desired firmware update file, in accordance with the device chosen (.bin file extension), and Click the "Next >" button.

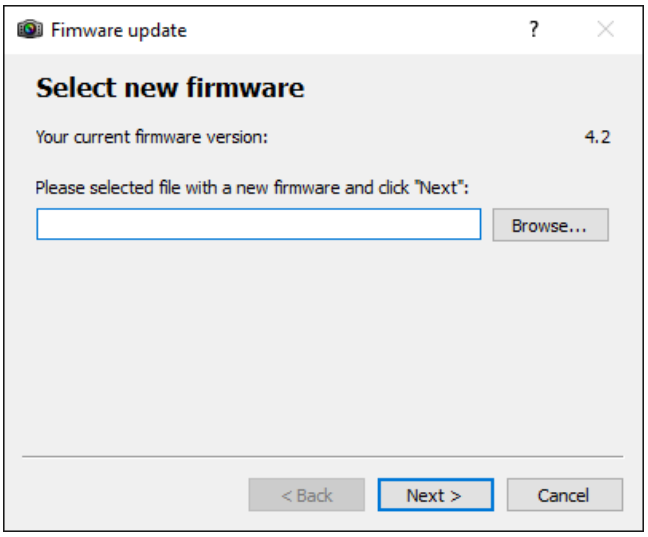

Figure 39 – Firmware update selection window

3. The following window would display both current and new firmware, as shown in Figure 40. The confirmation is made by clicking the "Next >" button, and the firmware update would start immediately.

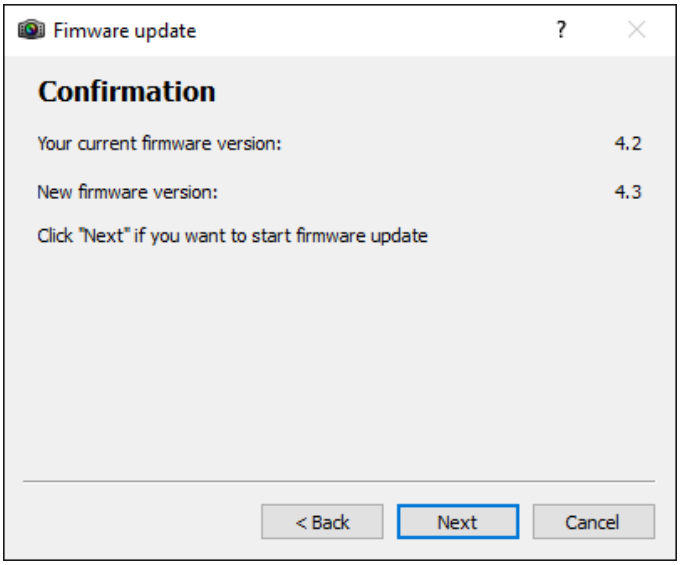

Figure 40 – Firmware update confirmation window

4. The following window displays the initiated firmware update. The firmware update process is displayed in the first progress bar, and the firmware validation is displayed in the second, as shown in Figure 41.
5. Do not interrupt the process!
   In case of an error, the firmware update would fail and return to the previous operation mode.
6. A successful update would be indicated by reaching 100% on both progress bars.
7. A complete PC power off cycle is required to activate the new firmware.
8. Turn on the PC and check the firmware version by opening the Vision Point application, Frame Grabber tab. The firmware version is located under Hardware information. Make sure that the firmware version matches the version supplied. That would ensure the success of the firmware update operation.

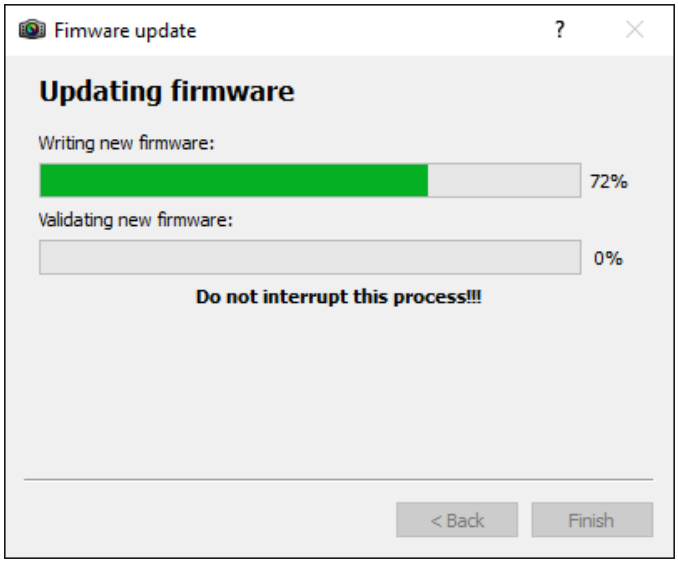

Figure 41 – Firmware update process window

12.2 Updating KAYA PCI Device firmware using a Pre-Built utility for Linux

To update the firmware of a KAYA Instrument's PCI device, an "XXX_XX.bin" file is required, when the "XXX" is the board name and "XX" is the desired firmware number.

WARNING: *Currently, this method is not suitable in setups where more than one board with the same product ID is installed on the same machine. Please consult KAYA's support team if you need to update the firmware in such setup.*

1. Make sure the .bin file is present in a local directory.
2. Open the Terminal and enter the directory path of the KAYA Hardware Update executable file: "cd 'opt/KAYA_Instruments/bin' ".
3. Execute the KAYA Hardware Update using the full path to the firmware update file as a parameter. For example: "./KAYA_Hardware_Update <path_to_folder_with_bin_file>/Chameleon_4_1.bin".
4. Press Enter and wait for a message that indicates the end of the process.
5. Do not interrupt the process!
6. A complete PC power off cycle is required to activate the new firmware.
7. The sequence of the steps is illustrated in the screenshot below.

Please, Contact KAYA Instruments' representative with any questions.

Figure 42 – Firmware update via terminal process window

12.3 Updating KAYA PCI Device Firmware Using a Pre-Built utility for Windows

To update the firmware of a KAYA Instrument's PCI device, an "XXX_XX.bin" file is required, when the "XXX" is the board name and "XX" is the desired firmware number.

WARNING: *Currently, this method is not suitable in setups where more than one board with the same product ID installed on the same machine. Please consult KAYA's support team if you need to update the firmware in such setup.*

1. Make sure the .bin file is present in a local directory.
2. Open the Command line and enter the directory path of the KAYA Hardware Update executable file: "cd '\Program Files\KAYA_Instruments\Common\bin' ".
3. Execute the KAYA Hardware Update using the full path to the firmware update file as a parameter.
4. For example: "KAYA_Hardware_Update <path_to_folder_with_bin_file>/Chameleon_4_1.bin ".
5. Press Enter and wait for a message that indicates the end of the process.
6. Do not interrupt the process!
7. A complete PC power off cycle is required to activate the new firmware.
8. The sequence of the steps is illustrated in the screenshot below.

Please, Contact KAYA Instruments' representative with any questions.

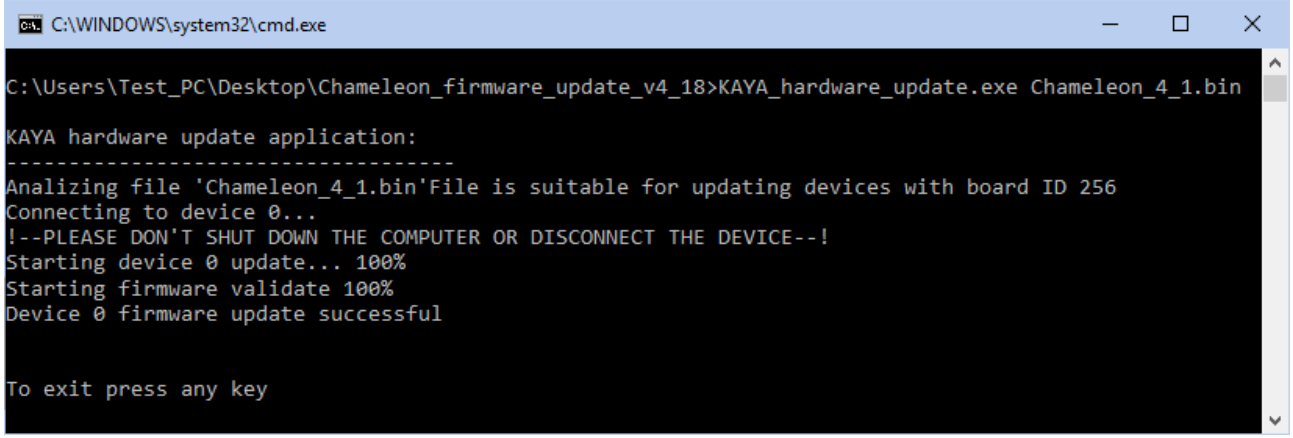

Figure 43 – Firmware update via command line process window

12.4 Collecting Log Files

The log files are created and override each time the application is launched.

12.4.1 Windows Operating System

KAYA's log folder can be easily opened using one of the two ways listed below:

1. Choose Log files folder under KAYA Instruments from the quick start:

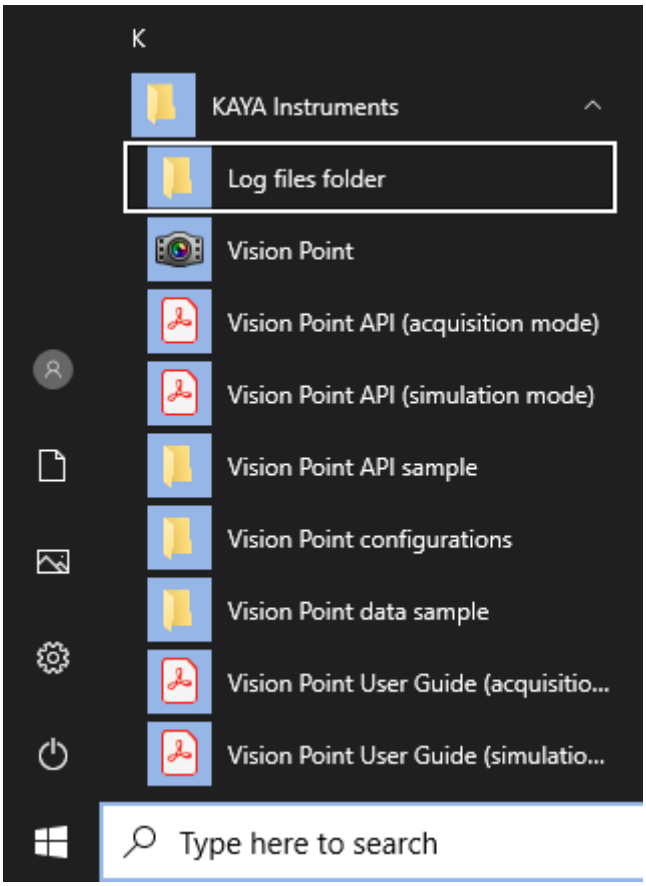

Figure 44 – Log files folder from the quick start menu path

2. Using Vision Point application. Go to the "Help" tab and click on the "Open logs folder" option.

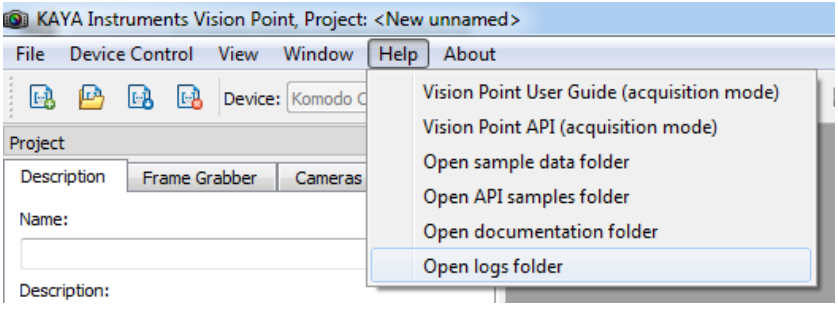

Figure 45 – Log files folder from Vision Point Help menu path

Remarks:

1. A separate log file is created for each application that uses KAYA API, with a display name of the main executable and process ID and timestamp.
2. The **Vision Point Application Installation Log Files Folder** can be found under the user's main driver: C:\Program Files\KAYA Instruments\Log\Installer folder.

12.4.2 Linux Operating System

KAYA's log files folder can be easily opened following the path: /var/log/KAYA_Instruments

12.4.3 Logs Retaining Policy

Users may configure the retaining policy of the log files by using the following setting in the registry:

- Number of files to keep in 'Archive' when (Default) is 2 - Keep N latest
  KYSettings::FeatureType::UserConf, "LogFilesKeep.Amount"
- Maximum age in seconds of a file to keep in 'Archive' when (Default) is 3 - Keep max-age
  KYSettings::InitInteger(KYSettings::FeatureType::UserConf, "LogFilesKeep.MaxAge", 1

12.5 Technical Support and Professional Services

If you searched the Vision Point API Data Book document and could not find the answers you need, contact KAYA Instruments support service. Phone numbers for our office are listed at the front of this document. You also can visit our kayainstruments.com Web site, which provides up-to-date contact information, support phone numbers, email addresses, and current events.

You can send mail to: support@kayainstruments.com
You can also create a support request on the web: http://support.kayainstruments.com
Our knowledge base is available on: http://support.kayainstruments.com/kb/index.php

12.6 Submitting a Support Request

When opening a support request, please provide the following information when applicable:

- Logs form Vision Point where applicable (See section 12.4)
- PC configuration
- Operation System
- Card part number or full name
- Firmware in use
- Software in use