ELDIM

TAPRISIOT

User Manual

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1 Introduction

Conoscope application drives the TAPRISIOT device. The application handles following features:
- Calibration data
- Taprisiot configuration: temperature and filter selection
- Capture: with specific exposure time or auto exposure option
- Export data: Raw Data or Processed data
- Capture Sequence: Capture required images to generate X, Y, Z images

2 Install

2.1 Requirement

You will need to install following Euresys drivers to drive the Frame Grabber: "coaxlink-win10-x86_64-11.0.3.82.exe". Once installed, launch GenICam browser. The application may request to update frame grabber firmware. Please select Coaxlink Quad G2 (2 camera), update firmware. Once done, shut down and unplug the PC to be sure the frame grabber board is properly switched off.

2.2 Application

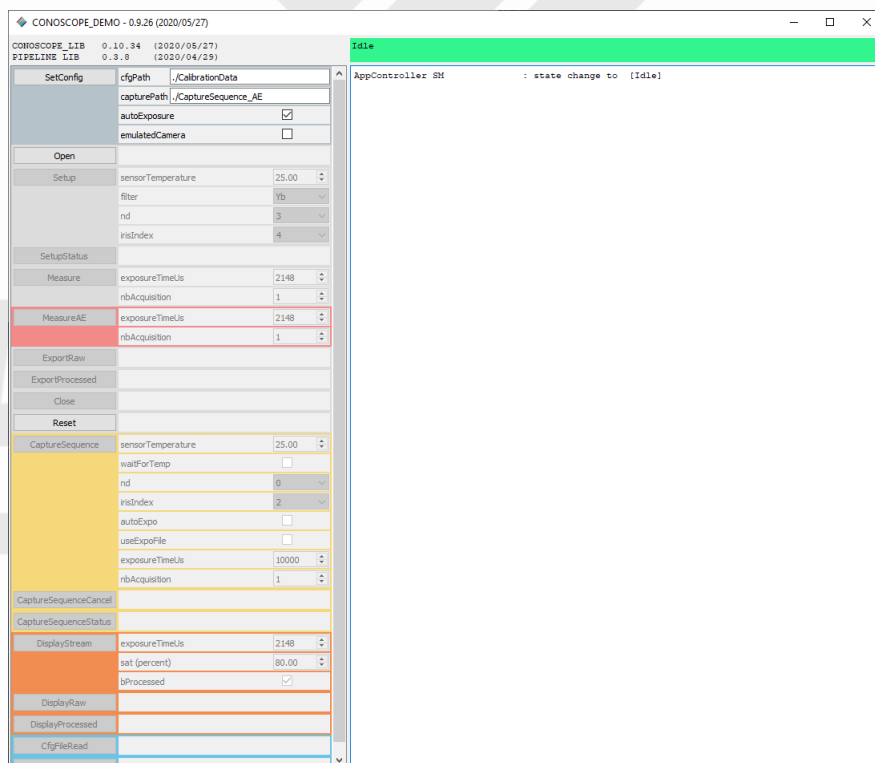The application is ConoscopeDemo.exe. The folder contains all required dependencies as shown beloz.
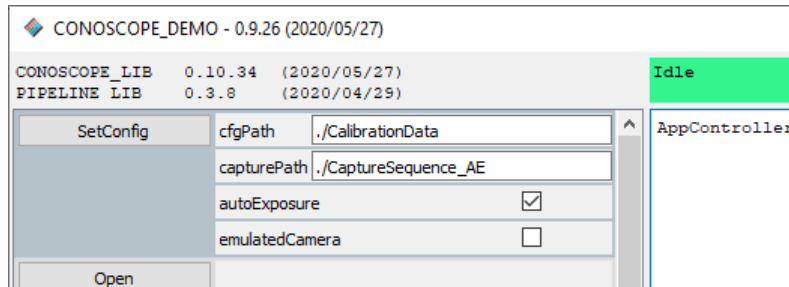
2.3 User interface

An example of the user interface is shown below.

Warning: When launching the application, it might be possible that an error pops-up indicating that a dll is missing. Please install "vcredist_x64.exe" and/or "vc_redist.x64.exe".
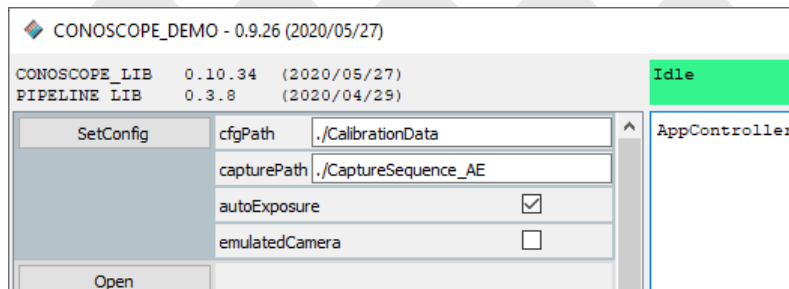
3 Application version

The application version and libraries version are indicated on the interface:

4 Calibration data

To run properly, the application must access calibration data of the Taprisiot. The folder where the calibration data are stored can be modified using "SetConfig" command: set path in "cfgPath" and press "SetConfig".

Note: It is only possible to change the Calibration data folder after application start-up. Once Taprisiot is open, the folder can not be changed any more.
Calibration Data folder can be populated by 2 ways:
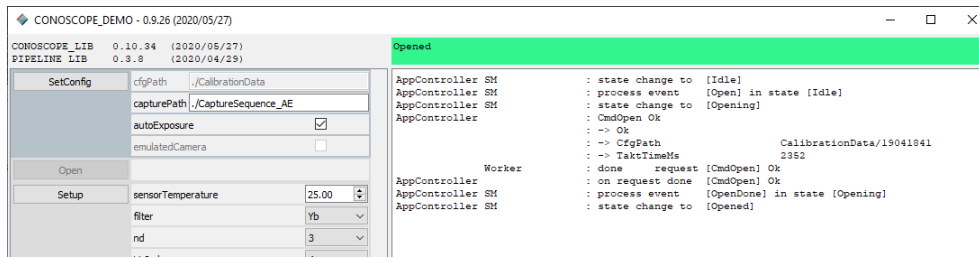- Manually. The user has calibration data and can copy it in the appropriate folder.
- From Taprisiot device: Data are stored in the memory of the Taprisiot and can be retrieved.

4.1 Manually

Copy calibration data into the folder.
Remark:The subfolder matches with the camera SN (not the serial number of the Taprisiot unit). To know the camera SN, press "Open" command. The Camera SN will be displayed in the log.

4.2   From Taprisiot device

Calibration data is stored in the camera. It is possible to populate the folder with those values by downloading the data from the device.

Remark: This upload takes a lot of time (around 30 minutes)

| Name	Date modified	Type	Size
CAMERA_19041841.cfg	26/03/2020 12:14	CFG File	27 KB
CAMERA_19041841_prnu.bin	26/03/2020 12:14	BIN File	92 875 KB
FlatField_iris_2_filter_IrCut.bin	06/03/2020 10:52	BIN File	70 336 KB
FlatField_iris_2_filter_X.bin	04/03/2020 17:20	BIN File	70 336 KB
FlatField_iris_2_filter_Xz.bin	04/03/2020 17:20	BIN File	70 336 KB
FlatField_iris_2_filter_Ya.bin	04/03/2020 17:20	BIN File	70 336 KB
FlatField_iris_2_filter_Yb.bin	04/03/2020 17:20	BIN File	70 336 KB
FlatField_iris_2_filter_Z.bin	04/03/2020 17:20	BIN File	70 336 KB
FlatField_iris_3_filter_IrCut.bin	06/03/2020 10:53	BIN File	70 336 KB
FlatField_iris_3_filter_X.bin	04/03/2020 17:20	BIN File	70 336 KB
FlatField_iris_3_filter_Xz.bin	04/03/2020 17:20	BIN File	70 336 KB
FlatField_iris_3_filter_Ya.bin	04/03/2020 17:20	BIN File	70 336 KB
FlatField_iris_3_filter_Yb.bin	04/03/2020 17:20	BIN File	70 336 KB
FlatField_iris_3_filter_Z.bin	04/03/2020 17:20	BIN File	70 336 KB
FlatField_iris_4_filter_IrCut.bin	06/03/2020 10:53	BIN File	70 336 KB
FlatField_iris_4_filter_X.bin	04/03/2020 17:20	BIN File	70 336 KB
FlatField_iris_4_filter_Xz.bin	04/03/2020 17:20	BIN File	70 336 KB
FlatField_iris_4_filter_Ya.bin	04/03/2020 17:20	BIN File	70 336 KB
FlatField_iris_4_filter_Yb.bin	04/03/2020 17:20	BIN File	70 336 KB
FlatField_iris_4_filter_Z.bin	04/03/2020 17:21	BIN File	70 336 KB
FlatField_iris_5_filter_IrCut.bin	06/03/2020 10:53	BIN File	70 336 KB
FlatField_iris_5_filter_X.bin	04/03/2020 17:21	BIN File	70 336 KB
FlatField_iris_5_filter_Xz.bin	04/03/2020 17:21	BIN File	70 336 KB
FlatField_iris_5_filter_Ya.bin	04/03/2020 17:21	BIN File	70 336 KB
FlatField_iris_5_filter_Yb.bin	04/03/2020 17:21	BIN File	70 336 KB
FlatField_iris_5_filter_Z.bin	04/03/2020 17:21	BIN File	70 336 KB
OpticalColumn.xml	09/03/2020 12:55	XML Document	8 KB

4.2.1 Open
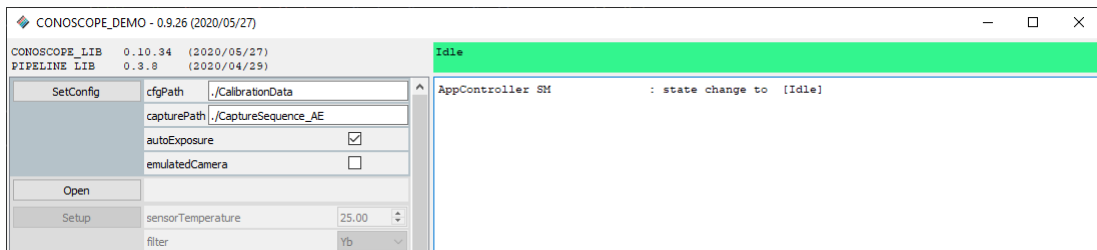
4.2.2 Read Data

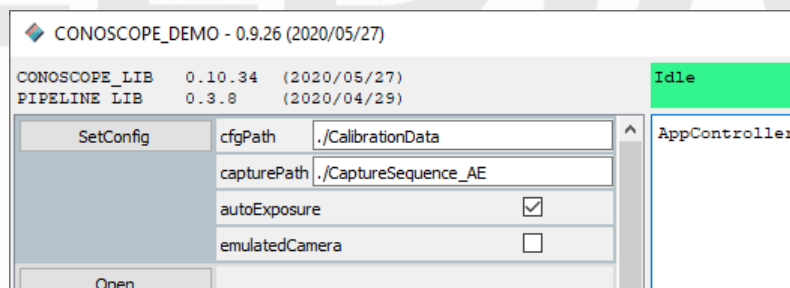Launch read using "CfgFileRead" command.
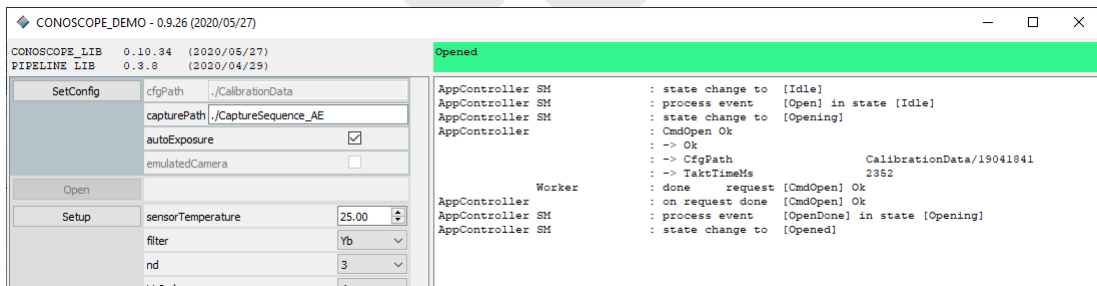
4.2.3 Read Status

Then regularly check Cfg with CfgFileStatus command until the process is complete.
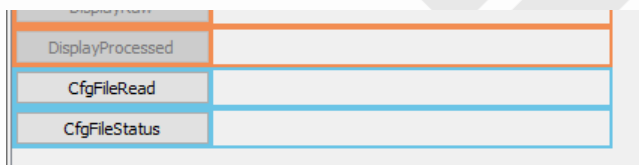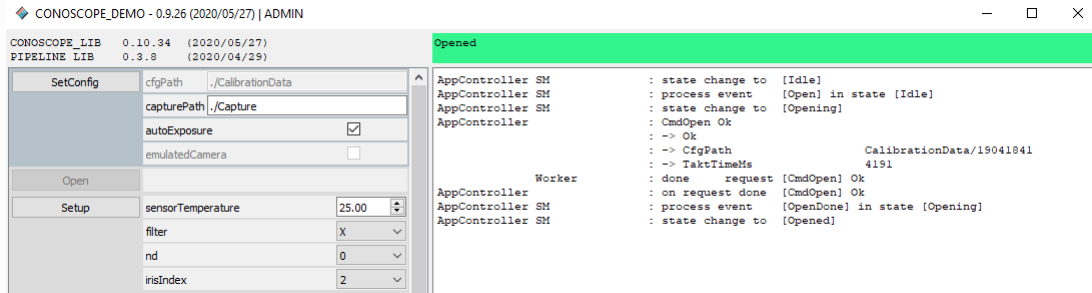

5 Capturing an image

5.1 Configure capture folder

When an image is captured, it is stored in a specific folder. Change the path in "capturePath" and press "SetConfig"

5.2 Open the device

Initially, Taprisiot is in Idle state. Press "Open" to bring the device in opened state.

5.3 Setup

Once opened, it is possible to setup the device:
- Targeted temperature: the device will be regulated at this temperature
- Filter: BK7, Mirror, X, Xz, Ya, Yb, Z, IrCut
- Nd filter: density 0, 1, 2, 3, 4
- Iris: aperture: 2mm, 3mm, 4mm, 5mm. Aperture must be changed manually.

Press "Setup" to go in ready state. Current configuration can be retrieved with "Setup-Status" command.

5.4 Image Capture

5.4.1 Measure command

Measure command will capture the image at the specified "ExposureTime".

5.4.2 MeasureAE command

"MeasureAE" will capture the image after an AutoExposure sequence. During MeasureAE processing, it is possible to know the status of the processing by pressing "MeasureAEStatus" and to stop the processing by using "MeasureAECancel"."MeasureAE" command works with several iterations and will take more time than "Measure" command.

During the algorithm, an image is captured and processed. The pixels of this image are arranged in decreasing order. The "MaxNbPixel"th pixel value is returned. (i.e. if MaxNbPixel = 1, the algorithm will return the brightest pixel value, if MaxNbPixel = 10, is will be the 10th brightest pixel value). The exposure time is tuned so the return value is 80% of saturation (80 is a fixed value).

"MaxNbPixel" can be changed in config.json file:
- Section "SettingsI"
- Entry "captureSequenceMaxNbPixel"
- Default value 5000

"Measure" Commands hold data internally.
To store capture, use command "ExportRaw" or "ExportProcessed".

To display capture, use "DisplayRaw" or "DisplayProcessed".

5.5   Export Capture

From state "MeasureDone", use Commands "ExportRaw" and "ExportProcessed" to store capture in binary format. Those commands do not perform a capture (Measure commands does, see previous chapter).Captures are stored in the folder specified by "SetConfig".
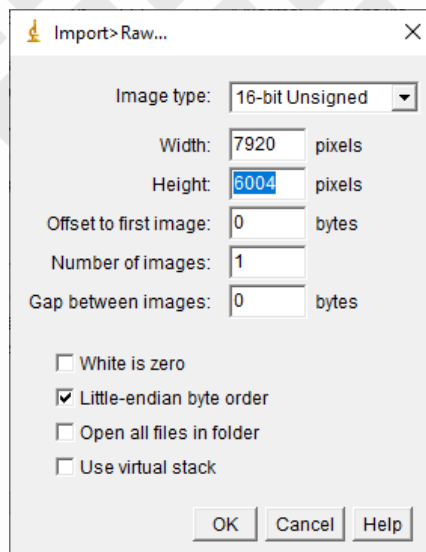
5.5.1   Raw Data Format

A capture is .bin file associated to a .json file containing information about the configuration of the device.
A binary file can be opened using ImageJ
File > Import > Raw
- Image type : 16 bits unsigned
- Width : 7920
- Height: 6004
- Little endian byte order

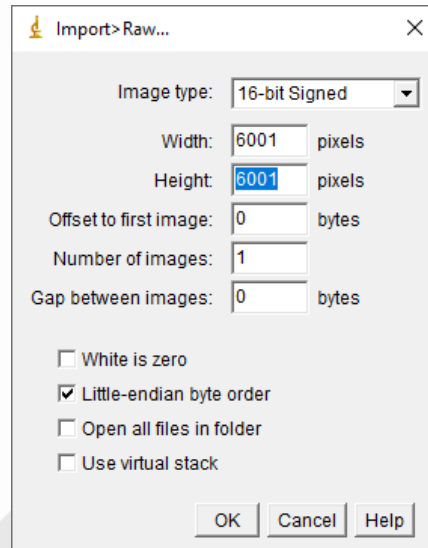### 5.5.2   Processed Data Format

Image processing:
- Bias compensation
- Sensor defect correction
- Sensor PRNU correction
- Linearisation (depends on Setup configuration)
- FlatField (depends on Setup configuration)

    File > Import > Raw
- Image type : 16 bits signed
- Width : 6001
- Height: 6001

- Little endian byte order

5.5.3   Display Capture

"DisplayRaw" and "DisplayProcessed" allow to display the image captured with "Measure" command. Those commands do not perform a capture.

5.6   Next Step

Once a capture has been done, it is possible Measure again or to Setup and Measure.

6   Closing the device / Reset

In any state, the device can be closed or reset. Reset command will perform a power sequence on the Taprisiot (it takes about 2 minutes)

7   Streaming

When the device is in Ready state (after a Setup command), it is possible to display stream by pressing "DisplayStream".
Streaming options: AutoExposure
Use "SetOption" command to enable
AutoExposure option: saturation level (default = 80%) and MaxNbPixel (see MeasureAE for detail)

8   Capture Sequence

8.1   Description

Capture sequence captures necessary images to generate X, Y, Z images.
5 capture are used:

8

- filter X
- filter Xz
- filter Ya
- filter Yb
- filter Z

8.2   Command

Command CaptureSequence can be called from Opened state.
Parameters:
- sensorTemperature: Target temperature for the Taprisiot
- waitForTemp: The sequence waits till the target temperature is reached
- nd: Setup the ND filter value
- iris: Indicate the iris installed on the Taprisiot
- exposure time: option 1: manual exposure, all captures are done with the same exposure time

CaptureSequence	sensorTemperature	25.00
	waitForTemp	☐
	nd	0
	irisIndex	2
	autoExpo	☐
	useExpoFile	☐
	exposureTimeUs	10000
	nbAcquisition	1

option 2: exposure time of each capture is defined in CaptureSequenceExposureTime.json

CaptureSequence	sensorTemperature	25.00
	waitForTemp	☐
	nd	0
	irisIndex	2
	autoExpo	☐
	useExpoFile	☑
	nbAcquisition	1

option 3: AutoExposure

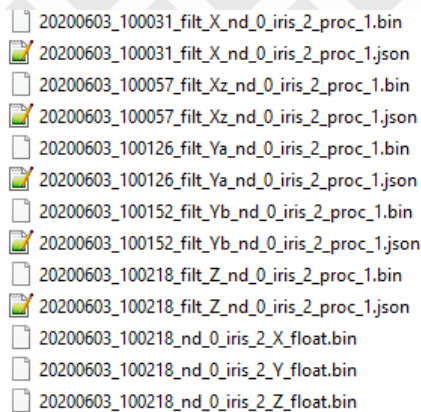| CaptureSequence	sensorTemperature	25.00
	waitForTemp	☐
	nd	0
	irisIndex	2
	autoExpo	☑
	nbAcquisition	1

CaptureSequenceExposureTime.json the exposure time for each filter and is in the application directory

```
{
"ExposureTimeUs": {
    "Filter_X" : 10000,
    "Filter_X z" : 10000,
    "Filter_Y a" : 10000,
    "Filter_Y b" : 10000,
    "Filter_Z" : 10000
    }
}
```

Once the processing is started, it is possible to cancel it with "CaptureSequenceCancel" command
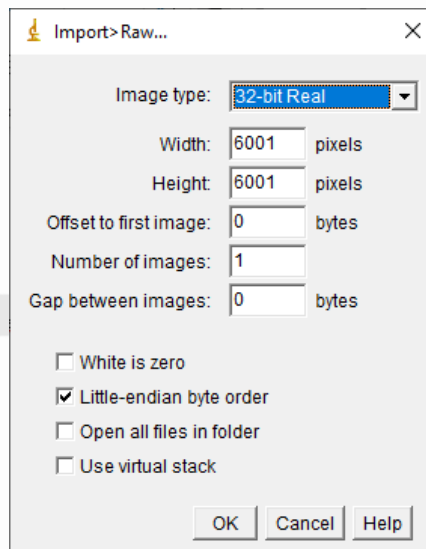
8.3   Result

Once the process is done, X, Y, Z images can be found in capture folder (SetConfig)
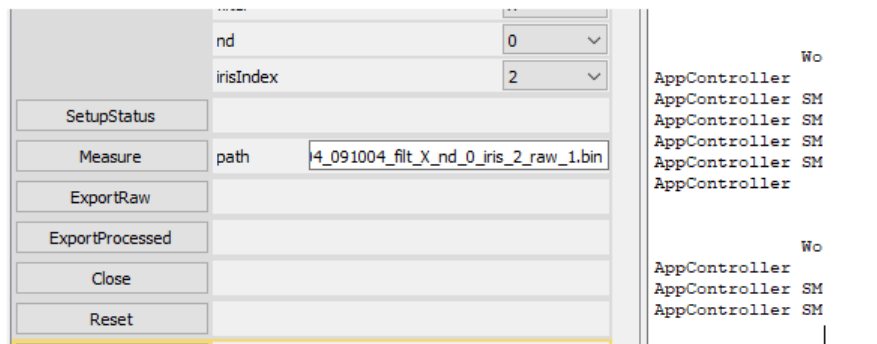

Images can be opened with ImageJ

9 Processing captured data

It is possible to process raw data already captured.From Idle state, set "emulatedCamera" option in "SetConfig" command (press SetConfig button to set.

9.1 Processing RawData

Follow the steps described in chapter "Capturing an image".
Parameter for "Measure" command is the path of the bin capture to process. (note the associated json file must be present)

Then ExportProcessed command will generate the processed image using the calibration data.

9.2 Processing CaptureSequence

Capture paths to be processed are defined in CaptureSequenceCaptures.json (in the application folder)
{
"FilePath": {
    "Filter$_X$" : "capture$_X$.bin",
    "$Filter_X z$" : "$capture_X z.bin$",
    "$Filter_Y a$" : "$capture_Y a.bin$",
    "$Filter_Y b$" : "$capture_Y b.bin$",
    "$Filter_Z$" : "$capture_Z.bin$"
    }
}

Remark: By default, CaptureSequenceCaptures.json does not exists. When CaptureSequence is launched without this file, it will generate a sample file. Then it is possible to update it. To process the data, follow the steps described in chapter "Capture Sequence".