chromasens
Imaging for Professionals

truePIXA | Chromantis Operating Guide

CD40150 Version R04

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1 Intorduction

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:

- Color line scan cameras
- 3D stereo line scan cameras
- Multi-spectral 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.

1.2 Contact Information

Chromasens GmbH

Max-Stromeyer-Str. 116

78467 Konstanz

Germany

Phone: +49 (0) 7531 / 876-0

Fax: +49 (0) 7531 / 876-303

Email: info@chromasens.de

1.3 Support

Chromasens GmbH

Max-Stromeyer-Str. 116

78467 Konstanz

Germany

Telephone: +49 (0) 7531 / 876-500

Fax: +49 (0) 7531 / 876-303

Email: support@chromasens.de

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

1.4 About Chromantis

Chromantis is a C++ program from the company Chromasens, which uses the TPAPI to calculate the multichannel color and spectral information of captured image(s). The diagram below shows the data workflow from the hardware (image capturing) up to the customer application or Chromantis.

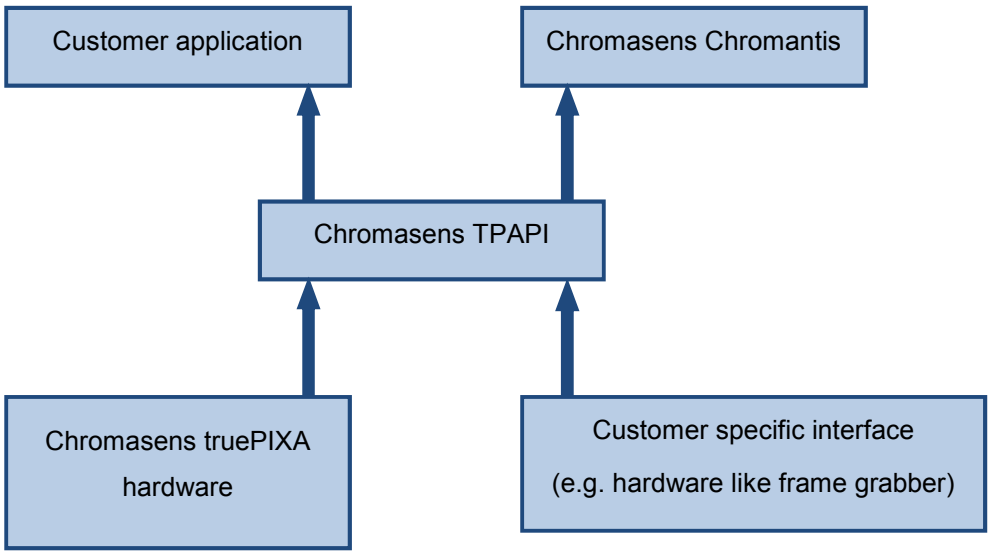


Figure 1: Work flow of truePIXA application

The information of an image in TIFF-format, (which can be captured from the truePIXA hardware, or obtained from customer specific interface, or can be loaded from a hard disk) is delivered to the Chromasens TPAPI for data processing. The result can be further processed for customer application, or shown directly in the Chromantis.

Running Chromantis is not difficult. However, the user should have a clear overview about the available functions to be able to run Chromantis properly. So we recommend strongly reading over all the function description (in this whole chapter) at first. Now start Chromantis by double clicking the icon on the desktop, you should see the user interface after a short initialization process. The user interface looks maybe a little varied because of the various versions, but the mainly important functions remain the same.

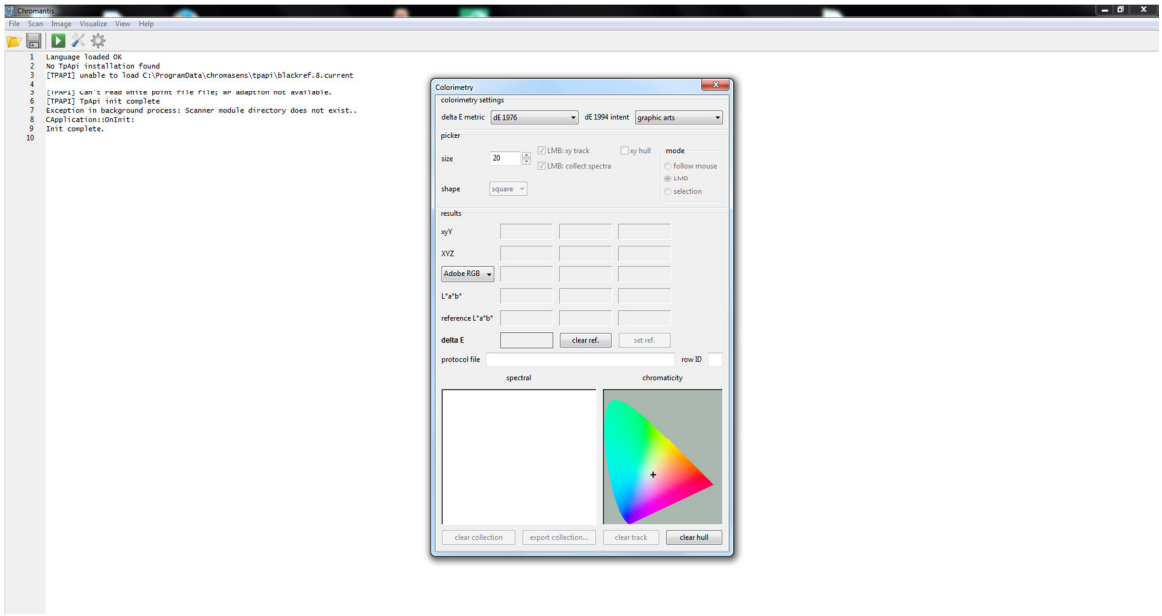


Figure 2: The user interface after the first start of Chromantis

The protocol shows which components and files are detected by Chromantis not all files are loaded at the beginning. Some need to be created during the calibration, but first we need to learn more about the main functions of Chromantis.

There are pull-down menus for example “File”, “Scan”, “Image”, “View”…on the top left, under those are some icons which are used as shortcut to run some functions. At the moment, we only see a protocol window, which shows the running info, in the main window area.

1.5 Software Requirements

- System
  - Windows 7 x64 (recommended), or Windows 8.1 x64
- Optional for using truePIXA-API
  - Development Environment
    - C++ Compiler (recommended Microsoft Visual Studio 2010 or later)
  - System
    - Windows 7 x64 (recommended), or Windows 8.1 x64
- Optional frame grabber software for image acquisition, if it is used to acquire image. (This software should be provided by the frame grabber manufacture, normally available on the frame grabber website as download.) About the supported frame grabbers, please refer to truePIXA-system-requirements in the partner area of the Chromasens homepage.

1.6 Hardware Requirements

- Quad Core >2,20 GHz
- > 4GB RAM (recommended >8GB RAM)
- Graphic card: with more than 1 GB RAM
- Power-supply with enough power for the GPU, camera and all accessories

The raw images from the camera are transformed into multichannel and spectral images on the CPU. Further calculations from the spectra take place on the CPU. Hence, a powerful CPU would lead to higher computing speeds. The raw images are temporarily stored in the memory. **Therefore, the RAM memory should be according to the memory requirements of the respective image sizes**. Larger images require larger RAMs. Assume that the source image with 12 channels has a size of 1GB. If one calculates a destination image with 36 channels from this source image, then the result will be 3 times as big as the source image. All of this (1GB source + 3GB result) will be located in the RAM. The RAM requirements of other programs running on the computer, e.g. Windows or any other applications/ processing/ controlling software etc. should be considered while calculating the RAM requirements for targeted image sizes.

2 Install Chromantis

First of all, Chromantis must be installed before we use it to scan image, calculate the color information and evaluate. Double click the executable file setup.exe to begin the setup-assistant.

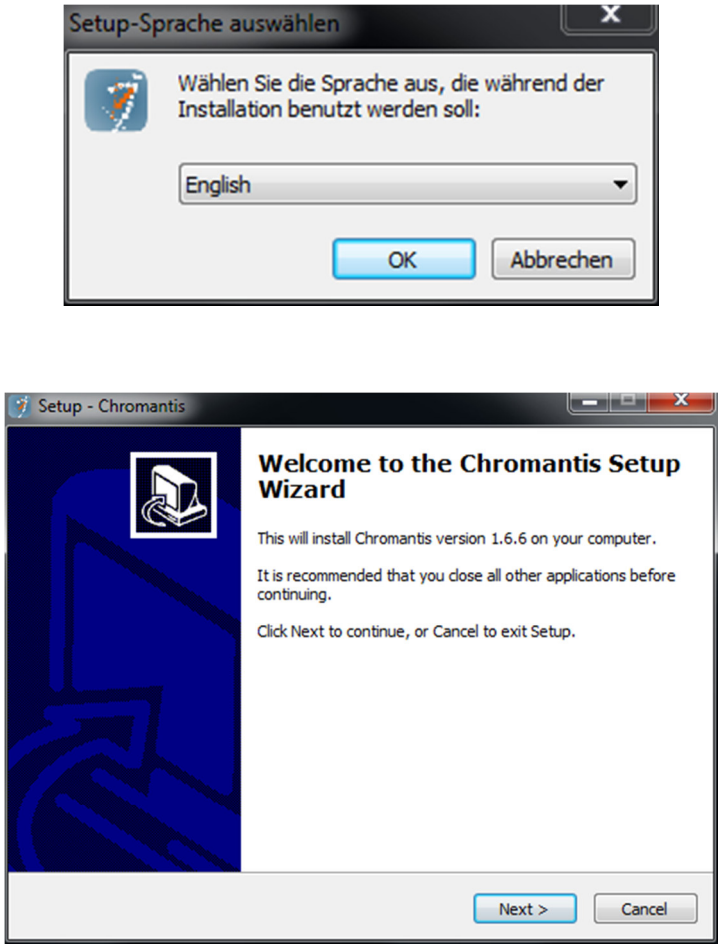


Figure 3: Installer-wizard of Chromantis

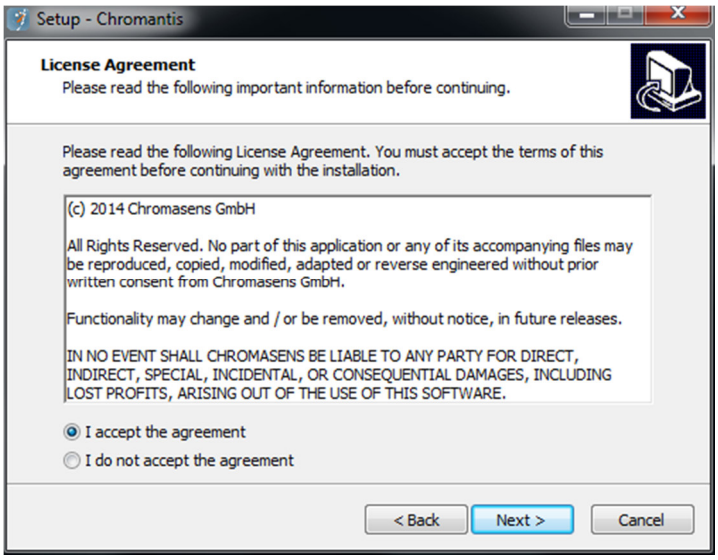


Figure 4: Installer-wizard accept the agreement

Here you can choose the path, where Chromantis should be installed. Then choose “I accept the agreement” to continue the installation.

3 Calibrations in Chromantis step by step

This chapter serves as the basis for using Chromantis. However, the user should not only know the single functionality of Chromantis, but also the whole iteration, how one starts Chromantis, checks the illumination and camera settings, scans images and does calculation. So in this Chapter the operation instructions for a whole iteration will be introduced.

3.1 Illumination settings

After all the components were mounted correctly, we can start to do the following steps. First of all, a constant illumination which is precisely adjusted is the precondition of using Chromantis. Normally, we use D50 Daylight (UV-cut) as our standard illumination condition. So the first step is to confirm the illumination settings.

We can use XLC4Commander to manage our illumination device to get D50 (or other illumination). The detailed information about the illumination adjustment with XLC4Commander can be found in the manual Corona-II XLC4. Please note that the device can give a constant illumination, if the device temperature stays stable.

3.2 Gain value settings

Another very important condition for Chromantis is to set the gain value properly. In this case, we need to use Camera Setup Tool (CST) to adjust the gain. We put the white reference material under the illumination and visualize the raw image as line plot.

The goal is to obtain a suitable white reference value, which means, that the four maximal visualized peaks (for 12 channels) should have almost the same height, and be set to about 190-200 so that they don't exceed 255 by later processing.

The detailed adjustment process of gain value can be found in the *"truePIXA Getting Started; Chapter 5.2.3 Gain values".*

3.3 Generating black reference (dark offset correction)

In a totally black area, the signal should be 0. But due to the unavoidable little noise, the signal is not 0 in fact. To suppress such noise, we let Chromantis generate a black reference, so that the noise can be subtracted lately.

3.3.1 Setup in Chromantis:

1) To obtain a raw image for “black reference”/”dark offset correction” with Chromantis

   a) Open a Chromantis and click the menu “Scan” → “Configure processing …” to open the setting dialog.

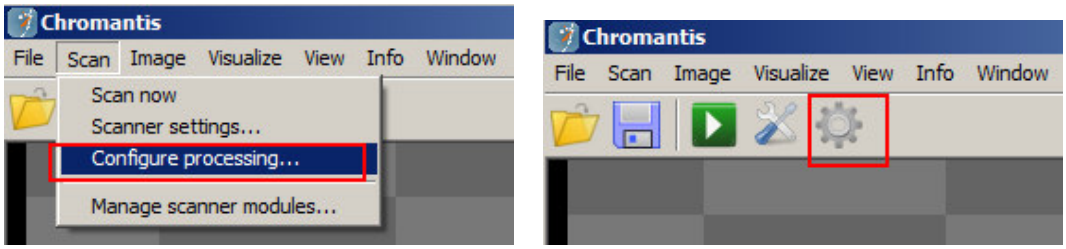
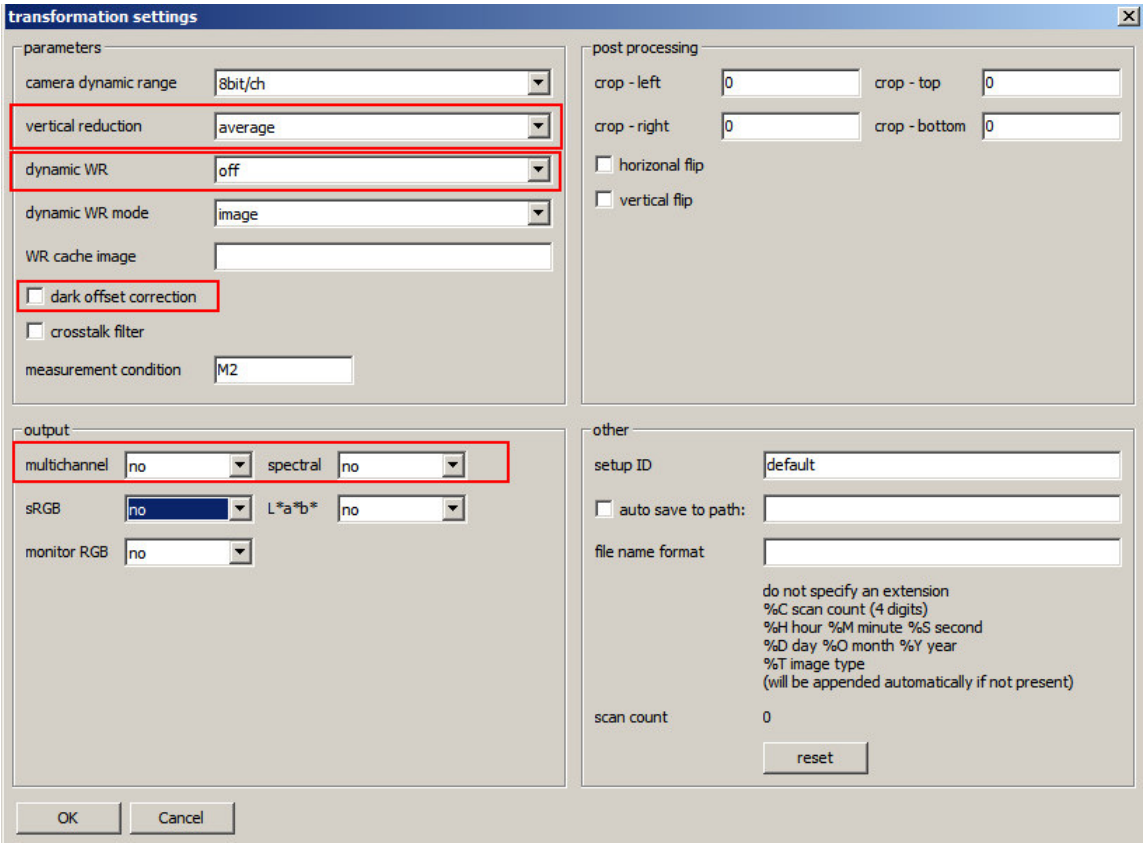


Figure 5: Configure processing…

   b) Set “dynamic WR” to “off”, because this measure should give only the correction value for the dark current of the sensor.

   c) Uncheck “dark offset correction”.



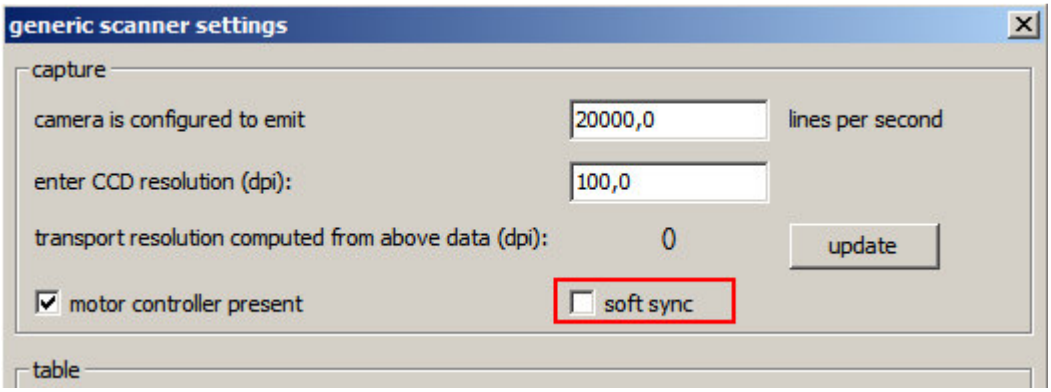


Figure 6: Settings for generating black reference

d) Uncheck “soft sync” in the generic scanner settings

e) Cover the camerafilters with for example a black piece of carton, so that they are completely covered and scan an raw image

2) To load a raw image for “black reference”/”dark offset correction”

a) File → Open image

3) To compute a “black reference”/”dark offset correction” from a raw image

a) Click menu “Image” → “Compute from image” → “Black reference”, then the black reference will be generated by Chromantis. It is saved as a file named blackref.8.current in the (hidden) folder: %ProgramData%\Chromasens\TpApi\

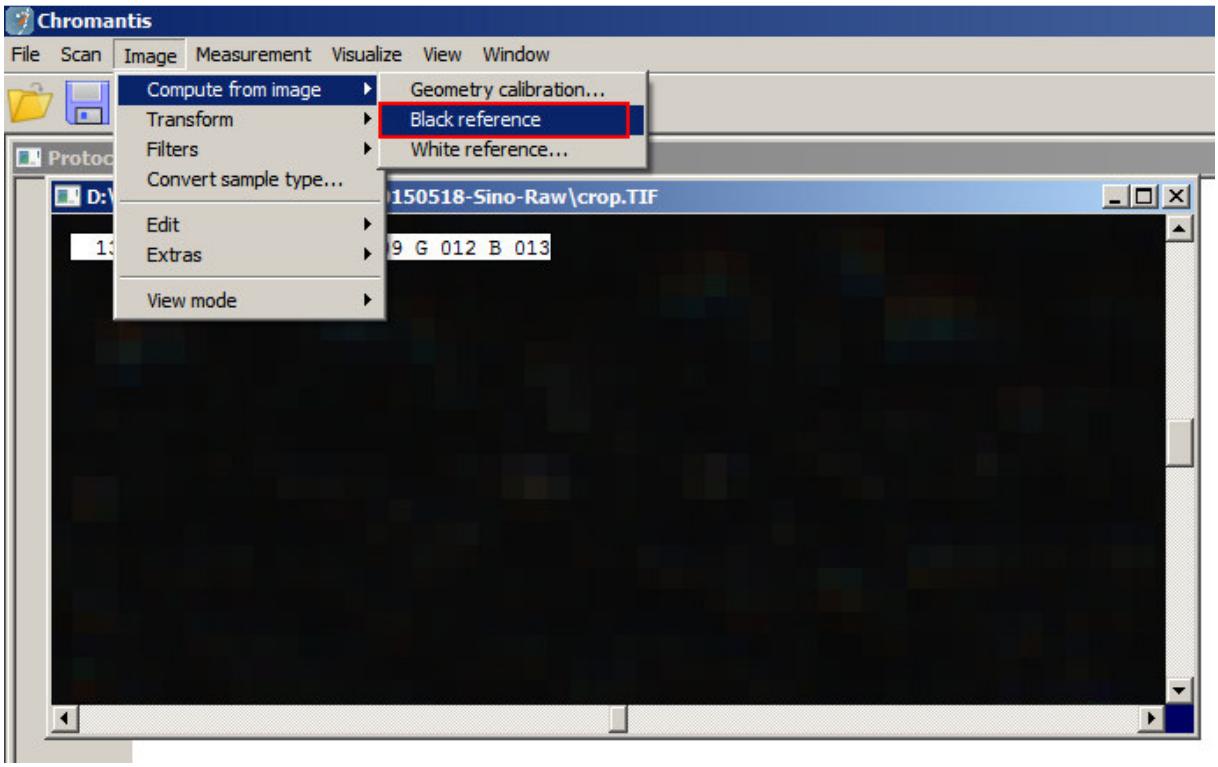


Figure 7: Compute black reference

4) - For all further scans the menu item “dark offset correction” should be selected with a checkmark
   - You have to compute a new “dark offset correction” if you change the gain values

3.4 Dynamic WR mode (“Shading correction”/ “flat field correction”)

Dynamic WR is also called “shading correction”. It corrects the effects of natural vignetting and has 2 different modes: image and cache.

You can apply shading “before geo transform” or “after geo transform”

In tpapi.xml you can define the target gray value of the shading correction in 8bit, <255 (recommended 220-240).

- dynamicshadingtargetlevel = "220"

You can also define the min gray value for applying the shading correction in 8 bit

- dynamicshadingminlevel="10.0"

3.4.1 Image mode:

In this mode the shading correction will be computed in every scanning process. You need a white reference stripe in every scanned image. The Position in every scanned image of the area used for “shading correction” is determined with parameters in the tpapi.xml which are always in millimeters:

- whiterefstart = " "
- whiterefend = ” ”
- showWRarea = “0” or “1”

3.4.2 Cache mode

In this mode you need to scan a raw image of a white reference stripe once. It will be used for shading correction for all further scans.

- Scan a raw image of a white reference stripe which is dark offset corrected. The rows will be
- averaged in the whole image.
- Save the image (for example as white.TIF) and set the path in the tpapi.xml
    - WR_mode="cached"
    - WR_default_file="C:\ProgramData\Chromasens\TpApi\white.TIF"

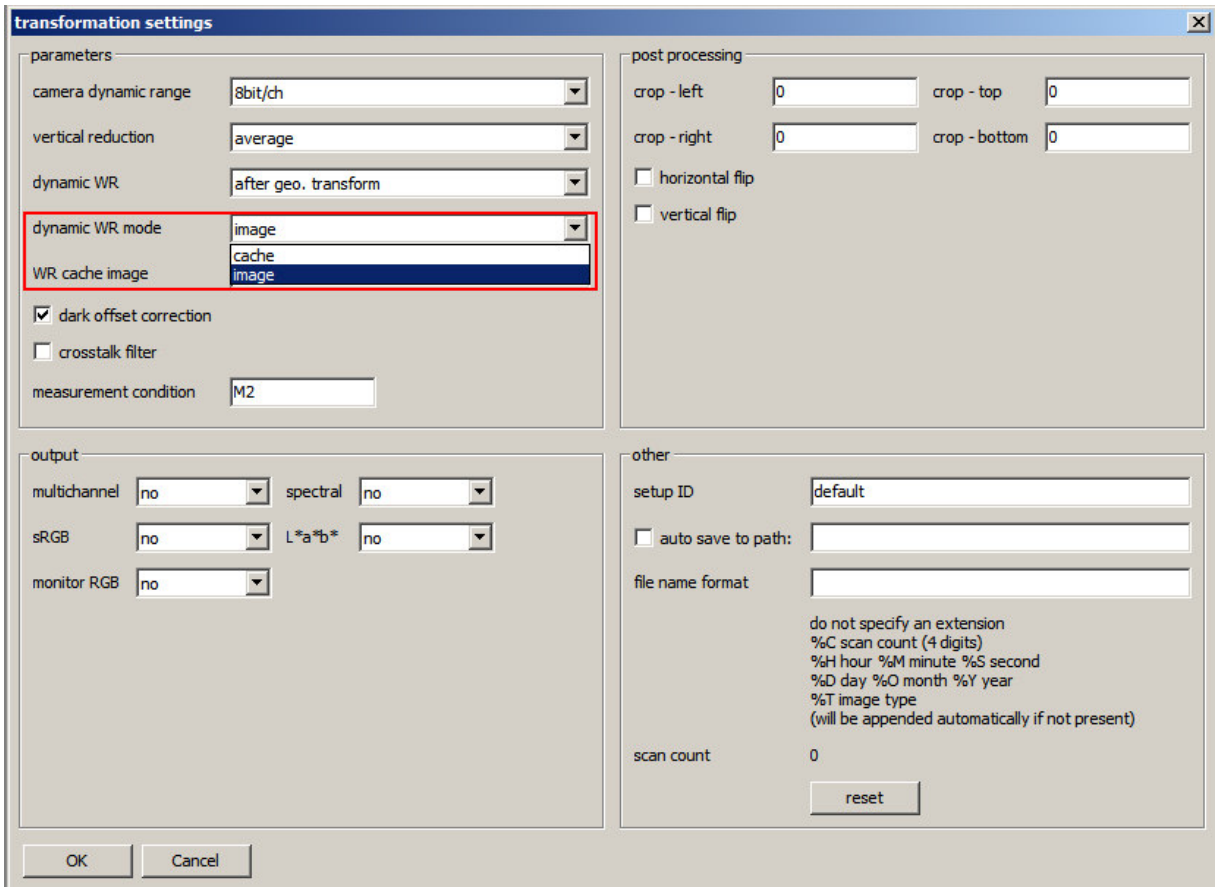


Figure 8: Dynamic WR mode

3.5 Geometry calibration

To compute the geometry calibration your raw image has to be shading corrected, otherwise the dots and markers on the geoCHART can't be detected due to a low signal of some of the channels.

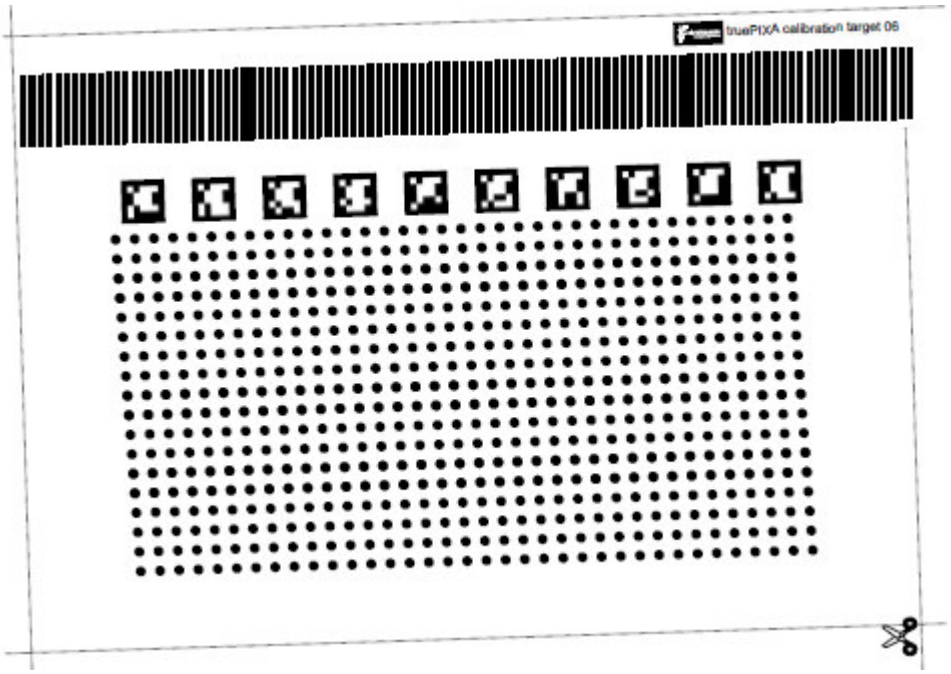


Figure 9: geometry calibration chart

a) Scan or open a shading corrected raw image of the geoCHART.
   i) The geoCHART should be almost as big as the FOV of the camera, or slightly bigger
   ii) At least 8/10 ArUco marker need to be in the Field of View (FOV) of the camera
   iii) At least 3 rows of the dots need to be on the image
   iv) The transport resolution should be the same as the lateral resolution
   v) There should be no saturation in the image

b) Click the menu "Image" → "Compute from image" → "Geometry calibration…" to generate the geometry calibration file for Chromantis. The information is saved in the file "geometry.xml" in the (hidden) folder: %ProgramData%\Chromasens\Chromantis\

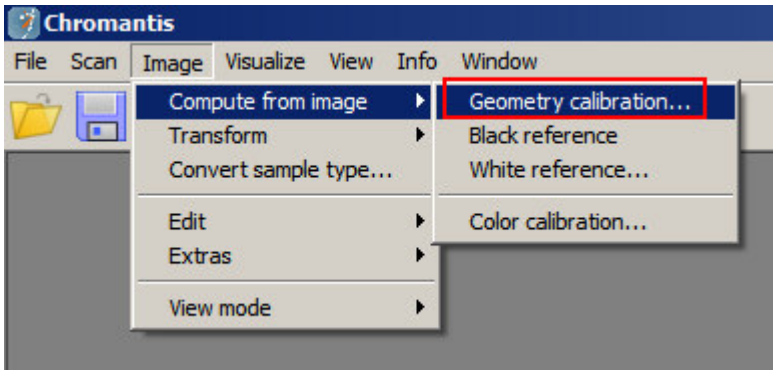


Figure 10: Geometry calibration

3.6 Color calibration

In the new version of Chromantis (above v1.58), the user can do color calibration by himself.

a) Scan or open a multichannel image of a colorCHART, which has to be

   i. Dark offset corrected

   ii. Shading corrected

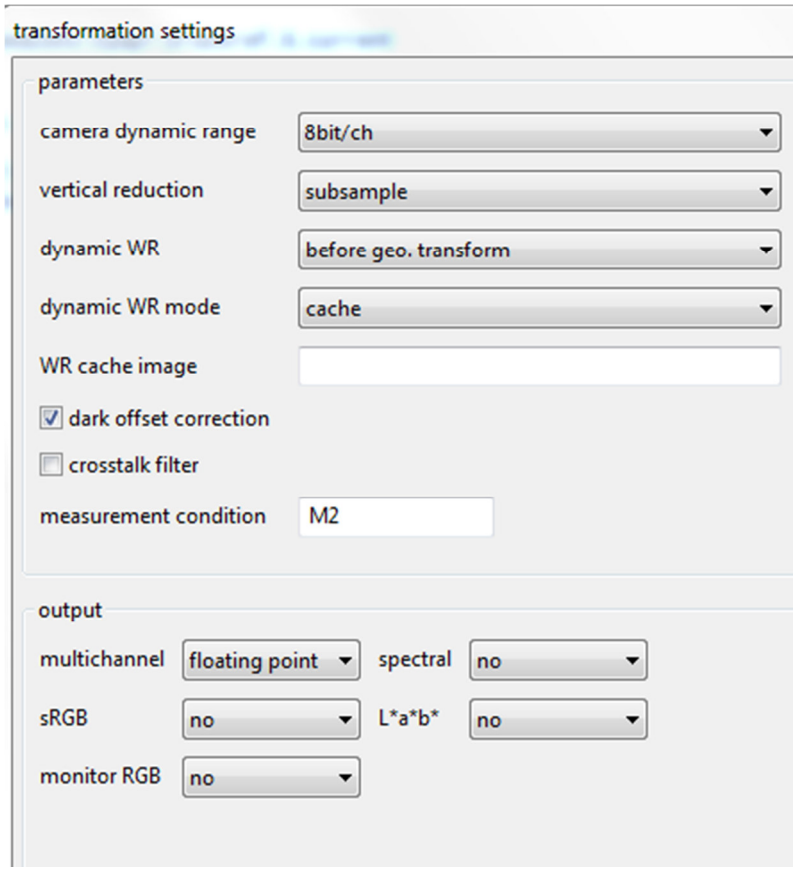


Figure 11: transformation setting for scanning a multichannel image

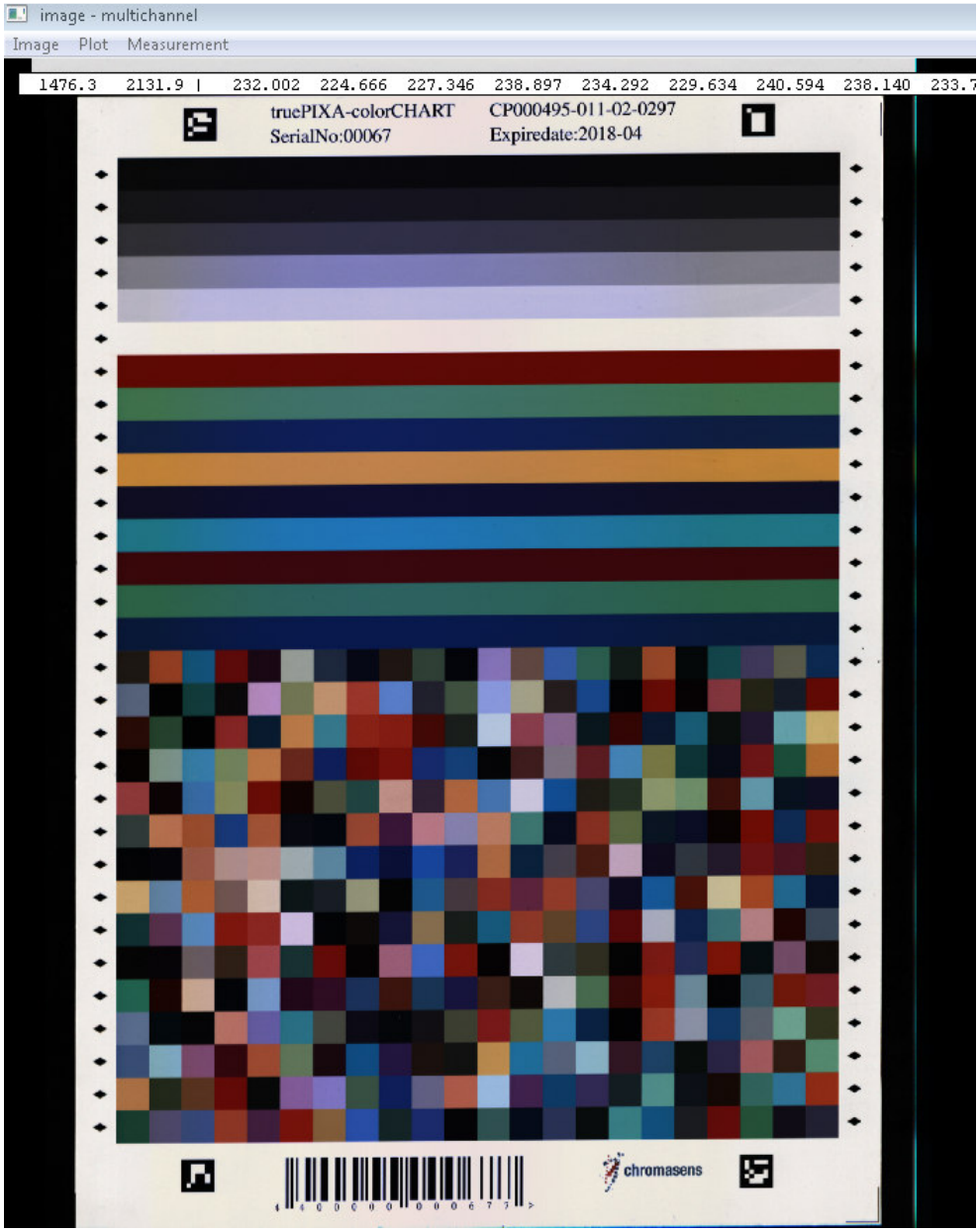


Figure 12: Scanned multichannel image of a colorCHART

b) Click menu “Image” → “Compute from image” → “Color calibration…”

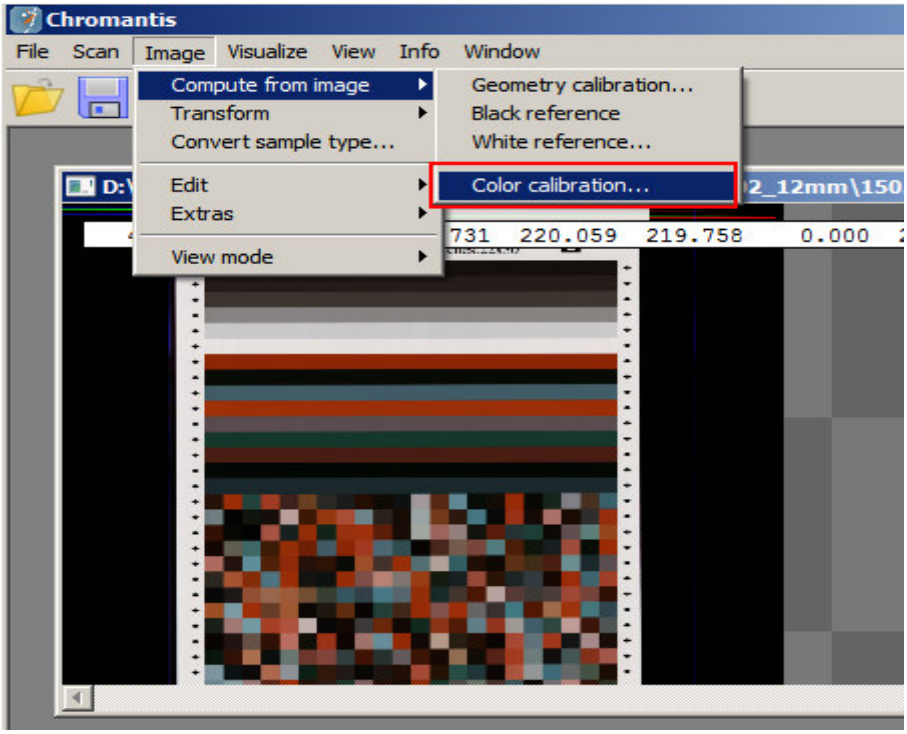


Figure 13: Click the menu for color calibration

c) Make sure that your computer is connected to the internet, so the reference data measured by a spectrometer can be obtained from the Chromasens server automatically.

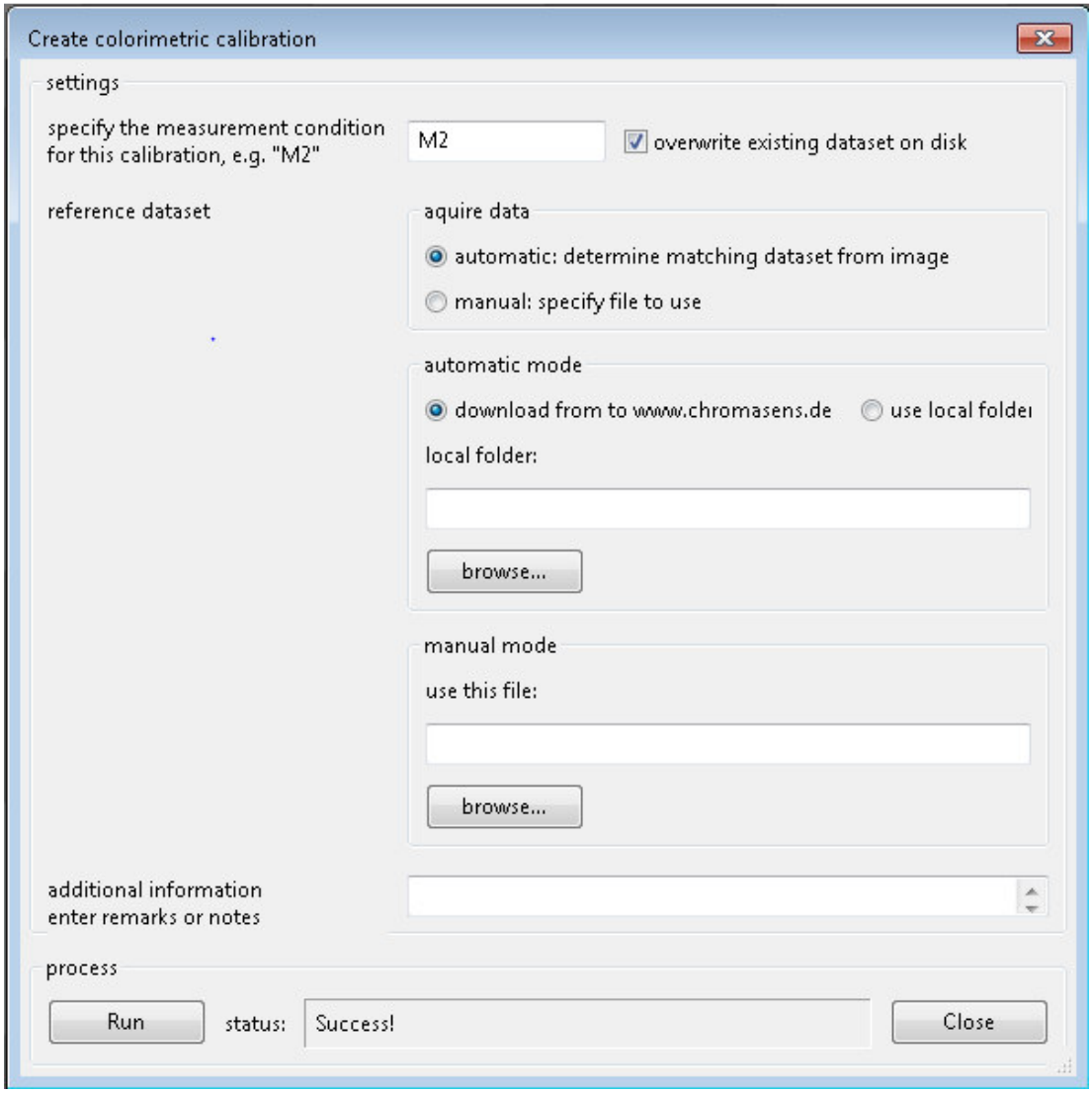


Figure 14: Settings for a color calibration

d) After pressing Run and the calibration succeeded, the quality of the calibration will be shown in the protocol window:

```
36
37  Using CIE2000
38  Mean delta E = 0.567748 Std deviation = 0.50326
39  Max deltaE = 3.51624 Min deltaE = 0.051283
40  95% delta E is smaller than 1.53553
41  90% delta E is smaller than 1.08113
42  85% delta E is smaller than 0.835924
43
```

e) Restart Chromantis to make the new color calibration available for further scans

3.7 Color information analysis

After generating or opening a spectral image, the color, spectral or other information can be analyzed. Sometimes it is useful to get a visualized spectral info, with corresponding L*a*b values. In this case, you can open or generate a spectral image, and then click “View” → “show colorimetry window” to check the values. Chapter shows some functionality about the analysis.

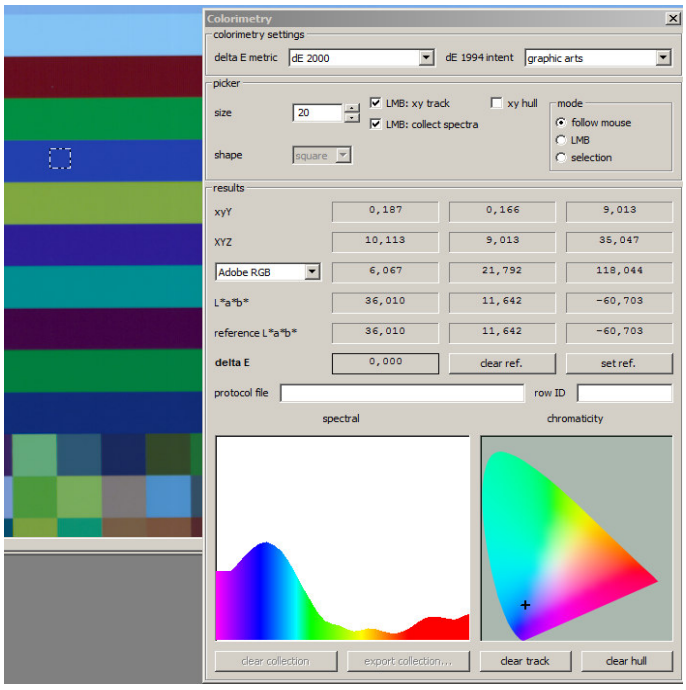


Figure 15: Colorimetry window

Table: Settings for various situations by using Chromantis

	Scan raw image for black reference	Scan raw image for geometry calibration	Scan multichannel image for color calibration	Scan spectral image After all calibrations were done
Camera dynamic range	8bit/ch	8bit/ch	8bit/ch	8bit/ch
Vertical reduction	Average or subsample	Average or subsample	Average or subsample	Average or subsample
Dynamic WR	off	Before geo transform	Before geo transform	Before geo transform
Dark offset correction	unchecked	checked	checked	checked
Measurement condition If M2.dat is given, then please make sure M2.dat exist in the folder… %ProgramData %\Chromasens\ TpApi\				M2
Output-multichannel	No	No	Floating point	no
Output-spectral	No	No	No	Floating point

The table shows, how to set proper values for various scan situation. Depending on which type of image should be generated directly after scanning.

4 Further functions in Chromantis

4.1 File

With the menu “File”, the user can do the following operations.

4.1.1 Open image

If you want to load an image, which is already saved on the hard disk, you can click this menu item to open it. TIF is the only supported format. Several images can be opened and shown in separate tabs.

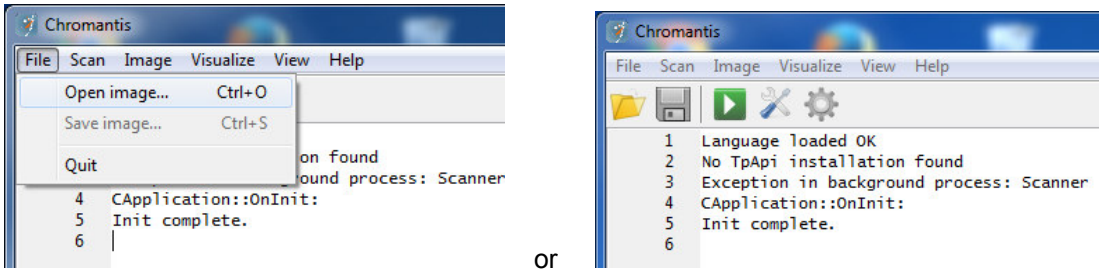


Figure 16: Import TIF-image in Chromantis

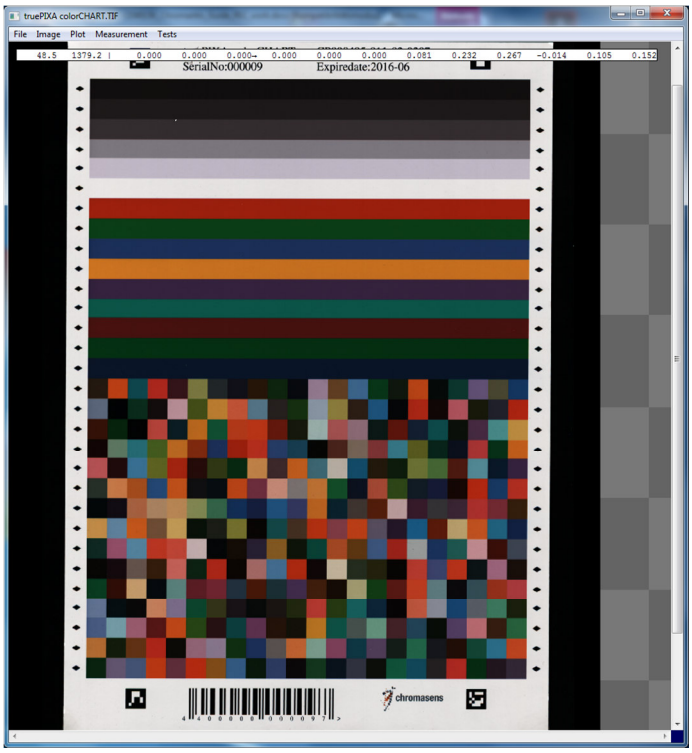


Figure 17: Show TIF-image in Chromantis

You can switch between the channels by using “space”. In the upper part of the window the channel values of the current cursor position are shown.

4.1.2 Save image

The image in the current window in Chromantis can be saved with File → Save image…

the format of saved image is also TIF.

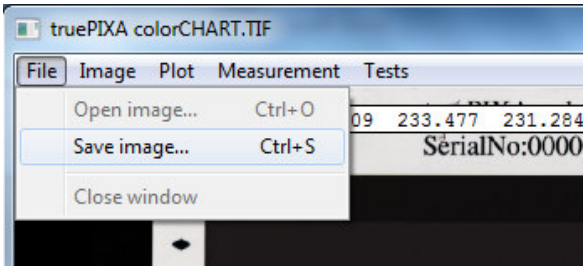


Figure 18: Menu point "Save image…"

4.1.3 Quit

If you want to close the image window or the application, you can choose the menu point "File" or you can also click the control element upright to finish the program.

4.2 Help

4.2.1 Chromantis manual

In the new version by clicking "Help" → "Chromantis Manual", a manual in pdf-format will be opened.

4.2.2 About Chromantis

The current version number of Chromantis will be shown by clicking "Help" → "About Chromantis".

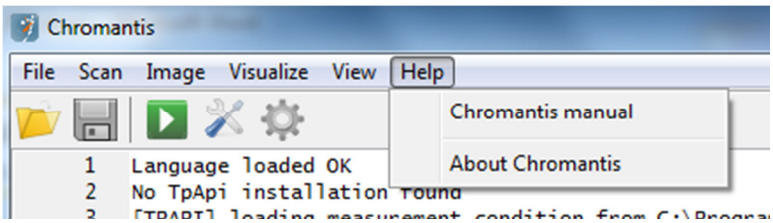


Figure 19: About Chromantis

4.3 Image

4.3.1 Transform

With this mode you can transform an image format into another. You can only transform the following combinations:

Raw image → raw image (if you want to subtract the dark offset or apply a shading correction)

Raw image → multichannel image (you need a geometry calibration file to do this)

Multichannel image →spectral image; sRGB; Lab 8bit (you need a color calibration file to do this)

Spectral image →16bit Lab image

4.3.2 Transform raw image → multichannel image or raw image →raw image

a) First you need to adjust the settings of the target image.

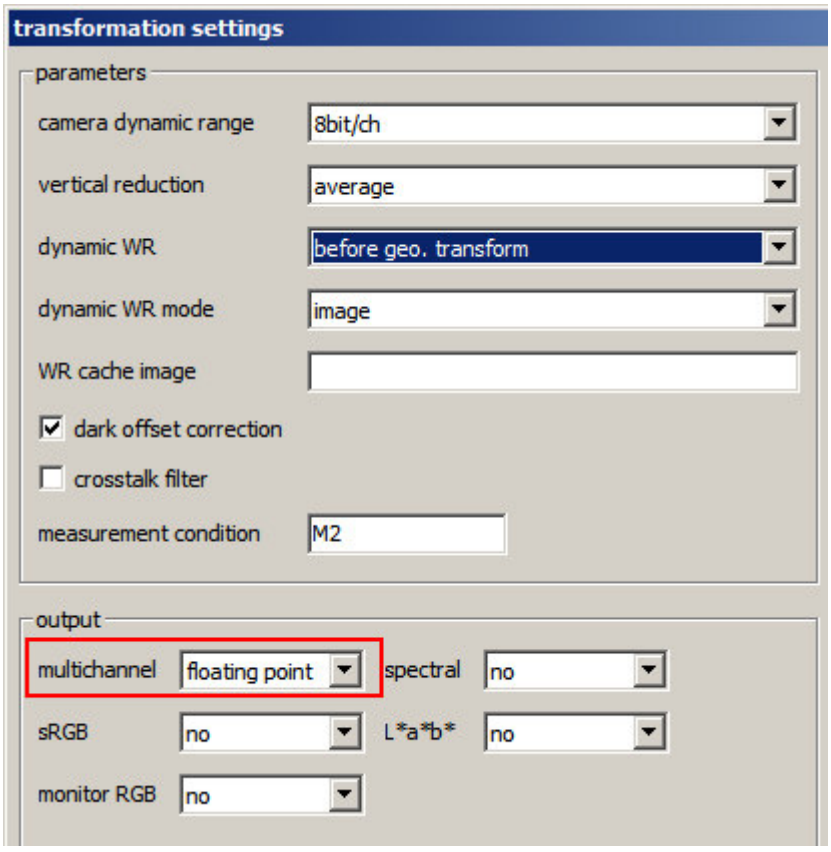


Figure 20: Settings which are used for Transform (Raw → Multichannel)

b) Then you transform the image by clicking "image" →"transform from" →"the actual source image form"

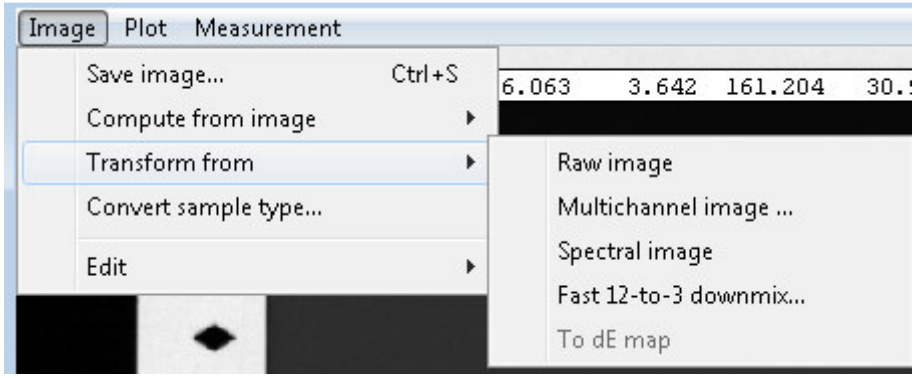
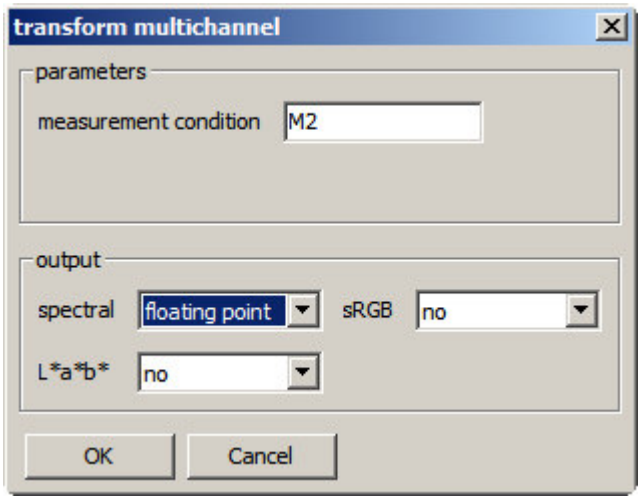


Figure 21: Choose the source image form you want transform from, it is not the target image

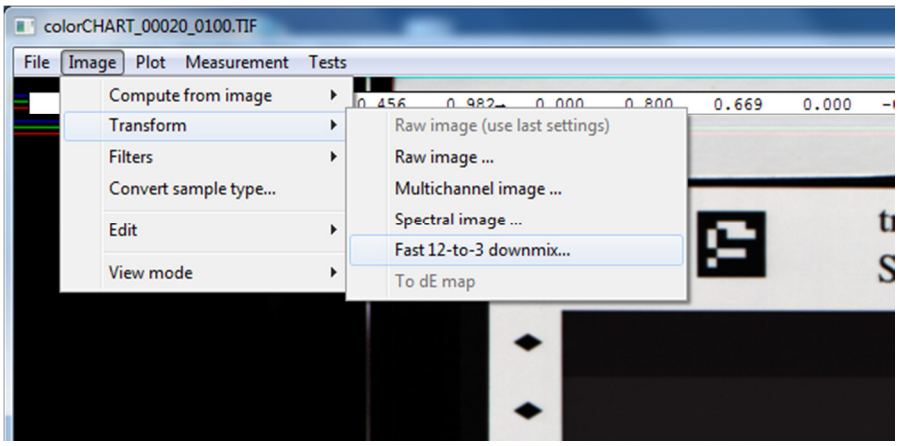
4.3.3 Transform multichannel image → spectral image (or sRGB, 8 bit L*a*b* image)

After clicking menu ”Image” → “Transform from” → “multichannel image…” you can decide the output type and then get the corresponding result.



4.3.4 Fast 12 to 3 downmix

This function requires a 12 (multi) channel image as input. It generates an RGB-image as result, which R, G, B can be adjusted, weighted and summed from the entire 12 channel.



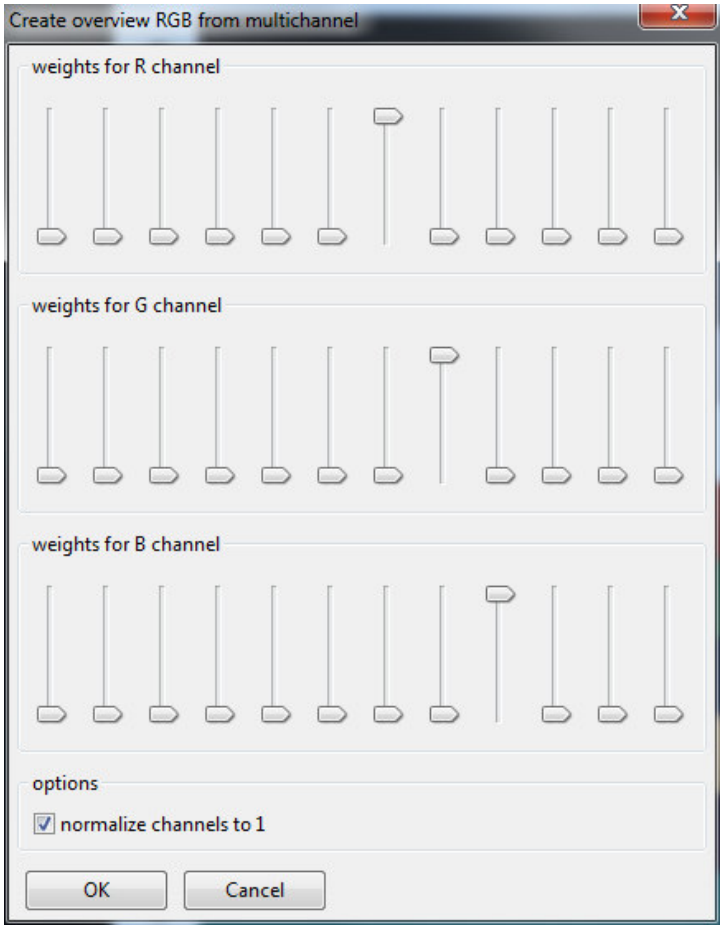


Figure 22: Create overview RGB from multichannel

4.3.5 Convert sample type

Normally, the scanned image as source has the data type of 32 bit float. If the image is loaded, the content is allocated in the memory, pixel-wise from left to right, from top to bottom. Every pixel holds a certain number of channels and the value in every channel is a 32 bit float type. Sometimes if we need to transform the value from 32 bit float into 8 bit unsigned (or signed) integer, we can click “Image” → “Convert sample type…”. After such a transformation, the image has a smaller size and can be viewed by some other image viewer tools directly. The transformation into 16bit or 32 bit is at the moment not available.

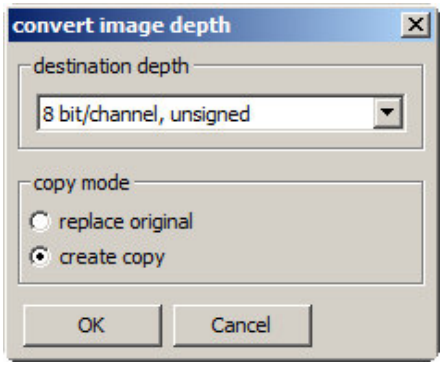


Figure 23: Convert image depth

4.3.6 Edit

- Crop to selection

  The user can select a region on the source image by (left)pressing und dragging the mouse, then click “Image” → “Edit” → “Crop to selection”, the image will be cropped to the selected region.

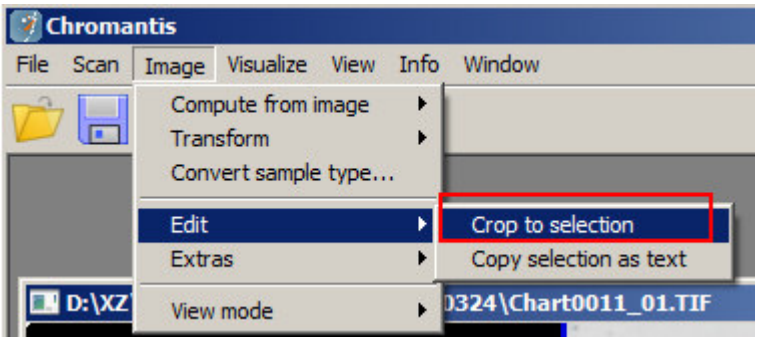


Figure 24: Crop to selection

- Copy selection as text

  The user can select a region on the source image by pressing und dragging the mouse, then click “Image” → “Edit” → “Copy selection as text”, the values of the first channel of the region will be copied as a text block and can be pasted in any text processing tools.

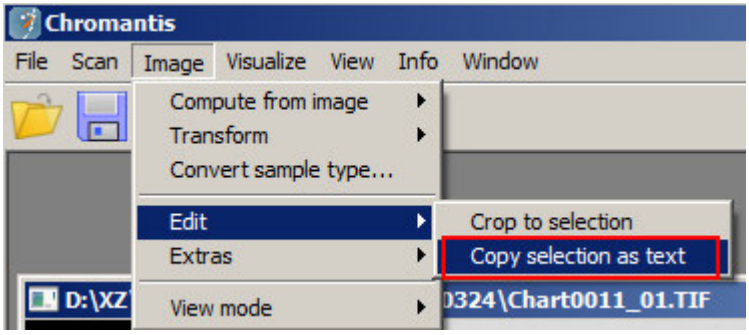


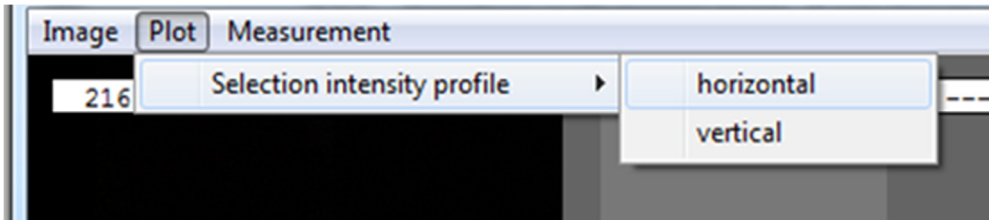
Figure 25: Crop to selection

4.4 Plot

4.4.1 Selection intensity profile

With this option you can get a horizontal or vertical line profile of the camera signal in your image

a) Select a region on the image with your cursor
b) Plot→Selection intensity profile→horizontal or vertical



4.5 View

4.5.1 Show protocol window

A protocol window is open by default setting. It records usually the application info by running. If there would be some unexpected errors by executing some functions, they should be also be logged, so that the user can be informed with the help of protocol window.

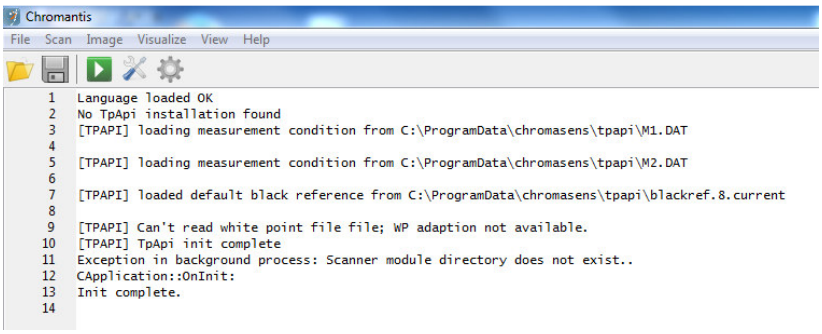


Figure 26: Protocol window

4.5.2 Show colorimetry window

The colorimetry window works on an opened spectral image.

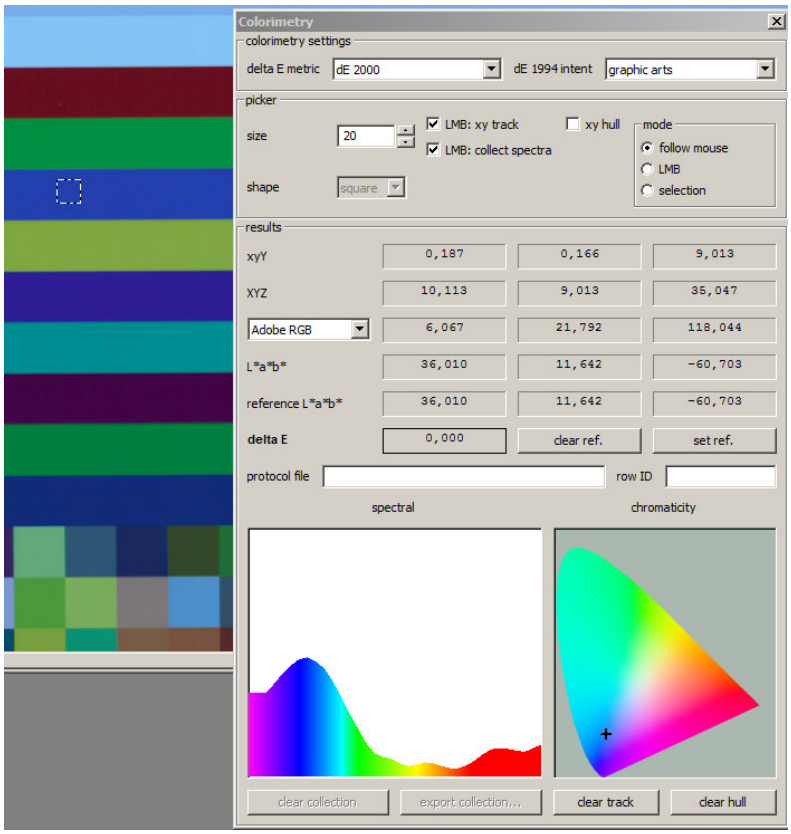


Figure 27: Colorimetry window

The mouse area on the spectral image is a square. The size of the square can be adjusted. The values in the area will be averaged. So if there is some noise on the spectral image and the noise should be suppressed, then a bigger size can be useful. If the user wants to do color inspection in a small area, so the square should also be small.

As the mouse moves, the values of various color spaces change too. If the user (left) click the mouse, the L*a*b* value of the current area is considered as reference. For a color homogeneous surface, the value of L*a*b* of the area around the reference point doesn't change much, and delta E should be therefore small.

Delta E metric has three various criteria dE1976, dE1994, dE2000. In dE1976 is delta E the Euclidean distance in L*a*b* color space. dE1994 and dE2000 uses additional parameters to describe and adjust the different visual sensitivity of certain colors.

If protocol file (e.g. it can be a txt-file.) and row ID are given, after clicking with the mouse of the spectral image, the spectral data will be written in the protocol file, and the row ID will be increased every time after clicking.

(Some functions of this colorimetry window are not yet available: LMB:xy track; LMB:collect spectra; xy hull; mode; clear ref.; set ref.; clear track; clear hull)

4.6 Key sequences

If the functions are not yet integrated in menu, the user can still use them via key-combination

- Single channel

  For multichannel image, the value of every channel can be read. With keyboard shortcut "Ctrl+Shift+G", then use the space-button to see the current channel value at the top of the image. By clicking the space-button further, the little arrow above will move to the next channel. All the pixel value from the current channel will be displayed as a greyscale image.

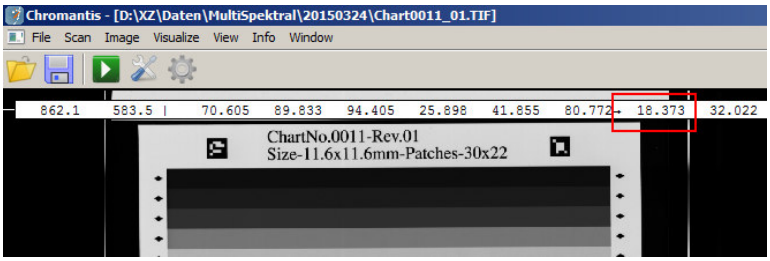


Figure 28: View mode single channel

- RGB groups

  The user can press space-key, to switch different RGB views. That means the 3 channels will be grouped.

- Channel average

  The values of a pixel of all the channels will be averaged and shown in one image. With the keyboard shortcut "Ctrl+Shift+A", the user can see the averaged result.

Chromasens GmbH
Max-Stromeyer-Straße 116
78467 Konstanz
Germany

Phone: +49 7531 876-0
Fax: +49 7531 876-303

www.chromasens.de
info@chromasens.de

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