# Image Engineering iQ-Luminance User Manual

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**INTRODUCTION**

The iQ-Luminance software calculates luminance values from the image data taken with a calibrated camera. The obligatory camera calibration provides how the camera's raw RGB data are mapped to the Luminance considering various exposure settings. Rectangular, elliptical, circular, or polygonal Regions of Interest (ROI) can be drawn on the image to evaluate the selected area. The corresponding Luminance is displayed as a grayscale or false-color image.

## PRECONDITIONS

### Camera Calibration
The obligatory camera calibration provides the knowledge of how the camera's raw RGB data are mapped to the Luminance considering various exposure settings. This camera- and lens-specific calibration is performed in our test lab.

### Attention!
You must send Image Engineering your camera for calibration before you use the software. Without a pre-calibration from IE, you will not be able to use the software.

The camera calibration requires two measurements:

- Opto-electronic conversion function (OECF)
- Spectral response (SR)
- Optional: Shading correction

### System Requirements
Operating system → Windows 7 64bit (or newer)

## GETTING STARTED WITH THE USER INTERFACE

You will need to input the license key when starting the software for the first time. The key can be found on the USB stick that will be sent to you upon purchase of the software. Without the license key, you can only access the demo version. Only the example images provided by IE are compatible with the demo version (images are available for download on our website).
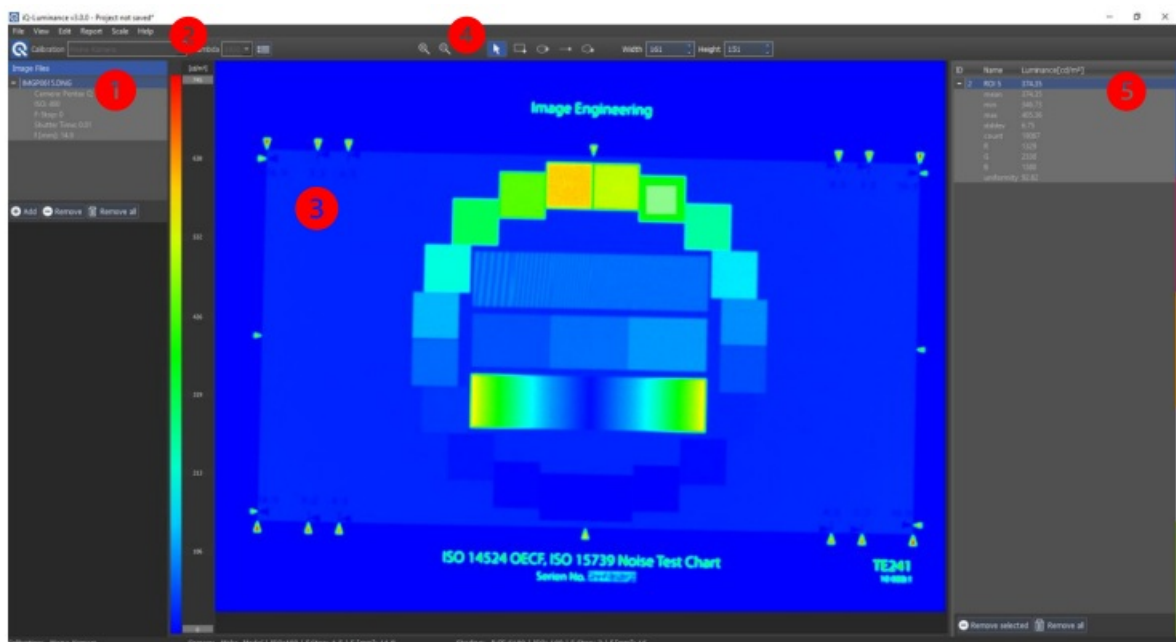The iQ-Luminance software is divided into three operation areas:



Image 1: The iQ-Luminance user interface.

1. **Control area**
   - Manage images for measurement in a file list
2. **Menu Bar**

   → Open/close image files

   - View → Switch between three different image views/export and import ROIs

     → ROI management
   - Report→ Edit report or Export report
   - Scale → Switch between logarithmic or linear scale/reset scale

   View and Report are visible if an image is loaded.

   Scale is visible when an image is loaded, and a luminance view is active.
3. Image
   - Displays the current image
   - Displays a color-coded luminance image with a color bar
   - ROIs can be drawn directly on the image
4. Image Toolbox
   - Contains measurement (Rectangle ROI, Ellipse ROI, Line, Polygon ROI) and display tools (zoom in / out)
5. Results Area
   - Displays and manages measurements of selected areas

Image area and Results area are visible if an image is loaded.

**Control Area**
**Manage Images**
The iQ-Luminance software only supports the usage of RAW image files, and the calibration data provided by IE are based on RAW images.

- Add image files to a list
- Remove selected image files from the list
- Clear list
- Show or hide additional meta-information of the image

**Load Calibration Data**

The camera and lens-specific calibration is performed in our test lab.
The software is delivered with calibration text files that can then be loaded in the calibration data screen: File →
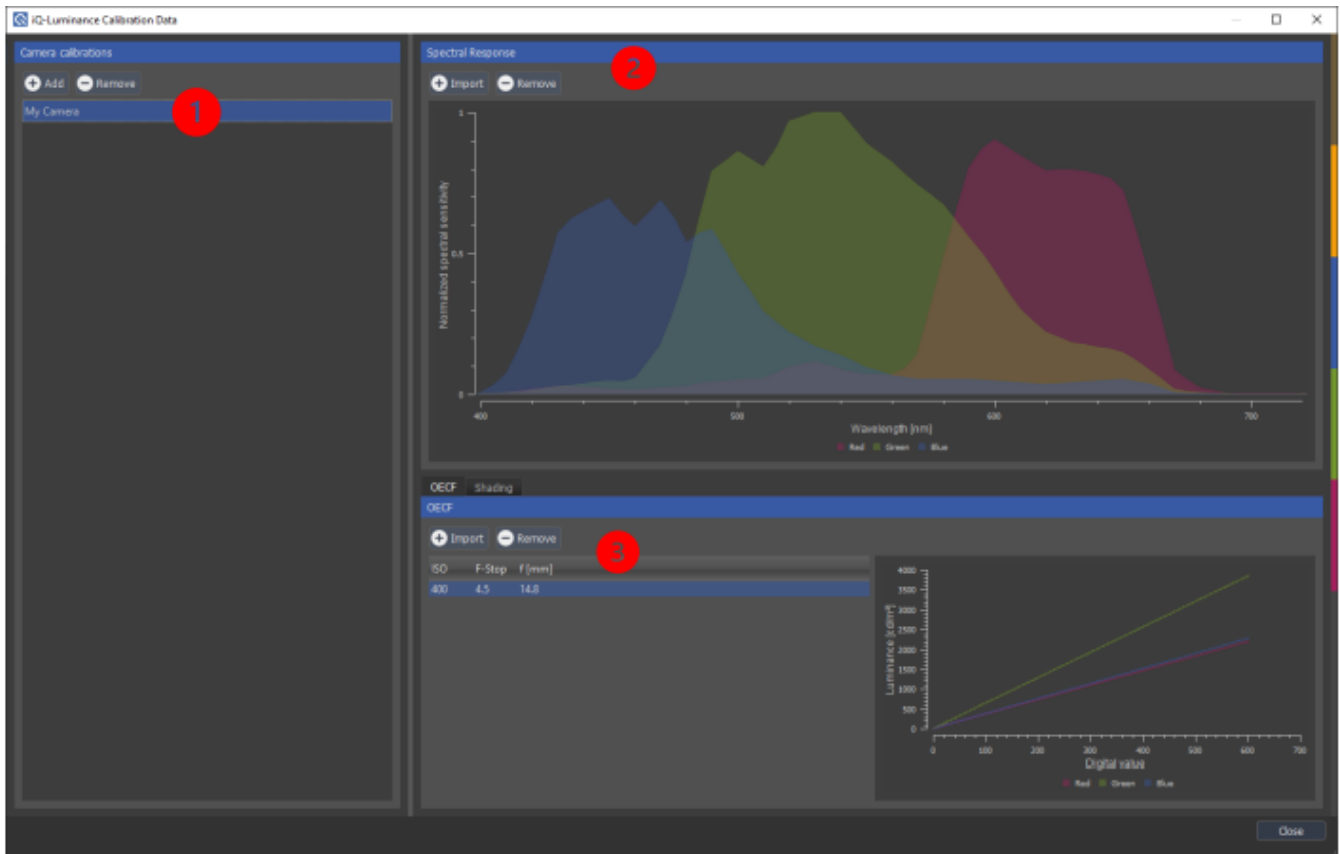Calibration Data
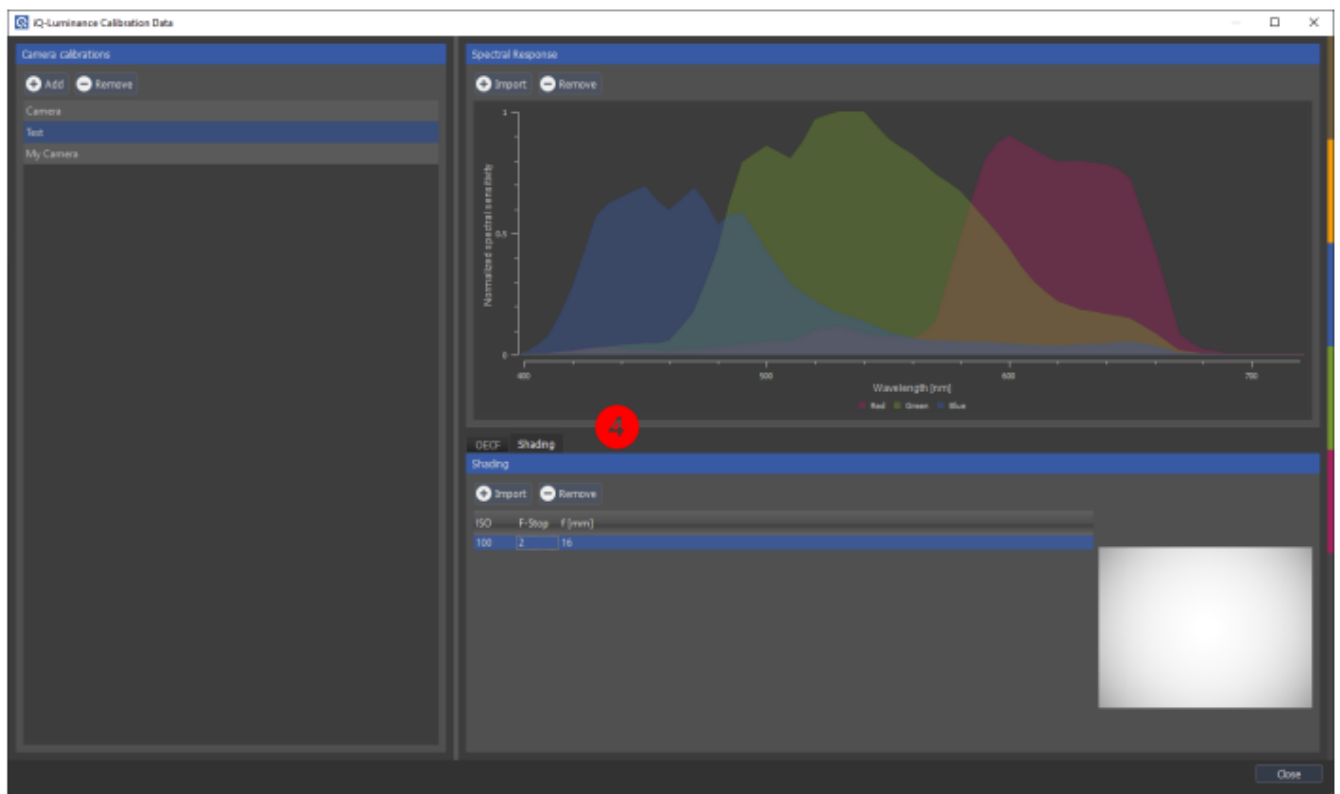


**Image 2: iQ-Luminance calibration data**



**Image 3: Optional shading measurements**

1. Add (+) or remove (-) a set of calibration data (e.g., for one camera lens combination). You can rename the set
   of files once loaded (double click the file name)

   Select a set of calibration data by clicking on the specific entry.

The currently active set displayed on the right side and used by the software is highlighted with a blue background color.

2. Spectral response (SR)

   Import or remove (-) the spectral response calibration file

3. Opto-electronic conversion function (OECF)

   Load or remove one or more OECF calibration files

4. Shading data (optional) – image 3

   Load one or more shading correction calibration files

If you select more than one OECF or shading calibration file, the software will choose the suited calibration files based on the exposure of the loaded image (ISO, f-stop, f [mm]). The software will ensure that the ISO and f-stop for both the calibration and image files match.
Your calibration data will be saved and available after loading the calibration files.
Once saved, the calibration data is also accessible from the calibration menu on the left side (image 4).
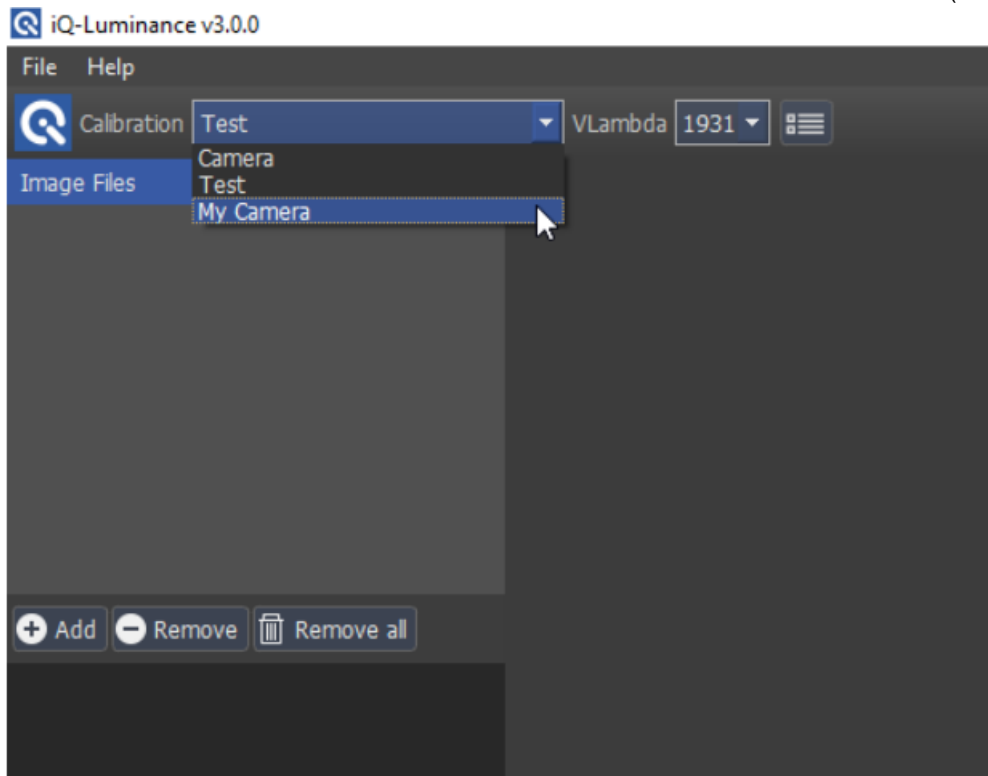


**Image 4: Accessing calibration data**

**Selecting Vλ**

For more information on vλ 2006, please follow the link below: Official publication:

**https://cie.co.at/publications/fundamental-chromaticity-diagram-physiological-axes-part-1** Additional text files for the v(symbol) curve 2006 (files already implanted into the iQ-Luminance software):
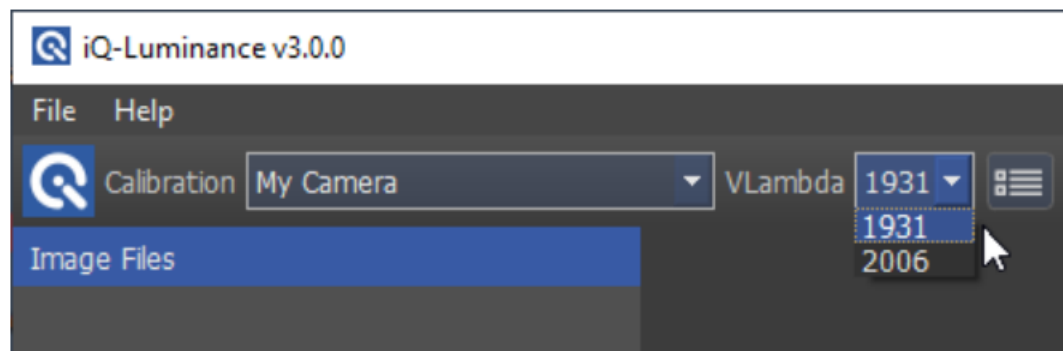**http://cvrl.ioo.ucl.ac.uk/ciepr.htm**

**Image 5: Set VLambda curve**

## Image Management

After loading and selecting an image, it is displayed in the image area.
The toolbox will then appear above the image and the result area to the right beside the image.



The toolbox contains tools to select ROIs for the measurement and some options for displaying the image.

## Zoom In and Out





- Zoom in: You can zoom to a specific area by clicking and dragging a rectangle over the desired location.
- Zoom out: Displays the entire image.

## Select an ROI

iQ-Luminance offers four different shapes when selecting a region of interest:







- Rectangular ROI
- Elliptical ROI
- Arbitrary line

After choosing one of the above tools, the ROI is created by clicking and dragging the desired shape over the image.

**Polygonal ROI**
The polygon is created by clicking into the image. Each click sets a point of the polygon. You can select a minimum of three points.





- After setting the points, you must confirm the shape. You can create multiple shapes on the image.
- Click to cancel a shape that has not been confirmed or to go back to the main menu bar.

Multiple ROIs may be created, which are managed in the result area. The ROIs can be moved and re-shaped afterward. To remove a shape that has been confirmed, right-click the shape and delete ROI.
**Please note:** While you are in Polygon mode, most of the GUI will be disabled until you confirm or cancel the polygon creation.

**ROI Management**
Control and move multiple ROIs at one time by holding down the Ctrl key and selecting the ROIs you would like to control.
You can delete an ROI by right-clicking and selecting delete.
Selected ROIs can be resized by typing new values into fields Width and Height.
Selected ROIs can be copied and pasted into the same or into other images (image 4).
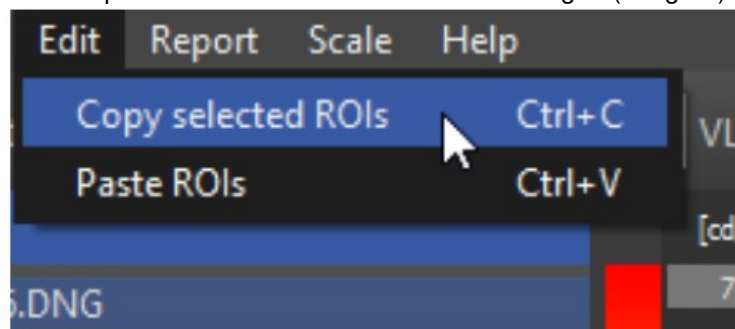


Image 6

You can save, export, and import ROIs in the View dropdown menu.

**Save and Load Projects**
You can save your project and load it again at any time. The image and the ROIs will be saved as well. File → Save Project

**Change the Display Mode**
The iQ-Luminance software offers three different display modes found in the menu bar:
View → Original RGB
View → Luminance (B/W)
View → Luminance (Color)
Luminance (Black/White) and Luminance (color) means that the measured luminance values in the image are displayed using grayscale (image 5) or false colors (image 6) with corresponding luminance values in candela per square meter.
A color bar on the left side of the image indicates the correlation between color or gray values in the image and luminance values.
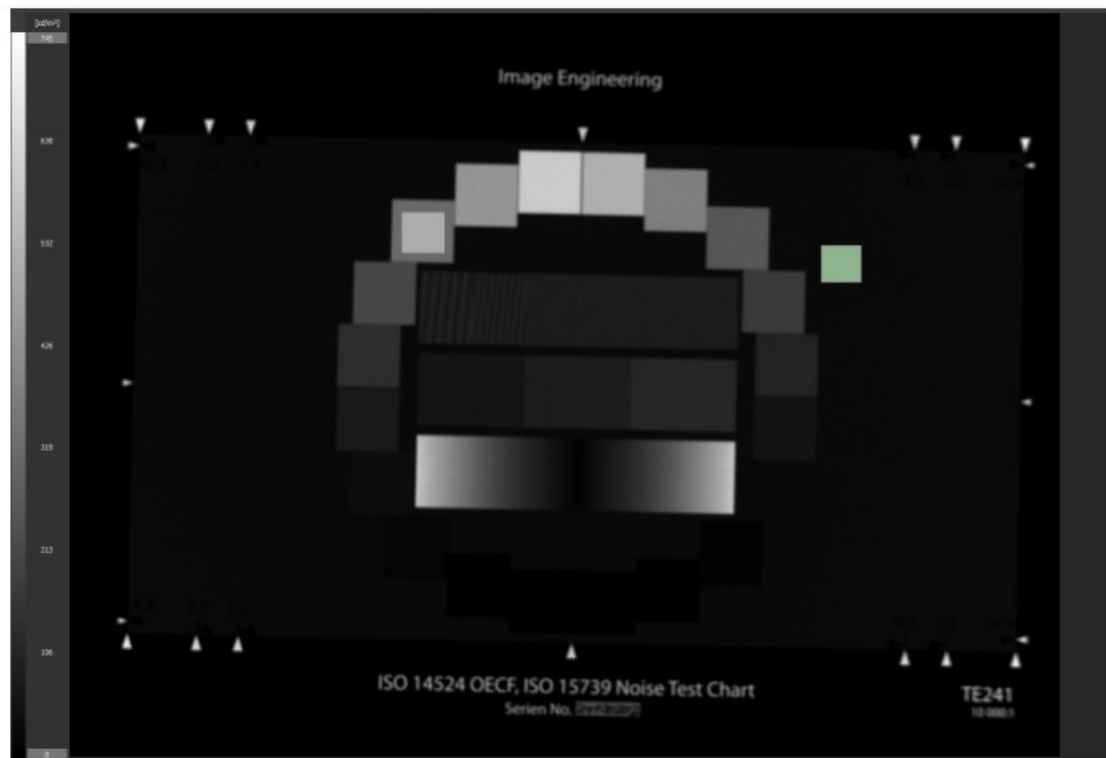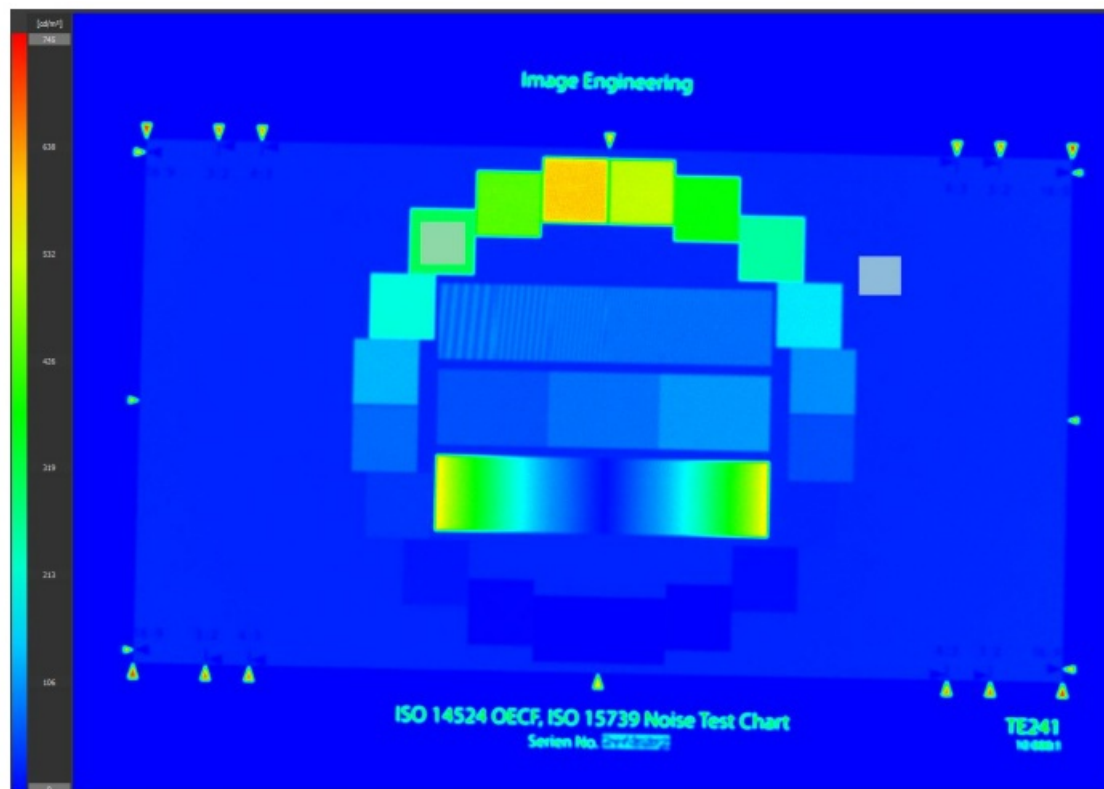
**Image 7: Luminance greyscale display**



**Image 8: Luminance false color display**

**Scaling the Luminance Value Range**

It is possible to change the correlation between color and luminance values.

The denotation of false colors / grayscale values:

Red (false color) / white (grayscale) means a high luminance value.

Blue (false color) / black (grayscale) means a low luminance value.

When loading an image, the maximum and minimum luminance values are calculated and used as limits for this scaling.

The scaling can be changed by entering new values in the fields for the minimum and maximum values.

**Image 9: Edit the minimum and maximum luminance value**
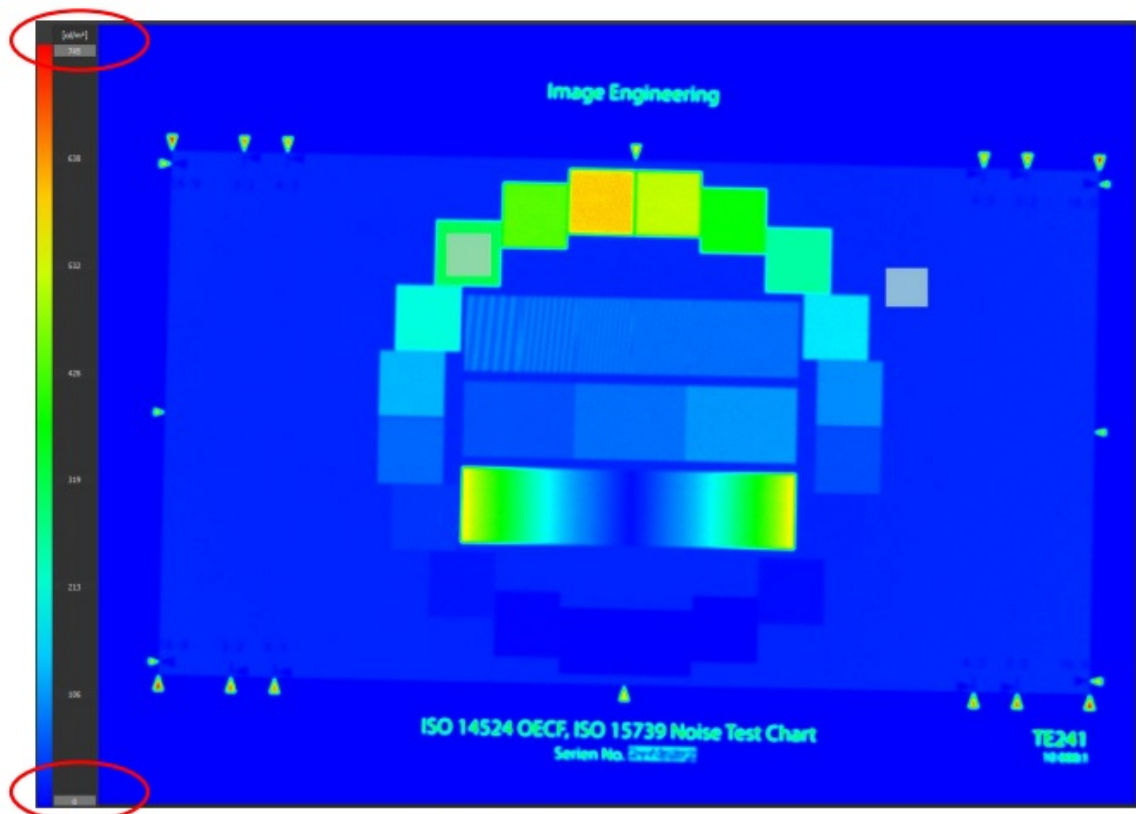
You can apply the scaling of the current image to all opened images in the menu bar:

- Scale → Apply Range to all Open Images
- Scale → Reset Range resets the limits of the current image to maximum and minimum luminance values of the image.

**Logarithmic Scaling**
You can switch to logarithmic scaling in the menu bar: Scale → Logarithmic Scale

**Result Area**
Every ROI created in the image appears in the results list along with the measured luminance value.

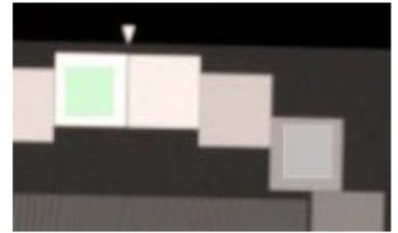| ID | Name | Luminance[cd/m²] |
|----|------|------------------|
| − 1 | ROI 30 | 314.56 |
| | mean | 314.56 |
| | min | 286.59 |
| | max | 341.00 |
| | stddev | 6.19 |
| | count | 21570 |
| | R | 1116 |
| | G | 1962 |
| | B | 1162 |
| | unifo... | 91.11 |
| − 2 | ROI 31 | 29.01 |
| | mean | 29.01 |
| | min | 21.39 |
| | max | 38.21 |
| | stddev | 1.89 |
| | count | 18571 |
| | R | 103 |
| | G | 183 |
| | B | 108 |
| | unifo... | 73.74 |

**Image 10: An example of ROIs with luminance values**

The currently selected ROI is highlighted in both the image and the result list. Toggling the selection in the list activates the corresponding ROI in the image.

**Profile Plot**

The line selection is used to evaluate a luminance distribution along a line with variable width. The luminance values along this line are be plotted in a chart:
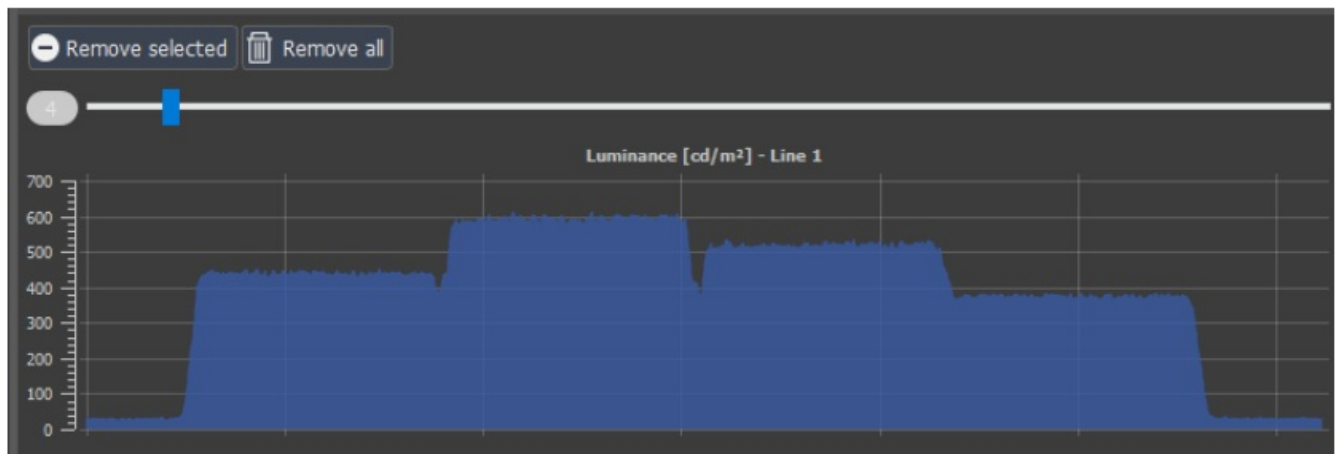


**Image 11: The slider above the plot changes the width of the line**

## RESULT EXPORT

You can export the results as an XML file.
You can add your logo, title, editor, and date to the PDF Export. You can open the relevant dialog in the menu bar: Report → Configure

**Report Generation (PDF)**
Fill out the correct information.
The "Show ROI" checkboxes imply that you can show the ROIs either on the false-color image or the report image.
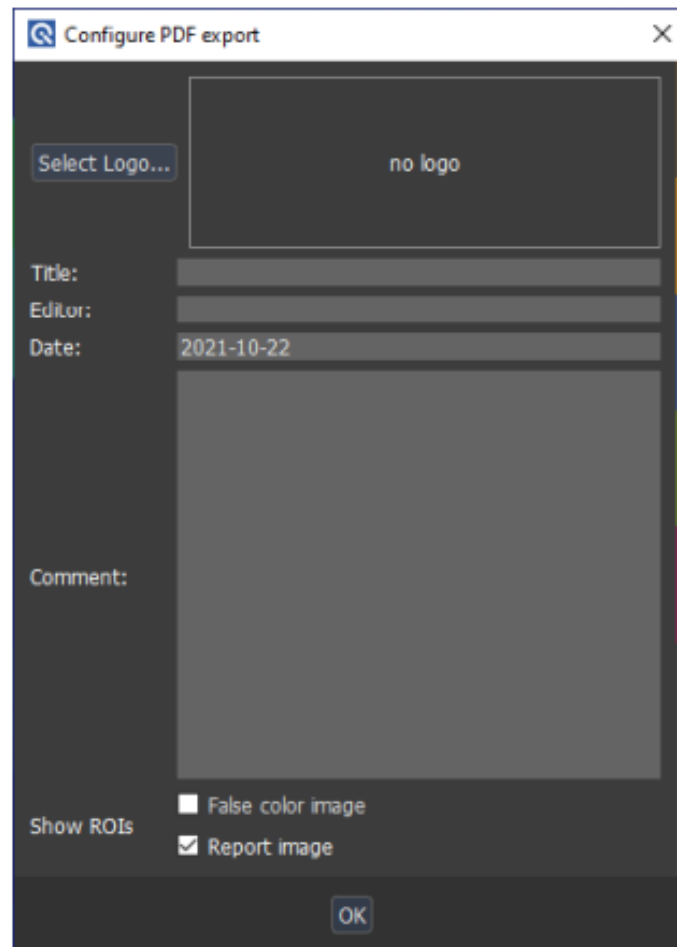


**Image 12: PDF configuration**

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The documentation can be found here: h**ttp://www.dechifro.org/dcraw/dcraw.1.html**
(**www.cybercom.net/~dcoffin/dcraw/**)

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## Documents / Resources

**Image Engineering iQ-Luminance** [pdf] User Manual
iQ-Luminance, iQ Luminance