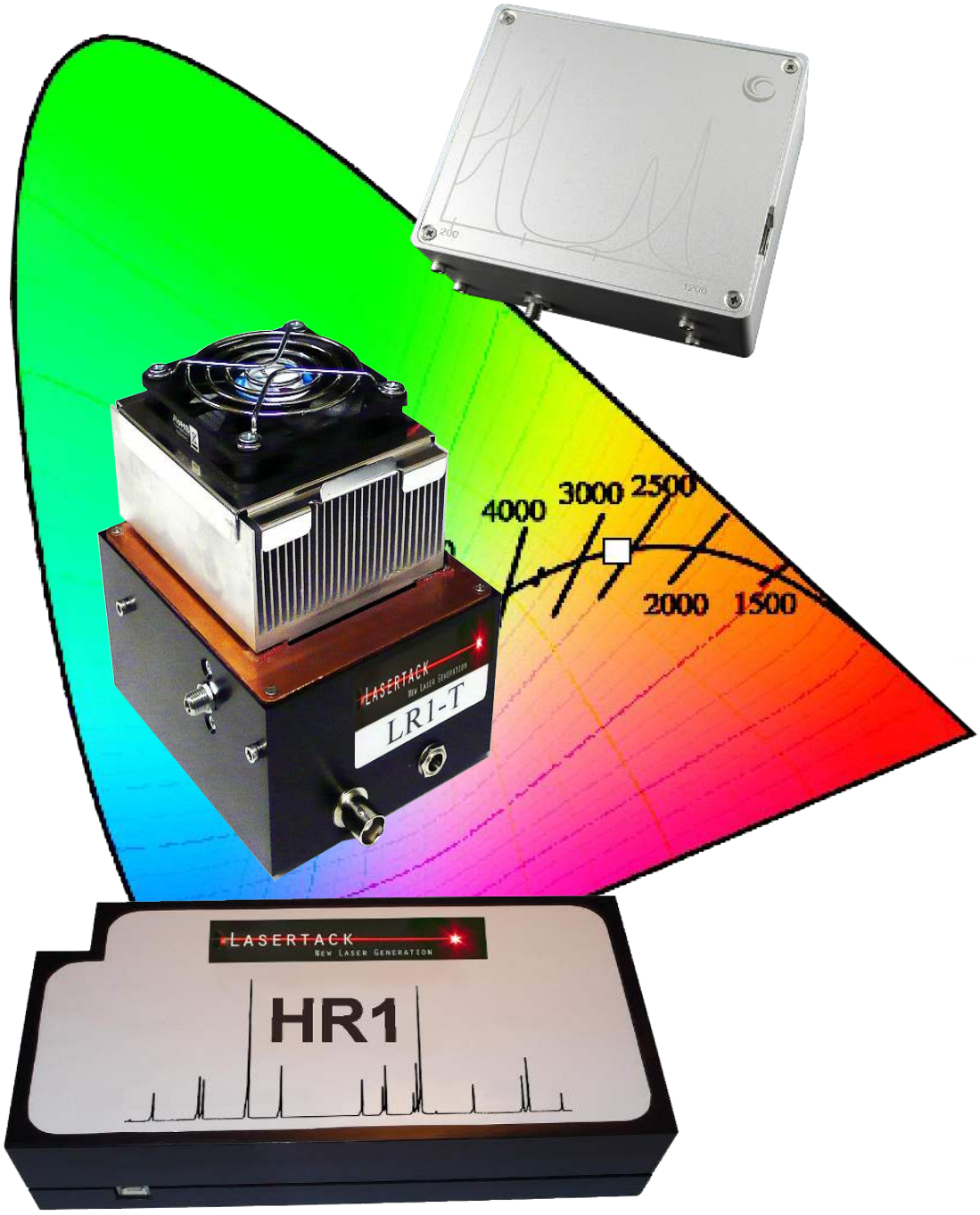
Lasertack LR2 Spectrometer

LR2 Spectrometer Users Manual



Download the PDF User´s Manual to use dynamic contents

Version April 2020

Contents

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1.1 Safety

All statements regarding safety of operation and technical data in this instruction manual will only apply when the unit is operated correctly as it was designed for.
The spectrometer must only be operated with proper shielded connection cables.

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1.2 Requirements

The Spectra software requires a Window PC.
In order to be able to take as precise measurements as possible, use equipment supplied with the spectrometer only. Measurements done with not approved equipment may be inaccurate.
In case some of components need to be replaced, please contact Lasertack GmbH.

System requirements:

-Operating system: Windows Vista, 7, 8, 10
-free USB 2 Port
-Pentium 4 or Athlon 3000 CPU or later
-1GB RAM

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2 Installation

No traditional software installation is required.
Start the Spectra software from the supplied USB drive or copy the data folder to the hard drive disk of your PC.

The spectrometer will be recognized by the PC as HID.
It may take up to several minutes until the Windows finishes the installation of the device.

First start may cause windows to recognize the software as „dangerous". You can ignore this message and start the software.

Package contents:

- LR2 Spectrometer
- 1m fiber
- Cosine corrector
- USB drive
- Carrying case

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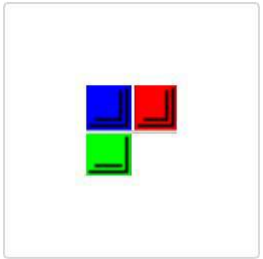
3 Getting started

Copy the data folder from the USB drive to your local hard driver or simply start the software from the USB drive.

LR2

Connect the spectrometer to the USB port of your PC. Windows now recognizes the spectrometer and install the HID driver. No additional driver is needed.

Now you can start Spectra.



LR2 Spectra 1.9.exe

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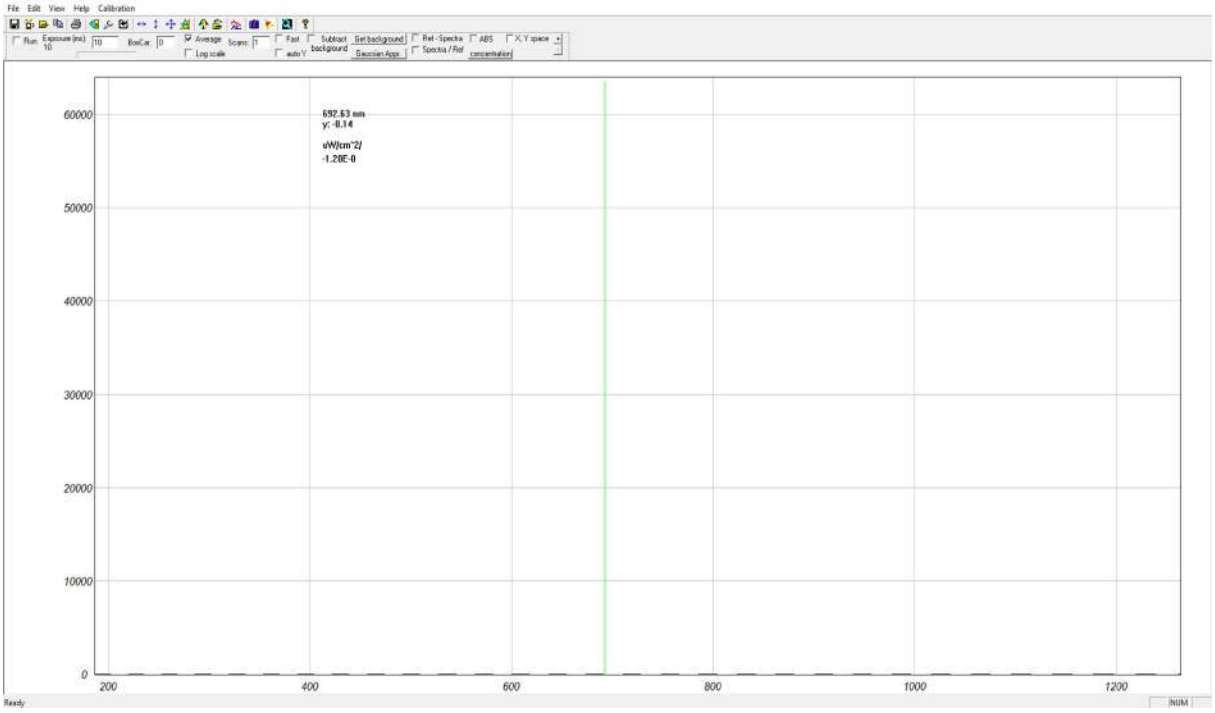
3 Getting started

After double clicking the Spectra.exe file the main window appears. The software is ready to collect data.



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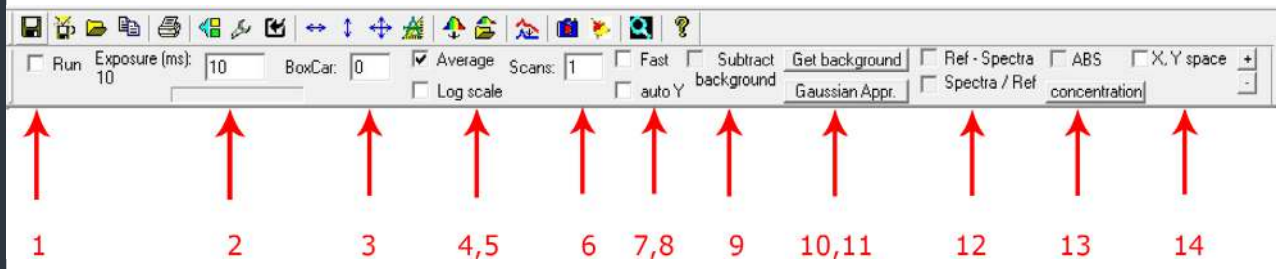
4 Toolbar

The toolbar is the control element for most important features.



1 *Run*: Starts collecting data. Disabling stops data collection and the last collected spectra is shown.

2 *Exposure time*: Is set in ms. The higher the value the stronger the signal appears on the screen. Keep in mind that dark current is also collected the same time and appears higher as well and may overlay the real signal.

3 *Boxcar*: Setting smoothes the signal curve. The higher the value the smoother the signal appear. Keep in mind that low signal can be erased when the set Boxcar value is too high.

4 *Average*: Shows the averaged value of ***Scans*** (6).

5 *Log scale*: Enables logarithmic view of the Y-axis.

6 *Scans*: Number of scans to take before showing an averaged spectra. When ***Average*** is not active all spectra will be shown at the same time according to the number set in Scans field but in different colors.

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4 Toolbar

7 ***Fast*****:** To increase speed of spectral data transfer and plotting to computer check: It causes transfer one out of every two consecutive spectral data points. Uncheck it to return to nor mal data transfer.

8 ***Auto Y*****:** Adjustes the signal to the full height of the Y-axis.

9 ***Subtract background*****:** Subtracts the reference spectra containing ambient light and dark current. Before aquiring data click ***Get background*** (10). After getting the back gournd you can press ***Subtract backgound*** and turn on the light source.

10 ***Get background*****:** Collects the dark current and the ambi ent light.

11 ***Gaussian Appr.*****:** Gauss-Approximation of the taken spect- ra.

12 ***Ref-Spectra*****:** The reference spectra is subtracted by the last measured spectra.

Spectra/Ref**:** Last measured spectra is devided by the re- ference spectra.

13 ***ABS*****:** Absorpion measurement. For details see the chapter Absorpion measurement.

14 ***X,Y Space*****:** Color (temperature, CRI etc.) data are calcula- ted when this option is active.

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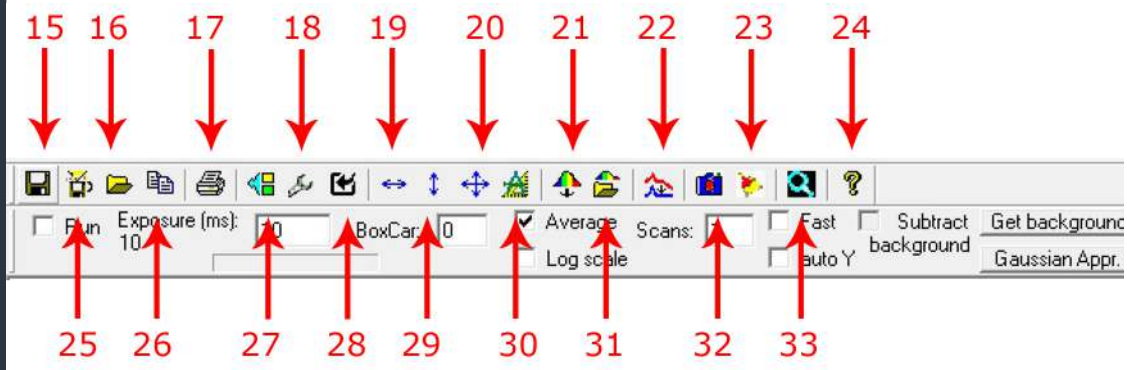
4 Toolbar



15 Saves current spectra as TXT file.

16 Opens a saved spectra from a TXT file.

17 Prints the main window.

18 Advanced settings.

19 One time adjustment of the X-axis to fit the screen.

20 One time adjustment of the X and Y to fit the screen.

21 Collects the reference spectra and saves it to system memory of the spectrometer.

22 Baseline correction (ONLY for Raman spectrometers).

23 Deletes all displayed data except the current spectra.

24 Version notes and device information.

25 Saves the screen as BMP file.

26 Copies X and Y values to the clip board.

27 Enables to chooses one of the connected spectrometers.

28 Trigger settings.

29 One time adjustment of the Y-axis to fit the screen..

30 Manual setting of X and Y axes.

31 Opens a previously saved reference spectra.

32 Catches and freezes the current spectra and continues to aquire data.

33 Database of saved spetra.

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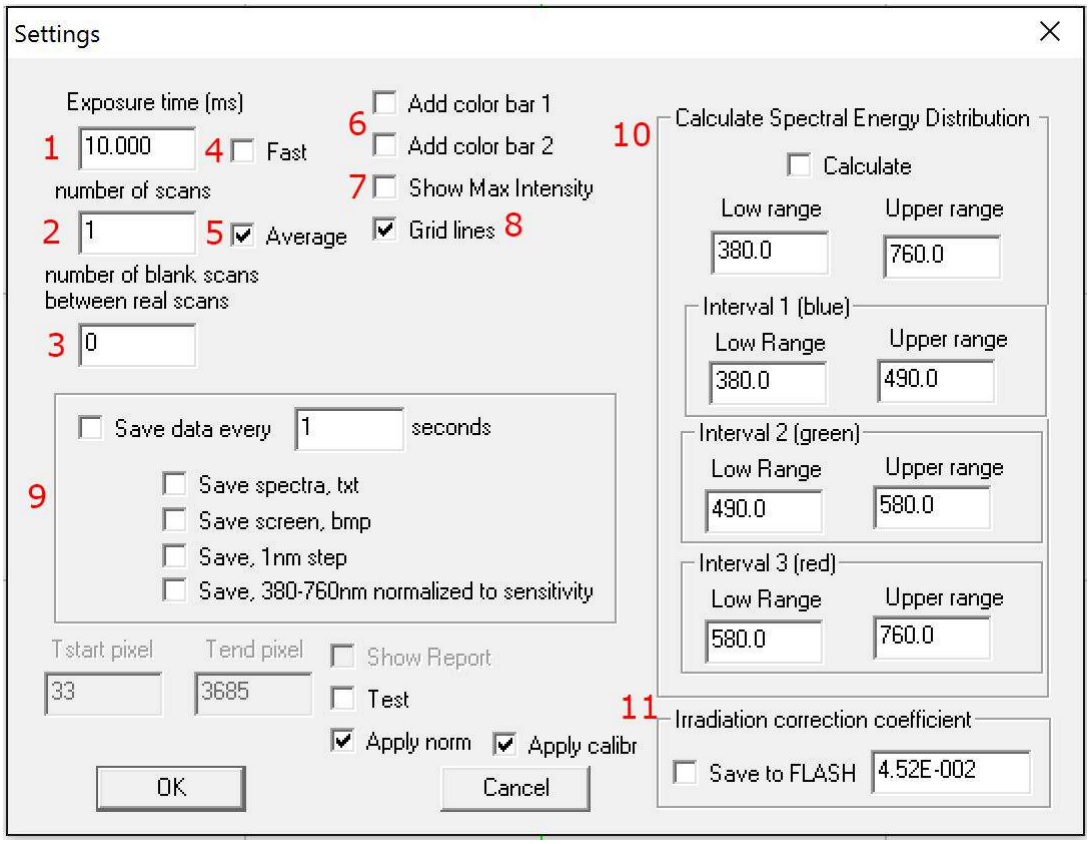
5 Settings

This menu allows to set additional parameters. werden.



1 Exposure time (identical to the toolbar).
2 Number of Scans (identical to the toolbar).
3 Number of blank scans between real scans.
4 Faster data transfer (identical to the toolbar).
5 Average (identical to the toolbar).
6 Color bar (400-700nm).
bar 1 -> linear color bar below the X-axis
bar 2 -> color filled spectra
7 Curser catches the the peak value of the spectra.
8 Shows grid lines on the screen.
9 Advanced settings for data saving.
10 Irradiance settings.
11 Correction coefficient for Irradiance.

IMPORTANT: *TEST*, *Apply norm* and *Apply calibration* must not be modified.
When the values in field 11 are modified and written to the flash memory of the spectrometer the calibration becomes invalid.

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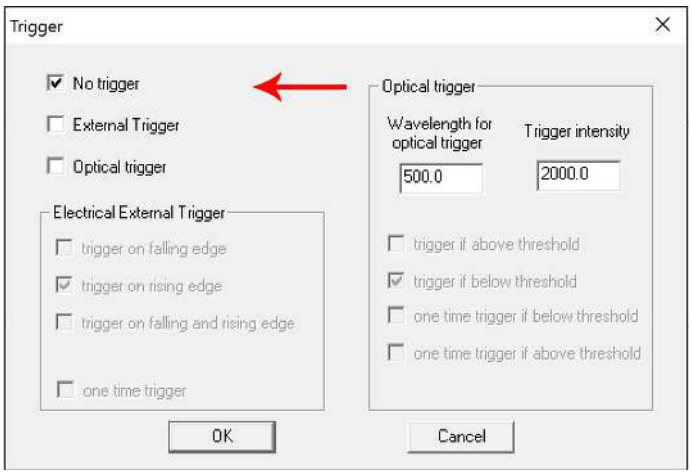
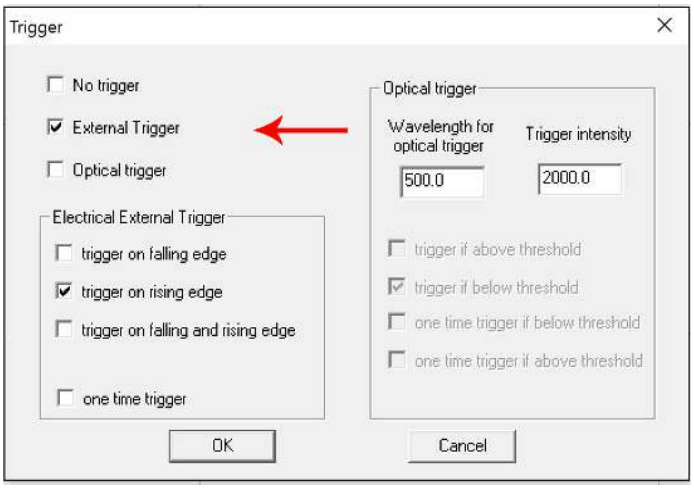
6 Trigger

Option 1 - no trigger



Trigger option not used.

Option 2 - external signal



An external TTL signal is used to trigger data collection.

The trigger signal (TTL) must have an amplitude of 4-5VDC with a duration of at least 1us.

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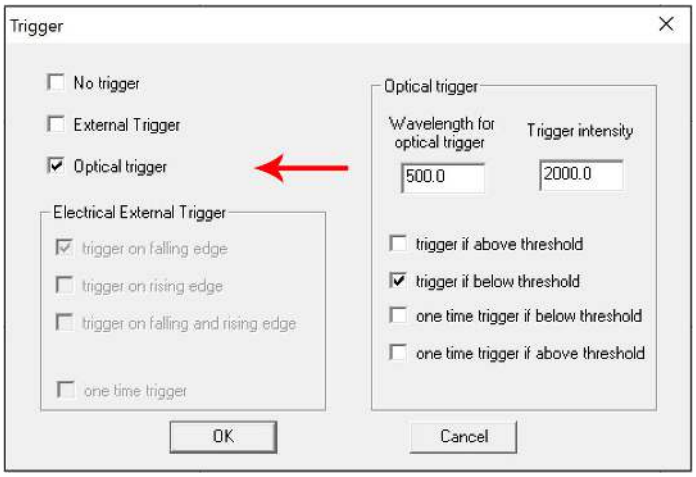
6 Trigger

Option 3 - optical trigger



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7 Transmission measurement

Before starting the measurement a reference spectra of the light source needs to be taken.
Turn on the light sourcs and adjust it to get the signal between 20,000 counts and 50,000 counts. Now click ***Get Spectra.***
Now click ***Spectra / Ref***.
The shown spectra should be flat now but noisy. Choose the right ***BoxCar*** value (10 or higher) to smooth the spectra.
Now you can place a sample between the light source and the spectrometer.
The transmission spectra is now shown. To get a transmission value use a right click at a specific point. The shown value may look like „y=0.62“. That means a transmission value of 62%.

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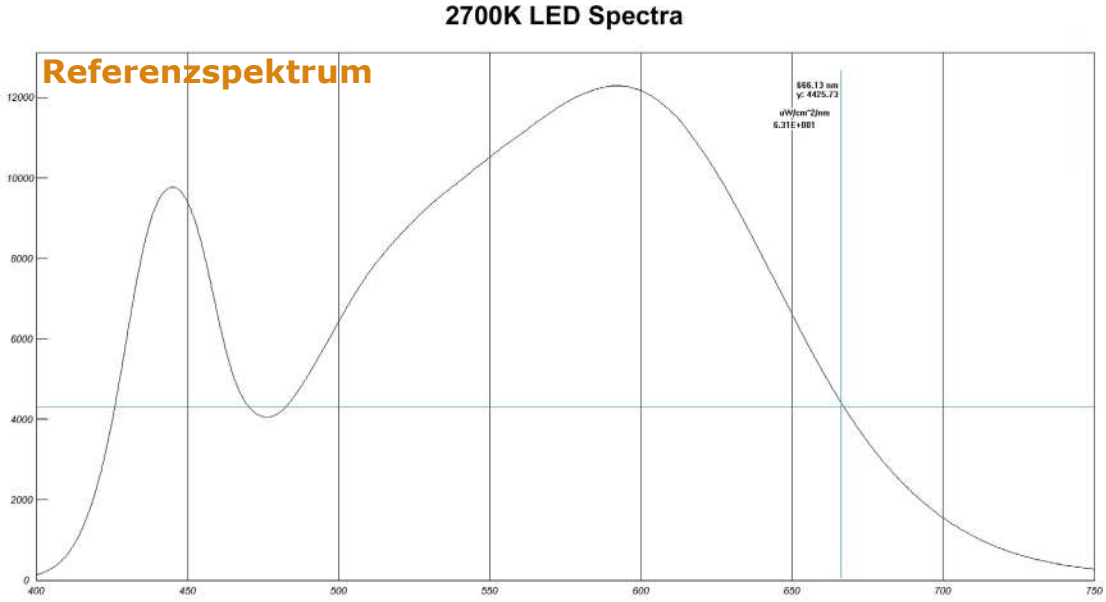
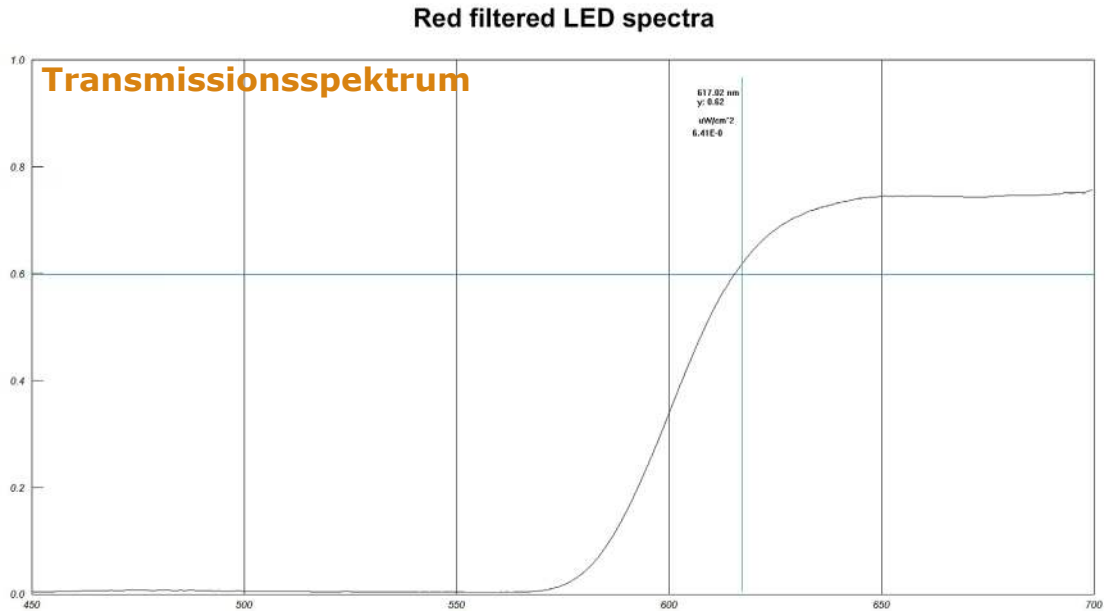
7 Transmission measurement

Example of a filter measurement of a warm light LED





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8 Absorption and concenration measurements

With the cuvette attachment absorption- and measurements can be made on liquids.
Therefore, mount the cuvette attachment with the integrated halogen ligth source on the spectrometer with the two screws supplied.
Screw the cosine corrector, located on the top of the fiber on delivery, directly onto the SMA connector of the spectrometer.

Insert the empty cuvette into the cuvette holder and switch on the light source.
Now adjust the exposure time to display an intensity of at least 7000 to 10000 counts.
Next, take a reference spectrum.
Turn off the light source and set ***Scan*** to between five and ten.
Boxcar should be set to a value of three or above.
Click ***Get background*** and than ***Subtract background.***

Turn on the lamp again. Wait about ten minutes until the lamp spectrum stabilizes by warming up.
Now you can fill the cuvette with a liquid sample and click on ***ABS***.
If the concentration has to be calculated at the same time, click on ***Concentration*** and enter the required values.

The absorption is defined by $A_\lambda = -\log_{10}(\text{Spectra} / \text{Ref})$

The calculation is based on the Beer-Lambert-Bouguer-Law.

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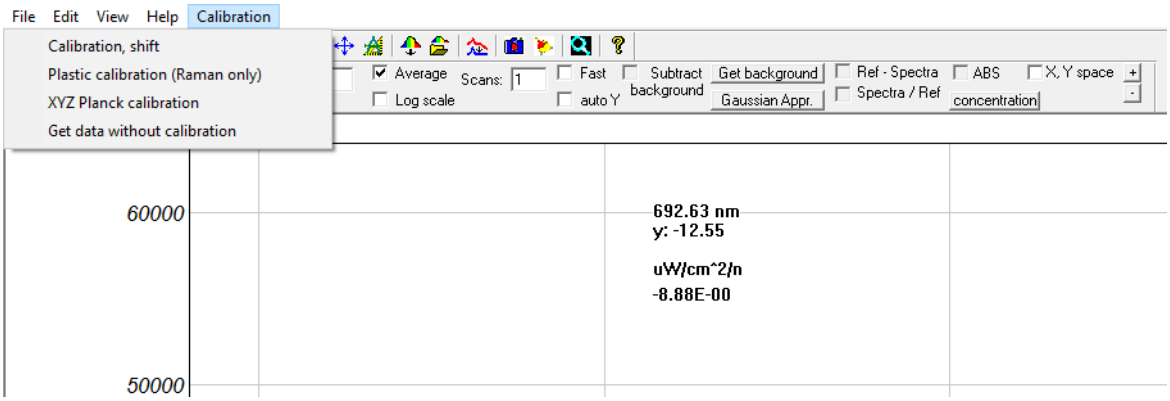
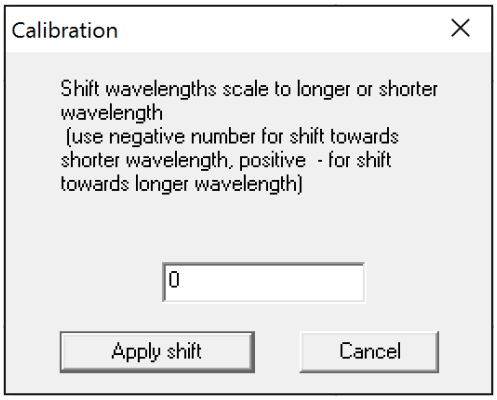
9 Calibration

Different configutations can be made under the menu item ***Calibration*** in the toolbar.



Calibration, shift
If the indicated spectrum is shifted over the entire spectral range due to strong vibrations or the like, you can enter a correction value here.
Check at regular intervals whether the displayed spectrum is correct by using a daylight lamp with a known gas spectrum (e.g., Hg lines). Should it e.g. be evenly shifted by 2nm, enter a value of two if the spectrum is blue-shifted by 2nm and otherwise minus two (-2), if there is a redshift.



CAUTION: Do not make any adjustments unless you are completely sure that you understand them. Some settings can not be undone and require a service at the owner`s expense.

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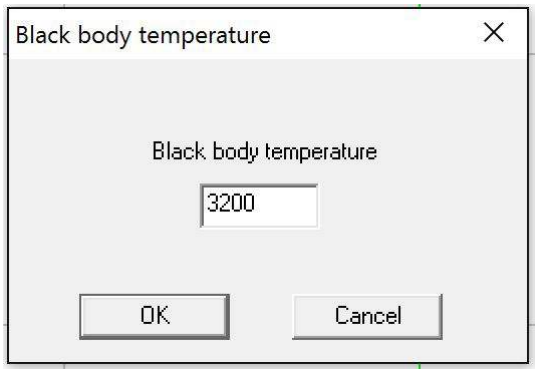
9 Calibration

Plastic calibration
Exclusively for calibration of Raman spectrometers

XYZ Planck calibration
Here, a color calibration can be made. It should **only** be done with light sources of known color temperature.



Get data without calibration
Raw data are gathered without involving calibration.

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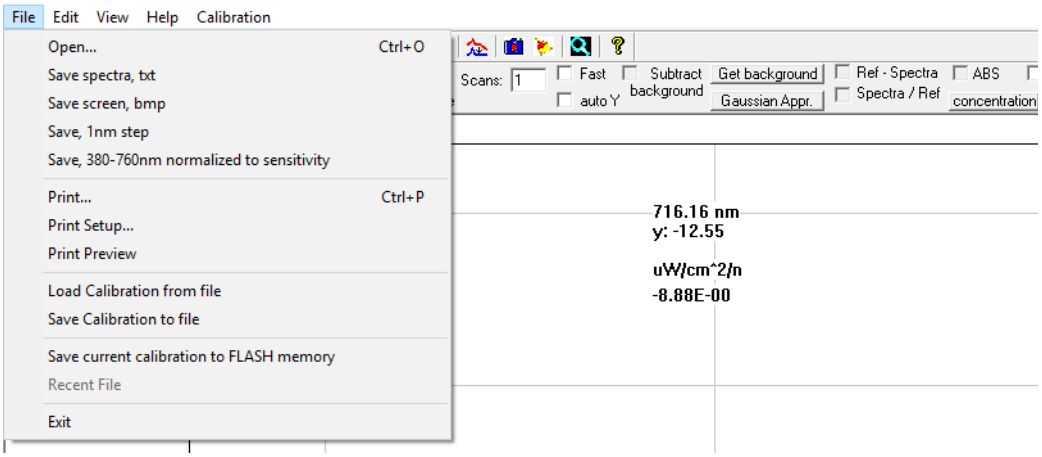
10 Menu item *File*

Further settings can be made under the item ***File*** in the tool-bar.



Save spectra, txt
The recorded spectrum is saved in txt format.

Save screen, bmp
Saves the current program screen as a bmp file.

Save, 1nm step
Saves the spectrum in 1nm steps in txt format.

Save, 380-760 normalized to sensitivity
Saves the current spectrum in consideration of the spectral sensitivity of the sensor in txt format.

Load calibration from File
Loading a calibration file for temporary use (a reset of the calibration, stored in the device, will be made after the program has finished).

Save calibration to file
Saves the calibration currently stored in the device in txt format.

Save calibration to FLASH memory
Saves a loaded calibration file to the device memory.

ATTENTION: this step irreversibly overwrites the original calibration stored in the device.

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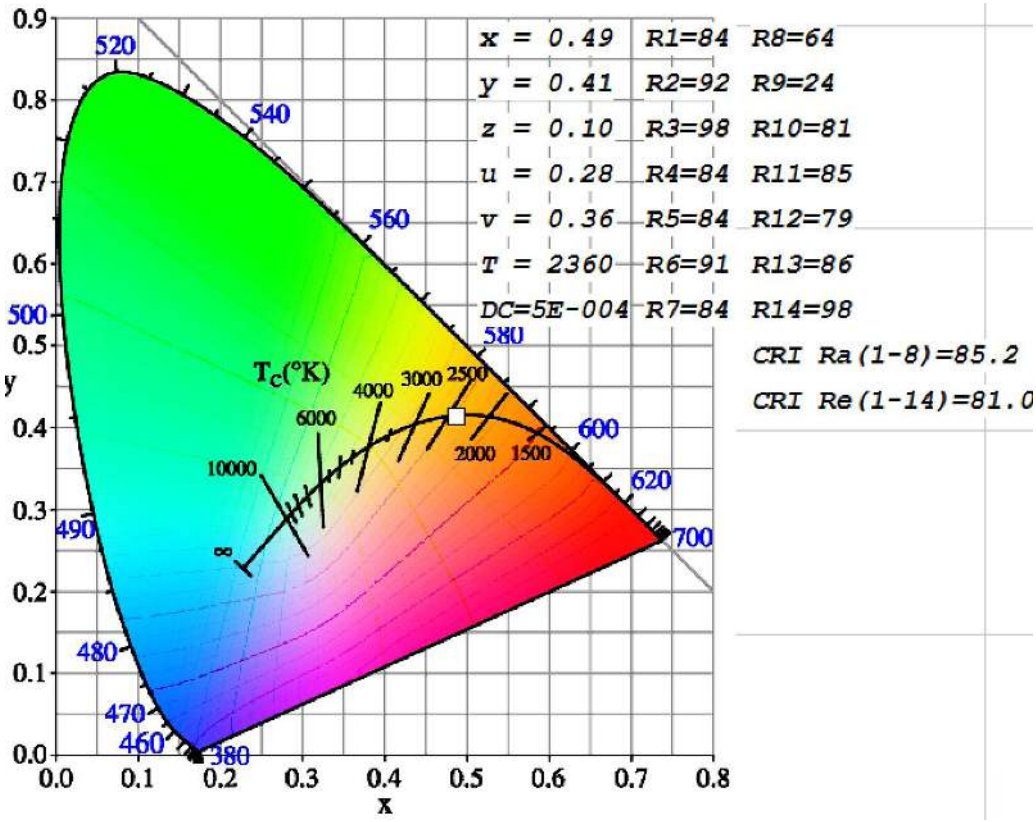
11 Color measurement

The Color calculation allows a comprehensive analysis of color temperature, CRI and other values.
To start the analysis, select the check box ***X,Y space***.



Set ***BoxCar*** to 3 for a smoother spectrum. Then, as described above, remove the background signal.
Now, if you switch on the light source, you will get the values as shown in the picture above.

CAUTION: This measurement option is only available if an XYZ option has been bought additionally.

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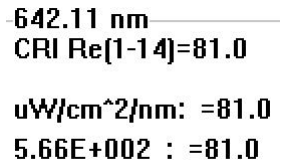
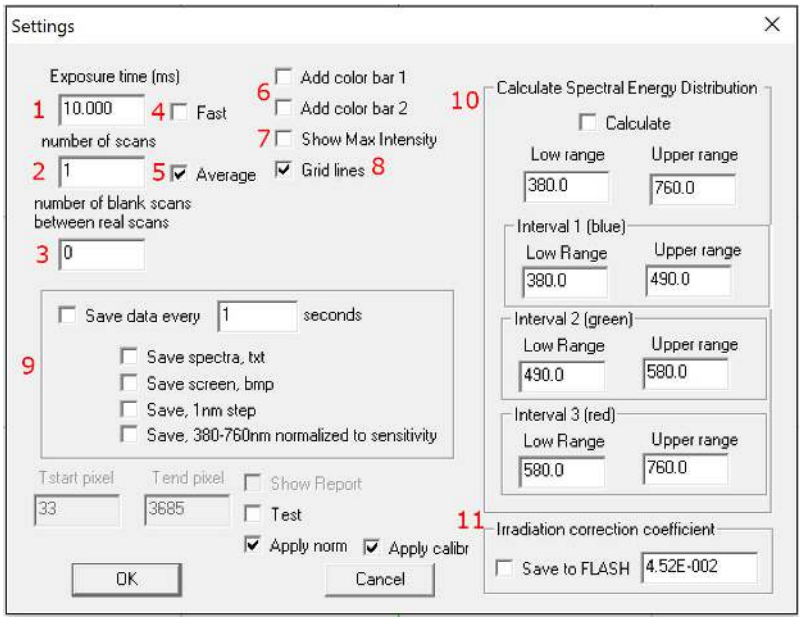
11 Color measurement

In addition, the power of the light source can be displayed in µW/cm²/nm. To do this, right-click on any area within the spectrum.
The display looks like this:



It is also possible to calculate the power in certain spectral ranges.
Therefore, open the advanced settings via the toolbar and go to point ten. Activate ***Calculate***.



You can now define different areas:

- broadband
- narrowband ranges with color separation

It is displayed in µW / cm².

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12 Technical details

model	LR2
sensor	Toshiba TCD1304DG Lineares CCD Array
detector spectrum	200-1200nm
number of pixels	3648
pixel size	8um x 200um
pixel depth	100000 electrons
S/N proportion	400:1 10000:1 with smoothing
1. A/D resolution	16 Bit
2. fiber connection	SMA905
3. diffraktion filter	included
4. exposure time	10us bis 60s
5. memory capacity	64 specta in the device memory
6. data transfer time	200ms
7. trigger options*	external via TTL (4-5V), internal, optical
8. PC Interface	Use of multiple devices possible at the same time
9. operating system	Win XP, Vista, 7, 8, 10, 32/64 Bit
10. software	Spectra, driver, LabView
11. hardware	spectrometer, USB cabel, Fiber probe with SMA coupling
12. conformity	CE
13. weight	430 grams

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13 CE-declaration of conformity

Cathegory	Standards and description	
EC Declaration of Conformity - EMC	Meets intent of Directive 2004/108/EC [1] for Electromagnetic Compatibility. Compliance was demonstrated to the following specifications as listed in the Official Journal of the European Communities:	
	EN 61326-1:2006	Electrical equipment for measurement, control and laboratory use – EMC requirements: Immunity: complies with basic immunity test requirements [2,3] . Emission: complies with EN 55011 Class B Limits [2,3,4] , IEC 610003-2 and IEC61000-3-3.
	IEC 61000-4-2	Electrostatic Discharge Immunity (Performance Criterion B)
	IEC 61000-4-3	Radiated RF Electromagnetic Field Immunity (Performance Criterion A) [5]
	IEC 61000-4-4	Electrical Fast Transient / Burst Immunity (Performance Criterion B)
	IEC 61000-4-6	Conducted RF Immunity (Performance Criterion A)
EC Declaration of Conformity - Low Voltage	Compliance was demonstrated to the following specification as listed in the Official Journal of the European Communities: Low Voltage Directive 2006/95/EC [6]	
	EN 61010-1:2010	
	IEC 61010-1:2010	
Equipment Type	Test and Measuring	
Safety Class	Class III equipment according to IEC 61140	

[1] Replaces 89/336/EEC.
[2] Compliance demonstrated using high-quality shielded interface cables shorter than or equal to 3 meters.
[3] Compliance demonstrated with laser diode dummy installed to the ZIF socket.
[4] Emissions, which exceed the levels required by these standards, may occur when this equipment is connected to a test object.
[5] Ext. Modulation port capped at IEC 61000-4-3 test.
[6] Replaces 73/23/EEC, amended by 93/68/EEC

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