

Linespectrometers

Spectrometer module MS 140



Name	MS 140 CCD	MS 140 PDA
Spectral area UV		200-560 nm
Spectral area UVVIS		200-780 nm
Spectral area VIS		360-790 nm
Spectral area VISNIR		360-1100 nm
Number of pixel	1024x128 option: 1024x256 und 1024 x 64	
Spectral resolution	1,2 nm 1,8 nm 2,0 nm ¹	
Coupling	Standard: SMA – fibre cross section converter with 25 µm slit option: 25 µm slit input	
Multi channel sensor	Back-Illuminated CCD-area sensor	NMOS Photodiode-line sensor
Sensitivity (sensor)	13 photons / count	175 photons / count
Sensor dynamic	65.000:1	32.700:1
Signal dynamic	16 Bit	
Scan time	min. 6 ms for 1024 Pixel programmable to 60 s option min. 1 ms	
Integration time	0,2 ms until max. 60 s	
Operational voltage	+/-15 / 12 VDC, 80 mA and +5 VDC, 120 mA	
Operational temperature	+5 bis +30°C	
Housing	L 180 mm, H 102 mm, D 80 mm	
Signal/Noise	1000:1	8000:1
Options		
Slits	25, 50, 80, 100 and 150 µm	
Shutter	automatically dark currents measurement	
Edge filter	suppression of the second diffraction order on the sensor	

¹ Spectral and spatial resolution also depend on the entrance objective as well as the used imaging sensor/camera and slit.

More suitable sensors for the MS 140

Sensorname	S9840 2048x14	S7030x55	S7030x128	S7030x255	S7031x55	S7031x128	S7031x255
Type	Back-thinned CCD-Array	Back-thinned CCD-Array	Back-thinned CCD-Array	Back-thinned CCD-Array	Back-thinned CCD-Array	Back-thinned CCD-Array	Back-thinned CCD-Array
#Pixel	2048x14	1024x64	1024x128	1024x255	1024x55	1024x128	1024x255
Pixel size $\mu\text{m} \times \mu\text{m}$	14 x 14	24 x 24					
Dark current $\text{e}^-/\text{pixel}/\text{s}$	500 at 25 °C	10 at 0°C; 100 at 25°C					
Active area $\text{mm} \times \text{mm}$	28.672 x 0,196	24.576 x 1392	24.576 x 2928	24.576 x 6000	24.576 x 1392	24.576 x 2928	24.576 x 6000
Readout noise	25 e^- rms	8 e^- rms					
Spectral range	200-1100 nm						
Frequency	Max. 5 MHz	Max. 1 MHz					
Sensor cooling	none				thermoelectric cooler		
PRNU	+/- 3%						
Window	Quartz glass (Option: Window-less)				AR-coated sapphire (Option: Window-less)		
Frame rate full line binning	461 fps	192 fps	160 fps	120 fps	192 fps	160 fps	120 fps

More aberration corrected Flat-Field gratings for the MS 140

Model	Grooves density (l/mm)	Wavelength range (nm)	Spectrum length (mm)	Dispersion (nm/mm)
103	285	190-800	25,2	24,2
104	285	250-850	24,7	24,3
202	140	190-800	12,2	50,0
1602	405	285-715	25,6	16,8
1603	405	190-410	12,8	17,2
1604	405	190-625	25,6	17,0
1605	405	380-780	24,0	16,7
1824	230	400-1100	23,3	30,0
1825	230	380-780	13,2	30,3

Compact spectrometer MST-IGA with InGaAs-sensor technology

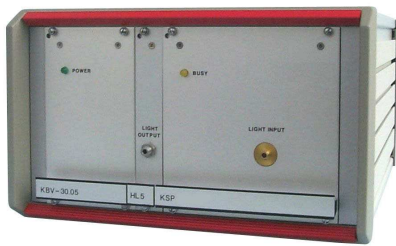


Name	MST-IGA 1.7 S	MST-IGA 1.7 H	MST-IGA 2.0	MST-IGA 2.2	MST-IGA 2.5
Spectrograph	f = 50 mm, VPH-transmission grating				
Spectral range	850-1670 nm	850-1670 nm	950-2050 nm	950-2250 nm	1150-2550nm
Number of pixels	256	512	256	256	256
Spectral resolution	6,2 nm	2,2 nm	10 nm	10 nm	14 nm
Coupling	Standard: SMA – fibre cross section converter with 50 µm slit Type H 25 µm slit, others available				
Sensor	InGaAs sensor with integrated single-stage, thermoelectric cooling		InGaAs sensor with integrated two-stage, thermoelectric cooling		
Edge filter	Suppression of the second diffraction order on the sensor				
Sensor dynamic	12.500:1 (@ 100 kHz)				
Signal/Noise (S/N)	4.000:1 (number of integrations: 1)				6500:1 (number of integrations:1)
Scan time	3 ms	6 ms	3 ms	3 ms	3 ms
Integration time	Programmable from 0.2 ms until max. 60 s				
Sensor cooling	Max. -20°C	Max. -20°C	Max. -25°C	Max. -25°C	Max. -40°C
Operational temperature	+5 to +35°C		+5 to +30°C		
Housing	L 220 mm, H 80 mm, D 80 mm				
Options					
Shutter	automatically dark currents measurement				
Slits	25, 50, 80, 100 and 150 µm				

Czerny-Turner spectrometer CT75

The miniaturised and symmetrically constructed Czerny-Turner spectrometer module (focal distance 75mm) offers, by means of its large selection of usable optical plane gratings, a multiplicity of spectral measurement ranges and resolutions. Slit widths from 10 to 500 μm are available, which are implemented with respect to the resolution and light throughput depending on the requirement of the applications. Detector coatings to increase the sensitivity in the UV and a collecting lens for bundling the light to the sensor are optionally available.

In conjunction with simple CCD line sensors, very affordable spectral systems can be manufactured. Equipped with a high-quality photodiode array or back-thinned sensors, even higher requirements in signal dynamics and (UV) sensitivity can be fulfilled.



Bezeichnung	CT75-2048	CT75-2048 TEC	CT75-2048x14	CT75-3648	CT75-3648 TEC
Sensortype	CCD line sensor	CCD line sensor	CCD area sensor	CCD line sensor	CCD line sensor
#Pixel	2048	2048	2048x14	3648	3648
Pixel size	14 μm x 56 μm	14 μm x 56 μm	14 μm x 14 μm	8 μm x 200 μm	8 μm x 200 μm
Sensitivity (sensor)	40 photons/count	40 photons/count	50 photons/count	60 photons/count	60 photons/count
Signal/Noise	200:1	200:1 uncooled ²	500:1	350:1	350:1 uncooled ²
Wavelengthrange	200-1100	200-1100	200-1160	200-1100	200-1100
Frequency	2 MHz	2 MHz	1,5 MHz	1 MHz	1 MHz
Cooling	none	$\Delta T = -25$ to -30°C below ambient temperature	none	none	$\Delta T = -25$ to -30°C below ambient temperature
Options					
Slit widths	10, 25, 50, 100, 200 and 500 μm				
Edge filter	Suppression of the second diffraction order on the sensor				
Cylindrical lense	Increase of sensitivity				
UV-coating	Increase of sensitivity in the UV				

² reduce of dark currents for measuring period > 5 s by facot 2-3

Combined compact-spectrometer for UV-VIS-NIR applications with LCCD- and InGaAs-sensor technology short: *Bi_Spec*

The combined spectrometer consists of two optical banks which are made up of the devices MST, MS140 or CT 75 depending on the selection made. The sensors are steered by operational electronics and work for the user like a single spectrometer. The interface is implemented as with all other devices and the spectra can be, as well as with all other devices, processed further without delay.

The technical data consists of the selection of the optical units. For more detailed information, we are happy to offer you a consultation.

- Measurement range from 200 nm to 2500 nm
- Only one unit with two spectrometers
- Good sensitivity
- Large and small spectral ranges
- Permanently adjusted construction



Spectral Imaging spectrographs



Spectral Imaging spectrograph
IST-UV 0.2440 for the UV area

Name	IST-UV 0.2440	IST- VIS 0.3878	IST-VIS 0.38100	IST-VNIR 0.65100	IST-NIR 0.85170	IST-NIR 1117
Spectral range nm	240-400	380-780	380-1000	650-1000	850-1700	1050-1700
Dispersion nm/mm	23,5	66	99	70	90	67
Spectral resolution FWHM	< 1nm with 30 μ m slit	7,2nm with 50 μ m slit	11nm with 50 μ m slit	9 nm with 30 μ m slit	9 nm with 50 μ m slit	7 nm with 50 μ m slit
Spectral image size	8 mm	Max. 10 mm	Max. 10 mm	Max. 10 mm	Max. 10 mm	Max. 10 mm
Local image size	8 mm	14 mm	14 mm	14 mm	14 mm	14 mm
Local resolution rms spot radius	< 30 μ m	< 35 μ m	< 35 μ m	<10 μ m	< 20 μ m	< 20 μ m
Grating performance	>45%	>40%	> 40%	>60%	>45%	>45%
Scattered light	< 1%					
Spectrograph angle	15,2°	10°	8°	15°	15°	23°
Options						
spectral range and dispersion can be customized to your application						
Slit sizes	10, 20, 30, 50, 80, 100, 150, 200 μ m special designs on request					
Entrance objectives	optimized objectives for the used spectral range can be purchased at inno-spec on request					
mathematical correction of Smile- and Keystone-aberrations						

Spectral Imaging systems: SpectralEyes

The Spectral Imaging systems are all-in-one devices which (except the LCTF-System) consist of a Spectral Imaging spectrograph (page 6), a Smart Camera with GigE data transfer and a PC based real-time classification system (page 9ff). This system is also available with USB interface. At the Mini SpectralEye the data evaluation is made by DSP and Microcontroller.

Name	SpectralEye USB	SpectralEye Ethernet	SpectralEyeRed17	LCTF-System	Mini SpectralEye
Typical spectral range	VIS-NIR, je nach Anwendung	VIS-NIR, je nach Anwendung	950-1700 nm	400-1100 nm	300-1000 nm possible
Spectrometer	IST-xxx, depending on application	IST-xxx, depending on application	Transmission VPH Grating	-----	Transmission VPH Grating
Standard entrance objective spectrometer	C-mount mega pixel objective	C-mount mega pixel objective	For NIR optimized C-mount objective	-----	C-mount mega pixel objective
Sensor	Monochrome CMOS	Monochrome CMOS	InGaAs FPA Sensor	Front-illuminated interline CCD	Monochrome CMOS
Data interface	USB 2.0	Gigabit Ethernet	Gigabit Ethernet	FireWire	USB 2.0
Data depth	12 bit (exemplary)	12 bit (exemplary)	14 bit	14 bit	10 bit
framerate (full frame)	14 fps full resolution @ 12 bits (exemplary)	14 fps full resolution @ 12 bits (exemplary)	Ca. 330 Hz	10,9 fps full resolution @ 14 bits	15 fps full resolution @ 10 bits
Pixel size	2.2 μm x 2.2 μm (exemplary)	2.2 μm x 2.2 μm (exemplary)	30 μm x 30 μm	6.45 μm x 6.45 μm	5,2 μm x 5,2 μm
Resolution	5 MP (exemplary)	5 MP (exemplary)	310 x 250	1392 x 1040	1,3 MP
Pixel rate	96MHz (exemplary)	96MHz (exemplary)	40 MHz	20 MHz	48 MHz

Options/Appendix

on demand the SpectralEye products can be equipped with other camera sensors (page 8)

adequate thermal halogen lamps or LED-based multispectral illuminations can be purchased at inno-spec

because CMOS or CCD sensors are also sensitive at lower wavelengths, spectrographs should be operated with primary or edge filters. Moreover special filters can optimise the spectral intensity characteristics.

generally we use C-mount mega pixel objectives from the Machine Vision. For VNIR optimized objectives can be purchased at inno-spec

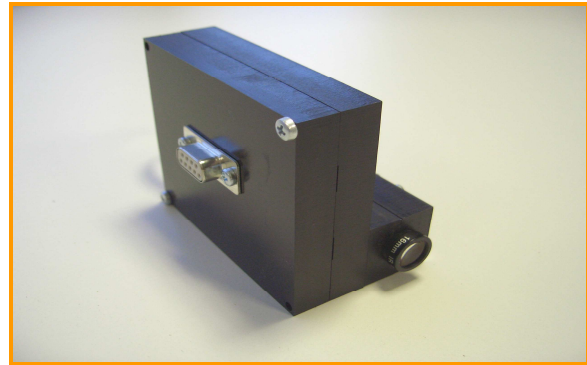
on demand a gain matrix for a hard-coded system for distortions like Smile and Keystone can be purchased at inno-spec

spectral range and dispersion can be customized to your application

spectral and spatial resolution also depend on the entrance objective as well as the used imaging sensor/camera and slit



SpectralEye system

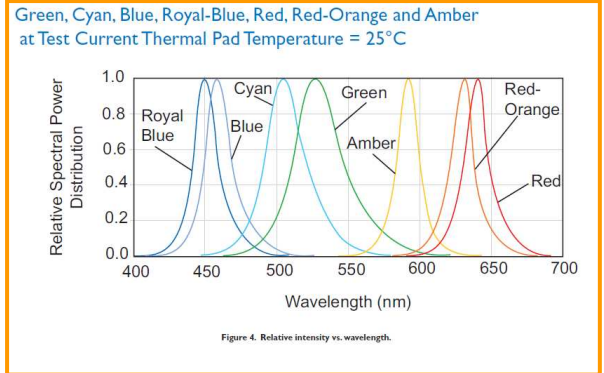
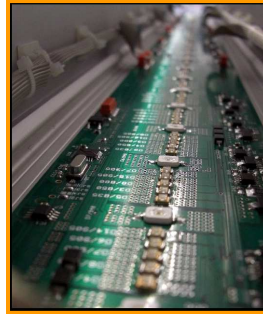
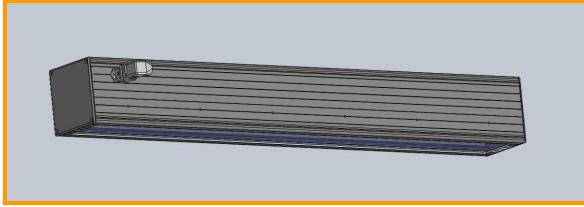


Mini SpectralEye

Available camera sensors for the SpectralEye system

Name	MT9P031	MT9M001C12STM	FPA-320x256 für RED17
Sensortype	CMOS	CMOS	InGaAs
Data depth	12 bit	10 bit	---
Resolution	5MP	1MP	320 x 256
Pixel size	2.2 μm x 2.2 μm	5.2 μm x 5.2 μm	30 μm x 30 μm
Pixel rate	96 MHz	48 MHz	10 MHz
Frame rate (full frame)	15 fps full resolution	30 fps full resolution	max. 350 fps full resolution
Active area	5.70mm(H) x 4.28mm(V)	6.66mm(H) x 5.32mm(V)	9.6mm(H) x 7.68mm(V)

LED illuminations



Bezeichnung	VNIR LED Multispectral Line	RGB LED Flash Line
Wavelengthrange	830 – 915 nm	Red, Green, Blue = VIS
Mean LED-lifespan	50.000 h	
Working distance	Standard 300 mm	200-1000 mm possible
Features	0 – 100% 255 step controlled PWM	2 – 257 μ s (adjustable in 1 μ s steps)
Illuminated line mm	750 x 14 at a length of 950 mm	
Housing L x B x H mm	950 x 120 x 120 <i>modular length</i>	
Weight	5,2 kg at a length of 950 mm	

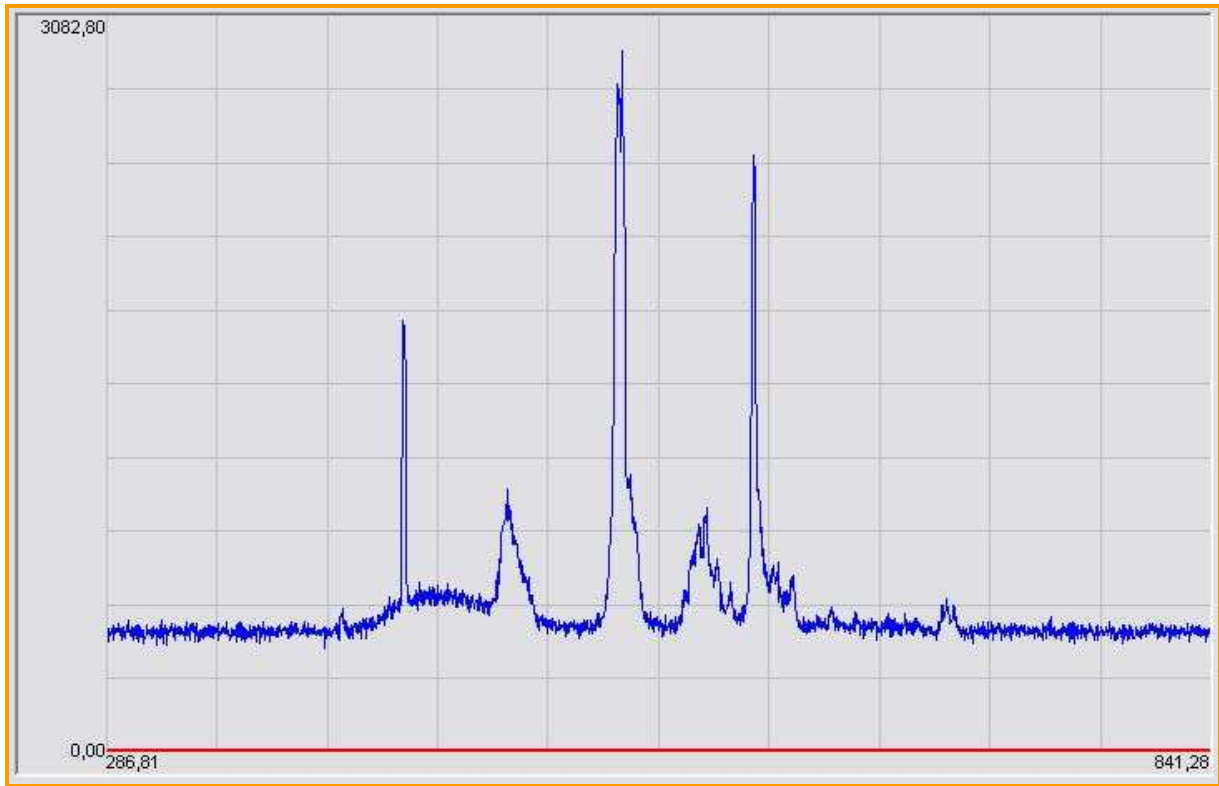
Software

- OMSDATA-05
- ir Analyze
- SICap-LCQC
- Panorama
- ScanViewer

OMSDATA-05

OMSDATA-05 is created to control the spectrometers of the inno-spec GmbH. It controls the hardware and makes the data transfer. The information is been visualized and can be saved as spc- and txt-files. The evaluation is made by third party programs like Panorama.

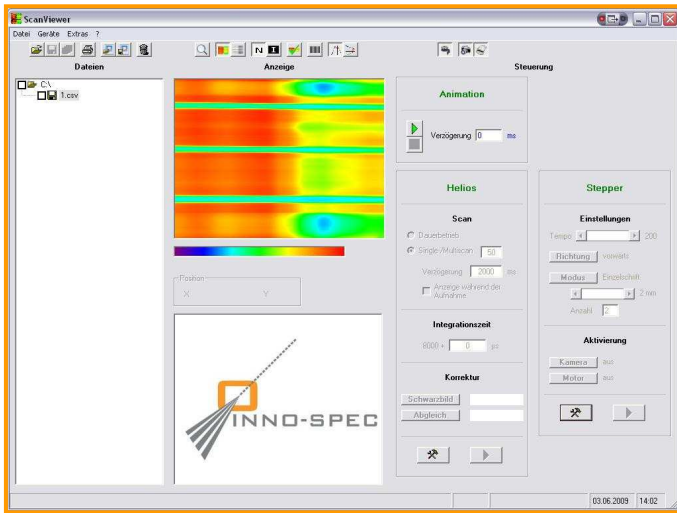
The graphic window shows the captured spectra.



Moving the mouse over the graphic window a green **crosshair** appears. It visualizes the values shown at **data**. With one single click the **crosshair** can be fixed to a wavelength. It will stay there though you move the mouse. That is quiet interesting in **Continuous Scan** because the crosshair will follow the varying intensities. If you click again the crosshair will be detached.

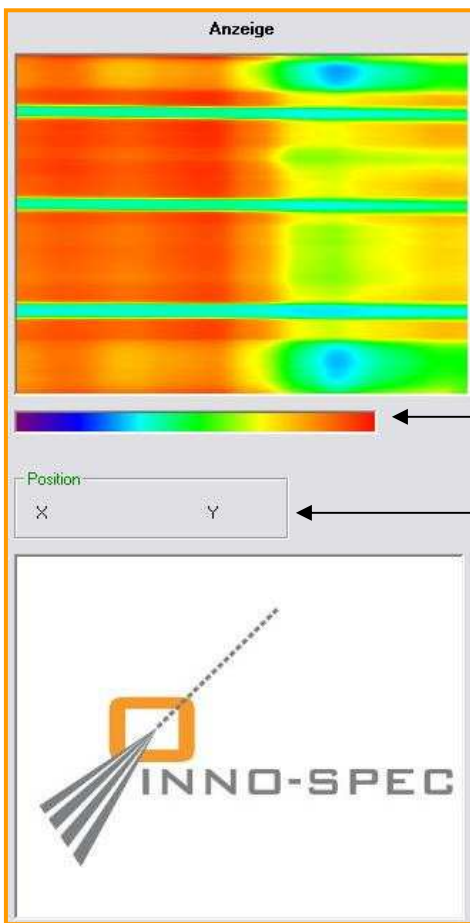
Integration Time: 1 RET: 14 ms Auto gain	Scan: Single Start Multi Scan count: (3 ... 500) 3 Start Scan Nr.: / < > << >>	Correction: Reference Start Dark scan <input type="checkbox"/> Enabled Start	Data: Intensity: Wavelength [nm]: Pixel#: 286,81 - 841,28 Range:	Summation: <input checked="" type="checkbox"/> Summation enabled Summand count: Mean: Sum: Sum accumulated:	Count: 0 Startpixel: 0 Endpixel: 1023 Corr.-Pixel: 765 Corr.-Val.: 0 Add Reset
--	--	--	---	---	--

ScanViewer



ScanViewer ist made to control a Helios camera, a Xenics camera and a stepper. The visualized data can be saved as svi-/csv-files or as jpg-/bmp-graphics. The evaluation is made by a third party program like Panorama. The main window is separated into three parts:

- data
- readout
- control and state region.



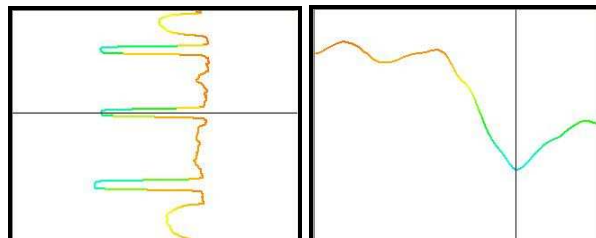
graphic window: The graphic window shows the opened and/or captured spectra and/or graphics.

colour bar: the colour bar shows the colour theme used in the graphic window

mouse position: If you move the mouse inside of the graphic window the x- and y- coordinates can be seen under position. Is a spectrum exposed, the x-coordinate gives you the wavelength concerning to that position.

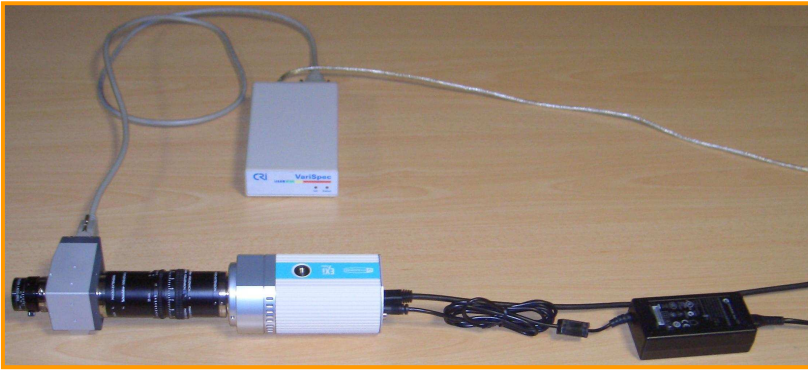
profile: If in the graphic window a spectrum is shown and the mouse is moved over the graphic window you can see a cut through the x- or y-coordinate where the cursor is located in the profile.

Position
X 242 [1537,78 nm] Y 188



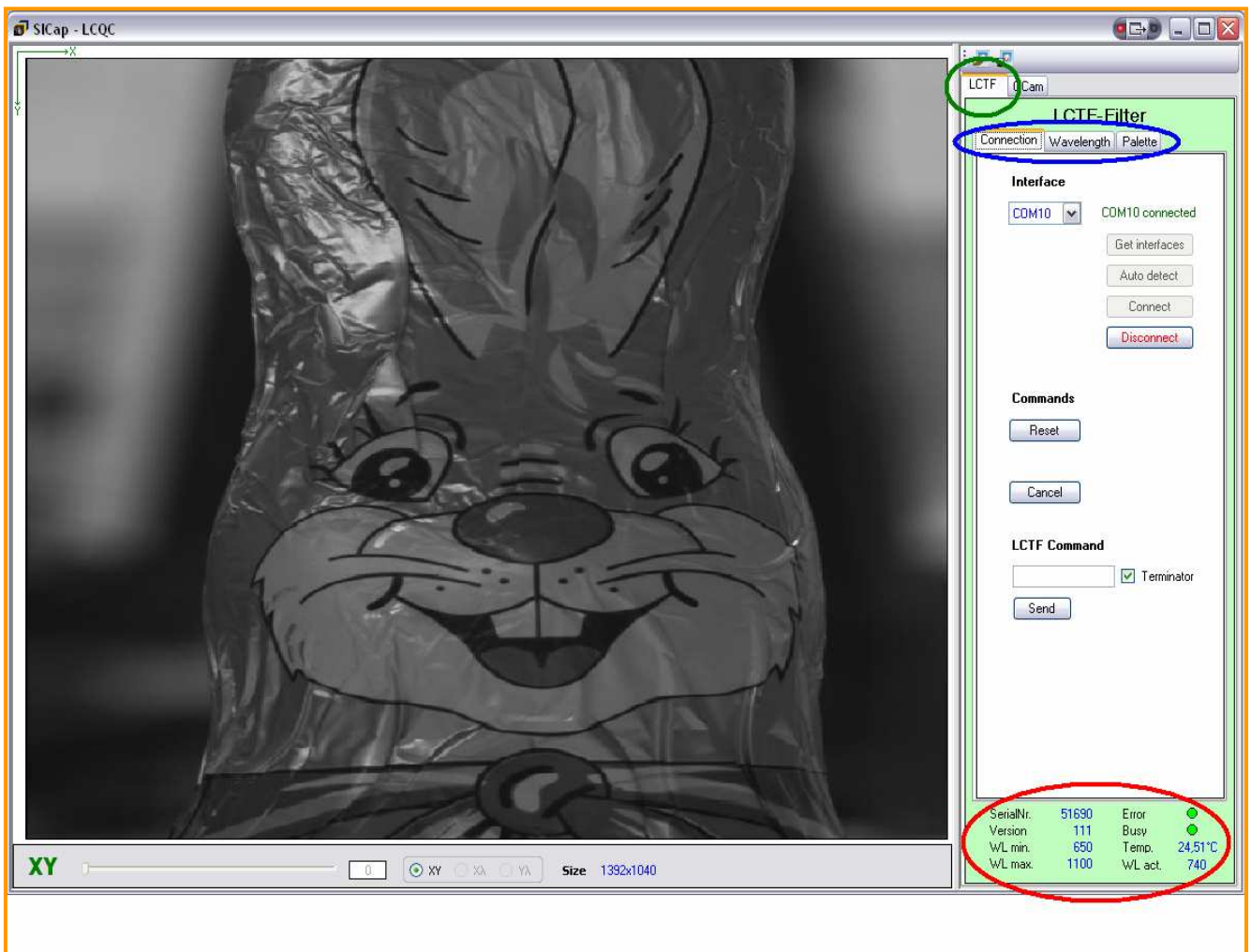
cut through x-and y-coordinate

SICap-LCQC



The software SICap-LCQC is created to control QImaging cameras in combination with CRI LCTF filters. With this program almost all hardware functionality can be controlled. Images can be captured with 8 or 16 bit data depth, stored and loaded in ENVI binary or multiple bitmap formats.

The LCTF filter controls are separated by three registers (**Connection**, **Wavelength** and **Palette**) and a **state region** at the bottom of the LCTF control module.



LCTF-Filter

Connection
Wavelength
Palette

Palette

	Nr.	WL
▶	0	650
	1	660
	2	750
	3	800
	4	760
	5	740
	6	850
	7	900
	8	1000
	9	1100
*		

Dwell time: ms

Auto
 Manual
 Cam

Set
Clear

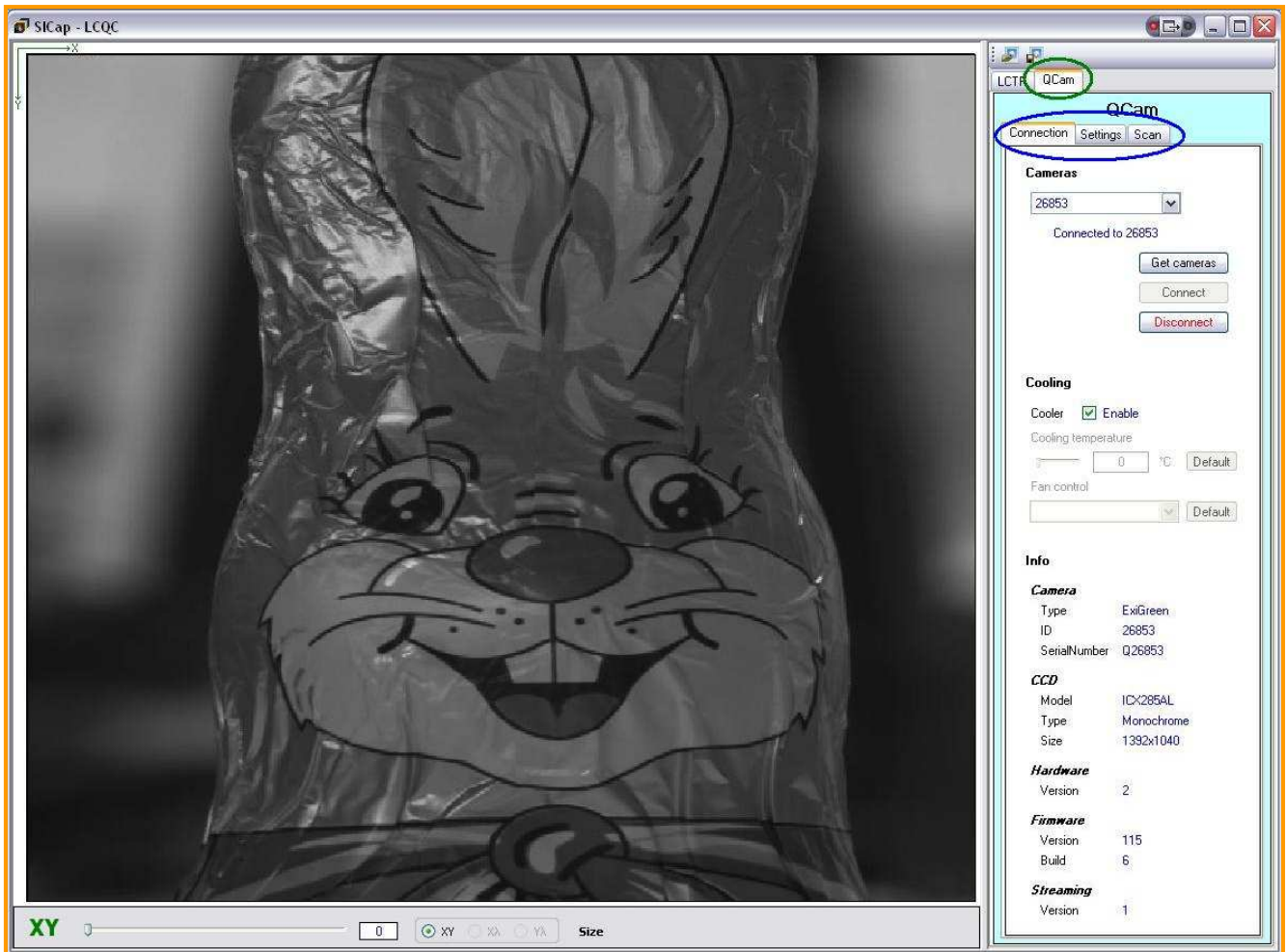
<
Get
Jump
>

Start

The **Palette** register contains functionality to move the filter wavelength by setting up a table with various wavelength values.

The **Palette table** shows the wavelengths the filter will be moved to in **Palette mode**.

	Nr.	WL
▶	0	650
	1	660
	2	750
	3	800
	4	760
	5	740
	6	850
	7	900
	8	1000
	9	1100
*		



The camera controls are separated by three registers ([Connection](#), [Settings](#) and [Scan](#)). To switch to the **QImaging camera control** module, select the **QCam** register on the right top of the main window. The **Settings** register contains controls to parameterize the camera.

Camera Camera type, unique ID and serial number.

CCD Sensor model, color type and maximum image size.

Hardware Hardware version.

Firmware Firmware version and build.

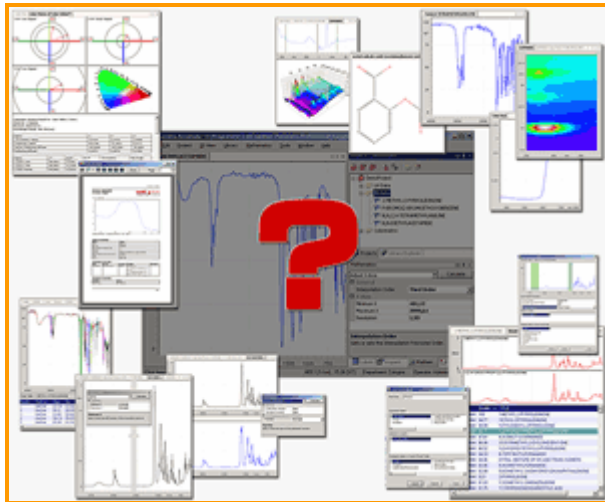
Streaming Streaming version

Info	
Camera	
Type	ExiGreen
ID	26853
SerialNumber	Q26853
CCD	
Model	ICX285AL
Type	Monochrome
Size	1392x1040
Hardware	
Version	2
Firmware	
Version	115
Build	6
Streaming	
Version	1

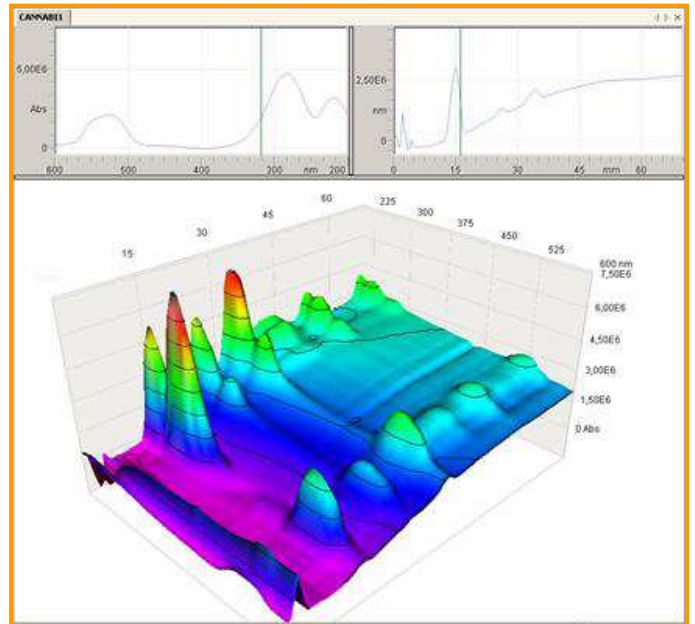
Panorama

Panorama is a modular laboratory software solution for spectroscopic data...

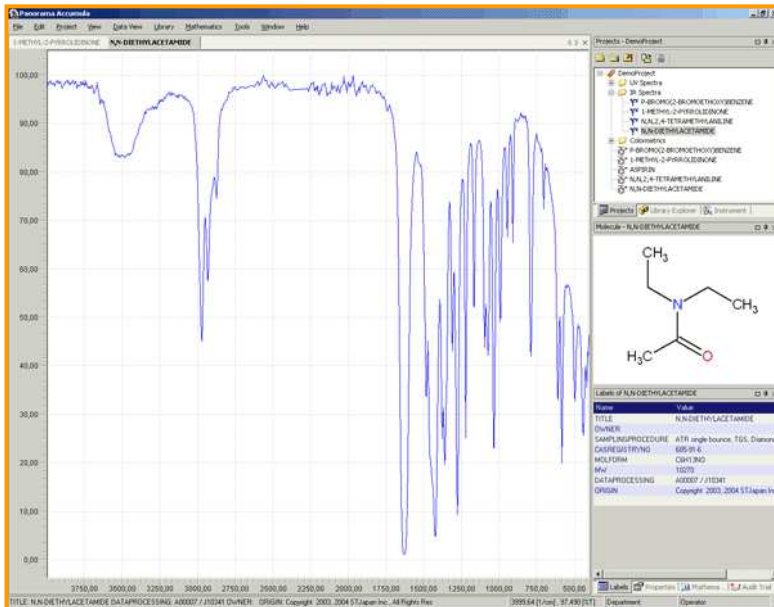
- Measurement with an instrument
- 2D & 3D data visualization
- Data optimization
- Mathematical evaluation
- Archiving in spectral libraries including additional information
- Searching in libraries
- Chemometric evaluation and prediction
- Printing with professional print templates
- Converting of many known data formats
- Sharing data with other office applications



source: <http://www.labcognition.com>



source: J&M Analytische Mess- und Regeltechnik GmbH, Robert-Bosch Str. 83, 73431 Aalen



source: <http://www.icamp.org/testdata/testdata.zip>

ir Analyze

irAnalyze is a sophisticated tool assisting you with IR spectrum interpretation. The workflows in irAnalyze are straight forward and efficient. The two main interpretation targets are shown below, but irAnalyze is more than that. Infrarot Spektreninterpretation

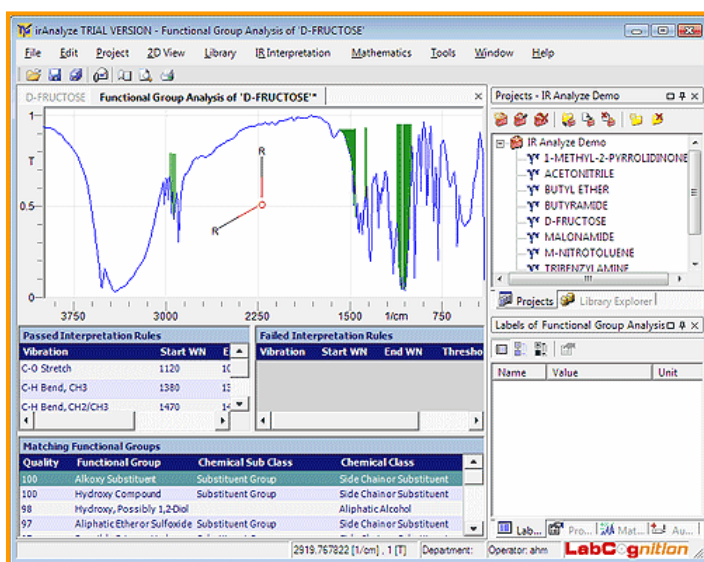
- Load your IR spectrum
- Click on IR interpretation
- Review the functional group assignments from automatic interpretation
- Optimize the obtained results with your knowledge.

Only a few clicks are necessary to provide you with reliable functional group assignments. IR spectrum interpretation becomes an easy job even for unexperienced users. You save a lot of time compared to the challenging manual interpretation based on printed IR frequency catalogs and functional group tables.

When you are analyzing an IR spectrum you want to know the functional group's name being responsible for a peak at a particular frequency. You also want to know related vibrations, vibration names and their frequencies. The electronic functional group dictionary answers your questions quickly.

- Load your IR spectrum
- Enable the online functional group dictionary
- Move the spectrum cursor to the frequency of interest.
- Review the list of potential functional groups sorted by matching quality.

There is no need anymore to dig in printed IR frequency catalogs. You neither need to know the functional group names nor their characteristic frequencies. irAnalyze knows them all for you.



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