



# Spectral Cameras

Cased & OEM Versions

for Next Generation Imaging

**Spectral Camera produces the image of the target at tens or hundreds of wavelengths simultaneously.**

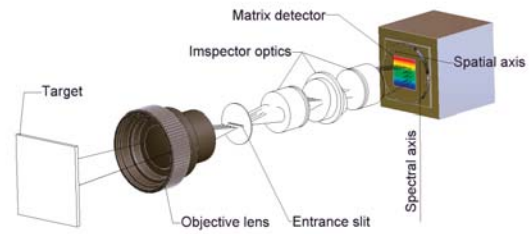
Spectral Camera is an integrated combination of ImSpector imaging spectrograph and a matrix camera forming a spectral imaging device in one compact package, which suits **both industrial and scientific applications**

Compared to conventional filter based imaging systems, Spectral Cameras provide high spectral and spatial resolution, flexible wavelength selections in software, and broad spectral coverage.



# Spectral Cameras

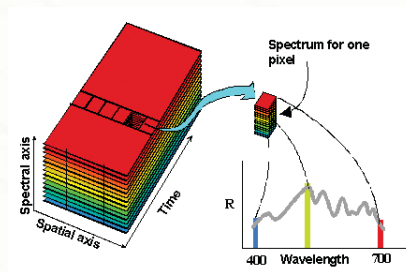
Spectral Camera is an integrated combination of ImSpector imaging spectrograph and an area monochrome camera. It works as a line scan camera, and provides full, contiguous spectral information for each pixel. Spectral resolution can range from ca. 2nm to 20nm.



Principle of spectral camera

The Spectral Camera Family is expanding with new members:

- **VIS (380-780nm)** cameras for precise industrial color control and matching, scanning of art work, display and printer testing...
- **VNIR (400-1000nm)** cameras for biomedical, forensic and counterfeit applications and light source testing...
- **UV (200-400nm) and NIR (900-1700 & 1000-2400nm)** cameras for material analysis in plastic identification, pharmaceutical quality control, paper industry...
- SPECIM is developing very high speed VIS and VNIR Spectral Cameras for on-line inspection and sorting applications.



Principle of spectral imaging



Paper web monitoring.  
Pictures: Metso Automation, Finland  
([www.metsoautomation.com](http://www.metsoautomation.com))



Document inspection.  
Pictures: MSMacroSystem, the Netherlands  
([www.msmacroSystem.nl](http://www.msmacroSystem.nl))

SPECIM offers a range of spectrally corrected fore lenses for the Spectral Cameras. Also instead of a fore lens, multiple channel fiber optics can be coupled to the input of the spectral camera.

If our standard cameras do not meet the needs of the application, then another commercial camera can be integrated to one of our OEM imaging spectrographs to create a spectral camera.

# Spectral Camera Standard versions

## Specifications

	<b>Spectral Camera B</b> <i>- Low cost, base model</i>	<b>Spectral camera QE</b> <i>- Scientific model</i>	<b>Spectral Camera VGA</b> <i>- Industrial uses</i>
<b>Electrical characteristics</b>			
Sensor	CMOS	CCD	CCD
Pixels in full frame	1280(spatial) x 1024(spectral)	1344(spatial) x 1024(spectral)	640(spatial) x 480(spectral)
Interface	USB2, 12 bits	Firewire, 12 bits	12 bits, PCI grabber included
Frame rate	Up to 14 fps Higher speed with addressable line readout	8 fps Up to 43 fps with binning	40 fps 140 fps, binning vert. 4x
Dynamic range	68 dB (2750:1)	65 dB (1800:1)	65 dB (1800:1)
<b>Optical characteristics</b>			
Imaging spectrograph options	V8, V8E (380-780nm) V10, V10E (400-1000nm)	V8, V8E (380-780nm) V10, V10E (400-1000nm)	V8 (380-780nm) V9 (430-900nm)
Fore lens options	OL8, OL12, OL17, OL23, OL35 OLE17, OLE23	OL8, OL12, OL17, OL23, OL35 OLE17, OLE23	OL8, OL12, OL17, OL23, OL35
For other optical characteristics, see the corresponding ImSpector imaging spectrograph data.			
<b>Mechanical characteristics</b>			
Size, cased (L x W x H)	-	-	197 x 70 x 60 mm
Size, OEM (L x W x H)	220 x 50 x 58 mm with V8/V10 260 x 60 x 70 mm with V8E/V10E	280 x 65 x 72 mm with V8/V10 320 x 65 x 80 mm with V8E/V10E	195 x 51 x 58 mm
User adjustments	None	None	None
Lens mount	Standard C-mount	Standard C-mount	Standard C-mount
<b>Environm. characteristics</b>			
Operating	+5 . +40 °C, non-condensing	+5 . +40 °C, non-condensing	+5 . +40 °C, non-condensing
<b>Software</b>			
	SpectralCube	SpectralCube	CubiCo

	<b>Spectral Camera UV</b>	<b>Spectral Camera NIR</b>	<b>Spectral camera SWIR</b>
<i>- Models are suitable for industrial and scientific use</i>			
<b>Electrical characteristics</b>			
Sensor	CCD	InGaAs	MCT
Pixels in full frame	1000(spatial) x 1000(spectral)	320(spatial) x 256(spectral)	320(spatial) x 256(spectral)
Interface	Camera Link, 12 bits	USB2, 12 bits	14 bits, PCI grabber included
Frame rate	33 fps Up to 150 fps with binning	30 fps	Up to 100 fps
Dynamic range	59 dB (920:1)	60 dB (1000:1)	68 dB (2400:1)
<b>Optical characteristics</b>			
Imaging spectrograph options	UV4E (200-400nm)	N17B, N17E (900-1700nm)	N24E (1000-2400nm)
Fore lens options		OLE22, OLE30, OLE50	OLE22, OLE30, OLE50
For other optical characteristics, see the corresponding ImSpector imaging spectrograph data.			
<b>Mechanical characteristics</b>			
Size, cased (L x W x H)	-	-	430 x 215 x 220 mm
Size, OEM (L x W x H)	245 x 90 x 100 mm	235 x 100 x 108 mm with N17B 320 x 100 x 115 mm with N17E	-
User adjustments	None	None	None
Lens mount	Standard C-mount	Standard C-mount	Standard C-mount
<b>Environm. characteristics</b>			
Operating	+5 . +40 °C, non-condensing	+5 . +40 °C, non-condensing	+5 . +40 °C, non-condensing
<b>Software</b>			
	SpectralCube (coming)	CubiCo, SpectralCube	SpectralCube



Cased version



OEM version

# Spectral Imaging Software

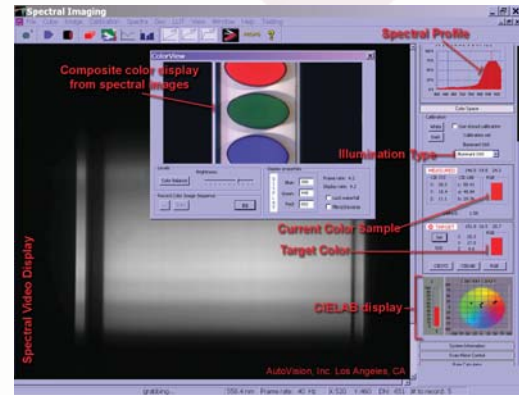
- Support for a range of cameras with USB2, IEEE-1394/ Firewire, Camera Link and LVDS interfaces for setting acquisition parameters like integration time, frame rate and region of interest,

- Display interface
  - spectral video window
  - color composite image display
  - spectral plots

- Recording control of spectral images (data cubes) to hard disk. Data format is compatible to ENVI processing software.

- Wavelength calibration from a file.

- White and dark field corrections.  
To setup the corrections, white and dark field images are stored for correction calculations. A white reference (white material of known reflectance) is placed at the image plane and its image is saved; a dark image with a shutter or f/stop of the lens closed is imaged and saved as well. The two images provide the offset and gain correction for all subsequent images.



## SpectralCube options

- Color calculation and statistics:  
Converts spectrum to CIEXYZ and CIELAB color coordinates and calculates the color distance or delta E(AE) from target colors. Colors and coordinates are displayed on the color panel.
- Scanning mirror control for acquiring 2D spectral images over stationing targets.
- X-stage control for sample movement.

## MicroCube software

- For spectral microscopy, with controls for high accuracy microscope staging.

