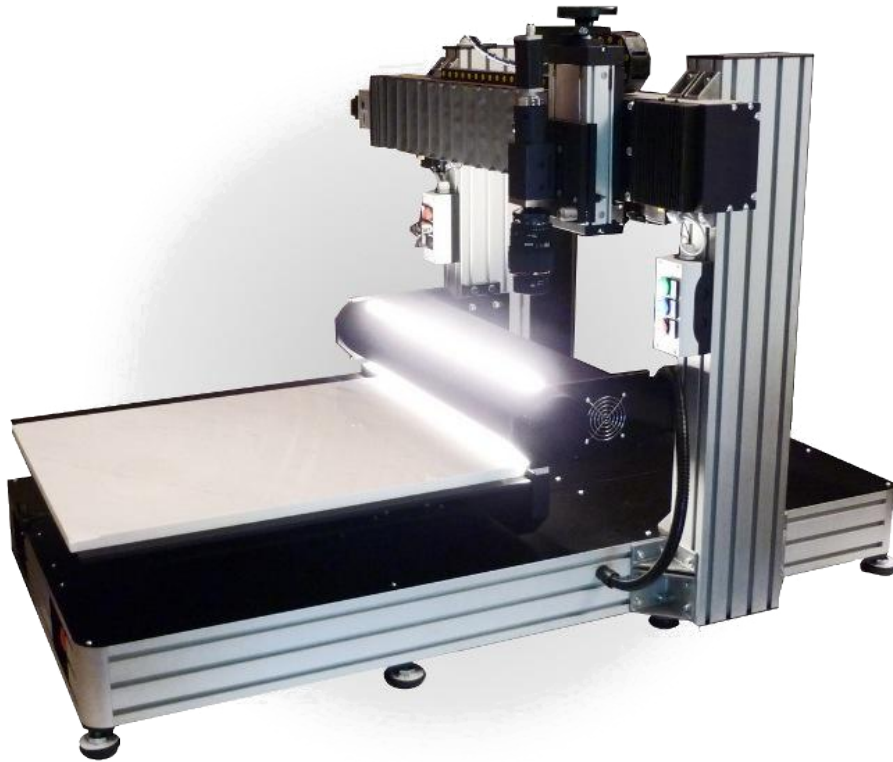# SPECTRAL SCANNER

The Spectral Scanner, produced on an original project of DV s.r.l., is an instrument to acquire with extreme simplicity the spectral distribution of the different wavelengths (spectral composition) of every single point of the inspected object. This represents a great advantage compared to traditional spectrophotometers which can perform the spectral analysis of only a single point at a time, or integrate the radiation from a whole area, losing the punctual localised information of the area.

the scanner is a useful tool for laboratories that industrial line for quality control and research of new techniques for improving production. The fields of application are in the printing industry, tile and wood industry, food, recycling, biology..
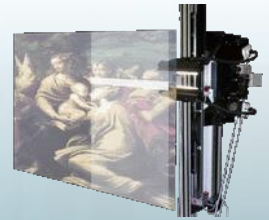
| Colour analisys and processing | Food analysis | Recycling | Biology Medical | Restoration |

Principles of operation

Let's suppose we want to reconstruct the image in Figure 1a, in which is indicated the line that the instrument is analyzing at a given time. This line crosses 4 samples of uniform color arranged on white background and illuminated by a light source almost spectrally uniform. In Figure 1b is represented in grayscale, the frame acquired in correspondence to this line: the spatial information relating to each pixel of this remains in horizontal axis (spatial axis) while the vertical axis (spectral axis) moves from 400 nm (bottom) to 700 nm (top).

The light intensity at various wavelengths shown in grayscale in Figure 1b, is represented on the y axis of the Cartesian chart in Figure 1c, for 4 points within the individual samples..
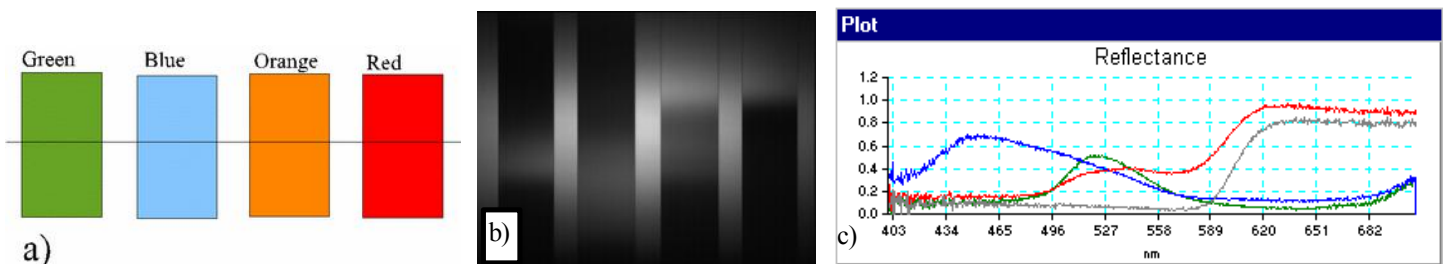
This analysis is obtained, as in the configuration in Figure 2, using a Spectral Camera, which is a line spectrometer coupled with a monochrome camera.
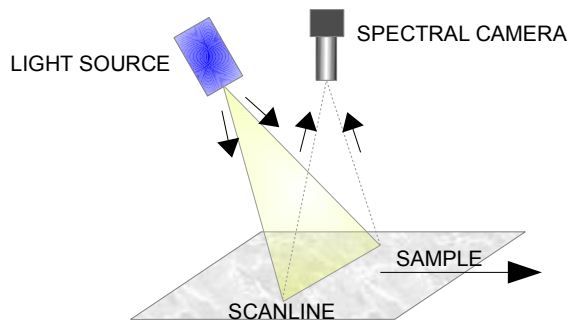
This device, as used in the SpectralScanner©, presents an entrance slit that acquires a sample line through an appropriate focusing optics. The light is collimated by lenses and spectrally dispersed by a dedicated optical system in the vertical direction on a two-dimensional matrix of photosensitive elements. Each pixel of the detector acquires the light intensity of a specific frequential component of the spectrum, in a particular point on the scanline.
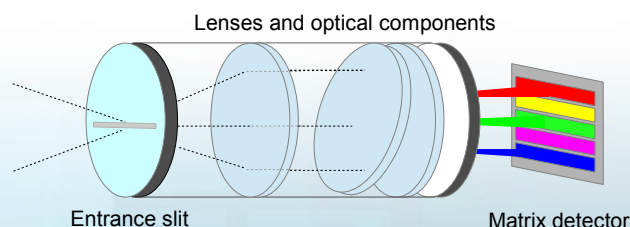
The Software controls through the serial port the movement of the sample or of the optics in ordero to acquire, line after line, the entire surface of interest. SpectralScanner© reconstructs 2D images making available the spectra, with the spectral and spatial resolutions of the optics, for each point of these.
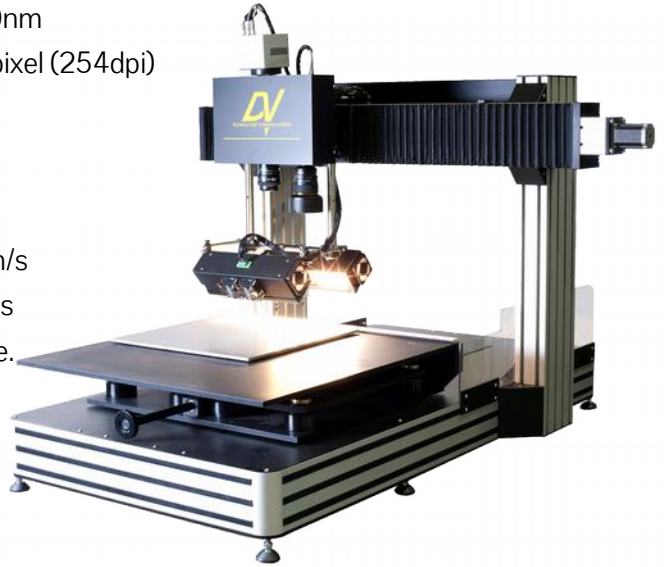
Characteristics

SSCANNER 750

Optical
- Spectral range avilable: 380-730nm, 950-1700nm, 1000-2500nm
- Spatial resolution (max): X: 0.08 mm/pixel (315dpi), Y: 0.1 mm/pixel (254dpi)

Electronic
- CCD, InGaAs, MCT sensors digital output AD 12/16bit
- Two stepper motor movimentation:
    X (camera axis) : L=700mm resolution=0.3mm Vmax=50mm/s
    Y (plate axis) : L=750mm resolution=0.02mm Vmax=80mm/s
- Light source: Cooled halogen lamp with stabilized power source.

Mechanical
- Dimensions and weight : 1230x1574xH800mm e 140Kg .
- Area for scanning: 700x700mm on moving table 750x770mm
(770 mm long and con 20 mm reserved to white reference tile).
- Spectrometer excursion on Y motorixed axis: 600mm.
- Spectrometer excursion on Z motorixed axis: 150mm.
- Cylindrical illuminator BaSO4/aluminium internal coating with adjustable height.
- Sample holder height adjustable.

DESKTOP SPECTRAL SCANNER

Optical
- Spectral range avilable: 380-730nm, 950-1700nm, 1000-2500nm
- Spatial resolution (max): X: 0.08 mm/pixel (315dpi), Y: 0.1 mm/pixel (254dpi)

Mechanics
- 300 mm single axis mechanical motion; mechanical sample support 420x300mm; Motion resolution 10 μm.
- Cylindrical illuminator BaSO4/aluminium internal coating for diffuse/0° measurement or fiber optic light line for 45±10°/0° reflectance measurement geometry)

Electronic
- Serial interface for remote PC control
- Stabilized 150W halogen light sources

*NOTE: Spatial resolution varies depending on sensor dimension and FOV setup and effective spectral resolution depends on the spectrograph model, slit size and sensor

SPECTRAL SCANNER SOFTWARE

Spectral reflectance | Munsell Diagram | Colorimetric data

2D image reconstruction
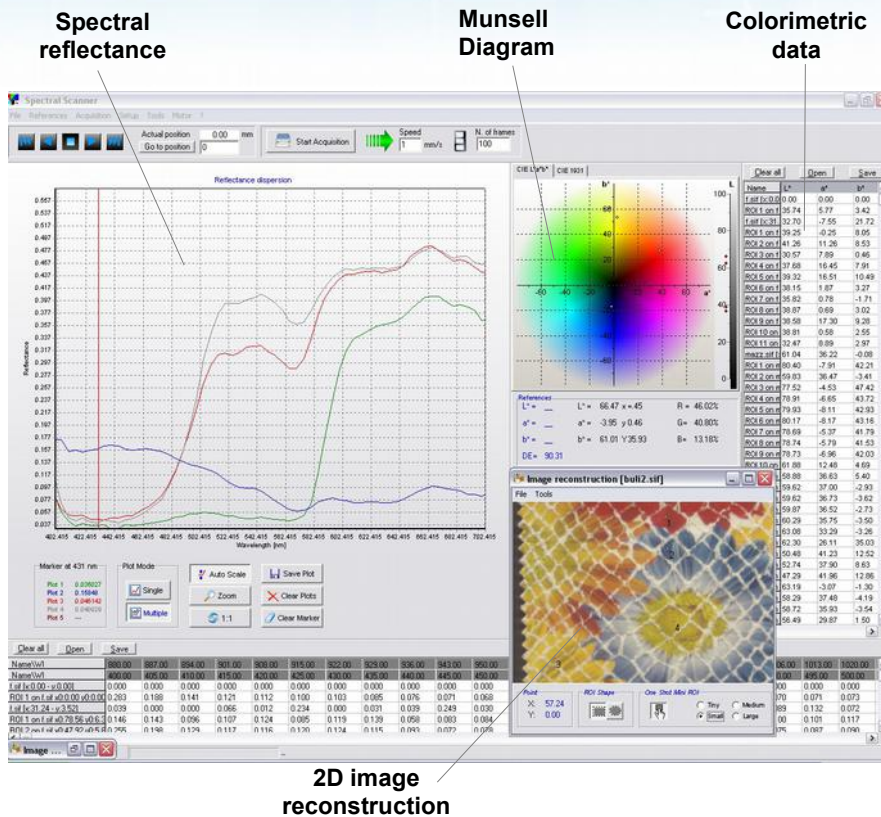
SpectralScanner© is a spectral imaging software that captures the spectral composition of each point of the sample using a line spectrometer. The Software controls a mechanical device which moves the optical system and captures a series of two-dimensional frames. By interpreting each of these as an array of spectra, point by point, the Software reconstructs an entire image on the screen line by line, making available all the spectral data which are displayed numerically and in graphical form on a chart, through L*a*b* coordinates and diagram and in the Munsell color space.

Reflectance, transmittance, absorbance

Many spectral imaging applications, like color measurement, require to determinate the absolute reflectance of the sample; Spectral Scanner calculates reflectance for every acquired pixel, evaluating the acquired signal ratio with a white reference sample. The mouse movement on the rendered image gives access to the spectral profiles of the selected pixels, instantly evaluates the colorimetric parameters and with one click lets you imediately save the data in various formats. Software filters allow narrow band analysis of the images. In the same way Spectral Scanner can render an image in transmittance mode for applications that require it.

Reflectance curve of green

point selected

Color differences and equalities

Spectral Scanner performs absolute and relative color measurements using the CIE L*a*b* standard colorimetric coordinates. L*a*b* data can be calculated in different modes: they depend mainly on an Observer curve and an Illuminant curve. Different curves are included in the Software, and can be loaded. Such parameters and the ΔE can be evaluated for the single pixel, for a selectable part of the image or for the whole image, making Spectral Scanner very versatile for color difference calculation.

L*a*b* data and statistics

Munsell L*a*b* diagram
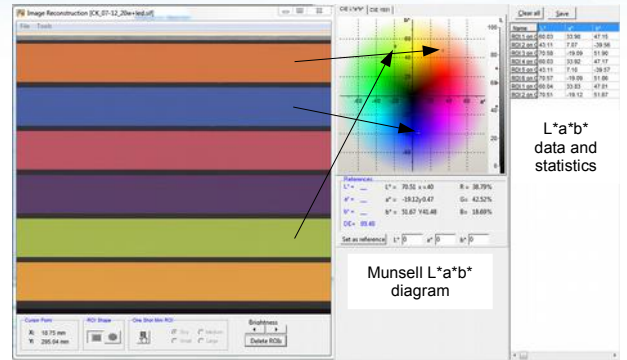
Single wavelength selection

Spectral Scanner allows the selection of single bands with defined wavelengths and the visualization to screen of the rendered filtered images.

Data exportation

All the spectral reflectance data and colorimetric calculated values can be quickly exported for further elaborations with other mathematical applications and tools...

Advanced analysis tools

Spectral Scanner provides many tools for thorough comparative analysis of the acquired spectral images, useful when a high grade of colorimetric conformity with a sample reference is demanded. Moreover other application software are available by DV for advanced spectral analisys and color proof and simulation.