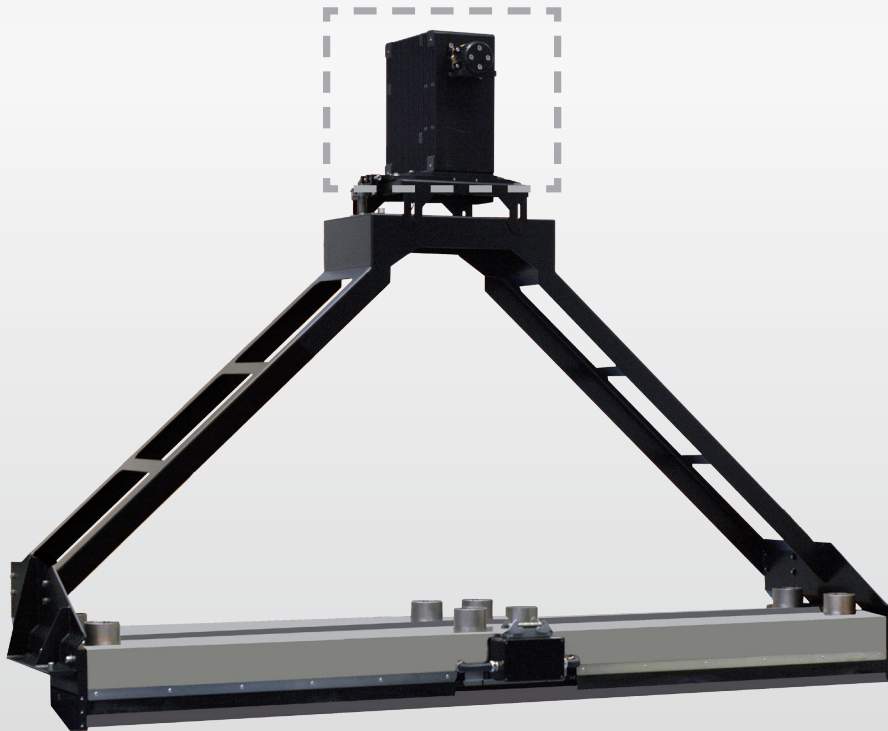


Analytical Imaging Process technology



NIR HYPERSPECTRAL CAMERAS



uniSPEC1.7HSI
uniSPEC1.9HSI
uniSPEC2.2HSI^{sens}

uniSPEC1.7HSI - uniSPEC1.9HSI - uniSPEC2.2HSI^{sens}

Purpose

The NIR hyperspectral imaging cameras uniSPEC1.7HSI, uniSPEC1.9HSI and latest model uniSPEC2.2HSI^{sens} (uniSPECx.xHSI, figure 1) feature three key parameters for successful process analytical technology: ■ high spectral resolution, ■ high spatial resolution and ■ high frame rates. The NIR hyperspectral imaging cameras are suitable for near infrared (NIR) imaging analysis in a wide field of applications. Applications include quality control in printing and coating processes, sorting and quality control of food/feed, minerals or online analysis of polymers and paper. Due to the high spatial resolution, even small objects such as polymeric granulate or seeds can be analysed reliably. In general, all NIR-active materials can be investigated.

Setup

The uniSPECx.xHSI is based on push-broom imaging technology (figure 2). The camera consists of an optical NIR spectrograph and a 2D InGaAs sensor array (cooled by peltier elements) as detector. Both components are integrated in a dust and waterproof housing (IP65). The reflectance spectrometer features distortion-free optical components which were especially designed for NIR application. This enables the generation of a distortion-free image of the line shaped detection area, eliminating the mixture of spectra for adjacent objects. In addition, the lens is NIR-corrected and exhibits a short focal length, allowing the detection of a large field of view at small working distances. For each image point of the line shaped detection area, a complete NIR spectrum is recorded simultaneously. A spatially resolved analysis is achieved by subsequent line scans of the object. The spatial resolution enables the identification of small objects in a material stream (≥ 2 mm). For applications requiring a high spatial resolution (≤ 1 mm), especially designed lenses are available

upon request. The NIR hyperspectral imaging camera is offered in combination with an industrial PC and pre-installed camera control software. Installation bridge, illumination unit, RGB colour camera and application development software are available as further accessories.

Key characteristics

- High resolution 2D-spectrograph with optically corrected focal plane image
- Camera with cooled InGaAs sensor array
- Comprehensive tools for setup and service
- Industrial PC including Windows® 7 Embedded (or higher) OS based industrial PC
- Application development software kit based on chemometrical analysis

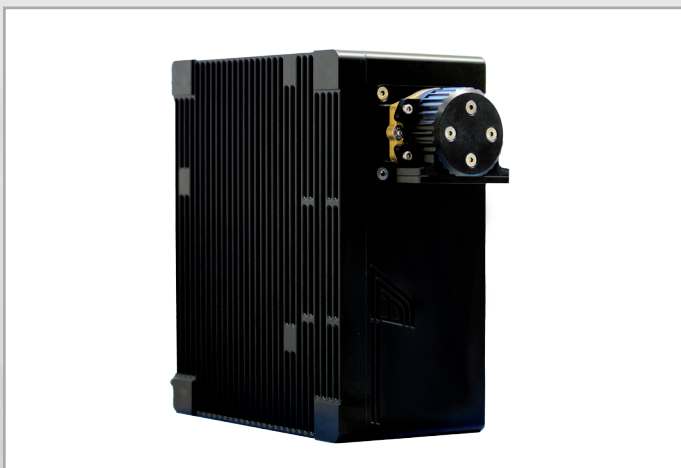


figure 1: NIR hyperspectral imaging camera

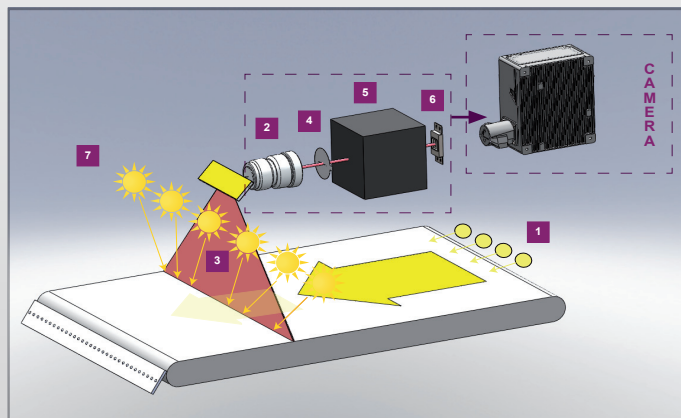


figure 2: Push-broom imaging technology
1-Material stream, 2-Lens, 3-Reflected NIR radiation,
4-Entrance slit, 5-Imaging spectrograph, 6-Sensor array
7-Illumination unit

Applications

The development of customised identification modules based on chemometrical methods is available upon request. NIR hyperspectral imaging cameras are used in a wide field of applications:

Food industries

- Quality control of food and feed (determination of fat (figure 4), carbohydrate protein or water content)
- Identification of foreign material (production residues or packaging material) e.g. paper, cardboard, plastics, stone, insects, stems and leaves

Polymer compounding industries

- Composition monitoring in production (analysis of educts, monitoring of mixture ratio)

Paper industries

- Analysis of paper ingredients
- Thickness determination of coatings
- Monitoring of UV curing for coatings

Mineral industries

- Mineral analysis in stone
- Optical sorting of valuable stone from waste rock

Research and development

- Chemical imaging of NIR active materials
- Aerial and area scanner for geological or vegetation survey and mapping



figure 3: Applications

Analytical control software

The uniSPECx.xHSI cameras are delivered including a comprehensive set of software. The control software KustaMSI (figure 5) permits adjusting of camera parameters, monitoring of camera status and NIR data acquisition. In addition to the camera control options, several standardised interfaces are implemented in KustaMSI for data transfer to an external process control device. Important device parameters are password protected and therefore changeable by service personnel only. The application routine can be changed, enabling an easy

adaption of the NIR hyperspectral imaging cameras to different analysis tasks. LLA offers software KustaSpec including AnaTools for chemometric application development. Implemented chemometric analysis algorithms include: PCR, PLS, Euklid, Fuzzy, neuronal networks and many more. Software for real-time and offline visualisation of material streams complete the software portfolio. Alternatively camera data formats for Evince and Camo Unscrambler are available.

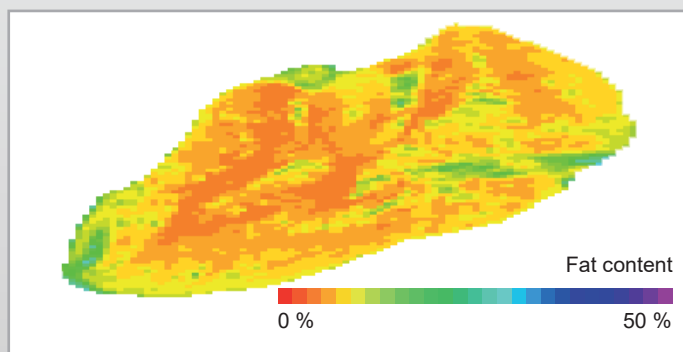


figure 4: Example for application in food analysis, determination of fat content in meat

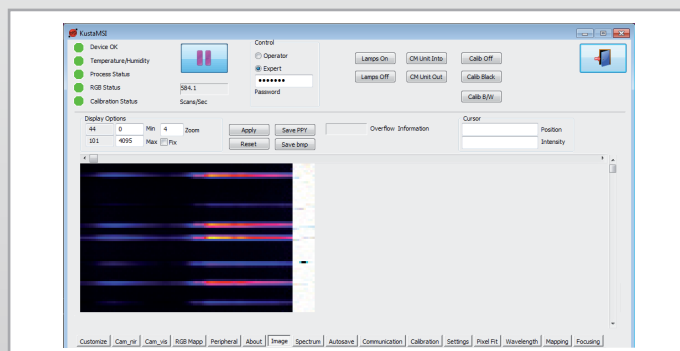


figure 5: Device control software KustaMSI, camera picture

Technical Data

Imaging spectrograph	uniSPEC1.7HSI	uniSPEC1.9HSI	uniSPEC2.2HSI ^{sens}
Camera type	Push-broom imaging camera		
Spectral range	0.95 μm – 1.7 μm	1.32 μm – 1.9 μm	1.62 μm – 2.19 μm
Dispersion	120.7 nm/mm		
Spectral resolution	< 8 nm		
Numeric aperture	F/2.4		
Lens	NIR-corrected, Zeiss F2.4 / 10 mm (standard), other lenses available		

2D spectral camera uniSPEC

Sensor	InGaAs photo diode array, thermo electrical cooling		
Image Frame (spatial x spektral)	320 Pixel x 256 Pixel	192 Pixel x 96 Pixel	
Dispersion / Pixel	3.61 nm	6 nm	
Digital resolution / grey scale levels	14 bit	16 bit	
Exposure time	10 μs – 3000 μs	1 μs – 10 ms	
Frame rate	Max. 270 (optional 310) Frames/s	Max. 795 Frames/s, no ROI Mode	
Typ. integration times for illumination unit PMAmSi	~2100 μs	~350 μs	~500 μs
Power supply	24 V, 2.5 A		
Power consumption	< 70 W		
Environmental operating temperature range	0 °C up to +50 °C		0 °C up to +45 °C
Environmental relative humidity	20 % up to 90 % (non-condensing)		20 % up to 80 % (non-condensing)
Weight camera	16.8 kg		
Dimension camera	295 mm x 166 mm x 345 mm (LxWxH)		

Illumination unit PMAmSi

Characteristics	Double-sided illumination with reflectors for vertical clearance of 500 mm (LR50)
NIR light source	Halogen light bulbs 120 W / 230 V AC or 115 V AC
Band width	500 mm up to 2000 mm with one camera 2000 mm up to 2800 mm with mirror unit or two cameras
Protection level	IP65
Illumination area in 500 mm distance	40 mm x measurement width
Power supply Input Output	230 VAC - 10 % to + 15 % 50...60 Hz, 115 VAC vavailable 80 VDC to 230 VDC / 200 W to 500 W

Installation details	30 μm slit	50 μm slit	50 μm slit
Spatial resolution Standard at 1 m FOV Minimum at 160 mm FOV	3.2 mm x 3.2 mm 0.5 mm x 0.5 mm	5.2 mm x 5.2 mm 0.9 mm x 0.9 mm	5.2 mm x 5.2 mm 0.9 mm x 0.9 mm