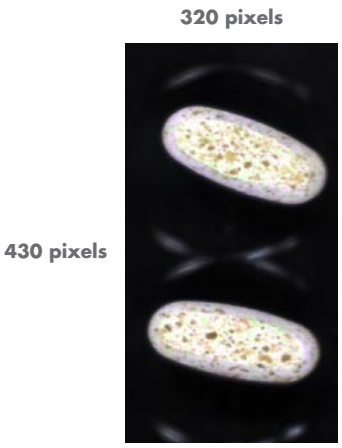
Hyperspectral Scanner

SisuChema

SisuChema imaging module

SisuChema brings simplicity and speed combined with superior performance. The system is modularly designed and is a complete chemical imaging solution. SisuChema employs a push-broom imaging technology, which provides several outstanding advantages for the user; highest speed, lowest heat load from illumination, and no limitations in the square or rectangular sample shape, but also series of samples can be imaged in a single linear scan.



Picture 1. False color visualization of tablets showing differences in ingredient distribution. The full hyperspectral image (data cube) with 320 x 430 spatial pixels and 256 spectral bands in 1000 - 2500nm was acquired in less than 6 seconds.

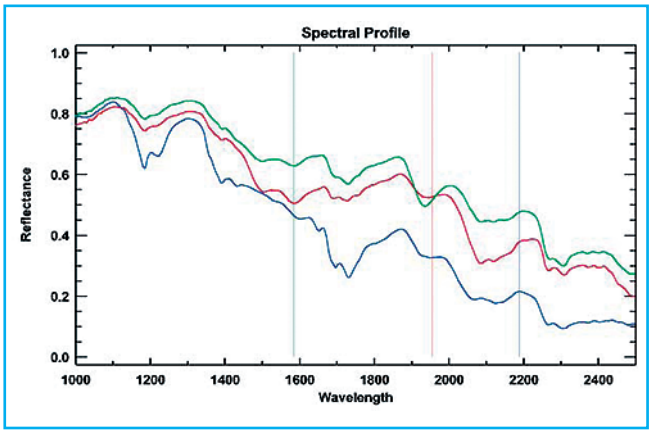
Applications

- Pharmaceutical product development and QA
- Process analytical technologies
- Life sciences
- Food product development and QA
- Seed screening and other agricultural applications
- Forensics, product authentification

Near Infrared (NIR) spectroscopy is widely used for chemical material analyses. SisuChema combines NIR spectroscopy with high resolution imaging; it provides detailed information on the chemical components, their quantities and distributions within the sample. It is invaluable information for the characterization and quality assurance of advanced materials, where the functionality of the material is dependent on its chemical and physical structure.

How SisuChema works

SisuChema is a complete chemical imaging workstation. Users place samples into specially designed sample trays, then using the ChemaDAQ data acquisition software, the spectral image is acquired and saved, in realtime. Each SisuChema workstation is pre-installed with the Evince hyperspectral image analysis package. This allows users instant application processing, chemical calibrations and predictions directly within the SisuChema system. Designed as a modular system, users can easily adapt the configuration of SisuChema for a variety of sample sizes. The system can image samples of 10 mm or smaller at a very high pixel resolution of 30 microns, or the width of the sample area can be increased to 100 mm, providing 300 micron resolution. SisuChema acquires imagery in a pushbroom manner, meaning it builds the image one line at a time while the sample is scanned on a moving sample tray. Each line has a 320 pixel field of view. In the scanning dimension, the number of pixels is dependent on the selected scanning length. The variable scanning length allows the user to image longer samples, or multiple sequential samples (like tablets), in a single linear scan.



SWIR spectra from three different ingredients within the tablets.

Please contact: Stefan Wittmer, phone: +49/6151/8806-63, eMail: wittmer@lot-oriel.de
LOT-Oriel Group Europe. Im Tiefen See 58. D-64293 Darmstadt. phone: +49/6151-8806-0. fax: +49/6151-880664. **www.lot-oriel.com/de**

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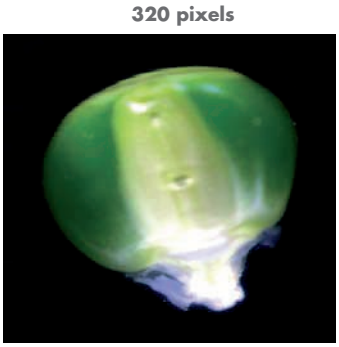
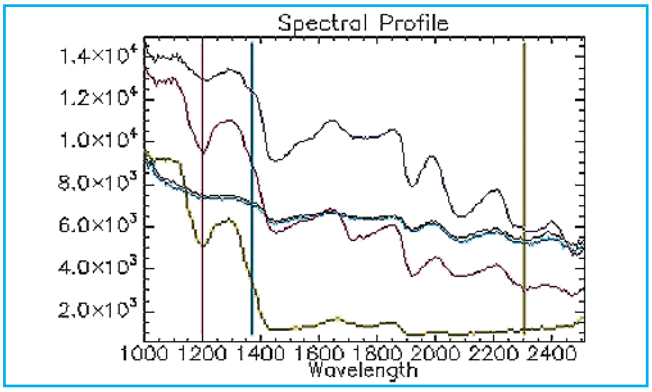
Spectral images in just a few seconds!

Due to rapid imaging and the low heat load from the illumination, SisuChema is ideal for chemical imaging of biological samples. Spectral images in just a few seconds!



Picture 3. Hyperspectral image of a seed as three-band image. The full hyperspectral image was acquired in less than 11 seconds.

Acknowledgement to the Department of Food Science, University of Stellenbosch, South Africa



Reflectance spectra in 1000-2500 nm picked from various locations on the seed.

Performance, efficiency and ease of use

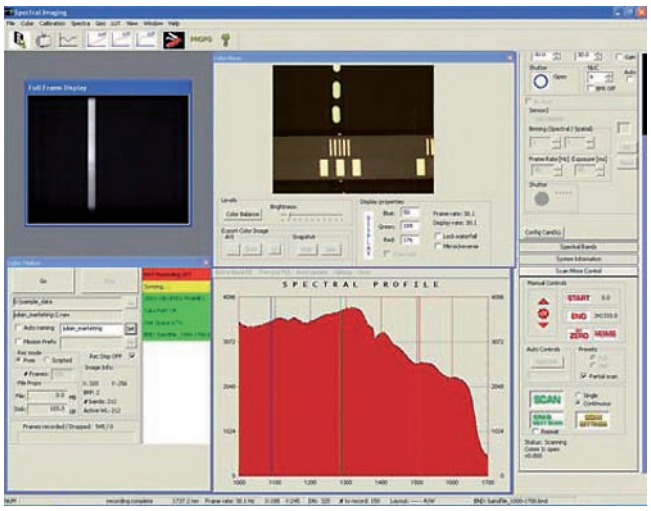
SisuChema is built on our Spectral Camera operating in 970 to 2500 nm range with high spectral resolution. This push-broom camera provides outstanding advantages. Its light throughput is 10 to 20 times higher than that in a tuneable filter imager. The result is considerably faster imaging under similar illumination conditions. Furthermore, push-broom imaging only requires line illumination on the sample, which significantly reduces the heat load on the sample. Our unique line illumination technique is designed to provide diffused line-illumination on the sample, thus optimizing the imaging of various surfaces. SisuChema's simple, user friendly, modular methodology brings out the best qualities of a turnkey solution in a form which is simple to use and maintain. Setting up SisuChema for the first time only requires connecting the cables between the imaging unit and the external enclosure (housing the computer, camera controllers and power units). SisuChema is supported by readily installed ChemaDAQ data acquisition software and Evince hyperspectral image analysis software.

From lab to process

Using a push-broom hyperspectral camera, SisuChema works like a high speed line-scan camera. It acquires and builds the spectral image of a moving sample line by line, and simultaneously acquires all wavelengths for each line. Thus, this imaging technique is also an ideal solution for on-line process monitoring, where samples are in continuous motion. This provides still another significant advantage to the SisuChema user – the applications that were initially developed for sample analysis in laboratory and near production lines can be directly moved to the real time world of on-line process and quality control. There is no need to adapt to and invest in different technologies for on-line monitoring. SPECIM SisuChema is the only chemical imaging technique offering a direct application path from laboratory to process.

ChemaDAQ

This combined user interface and data acquisition tool is delivered with SisuChema. It provides users with the basic tools necessary for system control, data acquisition, and data management.



Please contact: Stefan Wittmer, phone: +49/6151/8806-63, eMail: wittmer@lot-oriel.de

LOT-Oriel Group Europe. Im Tiefen See 58. D-64293 Darmstadt. phone: +49/6151-8806-0. fax: +49/6151-880664. **www.lot-oriel.com/de**

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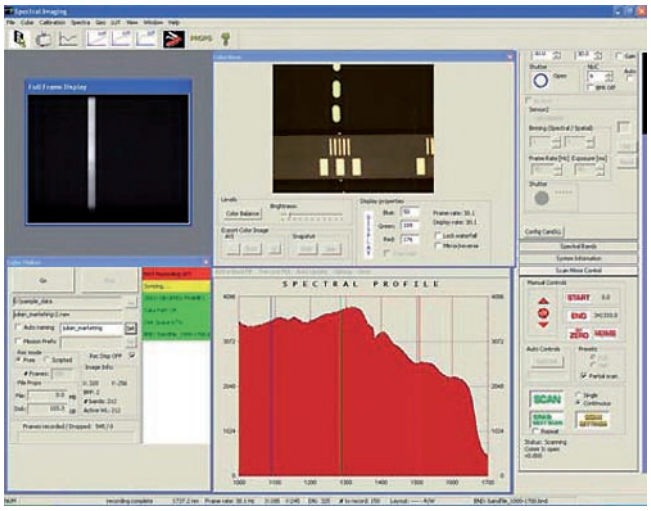
Evince - analysing the image

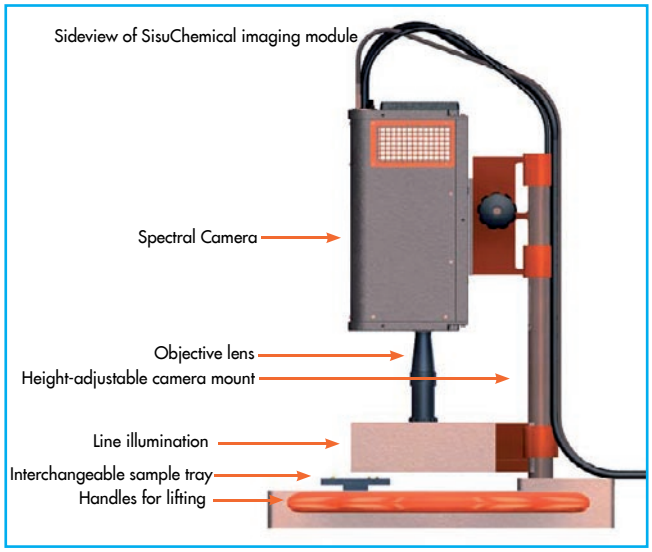
Evince is used for the exploration of hyperspectral image data. Its graphical user interface allows importing of images created by ChemaDAQ and various other image formats. Using Evince's powerful analysis techniques, the user can eficiently extract relevant information from the data cube. Numerous visualizations are available for both raw and processed data. Immediate visualizations of changes in data, and a streamlined workflow make the exploration fast and effective.



For exploration of hyperspectral image data.

Functionality

- Full exploration of hyperspectral image data and spectral analysis of each pixel
- Compression of image data with multivariate techniques such as PCA & PLS into multivariate models
- Visualizations available for raw spectra, pre-processed spectra, an entire measured channel and modelled image data (model components)
- Classification of image content
- Quantification of image content
- Segmentation of image content, for example background removal
- Detection of important wavelengths



Optical and technical characteristics	
Operation mode	High speed push-broom hyperspectral *)
Spectral range	970 - 2500nm 900 - 1700nm (optional)
Spectral sampling/ pixel	6.3 nm
Spectral resolution	10 nm
# spatial pixels/ line	320
Pixel size on sample	Scalable from 30 to 300 microns
Field of view on sample	Scalable from 9.6 to 96 mm
Scanning rate	100 hyperspectral line images/s (max), corresponding to - 3 mm/s with 30 micron pixel - 30 mm/s with 300 micron pixel
Typical scan time	3 to 10 s for an image with 320 x 320 spatial pixels and full 256 spectral bands
Illumination	Diffused line illumination
Data format	BIL file format, Evince end ENVI compatible
Instrument calibration	Instrument is delivered with spectral calibration. Image data is automatically calibrated to reflectance by measuring an internal standard reference target before each sample scan.
*) Optical characteristics based on SWIR Spectral Camera. Please find further details in the SWIR Spectral Camera data sheet.	

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