Electro Optical Components, Inc.
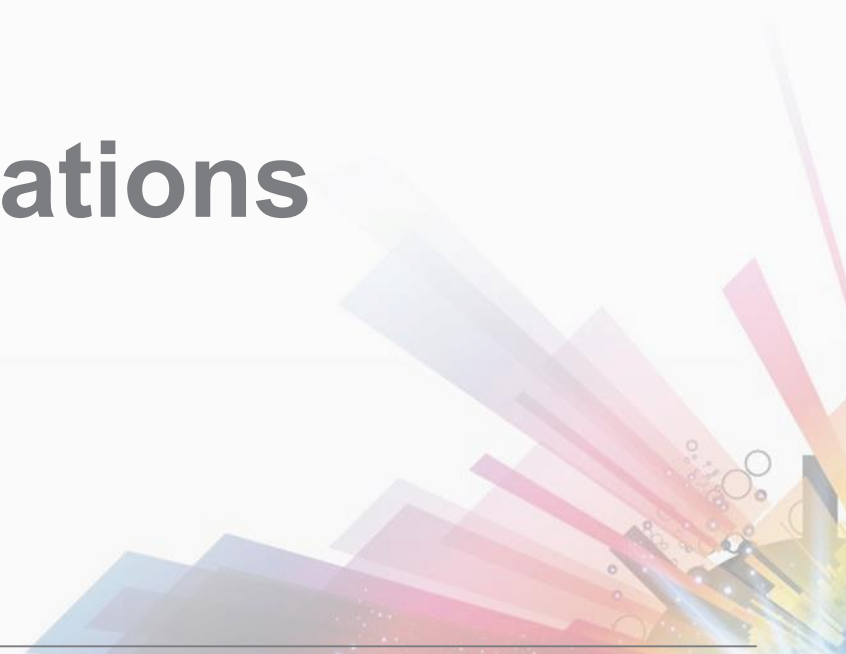5464 Skylane Boulevard, Suite D, Santa Rosa, CA 95403
Toll Free: 855-EOC-6300
www.eoc-inc.com | info@eoc-inc.com

Click to go to
Product Selector

INNO-SPEC
Visualize Invisibility

Hyperspectral Imaging
for
PAT applications

inno-spec

is an established manufacturer of spectral imaging solutions for process analytical applications

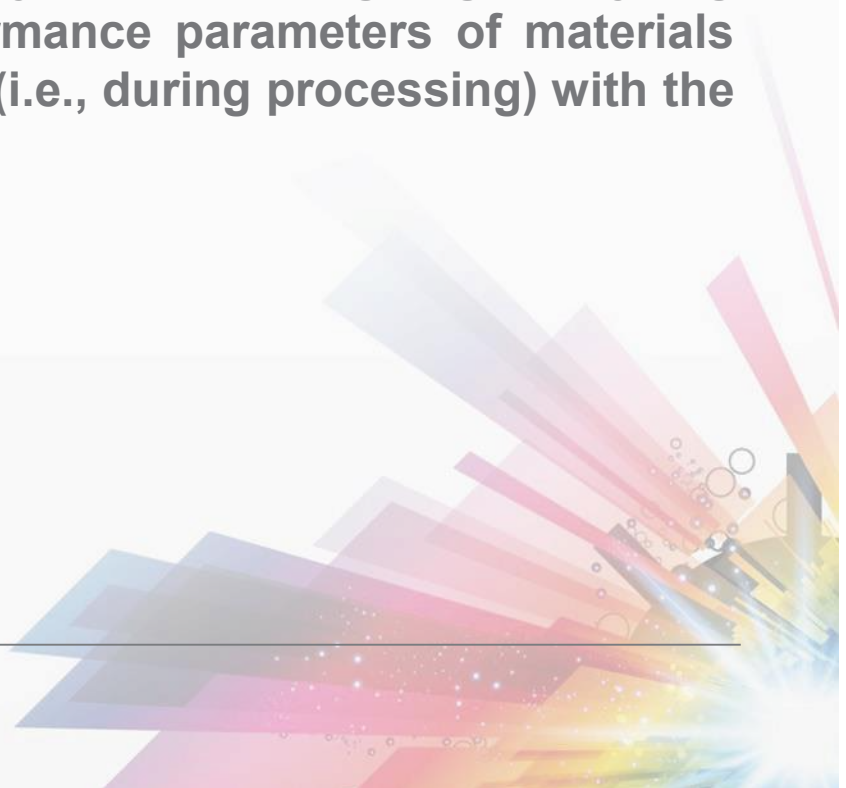

Germany

Berlin

Nuremberg

Founded in 2005

inno-spec group
today: ~60 employees

Process Analytics

Process Analytical Technology (PAT) - a system for designing, analyzing and controlling critical quality and performance parameters of materials and manufacturing processes <u>in real-time</u> (i.e., during processing) with the goal to ensure the final product quality.

Process Analytics

Purpose

Scientific

- Process capability: understanding and control of manufacturing processes and sub-processes for predictive operations
- Reduce process variability
- Assuring product quality *during* production

Regulatory

- New products: possible regulatory discretion
- Existing products: Reduce risk of Out-Of-Spec product reaching customers

Business

- Improving speed and accuracy of decision making
- Decrease scrap, rework, WIP, and returns
- Increase yields, equipment utilization, improve energy and material usage
- Increase market share, ROI, and stockholder value

Process Analytics

Task: going on-line

because laboratory analysis:

- Labor intensive

- Opportunities for errors occur

- Increased risk for product contamination

- Individual samples often are not representative enough

- Degradation of samples until these are analyzed

- High risk of out-of-spec production in between

- Automated processing is difficult due to the manual handling
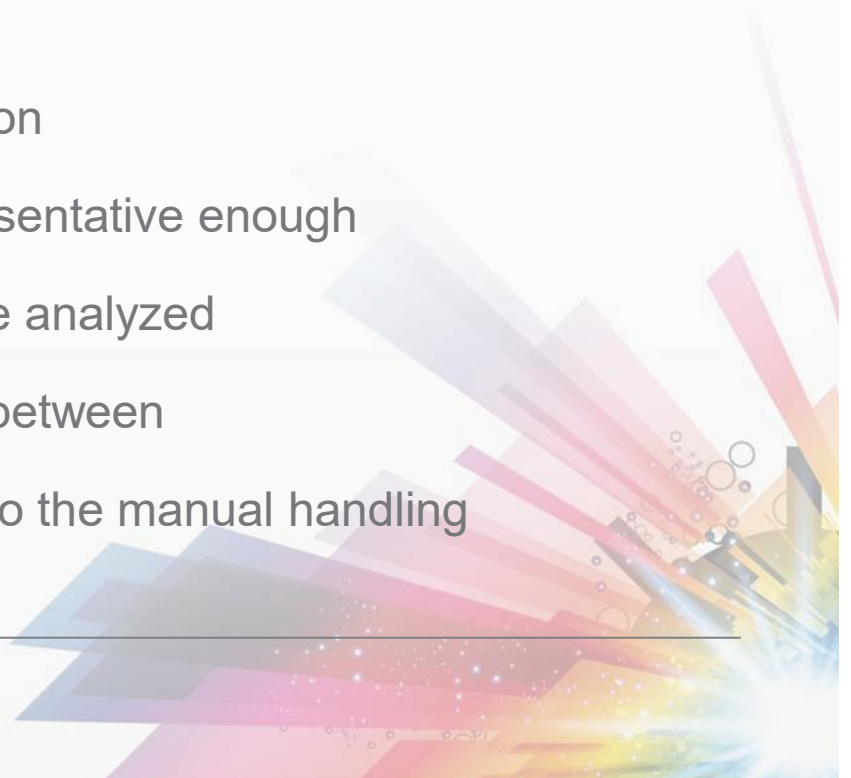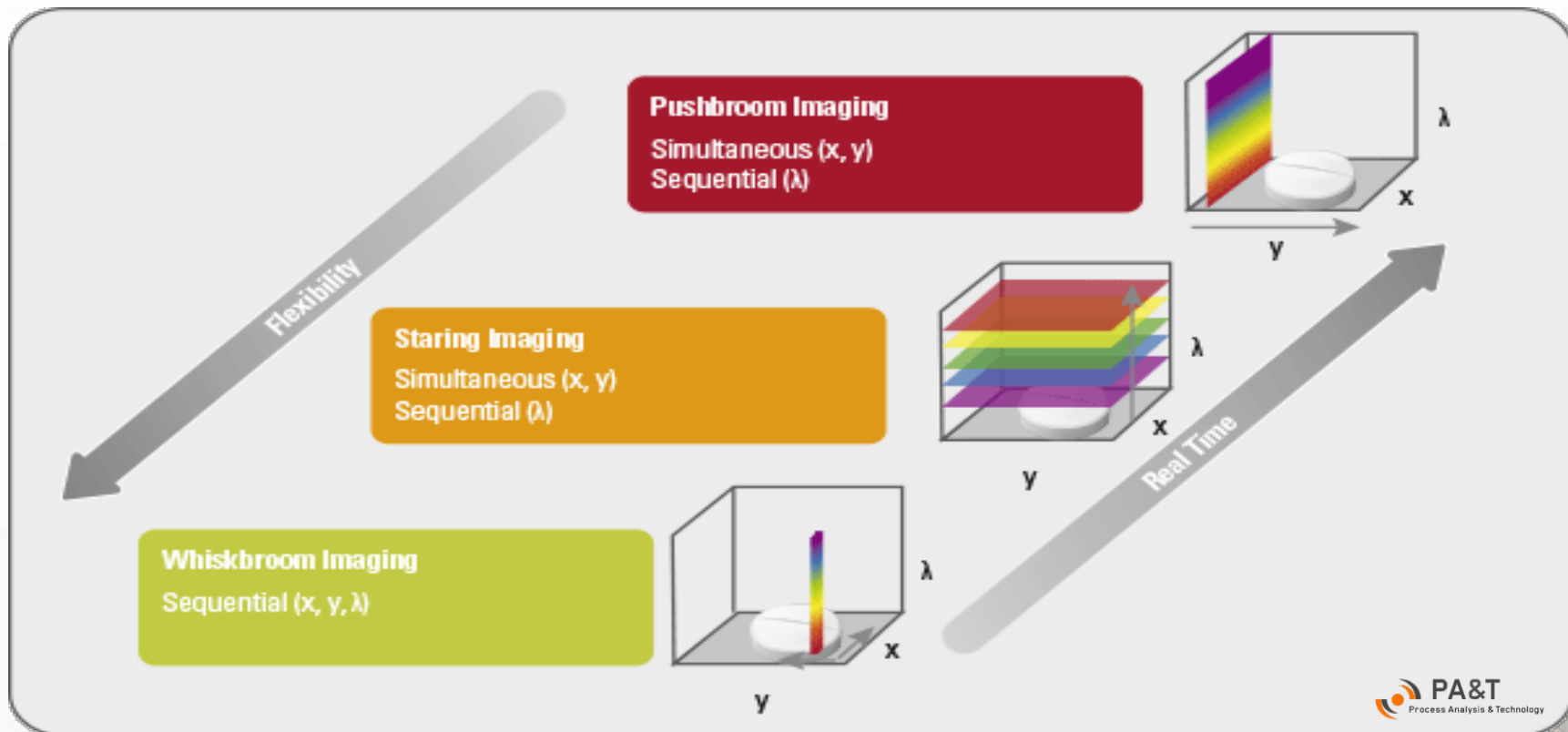
HSI for Process Applications

Industrial Requirements

- Robustness

- Reliability

- Measurement speed (high frame rate)

- Optical performance (throughput, resolution, etc.)

- Price

- Support

Hyperspectral Imaging (HSI)
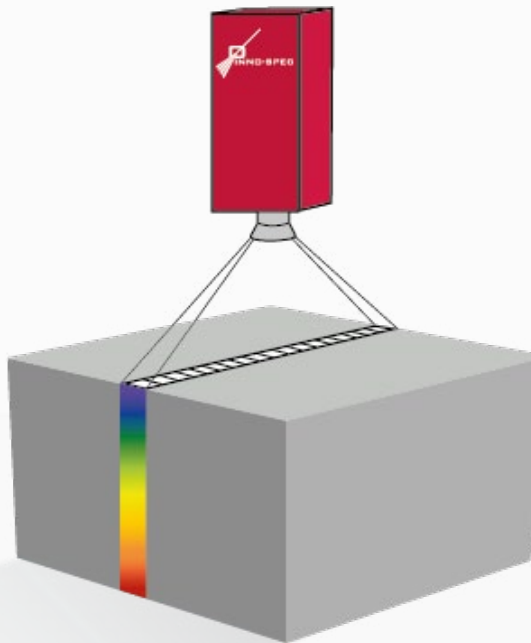
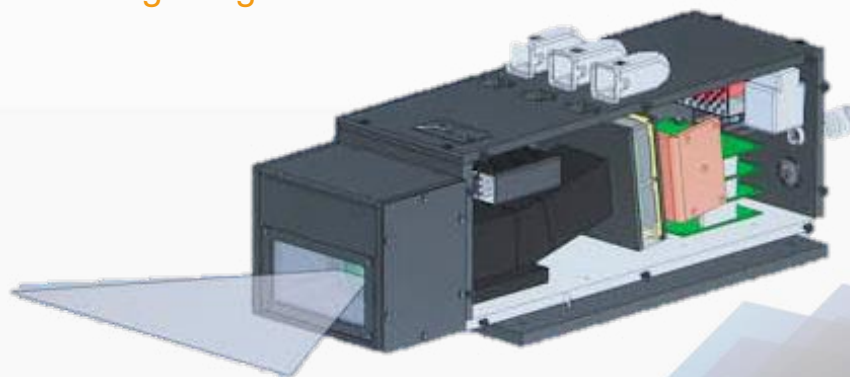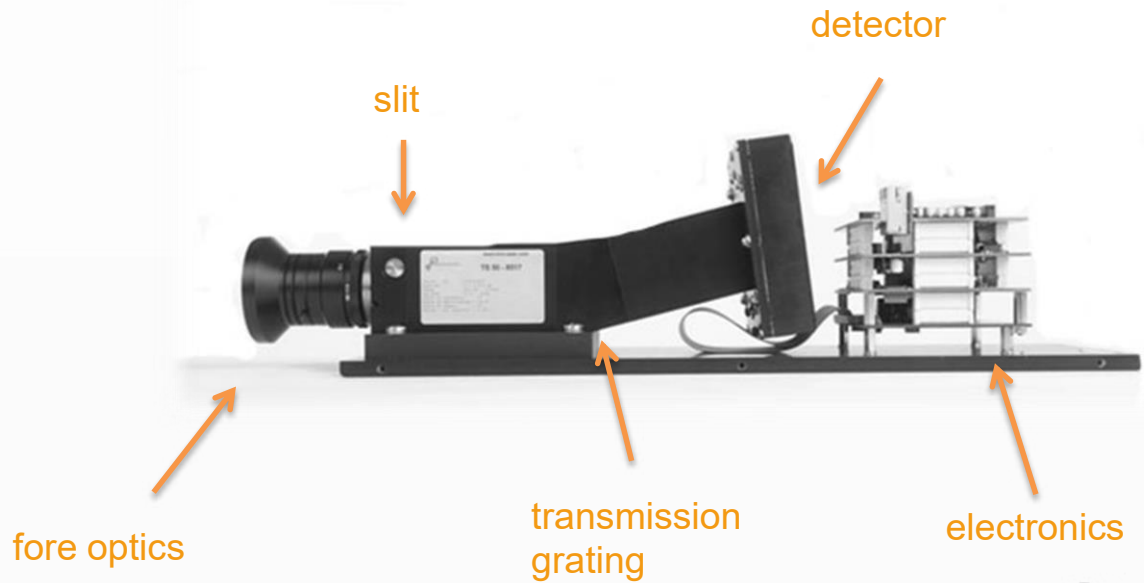**Image Acquisition Techniques**

Hyperspectral Imaging (HSI)

Pushbroom Imaging System

Pushbroom (line scan imaging) device record a whole line of an image.
A spectrum is generated for each point (spatial element - pixel) on the line.
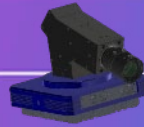
HSI Technology

detector

slit

fore optics

transmission
grating

electronics
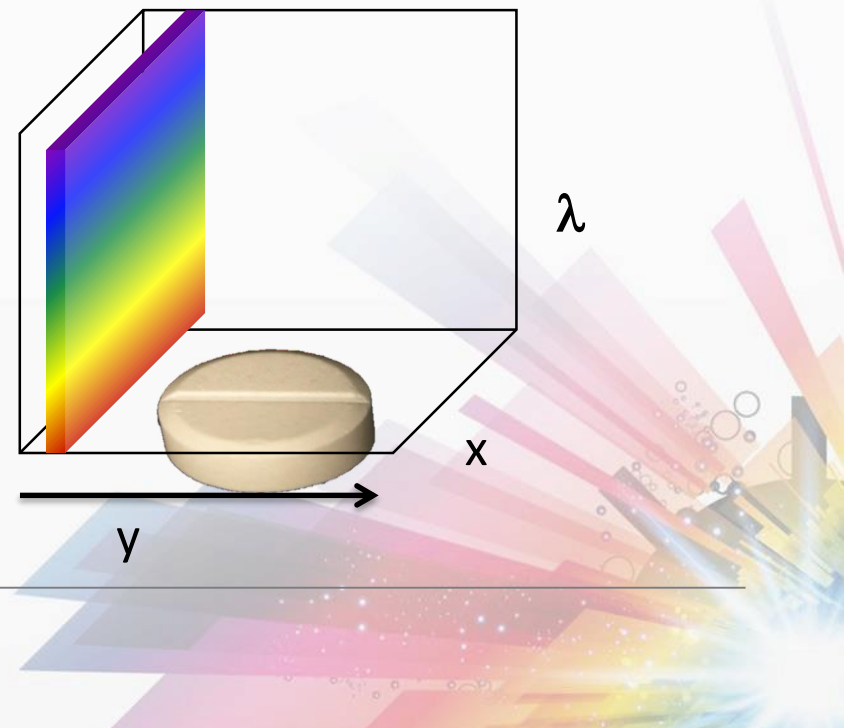
Product Overview

190 - 380nm
(Forensics)

750 – 1100nm
(Food / Agriculture)

2000 – 5000nm
(Mining)

UV
Ultra Violet

VNIR
Very Near Infrared

MIR
Mid Infrared

VIS
Visible

NIR
Near Infrared

LWIR
Long Wave Infrared

360 -780nm
(Color / Fluorescence)

920 – 1700 / 2200nm
(Recycling / Food)

400 – 1000nm
(Remote Sensing)

INNO-SPEC
Visualize Invisibility

Hyperspectral Imaging
From UV to MIR

INNO-SPEC
Visualize Invisibility

190 - 380nm
(Forensics)

UV
Ultra
Violet
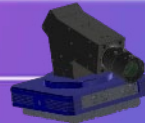
750 – 1100nm
(Food / Agriculture)

VNIR
Very Near
Infrared

2000 – 5000nm
(Mining)

MIR
Mid
Infrared

VIS
Visible

NIR
Near
Infrared

LWIR
Long Wave
Infrared

360 -780nm
(Color / Fluorescence)

950 – 1700 / 2200nm
(Recycling / Food)

400 – 1000nm
(Remote Sensing)

BlueEye
UV Spectral Imaging System

- Wavelength range 190nm - 380nm

- Reflection spectrograph

- 1024 x 1024px back-illuminated CCD detector

- USB 2.0 interface
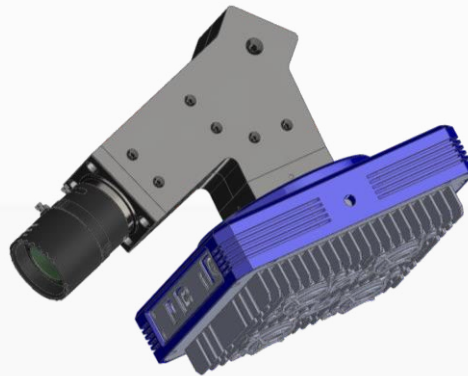
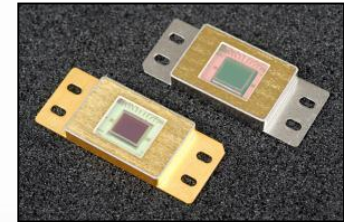# GreenEye
Imaging System

- Transmission spectrograph

- Wavelength range 400 nm - 1000 nm

- CMOS Camera

- 54 Hz at full resolution

- Gigabit Ethernet

- Made for operation in harsh environments

- SDK

OrangeEye Scan
Laboratory Spectral Imaging System

- Wavelength range 500nm - 950nm

- Pushbroom imager with integrated scanning unit

- Integrated broadband LED illumination

- No movement of samples or camera necessary

- USB 3 data interface

OrangeEye
Imaging transmission spectrograph

- Wavelength range 580nm - 1000nm

- CMOS Camera

- 108 Hz at full resolution

- Gigabit Ethernet

- Made for operation in harsh environments

- SDK

REDEYE

INNO-SPEC
Visualize Invisibility

- High-class imaging transmission spectrograph
  & InGaAs NIR camera

- Frame rates up to 330 Hz at full resolution

- Spectral ranges 950nm – 1700nm & 1200nm – 2200nm

- Made for operation in harsh environments

- Gigabit Ethernet interface

- Customization

- SDK available
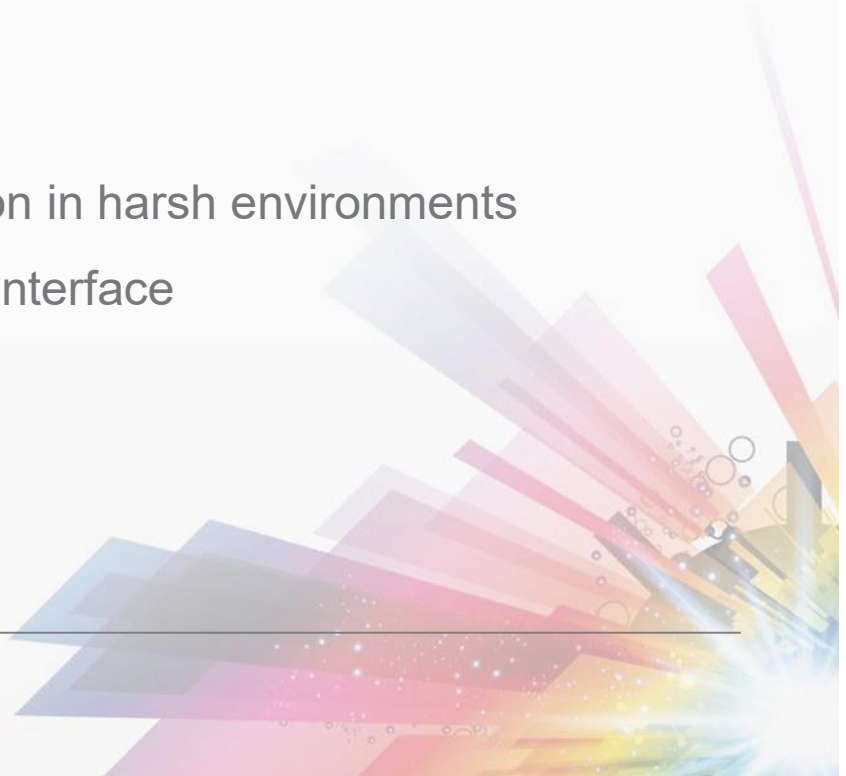
Color & NIR combined system

- Material and color determined at the same time
- Dichroic beam splitter
- 5 MPx RGB camera
- Spectral imaging system RedEye 1.7
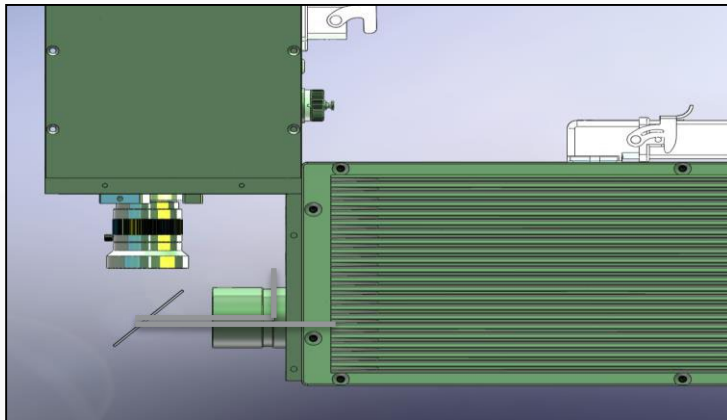
BlackEye
Imaging reflection spectrograph

- Wavelength range 2900nm – 4200nm

- InSb Camera

- 383 Hz at full resolution

- Gigabit Ethernet/ CameraLink

- Made for operation in harsh environments

- SDK

Staring imaging system
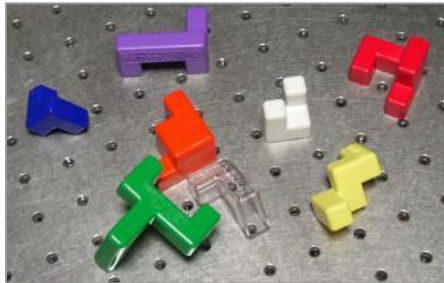
The same area is recorded at different wavelengths

The wavelengths are separated by tunable filters or filter wheels
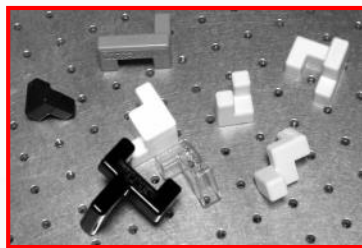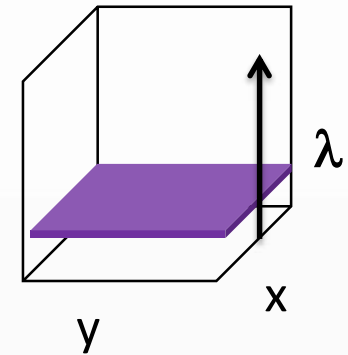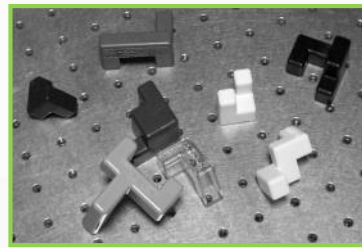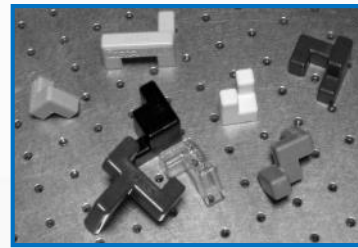
red   green   blue
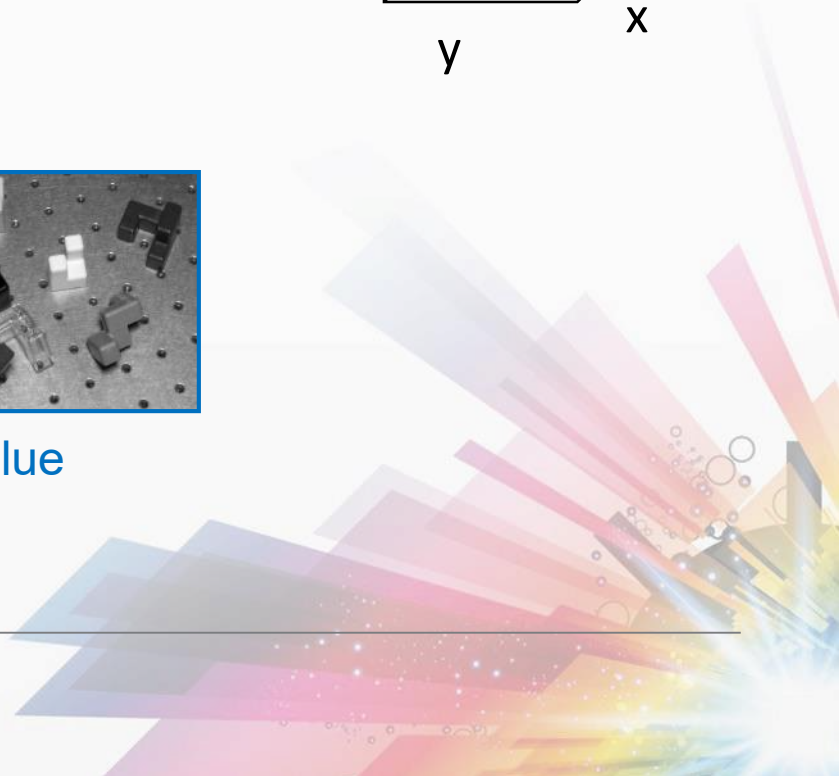
Accessories: Conveyor belt

- Use of high-quality materials like stainless steel and aluminum

- Large selection of transport belts

- Internal drive which means no disturbing contours

- Simple installation

- Low power consumption with high transport capacity

- Customized solutions are available on request
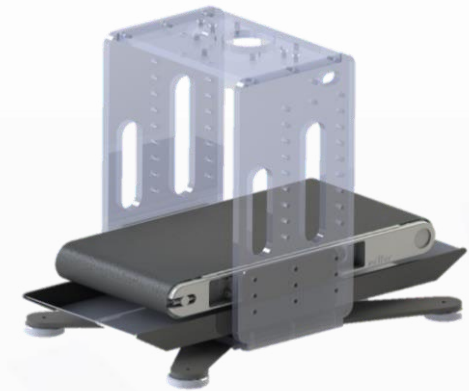
Accessories: Multi-fiber systems

By adding a multi-fiber bundle instead
of the fore optics a pushbroom
imaging system can be used as a
multi-point spectrometer.
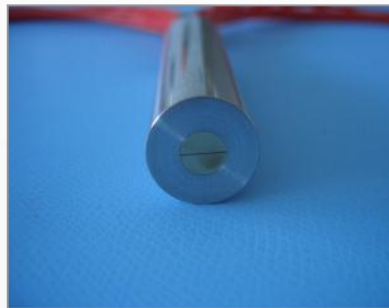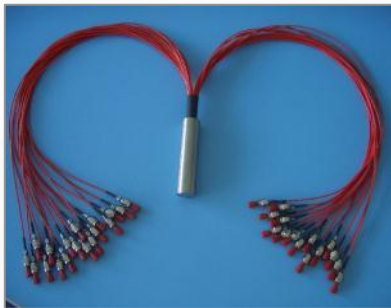
Accesories: LED line lighting

- Standard configuration with RGB LEDs, other LED wavelengths available on request

- Single and multichannel trigger operation

- Pulse width from 2µs – 65ms

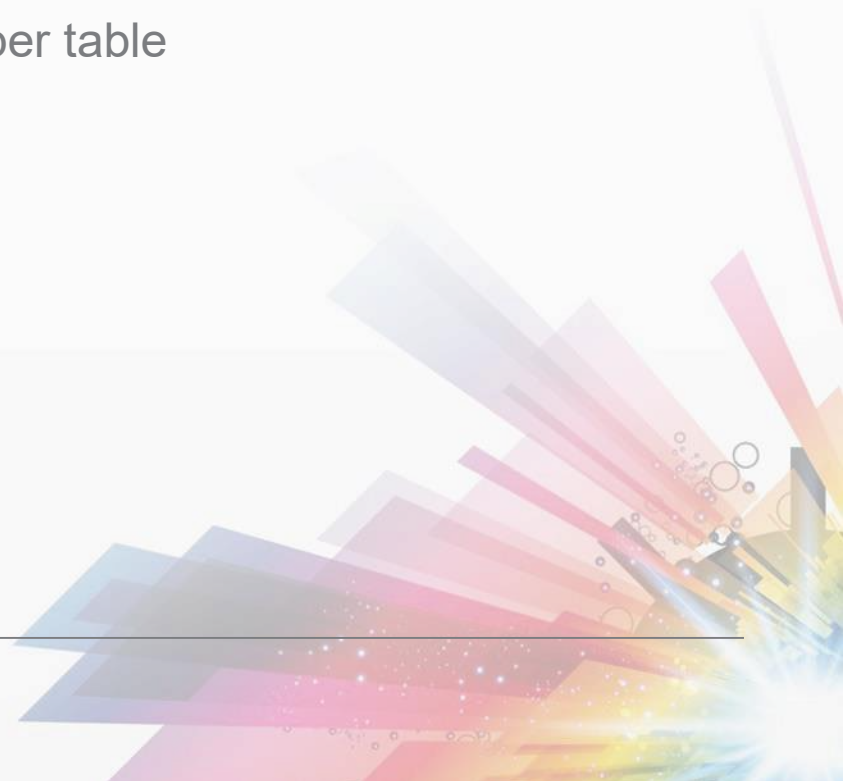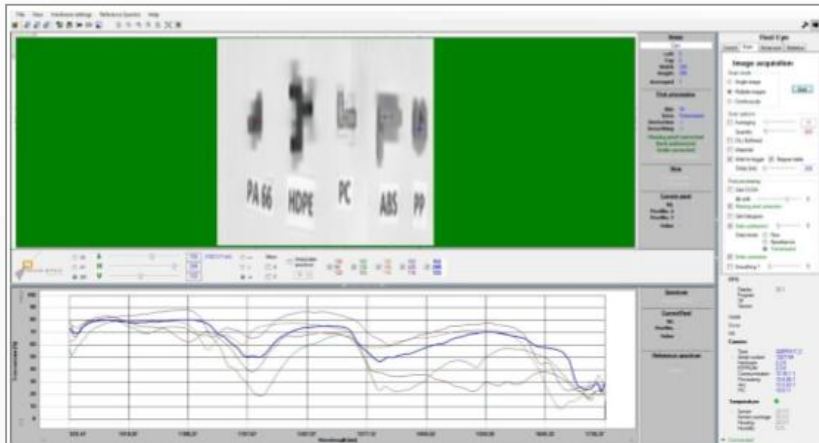- Trigger frequency up to 80kHz

- Available in variable lengths
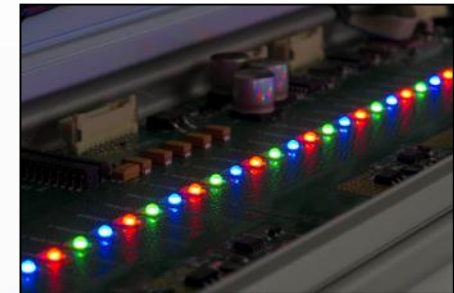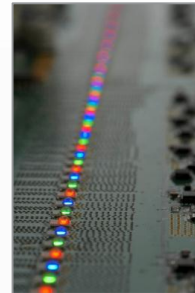
Software

SiCap GB (inno-spec)

Data acquisition Software

- Spectral camera parameterization
- Data handling
- Translation control for inno-spec stepper table

Software

Breeze (Prediktera)

- Software for multivariate image and data analysis
- Complete solution with efficient touch screen user interface
- User-friendly, fast and easy to use
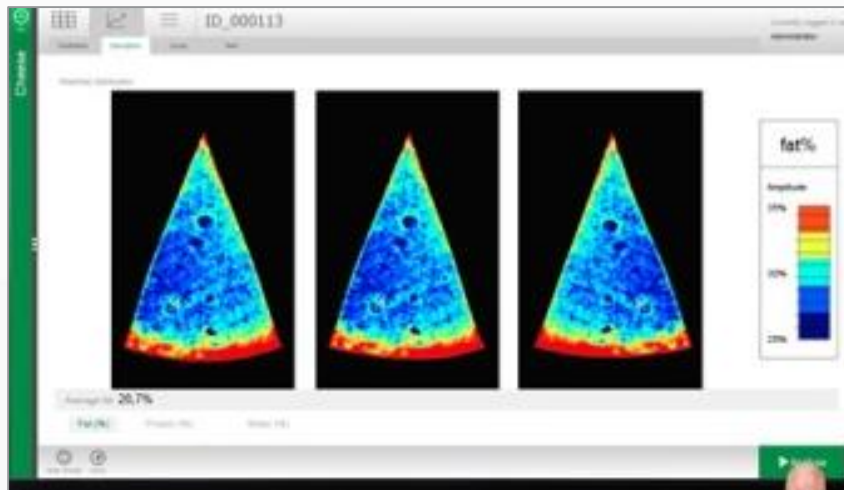
Software

Perception System (Perception Park)

- chemical color imaging
- data processing solution
  enabling industrial hyperspectral imaging
- including hardware perception box

Software

Perception Studio (Perception Park)

- chemical color imaging
- interpretation of hyperspectral data without in depth knowledge of the statistical methods
- software is suited for hyperspectral data acquisition and processing

Software

HSP Food Analyzer (BT-A)

- chemical color imaging
- software package for hyperspectral data processing
- specialized for food
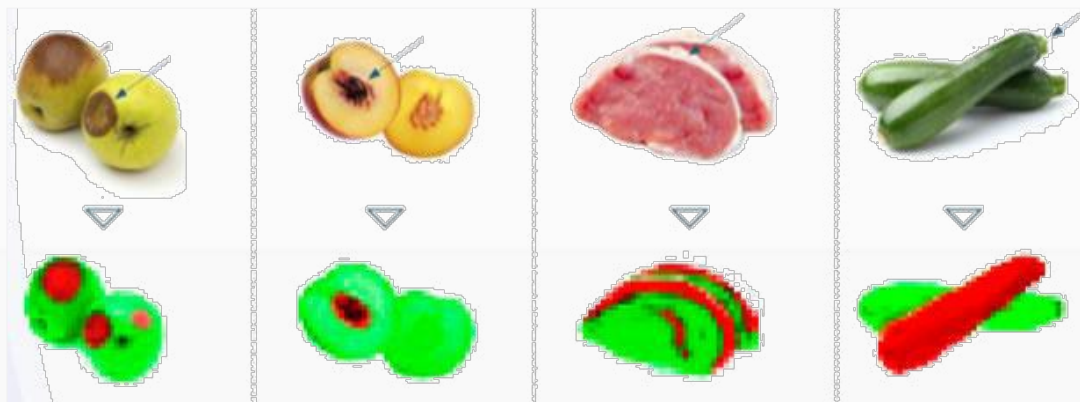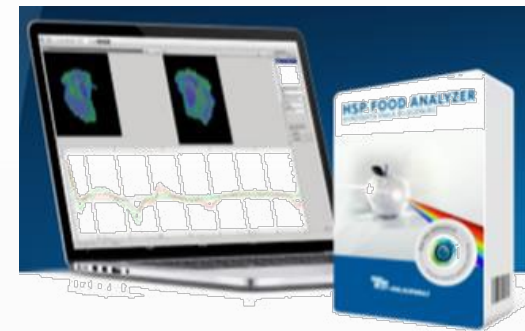
Application example
Wood processing sector

- Improved sorting of scrap wood

- Monitoring of moisture and adhesive distribution on wood-based material surfaces

- Quality assurance in the production of wood-based boards

- RedEye 2.2: 1200nm – 2200nm (extended InGaAs)
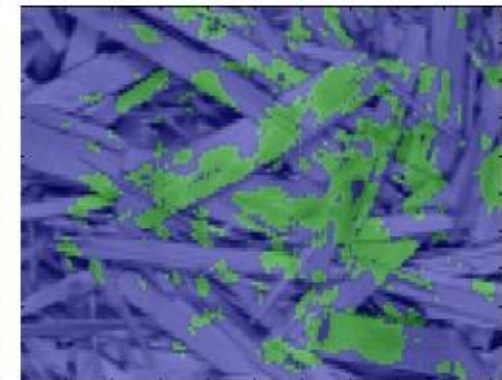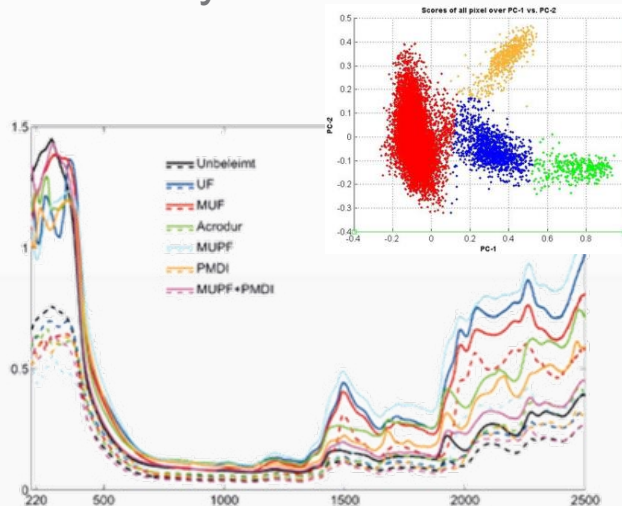
Application example
Pill packaging

- Measurements through not transparent packaging in the 950 nm – 1700 nm spectral range

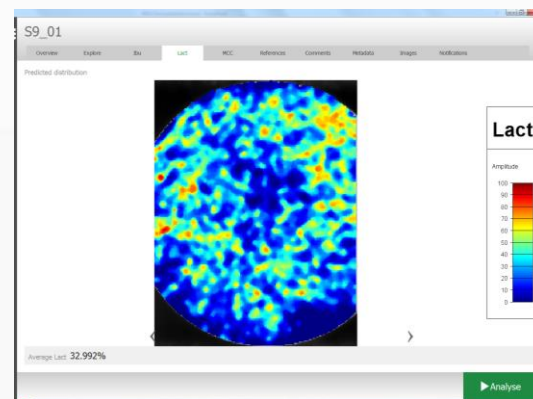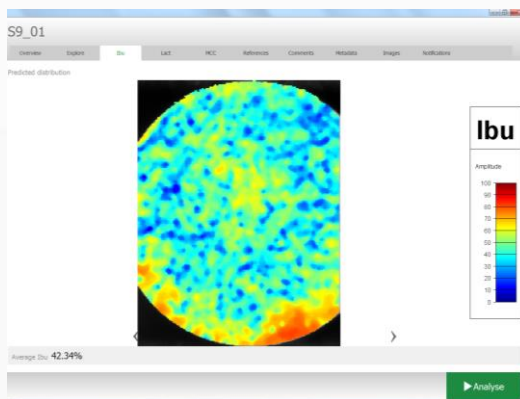- Identification of different pill categories in the blister
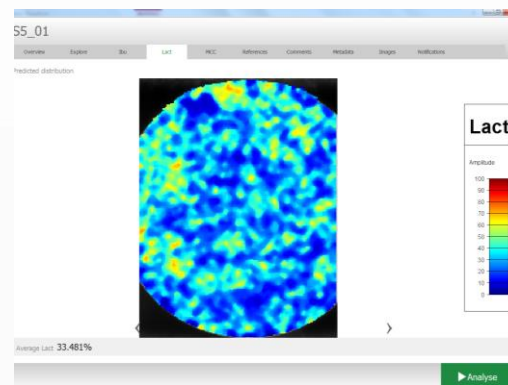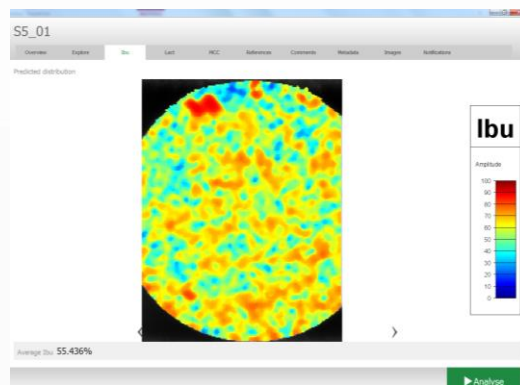
- Detection of missing or false pills
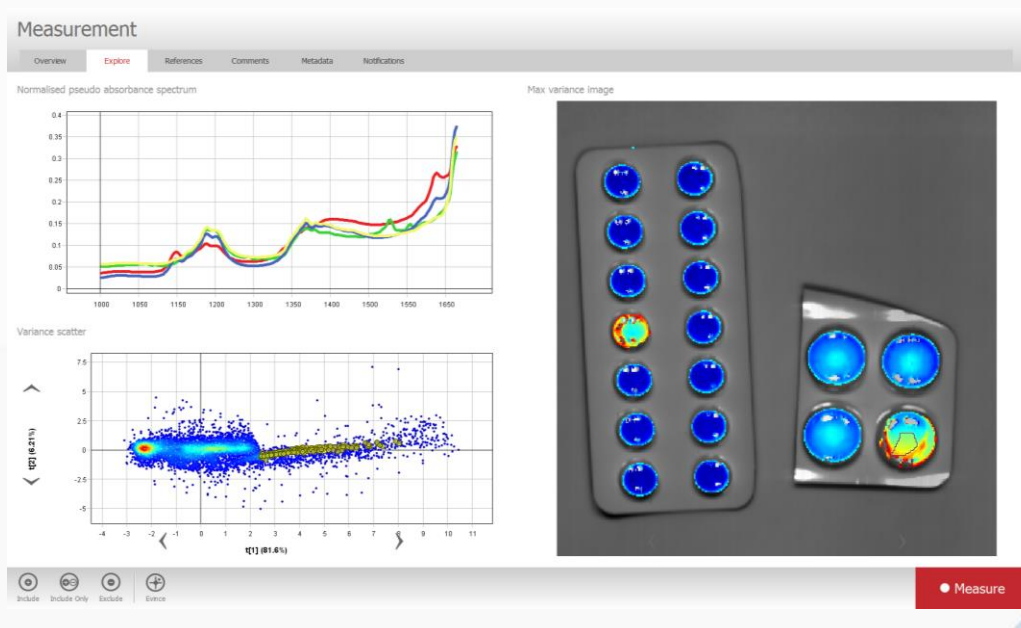
Application example
Ibuprofen tablet

Ibuprofen distribution measurements in the tablets: adult vs. child dosage
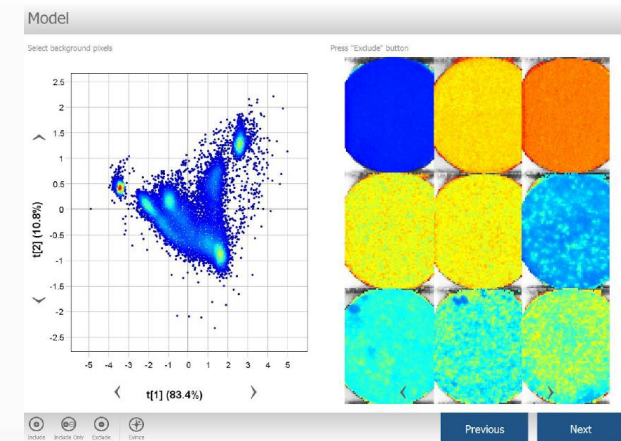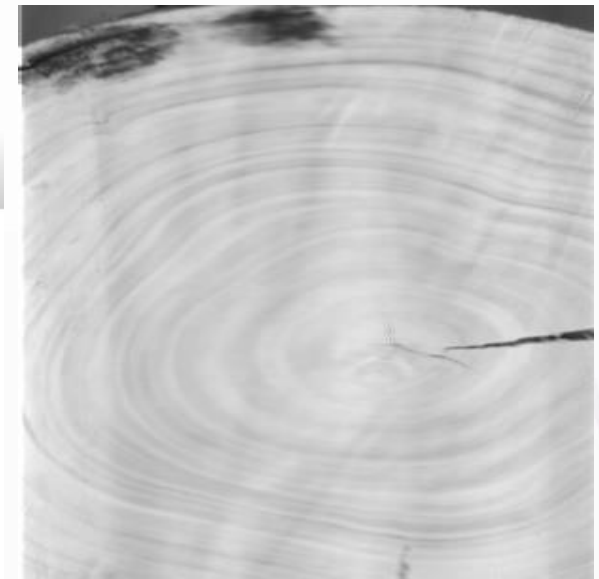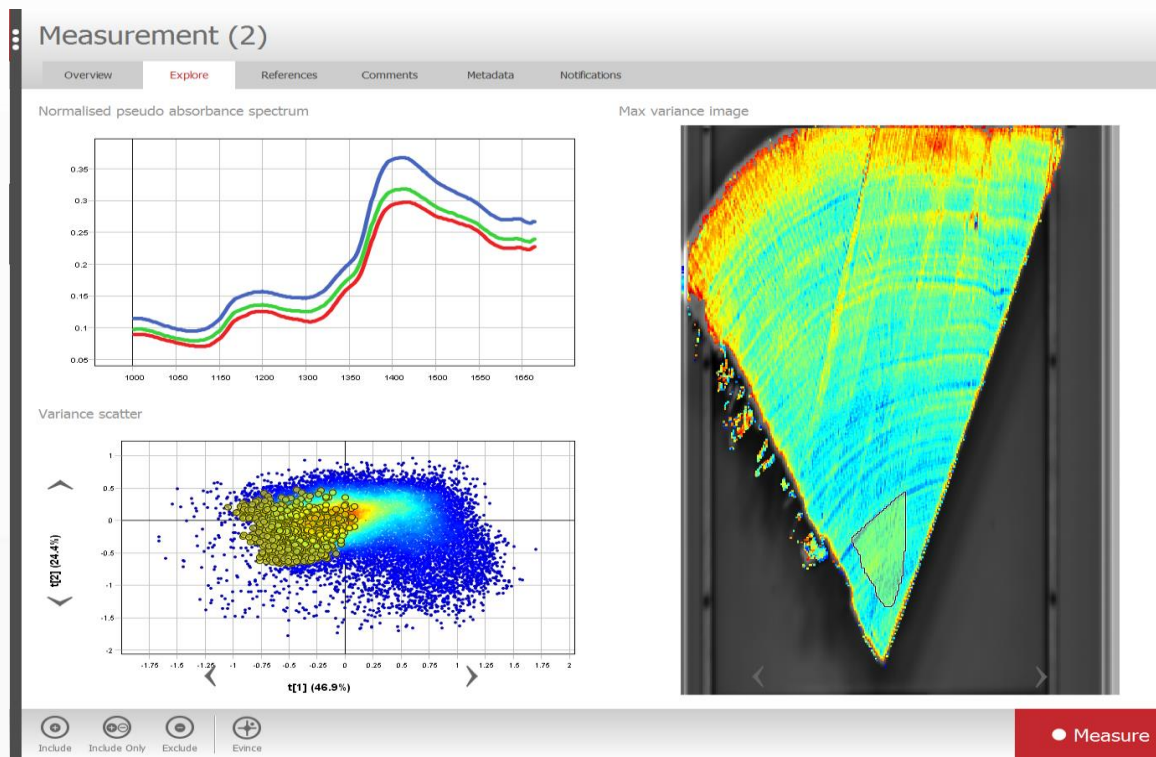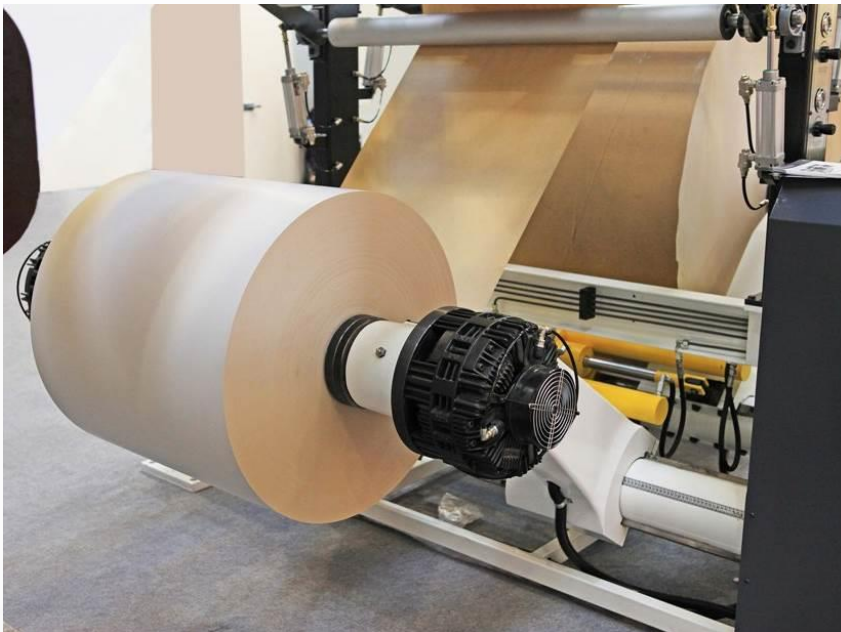
Application example
Tree trunk analysis

Identification of different trunk zones

Application example
Paper moisture measurements
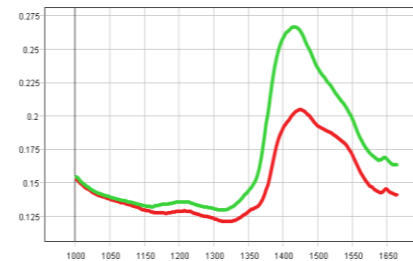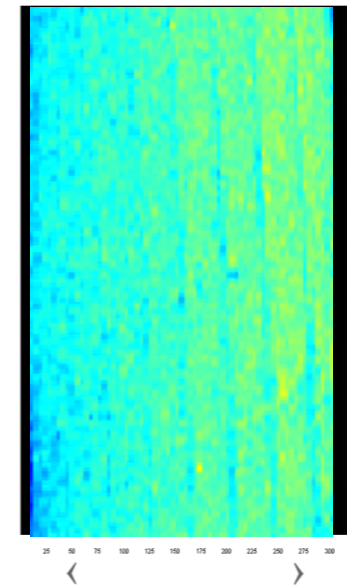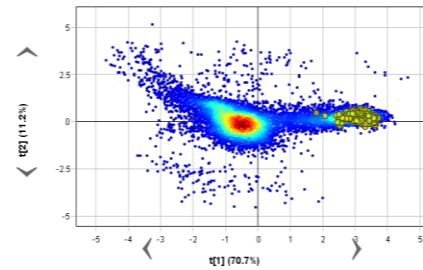
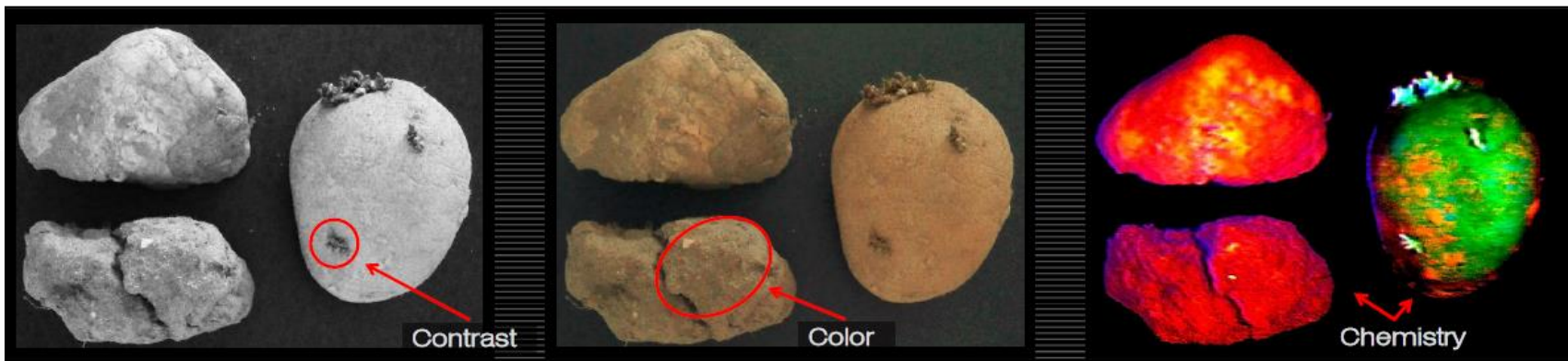Quantitative moisture profile mapping on paper rolls performed using RedEye HSI system in the 950 nm - 1700 nm spectral range.

Application example
Identification of potatoes, stones and soil

Contrast   Color   Chemistry

perception park

- Soil and stones must be removed before further processing of the potatoes but they can often not be discriminated by color

- VNIR 750 nm – 1100 nm spectral imaging identification performed with high certainty
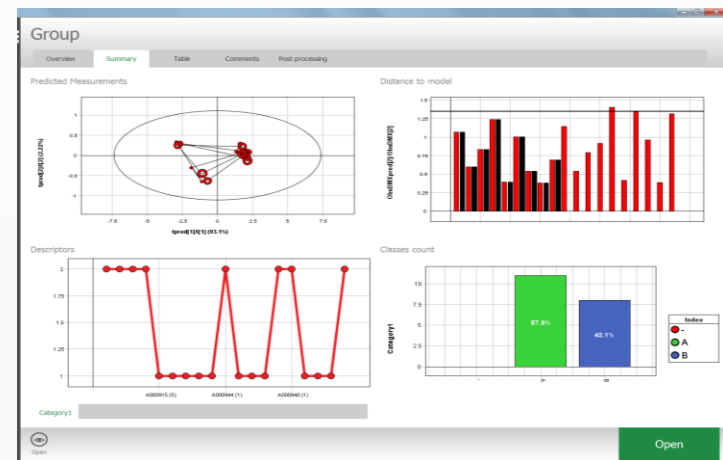
Application example
Almond processing

Detection of almond shells and other

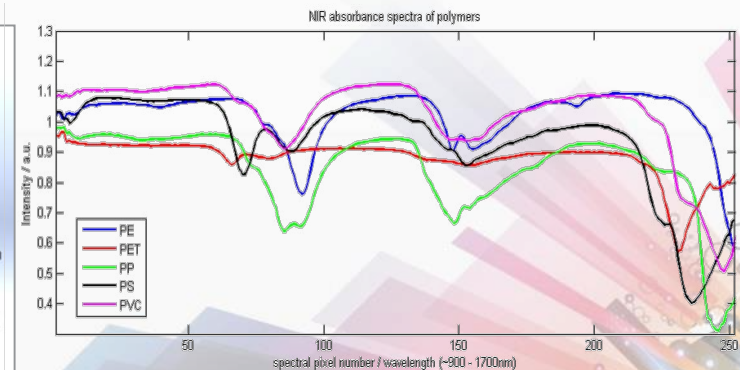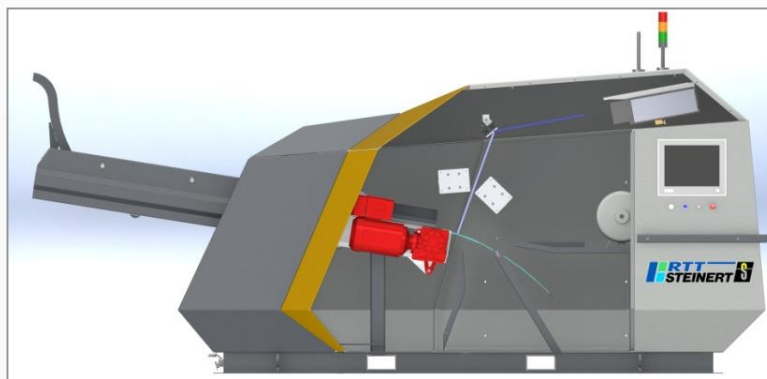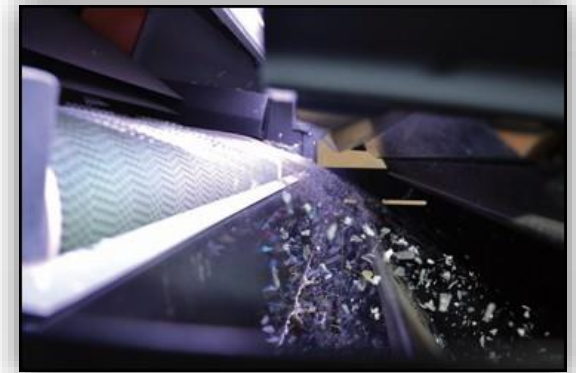foreign objects in the processing line.

Application example Flakesorter

Sorting of plastics or minerals

- Colour sorting for grain size fraction 1-40 mm
- NIR sorting for grain size fraction 5-40 mm
- Sorting width: 750 mm
- Belt speed: 3 - 4,5 m/s
- Line rate for colour sorting >10 kHz (> 2000 px/ line)
- Frame-Rate for NIR sorting up to 330 Hz
  (with reduced spectral resolution also > 1kHz)

Customized Solutions
Blood analysis

- Non invasive blood analysis in the spectral range of 500-850 nm
- Measuring under the skin surface
  - → tissue penetration depth of several mm
- Special development
- Cost efficient miniaturization of optics and electronics
- max. size 50x15x15 mm