



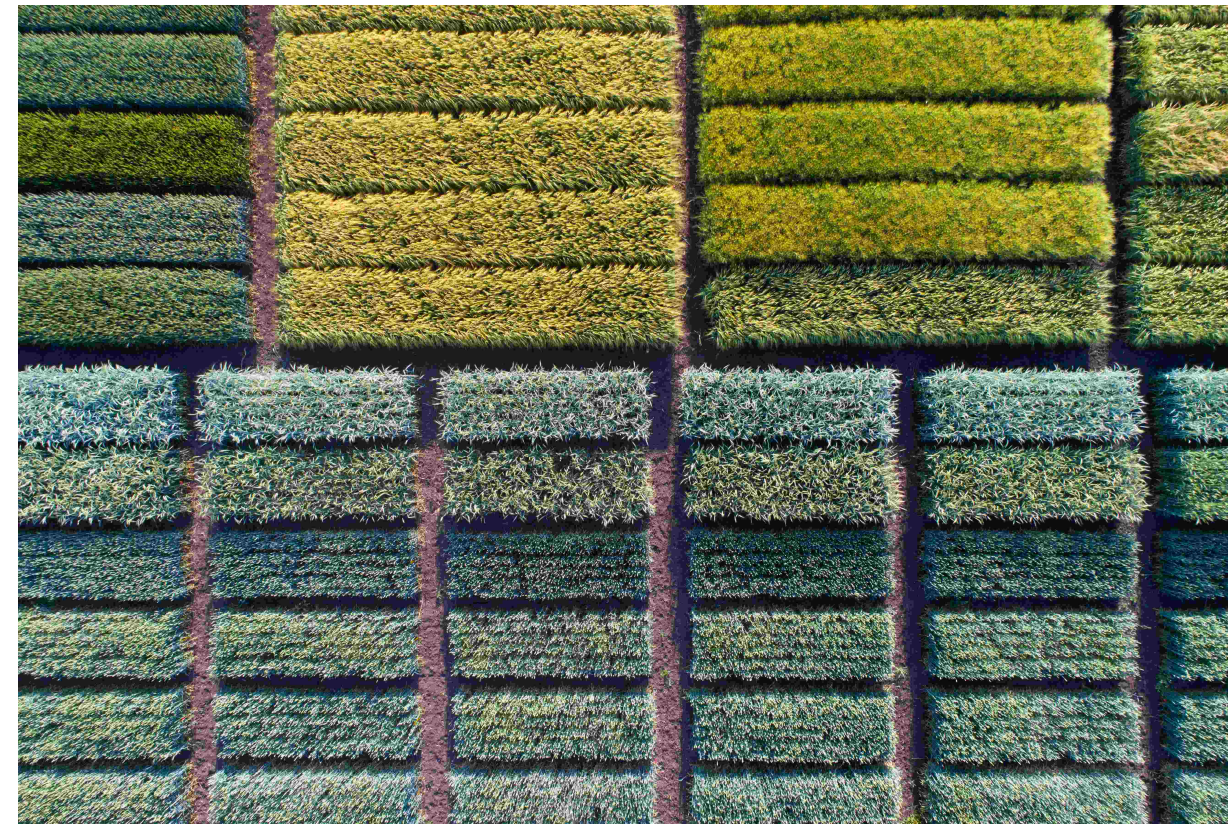
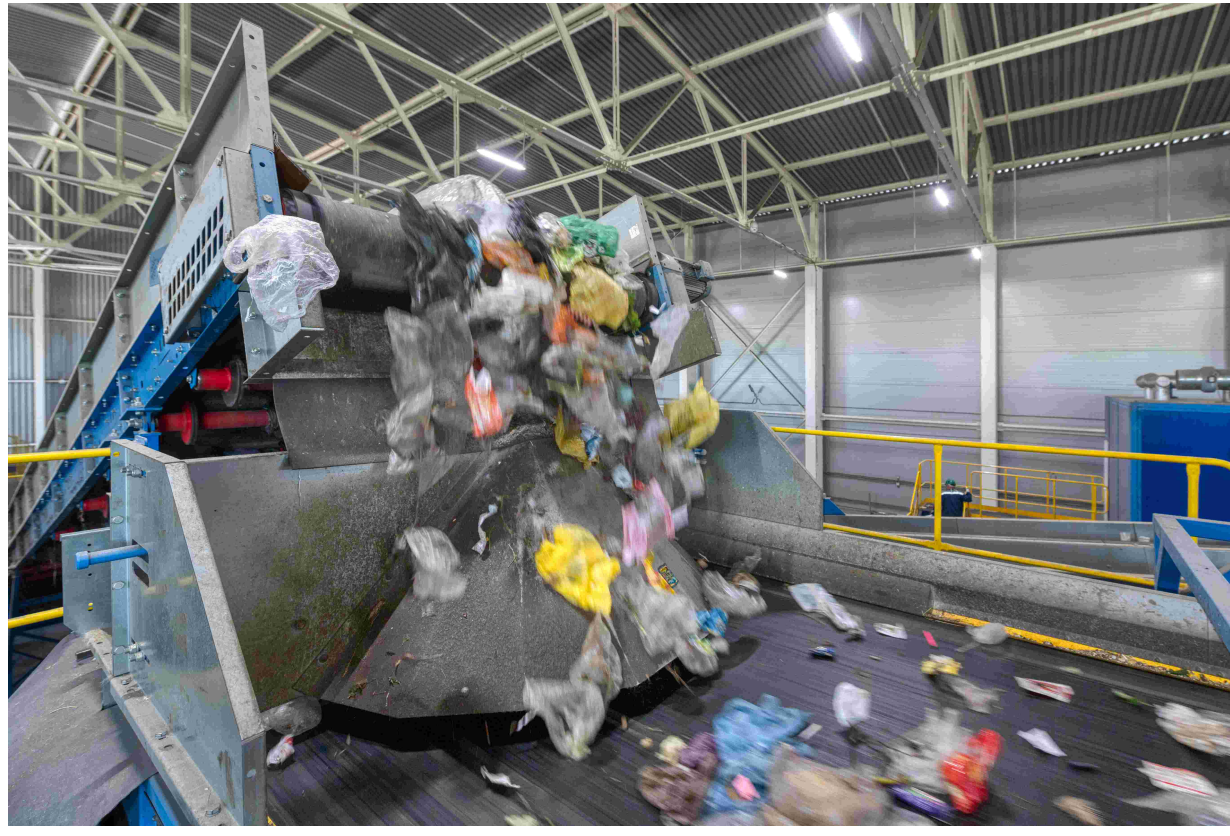
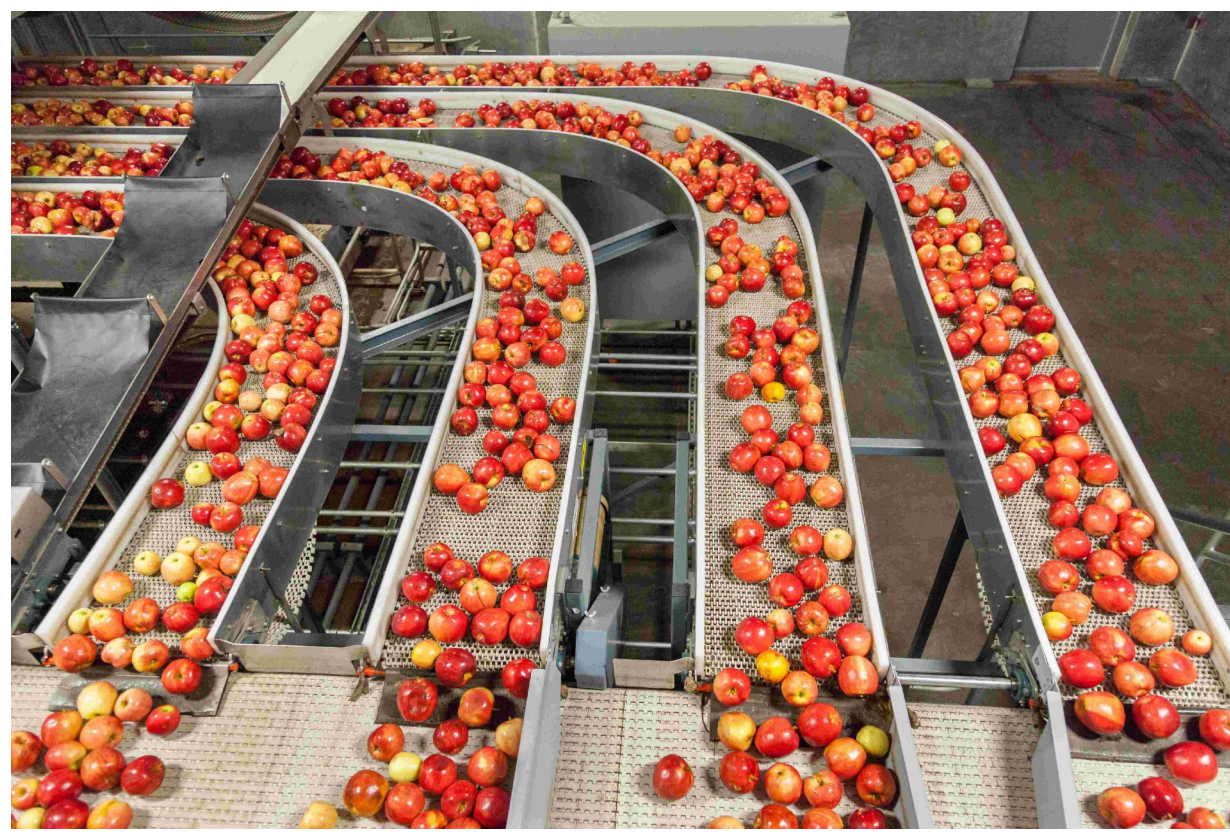
HAIP

Look beyond the visible

HAIP Solutions GmbH, Escherstraße 23, 30159 Hannover | www.haip-solutions.com | info@haip-solutions.com

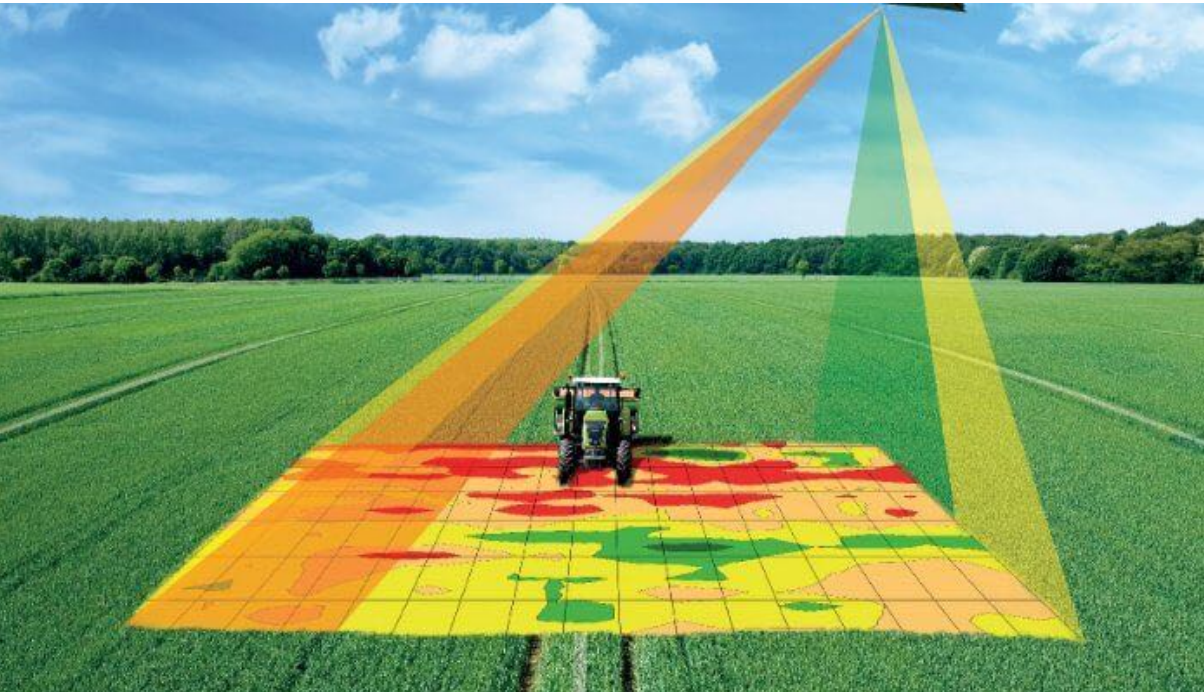
Environmental sector

Use Case



Precision Farming

Use Case



FUTURE FARMS small and smart

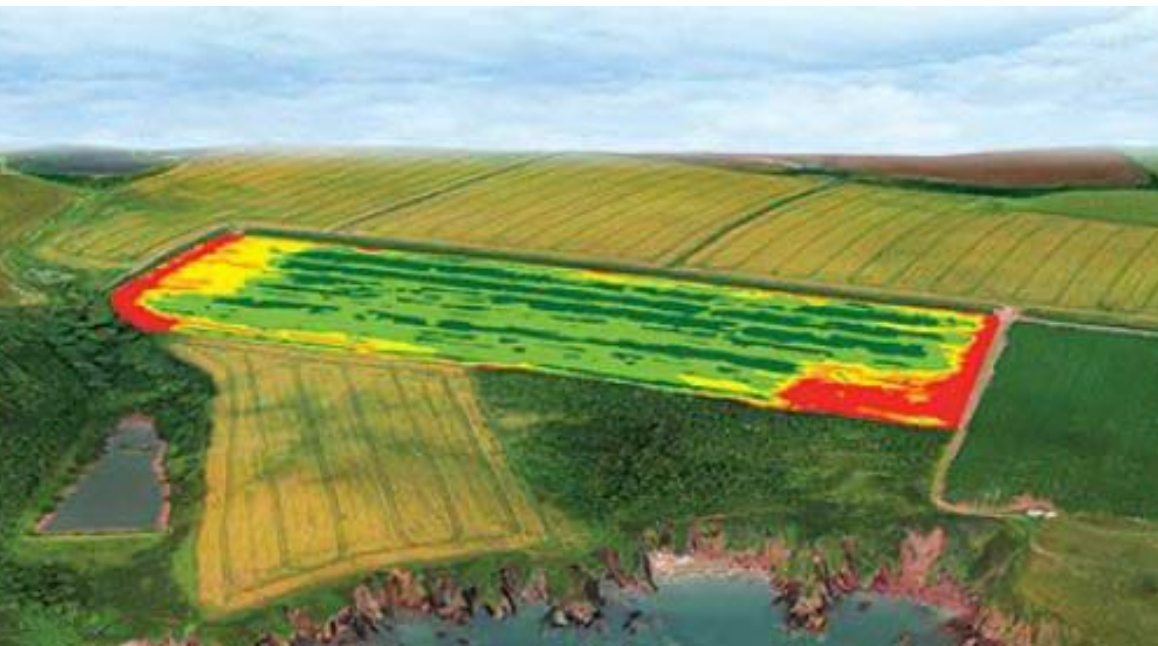
SURVEY DRONES
Aerial drones survey the fields, mapping weeds, yield and soil variation. This enables precise application of inputs, mapping spread of pernicious weed blackgrass could increase wheat yields by 2-5%.

FLEET OF AGRIBOTS
A herd of specialised agribots tend to crops, weeding, fertilising and harvesting. Robots capable of microdot application of fertiliser reduce fertiliser cost by 99.9%.

FARMING DATA
The farm generates vast quantities of rich and varied data. This is stored in the cloud. Data can be used as digital evidence reducing time spent completing grant applications or carrying out farm inspections saving on average £5,500 per farm per year.

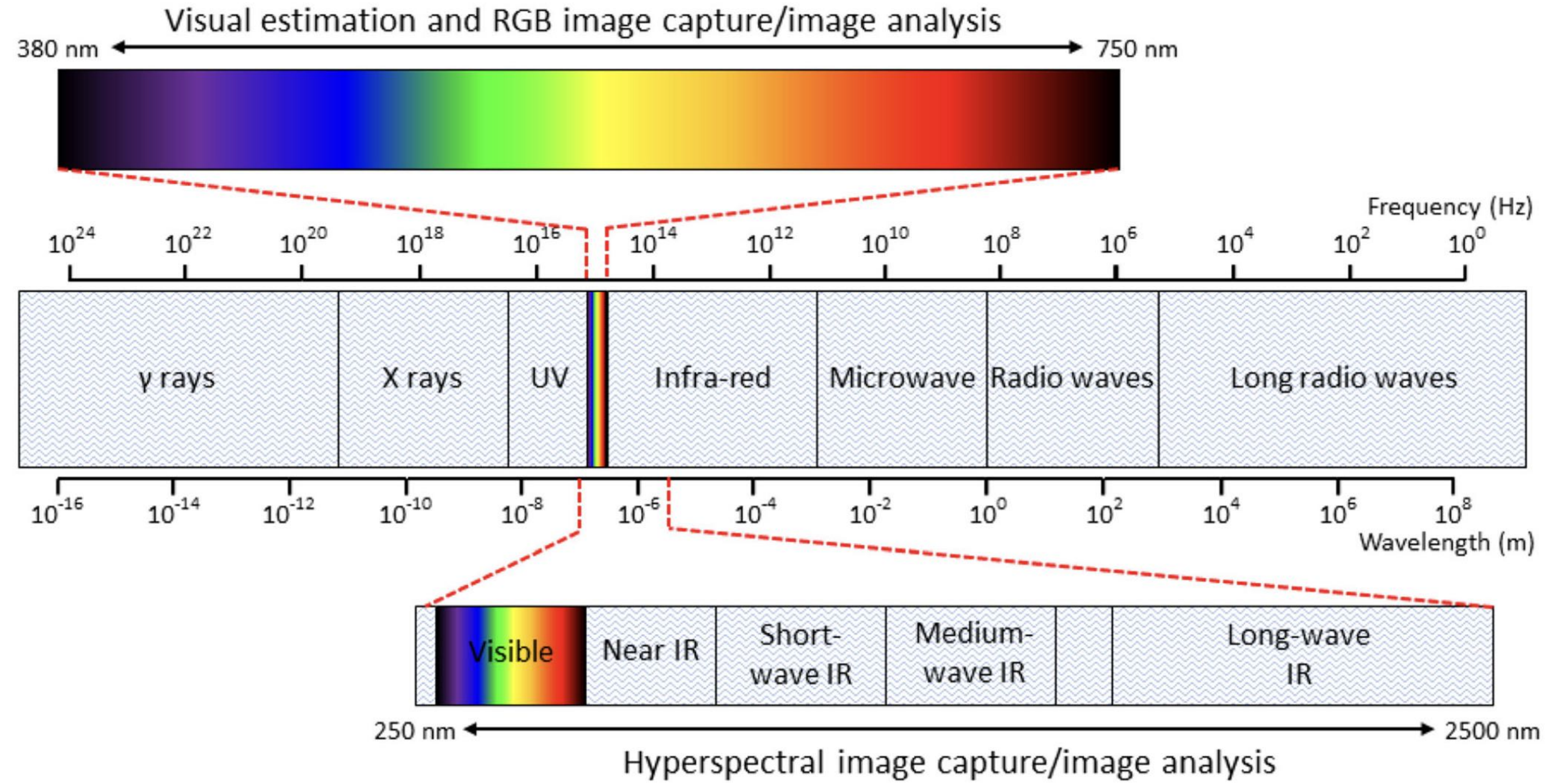
TEXTING COWS
Sensors attached to livestock allowing monitoring of animal health and wellbeing. They can send texts to alert farmers when a cow goes into labour or develops infection increasing herd survival and increasing milk yields by 10%.

SMART TRACTORS
GPS controlled steering and optimised route planning reduces soil erosion, saving fuel costs by 10%.



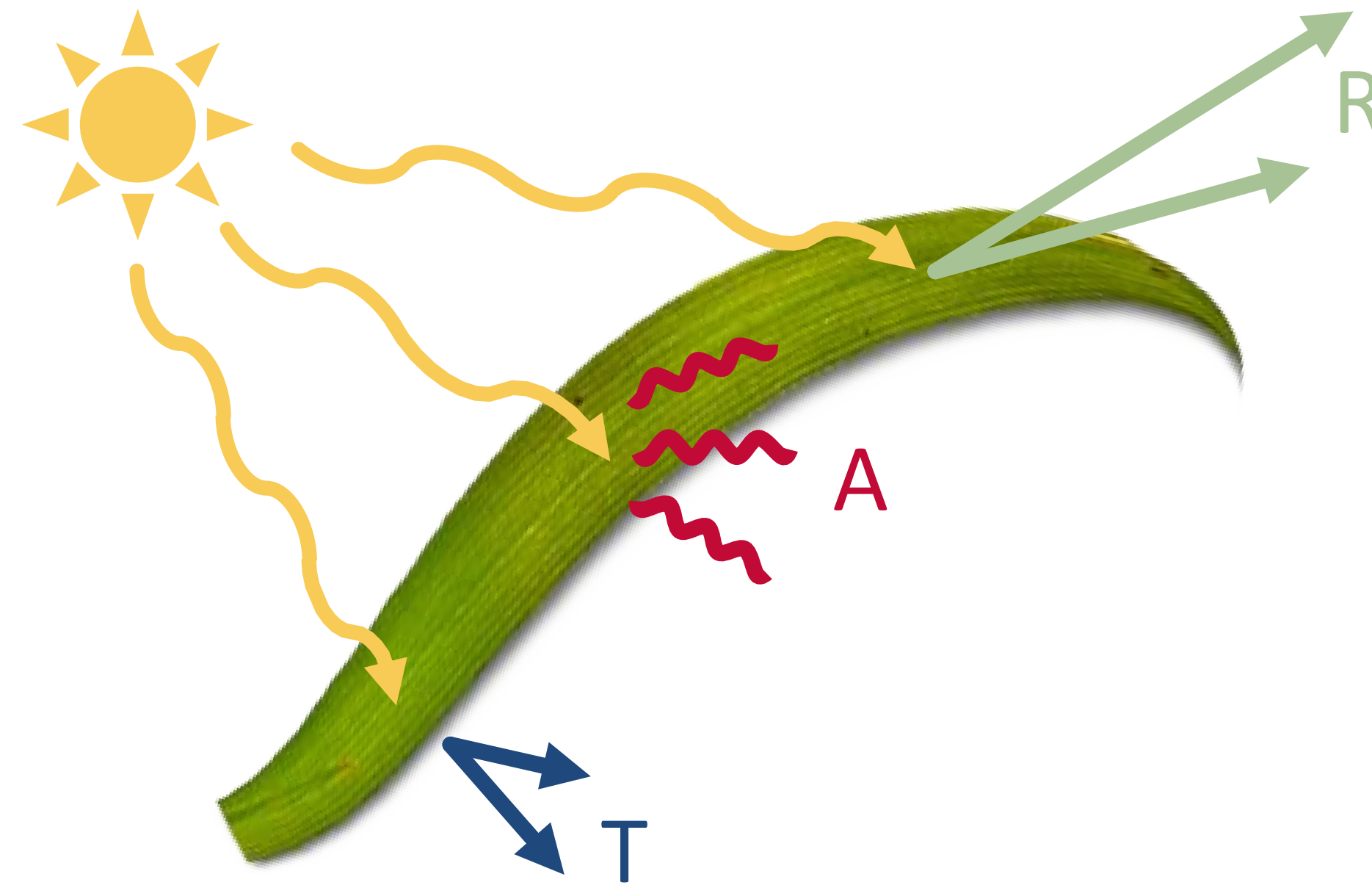
Electromagnetic radiation

Basics - Excursus



Electromagnetic radiation

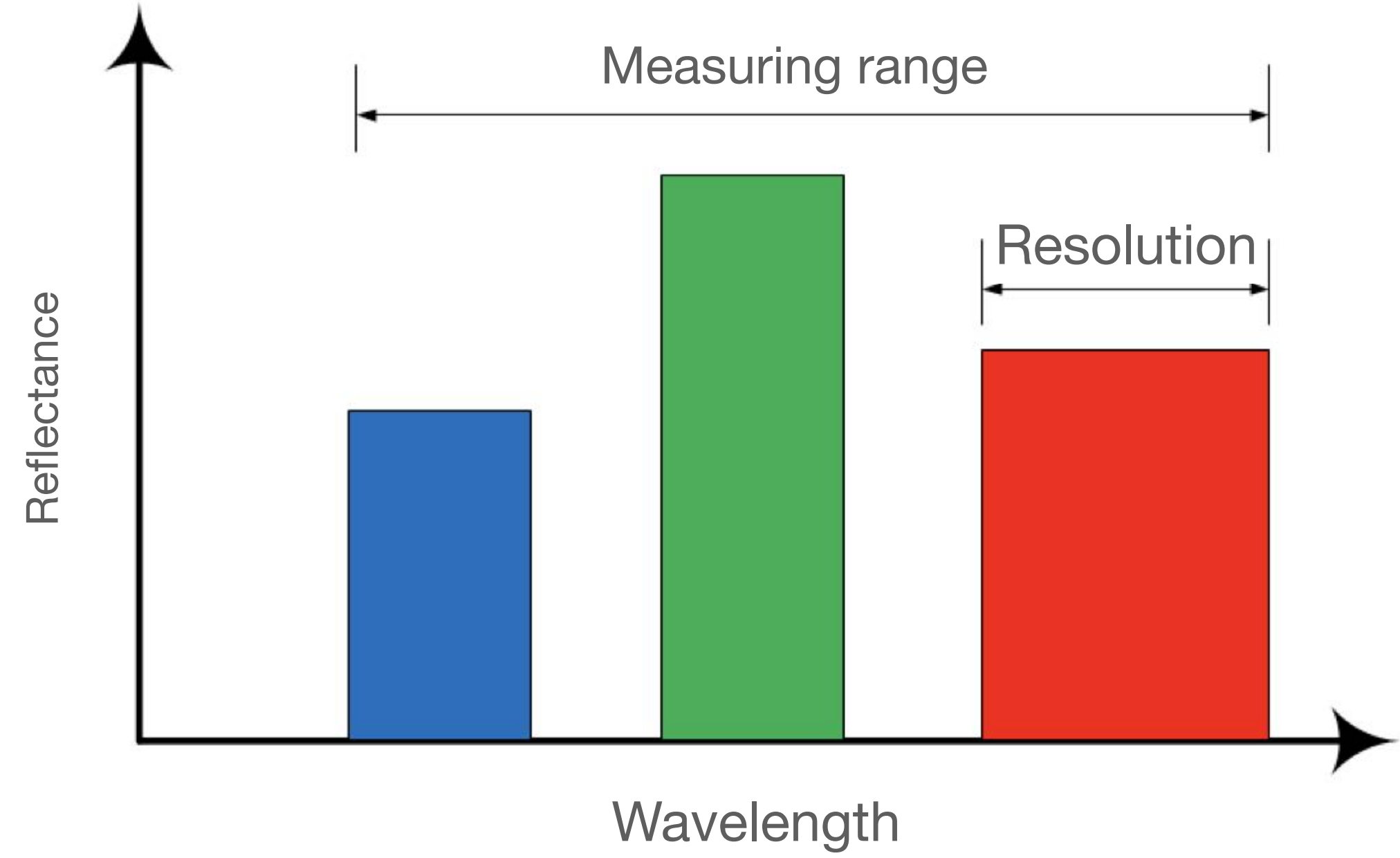
Basics - Excursus



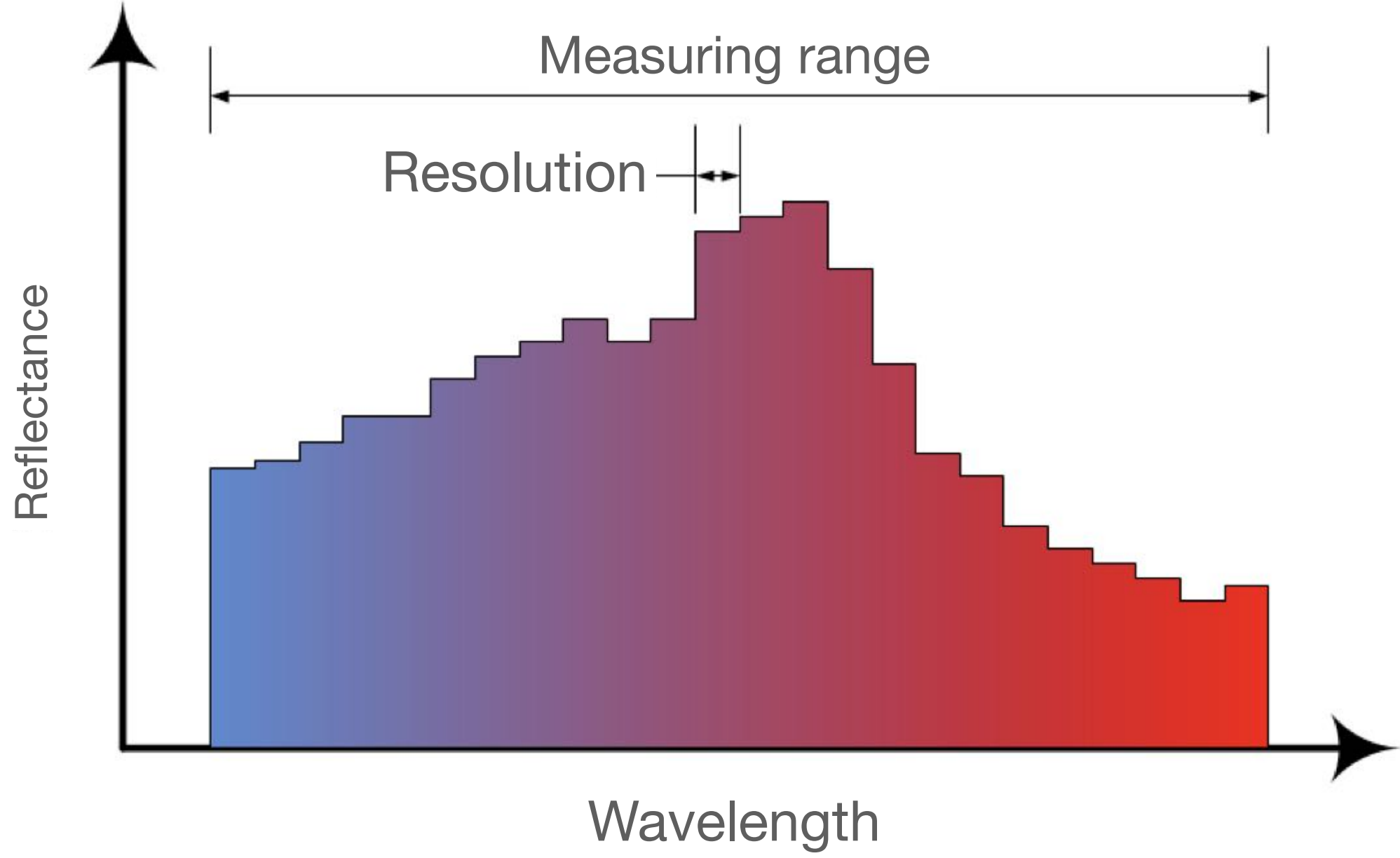
$$\text{Radiant flux} = \text{Absorption (A)} + \text{Transmission (T)} + \text{Reflexion (R)} = 1$$

Electromagnetic radiation

Basics - Excursus



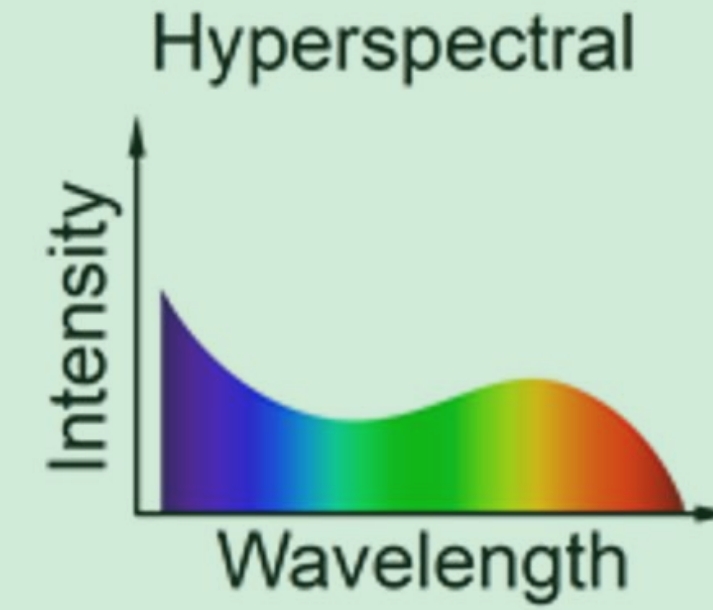
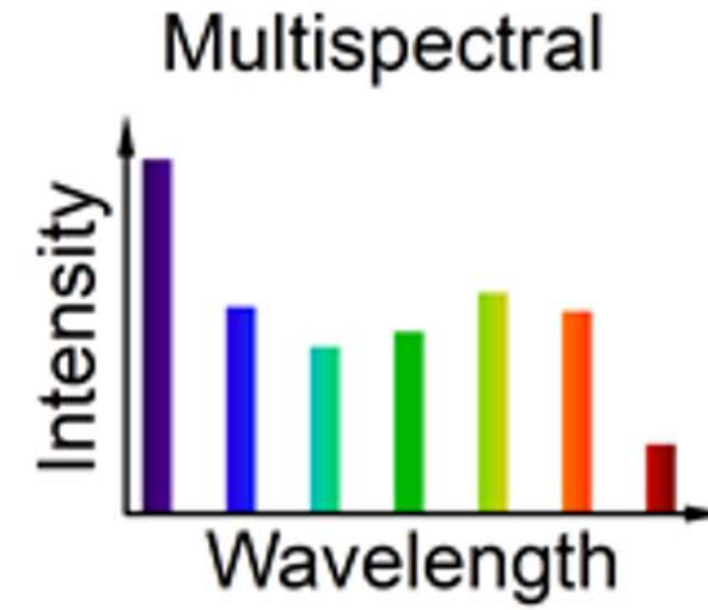
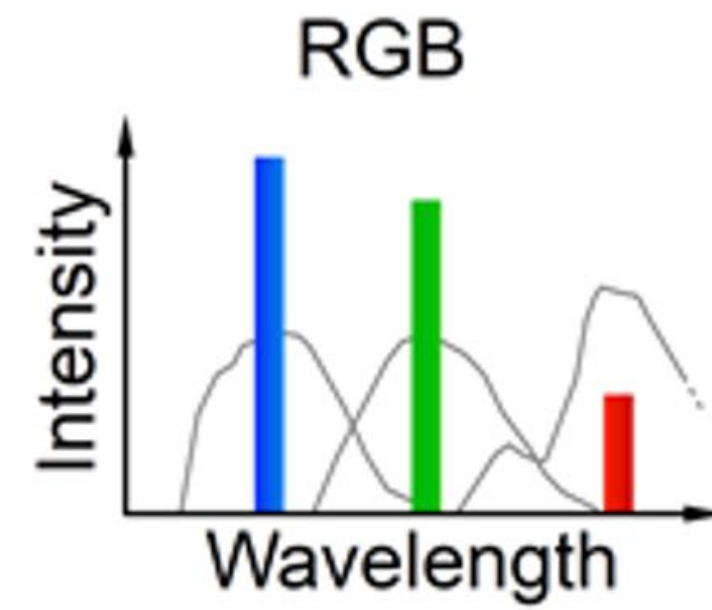
Multispectral



Hyperspectral

Electromagnetic radiation

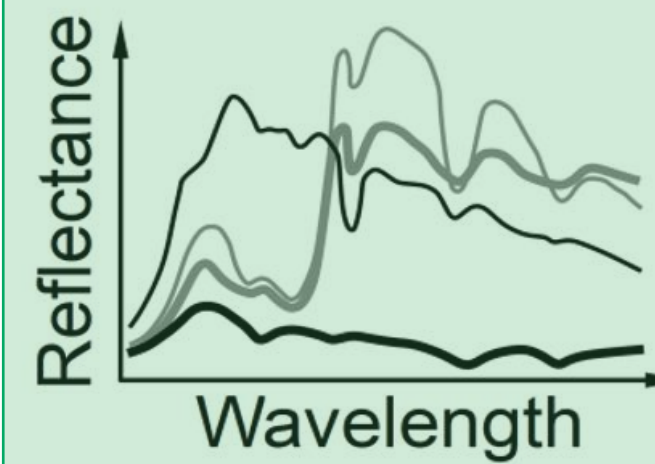
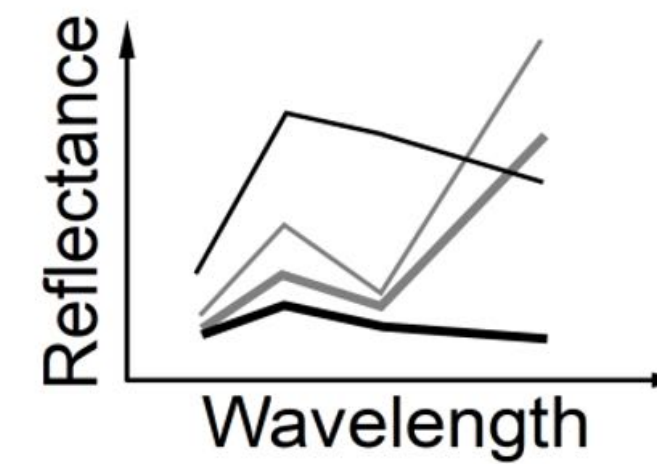
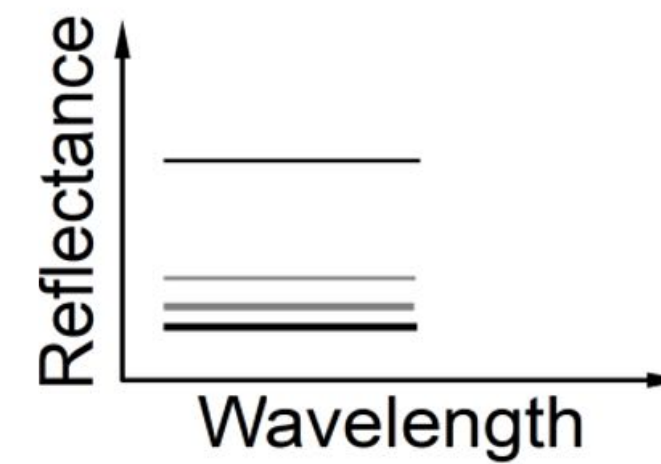
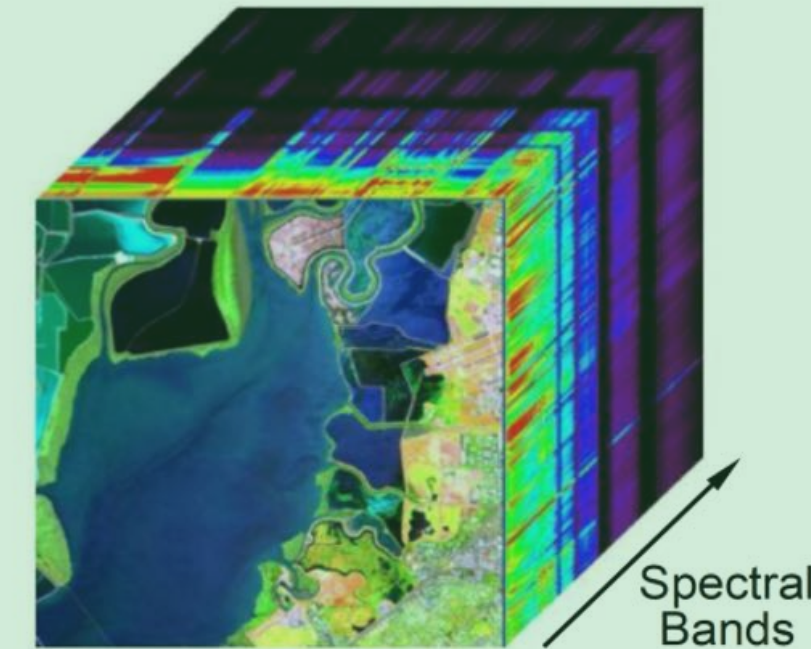
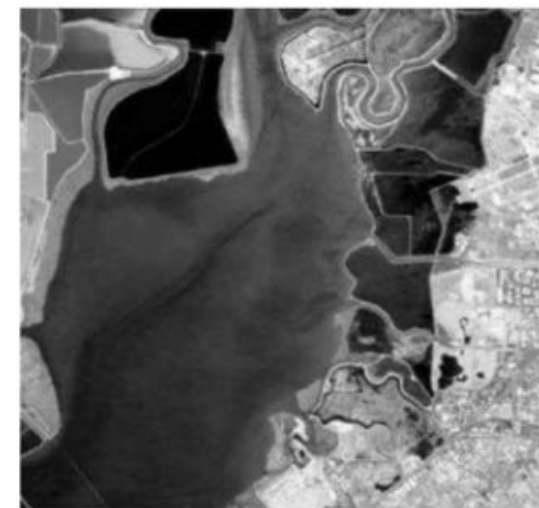
Basics - Excursus



Single Band

Multispectral

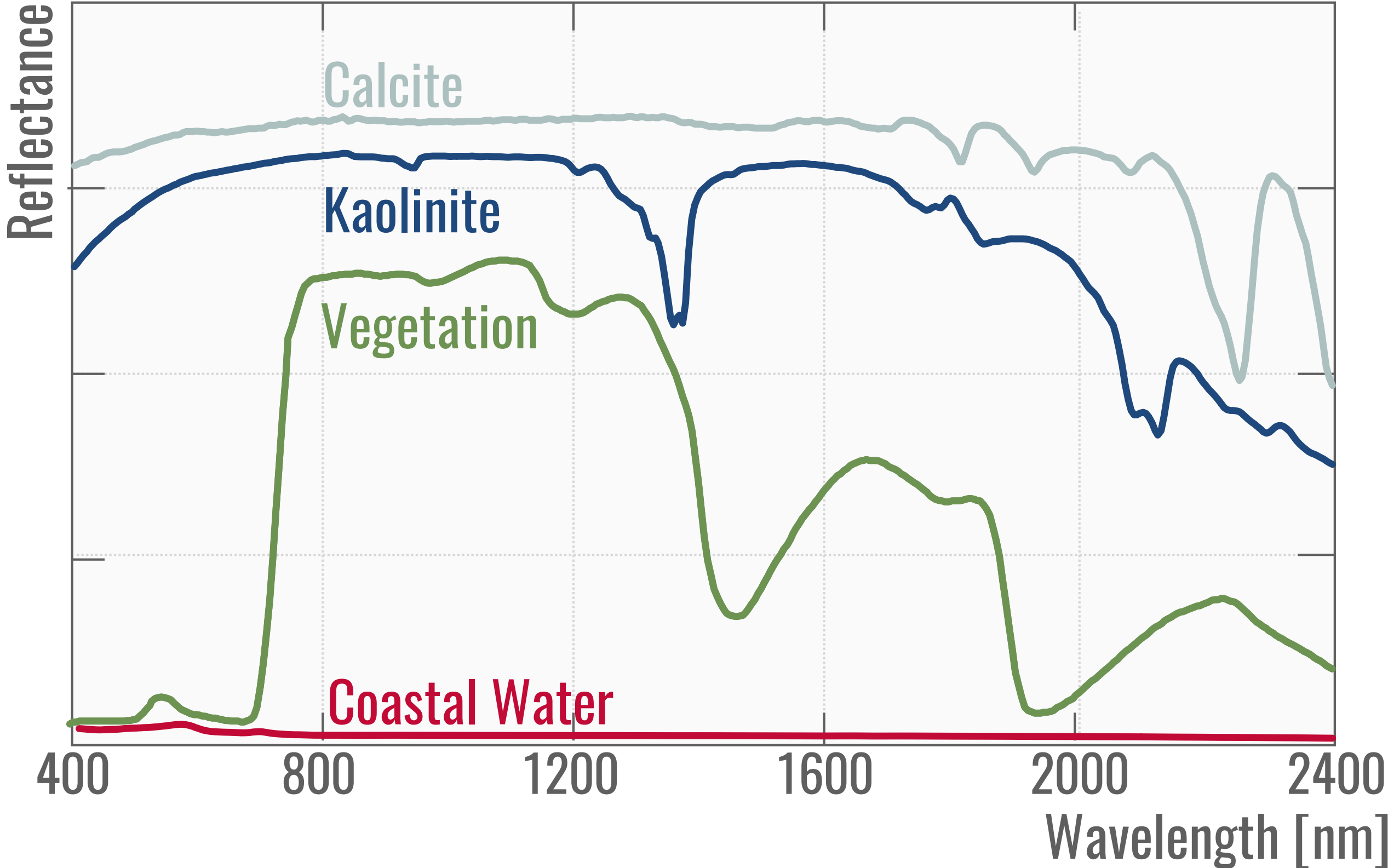
Hyperspectral



- Sandy Soil
- Grassland
- Pinewood
- Silty Water

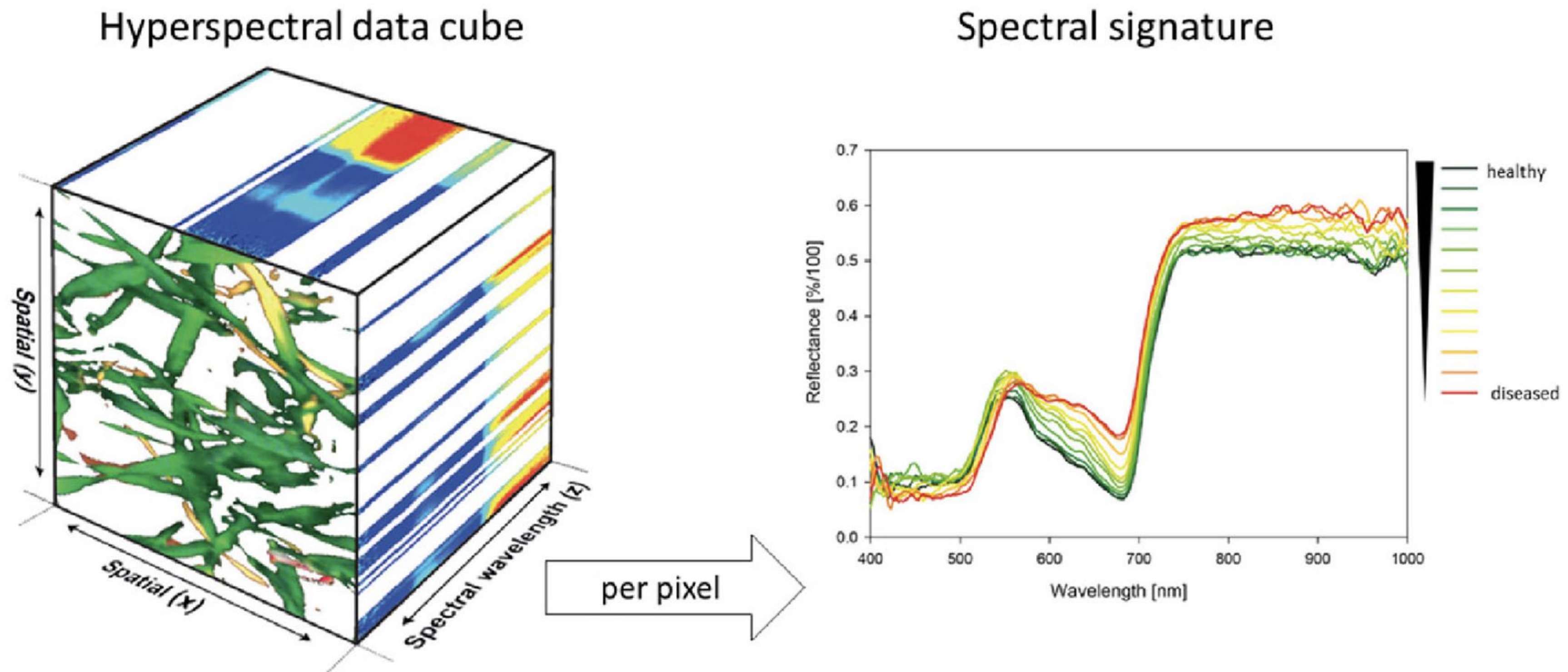
Reflection of surfaces

Basics



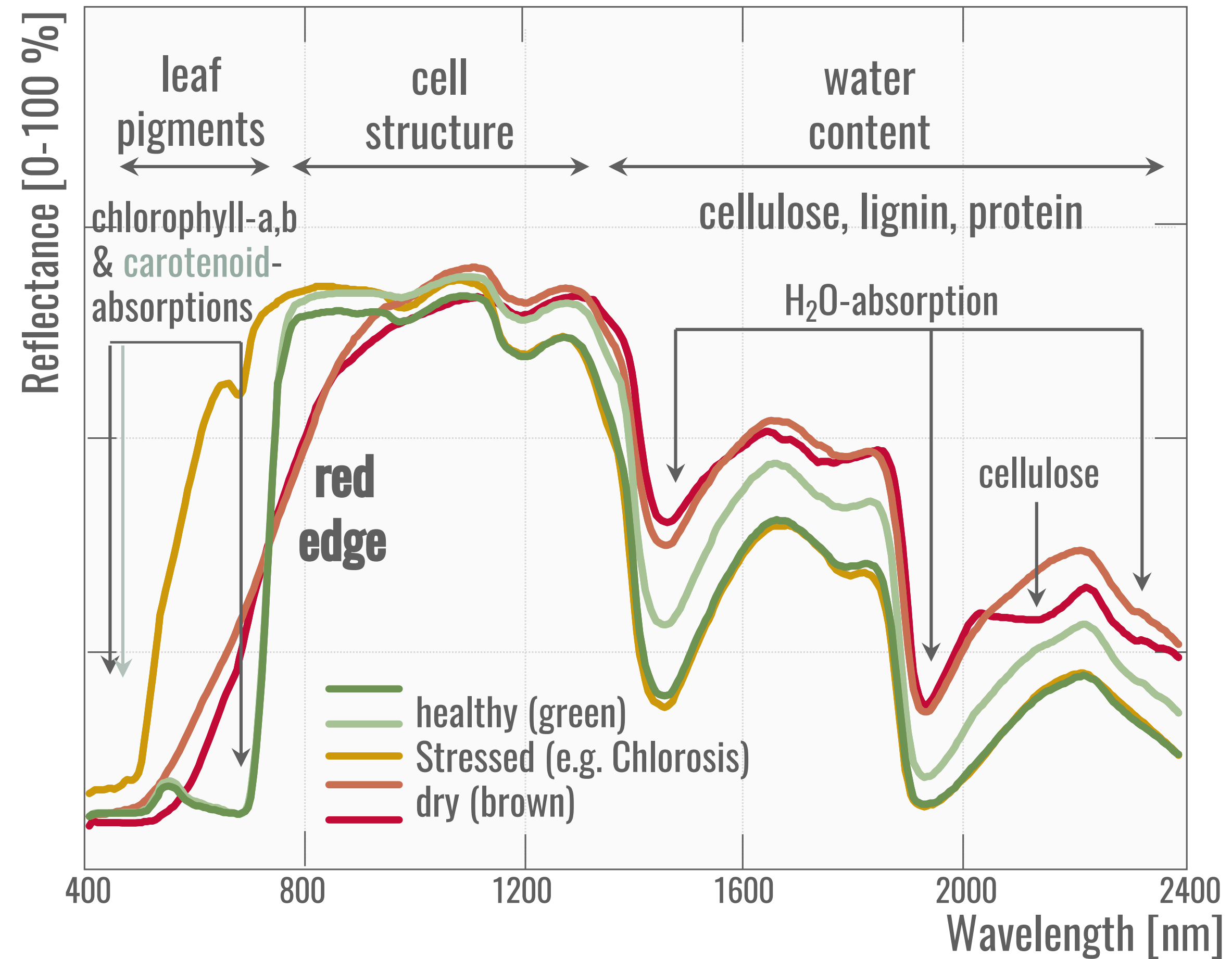
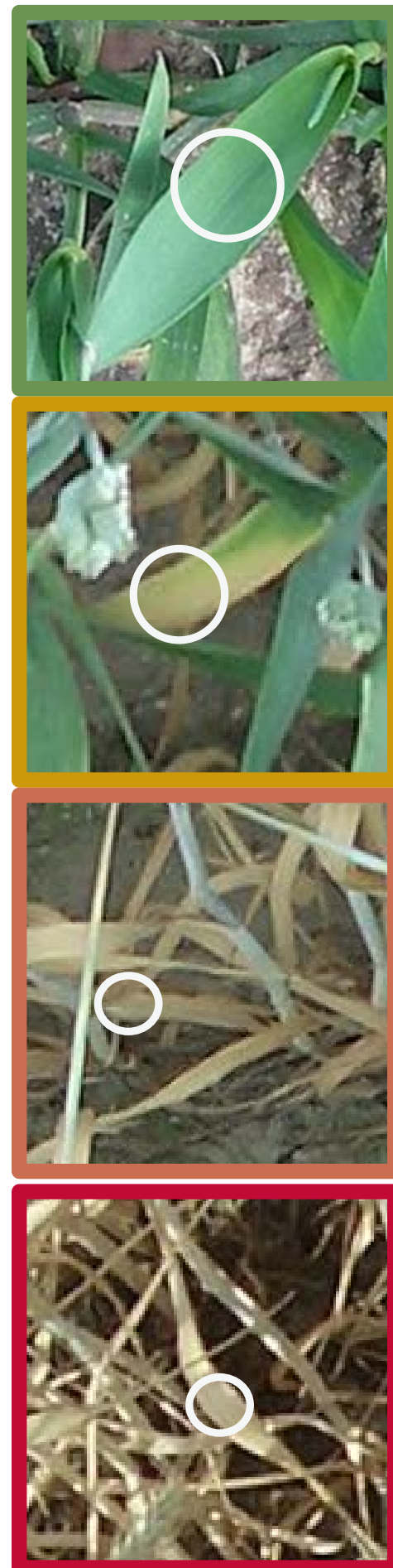
Reflection of vegetation

Basics



Reflection of vegetation

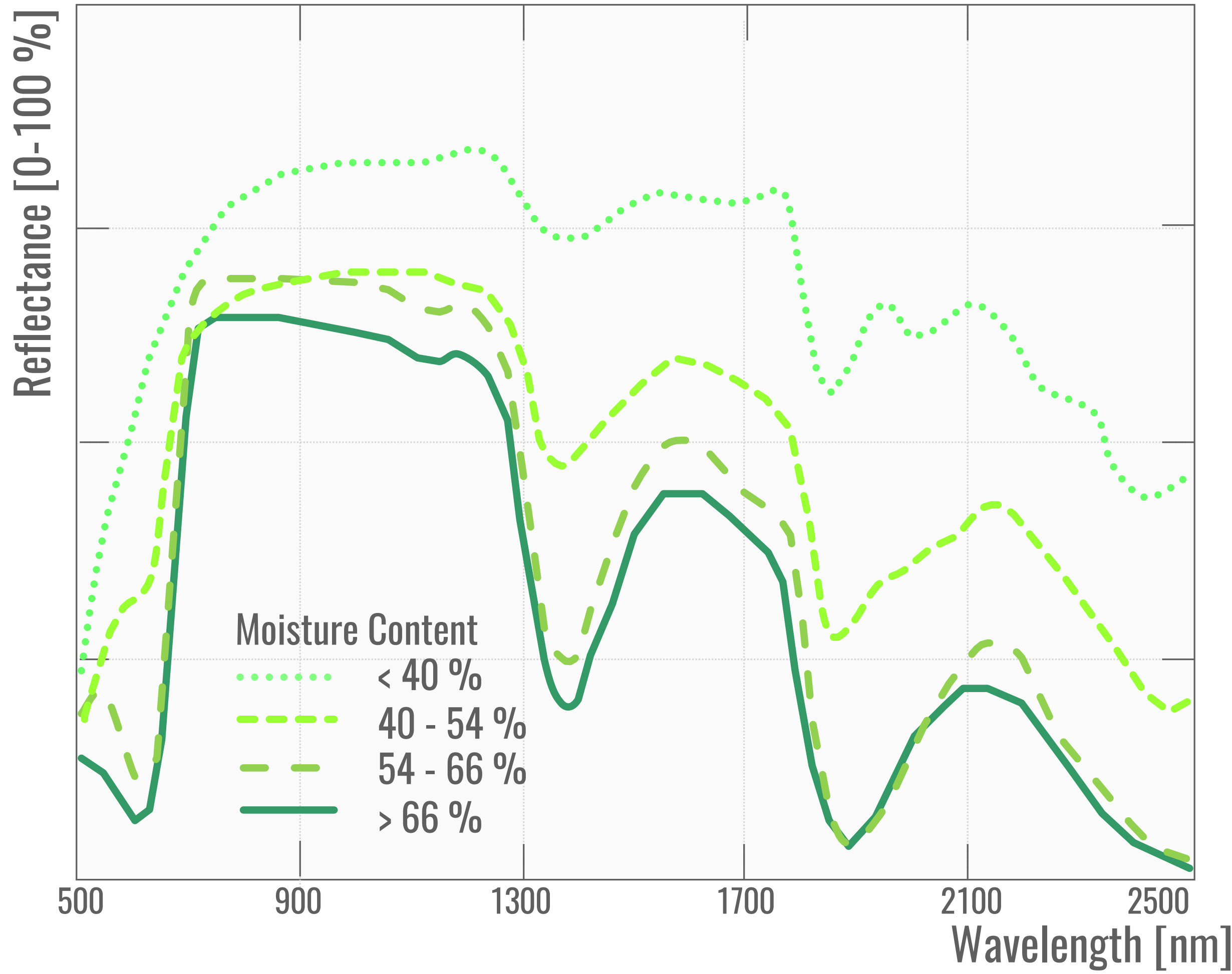
Basics



Chlorophylls
↓
↑
Anthocyanin
Carotenoids
Xanthophylls

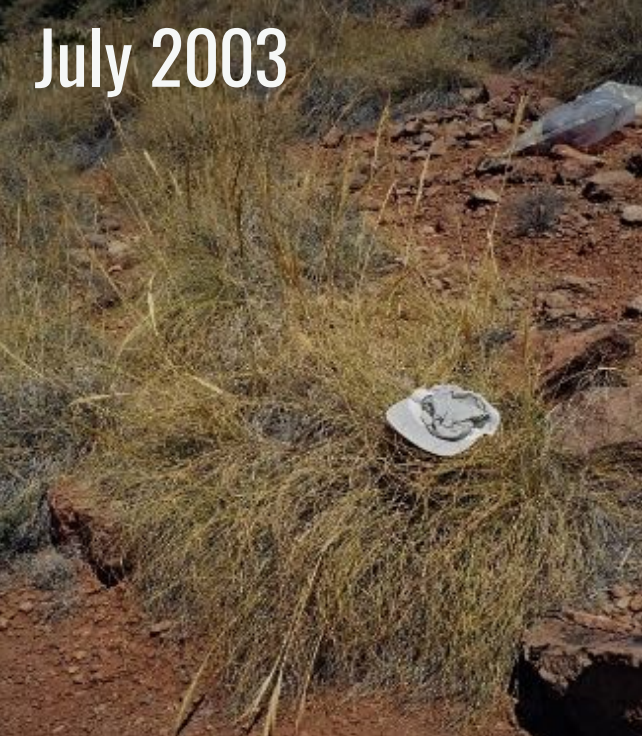
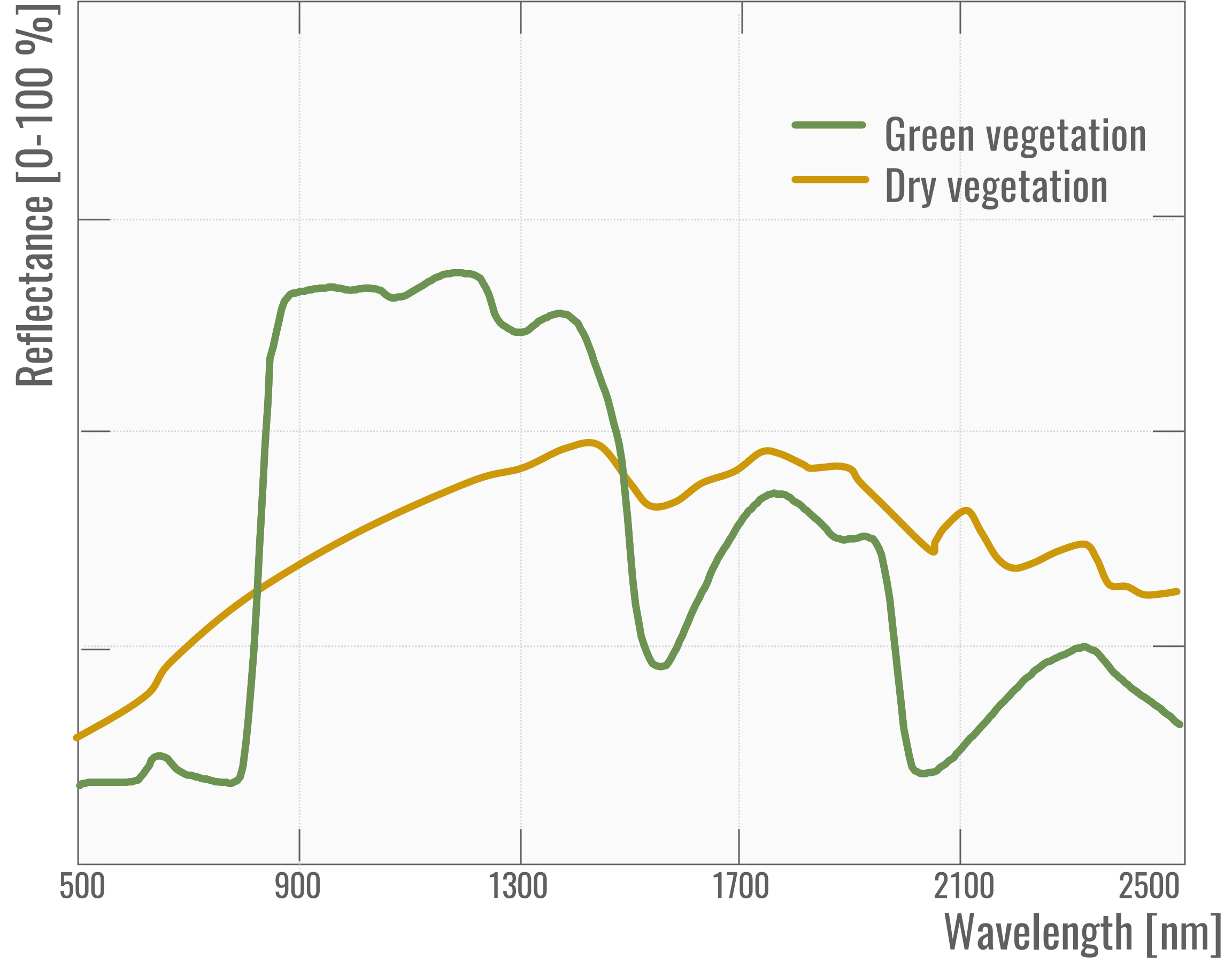
Reflection of vegetation

Basics



Reflection of vegetation

Basics



Stipa (*Stipa tenacissima*), Cabo de Gata, Spain

Userfriendly HSI-Technology

Products

HAIP *BlackBullet*



Smart VNIR Sensor

HAIP *BlackBox*



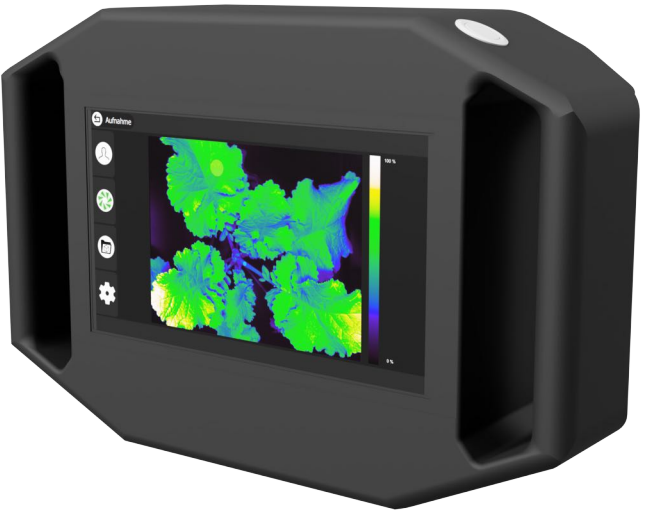
Controlled environment

HAIP *BlackBird V2*



UAV-based survey

HAIP *BlackMobile*



Mobile applications

HAIP *BlackIndustry*



Industrial in-line

HAIP BlackBird V2 - UAV-based survey Solution



Features

- Smart Hyperspectral Line-Scanner
- Two modes: Hover & Line-Scan
- VNIR (500-1000 nm)
- Two sensors: HSI & RGB
- 100 spectral bands
- High Signal-to-noise ratio in NIR range
- DJI Skyport 2.0 connector
- Internal GPU for pre-processing

Integration into DJI Payload SDK

Solution (Hardware)



HAIP BlackIndustry SWIR 1.7 / Max



PRODUCT DATA SHEET

BLACKINDUSTRY SWIR 1.7



HAIP Solutions BlackIndustry SWIR Spectral Imaging System is a smart line scanning (push-broom) near-infrared hyperspectral imaging camera that allows the acquisition of real-time spectral data with very high spatial resolution.

The outstanding sensitivity in the NIR range from 900 nm to 1730 nm is perfect for the use in industrial in-line applications. With a frame rate of 450 Hz at full frame and up to 1300 Hz with ROI, BlackIndustry SWIR is a high performance spectral imaging system designed for applications that require high light throughput, fast data acquisition and good imaging performance.

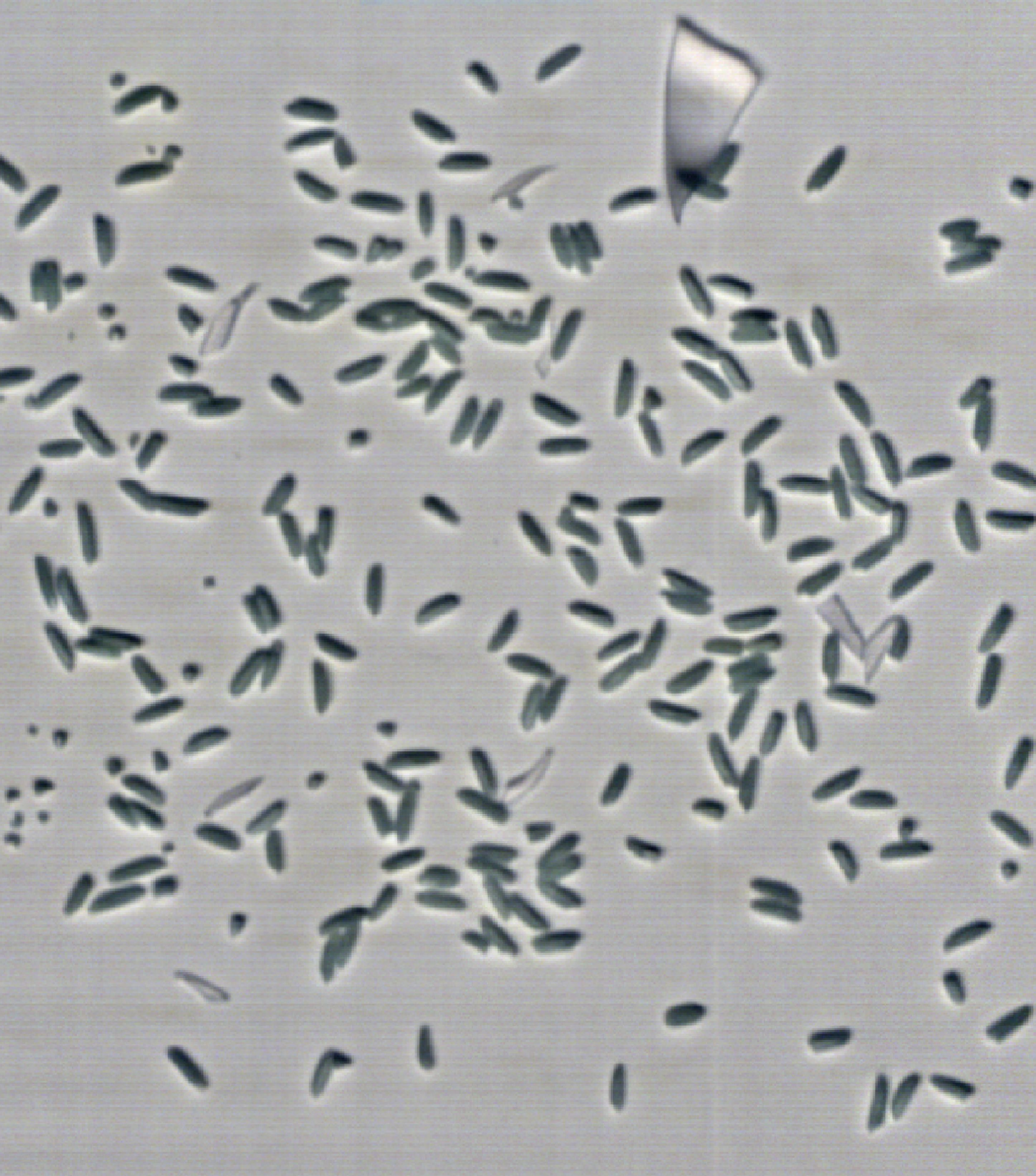
Features

- Smart Hyperspectral Line-Scanner
- Designed for industrial in-line applications
- SWIR (900-1730 nm)
- Up to 420 spectral bands (selectable)
- Spatial resolution: 640 px
- Framerate: 450/1300 Hz (Full Frame/ROI)
- Internal GPU for pre-processing



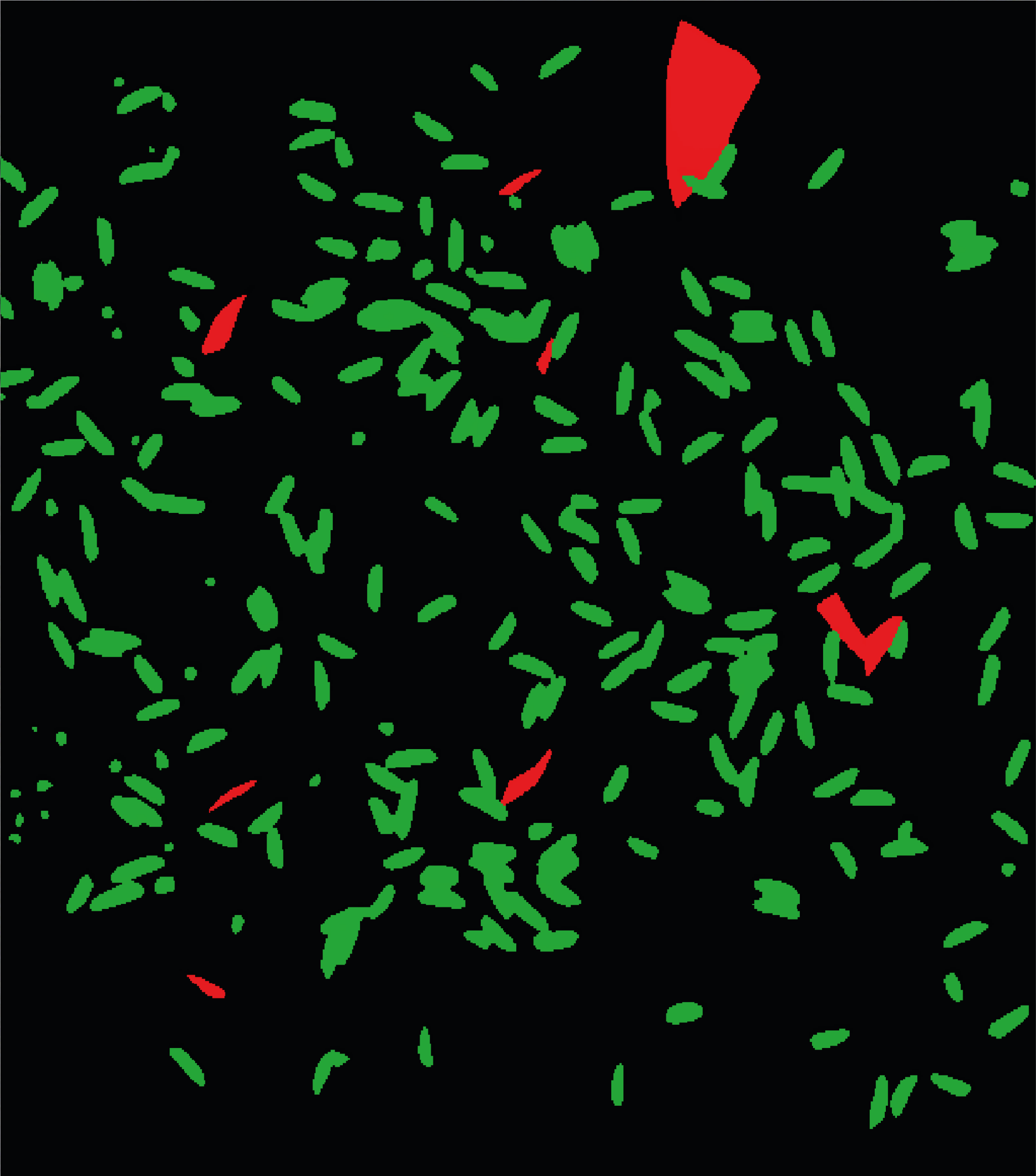
Food Quality Inspection

Use-Case



Food Quality Inspection

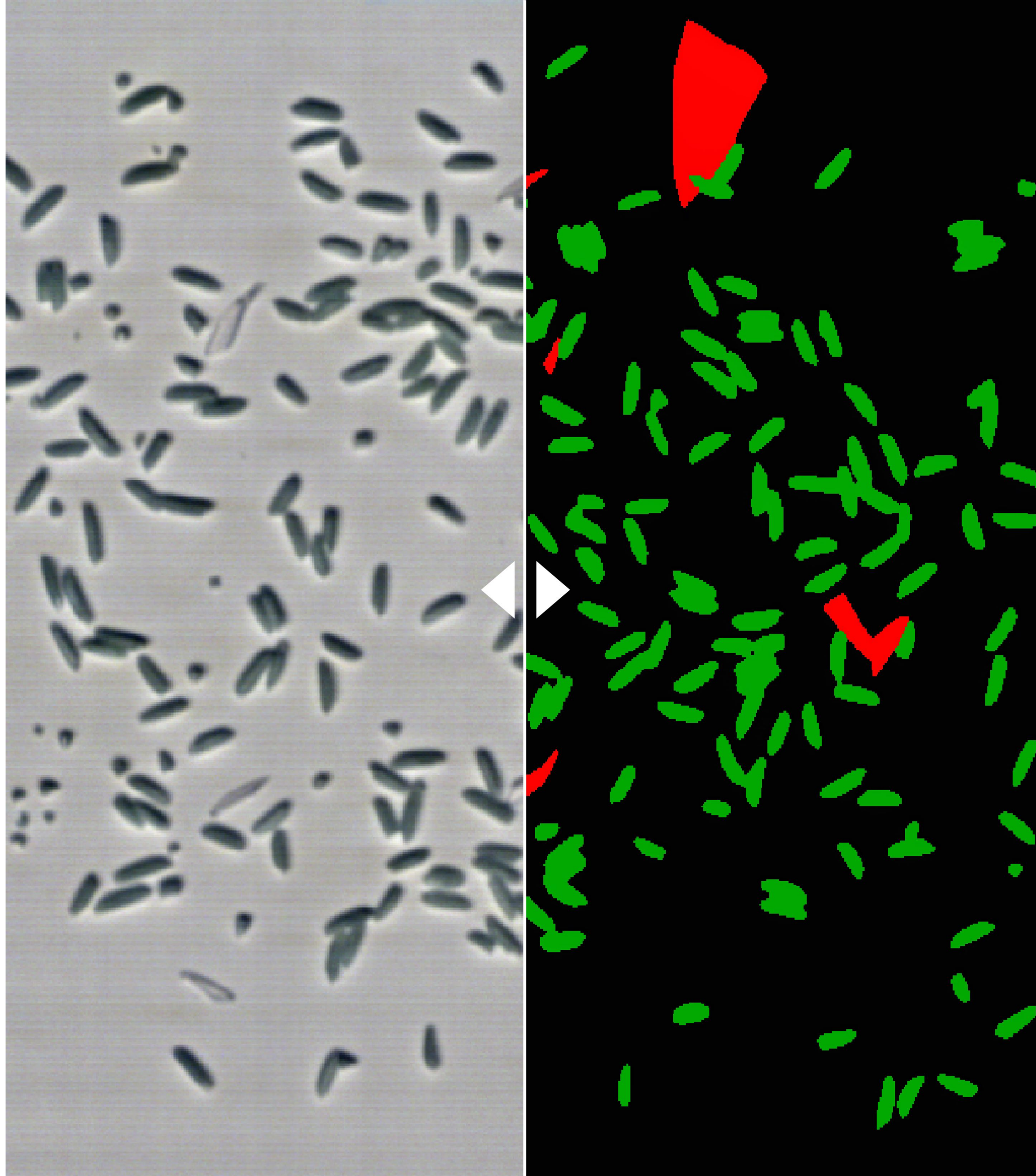
Use-Case



Food Quality Inspection

Use-Case

- Food fraud detection
- Foreign object detection
- Quality differentiation



- Chemical composition
- Ripeness measurement
- Protein content



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Look beyond the visible